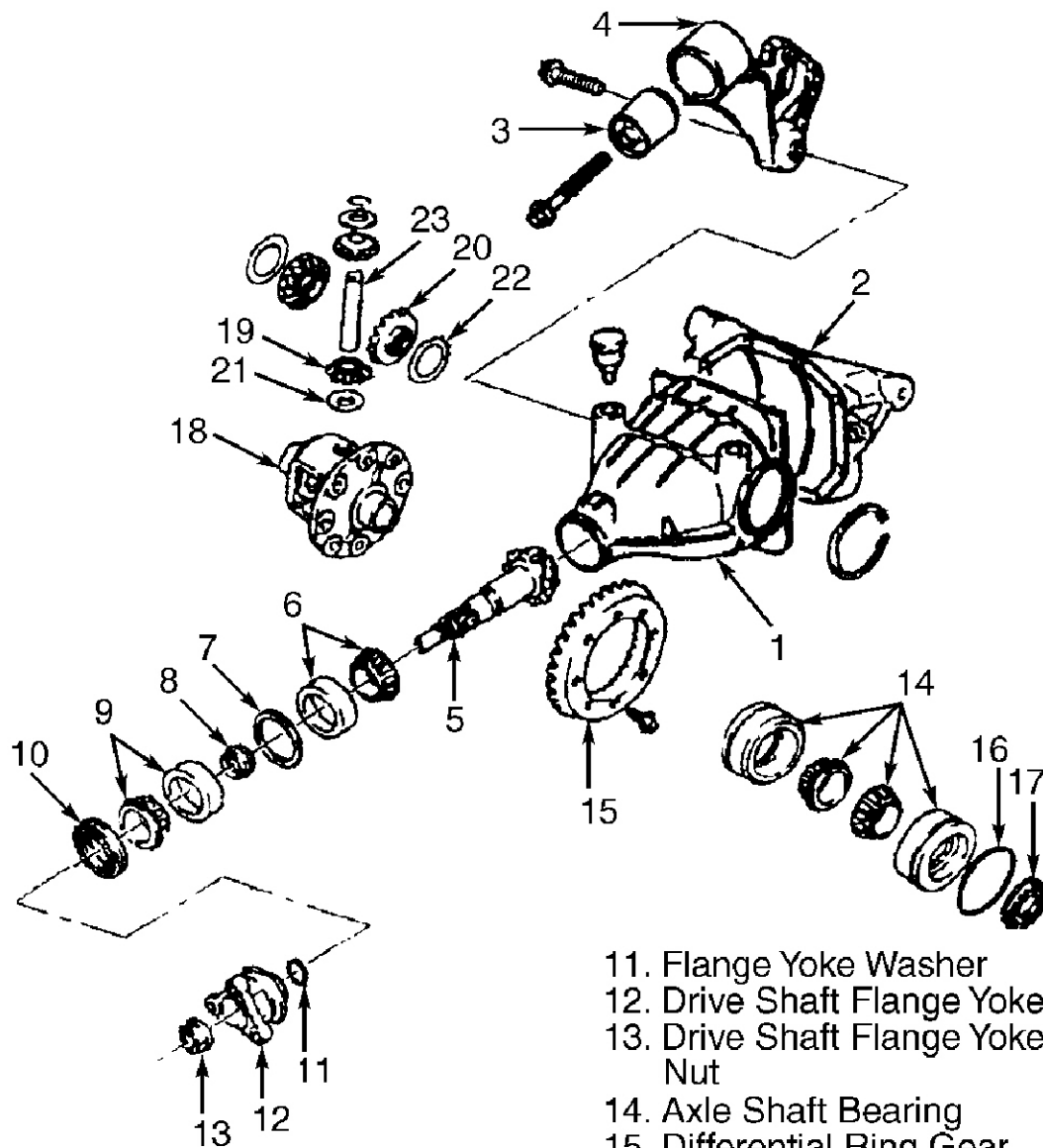


2000-01 DRIVE AXLES

Differentials & Axle Shafts - Catera

DESCRIPTION & OPERATION

Drive axle is a rigidly mounted housing, non-locking assembly. Drive axle is supported by rear axle cradle, attached to the body through rubber insulators. Axle shafts connect differential assembly to rear wheels through the use of inner and outer constant velocity joints. Differential assembly is connected to transmission through a 2-piece propeller shaft.



