

## 1997 Mazda MX-5 Miata

1997-98 DRIVE AXLES Differentials & Drive Axles - MPV & MX-5 Miata

### 1997-98 DRIVE AXLES

#### Differentials & Drive Axles - MPV & MX-5 Miata

## AXLE RATIO & IDENTIFICATION

See **AXLE RATIO SPECIFICATIONS** table. To determine axle ratio, divide number of ring gear teeth by number of pinion teeth.

### AXLE RATIO SPECIFICATIONS

Application	Number Of Teeth Pinion/Ring Gear	Ratio
Miata		
A/T	N/A	4.10:1
M/T	N/A	4.30:1
MPV		
2WD	11/43	3.91:1
4WD (Front & Rear)	10/41	4.10:1

## DESCRIPTION

**NOTE:** For models with independent suspension, see **AXLE SHAFTS - REAR** or **AXLE SHAFTS - FRONT** article for axle shaft overhaul.

A Limited Slip Differential (LSD) is optional on Miata. On MPV, rear axle bearings are held in place by a pressed-on collar. Front axle on MPV 4WD and rear axle on Miata use CV joints to connect differential to axle hubs.

## LUBRICATION

### CAPACITY

### DIFFERENTIAL CAPACITY SPECIFICATIONS

Application	(1) Qts. (L)
Miata	1.06 (1.00)
MPV 2WD	1.60 (1.50)
MPV 4WD	
Front	1.80 (1.70)
Rear	1.60 (1.50)

(1) Fill to lower edge of filler plug hole.

### FLUID TYPE

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### DIFFERENTIAL LUBRICATION SPECIFICATIONS

Application	(1) Specification
Warmer Than 0°F (-18°C)	GL-5/SAE 90W
Cooler Than 0°F (-18°C)	GL-5/SAE 80W

(1) Fill to lower edge of filler plug hole.

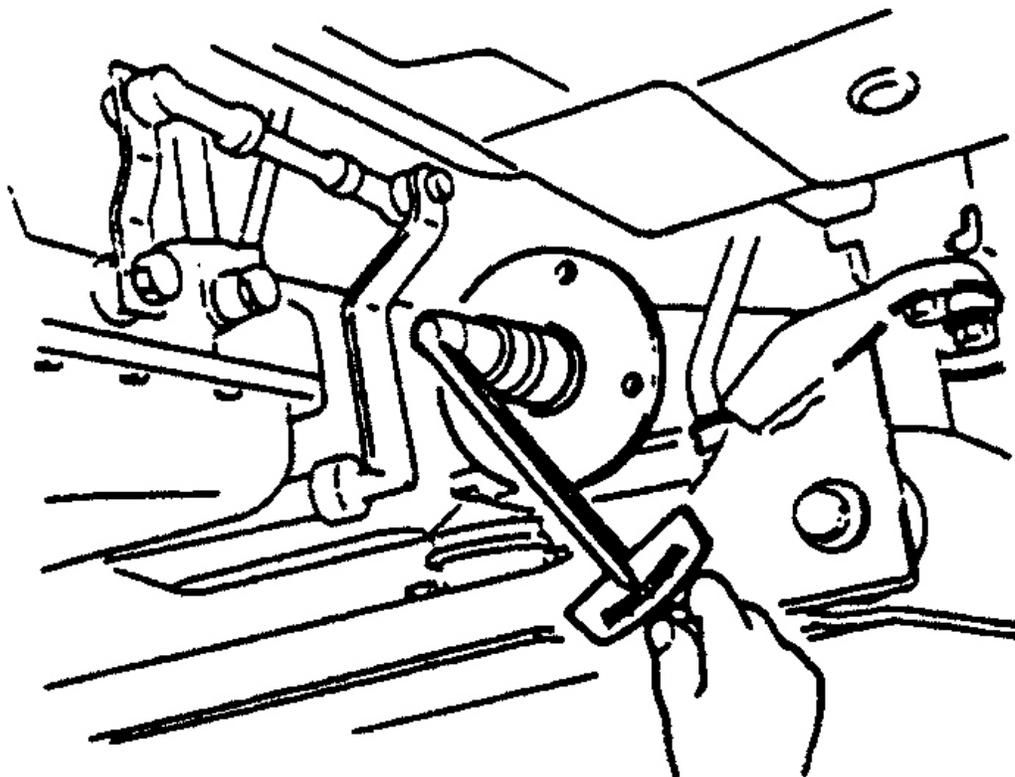
### TROUBLE SHOOTING

**NOTE:** See TROUBLE SHOOTING article in GENERAL INFORMATION.

### REMOVAL & INSTALLATION

#### FRONT DIFFERENTIAL OIL SEAL REPLACEMENT (MPV)

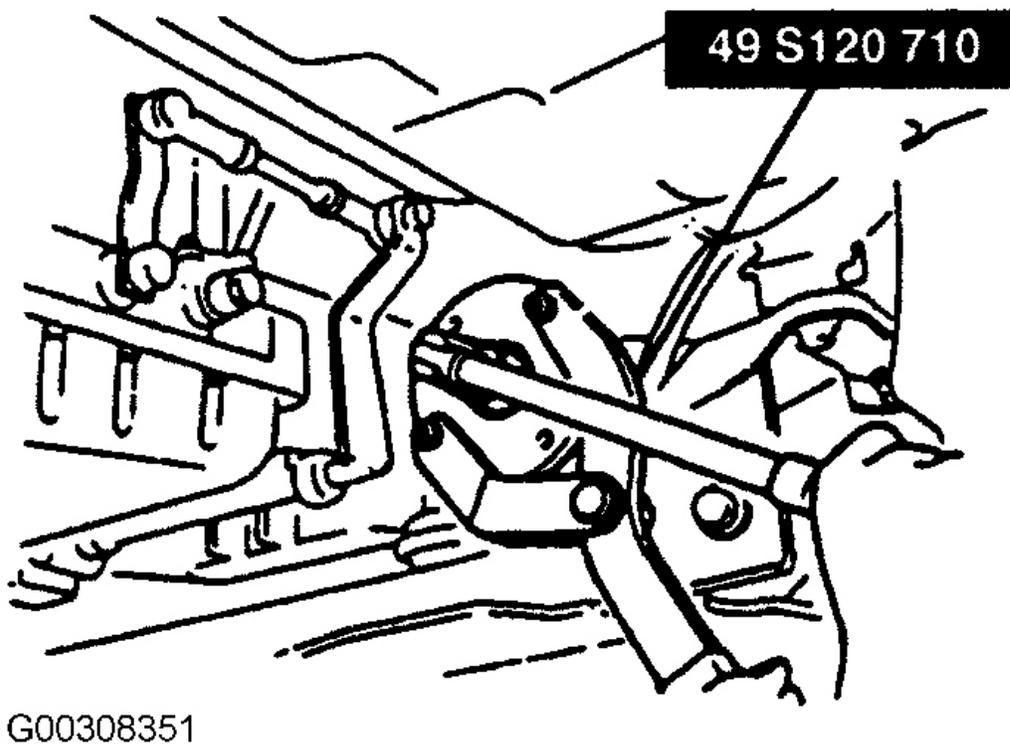
1. Jack up the vehicle and support it on safety stands.
2. Drain the differential oil.
3. Mark front drive shaft flange for reassembly reference. Remove drive shaft.
4. Before loosening the locknut, measure the rotation starting torque of the drive pinion (within the range of the drive pinion and ring gear backlash).



