

Spicer® Single Drive Axle



SPICER®
Drivetrain Products

Service Manual

AXSM-0072

February 2019

S172 Series

General Information

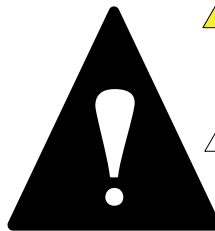
The description and specifications contained in this service publication are current at the time of printing. Dana reserves the right to discontinue or to modify its models and/or procedures and to change specifications at any time without notice.


Any reference to brand names in this publication is made simply as an example of the types of tools and materials recommended for use and should not be considered an endorsement. Equivalents, if available, may be used.


Important Notice


This symbol is used throughout this manual to call attention to procedures where carelessness or failure to follow specific instructions may result in personal injury and/or component damage.

Departure from the instructions, choice of tools, materials and recommended parts mentioned in this publication may jeopardize the personal safety of the service technician or vehicle operator.



 **WARNING:** Failure to follow indicated procedures creates a high risk of personal injury to the servicing technician.

 **CAUTION:** Failure to follow indicated procedures may cause component damage or malfunction.

 **IMPORTANT:** Highly recommended procedures for proper service of this unit.

Note: Additional service information not covered in the service procedures.

TIP: Helpful removal and installation procedures to aid in the service of this unit.

[Always use genuine Spicer replacement parts.](#)

Note: Interactive PDF functions may not work correctly unless viewed using the free [Adobe Acrobat Reader](#).

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General Information

Introduction

Dana Commercial Vehicle Systems Division, presents this publication to aid in maintenance and overhaul of Spicer single drive axles.

Instructions contained cover the models listed. Their design is similar, with primarily differences in load capacity. Capacity variations are achieved by combining basic differential carrier assemblies with different axle housings, axle shafts and wheel equipment.

The suffix letter "P" in the model number indicates optional lube pump. The pump is designed to provide additional lubrication to the inter-axle differential and related parts.

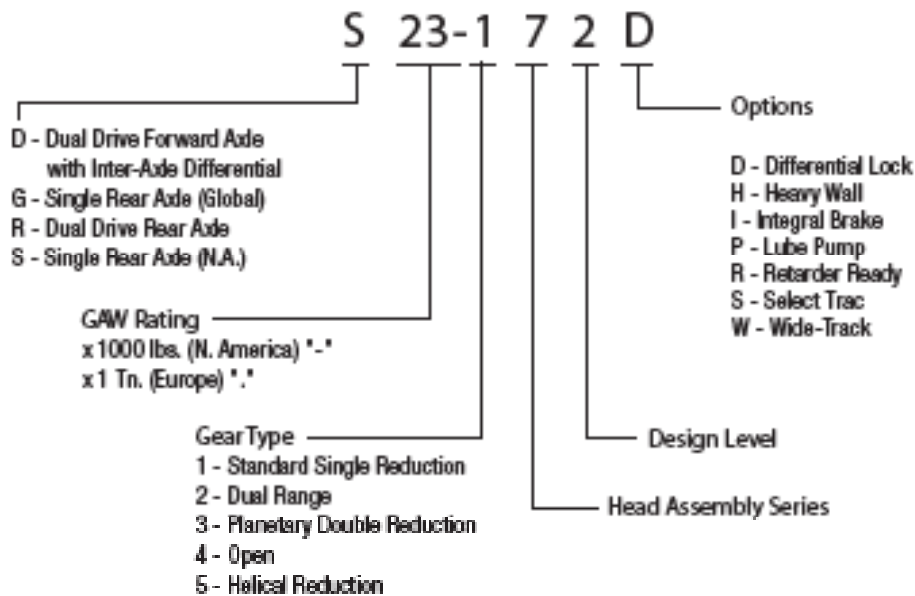
Model Listing

Model Information

The following models are included in this publication:

Model

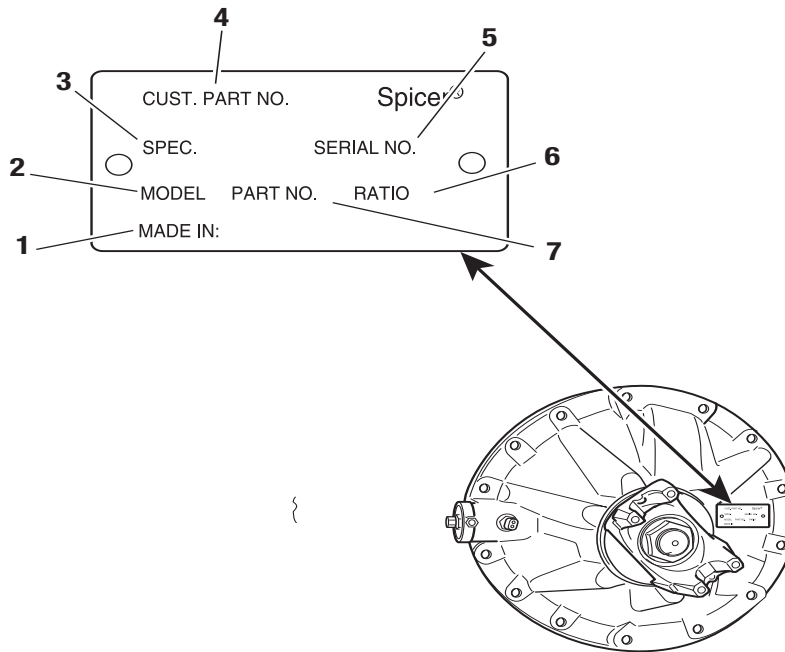
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Model Identification

Model Identification

Drive Axle



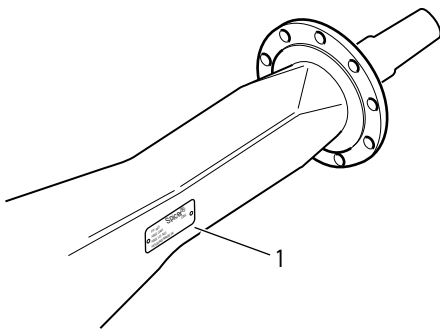
Rear Axle (Top View)

- 1** — Country or origin
- 2** — Axle model identification
- 3** — Specification number assigned to the axle built by Spicer. Identifies all component parts of the axle including special OEM requirements such as yokes or flanges

- 4** — OEM part number assigned to the axle build
- 5** — Carrier assembly serial number assigned by the manufacturing plant
- 6** — Axle gear ratio
- 7** — Carrier assembly production or service part number