1. Differential Casing
2. Rear Cover
3. Damper Bushing
4. Damper Bracket
5. Drive Pinion
6. Drive Pinion Inner Bearing
7. Shim
8. Drive Pinion Bushing
9. Drive Pinion Outer Bearing
10. Drive Pinion Oil Seal

11. Flange Yoke Washer
12. Drive Shaft Flange Yoke
13. Drive Shaft Flange Yoke Nut
14. Axle Shaft Bearing
15. Differential Ring Gear
16. Circlip
17. Axle Shaft Oil Seal
18. Differential Carrier
19. Differential Pinion Gear
20. Differential Side Gear
21. Differential Pinion Gear Thrust Washer
22. Differential Side Gear Thrust Washer
23. Differential Pinion Gear Shaft

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Fig. 1: Exploded View Of Differential

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Courtesy of GENERAL MOTORS CORP.

AXLE RATIO & IDENTIFICATION

AXEL RATIO IDENTIFICATION

Model	Axle Ratio
Catera	3.90:1

LUBRICATION

CAPACITY

NOTE: Differential lubricant fluid capacity information is not provided from manufacturer. When refilling differential assembly, add lubricant to bottom of fill hole.

FLUID TYPE

Fill differential with 80W-90 GL-5 Gear Lubricant (GM P/N 12345977) and add friction modifier additive (GM P/N 1052358).

TROUBLE SHOOTING

NOTE: See appropriate table in TROUBLE SHOOTING article in GENERAL INFORMATION.

REMOVAL & INSTALLATION

NOTE: Some of the following procedures require servicing suspension components near differential assembly. For more detailed information on suspension components, see appropriate REAR article in SUSPENSION.

CAUTION: Do not use corrosive cleaning agents, engine degreasers, solvents, or similar agents on or near fiberglass transverse leaf spring. These materials could cause extensive damage to spring. Use care not to scratch fiberglass transverse leaf spring.

AXLE SHAFTS

Removal & Installation

1. Place transmission in Neutral. Raise and support vehicle. Remove wheel and tire assemblies. Install Wheel Hub Brace (J42066) onto wheel hub and secure with wheel lug nuts.
2. While holding wheel hub stationary, remove axle shaft to wheel hub retaining bolts. Using pry bar, separate axle shaft from wheel hub. Support outboard joint.
3. Separate axle shaft inboard hub from differential using Separator (J42071). Remove axle shaft from vehicle.
4. To install, reverse removal procedure. Lubricate axle shaft splines and hub seating surfaces with differential fluid. Use soft faced mallet to drive axle shaft into differential. Tighten fasteners to specification. See **TORQUE SPECIFICATIONS** .

DIFFERENTIAL ASSEMBLY

Removal

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1. Raise and support vehicle. Support differential assembly with transmission jack. Remove ABS sensor electrical connectors from differential housing cover. Remove axle shafts. See **AXLE SHAFTS** . Remove drive shaft. See **DRIVE SHAFT** .
2. Remove drive shaft coupling from differential. Disconnect automatic level control height sensor link. Remove differential support bracket bolts. Remove differential bushing bolts.
3. Lower differential slightly and place drain pan under differential. Loosen differential housing cover bolts. Gently pry cover off differential housing to drain oil, do not remove rear cover. Lower differential from vehicle.

Installation

To install, reverse removal procedure. Ensure drive shaft alignment markings are properly aligned. Tighten fasteners to specification. See **TORQUE SPECIFICATIONS** . Refill differential with specified lubricant. See **FLUID TYPE** under LUBRICATION.

DRIVE PINION OIL SEAL

Removal

1. Raise and support vehicle. Remove drive shaft. See **DRIVE SHAFT** . Remove drive shaft coupling.
2. Apply reference marks to differential drive pinion flange nut, washer and pinion gear end. Using Brace (J42066), support drive pinion. Remove drive pinion flange nut and remove brace.
3. Using universal puller, remove pinion flange yoke from pinion shaft. See **Fig. 1** . Using suitable drift, remove oil seal from differential housing.

Installation

1. Ensure pinion shaft threads are free from burrs. Lubricate lip of NEW seal with differential lubricant. Using Seal Installer (J42108), drive NEW oil seal onto pinion shaft.