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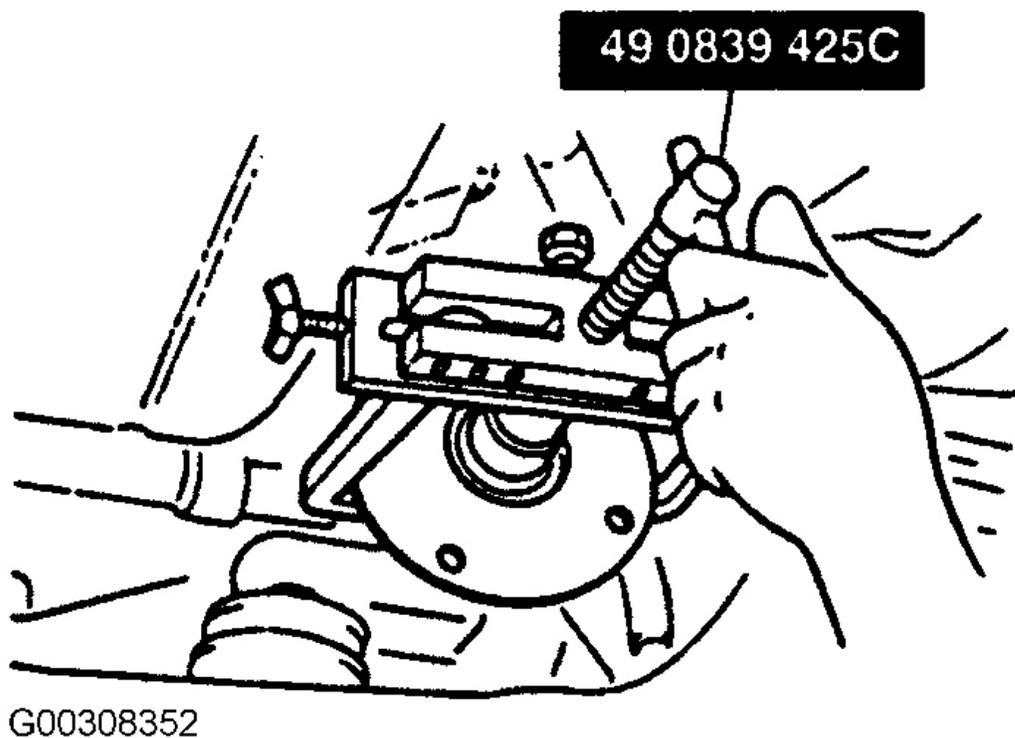
**Fig. 1: Measuring Rotation Starting Torque (MPV)**  
Courtesy of MAZDA MOTORS CORP.

5. Hold the companion flange by using Flange Holder (49 S120 710), and remove the locknut.



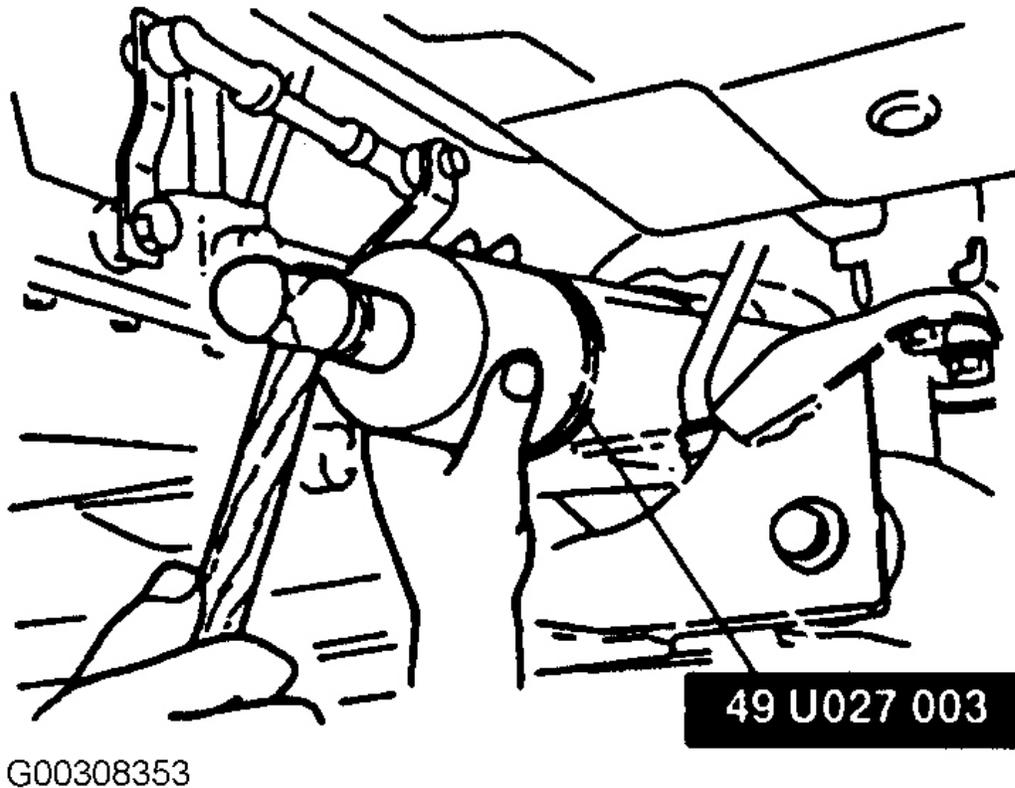
**Fig. 2: Holding Companion Flange (MPV)**  
Courtesy of MAZDA MOTORS CORP.

6. Remove the companion flange by using Puller (49 0839 425C).



**Fig. 3: Removing Companion Flange (MPV)**  
Courtesy of MAZDA MOTORS CORP.

7. Remove the oil seal.
8. Apply a thin coat of lithium-based grease to the lip of a new oil seal, and install it by using the Seal Installer (49 U027 003).



**Fig. 4: Installing Oil Seal (MPV)**  
 Courtesy of MAZDA MOTORS CORP.

9. Install the companion flange and tighten the locknut to get the starting torque measured in step 4 .
10. Install the drive shaft. Tighten bolts to specification. See **TORQUE SPECIFICATIONS** . Add differential oil to the specified level. See **FLUID TYPE** .

## REAR AXLE SHAFTS & BEARINGS

### Removal (MPV)

1. Raise and support vehicle. Remove rear wheel and tire assembly. Remove brake caliper and support aside. Remove brake disc plate. See **Fig. 5** . Using dial indicator, measure axle bearing play. Replace axle bearing if play exceeds .023" (.57 mm).
2. Remove hold pin from parking brake shoe assembly and remove parking brake shoe assembly. Disconnect parking brake cable. Using Flare Nut Wrench (49-0259-770B), disconnect brake pipe. Plug brake pipe openings.
3. Remove rear axle shaft assembly-to-axle shaft housing retaining nuts. Using Puller (49-0223-630B) and Attachment (49-8501-631A), remove rear axle shaft, backing plate and dust cover as an assembly from

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axle shaft housing. Remove axle oil seal. See **Fig. 5** . With axle shaft removed, remove retaining ring. Remove ABS sensor rotor.