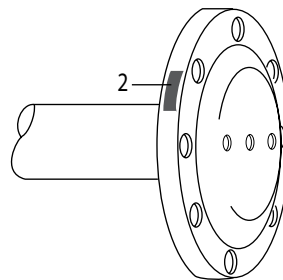
Parts Identification

Axle Housing



- 1** — ID Tag

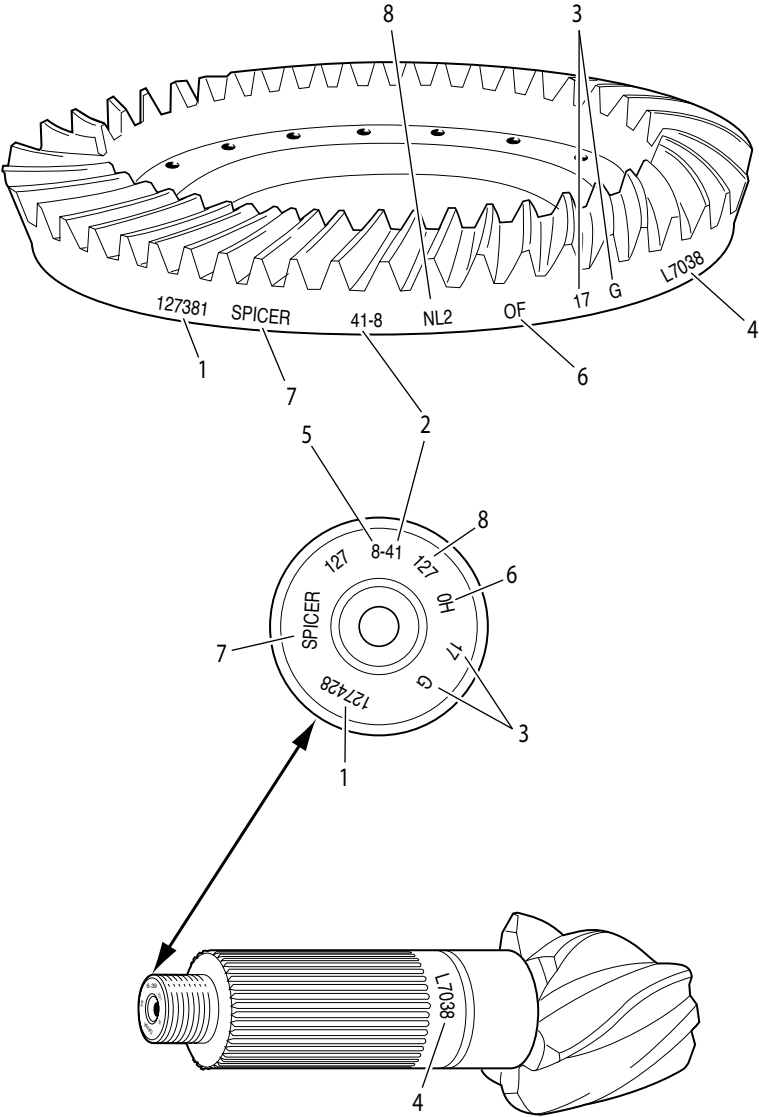
Axle Shaft



- 2** — Axle shaft part number

Ring Gear and Pinion Nomenclature

Note: Ring gear and drive pinion are matched parts and must be replaced in sets.



- 1 — Part number
- 2 — Number of ring gear teeth
- 3 — Manufacturing numbers
- 4 — Matching gear set number
- 5 — Number of pinion teeth
- 6 — Date code
- 7 — Indicates genuine Spicer parts
- 8 — Heat code

Inspection

Failure Analysis Process

Failure analysis is the process of determining the original cause of a component failure in order to keep it from happening again. Too often, when a failed component is replaced without determining its cause, there will be a recurring failure. If a carrier housing is opened, revealing a ring gear with a broken tooth, it is not enough to settle on the broken tooth as the cause of the carrier failure. Other parts of the carrier must be examined. For a thorough understanding of the failure and possible insight into related problems, the technician needs to observe the overall condition of the vehicle.

No one benefits when a failed component goes on the junk pile with the cause unknown. Nothing is more disturbing to a customer than a repeat failure. Systematically analyzing a failure to prevent a repeat occurrence assures quality service by avoiding unnecessary downtime and further expense to the customer.

The true cause of a failure can be better determined by knowing what to look for, determining how a piece of the equipment was running, and learning about previous problems. In the case of a rebuilt rear axle, mismatched gears may have been installed.

The more successful shops prevent repeat equipment failures by developing good failure analysis practices. Knowing how to diagnose the cause of a premature failure is one of the prerequisites of a good heavy-equipment technician.

How to Diagnose a Failure

The following five steps are an effective approach to good failure diagnostics.

1. Document the problem.
2. Make a preliminary investigation.
3. Prepare the parts for inspection.
4. Find the cause of the failure.
5. Correct the cause of the problem.

Document the Problem

Here are some guidelines for starting to learn about a failure.

- Talk to the operator of the truck.
- Look at the service records.
- Find out when the truck was last serviced.

Ask the following questions:

- In what type of service is the truck being used?
- Has this particular failure occurred before?
- How was the truck working prior to the failure?

You need to be a good listener. Sometimes insignificant or unrelated symptoms can point to the cause of the failure.

Ask the following questions:

- Was the vehicle operating at normal temperatures?
- Were the gauges showing normal ranges of operation?
- Was there any unusual noise or vibration?

After listening, review the previous repair and maintenance records. If there is more than one driver, talk to all of them and compare their observations for consistency with the service and maintenance records. Verify the chassis Vehicle Identification Number (VIN) number from the vehicle identification plate, as well as the mileage and hours on the vehicle.

Make a Preliminary Investigation

These steps consist of external inspections and observations that will be valuable when combined with the results of the parts examination:

- Look for leaks, cracks or other damage that can point to the cause of the failure.
- Make note of obvious leaks around plugs and seals. A missing fill or drain plug would be an obvious cause for concern.
- Look for cracks in the carrier housing (harder to see, but sometimes visible).
- Does the general mechanical condition of the vehicle indicate proper maintenance or are there signs of neglect?
- Are the tires in good condition and do the sizes match?
- If equipped with a torque-limiting device, is it working properly?

During the preliminary investigation, write down anything out of the ordinary for later reference. Items that appear insignificant now may take on more importance when the subassemblies are torn down.

Prepare the Parts for Inspection

After the preliminary investigation, locate the failure and prepare the part for examination. In carrier failure analysis, it may be necessary to disassemble the unit.

- When disassembling subassemblies and parts, do not clean the parts immediately since cleaning may destroy some of the evidence.
- When tearing down the drive axle, do it in the recommended manner. Minimize any further damage to the unit.
- Ask more questions when examining the interior of the carrier. Does the lubricant meet the manufacturer specifications regarding quality, quantity and viscosity? As soon as you have located the failed part, take time to analyze the data.

Find the Cause of the Failure

Here begins the real challenge to determine the exact cause of the failure. Keep in mind that there is no benefit to replacing a failed part without determining the cause of the failure. For example, after examining a failed part and finding that the failure is caused by a lack of lubrication, you must determine if there was an external leak. Obviously, if there is an external leak, just replacing the failed gear is not going to correct the situation.

Another important consideration is to determine the specific type of failure which can be a valuable indicator for the cause of failure. The following pages show different types of failures and possible causes. Use this as a guide in determining types of failures and to correct problems.

Correct the Cause of the Problem

Once the cause of the problem has been determined, refer to the appropriate service manual to perform the repairs.

Inspection

Inspection

Clean

1. Wash steel parts with ground or polished surfaces in solvent. There are many suitable commercial solvents available. Kerosene and diesel fuel are acceptable.

WARNING: Gasoline is not an acceptable solvent because of its extreme combustibility. It is unsafe in the workshop environment.

2. Wash castings or other rough parts in solvent or clean in hot solution tanks using mild alkali solutions.

Note: If a hot solution tank is used, make sure parts are heated thoroughly before rinsing.

3. Rinse thoroughly to remove all traces of the cleaning solution.

4. Dry parts immediately with clean rags.

5. Oil parts.

- If parts are to be reused immediately: Lightly oil.
- If parts are to be stored: Coat with oil, wrap in corrosion resistant paper and store in a clean, dry place.

Inspect Axle Housing

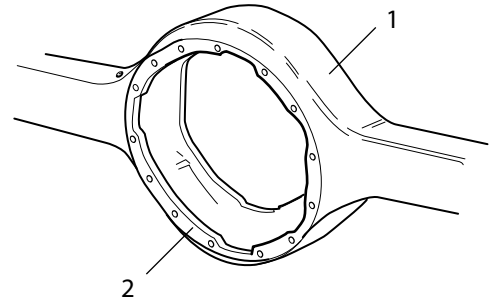
Axle housing inspection and repairs are limited to the following checks or repairs.

- Visually inspect axle housing for cracks, nicks, and burrs on machined surfaces.
- Check carrier bolt holes and studs for foreign material.
- Replace damaged fasteners. Look for loose studs or cross threaded holes.