CAUTION: Drive pinion flange has an interference fit with respect to pinion shaft splines. Pinion flange should only be pulled into place by tightening of retaining nut. Do not use force or hammer flange during installation of drive pinion flange.

2. Coat pinion flange with differential lubricant. Install drive pinion flange onto pinion shaft. Install drive pinion flange nut and washer. Gradually tighten flange nut until pinion shaft end play is reduced to .020 INCH (.50 mm). Continue tightening nut while turning pinion gear until alignment marks line up.
3. Set drive pinion bearing preload to specification. See **DRIVE BEARING PRELOAD SPECIFICATIONS** table. To complete installation, reverse removal procedure. Tighten fasteners to specification. See **TORQUE SPECIFICATIONS** .

DRIVE BEARING PRELOAD SPECIFICATIONS

Drive Pinion Bearing Condition	Preload INCH Lbs. (N.m)
New	9-15 (1-1.7)
Used	8-11 (.9-1.2)

DRIVE SHAFT

Removal & Installation

1. Place transmission in Neutral. Raise and support vehicle. Remove wheel and tire assemblies. Remove center drive shaft heatshield nuts and remove heatshield.

2. Place reference mark at transmission drive shaft flange to assist installation. Remove center bearing bracket-to-body bolt. Remove drive shaft-to-transmission coupling bolts. Gently slide drive shaft back to clear transmission and lower drive shaft.
3. Place reference mark at differential drive shaft flange to assist installation. Remove drive shaft-to-differential coupling bolts. Slide drive shaft forward to clear differential and lower drive shaft. Remove drive shaft from vehicle.
4. To install, reverse removal procedure. Align reference marks on drive shaft to transmission and differential. Tighten fasteners to specification. See **TORQUE SPECIFICATIONS** .

OUTPUT SHAFT SEAL

Removal & Installation

1. Raise and support vehicle. Remove left axle shaft. See **AXLE SHAFTS** . Use a suitable pry bar, carefully remove axle shaft oil seal. See **Fig. 1** .
2. To install, lubricate lip of NEW seal with differential lubricant. Install oil seal into differential using Oil Seal Installer (J26234). To complete installation, reverse removal procedure. Tighten fasteners to specification. See **TORQUE SPECIFICATIONS** .

OVERHAUL

DISASSEMBLY

NOTE: Overhaul assumes differential assembly has been removed. See **DIFFERENTIAL ASSEMBLY** under REMOVAL & INSTALLATION.

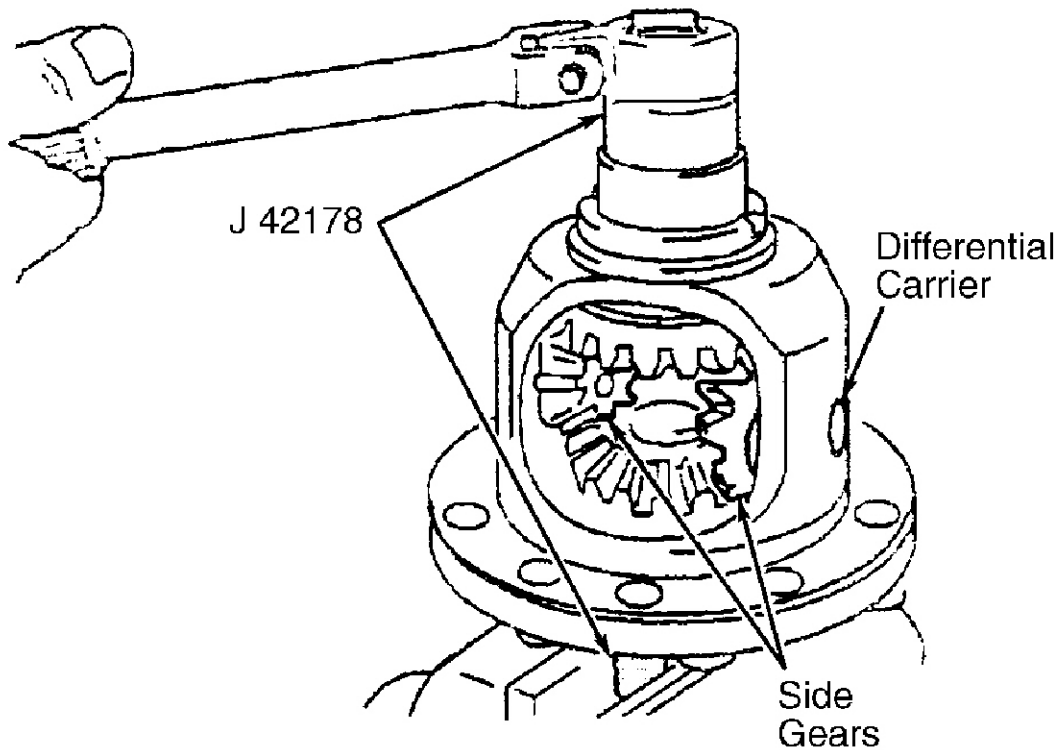
NOTE: It is necessary to inspect tooth contact pattern before disassembling differential. See **INSPECTION** .