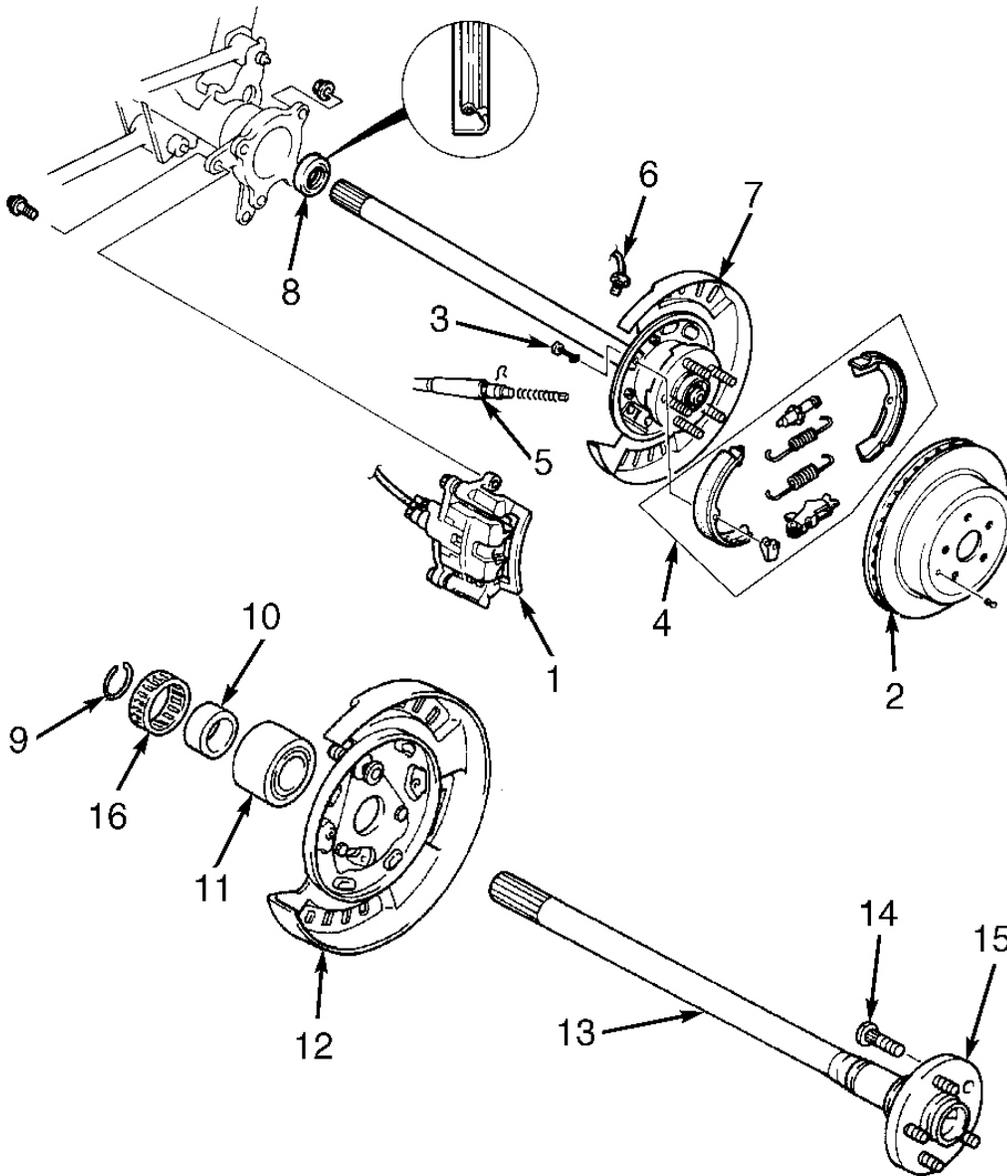
4. To remove bearing collar, grind collar until a section about .02" (.50 mm) remains. Using chisel, cut remaining bearing collar from axle shaft. Using Puller (49-S121-520A), remove axle bearing from axle shaft. Remove dust shield and backing plate.
5. Using dial indicator and "V" blocks, check axle shaft for straightness. Maximum axle shaft runout is .059" (1.50 mm). Also check axle shaft splines for wear and damage. Use a press to replace wheel studs as necessary. DO NOT reuse wheel studs if removed.

### Installation

To install, reverse removal procedure. Lubricate oil seal lip before replacement. Use Attachment (49-1011-748) and a press to install axle bearing onto axle shaft. DO NOT lubricate bearing collar before replacement. Use Attachment (49-1011-748) and a press to install NEW bearing collar. If press fit of collar requires less than 2.7 tons (2699 kg) to install, replace axle shaft. Tighten nuts to specification. See **TORQUE SPECIFICATIONS** .

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1. Brake Caliper Assembly
2. Disc Plate
3. Hold Pin
4. Parking Brake Shoe Assembly
5. Parking Brake Cable
6. Brake Pipe
7. Dust Cover & Axle Shaft Assembly
8. Axle Oil Seal

9. Retaining Ring
10. Bearing Collar
11. Axle Bearing
12. Dust Cover
13. Rear Axle Shaft
14. Wheel Stud
15. Hub
16. ABS Sensor Rotor

**Fig. 5: Exploded View Of Rear Axle Shaft (MPV)**  
Courtesy of MAZDA MOTORS CORP.

**DIFFERENTIAL ASSEMBLY**

**Removal (Front MPV 4WD)**

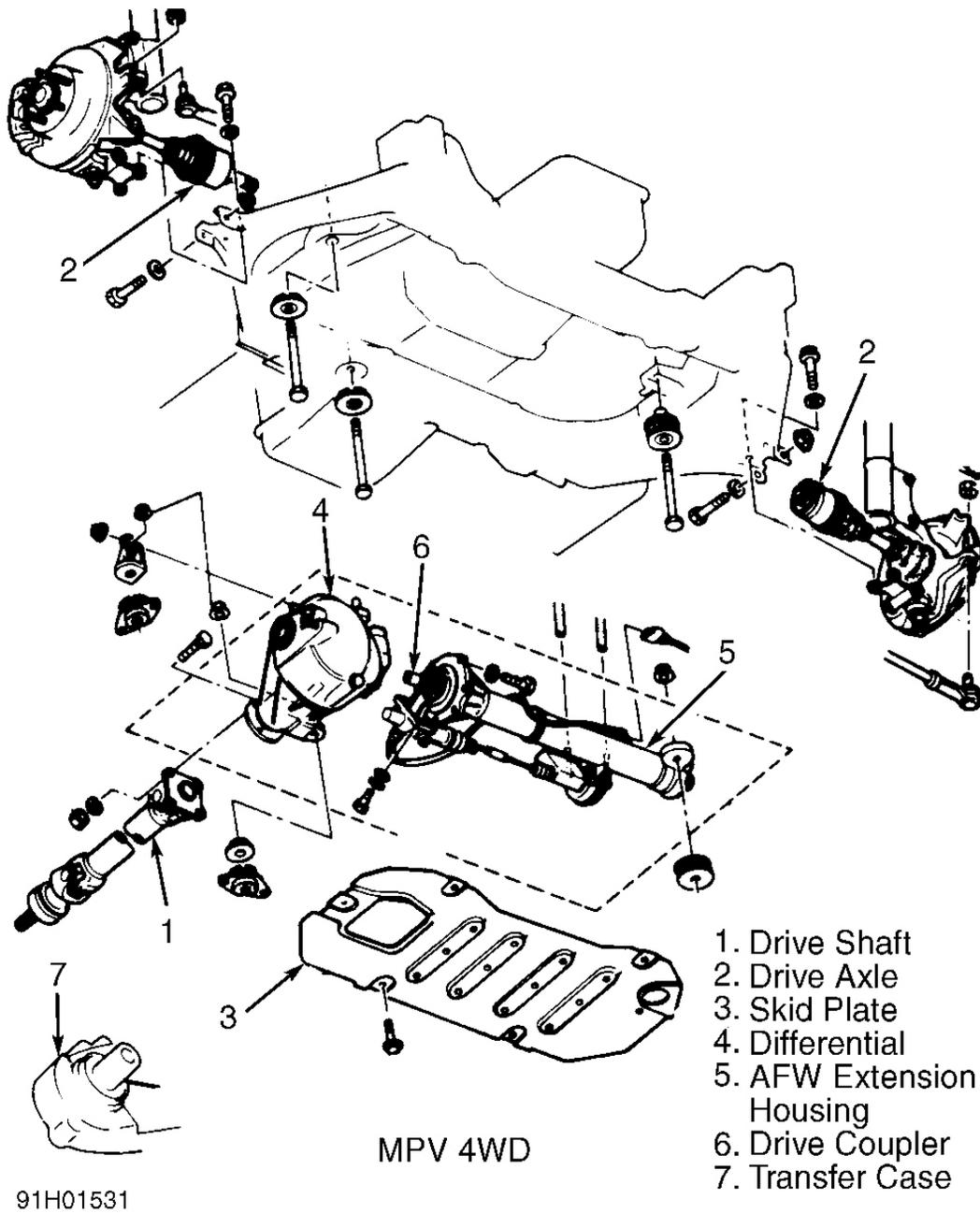
1. Raise and support vehicle. Remove engine skid plate. See **Fig. 6** . Drain front differential fluid. Remove tie rod ends and lower control arms. Remove front axle shafts. See **AXLE SHAFTS - FRONT** article.
2. Mark drive shaft and differential carrier flanges for reassembly reference, and remove drive shaft from differential carrier. See **Fig. 6** . Disconnect Automatic Free Wheel (AFW) vacuum hoses and electrical connector.
3. Place floor jack under differential assembly. Remove differential-to-chassis mounting bolts and AFW extension housing mounting nuts. Remove differential and AFW extension housing from vehicle. Remove AFW assembly from left side of differential housing. Pull drive coupler from carrier. Remove differential carrier-to-housing bolts. Remove differential carrier.