CAUTION: Any damage which affects the alignment or structural integrity of the housing requires housing replacement. Do not repair by bending or straightening. This process can affect the material's properties and cause it to fail completely under load.

- Check all seals and gaskets.

Note: Replace conventional gaskets with silicone rubber gasket compound (included in many repair kits). The compound provides a more effective seal against lube seepage and is easier to remove from mating surfaces when replacing parts.



1 — Axle housing

2 — Machined surface

Inspect Components

Inspect all steel parts for:

- Notches, visible steps or grooves created by wear
- Pitting or cracking along gear contact lines
- Scuffing, deformation or discolorations. These are signs of excessive heat in the axle and are usually related to low lubrication levels or improper lubrication practices.

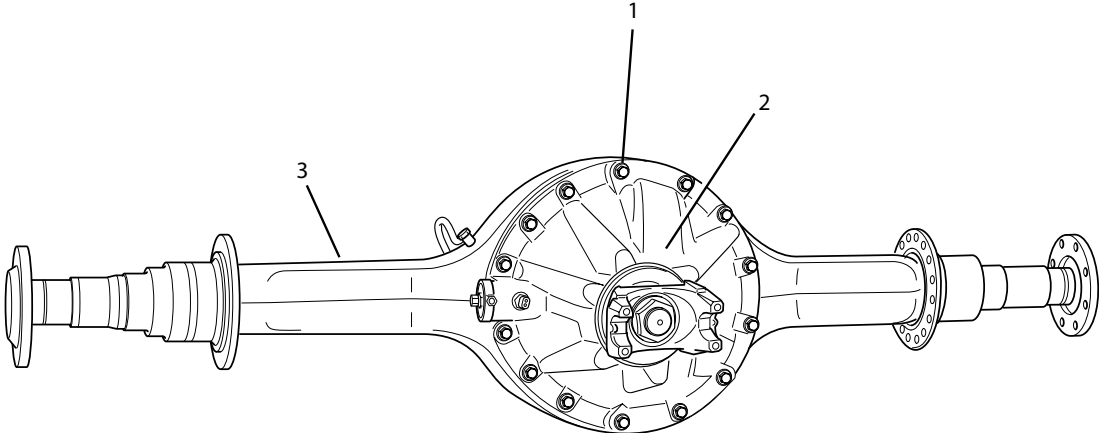
In addition, inspect the following for damage:

- Differential gearing.
- Bearings for loose fit on drive pinion, pilot bearing, and differential bearings.
- All fasteners for rounded heads, bends, cracks or damaged threads.
- Inspect machined surfaces of cast or malleable parts. They must be free of nicks, burrs, cracks, scoring, and wear.
- Look for elongation of drilled holes, wear on surfaces machined for bearing fits and nicks or burrs in mating surfaces.

Inspect Primary Gearing

Before reusing a primary gearset, inspect teeth for signs of excessive wear. Check tooth contact pattern for evidence of incorrect adjustment.

Drive Axle Assembly - Parts



- 1 — Carrier fasteners
- 2 — Carrier assembly
- 3 — Single axle assembly

Differential Carrier

Remove Carrier Carrier

Standard Differentials

1. Block the vehicle.
2. Drain axle lubricant.
3. Disconnect lead wires to the selector switch and air line at shift cylinder.
4. Remove axle shafts.

Do not lie under carrier after fasteners are removed. Use transmission jack to support differential carrier assembly prior to loosening fasteners.

5. To remove axle shaft, remove axle stud nuts (If used, remove lock washers and taper dowels).
6. Remove axle shafts.

Note: All models in this publication use axle shafts with unequal lengths. Axle shafts may also be location specific with various wheel equipment. Do not misplace axle shafts from their intended location. Identify left and right shafts for reference during reassembly.

TIP: If necessary, loosen dowels by holding a brass drift in the center of the shaft head and striking drift with a sharp blow with a hammer.

CAUTION: Do not strike the shaft head with a steel hammer. Do not use chisels or wedges to loosen shaft or dowels.

7. Remove carrier capscrews, nuts, and lock washers.
8. Remove carrier assembly.

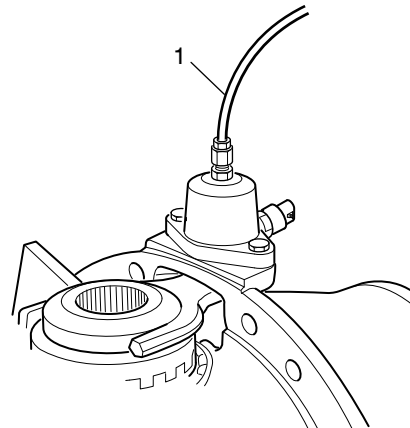
With Wheel Differential Lock

1. Diff-Lock Models

For removal of the locking wheel differential carrier assembly, the differential lock must be engaged and held in the engaged position. This can be accomplished by one of two methods; either engage via air pressure or engage manually.

a. Engage via Air Pressure

Using an auxiliary air line, apply 80–120 PSI air pressure to shift cylinder air port to engage clutch.

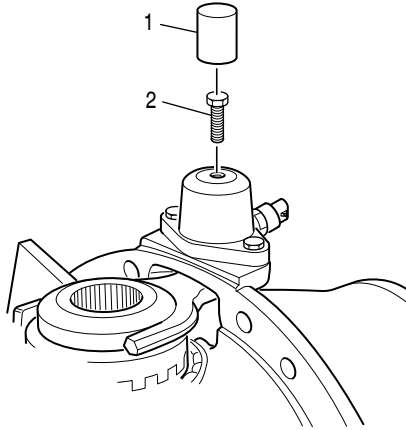


1 — Connect 80-120 PSI air line to cylinder port

Engage Manually

- b. Install a .250 – 18 NPTF bolt over 1.5” long in the cylinder air port to manually engage the clutches. GM models require a M12 X 1.5 X 38mm bolt.

Note: Hand-tighten the bolt, over-torquing may cause damage to the shift unit. To facilitate hand-tightening, coat bolt threads with axle lube.



- 1 — Hand tighten with socket
- 2 — M12 x 1.5 x 38mm bolt – GM only .250 – 18 NPTF – all models except GM

Note: With either method, the axle shaft may have to be rotated to permit the clutch to become engaged.

WARNING: Do not lie under carrier after fasteners are removed. Use transmission jack to support differential carrier assembly prior to loosening fasteners.

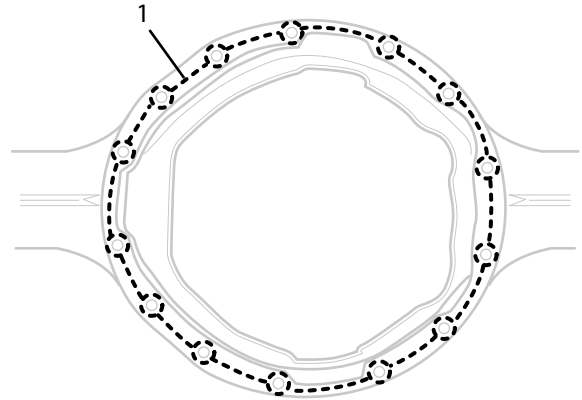
2. To remove axle shaft, remove axle stud nuts. (If used, remove lock washers and taper dowels.)
3. Remove axle shafts.

All models in this publication use axle shafts with unequal lengths. Axle shafts may also be location specific with various wheel equipment. Do not misplace axle shafts from their intended location. Identify left and right shafts for reference during reassembly.

Install Differential Carrier

IMPORTANT: Before installing carrier assembly, inspect and thoroughly clean interior of axle housing using an appropriate solvent and clean rag.