Differential Case

1. Mount differential casing onto suitable frame brace. Remove rear cover bolts and remove rear housing cover. See **Fig. 1** . Remove axle shaft oil seals using a suitable pry bar.
2. Install Side Bearing Preload Clamp (J42143) and Plate (J42149) onto differential casing. Tighten clamp to relieve significant amount of bearing preload from snap ring. Remove adjuster snap ring from bearing bore. Remove preload clamp assembly from differential.
3. Remove adjuster ring from left side of differential. Drive out right differential side bearing outer race from cover opening of differential. Remove differential side bearing seal. Lightly tap carrier through right side of bearing bore. Remove differential carrier from differential housing.

Ring Gear & Differential Case

1. Support differential carrier with soft jawed vice. Remove ring gear bolts. Drive off ring gear using a piece of hardwood or brass drift and hammer. Set ring gear aside.
2. Press out differential pinion gear shaft from differential carrier. Remove differential pinion gear shaft retaining ring from differential carrier. Mount first Differential Carrier Gear Alignment Shaft (J42178) into vice. Lower differential carrier onto alignment shaft with ring gear flange on bottom. Mount second differential carrier alignment shaft into drive shaft pinion gear. See **Fig. 2** .
3. Using ratchet, rotate alignment shaft. Walk pinion gears and conical washers from installed positions. Remove alignment shafts. Remove differential side gears and shims from differential carrier.



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Fig. 2: Removing Differential Side Gears
 Courtesy of GENERAL MOTORS CORP.

Side Bearings

Install Bearing Puller (J22888-20A) onto differential carrier. Remove differential carrier side bearings from differential carrier.

Drive Pinion

1. Remove differential drive pinion flange. See **DRIVE PINION OIL SEAL** under REMOVAL & INSTALLATION. Support drive pinion with block of wood and gently drive pinion out of differential case.
2. Remove differential drive pinion gear spacer from differential drive pinion. See **Fig. 1**. Remove differential drive pinion inner bearing from drive pinion gear. Remove drive pinion seal from differential case.
3. Drive differential drive pinion inner bearing race from differential case using Bearing Race Remover (J42176) and Shaft (J42154). Remove differential drive pinion gear shim from differential housing.
4. Remove drive pinion outer bearing from differential case. Using race remover, remove outer bearing race.