**Installation**

To install, reverse removal procedure. Apply sealant to carrier mating flange. Align marks made during removal. Refill differential with lubricant. Tighten all nuts and bolts to specification. See TORQUE SPECIFICATIONS.

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**Fig. 6: Removing & Installing Front Differential (MPV 4WD)**  
Courtesy of MAZDA MOTORS CORP.

## Removal (Rear MPV)

1. Raise and support vehicle. Remove wheel and tire assembly. Drain rear differential fluid. Remove axles.

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See REAR AXLE SHAFTS & BEARINGS.

2. Remove ABS wheel speed sensor. Mark drive shaft and differential carrier flanges for reassembly reference and remove drive shaft from differential carrier. Remove differential carrier-to-housing bolts. Remove differential carrier.

### Installation

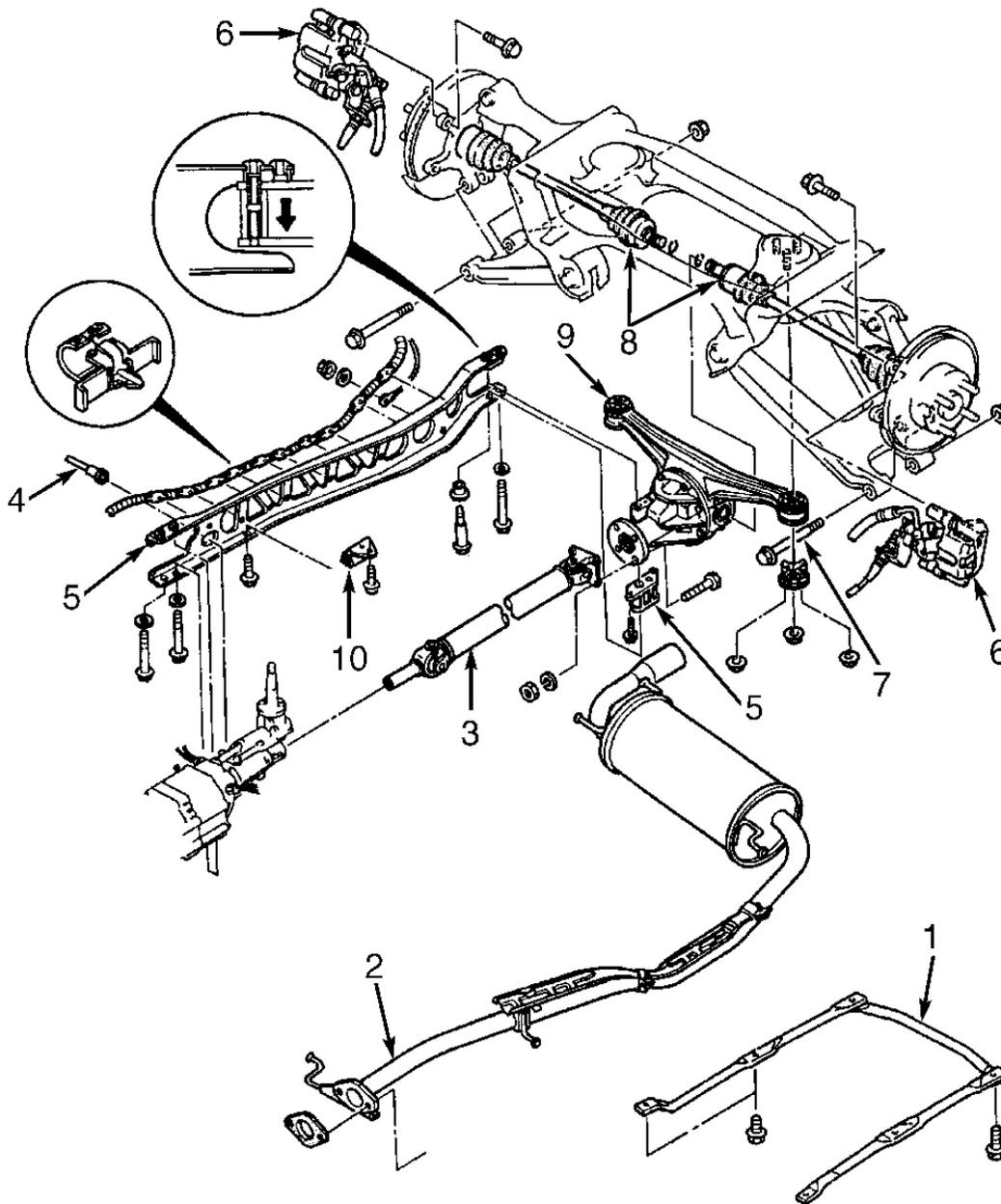
To install, reverse removal procedure. Apply sealant to carrier mating flange. Align marks made during removal. Refill differential with lubricant. Tighten all nuts and bolts to specification. See **TORQUE SPECIFICATIONS** .

### Removal (Miata)

1. Raise and support vehicle. Remove wheel and tire assembly. Drain differential. Remove differential mounting pipe. Remove exhaust pipe. Mark drive shaft and differential carrier flanges for reassembly reference and remove drive shaft from differential carrier. See **Fig. 7** . Disconnect speedometer cable from transmission. Noting locations, disconnect wiring harness from Power Plant Frame (PPF).