1. Apply Spicer approved RTV compound on axle housing mating surface as shown in the illustration. Completely remove all old gasket material prior to applying new material. Compound will set in 5 minutes. Install carrier before compound sets or reapply.



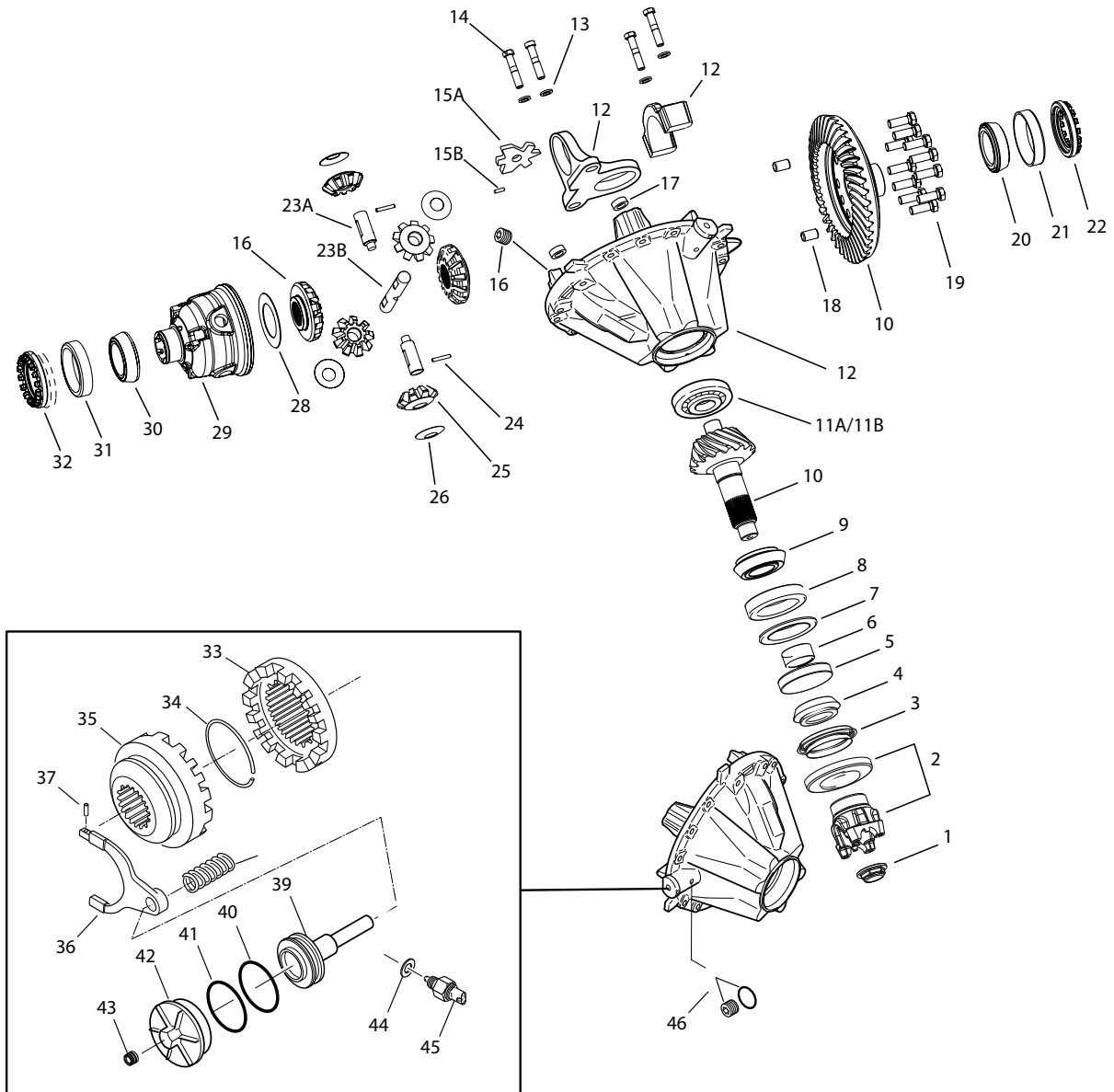
- 1 — Apply silicone gasket in this pattern

Differential Carrier Assembly

TIP: To assist in installing complete differential carrier, use two pieces of threaded rod (M16 X 1.5) threaded into carrier cap screw holes. Rod should be approximately 6" long. Use these to pilot the carrier into the housing.

2. Install carrier to housing, lock washers, capscrews and nuts. Torque to proper specification. Torque to 250–290 lbs. ft. (339–393 N•m).
3. Install axle shafts and axle stud nut (If used, also install lock washers and tapered dowels).
4. Add axle lubricant. Fill to bottom of filler hole.

Differential Carrier Assembly - Parts Exploded View

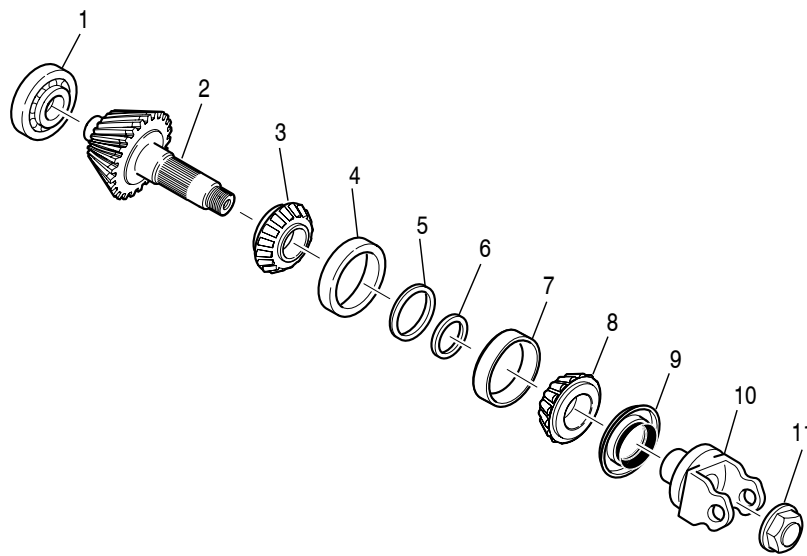


WHEEL DIFFERENTIAL LOCK
SHIFT PARTS

- | | | |
|-------------------------------|-----------------------------------|--------------------------------------|
| 1 — Pinion nut | 16 — Alignment dowels | 31 — Plain half bearing cup |
| 2 — End yoke and slinger | 17 — Plug | 32 — Plain half bearing adjuster |
| 3 — Oil seal | 18 — Ring gear dowels | 33 — Fixed clutch |
| 4 — Outer pinion bearing cone | 19 — Ring gear bolts | 34 — Snap ring |
| 5 — Outer pinion bearing cup | 20 — Flange half bearing cone | 35 — Sliding clutch |
| 6 — Pinion spacer | 21 — Flange half bearing cup | 36 — Roll pin |
| 7 — Pinion shim | 22 — Flange half bearing adjuster | 37 — Shift fork |
| 8 — Inner pinion bearing cup | 23 — Wheel diff shafts | 38 — Compression spring |
| 9 — Inner pinion bearing cone | 24 — Diff shaft pins | 39 — Shaft piston and shaft assembly |
| 10 — Ring & pinion set | 25 — Side pinion gears | 40 — Piston o-ring |
| 11 — Pinion pilot bearing | 26 — Side pinion thrust washers | 41 — Piston cap o-ring |
| 12 — Carrier sub assembly | 27 — Wheel diff side gear | 42 — Piston cap |
| 13 — Washers | 28 — Side gear thrust washers | 43 — Shipping screw |
| 14 — Carrier cap bolts | 29 — Plain half diff case | 44 — Plastic washer |
| 15 — Adjuster lock assembly | 30 — Plain half bearing cone | 45 — Diff lock indicator switch |

