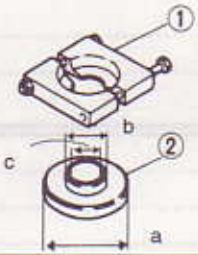
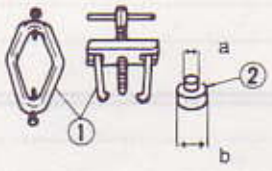
# PROPELLER SHAFT & DIFFERENTIAL CARRIER

# SECTION PD

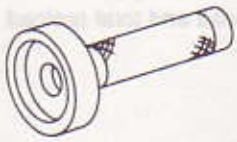
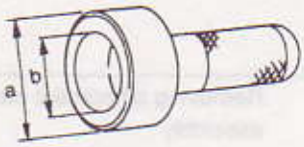
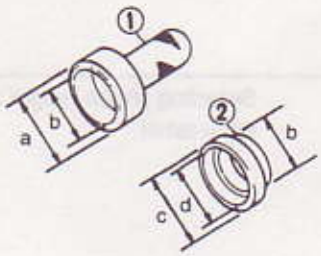
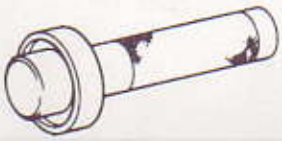
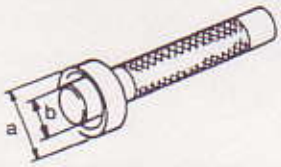
## CONTENTS

## SPECIAL SERVICE TOOLS

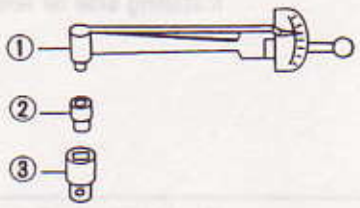
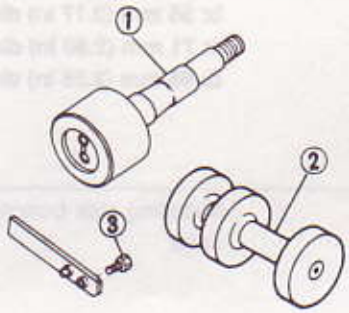
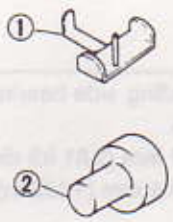
*: Special tool or a commercial equivalent

| Tool number<br>Tool name | Description | | Unit application | |
|---|---|---|---|---|
| | | | R200V | H190A |
| ST38060002*<br>Drive pinion flange wrench |  | Removing and installing propeller shaft lock nut, and drive pinion lock nut. | X | X |
| KV38100800<br>Differential attachment |  **a: 152 mm (5.98 in)** | Mounting final drive<br>(To use, make a new hole.) | X | — |
| ST06310000<br>Differential attachment |  | Mounting final drive | — | X |
| ST3090S000*<br>Drive pinion rear inner race puller set<br>① ST30031000 Puller<br>② ST30901000 Base |  | Removing and installing drive pinion rear cone<br>**a: 79 mm (3.11 in) dia.**<br>**b: 45 mm (1.77 in) dia.**<br>**c: 35 mm (1.38 in) dia.** | X | X |
| ST3306S001<br>Differential side bearing puller set<br>① ST33051001* Body<br>② ST33061000* Adapter |  | Removing and installing differential side bearing inner cone<br>**a: 28.5 mm (1.122 in) dia.**<br>**b: 38.0 mm (1.50 in) dia.** | X | X |
| ST30611000*<br>Drift |  | Installing pinion rear bearing outer race | X | X |
| ST30613000*<br>Drift |  | Installing pinion rear bearing outer race<br>**a: 71.5 mm (2.815 in) dia.**<br>**b: 47.5 mm (1.870 in) dia.** | X | X |
| ST30701000*<br>Drift |  | Installing pinion front bearing outer race<br>**a: 61.5 mm (2.421 in) dia.**<br>**b: 41.0 mm (1.610 in) dia.** | X | — |

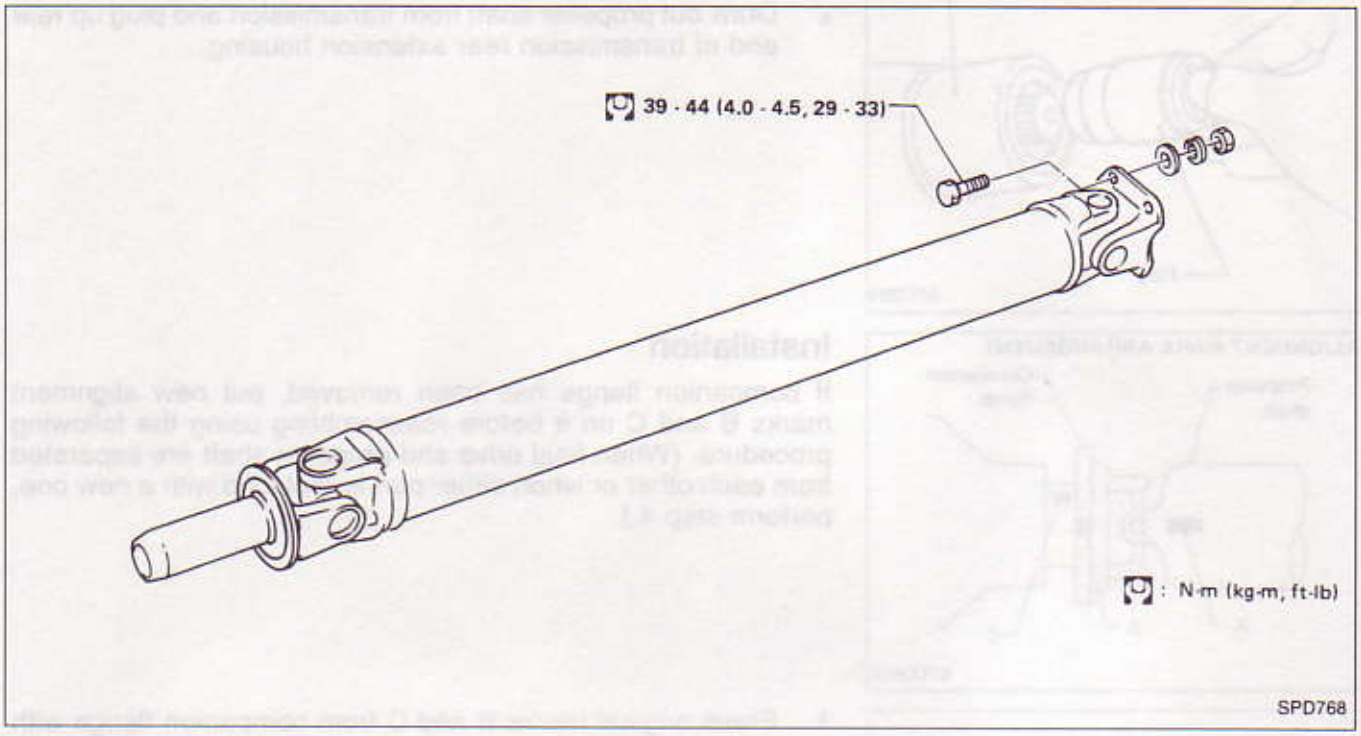
*: Special tool or a commercial equivalent

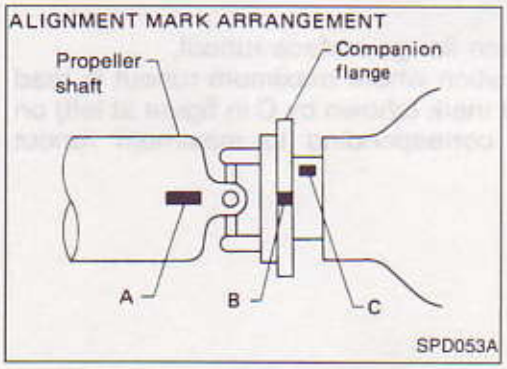
| Tool number<br>Tool name | Description | | Unit application | |
|---|---|---|---|---|
| | | | R200V | H190A |
| KV38100200<br>Gear carrier side oil seal drift |  | Installing side oil seal | X | — |
| KV38100500*<br>Gear carrier front oil seal drift |  | Installing front oil seal<br>**a: 85 mm (3.35 in) dia.**<br>**b: 60 mm (2.36 in) dia** | X | — |
| KV381025S0*<br>Oil seal fitting tool<br>① ST30720000 Drift bar<br>② KV38102510 Drift |  | Installing front oil seal<br>**a: 77 mm (3.03 in) dia.**<br>**b: 55 mm (2.17 in) dia.**<br>**c: 71 mm (2.80 in) dia.**<br>**d: 65 mm (2.56 in) dia.** | — | X |
| KV38100300<br>Differential side bearing inner cone |  | Installing side bearing inner cone | X | — |
| ST33230000*<br>Diff. side bearing drift |  | Installing side bearing inner cone<br>**a: 51 mm (2.01 in) dia.**<br>**b: 28.5 mm (1.122 in) dia.** | — | X |
| KV38100600*<br>Side bearing spacer drift |  | Installing side bearing spacer<br>**a: 8 mm (0.31 in)**<br>**b: 42.5 mm (1.673 in)** | X | X |
| ST30621000*<br>Drift |  <br>**a: 79 mm (3.11 in) dia.**<br>**b: 59 mm (2.32 in) dia.** | Installing pinion rear bearing outer race<br>**a: 79 mm (3.11 in) dia.**<br>**b: 59 mm (2.32 in) dia.** | — | X |

*: Special tool or a commercial equivalent

| Tool number<br>Tool name | Description | | Unit application | |
|---|---|---|---|---|
| | | | R200V | H190A |
| ST3127S000<br>Preload gauge<br>① GG91030000<br>Torque wrench<br>② HT62940000<br>Socket adapter<br>③ HT62900000<br>Socket adapter |  | Measuring pinion bearing preload and total preload | X | X |
| HT72400000<br>Slide hammer |  | Removing differential case assembly | X | — |
| KV381039S0<br>Drive pinion setting gauge<br>① KV38103910<br>Dummy shaft<br>② KV38100120<br>Height gauge<br>③ KV38100140<br>Stopper |  | Selecting pinion height adjusting washer | X | — |
| ST3194S000<br>Drive pinion setting gauge set<br>① ST31941000<br>Height gauge<br>② ST31942000<br>Dummy shaft |  | Selecting pinion height adjusting washer | — | X |
| ST31970000<br>Collar |  | Selecting pinion height adjusting washer | — | X |
| ST32501000<br>Weight block |  | Selecting side bearing adjusting shim | X | X |
| KV38101900<br>Master gauge<br>[20.0 mm (0.787 in)] |  | Selecting side bearing adjusting shim | — | X |

## Propeller Shaft (Model 2S63A)




## On-vehicle Service

### PROPELLER SHAFT VIBRATION

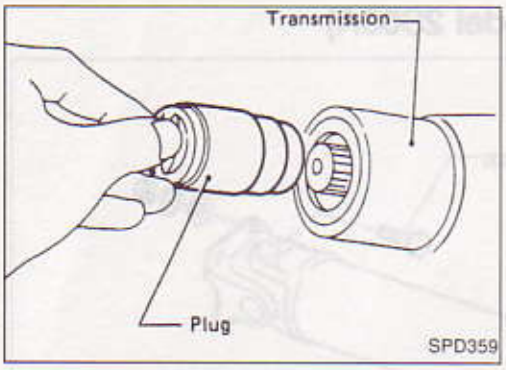
If vibration is present at high speed, check mounting between propeller shaft and companion flange of rear differential.

**Make sure alignment marks A and B are located as close to each other as possible.**

If not, change mounting as described in "Installation".

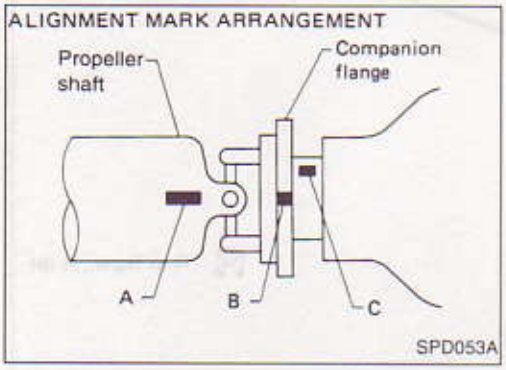
### APPEARANCE CHECKING

- Inspect propeller shaft tube surface for dents or cracks. If damaged, replace propeller shaft assembly.



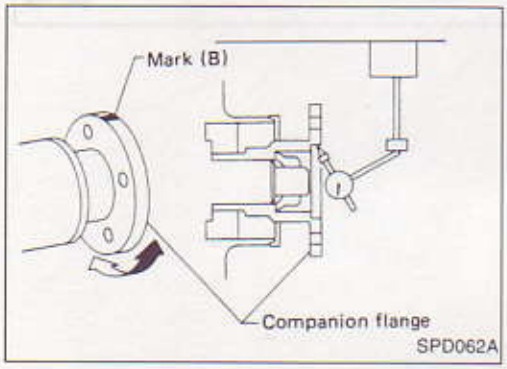

## Removal

- Draw out propeller shaft from transmission and plug up rear end of transmission rear extension housing.

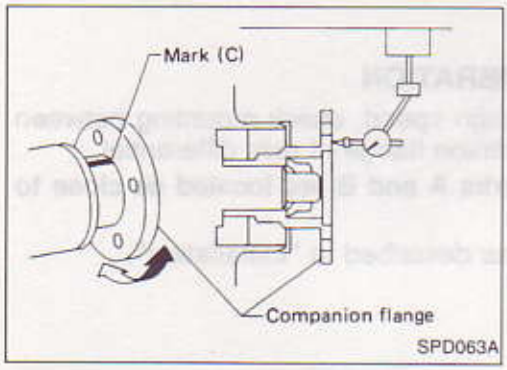



## Installation

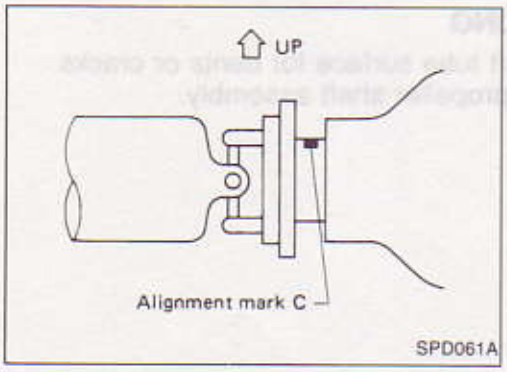
If companion flange has been removed, put new alignment marks B and C on it before reassembling using the following procedure. (When final drive and propeller shaft are separated from each other or when either part is replaced with a new one, perform step 4.)



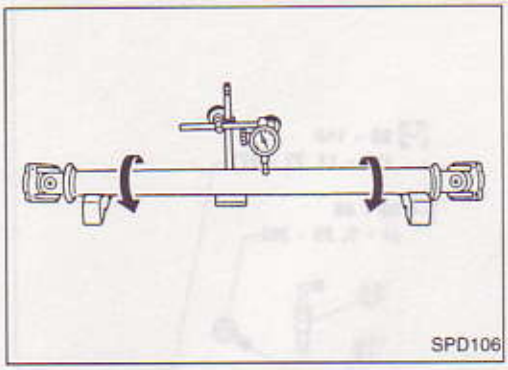

1. Erase original marks B and C from companion flange with suitable solvent.
2. Mark (B)
   A. Measure companion flange vertical runout.
   B. Determine the position where maximum runout is read on dial gauge. Put mark (shown by B in figure at left) on flange perimeter corresponding to maximum runout position.




3. Mark (C)
   A. Measure companion flange surface runout.
   B. Determine the position where maximum runout is read on dial gauge. Put mark (shown by C in figure at left) on flange perimeter corresponding to maximum runout position.

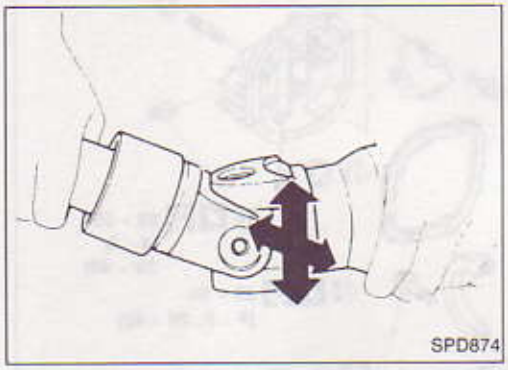



4. Position companion flange and propeller shaft so that alignment marks A and B are as close to each other as possible. Temporarily attach bolts and nuts.
5. While pressing down propeller shaft with alignment mark C facing upward, tighten the lower nut to specified torque.
6. Tighten remaining nuts to specified torque.

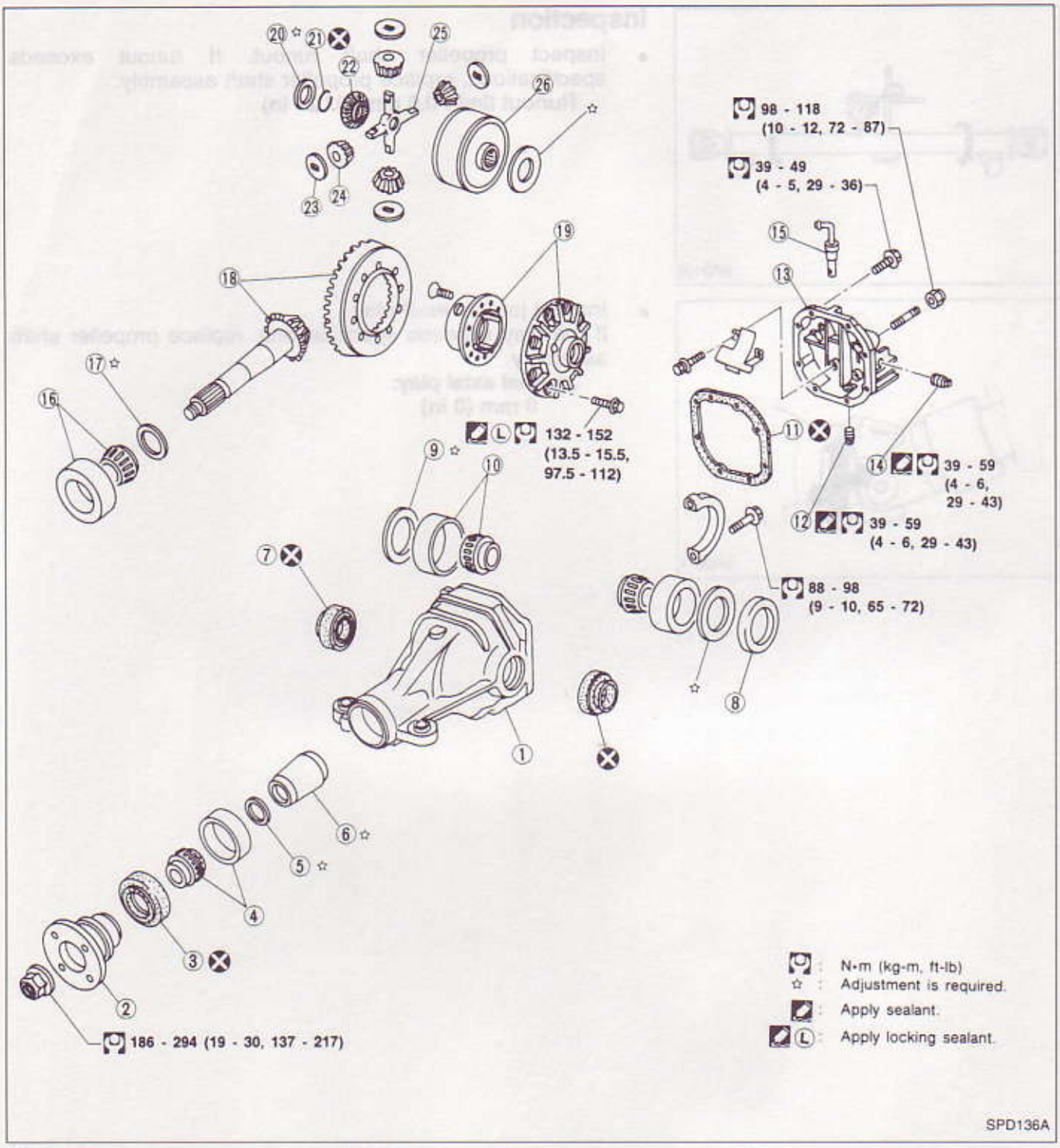

SPD106

## Inspection

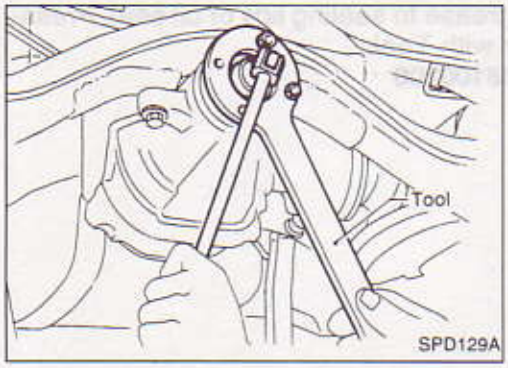
- Inspect propeller shaft runout. If runout exceeds specifications, replace propeller shaft assembly.
  **Runout limit: 0.6 mm (0.024 in)**


SPD874

- Inspect journal axial play.
  If the play exceeds specifications, replace propeller shaft assembly.
  **Journal axial play:**
  **0 mm (0 in)**



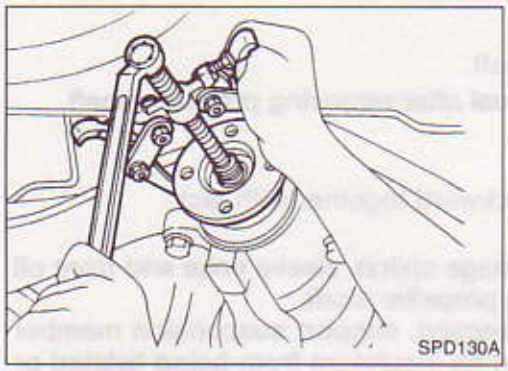

① Gear carrier
② Companion flange
③ Front oil seal
④ Pinion front bearing
⑤ Pinion bearing adjusting washer
⑥ Pinion bearing adjusting spacer (Solid spacer)
⑦ Side oil seal
⑧ Side bearing spacer
⑨ Side bearing adjusting washer
⑩ Side bearing
⑪ Gasket
⑫ Drain plug
⑬ Rear cover
⑭ Filler plug
⑮ Breather
⑯ Pinion rear bearing
⑰ Pinion height adjusting washer
⑱ Hypoid gear set
⑲ Differential case
⑳ Side gear thrust washer
㉑ Circular clip
㉒ Side gear (R.H.)
㉓ Pinion mate thrust washer
㉔ Pinion mate gear
㉕ Pinion mate shaft
㉖ Side gear (L.H.) with viscous coupling