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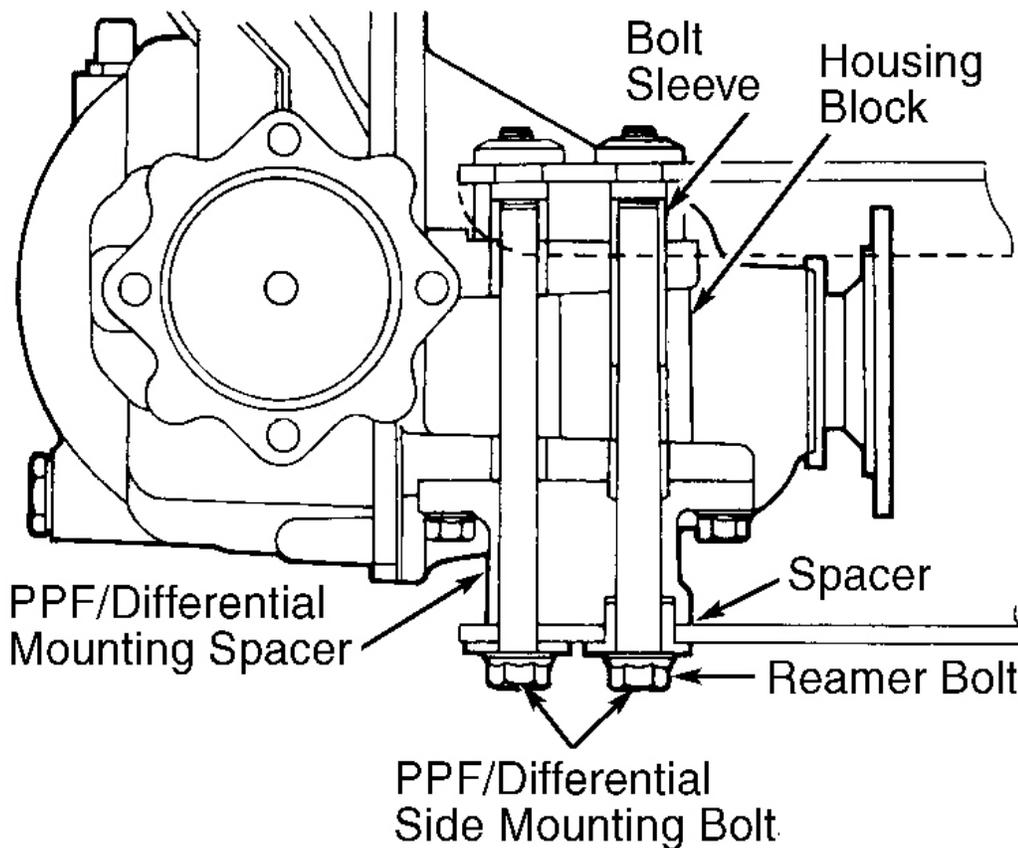
1. Differential Mounting Pipe
2. Exhaust Pipe
3. Drive Shaft
4. Speedometer Cable
5. Power Plant Frame (PPF)

6. Brake Caliper
7. Lower Arm Bolt
8. Axle Shafts
9. Differential Assembly
10. Manual Transmission Only

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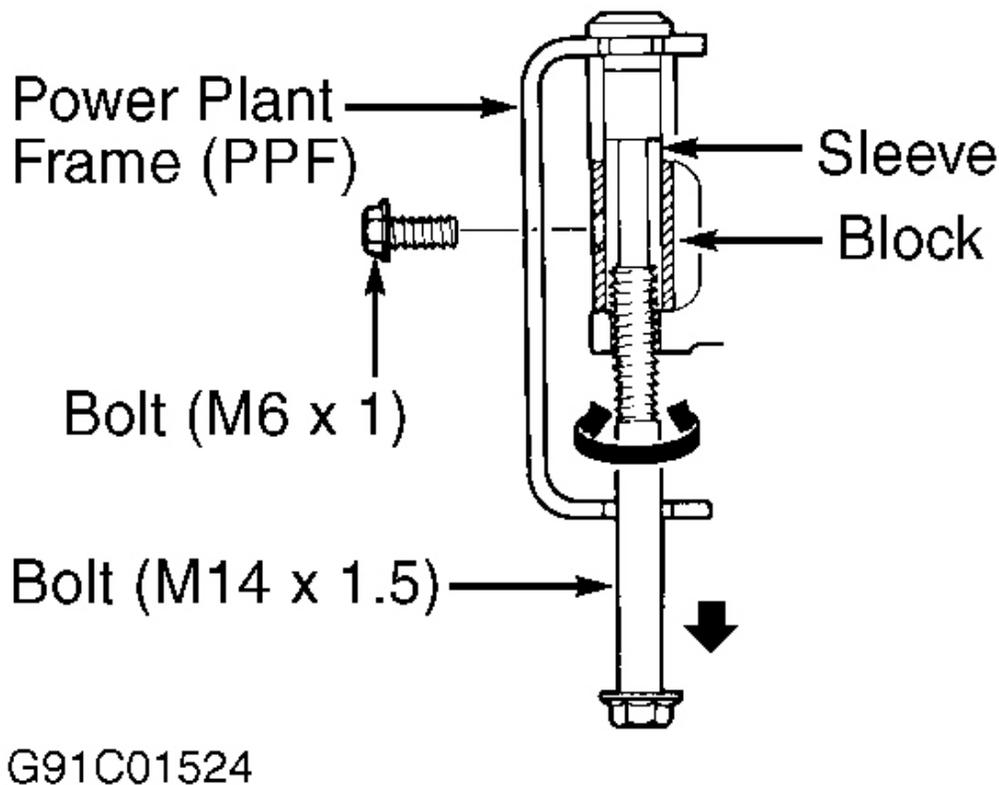
**Fig. 7: Exploded View Of Differential Components (Miata)**  
 Courtesy of MAZDA MOTORS CORP.

2. Support transmission using a jack. Remove PPF bracket from rear transmission extension housing (M/T only). Remove PPF-to-differential side bolts. Pry out spacer. Remove PPF/differential mounting spacer. See **Fig. 8** . Install bolt (M14 X 1.5) into sleeve. See **Fig. 9** .
3. Twist bolt from side to side while pulling it downward. Install a metric bolt (M6 X 1) into hole in housing block to hold sleeve and remove long bolt (M14 X 1.5). Remove short bolt (M6 X 1).
4. Remove PPF-to-transmission side bolts and remove PPF. Remove caliper assembly. Remove lower arm bolt. Mark and disconnect CV joint axle shafts from differential assembly, and support aside.
5. Support differential assembly and remove differential-to-chassis mounting nuts. Remove differential from vehicle. Remove drive axle output shafts from carrier. Remove differential carrier-to-housing bolts. Remove differential carrier.



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**Fig. 8: View Of Power Plant Frame (PPF) Components (Miata)**  
 Courtesy of MAZDA MOTORS CORP.



**Fig. 9: Removing Reamer Bolt Sleeve (Miata)**  
 Courtesy of MAZDA MOTORS CORP.

#### Installation

1. To install, reverse removal procedure. Apply sealant to carrier mating flange. Align marks made during removal and install axle shafts. Install differential. Raise transmission until engine and transmission are level.
2. Position Power Plant Frame (PPF) in place. Install PPF/differential mounting spacer. Tighten bolts to 27-38 ft. lbs. (37-52 N.m). Install and tighten PPF-to-transmission side mounting bolts.
3. Ensure sleeve is installed into PPF housing block. Install spacer and bolts. Ensure reamer bolt is installed into front hole and tighten bolt. See **Fig. 8**.