INSPECTION

Gear Tooth Contact Pattern

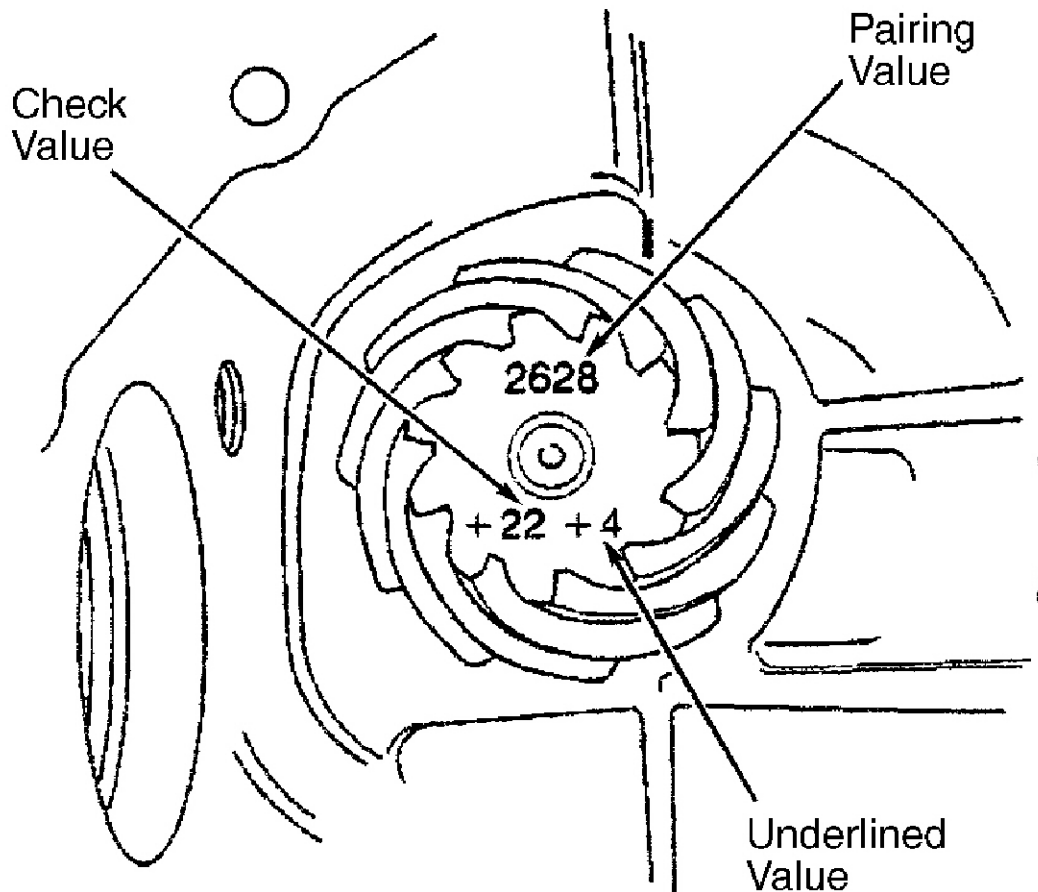
1. Remove differential. See **DIFFERENTIAL ASSEMBLY** under REMOVAL & INSTALLATION. Remove differential housing cover. Thoroughly clean each tooth of ring gear.
2. Apply marking compound (GM Part Number 1052351 or equivalent) sparingly to all ring gear teeth. Insert Carrier Gear Alignment Shaft (J42178) into differential side bearing bore. Attach ratchet onto alignment shaft to hold it steady.
3. Rotate pinion gear flange and rotate ring gear one full revolution, then rotate one full revolution in opposite direction.
4. Inspect gear contact pattern on ring gear. Adjust as follows:

- If contact is primarily in valley between gear teeth, decrease pinion bearing shim thickness.
- If contact pattern is primarily on outer edge of gear teeth, increase pinion bearing shim thickness.
- If contact pattern is primarily on inner edge of ring gear teeth, increase backlash.
- If contact pattern is primarily on outer edge of ring gear teeth, decrease backlash.
- If contact pattern is primarily in the center of ring gear teeth, no adjustments are necessary.

REASSEMBLY

Pinion Depth Adjustment

1. If reusing pinion and differential ring set, reuse pinion adjusting shim, if undamaged. If pinion shim is damaged, replace with shim of corresponding thickness. Check gear tooth contact pattern. See **INSPECTION**.
2. If replacing drive pinion, replace pinion and differential ring as a matched set. Compare CHECK VALUE of old and new drive pinions. See **Fig. 3**.
3. CHECK VALUE shows in hundredths of a millimeter how deep drive pinion should be installed relative to drive pinion gear line. For example, +22 = .22 mm (.008 INCH).
4. Difference of old and new drive pinion CHECK VALUES is adjustment necessary for NEW shim. For example: new CHECK VALUE is +22 and old CHECK VALUE is +8, add .13 mm (.003 INCH) to shim thickness. Check gear tooth contact pattern and adjust shim as necessary. See **INSPECTION**.



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Fig. 3: Identifying Pinion Alignment Markings
 Courtesy of GENERAL MOTORS CORP.