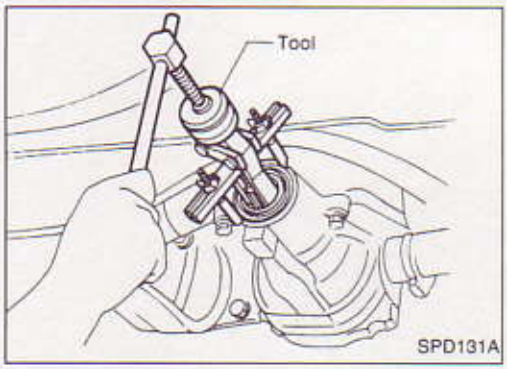

## On-vehicle Service

### FRONT OIL SEAL REPLACEMENT

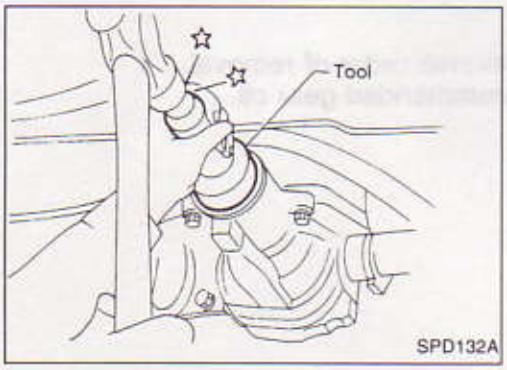
1. Remove propeller shaft.
2. Loosen drive pinion nut with Tool.
   **Tool number: ST38060002**




3. Remove companion flange.



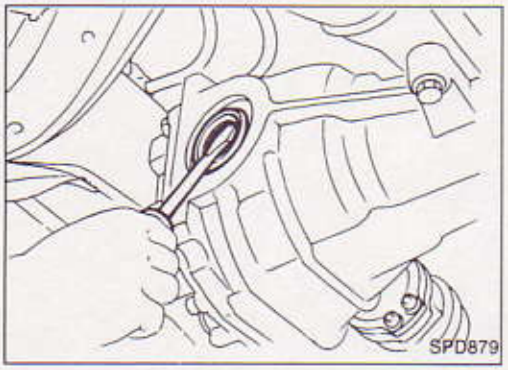

4. Remove front oil seal.



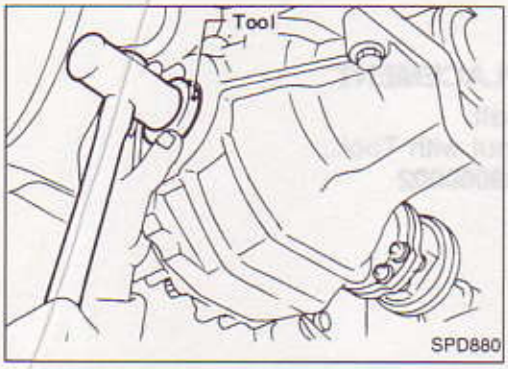

5. Apply multi-purpose grease to sealing lips of oil seal. Press front oil seal into carrier.
6. Install companion flange and drive pinion nut.
7. Install propeller shaft.

### SIDE OIL SEAL REPLACEMENT

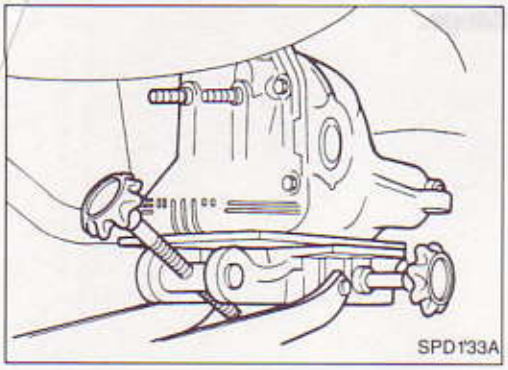
1. Remove drive shafts.
   Refer to RA section.
2. Remove oil seal.



## On-vehicle Service (Cont'd)




3. Apply multi-purpose grease to sealing lips of oil seal. Press-fit oil seal into carrier with Tool.
   **Tool number: KV38100200**
4. Install drive shafts.




## Removal

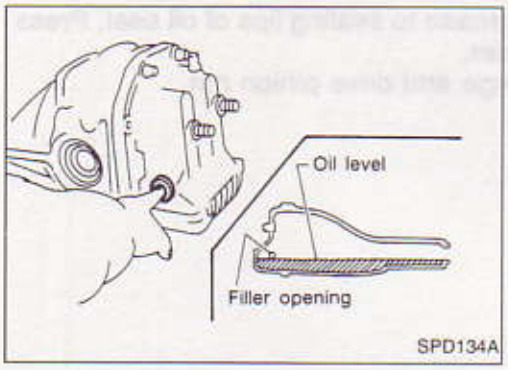
- Remove propeller shaft.

**Insert plug into rear oil seal after removing propeller shaft.**

- Remove drive shafts.
  Refer to RA section.
- Pull off final drive backward together with jack.

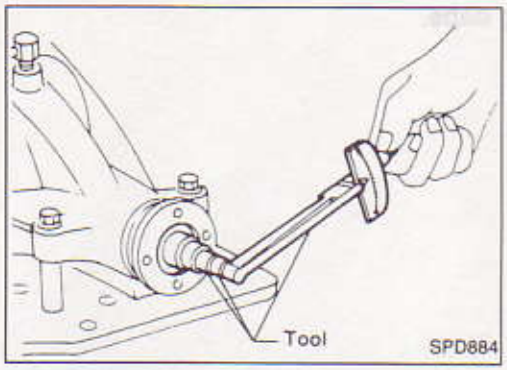
**CAUTION:**

- **Be careful not to damage spline, sleeve yoke and front oil seal, when removing propeller shaft.**
- **After final drive is removed, support suspension member on a stand to prevent its insulators from being twisted or damaged.**




## Installation

- Installation is in the reverse order of removal.
- Fill final drive with recommended gear oil.




## Pre-inspection

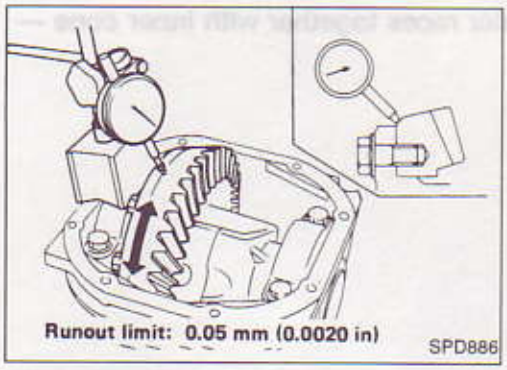
Before disassembling final drive, perform the following inspection.

- Total preload

1) Turn drive pinion in both directions several times to set bearing rollers.
2) Check total preload with Tool.
   **Tool number: ST3127S000**
   **Total preload:**
   **1.5 - 2.4 N·m**
   **(16 - 25 kg-cm, 13.5 - 21.5 in-lb)**


- Ring gear to drive pinion backlash

Check ring gear-to-drive pinion backlash with a dial indicator at several points.
**Ring gear backlash:**
**0.13 - 0.18 mm (0.0039 - 0.0059 in)**




- Ring gear runout

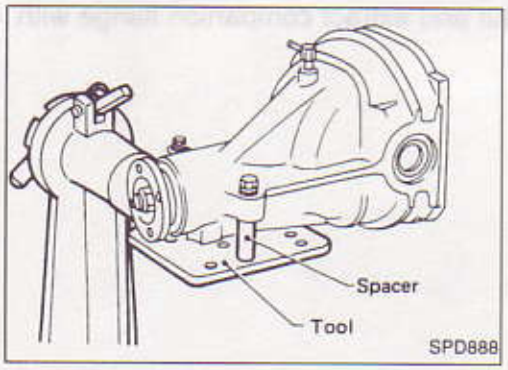
Check runout of ring gear with a dial indicator.
**Runout limit:**
**0.05 mm (0.0020 in)**

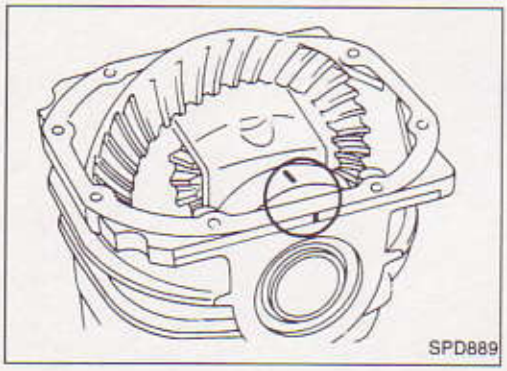
- Tooth contact

Check tooth contact. (Refer to Adjustment.)

## Differential Carrier

1. Using two 45 mm (1.77 in) spacers, mount carrier on Tool.
   **Tool number: KV38100800**

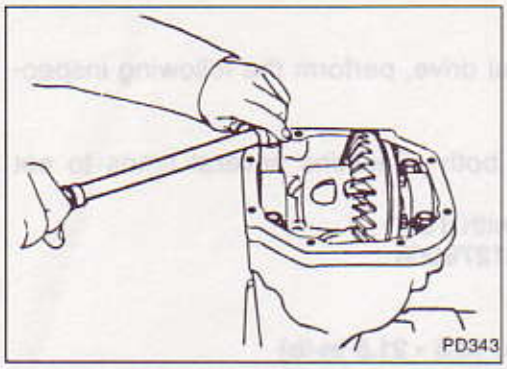


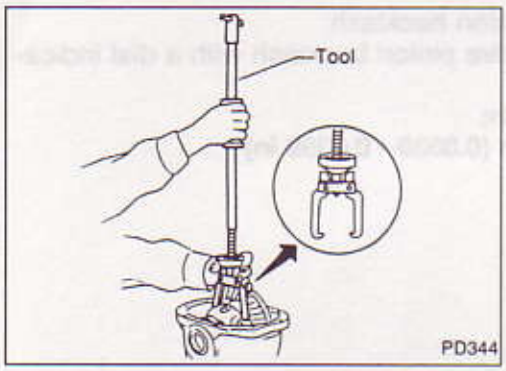

2. Paint or punch matchmarks on one side of the side bearing cap so it can be properly reinstalled.

**Bearing caps are line-board during manufacture. Replace them in their proper positions.**

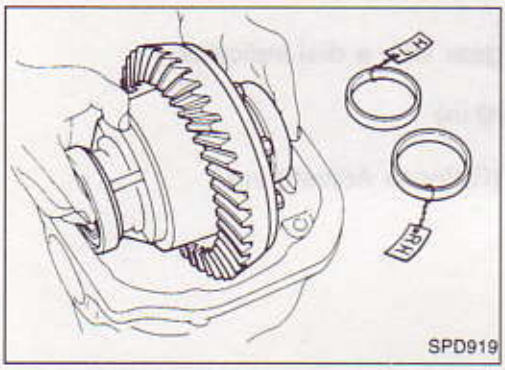
## Differential Carrier (Cont'd)



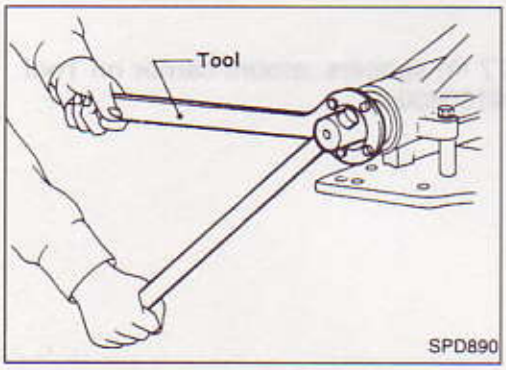

3. Remove side bearing caps.



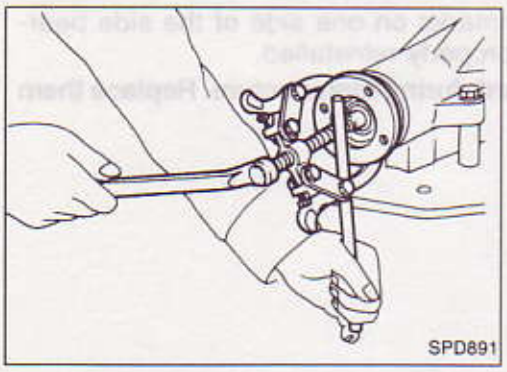

4. Lift differential case assembly out with Tool.
   **Tool number: HT72400000**



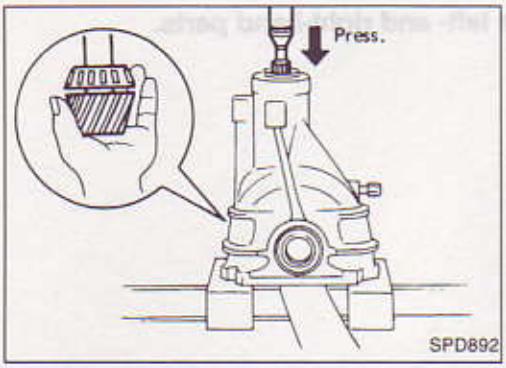

**Keep the side bearing outer races together with inner cone — do not mix them up.**



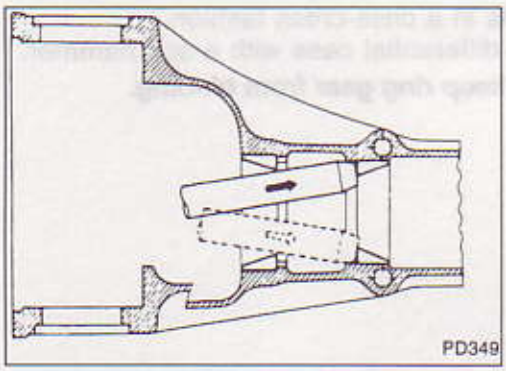

5. Loosen drive pinion nut and extract companion flange with a puller.



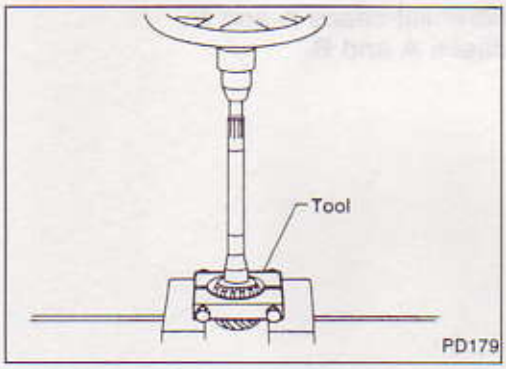
## Differential Carrier (Cont'd)




6. Take out drive pinion (together with rear bearing inner race, bearing spacer and adjusting washer).
7. Remove front oil seal.
8. Remove front bearing inner race.
9. Remove side oil seals.

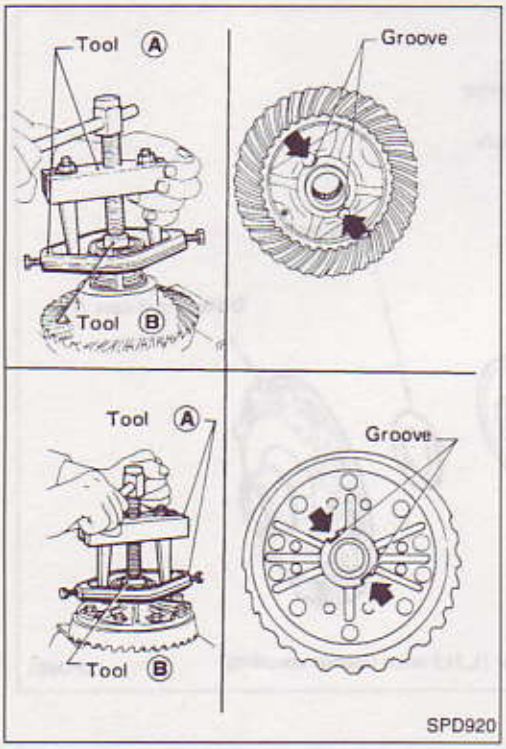



10. Remove pinion bearing outer races with a brass drift.




11. Remove pinion rear bearing inner race and drive pinion height adjusting washer with suitable tool.

## Differential Case




1. Remove side bearing inner cones.

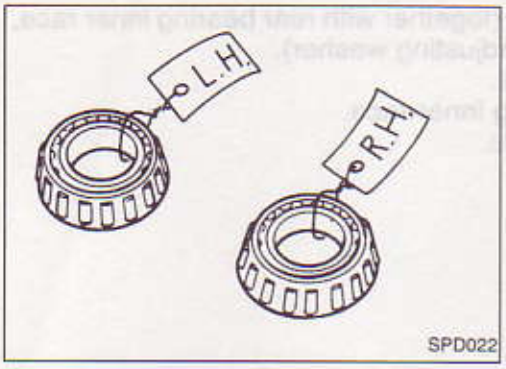
**To prevent damage to bearing, engage puller jaws in groove.**

**Tool number:**

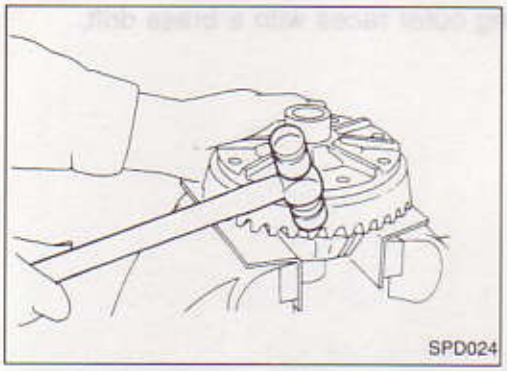
**Ⓐ ST33051001**

**Ⓑ ST33061000**

## Differential Case (Cont'd)

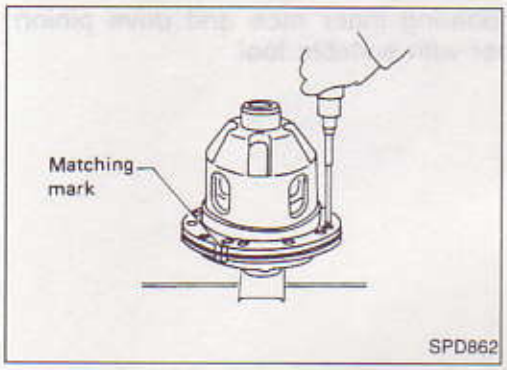



**Be careful not to confuse left- and right-hand parts.**

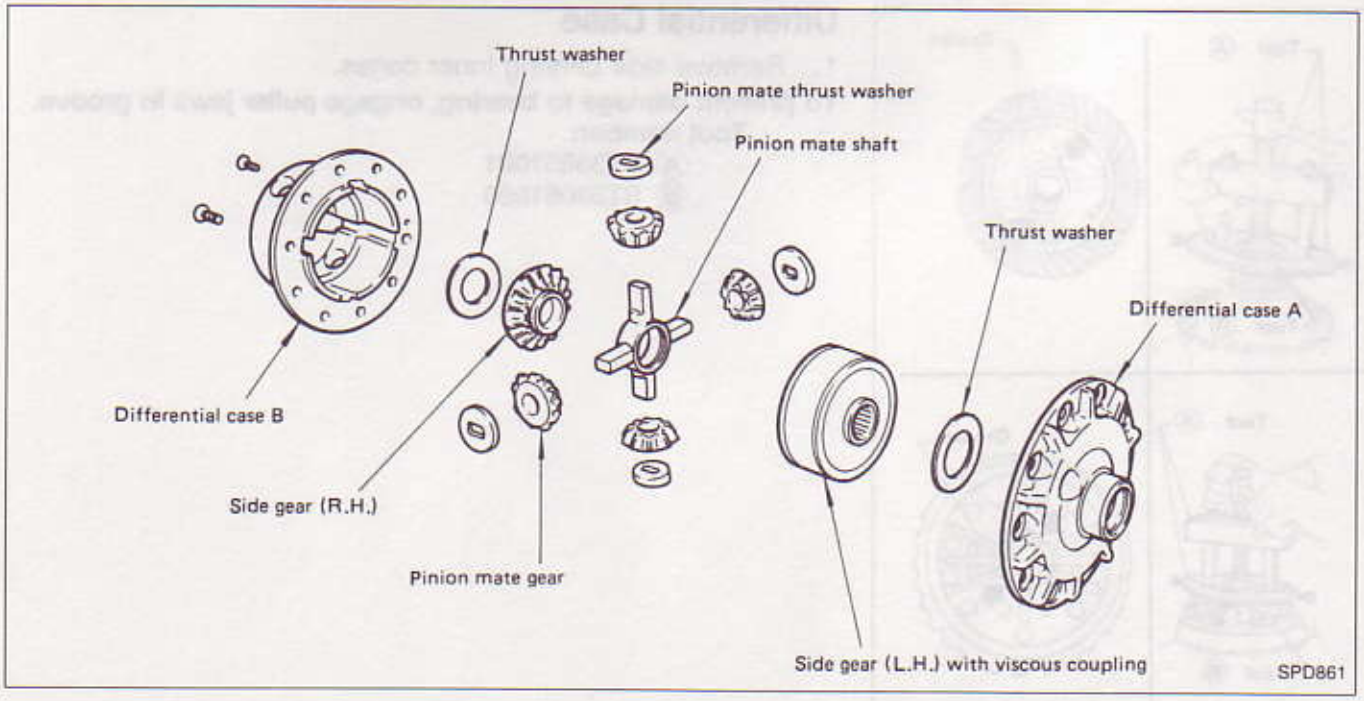



2. Loosen ring gear bolts in a criss-cross fashion.
3. Tap ring gear off the differential case with a soft hammer.

**Tap evenly all around to keep ring gear from binding.**

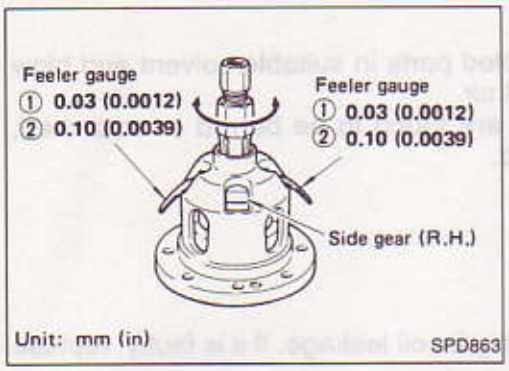



4. Loosen screws on differential cases A and B.
5. Separate differential cases A and B.



## Contact Surfaces

1. Clean the disassembled parts in suitable solvent and blow dry with compressed air.
2. If following surfaces are found to be burred or scratched, smooth with oil stone.
   - Differential case A
   - Differential case B
   - Side gear
   - Pinion mate gear
   - Pinion mate shaft
3. Check viscous coupling for oil leakage. If it is faulty, replace it with new one.