**NOTE:** Front PPF-to-differential side mounting bolt is reamer bolt which aligns PPF. See **Fig. 8**.

4. Install transmission-to-PPF bracket (M/T only). Install remaining PPF bolts. Refill differential with

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lubricant. Tighten all nuts and bolts to specification. See **TORQUE SPECIFICATIONS** . To complete installation, reverse removal procedure.

### OVERHAUL

#### DIFFERENTIAL

**NOTE:** Mark positions of all components before disassembly.

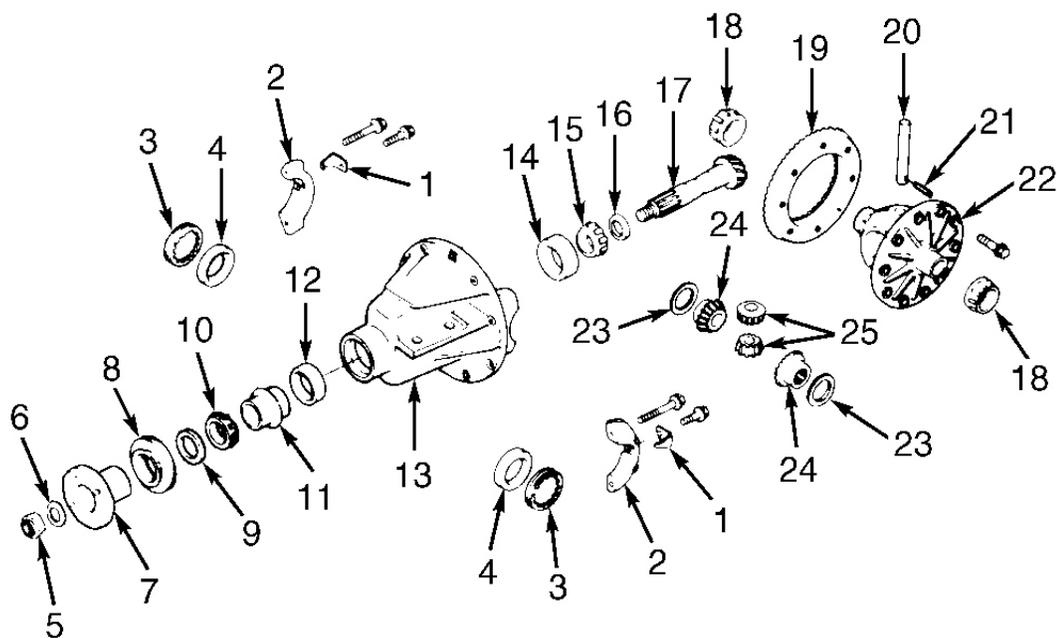
**NOTE:** Overhaul procedure for Limited Slip Differential (LSD) is not available.

#### Disassembly (Standard Type)

1. Mount carrier in Differential Carrier Hanger (49-M005-561). Mark side bearing caps for reassembly reference. Remove adjuster lock plates (if equipped). See **Fig. 10** .
2. Loosen side bearing cap bolts and slightly back off adjusters. Remove side bearing caps. Remove differential assembly from carrier. Mark side bearing races for reassembly reference. Remove adjusters and side bearing races from differential.
3. Remove drive pinion lock nut and washer. Remove companion flange using Puller (49-0839-425C). Remove oil seal, spacer, front bearing and collapsible spacer from carrier. Remove drive pinion, spacer and rear bearing assembly from carrier. Remove bearing races using a drift and hammer in slots provided on inner lip (as necessary).
4. Remove ring gear retaining bolts. Separate ring gear from differential case. Mark side bearings for reassembly reference. Using Puller (49-0839-425C), remove side bearings from differential case. Remove knock pin. Remove pinion shaft, pinion gears, thrust washers, and side gears. See **Fig. 10** .

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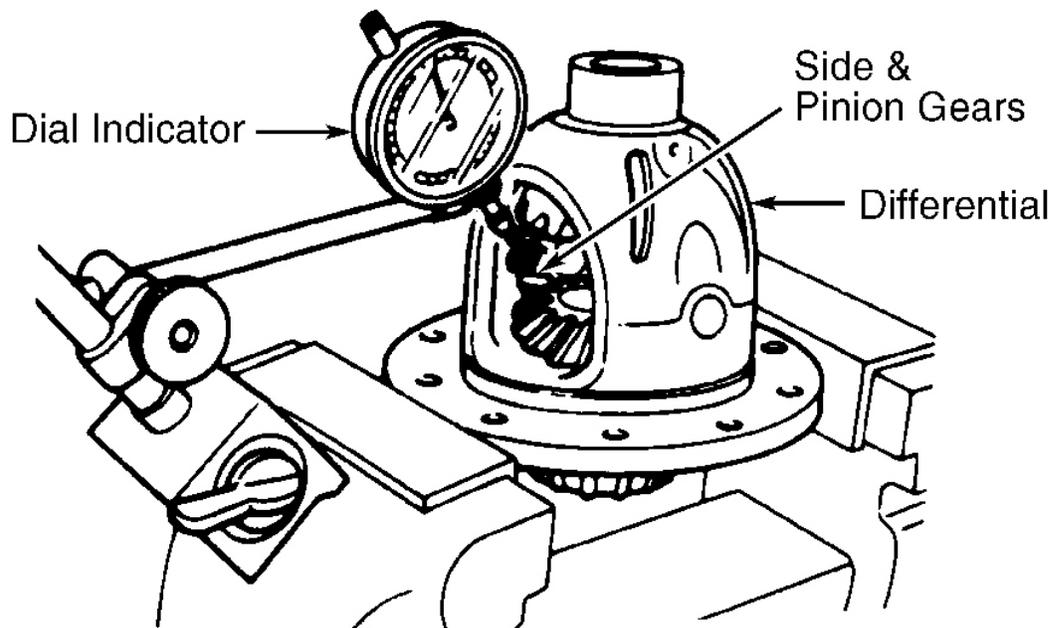
- |                        |                          |
|------------------------|--------------------------|
| 1. Lock Plate          | 13. Differential Carrier |
| 2. Bearing Cap         | 14. Bearing Race         |
| 3. Adjuster            | 15. Rear Bearing         |
| 4. Side Bearing Race   | 16. Spacer               |
| 5. Lock Nut            | 17. Drive Pinion         |
| 6. Washer              | 18. Side Bearing         |
| 7. Companion Flange    | 19. Ring Gear            |
| 8. Oil Seal            | 20. Pinion Shaft         |
| 9. Spacer              | 21. Knock Pin            |
| 10. Front Bearing      | 22. Differential         |
| 11. Collapsible Spacer | 23. Thrust Washer        |
| 12. Bearing Race       | 24. Side Gear            |
|                        | 25. Pinion Gear          |

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**Fig. 10: Exploded View Of Standard Differential & Carrier Assembly**  
Courtesy of MAZDA MOTORS CORP.

### Reassembly & Adjustment (Standard Type)

1. Install side gears, thrust washers, pinion gears and pinion shaft. Position dial indicator against pinion gear. See **Fig. 11** . Secure one side gear.



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**Fig. 11: Measuring Side Gear & Pinion Gear Backlash**

Courtesy of MAZDA MOTORS CORP.

2. Check side gear and pinion gear backlash. If backlash exceeds .004" (.10 mm), replace thrust washers. See **THRUST WASHER SPECIFICATIONS** table. Install and stake knock pin. Noting marks made during disassembly, press side bearings onto differential assembly using Bearing Installer (49-G030-338 or 49-UB71-525) and Body (49-F401-331).