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1. Use Bearing Race Installer Set (J42148 and J42176) to press outer bearing race into differential housing. Lubricate outer bearing with axle grease. Install drive pinion outer bearing into housing. Install pinion seal.
2. Install correct drive pinion shim into differential housing. See **Pinion Depth Adjustment**.
3. Use bearing race installer set to install inner bearing race into differential housing. Lubricate drive pinion shaft and inner bearing with axle lubricant. Press inner bearing onto drive pinion shaft.
4. Install drive pinion gear bearing spacer onto drive pinion. Install drive pinion gear into differential housing. Install differential drive flange and oil seal. See **DRIVE PINION OIL SEAL** under REMOVAL & INSTALLATION.

Differential Carrier

1. Mount Differential Carrier Gear Alignment Shaft (J42178) into vice and place differential carrier onto shaft with ring gear flange on bottom. Install second alignment shaft into opposing differential carrier bore.
2. Install NEW differential pinion gear retaining ring into differential carrier. Place shims onto differential side gears. Ensure conical washer is mounted towards differential side gear and notched shim is mounted towards differential carrier.
3. Place gear and shim assemblies into differential carrier and onto alignment shafts. Engage differential pinion gears and engage conical washers with differential side gears. Position conical washers forward in intended rotational direction so they will lead pinion gears into mounting position.
4. Attach ratchet to alignment shaft, then rotate shaft to draw pinion gears and conical washers into position. Drive pinion gear shaft into carrier bore. Remove ratchet from alignment shaft.
5. Ensure pinion rotating torque is 11-22 ft. lbs. (15-30 N.m). Heat ring gear to 212°F (100°C) and install ring gear onto differential carrier. Tighten ring gear bolts to specification. See **TORQUE SPECIFICATIONS**.

Differential

1. Establish pinion gear depth. See **Pinion Depth Adjustment**. Install drive pinion into rear differential housing. See **Drive Pinion**. Using Seal Installer (J42108), install drive pinion seal into differential housing.
2. Install differential carrier into housing. Install Side Bearing Preload Clamp (J42143) and Plate (J42149) onto differential case. Attach Dial Indicator Set (J8001) onto preload clamp assembly. Set up indicator to measure movement of carrier case.
3. Install left adjuster snap ring into differential carrier bore. Install right adjuster snap rings of varying thickness while moving differential carrier assembly. Add adjuster rings of sufficient thickness until there is no movement of differential carrier as indicated on dial indicator.
4. Add additional .005 INCH (.125 mm) adjuster ring to each side. Remove bearing preload clamp and plate from differential case. Install Gear Alignment Shaft (J42178) into differential carrier side gear bore. Ensure rotating torque of differential carrier is 5-6 INCH Lbs. (.6-.7 N.m). Remove alignment shaft from differential carrier.
5. Fix bearing preload clamp onto differential housing. Mount dial indicator set onto preload clamp. Set up indicator to measure ring gear backlash. Measure backlash at 4 points equally spaced around ring gear. See **DIFFERENTIAL BACKLASH SPECIFICATIONS** table.
6. Using Seal Installer (J26234), install drive axle seals into differential housing. Install housing cover and tighten to specification. See **TORQUE SPECIFICATIONS**

DIFFERENTIAL BACKLASH SPECIFICATIONS

Measurement	INCH (mm)
Backlash	.004-.008 (.10-.20)
Maximum Backlash Variation ⁽¹⁾	.0002 (.05)
(1) Between 4 measuring points.	

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TORQUE SPECIFICATIONS

TORQUE SPECIFICATIONS

Application	Ft. Lbs. (N.m)
ABS Sensor Bolt	(1)
Differential Bushing Bolt	74 (100)
Differential Cover Bolt	44 (60)
Differential Filler Plug	15 (22)
Differential Ring Gear Bolt	85 (115)
Differential Support Bracket Lower Bolt	
First Pass	66 (90)
Second Pass	(2)
Differential Support Bracket Upper Bolt	74 (100)
Drive Axle Flange Bolt	
First Pass	37 (50)
Second Pass	(3)
Drive Shaft Coupler Bolt	70 (95)
Drive Shaft Coupler Nut	70 (95)
Front Drive Shaft Bearing Bracket Bolt	15 (20)
Front Drive Shaft Bearing Insulator Bolt	16 (22)
Height Sensor Bolt	(4)
(1) Tighten to 62 INCH Lbs. (7 N.m) (2) Tighten an additional 38 degrees. (3) Tighten an additional 67 degrees. (4) Tighten to 124 INCH Lbs. (14 N.m)	

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