## Differential Case

### THRUST WASHER SELECTION

Whenever side gears or pinion mate gears are replaced, select suitable thrust washers as follows:

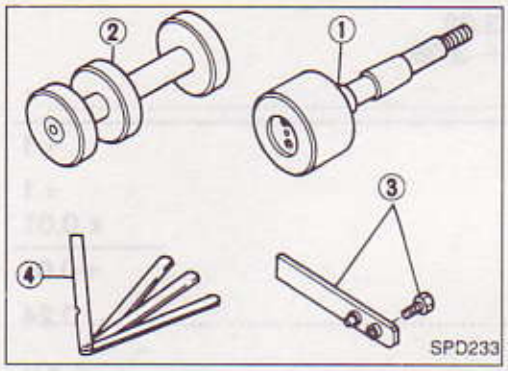
1. Clean side gears and pinion mate gears using white gasoline.
2. Before assembling gears, apply hypoid gear oil to frictional surfaces.
3. Install the previously removed thrust washer on right side gear. On left side gear, install a suitable thrust washer. Temporarily tighten differential cases using two screws.
4. Position differential assembly so that right side gear is on the upper side. Place a 0.03 mm (0.0012 in) feeler gauge (for example) between right side gear and thrust washer.

**Do not place feeler gauge at groove side of differential case.**

5. Also place a 0.03 mm (0.0012 in) additional feeler gauge between right side gear and thrust washer so that it is positioned diagonal to (180° apart from) the feeler gauge described previously.
6. Rotate right side gear with a suitable tool attached to splines. If right side gear cannot be rotated, replace thrust washer used on left side gear with a thinner one.
7. Replace both 0.03 mm (0.0012 in) feeler gauges with 0.10 mm (0.0039 in) gauges. At this point, make sure right side gear does not rotate. If it does, replace thrust washer on left side gear with a thicker one so that right side gear does not rotate.
8. As explained in above example, select suitable thrust washers to ensure that:

a) Both side gears rotate. [0.03 mm (0.0012 in) feeler gauges are used in this case.]
b) Side gear is held stationary. [0.10 mm (0.0039 in) gauges are used in this case.]

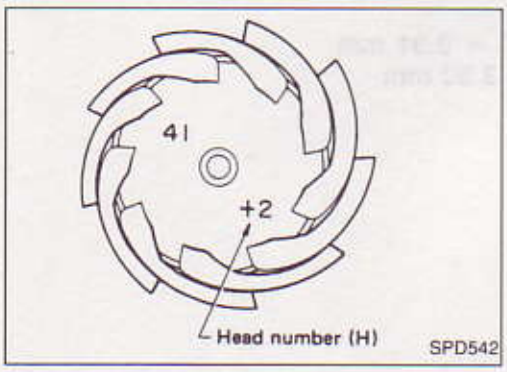
To avoid confusion while calculating bearing shims, it is absolutely necessary to stay with the metric system. If you measure anything in inches, **the results must be converted to the metric system.**



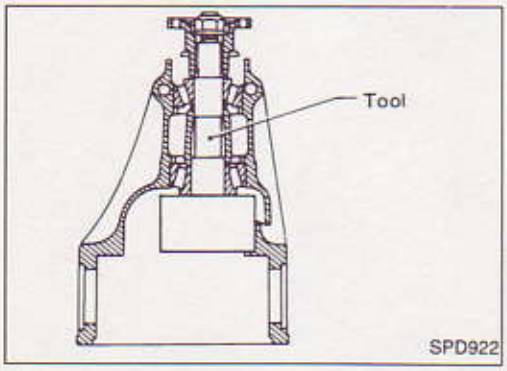

## Drive Pinion Height

1. First prepare Tools for pinion height adjustment.
   ① Dummy Shaft (KV38103910)
   ② Height Gauge (KV38100120)
   ③ Stopper (KV38100140)
   ④ Feeler Gauge
2. To simplify the job, make a chart, like the one below, to organize your calculations.

| LETTERS | HUNDREDTHS OF A MILLIMETER |
|---|---|
| H: Head number | |
| N: Measuring clearance | |

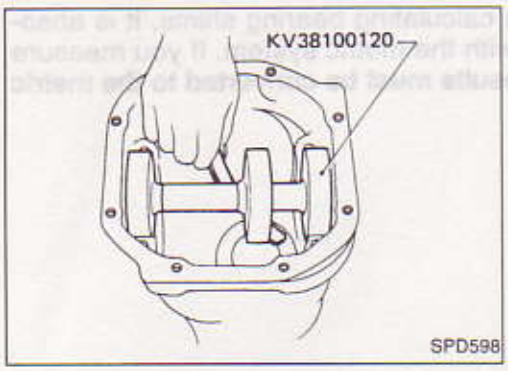



3. Write the following numbers down the chart.
   H: Head number (stamped on head of drive pinion)




4. Set Tool (Dummy shaft) as shown below and tighten drive pinion nut carefully to correct preload of 1.1 to 1.4 N·m (11 to 14 kg-cm, 9.5 to 12.2 in-lb).
   **Tool: Dummy shaft (KV38103910)**

## Drive Pinion Height (Cont'd)




5. Attach Tool (Height gauge) to gear carrier, and measure the clearance between the height gauge and the dummy shaft face.
6. Substitute these values into the equation to calculate the thickness of the washer.

**If value signifying H is not given, regard it as zero and calculate.**

T (Thickness of washer) = N − (H x 0.01) + 3.08

Example:

N = 0.24
H = 1

T = N − (H x 0.01) + 3.08
= 0.24 − (1 x 0.01) + 3.08

(1) H ..... 1
+1

(2)
+1
x 0.01
+0.01

(3) N ..... 0.24
−
(+0.01)
0.23

(4)
0.23
+3.08
3.31

∴T = 3.31

7. Select the proper washer. (Refer to S.D.S.)

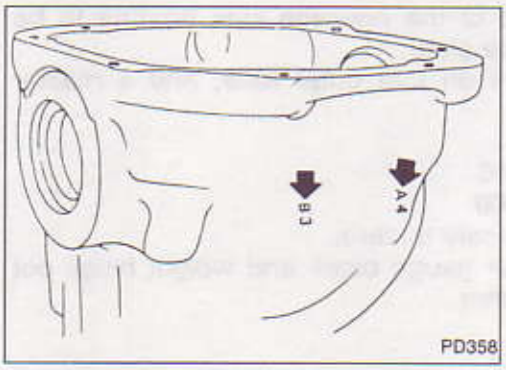
**If you cannot find the desired thickness of washer, use washer with thickness closest to the calculated value.**

Example:
Calculated value ... T = 3.31 mm
Used washer ... T = 3.30 mm

## Side Bearing Preload

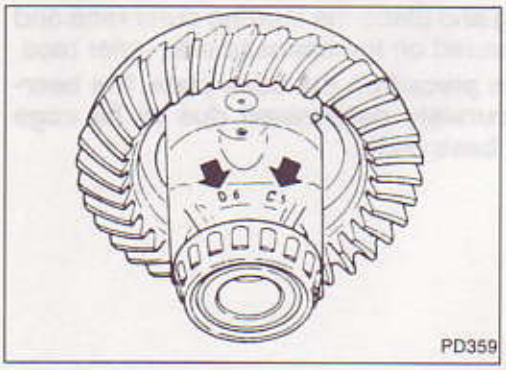
1. To simplify the job, make a chart like the one below to organize your calculations.

| LETTERS | HUNDREDTHS OF A MILLIMETER |
|---|---|
| A - Left housing | |
| B - Right housing | |
| C - Differential case | |
| D - Differential case | |
| E - Left side bearing | |
| F - Right side bearing | |
| G - Spacer measurement | |
| H - (+) or (−): ring gear | |



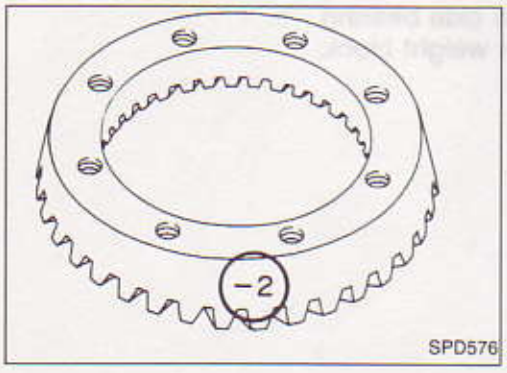
PD358

2. Write the following numbers down in the chart.
   A & B: Figures marked on gear carrier



PD359

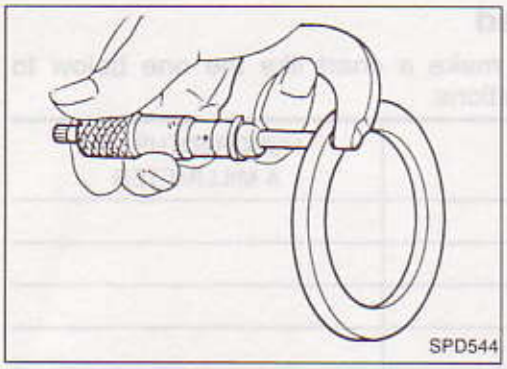
C & D: Figures marked on differential case



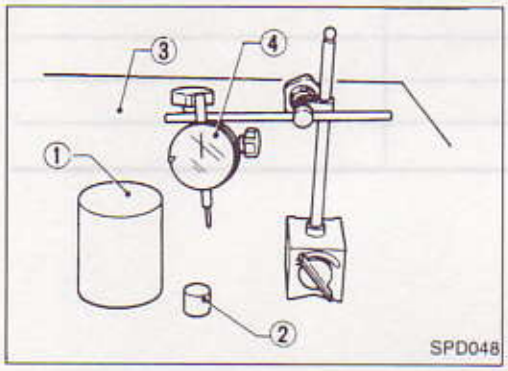
SPD576

H: Figure marked on ring gear

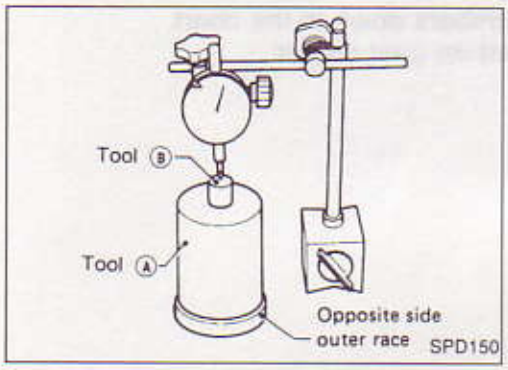
## Side Bearing Preload (Cont'd)



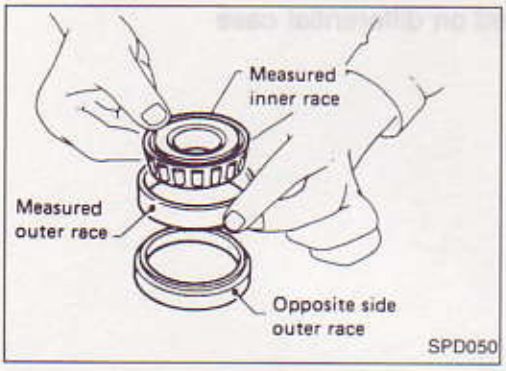

G: This is the difference in thickness of side spacer against standard width [8.10 mm (0.3189 in)].
(G = Standard spacer − Measured spacer)




3. Measure how far under the standard thickness [21 mm (0.83 in)] the side bearings are.
   It will require tools shown to the left.
   ① Weight Block (ST32501000)
   ② Master Gauge (KV38102000)
   ③ Base Plate
   ④ Dial Indicator

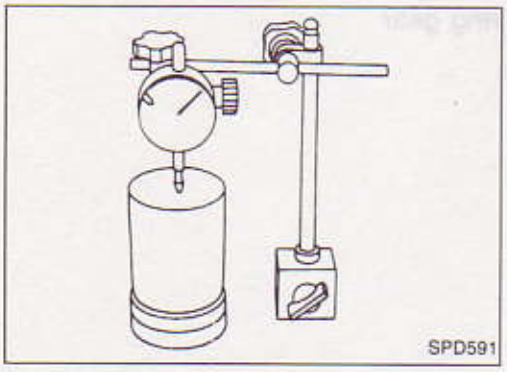



4. Place the outer race of the opposite side bearing to be measured on the base plate.
5. Place a weight block on that outer race, and a master gauge on that block.
   **Tool number:**
   **Ⓐ ST32501000**
   **Ⓑ KV38102000**
6. Adjust dial indicator scale to zero.
7. Carefully slide master gauge block and weight block out from under dial indicator.



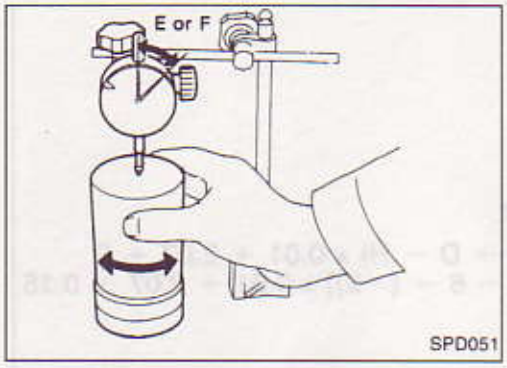

8. Lubricate side bearing and place the bearing outer race and inner cone to be measured on the opposite side outer race.

**If the bearing assembly is placed on the base plate, the bearing width cannot be accurately determined due to its cage being in contact with the base plate.**




9. Place weight block on side bearing.
10. Slide dial indicator on weight block.

## Side Bearing Preload (Cont'd)




11. Turn weight block a few times to ensure that bearing is properly seated.
12. Read dial indicator.
- **Normal indication:**
  **0.10 - 0.30 mm (0.0039 - 0.0118 in)**
- **If the needle fluctuated erratically then bearing is either dirty or damaged and should be cleaned or replaced.**
13. Measure both bearings in the same way and write the left side bearing measurement next to "E" and the right side bearing measurement next to "F".
14. Substitute these values into the equation to calculate the thickness of the shim.

**If values signifying A, B, C, D and H are not given, regard them as zero and calculate.**

**Left side**

$$T_1 = (A - C + D + H) \times 0.01 + 1.97 + E + G$$

**Right side**

$$T_2 = (B - D - H) \times 0.01 + 2.07 + F$$

## Side Bearing Preload (Cont'd)

Example:

A = 4, B = 3, C = 5, D = 6, H = −2, E = 0.18, F = 0.15, G = 0.08

Left side

$T_1 = (A - C + D + H) \times 0.01 + 1.97 + E + G$
$= [4 - 5 + 6 + (-2)] \times 0.01 + 1.97 + 0.18 + 0.08$

(1) A ..... 4
− C ..... −5
−1
+ D ..... +6
5
+ H ..... +(−2)
3

(2) 3 x 0.01 = 0.03

(3) 0.03 + 1.97 = 2.00

(4) 2.00 + E ..... +0.18
2.18

(5) 2.18 + G ..... +0.08
2.26

$\therefore T_1 = 2.26$ mm

Right side

$T_2 = (B - D - H) \times 0.01 + 2.07 + F$
$= [3 - 6 - (-2)] \times 0.01 + 2.07 + 0.15$

(1) B ..... 3
− D ..... −6
−3
− H ..... −(−2)
−1

(2) −1 x 0.01 = −0.01

(3) −0.01 + 2.07 = 2.06

(4) 2.06 + F ..... +0.15
2.21

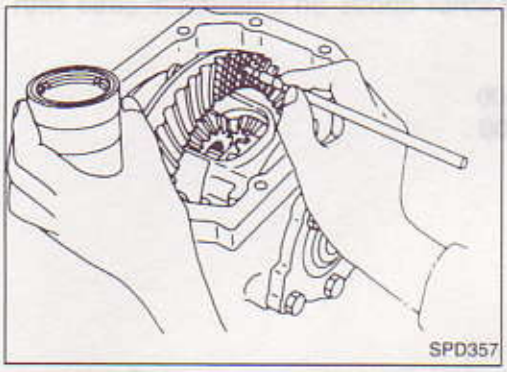
$\therefore T_2 = 2.21$ mm

15. Select the proper shims (Refer to S.D.S.).

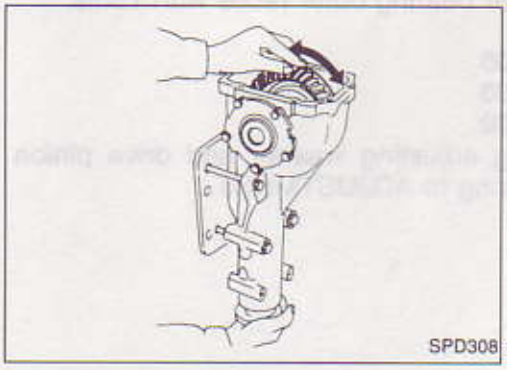
**If you cannot find the desired thickness of shims, use shims with the total thickness closest to the calculated value.**

## Tooth Contact

Checking gear tooth contact pattern is necessary to verify correct relationship between ring gear and drive pinion.
Hypoid gear set which is not positioned properly in relation to one another may be noisy, or have short life or both. With the checking of gear tooth contact pattern, the most desirable contact for low noise level and long life can be assured.

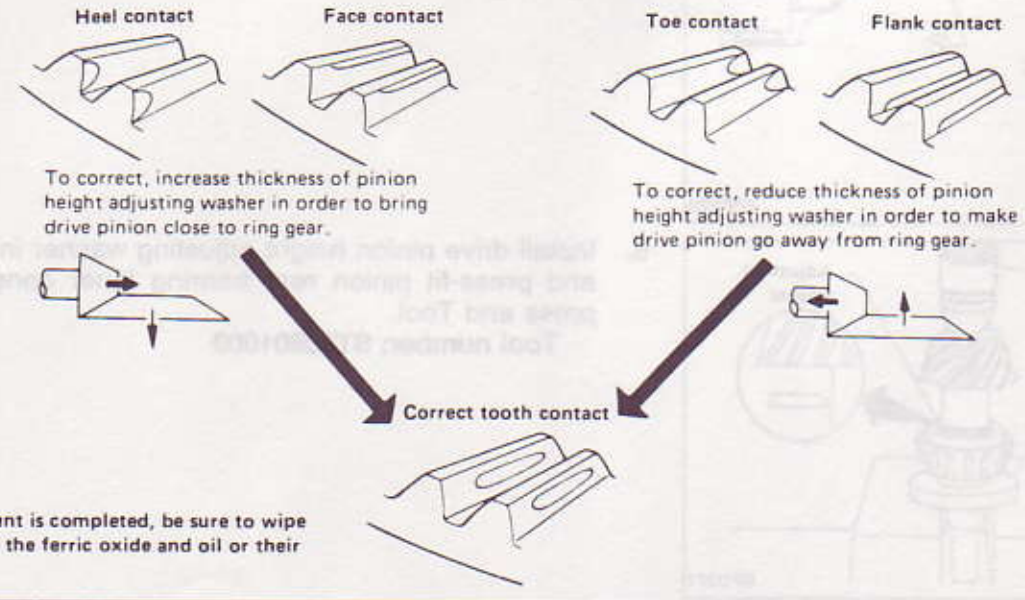

SPD357

1. Thoroughly clean ring gear and drive pinion teeth.
2. Sparingly apply a mixture of powdered ferric oxide and oil or equivalent to 3 or 4 teeth of ring gear drive side.


SPD308

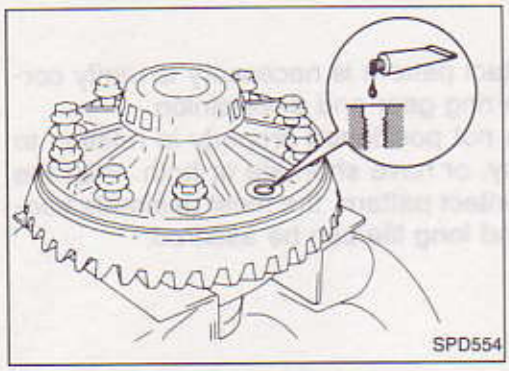
3. Hold companion flange steady by hand and rotate the ring gear in both directions.