**THRUST WASHER SPECIFICATIONS**

Identifying Mark	Thickness - In. (mm)
0	.0787 (2.000)
05	.0807 (2.050)
1	.0827 (2.100)
15	.0846 (2.150)
2	.0866 (2.200)

3. Apply locking compound to rear face of ring gear. Install ring gear and tighten ring gear retaining bolts to 51-61 ft. lbs. (69-83 N.m). Using appropriate bearing installer set and press, install drive pinion bearing races into differential carrier.
4. Put original spacer, rear bearing and Collar (49-H027-001) on Dummy Drive Pinion (49-8531-565). See **Fig. 12** . Secure collar with "O" ring. Install assembly into differential carrier.

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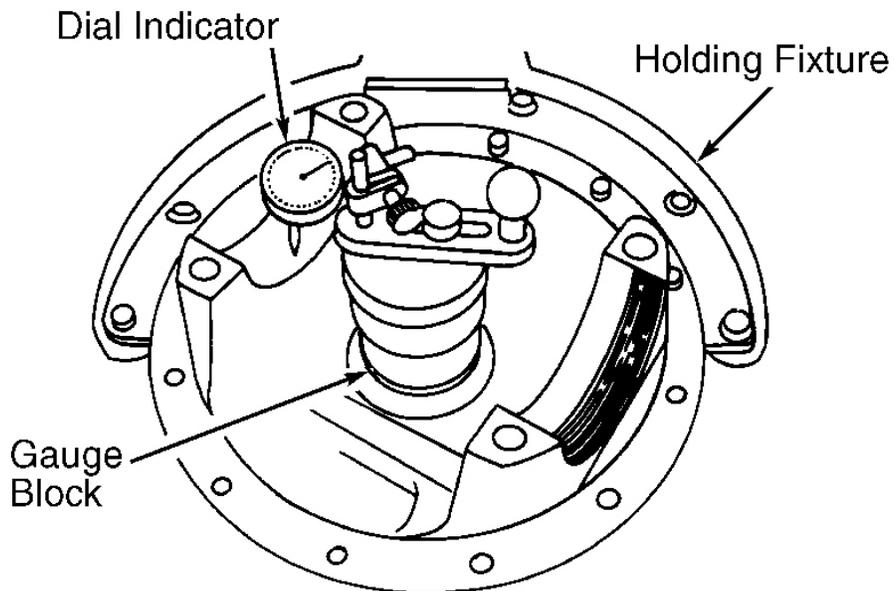
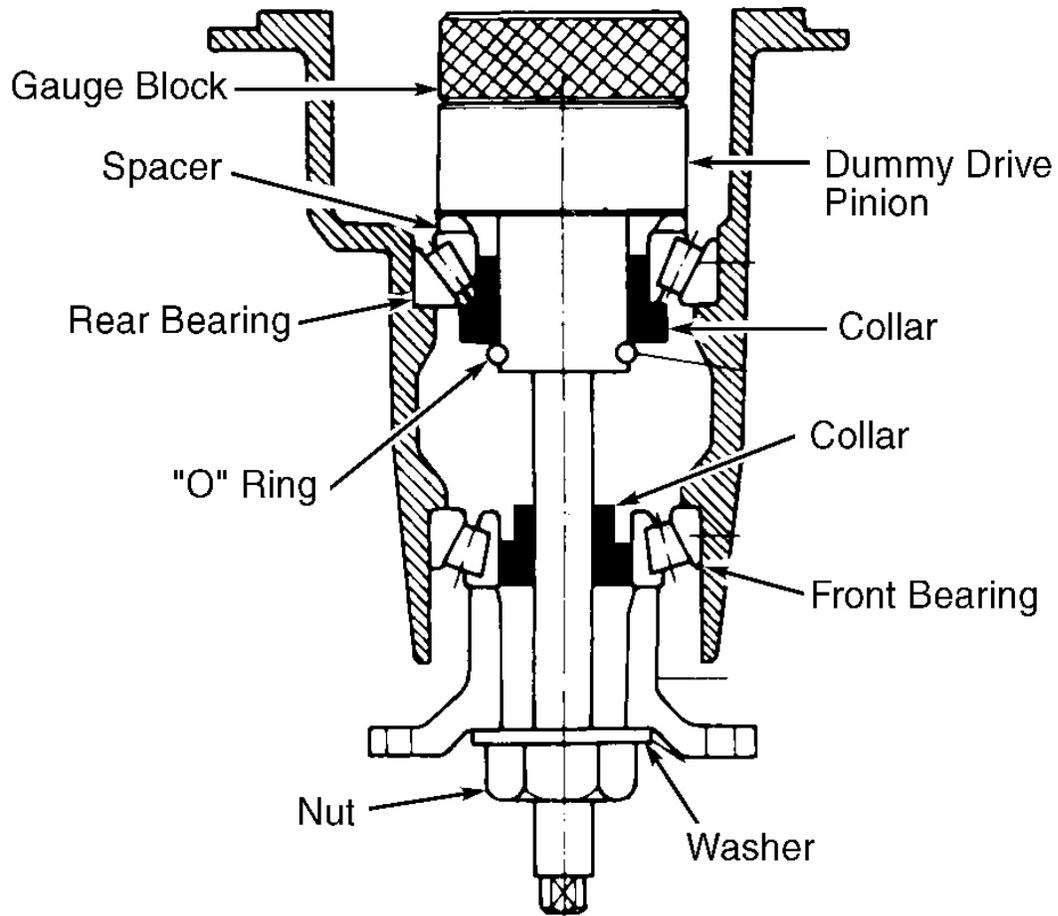
5. Install front bearing and collar on dummy drive pinion. See **COLLAR SELECTION** table. Install companion flange, washer and original drive pinion lock nut. Tighten drive pinion lock nut so dummy drive pinion assembly can be turned by hand.

### COLLAR SELECTION

Application	Collar No.
Miata	49-8531-567
MPV	49-U027-001

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### **Fig. 12: Checking Drive Pinion Installation & Position** Courtesy of MAZDA MOTORS CORP.

6. Install dial indicator on Pinion Height Gauge (49-0727-570). Place pinion height gauge on a flat surface and zero dial indicator. Position gauge block on top of dummy drive pinion assembly. See **GAUGE BLOCK SELECTION** table.

#### **GAUGE BLOCK SELECTION**

<b>Application</b>	<b>Gauge Block No.</b>
Front Differential	
MPV 4WD	49-0305-555
Rear Differential	
Miata	49-0305-555
MPV	49-0660-555

7. Place pinion height gauge on top of gauge block. Position dial indicator to measure distance to a point where side bearing sits. Measure lowest point. See **Fig. 12** . Measure both sides. Add both measurements together and divide by 2.
8. If result is not zero, replace pinion spacer. Spacers are available in a range of .1213-.1366" (3.080-3.470 mm) in .001" (.03 mm) increments. Remove dummy drive pinion. Press rear bearing onto drive pinion.
9. Install drive pinion, spacer, front bearing, collapsible spacer and companion flange in differential carrier. DO NOT install pinion oil seal yet. DO NOT exceed one-ton force; collapsible spacer will be damaged.
10. Install washer and drive pinion lock nut. Temporarily tighten drive pinion lock nut. Turn companion flange by hand to seat bearing. Using torque wrench, tighten drive pinion lock nut to specification. See **TORQUE SPECIFICATIONS** . Check pinion bearing preload at drive pinion lock nut. See **PINION PRELOAD SPECIFICATIONS** table. If pinion bearing preload is not as specified, replace collapsible spacer and recheck preload.