Pinion Assembly

Axle Pinion Assembly - Parts Exploded View

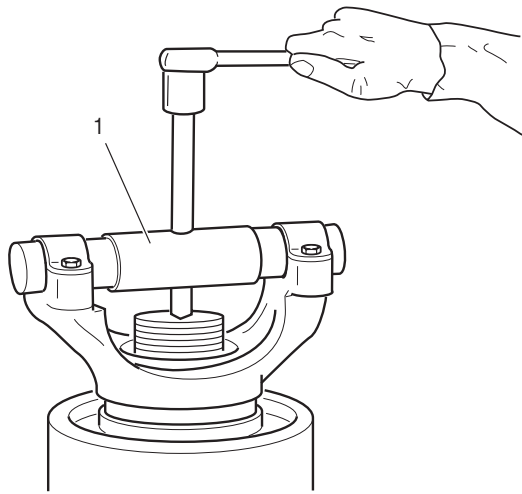


- 1 — Pinion pilot bearing
- 2 — Pinion
- 3 — Pinion bearing cone - inner
- 4 — Pinion bearing cup - inner
- 5 — Pinion shim
- 6 — Pinion bearing spacer

- 7 — Pinion bearing cup - outer
- 8 — Pinion bearing cone - outer
- 9 — Oil seal
- 10 — Yoke
- 11 — Pinion nut

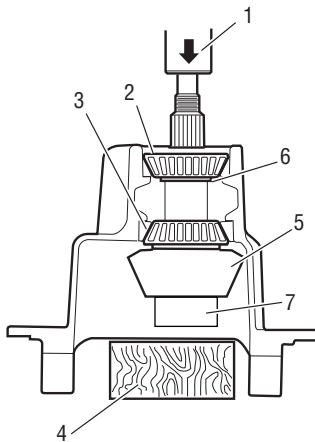
Pinion Removal

1. Remove yoke nut.
2. Remove yoke using a yoke puller service tool.



1 — Yoke puller

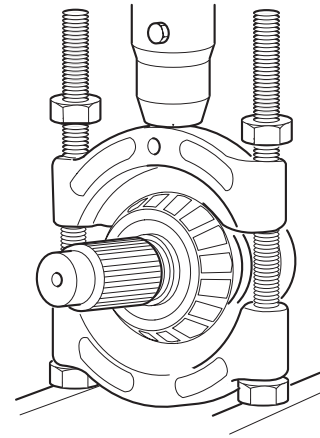
3. Remove oil seal.
4. Place carrier in a press with threaded end of pinion face up.
5. Place a wood block under pinion to avoid damage to gear teeth.



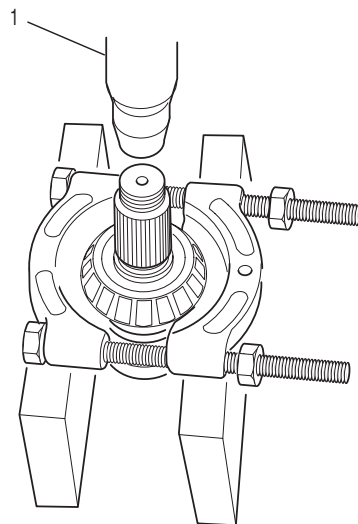
- 1 — Press
- 2 — Outer bearing
- 3 — Inner bearing
- 4 — Wood block
- 5 — Drive pinion
- 6 — Bearing preload spacer
- 7 — Pinion pilot bearing

6. Press pinion through outer bearing and out of carrier casting.
7. Remove bearing preload spacer and save for use in reassembly.

8. Remove inner bearing cone from pinion using a split-type puller. Use two procedure steps to remove each bearing.
 - a. Mount puller vertically to separate the bearing. This action will force puller halves under bearing and start moving bearing off pinion.



- b. Mount puller horizontally to press pinion out of bearing.



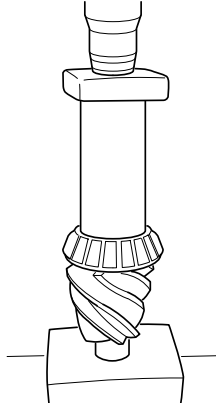
1 — Press

9. Use the same puller and process to remove the pinion pilot bearing.
10. If bearings are to be replaced, remove bearing cups from carrier casting at this time. Pinion removal complete.

Rear Axle Pinion

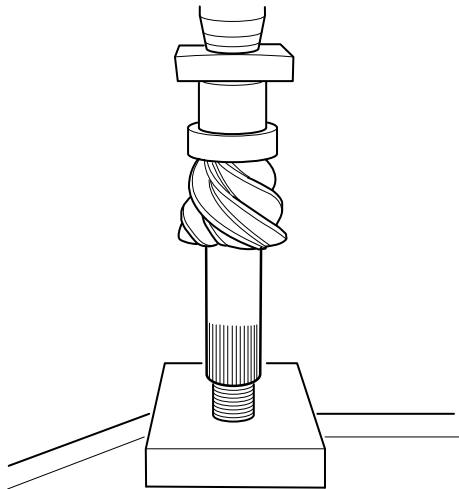
Axle Pinion Assembly

1. Use a press sleeve to install the inner pinion bearing cone. Apply pressure until the bottom of the cone touches the shoulder of the pinion. Apply lubricant to the surfaces of the bearing.

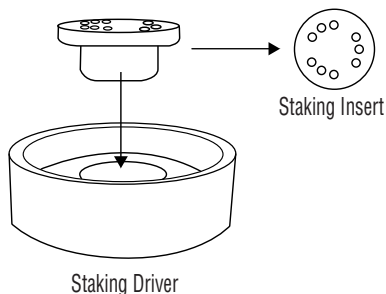


2. Press the pinion pilot bearing to the stub end of the pinion.

IMPORTANT: To prevent bearing damage, use suitable sleeve that only contacts the inner race of the bearing.



3. Staking the pinion pilot bearing is essential to retain the bearing. This axle model requires a special staking tool to insure a proper repair. Use the chart to determine which stake pattern is required for the pinion you are assembling.



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S172 Stake (35mm) Ratios 4.78 to 6.14

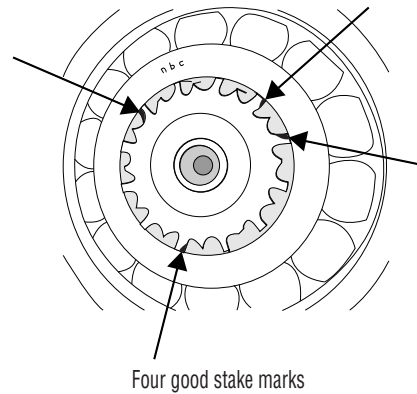
Press and Stake Tool Base	10130404
Press and Stake Tool S172 Piloting Tool	10130409
9-Ball 35mm Stake Tool	10130411

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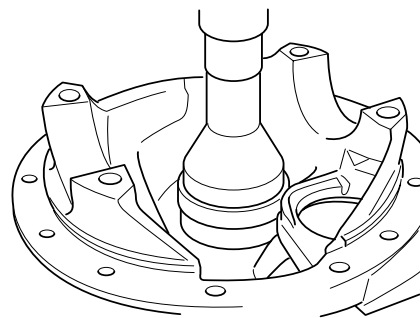
S172 Stake (40mm) Ratios 3.07 to 4.56

Press and Stake Tool Base	10130404
Press and Stake Tool S172 Piloting Tool	10130409
9-Ball 40mm Stake Tool	10130410

4. Using the correct staking driving insert, apply a minimum of 15 tons to the press.
5. Inspect the end of the pinion to insure there is a minimum of four stakes marks. If necessary, rotate the staking tool slightly and repeat the pressing process.