**Usually the pattern will be correct if you have calculated the shims correctly and the backlash is correct.**
**However, in rare cases you may have to use trial-and-error processes until you get a good tooth contact pattern.**
**The tooth pattern is the best indication of how well a differential has been set up.**



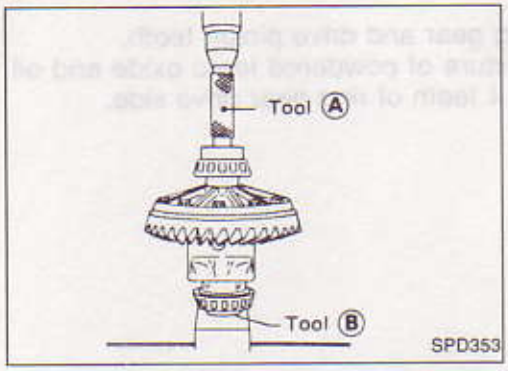

**When adjustment is completed, be sure to wipe off completely the ferric oxide and oil or their equivalent.**

SPD007



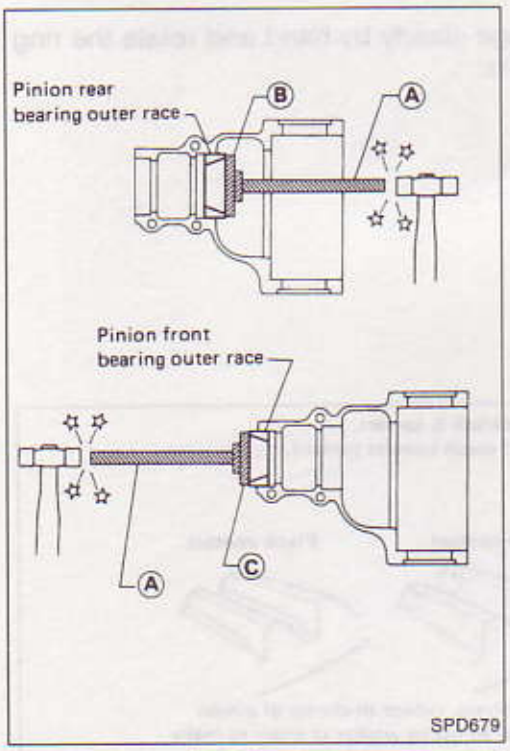

1. Place differential case on ring gear.
2. Apply locking sealant to ring gear bolts, and install them.

**Tighten bolts in a criss-cross fashion, lightly tapping bolt head with a hammer.**




3. Press-fit side bearing inner cones on differential case with Tool.

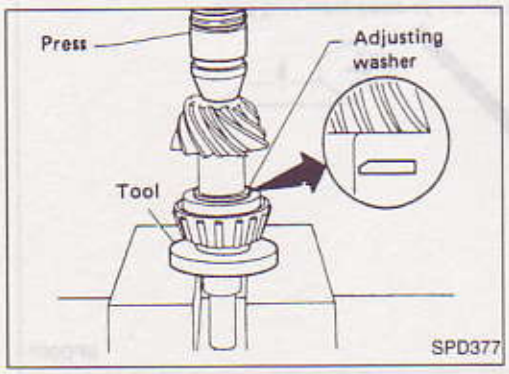
**Tool number:**
**(A) KV38100300**
**(B) ST33061000**




4. Press-fit front and rear bearing outer races with Tools.

**Tool number:**
**(A) ST30611000**
**(B) ST30613000**
**(C) ST30701000**

5. Select pinion bearing adjusting washer and drive pinion bearing spacer, referring to ADJUSTMENT.

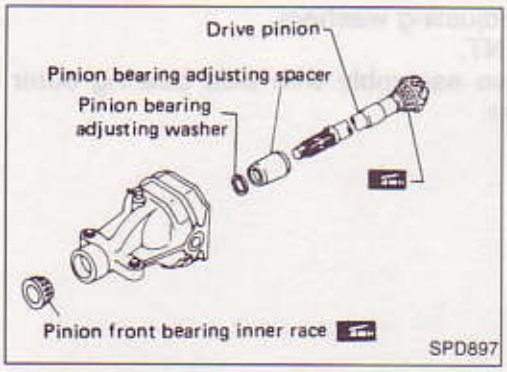



6. Install drive pinion height adjusting washer in drive pinion, and press-fit pinion rear bearing inner cone in it, using press and Tool.

**Tool number: ST30901000**

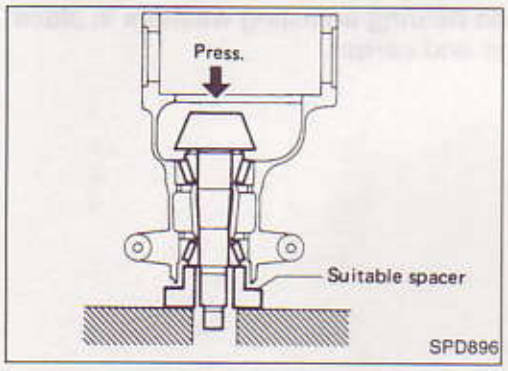

SPD581

7. Place pinion front bearing inner cone in final drive housing.



SPD897

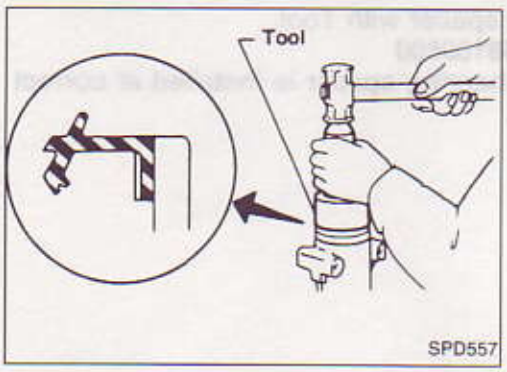
8. Set drive pinion assembly with all parts, as shown in figure at left, in differential carrier.



SPD896

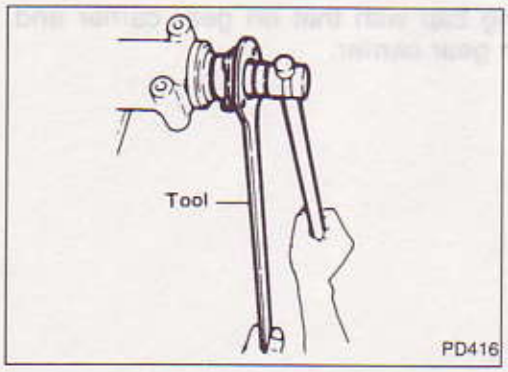
9. Press drive pinion assembly into differential carrier, using a suitable tool.

**Stop when drive pinion touches bearing.**
**Apply multi-purpose grease to pinion rear bearing inner race and pinion front bearing inner race.**



SPD557

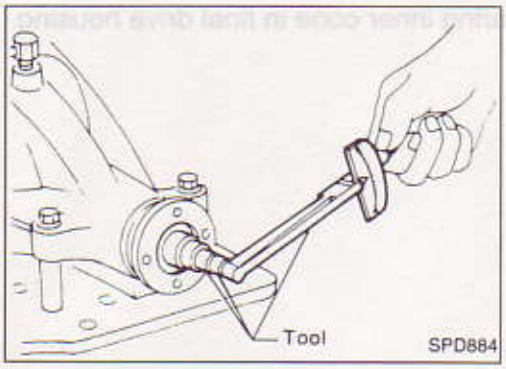
10. Install front oil seal with Tool.
**Tool number: KV38100500**



PD416

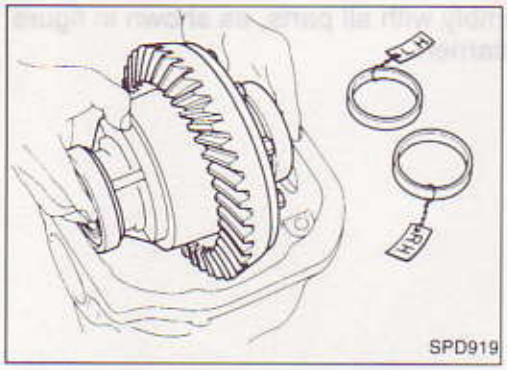
11. Install companion flange, and tighten pinion nut to specified torque with Tool.

**Ascertain that threaded portion of drive pinion and pinion nut are free from oil or grease.**
**Tool number: ST38060002**

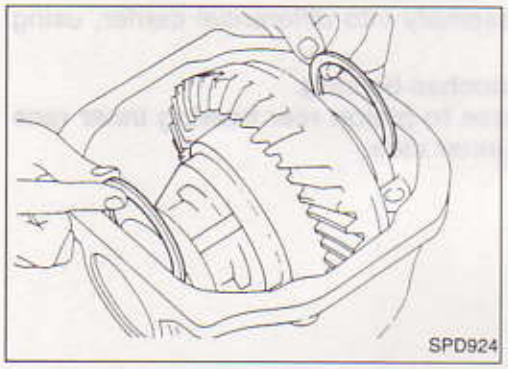



12. Turn drive pinion in both directions several times, and measure pinion bearing preload.
    **Pinion bearing preload:**
    **1.1 - 1.7 N·m**
    **(11 - 17 kg-cm, 9.5 - 14.7 in-lb)**

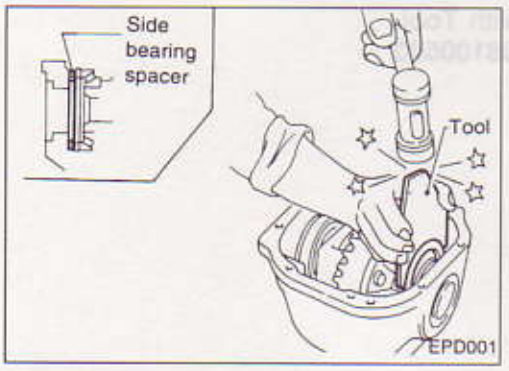
**When pinion bearing preload is outside the specifications, replace pinion bearing adjusting washer and spacer with a different thickness.**




13. Select side bearing adjusting washers.
    Refer to ADJUSTMENT.
14. Install differential case assembly with side bearing outer races into gear carrier.

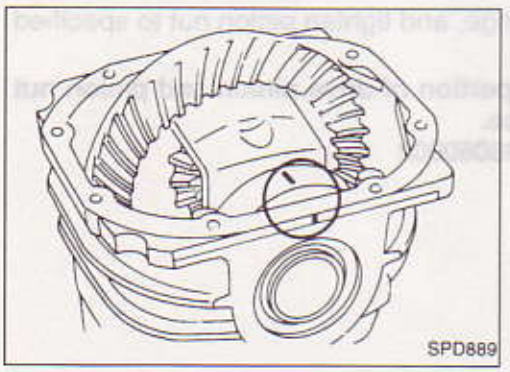



15. Insert left and right side bearing adjusting washers in place between side bearings and carrier.

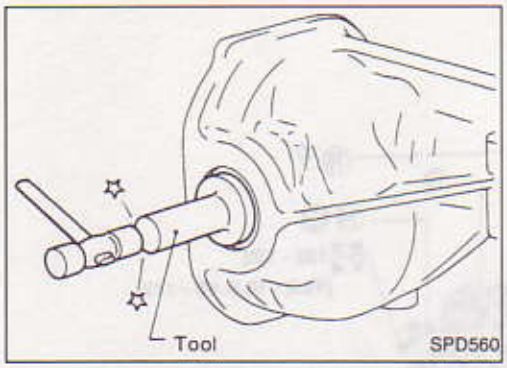



16. Drive in side bearing spacer with Tool.
    **Tool number: KV38100600**

- **Make sure that side bearing spacer is installed at correct side. See illustration.**




17. Align mark on bearing cap with that on gear carrier and install bearing cap on gear carrier.

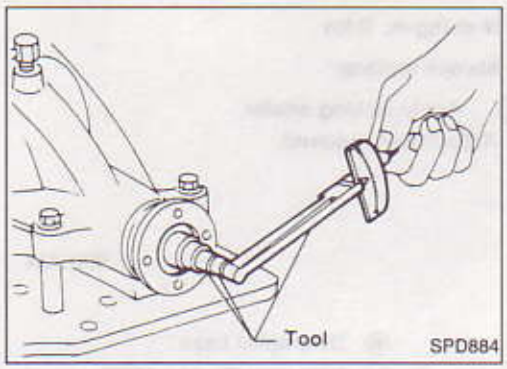



18. Install side oil seal.
    **Tool number: KV38100200**


19. Measure ring gear-to-drive pinion backlash with a dial indicator.
    **Ring gear backlash:**
    **0.13 - 0.18 mm**
    **(0.0050 - 0.0071 in)**

- If backlash is too small, decrease thickness of left shim and increase thickness of right shim by the same amount.
  If backlash is too great, reverse the above procedure.

**Never change the total amount of shims as it will change the bearing preload.**




20. Check total preload with Tool.

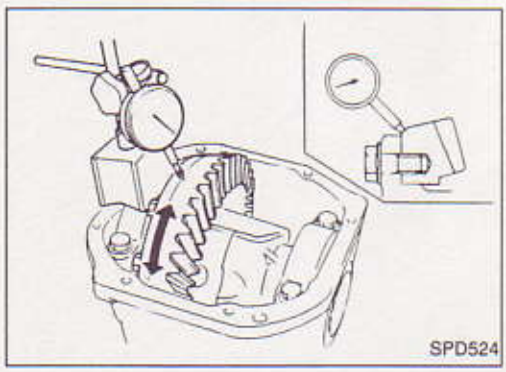
**When checking preload, turn drive pinion in both directions several times to seat bearing rollers correctly.**

**Total preload:**
**1.5 - 2.4 N·m**
**(16 - 25 kg-cm, 13.5 - 21.5 in-lb)**

- If preload is too great, remove the same amount of shim to each side.
- If preload is too small, add the same amount of shim to each side.

**Never add or remove a different number of shims for each side as it will change ring gear backlash.**

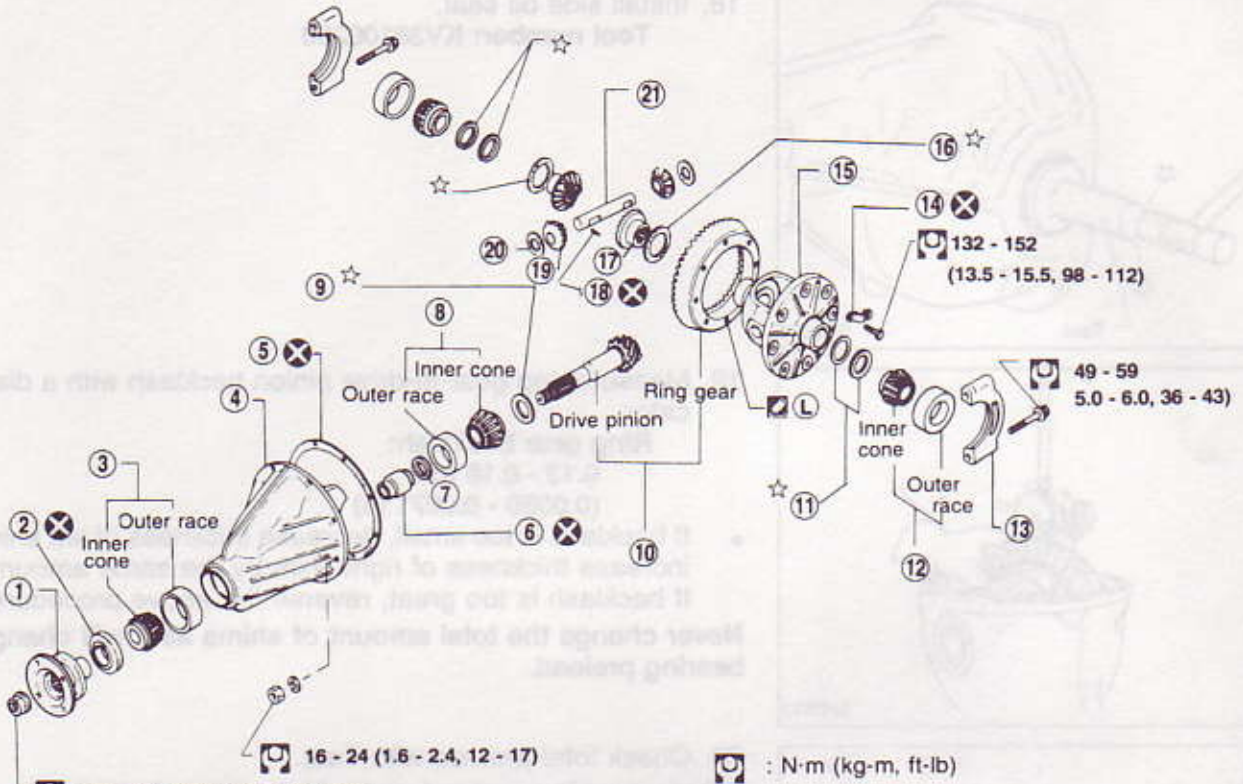
21. Recheck ring gear backlash because increase or decrease in thickness of shims will cause change of ring gear-to-pinion backlash.



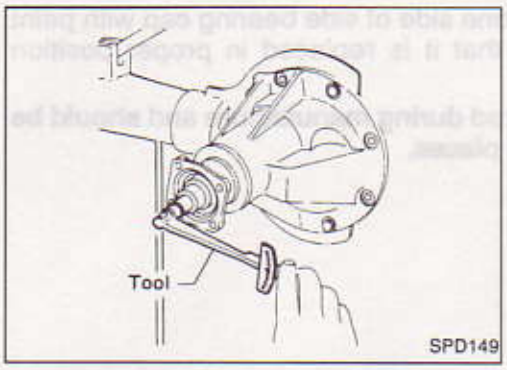

22. Check runout of ring gear with a dial indicator.
    **Runout limit: 0.05 mm (0.0020 in)**

- If backlash varies excessively in different places, foreign matter may be caught between the ring gear and the differential case.
- If the backlash varies greatly when the ring gear runout is within a specified range, replace the hypoid gear set or differential case.

23. Check tooth contact.
    Refer to ADJUSTMENT.
24. Install rear cover and gasket.




① Companion flange
② Front oil seal
③ Pinion front bearing
④ Gear carrier
⑤ Gasket
⑥ Collapsible spacer
⑦ Drive pinion washer
⑧ Pinion rear bearing
⑨ Drive pinion height adjusting washer
⑩ Hypoid gear set
⑪ Side bearing adjusting shim
⑫ Side bearing
⑬ Side bearing cap
⑭ Lock strap
⑮ Differential case
⑯ Side gear thrust washer
⑰ Side gear
⑱ Lock pin
⑲ Pinion mate gear
⑳ Pinion mate thrust washer
㉑ Pinion mate shaft

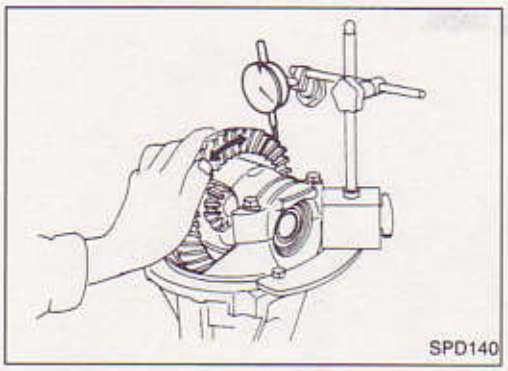



## Pre-inspection

Before disassembling final drive, perform the following inspection.

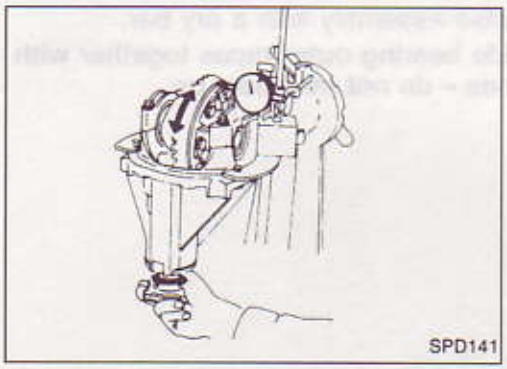
- Total preload

1) Turn drive pinion in both directions several revolutions to seat bearing rollers correctly.
2) Check total preload with Tool.
   **Tool number: ST3127S000**
   **Total preload:**
   **1.4 - 2.4 N·m**
   **(15 - 25 kg-cm, 13 - 21.5 in-lb)**



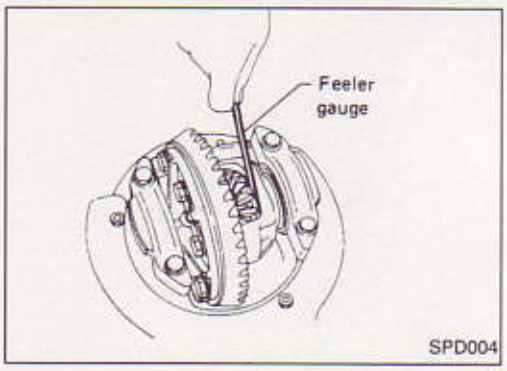

- Ring gear to drive pinion backlash

Check backlash of ring gear with a dial indicator at several points.
**Ring gear-to-drive pinion backlash:**
**0.13 - 0.18 mm (0.0051 - 0.0071 in)**




- Ring gear runout

Check runout of ring gear with a dial indicator.
**Runout limit:**
**0.08 mm (0.0031 in)**

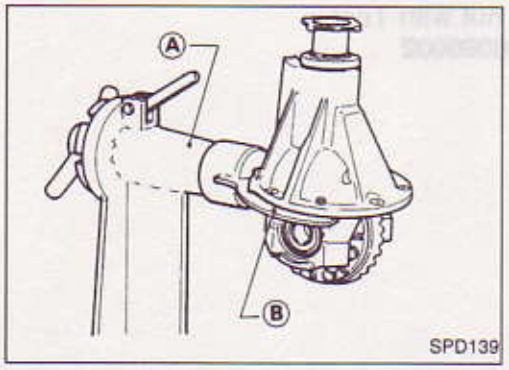



- Tooth contact

Check tooth contact, refering to Adjustment.

- Side gear to pinion mate gear backlash

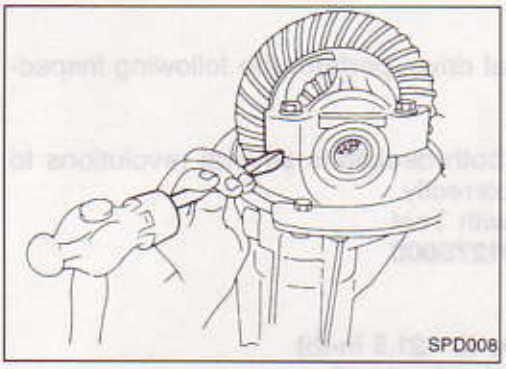
Measure clearance between side gear thrust washer and differential case with a feeler gauge.
**Clearance between side gear thrust washer and differential case:**
**0 - 0.20 mm (0 - 0.0079 in)**




## Differential Carrier

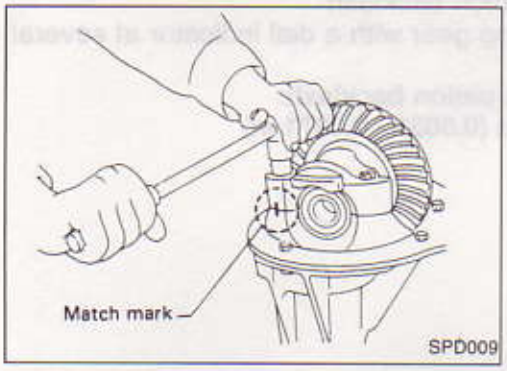
1. Mount differential carrier on Tools.
   **Tool number:**
   **Ⓐ ST0501S000**
   **Ⓑ ST06310000**

## Differential Carrier (Cont'd)

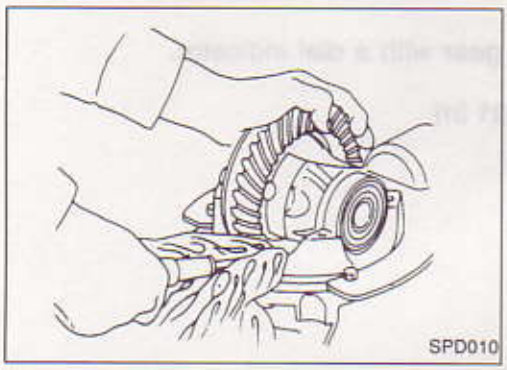



2. Put match marks on one side of side bearing cap with paint or punch to ensure that it is replaced in proper position during reassembly.