#### **PINION PRELOAD SPECIFICATIONS**

<b>Application</b>	<b>INCH Lbs. (N.m)</b>
Miata	7.8-12.1 (0.9-1.3)
MPV 2WD	11.3-15.6 (1.3-1.8)
MPV 4WD	
Front	7.8-12.2 (0.9-1.4)
Rear	11.3-15.6 (1.3-1.8)

11. Remove drive pinion lock nut, washer and companion flange. Install pinion oil seal. Lubricate oil seal lip with differential oil. Install companion flange and washer. Install NEW drive pinion lock nut and tighten to specification. See **TORQUE SPECIFICATIONS** . Recheck pinion bearing preload. Lubricate end of companion flange with grease.
12. Position differential assembly into differential carrier. Install side bearing adjusters. Position side bearing caps. Align marks made during disassembly. Install side bearing cap bolts and hand-tighten bolts.
13. Tighten side bearing adjusters equally until adjusters contact bearing races. Mark ring gear in 4 locations.

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90 degrees apart. Position dial indicator against ring gear to check ring gear backlash.

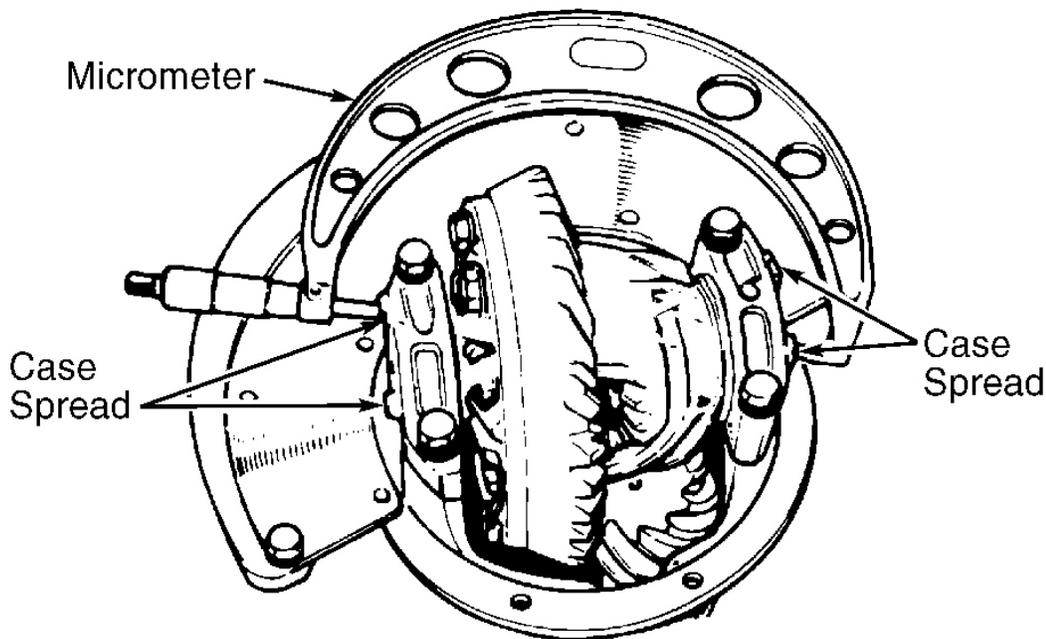
14. Check backlash at all 4 locations. Tighten side bearing adjusters equally until backlash is .0035-.0043" (.09-.11 mm). Minimum backlash at any point is .002" (.05 mm). Difference between minimum and maximum backlash should not exceed .0028" (.07 mm).
15. To set differential bearing preload, tighten adjusters equally until distance between measuring points on carrier bearing caps is within specification. See **Fig. 13** . See **DIFFERENTIAL CARRIER DIMENSIONS** table.
16. Ensure backlash did not change when preload was set. Tighten side bearing cap bolts to specification. See **TORQUE SPECIFICATIONS**. Check ring gear tooth patterns. See **GEAR TOOTH CONTACT PATTERNS** article in GENERAL INFORMATION.
17. To complete reassembly, reverse disassembly procedure. Tighten all nuts and bolts to specification. See **TORQUE SPECIFICATIONS** .

### DIFFERENTIAL CARRIER DIMENSIONS

Application	(1) In. (mm)
Miata	7.300-7.303 (185.43-185.50)
MPV 2WD	8.022-8.050 (203.78-204.50)
MPV 4WD	
Front	7.275-7.303 (184.78-185.50)
Rear	8.022-8.050 (203.78-204.50)
(1) See illustration for measuring point. See <b>Fig. 13</b> .	

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**Fig. 13: Measuring Carrier Case Spread**  
Courtesy of MAZDA MOTORS CORP.

## TORQUE SPECIFICATIONS

### TORQUE SPECIFICATIONS (MIATA)

Application	Ft. Lbs. (N.m)
Differential Carrier Bearings Cap Bolts	28-38 (38-52)
Differential Carrier Bearings Lock Plate Bolt	13-18 (18-25)
Differential Carrier-To-Housing Bolts	17-19 (23-26)
Differential-To-Chassis Mount Nuts	
Inner Nut	61-72 (83-98)
Outer Nuts (2)	13-20 (18-27)
Drive Axle Inner CV Joint Flange Nuts	40-47 (54-64)
Drive Pinion Lock Nut	94-209 (128-284)
Drive Shaft Companion Flange Nuts	20-22 (27-30)
Exhaust Pipe Mount Nuts	30-41 (40-55)
Filler Plug	29-40 (39-54)
Power Plant Frame Bracket	
To-Power Plant Frame Bolt (M/T)	77-91 (104-123)
To-Transmission Bolts (M/T)	27-40 (37-54)

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Power Plant Frame-To-Differential	
Side Mounting Bolts (Long)	77-91 (104-123)
Spacer Bolt (Short)	27-38 (37-52)
Power Plant Frame-To-Transmission Side Mounting Bolts (Long)	77-91 (104-123)
Ring Gear Retaining Bolts	51-61 (69-83)
Wheel Lug Nuts	65-87 (88-118)

**TORQUE SPECIFICATIONS (MPV)**

<b>Application</b>	<b>Ft. Lbs. (N.m)</b>
AFW Extension Housing Mount Nut (4WD)	49-72 (66-98)
Brake Pipe Union	10-16 (14-22)
Differential Carrier Bearings Cap Bolts Front Differential	27-38 (37-52)
Differential Carrier Bearings Cap Bolts Rear Differential	54-78 (73-106)
Differential Carrier Bearings Lock Plate Bolt	13-19 (18-26)
Differential Carrier-To-Housing Nuts/Bolts	17-19 (23-26)
Differential-To-Chassis Mount Nuts (4WD)	49-72 (66-98)
Drive Pinion Lock Nut	94-210 (127-284)
Drive Shaft Companion Flange Nuts	37-43 (50-58)
Filler Plug	29-40 (39-54)
Lower Ball Joint-To-Control Arm Bolts (4WD)	75-101 (102-137)
Lower Ball Joint-To-Control Arm Nut (4WD)	94-127 (127-172)
Rear ABS Wheel Speed Sensor Bolt	12-16 (16-22)
Rear Axle Shaft Assembly-To-Axle Shaft Housing Retaining Nuts	40-49 (54-66)
Rear Brake Caliper Bolts	37-43 (50-58)
Ring Gear Retaining Bolts	51-61 (69-83)
Skid Plate Bolts (4WD)	12-17 (16-23)
Tie Rod End Nut (4WD)	43-58 (58-78)
Wheel Lug Nuts	65-87 (88-118)