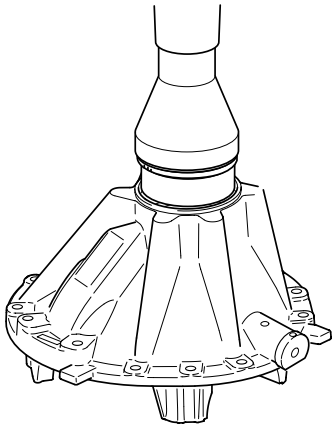


6. To install the new inner pinion bearing cup, place the carrier into a press with the bottom of the carrier facing up.

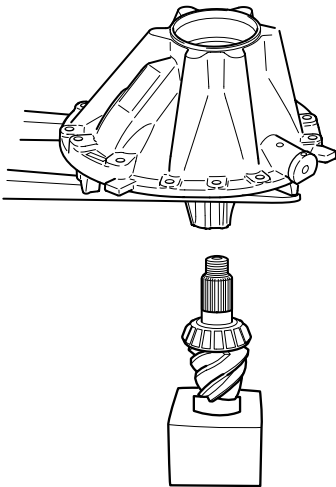


7. Place the cup in the bore, use a sleeve or bearing driver tool to press the cup until it is fully seated. Use a feeler gauge between the cup and carrier to insure the cup is seated properly.
8. To install the outer pinion bearing cup, place the carrier in the press with the top of the carrier facing up.

9. Place the cup in the bore, use a sleeve or bearing driver tool to press the cup until it is fully seated. Use a feeler gage to make sure the cup is fully seated.

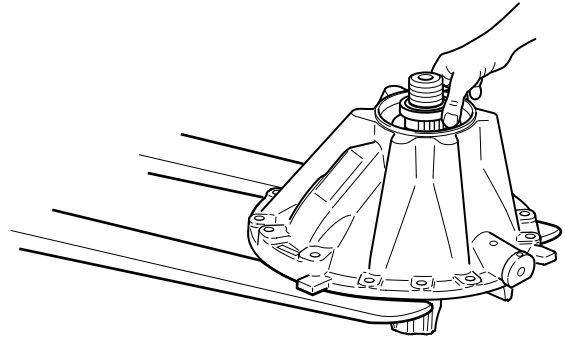


10. Place the pinion on a 6" x 6" x 6" block of wood and lower the carrier over the pinion.

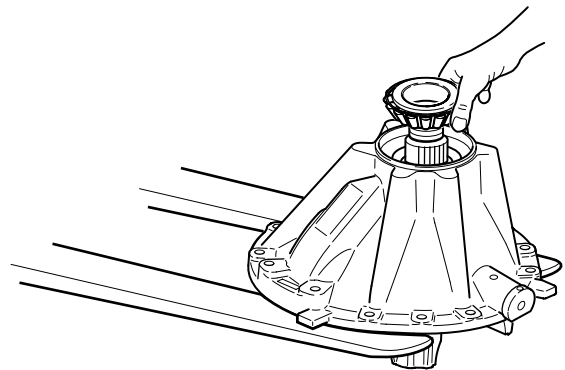


11. Install the pinion spacer.

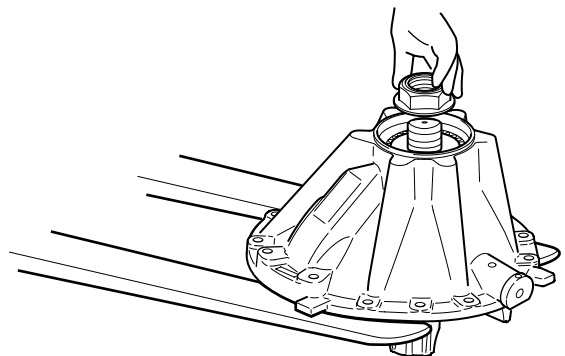
Note: If you are using the same drive pinion, use the same spacer that was originally installed in the assembly. If the drive pinion is to be replaced, the original spacer will be used as the starting point of adjustment.



12. Install the outer bearing cone.

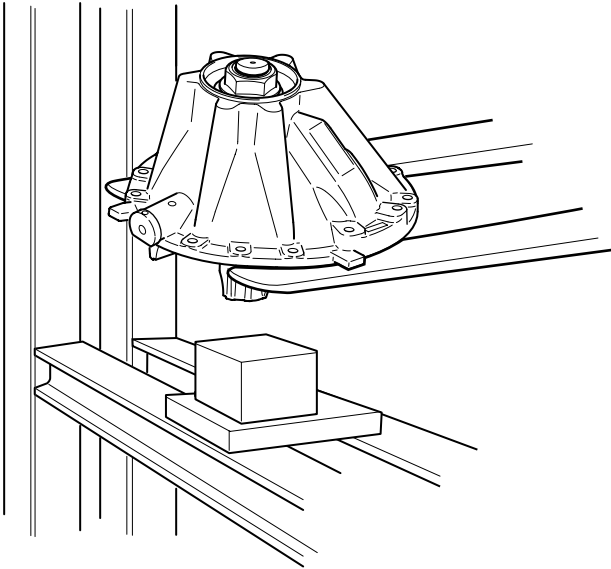


13. Install a pinion nut finger tight. This will hold the pinion in place while it is positioned into the press.



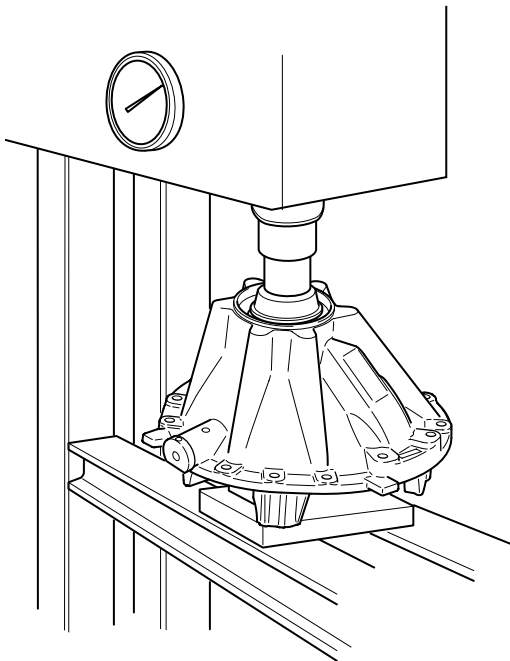
Rear Axle Pinion

14. Align a 6" x 6" x 6" wood block under the drive pinion, then lower the carrier and pinion assembly into a press so that it is supported by the block.

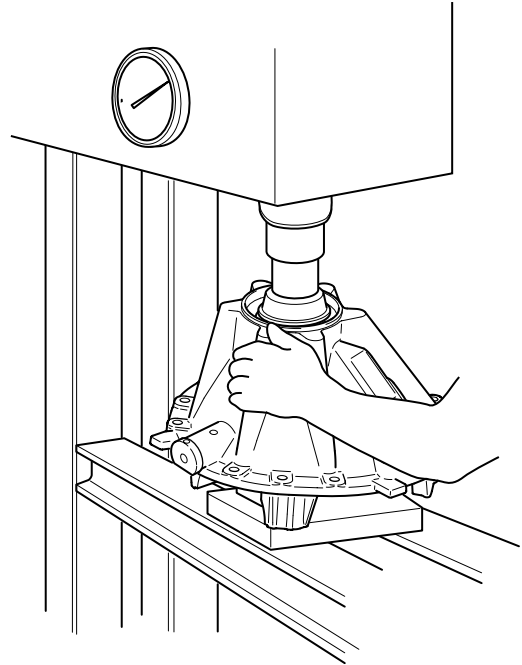


15. Remove the pinion nut.

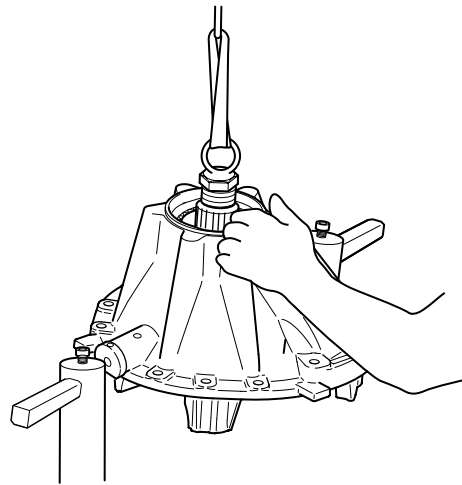
16. Place a press sleeve over the top of the outer bearing cone. Use the press to apply 5 tons of force. It is important to rotate the carrier slightly to make sure that the rollers of the bearing are properly seated.