**Bearing caps are line-bored during manufacture and should be put back in their original places.**

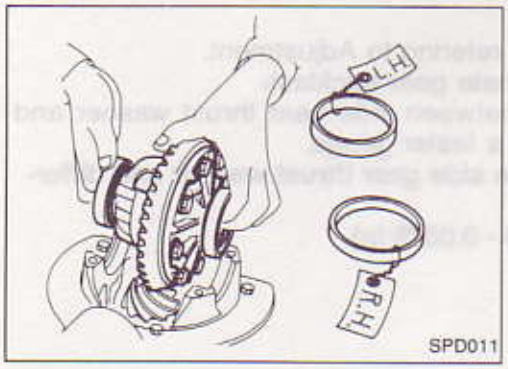


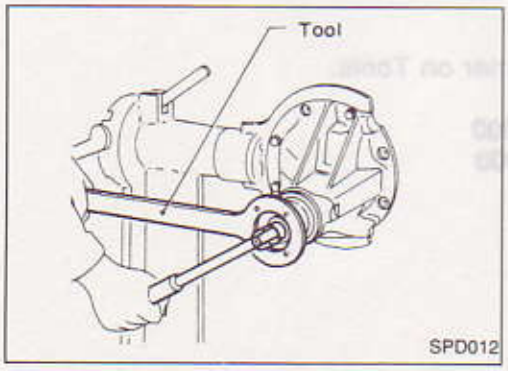

3. Remove side bearing caps.




4. Remove differential case assembly with a pry bar.

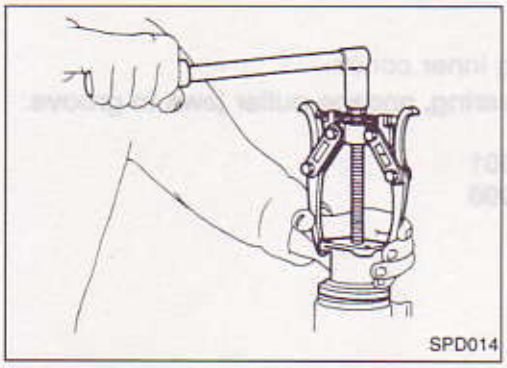
**Be careful to keep the side bearing outer races together with their respective inner cones – do not mix them up.**



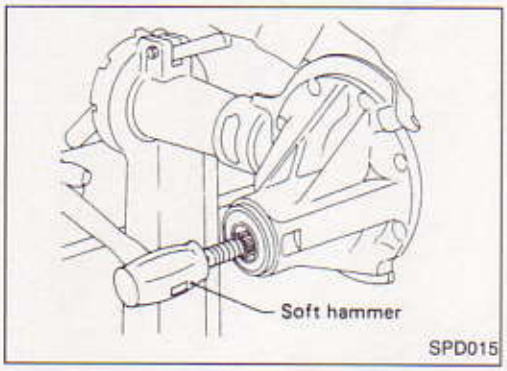




5. Remove drive pinion nut with Tool.
   **Tool number: ST38060002**

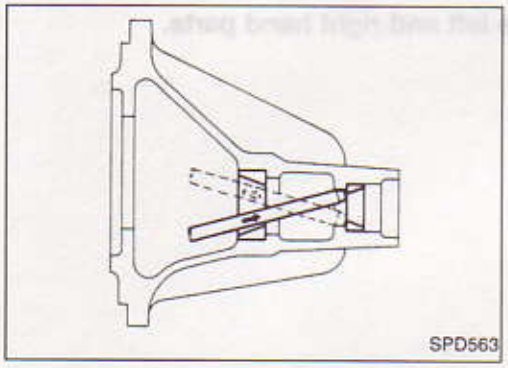
## Differential Carrier (Cont'd)



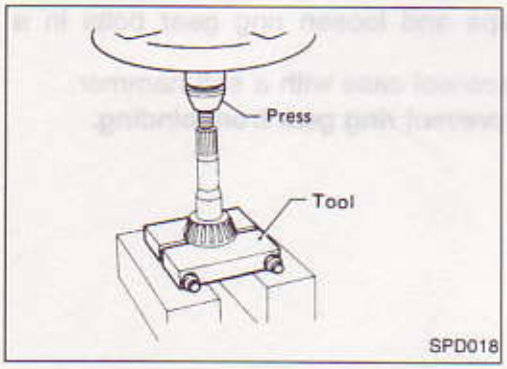

6. Remove companion flange with puller.




7. Remove drive pinion with soft hammer.
8. Remove oil seal.



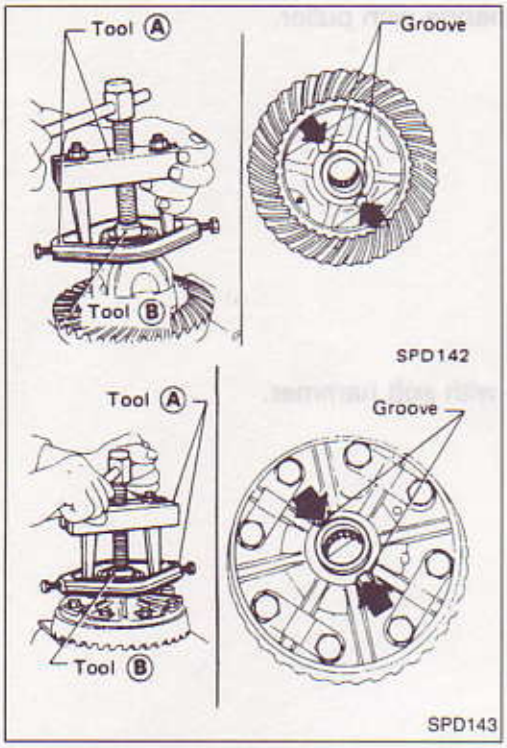

9. Remove pinion bearing outer races with a brass drift.




10. Pull out rear bearing inner cone with a press and Tool.

**Be carefull not to damage cage of bearing.**

**Tool number: SWT30031000**

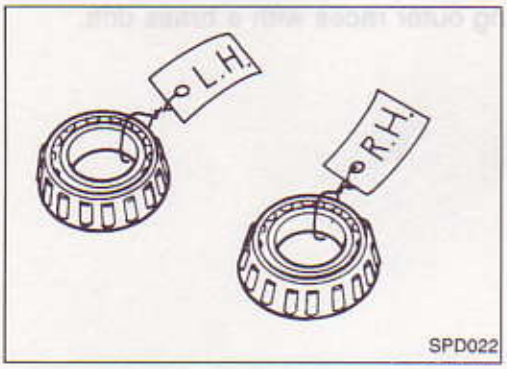



## Differential Case

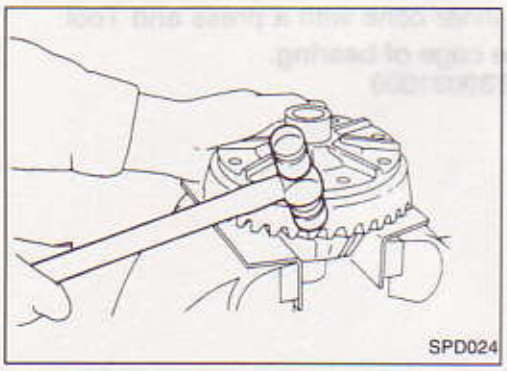
1. Remove side bearing inner cones.

**To prevent damage to bearing, engage puller jaws in groove.**

**Tool number:**
**Ⓐ ST33051001**
**Ⓑ ST33061000**

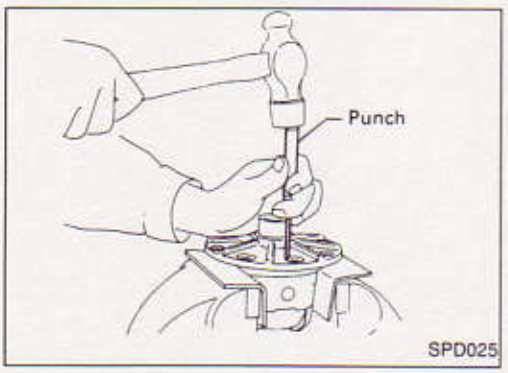



**Be careful not to confuse left and right hand parts.**




2. Spread out lock straps and loosen ring gear bolts in a criss-cross fashion.
3. Tap ring gear off differential case with a soft hammer.

**Tap evenly all around to prevent ring gear from binding.**

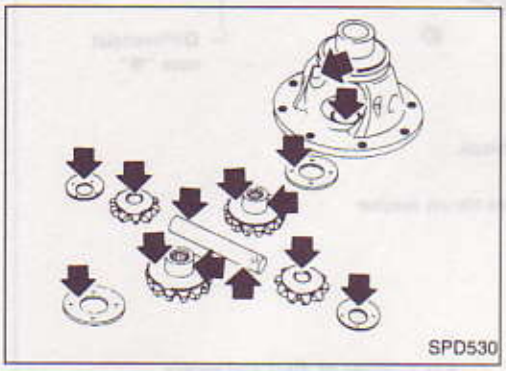



4. Drive out pinion mate shaft lock pin, with Tool from ring gear side.

**Lock pin is caulked at pin hole mouth on differential case.**

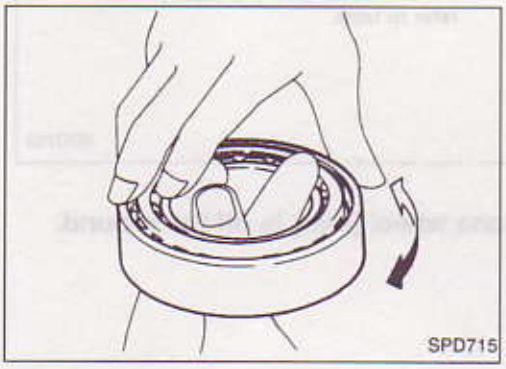
## Ring Gear and Drive Pinion

Check gear teeth for scoring, cracking or chipping.
If any damaged part is evident, replace ring gear and drive pinion as a set (hypoid gear set).


SPD530

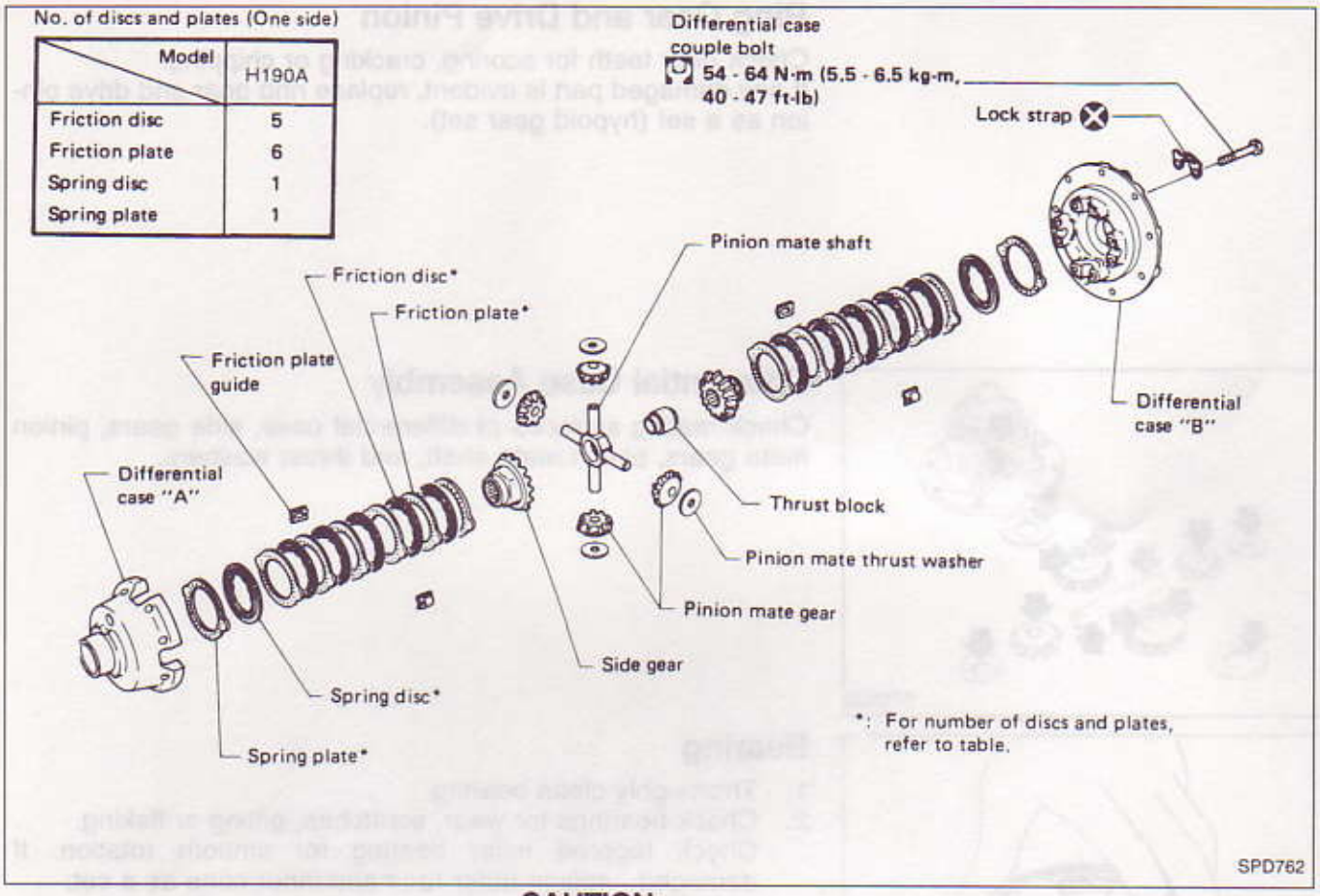
## Differential Case Assembly

Check mating surfaces of differential case, side gears, pinion mate gears, pinion mate shaft, and thrust washers.


SPD715

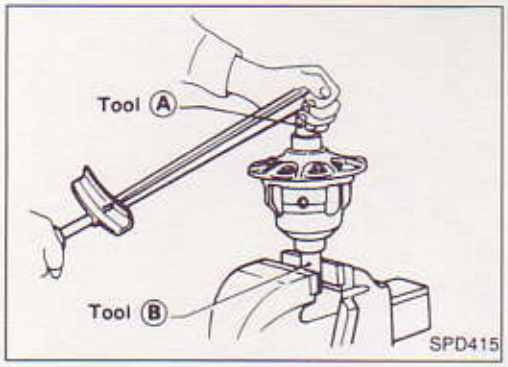
## Bearing

1. Thoroughly clean bearing.
2. Check bearings for wear, scratches, pitting or flaking.
   Check tapered roller bearing for smooth rotation. If damaged, replace outer race and inner cone as a set.




**CAUTION:**

**Do not run engine when one wheel (rear) is off the ground.**

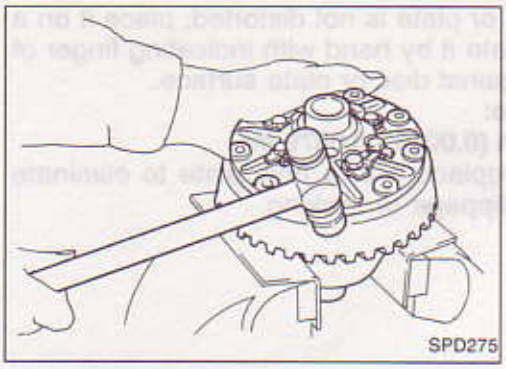



## Preparation for Disassembly

### CHECKING DIFFERENTIAL TORQUE

Measure differential torque with Tool.
If it is not within the specifications, inspect components of limited slip differential.

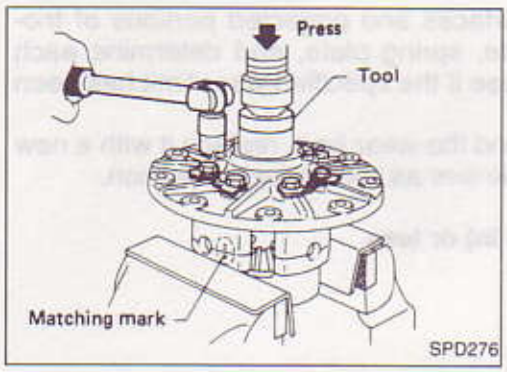
**Differential torque:**
**147 - 196 N·m**
**(15 - 20 kg-m, 108 - 145 ft-lb)**
**Tool number:**
**(A) KV38105210**
**(B) KV38105220**


SPD275

## Disassembly

1. Remove side bearing inner cone with Tool.
2. Remove ring gear by spreading out lock straps.
3. Loosen ring gear bolts in a criss-cross fashion.
4. Tap ring gear off gear case with a soft hammer.

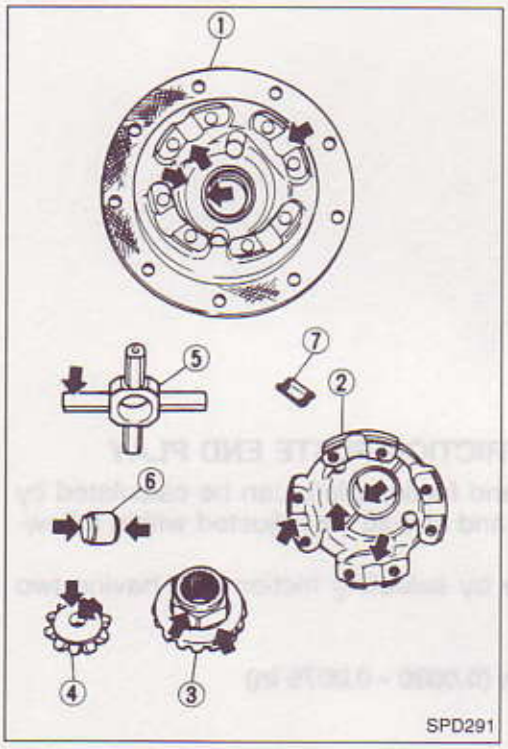
**Tap evenly all around to prevent ring gear from binding.**



SPD276

5. Remove differential case by spreading out lock straps.
6. Remove couple bolts on differential cases A and B with a press.
   **Tool number: ST33081000**
7. Separate differential case A and B.
   Draw out component parts (discs and plates, etc.).

**Put marks on gears and pressure rings so that they can be reinstalled in their original positions from which they were removed.**



SPD291

## Inspection

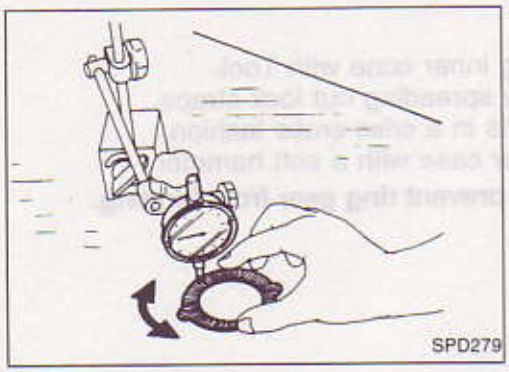
### CONTACT SURFACES

1. Clean the disassembled parts in suitable solvent and blow dry with compressed air.
2. If following surfaces are found with burrs or scratches, smooth with oil stone.
   ① Differential case A
   ② Differential case B
   ③ Side gear
   ④ Pinion mate gear
   ⑤ Pinion mate shaft
   ⑥ Thrust block
   ⑦ Friction plate guide

### DISC AND PLATE

1. Clean the discs and plates in suitable solvent and blow dry with compressed air.
2. Inspect discs and plates for wear, nicks and burrs.

## Inspection (Cont'd)

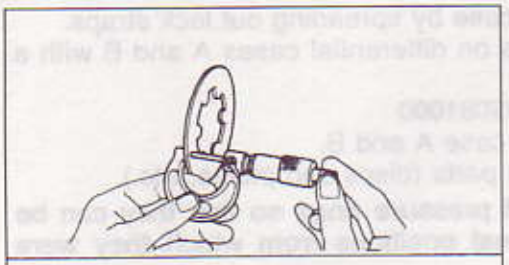

SPD279

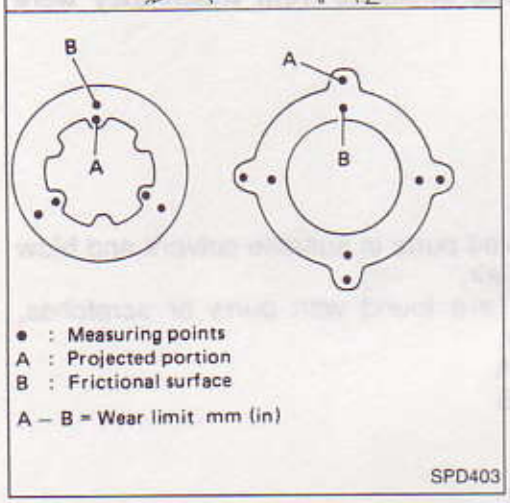
3. To test if friction disc or plate is not distorted, place it on a surface plate and rotate it by hand with indicating finger of dial gauge resting against disc or plate surface.

**Allowable warpage:**

**0.05 - 0.20 mm (0.0020 - 0.0079 in)**

If it exceeds limits, replace with a new plate to eliminate possibility of clutch slippage or sticking.





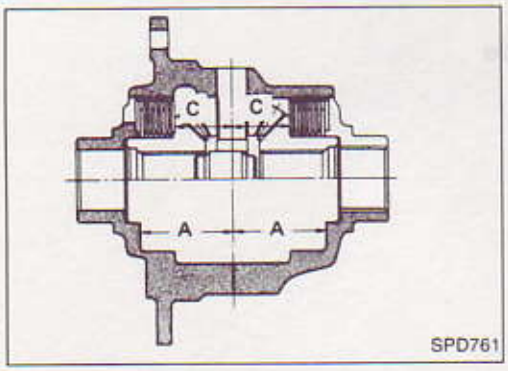
SPD403

4. Measure frictional surfaces and projected portions of friction disc, friction plate, spring plate, and determine each part's differences to see if the specified wear limit has been exceeded.

If any part has worn beyond the wear limit, replace it with a new one that is the same thickness as the projected portion.

**Wear limit:**

**0.1 mm (0.004 in) or less**



SPD761

## Adjustment

### FRICTION DISC AND FRICTION PLATE END PLAY

End play of friction disc and friction plate can be calculated by using following equation and should be adjusted within following range.

Adjustment can be made by selecting friction disc having two different thicknesses.

**End play E:**

**0.05 - 0.20 mm (0.0020 - 0.0079 in)**

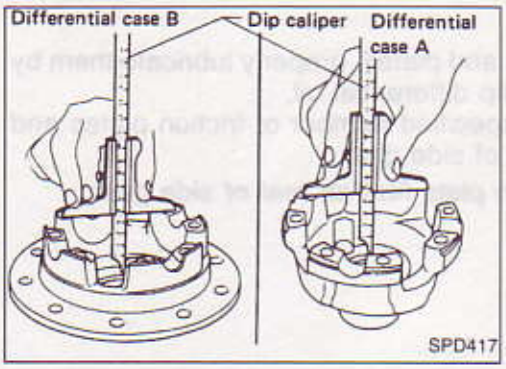
$$E = A - (B + C)$$

A: Length of differential case contact surface to differential case inner bottom.

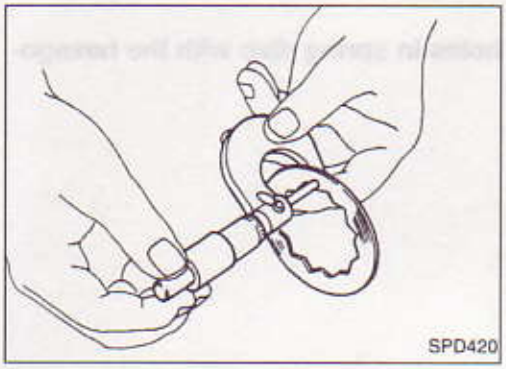
B: Total thickness of friction discs, friction plates, spring disc and spring plate in differential case on one side.

C: Length of differential case contact surface to back side of side gear.

## Adjustment (Cont'd)



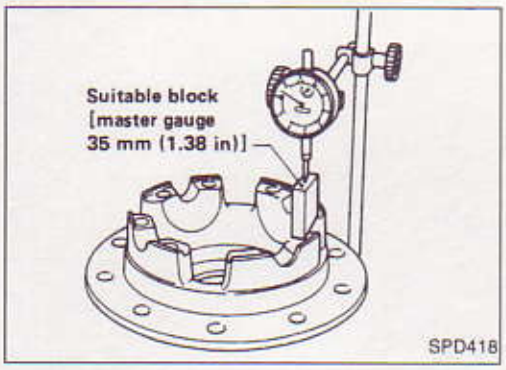

1. Measure values of "A".
   **Standard length A:**
   **45.55 - 45.60 mm (1.7933 - 1.7953 in)**




2. Measure thickness of each disc and plate.
   **Total thickness "B":**
   **10.38 - 10.62 mm (0.4087 - 0.4181 in)**

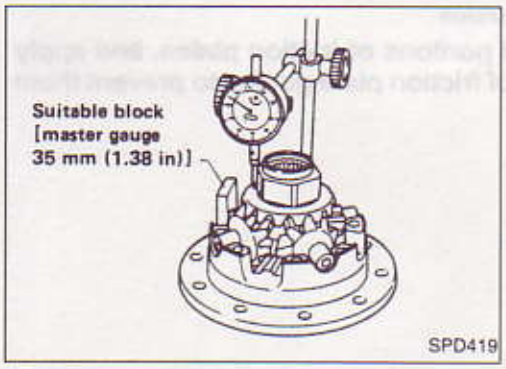
**No. of discs and plates (One side)**

| Model | H190A |
|---|---|
| Friction disc | 2 |
| Friction plate | 2 |
| Spring disc | 1 |
| Spring plate | 1 |




3. Measure values of "C".
(1) Attach a dial indicator to the base plate.
(2) Place differential case B on the base plate, and install a master gauge on case B.

**Then adjust the dial indicator scale to zero with its tip on the master gauge.**




(3) Install pinion mate gears, side gears and pinion mate shaft in differential case B.
(4) Set dial indicator's tip on the side gear, and read the indication.

Example:

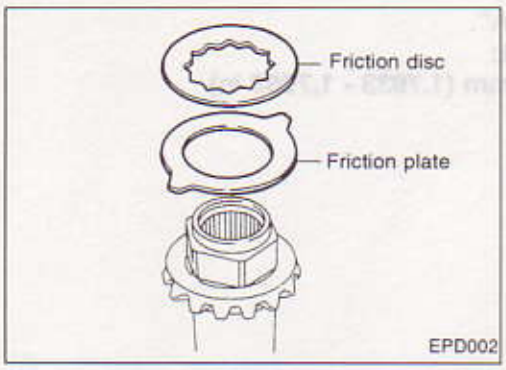
E = A–D
= A–(B + C)
= 0.05 to 0.2 mm
A = 45.58 mm
B = 10.4 mm
C = 34.93 mm
D = B + C

| | |
|---|---|
| B ... | 10.4 |
| + C ... | 34.93 |
| | 45.33 |

E = A–D

| | |
|---|---|
| A ... | 45.58 |
| – D ... | 45.33 |
| | 0.25 |

From the above equation, end play of 0.25 mm exceeds the specified range of 0.05 to 0.2 mm.
Select suitable discs and plates to adjust correctly.

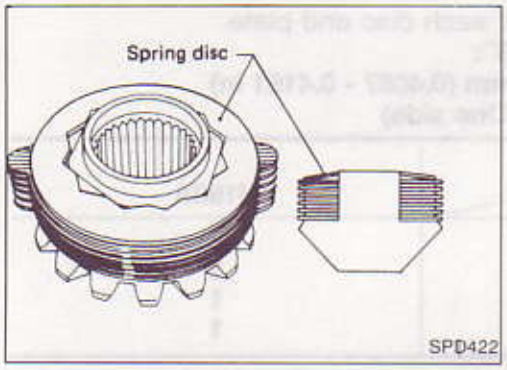



## Assembly

Prior to assembling discs and plates, properly lubricate them by dipping them in limited slip differential oil.

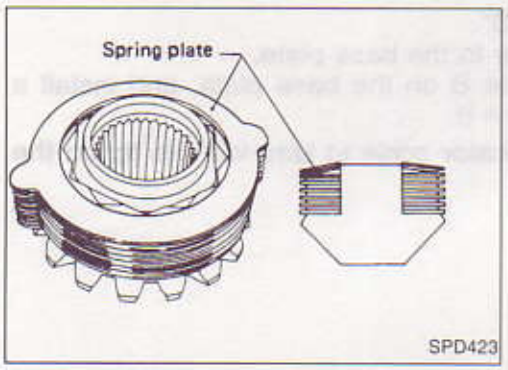
1. Alternately position specified number of friction plates and friction discs on rear of side gear.

**Always position a friction plate first on rear of side gear.**

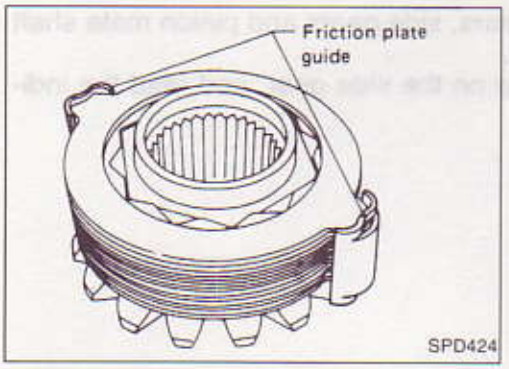



2. Install spring disc.

**Align the twelve angular holes in spring disc with the hexagonal area of the side gear.**

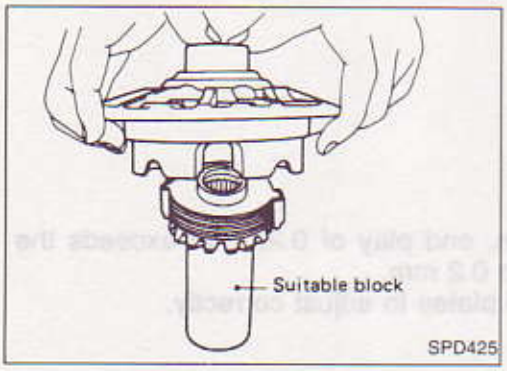



3. Install spring plate.




4. Install friction plate guides.

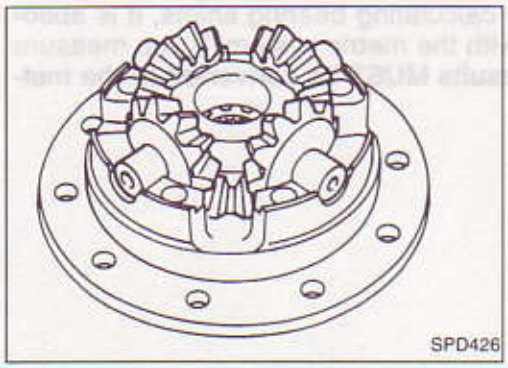
**Correctly align the raised portions of friction plates, and apply grease to inner surfaces of friction plate guides to prevent them from falling.**



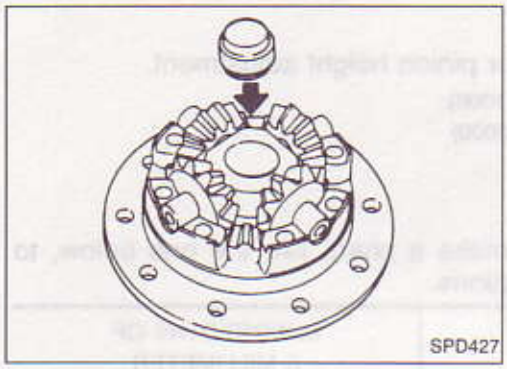

5. Install differential case B over side gear, discs, plates and friction plate guide assembly.

- **Install differential case B while supporting friction plate guides with your middle finger inserted through oil hole in differential case.**
- **Be careful not to detach spring disc from the hexagonal part of the side gear.**

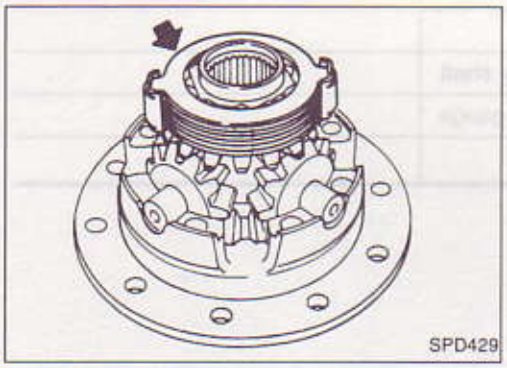
## Assembly (Cont'd)


SPD426

6. Install pinion mate gears and pinion shaft to differential case B.

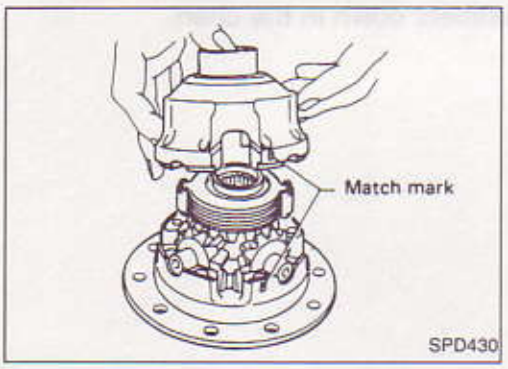

SPD427

7. Install thrust block.


SPD429

8. Install side gear to pinion mate gears.
9. Install each disc and plate.

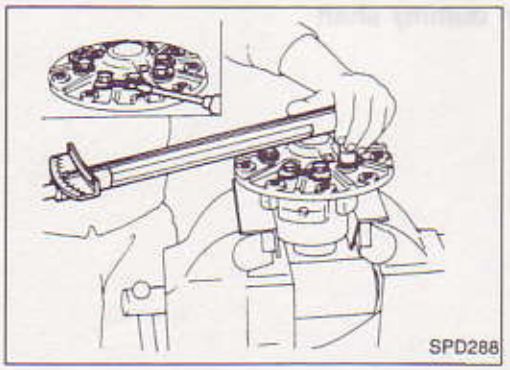
**Use same procedures as outlined in steps 1. through 4. above.**



SPD430

10. Install differential case A.

**Position differential cases A and B by correctly aligning marks stamped on cases.**

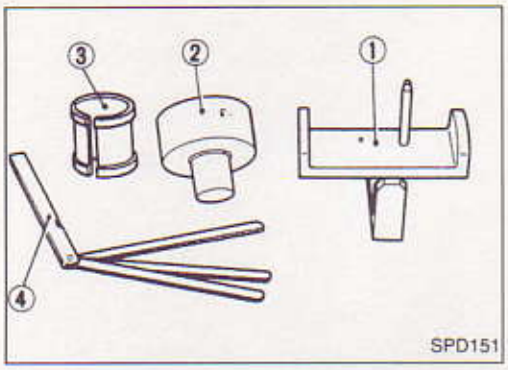

SPD288

11. Tighten differential case bolts.
12. Place ring gear on differential case and install new lock straps and bolts.

**Tighten bolts in a criss-cross fashion, lightly tapping bolt head with a hammer.**
**Then bend up lock straps to lock the bolts in place.**

13. Install side bearing inner cone.
14. Check differential torque.

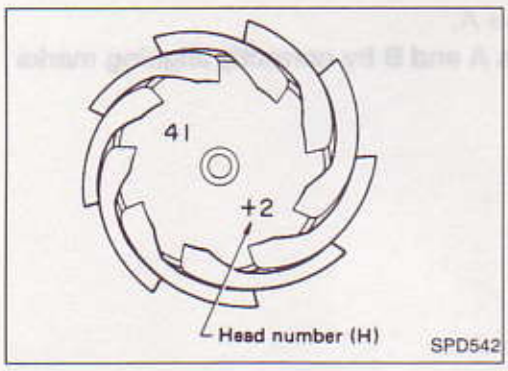
To avoid confusion while calculating bearing shims, it is absolutely necessary to stay with the metric system. If you measure anything in inches, **the results MUST be converted to the metric system.**



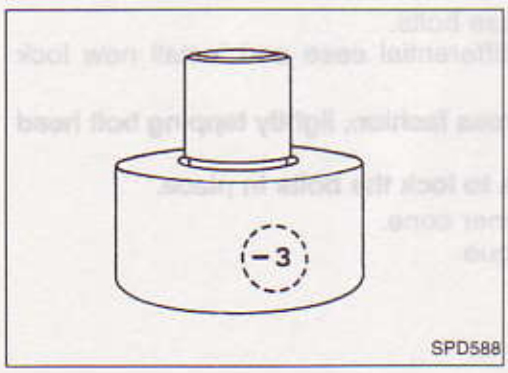

## Drive Pinion Height

1. First prepare Tools for pinion height adjustment.
   - ① Height Gauge (ST31941000)
   - ② Dummy Shaft (ST31942000)
   - ③ Collar (ST31970000)
   - ④ Feeler Gauge
2. To simplify the job, make a chart, like the one below, to organize your calculations.

| LETTERS | HUNDREDTHS OF A MILLIMETER |
|---|---|
| H: Head number | |
| D': Figure marked on dummy shaft | |
| S: Figure marked on height gauge | |
| N: Measuring clearance | |



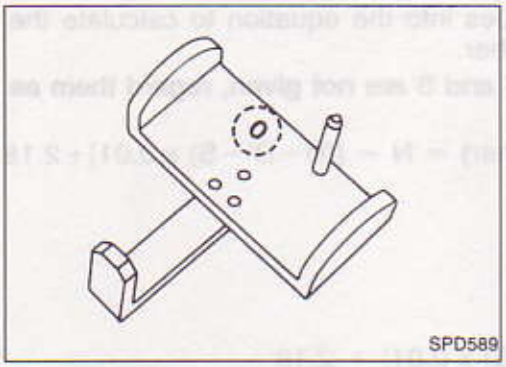

3. Write the following numbers down in the chart.
   H: Head number

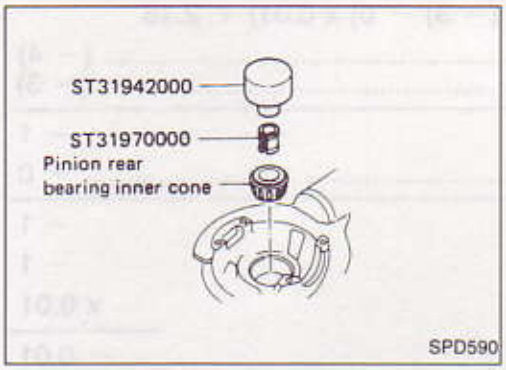



D': Figure marked on dummy shaft

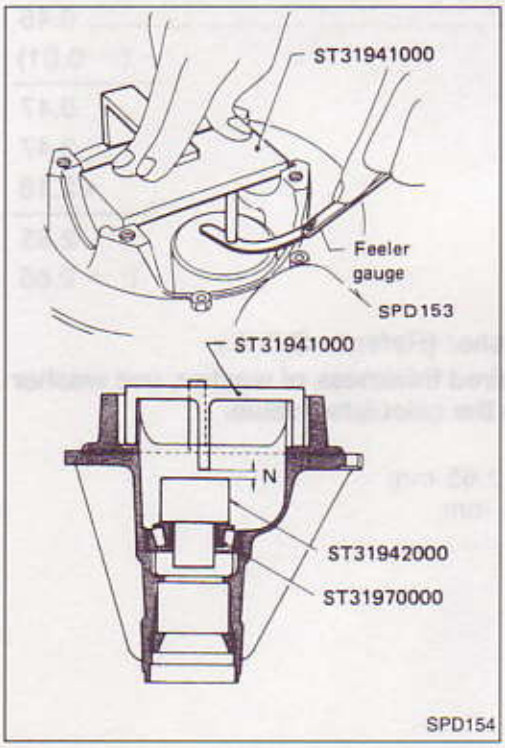
## Drive Pinion Height (Cont'd)

S: Figure marked on height gauge




4. Place pinion rear bearing inner cone and Tools on gear carrier.




5. Attach Tool (Height gauge) to gear carrier, and measure the clearance between the height gauge tip and the dummy shaft face.

## Drive Pinion Height (Cont'd)

6. Substitute these values into the equation to calculate the thickness of the washer.

**If values signifying H, D' and S are not given, regard them as zero and calculate.**

T (Thickness of washer) = N − [(H − D' − S) x 0.01] + 2.18

Example:

N = 0.46
H = −4
D' = −3
S = 0

T = N − [(H − D' − S) x 0.01] + 2.18
= 0.46 − [{(− 4) − (− 3) − 0} x 0.01] + 2.18

(1)
H ..... (− 4)
−D' ..... − (− 3)
− 1
−S ..... − 0
− 1

(2)
− 1
x 0.01
− 0.01

(3)
N ..... 0.46
−(− 0.01)
0.47

(4)
0.47
+2.18
2.65
∴T = 2.65

7. Select the proper washer (Refer to S.D.S.).

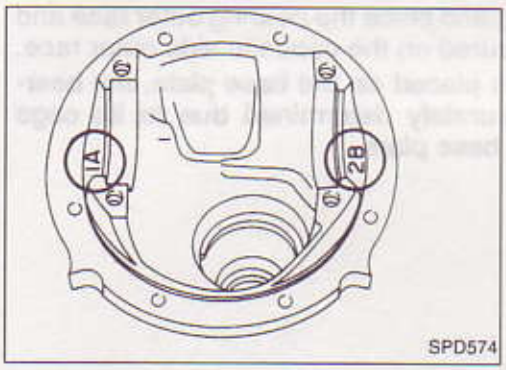
**If you cannot find the desired thickness of washer, use washer with thickness closest to the calculated value.**

Example:
Calculated value ... T = 2.65 mm
Used washer ... T = 2.64 mm

## Side Bearing Preload

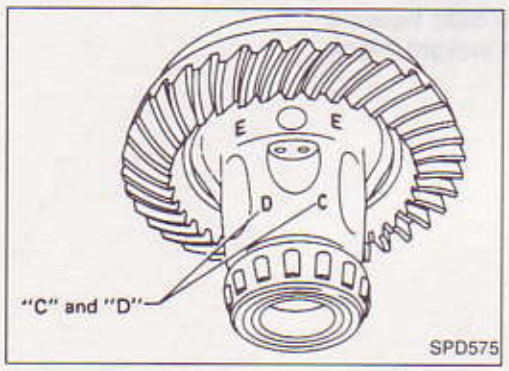
1. To simplify the job, make a chart like the one below to organize your calculations.

| LETTERS | HUNDREDTHS OF A MILLIMETER |
|---|---|
| A - Left housing | |
| B - Right housing | |
| C - Differential case | |
| D - Differential case | |
| E - Left side bearing | |
| F - Right side bearing | |
| H - (+) or (–): ring gear | |



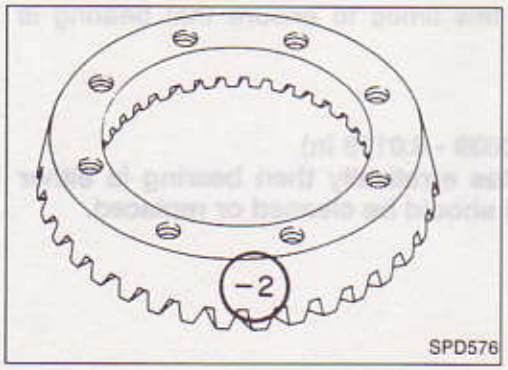
SPD574

2. Write the following numbers down in the chart.
   A & B: Figures marked on gear carrier



SPD575

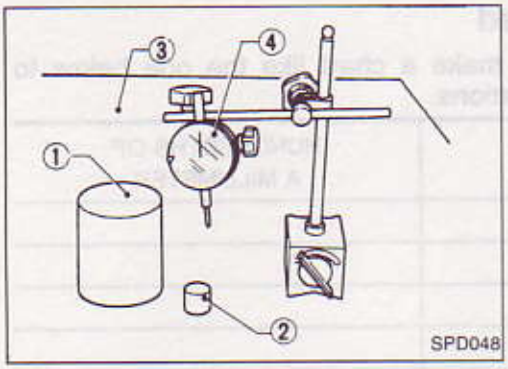
C & D: Figures marked on differential case



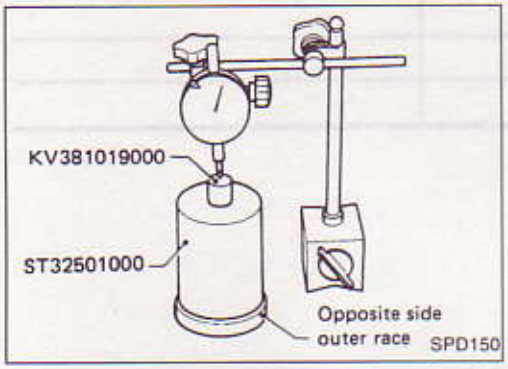
SPD576

H: Figures marked on ring gear

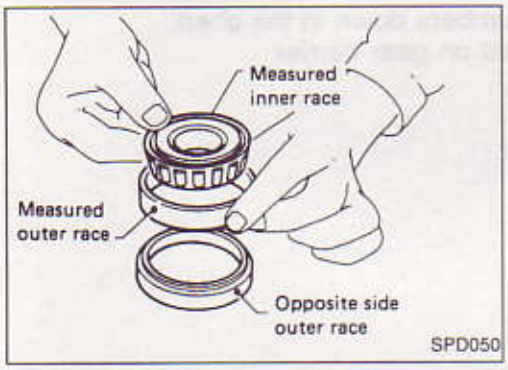
## Side Bearing Preload (Cont'd)




3. Measure how far under the standard thickness [20 mm (0.79 in)] the side bearings are.
   It will require tools shown in the illustration at left.
   ① Weight Block (ST32501000)
   ② Master Gauge (KV38101900)
   ③ Base Plate
   ④ Dial Indicator

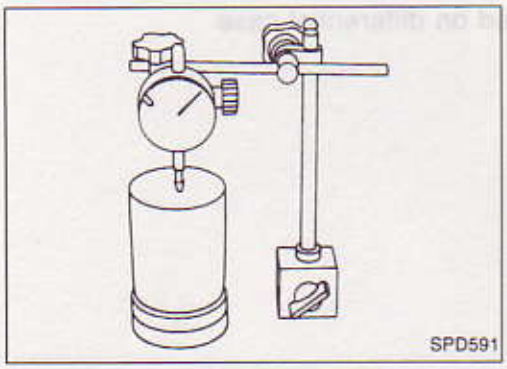



4. Place the outer race of the opposite side bearing to be measured.
5. Place a weight block on that outer race, and a master gauge on that block.
6. Adjust dial indicator scale to zero.
7. Carefully slide master gauge and weight block out from under dial indicator.