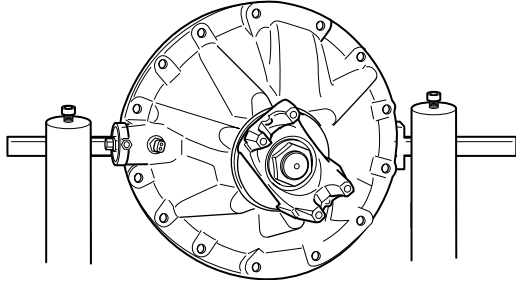
17. With 5 tons of force on the press, you should be able to feel a small amount of drag from the bearing as you rotate the carrier. If the carrier turns with no drag at all, the pinion spacer thickness should be decreased by using a thinner spacer. If the carrier is hard to turn, the spacer thickness must be increased.



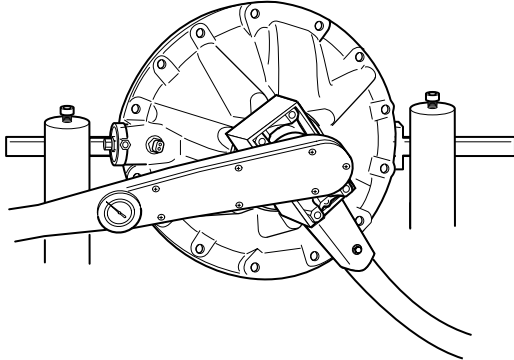
18. Remove the carrier from the press. Secure the carrier in a head stand.



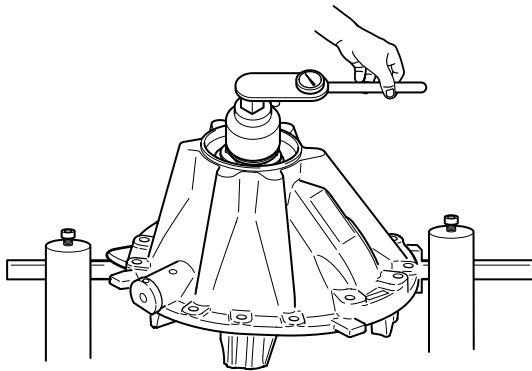
19. Install the drive yoke and pinion nut.



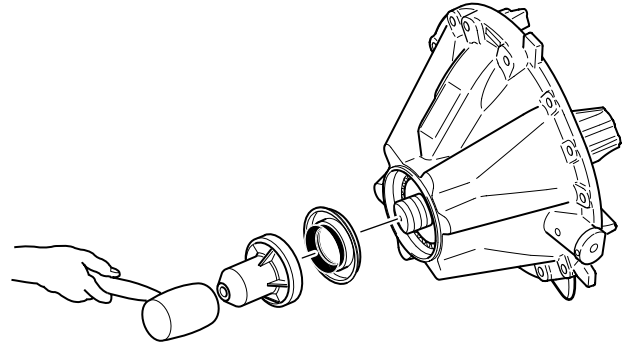
20. Torque the nut to 800-1000 lbs. ft. (1084-1355 N•m).



21. Use an in. lbs. torque wrench and correct socket to check the rolling torque of the pinion. Read torque while rotating the assembly. Record the rotating torque, not the breakaway torque. Torque must be between 20 to 50 lbs. in. If the torque recorded is not within the specified torque, the pinion spacer must be changed. Repeat Steps 4-15.

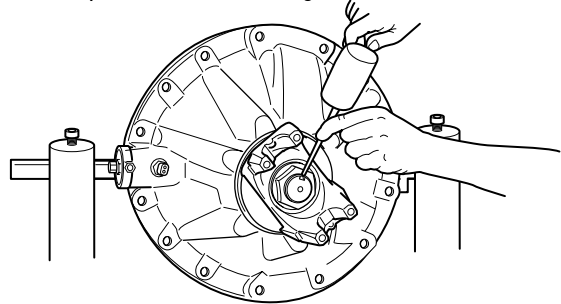


22. Now remove the pinion nut and yoke and install the pinion seal. Use Spicer's seal drive (part number 210749) and drive adapter (part number 10095470).



23. Reinstall the yoke and pinion nut. Torque to 900 lbs. ft.

24. Once the proper rolling torque is achieved, use a punch with a round tip to stake the pinion nuts flange into the machined slot in the pinion shaft. See diagram below.



⚠ CAUTION: The stake must be deep enough to enter the machined slot of the pinion.

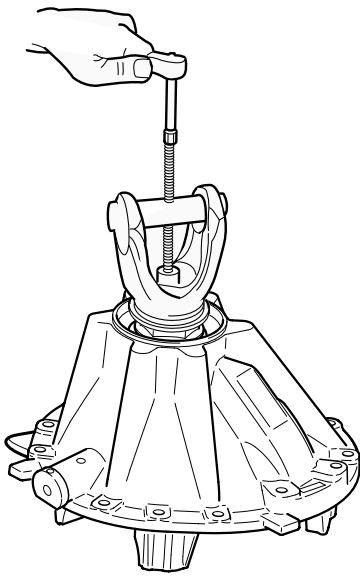
Rear Axle Pinion

Replace Seal

Spicer strongly recommends using seal drivers when installing new seals. Use the proper driver to make sure that the seal is square and installed to the proper depth.

! IMPORTANT: Oil seals can be easily damaged prior to installation. Use care when handling the new seal to prevent damage or contamination. Leave the seal in its package until installation. On new yokes, leave the protector on the yoke until it is installed on the shaft to prevent damage or contamination.

1. Remove the old yoke using appropriate tool. A yoke puller tool may be made from the center section of most gear puller tools, or may be purchased from your local tool distributor.



2. Remove seal. Use care when removing the old seal to prevent damage to the housing seal bore.

3. Inspect the seal bore area for any damage (nicks, gouges, corrosion). Carefully remove any slight damage with a crocus cloth. Clean the bore area to remove any loose debris.

! CAUTION: Do not use any silicone or permatex-type bore sealant with this seal.

4. Remove the new seal from its package and install with the proper driver:

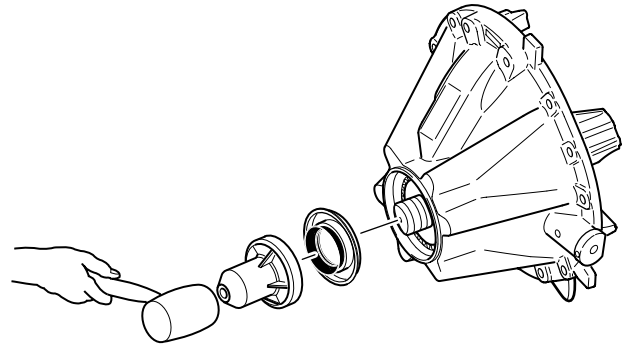
R - Pinion Driver - 210749

R - Pinion Insert - 10095470

! WARNING: Due to the resiliency of the plastic driver, hammer rebound may occur when the seal is seated. Keep clear of the hammer rebound path!