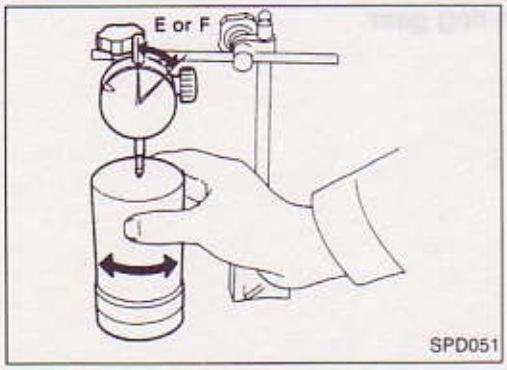



8. Lubricate side bearing and place the bearing outer race and inner race to be measured on the opposite side outer race.

**If the bearing assembly is placed on the base plate, the bearing width cannot be accurately determined due to its cage being in contact with the base plate.**




9. Place weight block on side bearing.
10. Slide dial indicator on weight block.




11. Turn weight block a few times to ensure that bearing is properly seated.
12. Read dial indicator.

- **Normal indication:**
  **0.10 - 0.30 mm (0.0039 - 0.0118 in)**
- **If the needle fluctuates erratically then bearing is either dirty or defective and should be cleaned or replaced.**

## Side Bearing Preload (Cont'd)

13. Measure both bearings in the same way and write the left side bearing measurement next to "E" and the right side bearing measurement next to "F".
14. Substitute these values into the equation to calculate the thickness of the shim.

**If values signifying A, B, C, D and H' are not given, regard them as zero and calculate.**

**Ring gear with "+":**

**Left side:**

$$T_1 = (A - C + D - H') \times 0.01 + 0.175 + E$$

**Right side:**

$$T_2 = (B - D + H') \times 0.01 + 0.15 + F$$

**Ring gear with "−":**

**Left side:**

$$T_1 = (A - C + D + H') \times 0.01 + 0.175 + E$$

**Right side:**

$$T_2 = (B - D - H') \times 0.01 + 0.150 + F$$

Example:

A = 1
B = 2
C = 2
D = 3
H = −2
E = 0.11
F = 0.18

Left side

$T_1 = (A - C + D + H') \times 0.01 + 0.175 + E$
$= [1 - 2 + 3 + (-2)] \times 0.01 + 0.175 + 0.11$

(1) A ..... 1
− C ..... −2
−1
+ D ..... +3
2
− H' ..... +(−2)
0
(2) 0
0
x 0.01
0.00
(3) 0.00
0.00
+0.175
0.175
(4) 0.175
+ E ..... +0.11
0.285

$\therefore T_1 = 0.285$ mm

Right side

$T_2 = (B - D - H') \times 0.01 + 0.15 + F$
$= [2 - 3 - (-2)] \times 0.01 + 0.15 + 0.18$

(1) B ..... 2
− D ..... −3
−1
+ H' ..... −(−2)
+1
(2) +1
x 0.01
+0.01
(3) +0.01
+0.15
0.16
(4) 0.16
+ F ..... +0.18
0.34

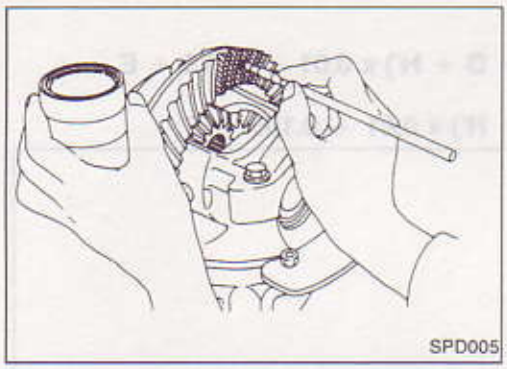
$\therefore T_2 = 0.34$ mm

15. Select the proper shims (Refer to S.D.S.).

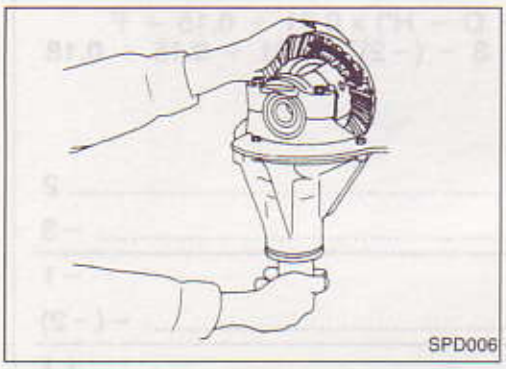
**If you cannot find the desired thickness of shims, use shims with the total thickness closest to the calculated value.**

## Tooth Contact

Checking of gear tooth contact pattern is necessary to verify correct relationship between ring gear and drive pinion.
Hypoid gear set which are not positioned properly in relation to one another may be noisy, or have short life or both. With the checking of gear tooth contact pattern, the most desirable contact for low noise level and long life can be assured.

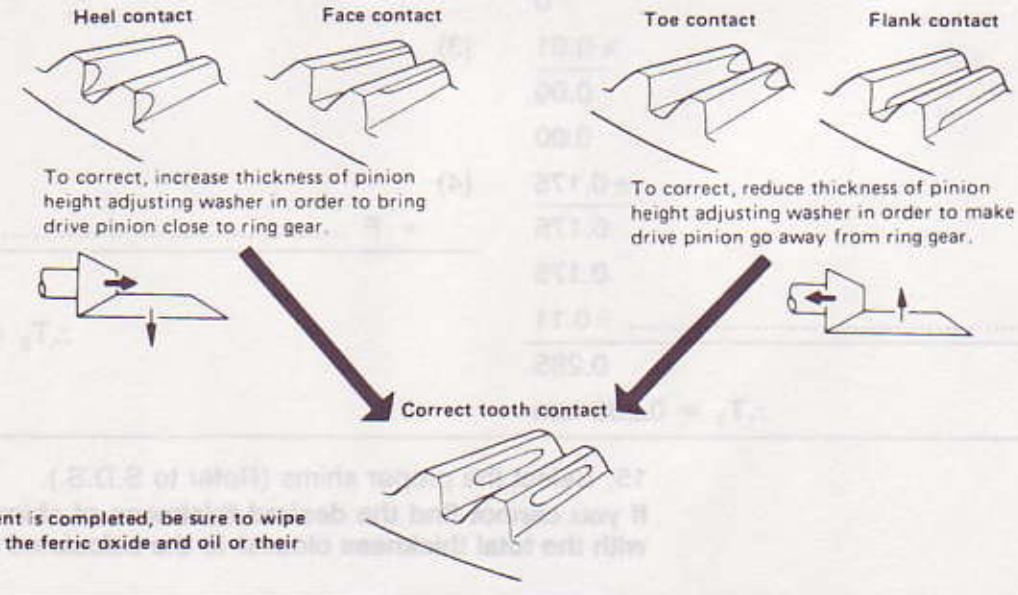

SPD005

1. Thoroughly clean ring gear and drive pinion teeth.
2. Sparingly apply a mixture of powdered ferric oxide and oil or equivalent to 3 or 4 teeth of ring gear drive side.


SPD006

3. Hold companion flange steady by hand and rotate the ring gear in both directions.

**Usually the pattern will be correct if you have calculated the shims correctly and the backlash is correct.**
**However, in rare cases you may have to use trial-and-error processes until you get a good tooth contact pattern.**
**The tooth pattern is the best indication of how well a differential has been set up.**




**When adjustment is completed, be sure to wipe off completely the ferric oxide and oil or their equivalent.**

SPD007

## Side Bearing Preload (Cont'd)

13. Measure both bearings in the same way and write the left side bearing measurement next to "E" and the right side bearing measurement next to "F".
14. Substitute these values into the equation to calculate the thickness of the shim.

**If values signifying A, B, C, D and H' are not given, regard them as zero and calculate.**

**Ring gear with "+":**

**Left side:**

$$T_1 = (A - C + D - H') \times 0.01 + 0.175 + E$$

**Right side:**

$$T_2 = (B - D + H') \times 0.01 + 0.15 + F$$

**Ring gear with "−":**

**Left side:**

$$T_1 = (A - C + D + H') \times 0.01 + 0.175 + E$$

**Right side:**

$$T_2 = (B - D - H') \times 0.01 + 0.150 + F$$

Example:

A = 1
B = 2
C = 2
D = 3
H = −2
E = 0.11
F = 0.18

Left side

$T_1 = (A - C + D + H') \times 0.01 + 0.175 + E$
$= [1 - 2 + 3 + (-2)] \times 0.01 + 0.175 + 0.11$

(1) A ..... 1
− C ..... −2
−1
+ D ..... +3
2
− H' ..... +(−2)
0
(2) 0
0
x 0.01
0.00
(3) 0.00
+0.175
0.175
(4) 0.175
+ E ..... +0.11
0.285

$\therefore T_1 = 0.285$ mm

Right side

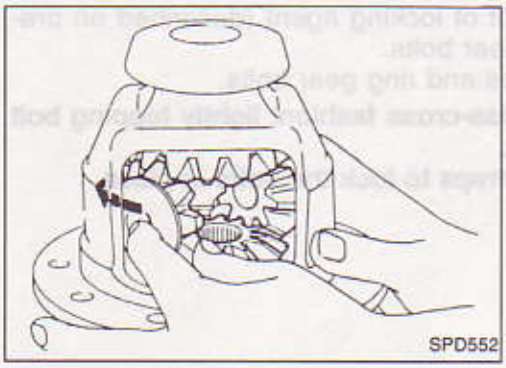
$T_2 = (B - D - H') \times 0.01 + 0.15 + F$
$= [2 - 3 - (-2)] \times 0.01 + 0.15 + 0.18$

(1) B ..... 2
− D ..... −3
−1
+ H' ..... −(−2)
+1
(2) +1
x 0.01
+0.01
(3) +0.01
+0.15
0.16
(4) 0.16
+ F ..... +0.18
0.34

$\therefore T_2 = 0.34$ mm

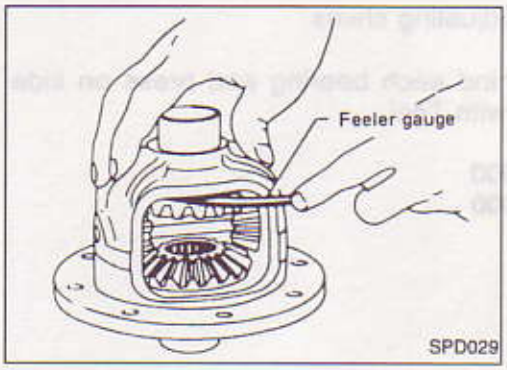
15. Select the proper shims (Refer to S.D.S.).

**If you cannot find the desired thickness of shims, use shims with the total thickness closest to the calculated value.**


SPD552

## Differential Case

1. Install side gears, pinion mate gears and thrust washers into differential case.

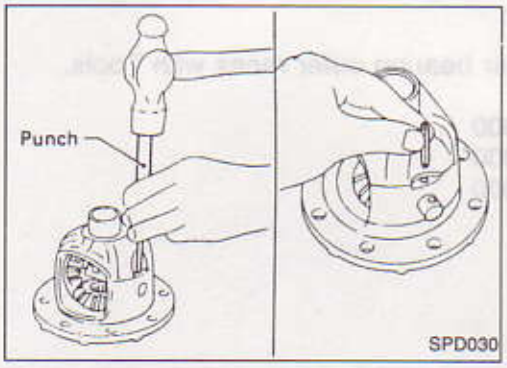


SPD029

2. Fit pinion mate shaft to differential case so that it meets lock pin holes.
3. Adjust backlash between side gear and pinion mate gear by selecting side gear thrust washer (Refer to S.D.S.).

**Backlash between side gear and pinion mate gear (Clearance between side gear thrust washer and differential case)**

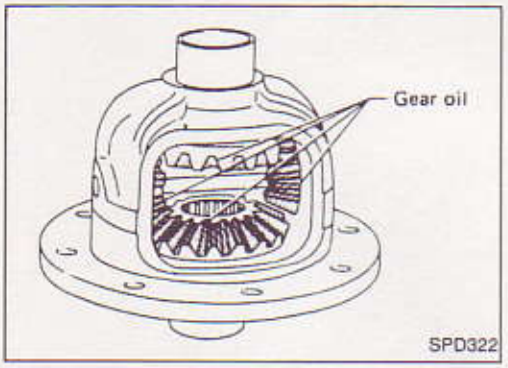
**0 - 0.20 mm (0 - 0.0079 in)**



SPD030

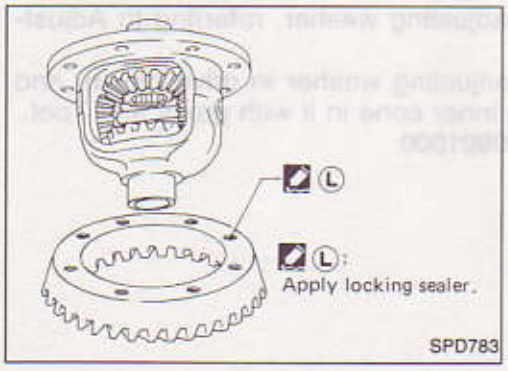
4. Install pinion mate shaft lock pin with a punch.

**Make sure lock pin is flush with case.**



SPD322

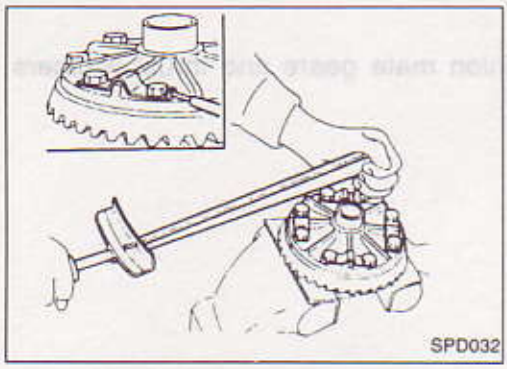
5. Apply gear oil to gear tooth surfaces and thrust surfaces and check to see they turn properly.



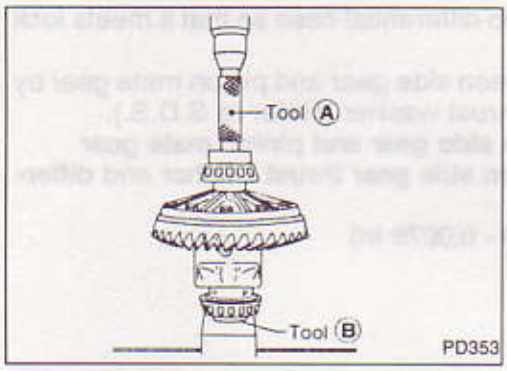
SPD783

6. Apply locking agent [Locktite (stud lock) or equivalent] to contacting surfaces of ring gear and differential case, then place differential case on ring gear.

## Differential Case (Cont'd)

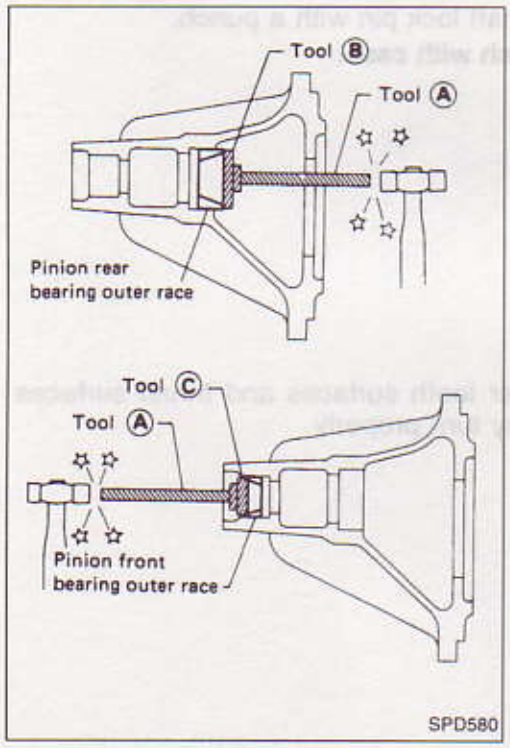



7. Apply a small amount of locking agent (described on previous page) to ring gear bolts.
8. Install new lock straps and ring gear bolts.
   - **Tighten bolts in a criss-cross fashion, lightly tapping bolt head with a hammer.**
   - **Then bend up lock straps to lock the bolts in place.**

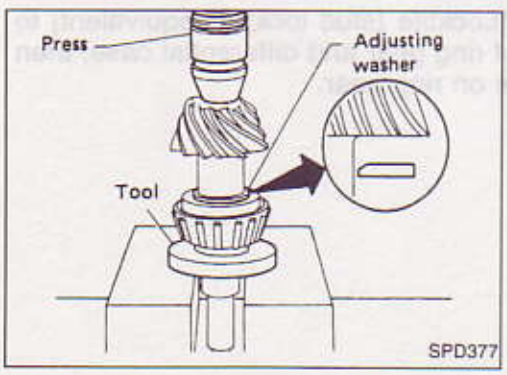



9. Select side bearing adjusting shims.
   Refer to Adjustment.
10. Install the shims behind each bearing and press on side bearing inner cones with Tool.
    **Tool number:**
    **(A) ST33230000**
    **(B) ST33061000**

## Differential Carrier

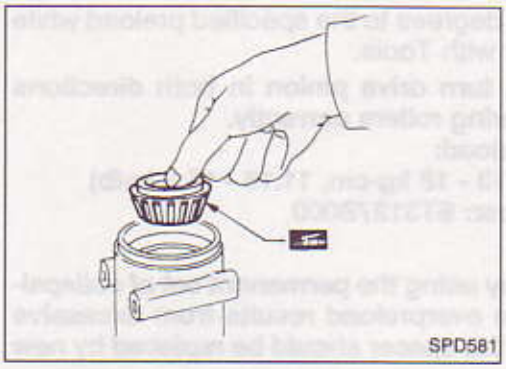



1. Press fit front and rear bearing outer races with Tools.
   **Tool number:**
   **(A) ST30611000**
   **(B) ST30621000**
   **(C) ST30613000**

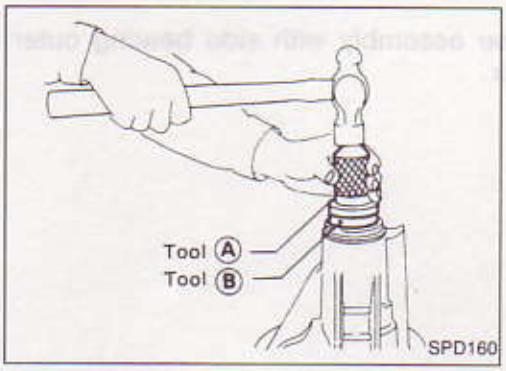



2. Select pinion height adjusting washer, referring to Adjustment.
3. Install pinion height adjusting washer in drive pinion, and press fit rear bearing inner cone in it with press and Tool.
   **Tool number: ST30901000**

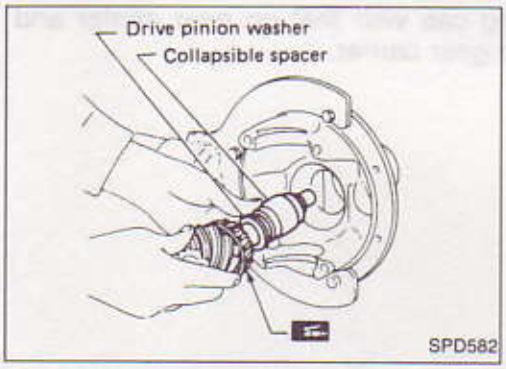
## Differential Carrier (Cont'd)



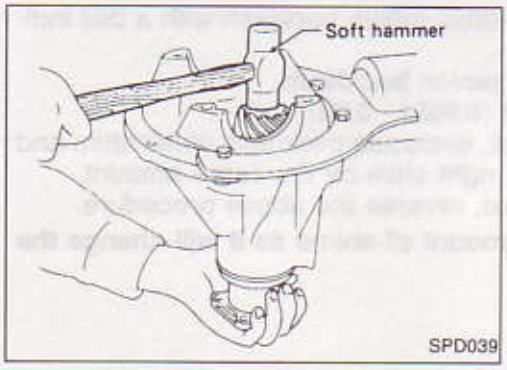

4. Place pinion front bearing inner cone in gear carrier.



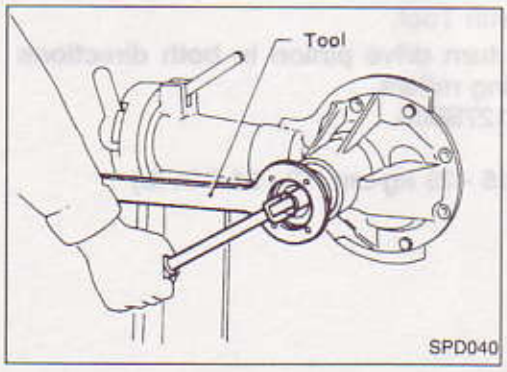

5. Apply multi-purpose grease to cavity at sealing lips of oil seal.
   Install front oil seal.
   **Tool number:**
   **(A) ST30720000**
   **(B) KV38102510**




6. Install drive pinion washer, collapsible spacer and drive pinion in gear carrier.

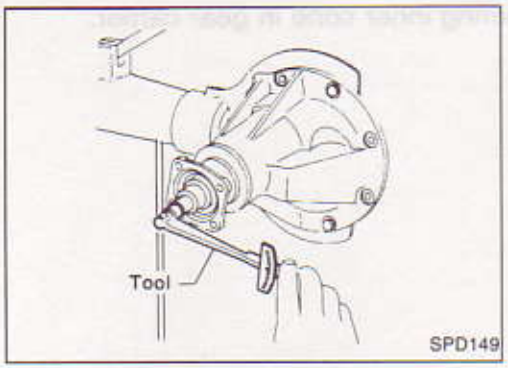



7. Install companion flange and hold it firmly.
   Insert pinion into companion flange by tapping its head with a soft hammer.




8. Temporarily tighten pinion nut until there is no axial play.
   **The threaded portion of drive pinion and pinion nut should be free from oil or grease.**
   **Tool number: ST38060002**

## Differential Carrier (Cont'd)



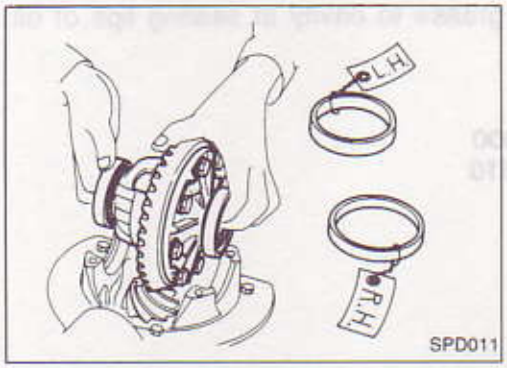

9. Tighten pinion nut by degrees to the specified preload while checking the preload with Tools.

**When checking preload, turn drive pinion in both directions several times to seat bearing rollers correctly.**

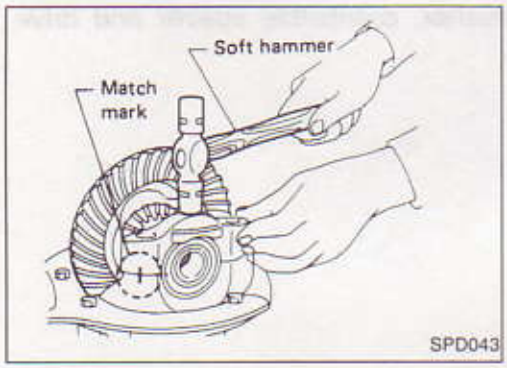
**Pinion bearing preload:**
**1.2 - 1.7 N·m (13 - 18 kg-cm, 11.15 - 15.3 in-lb)**
**Tool number: ST3127S000**

**CAUTION:**

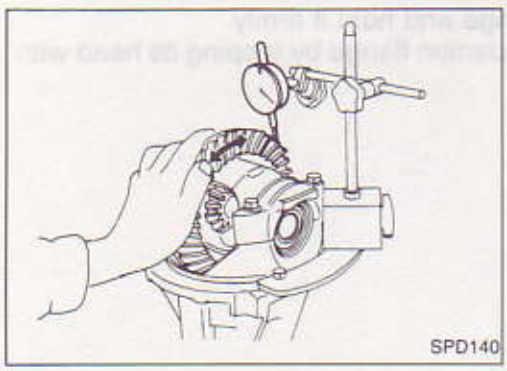
**The preload is achieved by using the permanent set of collapsible spacer. So here, if an overpreload results from excessive turning of the pinion nut, the spacer should be replaced by new one.**




10. Install differential case assembly with side bearing outer races into gear carrier.




11. Align mark on bearing cap with that on gear carrier and install bearing cap on gear carrier.

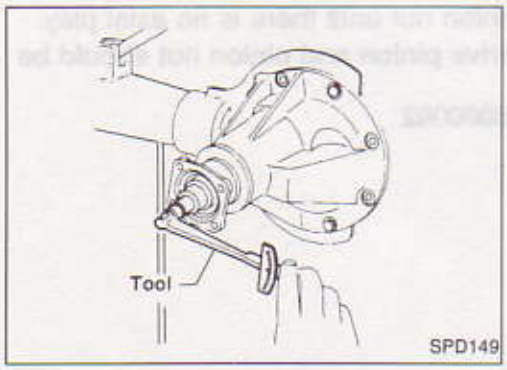



12. Measure ring gear-to-drive pinion backlash with a dial indicator.

**Ring gear-to-drive pinion backlash:**
**0.13 - 0.18 mm (0.0051 - 0.0071 in)**

- If backlash is too small, decrease thickness of left shim and increase thickness of right shim by the same amount.
- If backlash is too great, reverse the above procedure.

**Never change the total amount of shims as it will change the bearing preload.**

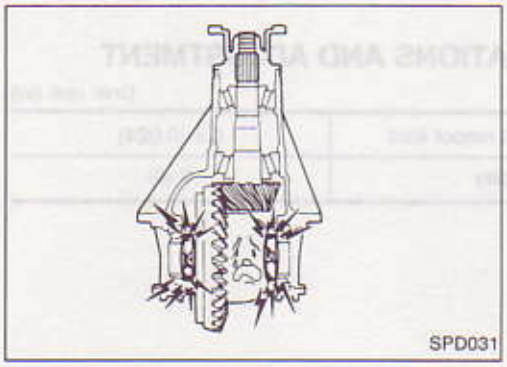



13. Check total preload with Tool.

**When checking preload, turn drive pinion in both directions several times to set bearing rollers.**

**Tool number: ST3127S000**
**Total preload:**
**1.4 - 2.4 N·m (15 - 25 kg-cm, 13 - 21.5 in-lb)**

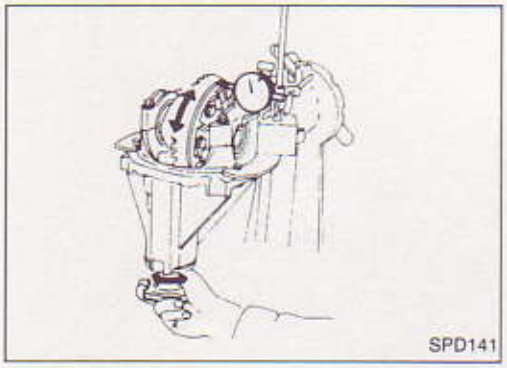
## Differential Carrier (Cont'd)


SPD031

- If preload is too great, remove the same amount of shims from each side.
- If preload is too small, add the same amount of shims to each side.

**Never add or remove a different number of shims for each side as it will change ring gear-to-drive pinion backlash.**

14. Recheck ring gear-to-drive pinion backlash because an increase or decrease in thickness of shims will cause change of ring gear-to-drive pinion backlash.


SPD141

15. Check runout of ring gear with a dial indicator.
    **Runout limit: 0.08 mm (0.0031 in)**
- If backlash varies excessively in different places, the variance may have resulted from foreign matter caught between the ring gear and the differential case.
- If the backlash varies greatly when the runout of the ring gear is within a specified range, the hypoid gear set or differential case should be replaced.

16. Check tooth contact.
    Refer to Adjustment.

# Propeller Shaft

## GENERAL SPECIFICATIONS

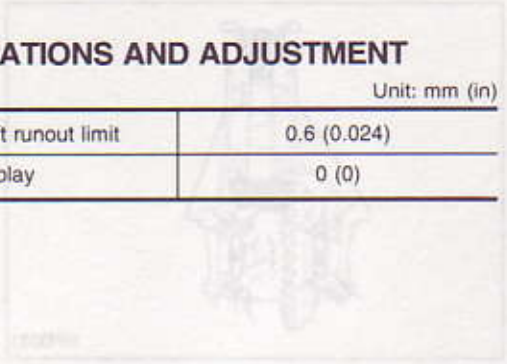
Unit: mm (in)

| | |
|---|---|
| Propeller shaft model | 2S63A |
| Number of joints | 2 |
| Coupling method with transmission | Sleeve type |
| Type of journal bearings | Shell type (Non-disassembly type) |
| Shaft length (Spider to spider) | |
| SR20DE, LD20-II | 545 (22.63) |
| GA16DE | 575 (22.63) |
| Shaft outer diameter | 75.0 (2.953) |

## SPECIFICATIONS AND ADJUSTMENT

Unit: mm (in)

| | |
|---|---|
| Propeller shaft runout limit | 0.6 (0.024) |
| Journal axial play | 0 (0) |





# Final Drive

## GENERAL SPECIFICATIONS

| Engine | GA16DE | LD20-II | SR20DE |
|---|---|---|---|
| Final drive model | H190A/H190A (LSD)* | | R200V |
| Ring gear pitch diameter mm (in) | 193 (7.59) | | 205 (8.07) |
| Gear ratio | 4.636 | 4.363 | |
| Number of teeth (Ring gear/Drive pinion) | 51/11 | 48/11 | |
| Oil capacity (approx.) ℓ (Imp pt) | 1.5 (2-5/8) | | 1.3 (2-1/4) |
| Number of pinion gears | 4 | | 4 |
| Side bearing spacer location | Left | | |

* Option

## INSPECTION AND ADJUSTMENT (R200V)

### Ring gear runout

| | |
|---|---|
| Ring gear runout limit mm (in) | 0.05 (0.0020) |

### Side gear adjustment

| | |
|---|---|
| Clearance between side gear and differential case mm (in) | 0.03 - 0.09 (0.0012 - 0.0035) |

## Final Drive (Cont'd)

**Available side gear thrust washers**

| Thickness mm (in) | Part number |
|---|---|
| 0.80 (0.0315) | 38424-40F60 |
| 0.83 (0.0327) | 38424-40F61 |
| 0.86 (0.0339) | 38424-40F62 |
| 0.89 (0.0350) | 38424-40F63 |
| 0.92 (0.0362) | 38424-40F64 |
| 0.95 (0.0374) | 38424-40F65 |
| 0.98 (0.0386) | 38424-40F66 |
| 1.01 (0.0398) | 38424-40F67 |
| 1.04 (0.0409) | 38424-40F68 |
| 1.07 (0.0421) | 38424-40F69 |
| 1.10 (0.0433) | 38424-40F70 |
| 1.13 (0.0445) | 38424-40F71 |
| 1.16 (0.0457) | 38424-40F72 |
| 1.19 (0.0469) | 38424-40F73 |
| 1.22 (0.0480) | 38424-40F74 |
| 1.25 (0.0492) | 38424-40F75 |
| 1.28 (0.0504) | 38424-40F76 |
| 1.31 (0.0516) | 38424-40F77 |
| 1.34 (0.0528) | 38424-40F78 |
| 1.37 (0.0539) | 38424-40F79 |
| 1.40 (0.0551) | 38424-40F80 |
| 1.43 (0.0563) | 38424-40F81 |
| 1.46 (0.0575) | 38424-40F82 |
| 1.49 (0.0587) | 38424-40F83 |

### Drive pinion height adjustment

**Available pinion height adjusting washers**

| Thickness mm (in) | Part number |
|---|---|
| 3.09 (0.1217) | 38154-P6017 |
| 3.12 (0.1228) | 38154-P6018 |
| 3.15 (0.1240) | 38154-P6019 |
| 3.18 (0.1252) | 38154-P6020 |
| 3.21 (0.1264) | 38154-P6021 |
| 3.24 (0.1276) | 38154-P6022 |
| 3.27 (0.1287) | 38154-P6023 |
| 3.30 (0.1299) | 38154-P6024 |
| 3.33 (0.1311) | 38154-P6025 |
| 3.36 (0.1323) | 38154-P6026 |
| 3.39 (0.1335) | 38154-P6027 |
| 3.42 (0.1346) | 38154-P6028 |
| 3.45 (0.1358) | 38154-P6029 |
| 3.48 (0.1370) | 38154-P6030 |
| 3.51 (0.1382) | 38154-P6031 |
| 3.54 (0.1394) | 38154-P6032 |
| 3.57 (0.1406) | 38154-P6033 |
| 3.60 (0.1417) | 38154-P6034 |
| 3.63 (0.1429) | 38154-P6035 |
| 3.66 (0.1441) | 38154-P6036 |

### Drive pinion preload adjustment

| | |
|---|---|
| Drive pinion bearing adjusting method | Pinion bearing adjusting washer and spacer |
| Drive pinion preload with front oil seal N·m (kg-cm, in-lb) | 1.1 - 1.7 (11 - 17, 9.5 - 14.7) |

**Available drive pinion bearing preload adjusting washers**

| Thickness mm (in) | Part number |
|---|---|
| 3.80 - 3.82 (0.1496 - 0.1504) | 38125-61001 |
| 3.82 - 3.84 (0.1504 - 0.1512) | 38126-61001 |
| 3.84 - 3.86 (0.1512 - 0.1520) | 38127-61001 |
| 3.86 - 3.88 (0.1520 - 0.1528) | 38128-61001 |
| 3.88 - 3.90 (0.1528 - 0.1535) | 38129-61001 |
| 3.90 - 3.92 (0.1535 - 0.1543) | 38130-61001 |
| 3.92 - 3.94 (0.1543 - 0.1551) | 38131-61001 |
| 3.94 - 3.96 (0.1551 - 0.1559) | 38132-61001 |
| 3.96 - 3.98 (0.1559 - 0.1567) | 38133-61001 |
| 3.98 - 4.00 (0.1567 - 0.1575) | 38134-61001 |
| 4.00 - 4.02 (0.1575 - 0.1583) | 38135-61001 |
| 4.02 - 4.04 (0.1583 - 0.1591) | 38136-61001 |
| 4.04 - 4.06 (0.1591 - 0.1598) | 38137-61001 |
| 4.06 - 4.08 (0.1598 - 0.1606) | 38138-61001 |
| 4.08 - 4.10 (0.1606 - 0.1614) | 38139-61001 |

**Available drive pinion bearing preload adjusting spacers**

| Length mm (in) | Part number |
|---|---|
| 54.50 (2.1457) | 38165-B4000 |
| 54.80 (2.1575) | 38165-B4001 |
| 55.10 (2.1693) | 38165-B4002 |
| 55.40 (2.1811) | 38165-B4003 |
| 55.70 (2.1929) | 38165-B4004 |
| 56.00 (2.2047) | 38165-61001 |

### Total preload adjustment

| | |
|---|---|
| Drive pinion to ring gear backlash mm (in) | 0.13 - 0.18 (0.0039 - 0.0059) |
| Total preload N·m (kg-cm, in-lb) | 1.5 - 2.4 (16 - 25, 13 - 21.5) |

**Available side bearing adjusting washers**

| Thickness mm (in) | Part number |
|---|---|
| 2.00 (0.0787) | 38453-G9500 |
| 2.05 (0.0807) | 38453-G9501 |
| 2.10 (0.0827) | 38453-G9502 |
| 2.15 (0.0846) | 38453-G9503 |
| 2.20 (0.0866) | 38453-G9504 |
| 2.25 (0.0886) | 38453-G9505 |
| 2.30 (0.0906) | 38453-G9506 |
| 2.35 (0.0925) | 38453-G9507 |
| 2.40 (0.0945) | 38453-G9508 |
| 2.45 (0.0965) | 38453-G9509 |
| 2.50 (0.0984) | 38453-G9510 |
| 2.55 (0.1004) | 38453-G9511 |
| 2.60 (0.1024) | 38453-G9512 |
| 2.65 (0.1043) | 38453-G9513 |

# Final Drive (Cont'd)

## INSPECTION AND ADJUSTMENT (H190A)

### Ring gear runout

| | |
|---|---|
| Ring gear runout limit mm (in) | 0.08 (0.0031) |

### Side gear adjustment

| | |
|---|---|
| Side gear backlash (Clearance between side gear and differential case) mm (in) | 0 - 0.20 (0 - 0.0079) |

Available side gear thrust washers

Conventional models

| Thickness mm (in) | Part number |
|---|---|
| 0.775 (0.0305) | 38424-E3000 |
| 0.825 (0.0325) | 38424-E3001 |
| 0.875 (0.0344) | 38424-E3002 |
| 0.925 (0.0364) | 38424-E3003 |

L.S.D. models

| Thickness mm (in) | ID color | Part number |
|---|---|---|
| 1.50 (0.0591) | None | 38424-41W00 |
| 1.60 (0.0630) | White | 38424-41W01 |
| 1.70 (0.0669) | Yellow | 38424-41W02 |

### – Additional service for limited slip differential model – Differential torque adjustment

| | |
|---|---|
| Differential torque N·m (kg-m, ft-lb) | 147 - 196 (15 - 20, 108 - 145) |
| Number of discs and plates (One side) | |
| Friction disc | 2 |
| Friction plate | 2 |
| Spring disc | 1 |
| Spring plate | 1 |
| Wear limit of plate and disc mm (in) | 0.1 (0.004) or less |
| Allowable warpage mm (in) Friction disc and plate | 0.05 - 0.20 (0.0020 - 0.0079) |

Available discs and plates

| Part name | Thickness mm (in) | Part number |
|---|---|---|
| Friction disc | 1.73 - 1.77 (0.0681 - 0.0697) | 38433-N9000 |
| | 1.83 - 1.87 (0.0720 - 0.0736) | 38433-N9001 |
| Friction plate | 1.73 - 1.77 (0.0681 - 0.0697) | 38432-N9000 |
| Spring disc | 1.74 - 1.76 (0.0685 - 0.0693) | 38436-N3210 |
| Spring plate | 1.74 - 1.76 (0.0685 - 0.0693) | 38435-N3210 |

### Drive pinion height adjustment

Available drive pinion preload adjusting washers

| Thickness mm (in) | Part number |
|---|---|
| 2.58 (0.1016) | 38154-P6000 |
| 2.61 (0.1028) | 38154-P6001 |
| 2.64 (0.1039) | 38154-P6002 |
| 2.67 (0.1051) | 38154-P6003 |
| 2.70 (0.1063) | 38154-P6004 |
| 2.73 (0.1075) | 38154-P6005 |
| 2.76 (0.1087) | 38154-P6006 |
| 2.79 (0.1098) | 38154-P6007 |
| 2.82 (0.1110) | 38154-P6008 |
| 2.85 (0.1122) | 38154-P6009 |
| 2.88 (0.1134) | 38154-P6010 |
| 2.91 (0.1146) | 38154-P6011 |
| 2.94 (0.1157) | 38154-P6012 |
| 2.97 (0.1169) | 38154-P6013 |
| 3.00 (0.1181) | 38154-P6014 |
| 3.03 (0.1193) | 38154-P6015 |
| 3.06 (0.1205) | 38154-P6016 |
| 3.09 (0.1217) | 38154-P6017 |
| 3.12 (0.1228) | 38154-P6018 |
| 3.15 (0.1240) | 38154-P6019 |
| 3.18 (0.1252) | 38154-P6020 |

### Drive pinion preload adjustment

| | |
|---|---|
| Drive pinion preload N·m (kg-cm, in-lb) With front oil seal | 1.2 - 1.7 (13 - 18, 11 - 15.3) |

### Side bearing adjustment

Available side bearing ajusting shims

| Thickness mm (in) | Part number |
|---|---|
| 0.10 (0.0039) | 38455-61200 |
| 0.12 (0.0047) | 38453-61201 |
| 0.15 (0.0059) | 38453-61202 |
| 0.17 (0.0066) | 38453-61203 |
| 0.20 (0.0078) | 38453-61200 |
| 0.25 (0.0098) | 38453-61204 |
| 0.30 (0.0118) | 38453-61205 |
| 0.40 (0.0157) | 38453-61206 |
| 0.50 (0.0196) | 38453-61200 |

### Total preload adjustment

| | |
|---|---|
| Total preload N·m (kg-cm, in-lb) | 1.4 - 2.4 (15 - 25, 13 - 21.5) |
| Ringer gear backlash mm (in) | 0.13 - 0.18 (0.0051 - 0.0071) |

## Tightening Torque

### Model R200V

| Unit | N·m | kg-m | ft-lb |
|---|---|---|---|
| Final drive installation | | | |
| Companion flange to propeller shaft | 39 - 44 | 4.0 - 4.5 | 29 - 33 |
| Final drive assembly | | | |
| Drive pinion nut | 186 - 294 | 19 - 30 | 137 - 217 |
| Rear cover nuts | 39 - 49 | 4.0 - 5.0 | 29 - 36 |
| Ring gear bolts | 132 - 152 | 13.5 - 15.5 | 97.5 - 112 |
| Side bearing cap bolts | 88 - 98 | 9.0 - 10 | 65 - 72 |
| Drain and filler plugs | 39 - 59 | 4.0 - 6.0 | 29 - 43 |

### Model H190A

| Unit | N·m | kg-m | ft-lb |
|---|---|---|---|
| Final drive installation | | | |
| Differential carrier to rear axie case fixing bolt | 16 - 24 | 1.6 - 2.4 | 12 - 17 |
| Companion flange to propeller shaft | 39 - 44 | 4.0 - 4.5 | 29 - 33 |
| Final drive assembly | | | |
| Drive pinion nut | 127 - 294 | 13 - 30 | 94 - 217 |
| Ring gear bolt | 132 - 152 | 13.5 - 15.5 | 98 - 112 |
| Side bearing cap bolt | 49 - 59 | 5 - 6 | 36 - 43 |
| Drain and filler plugs | 59 - 98 | 6 - 10 | 43 - 72 |