5. Handle the seal by its outside diameter avoiding any contact with the seal lips. During installation, use the proper driver to make sure that the seal is mounted properly.

6. Use a rubber mallet to drive the seal tool in until the flange bottoms on the housing cover bore face. The flange will locate the seal at the proper depth.

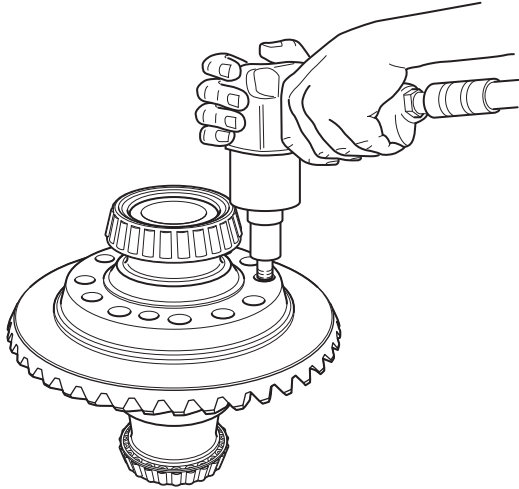


Disassemble, Overhaul, and Assemble Wheel Differential

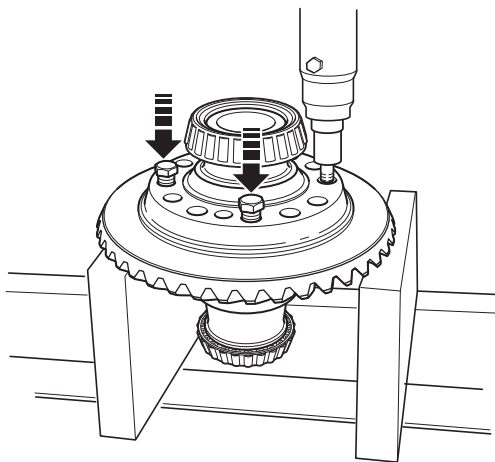
Disassemble Wheel Differential

⚠ IMPORTANT: Do not press on the wheel differential shaft to free the ring gear from the case. Pressing on the wheel differential shaft may cause it to bend.

1. Remove capscrews fastening the ring gear to differential case.

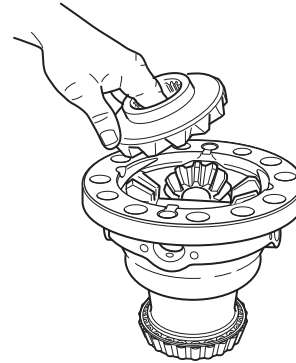


2. The ring gear to differential case interface is a press fit. Place the assembly in a press with the case facing downward. Support the assembly on either side of the ring gear. Thread a cap screw back into one of the case holes by hand. Press down on the head of the cap screw, you will need to press in more than one position to free the ring gear from the case.



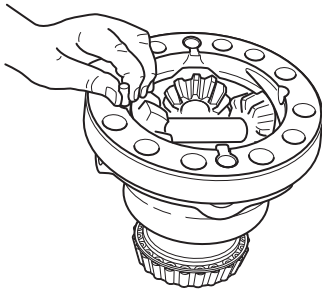
⚠ CAUTION: The differential case and gears will fall after separation. Support the case so that it will not cause damage to the differential or bodily injury.

3. Remove the outer side gear.

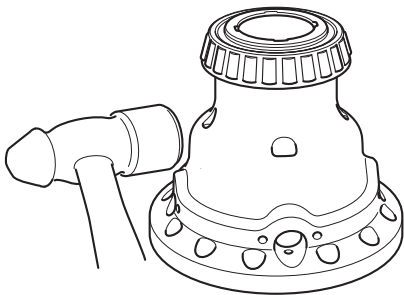


Wheel Differential

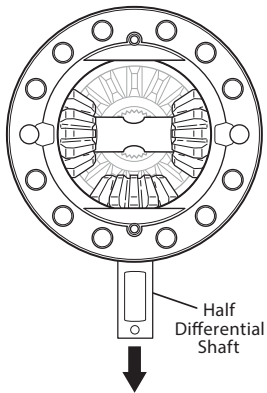
4. The locking pins are a slip fit and should be easily removed from the differential case.



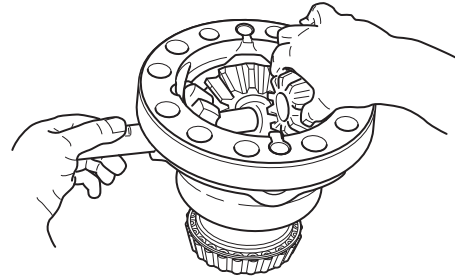
5. Remove the differential shaft locking pins by turning the differential case opening facing down. Use a hammer to lightly tap on the side of the case to free the locking pins.



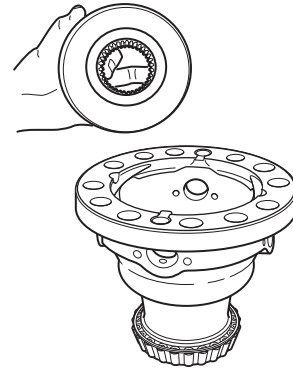
6. Remove the two half shafts first and then remove their side pinions and thrust washers.



7. Remove the full shaft, side pinions and thrust washers.

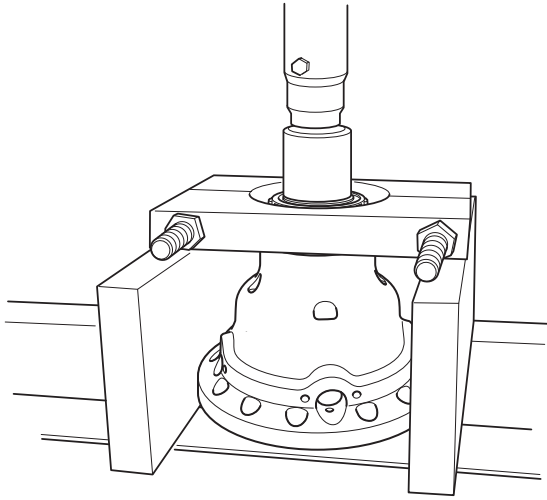


8. Remove inner side gear and thrust washer.

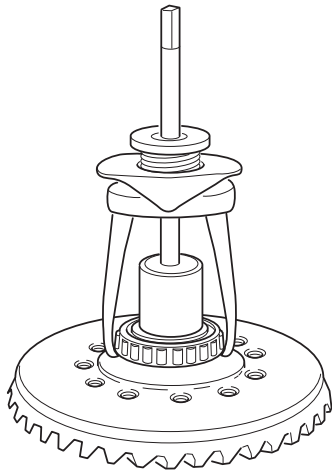


9. Remove bearing cones from ring gear and differential case in two steps:

a. Mount puller vertically to split bearing. This action will start moving the bearing off case and gear.

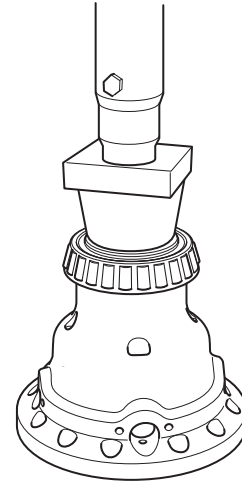


b. Mount puller horizontally to remove cone.

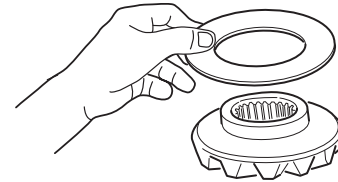


Assemble Wheel Differential

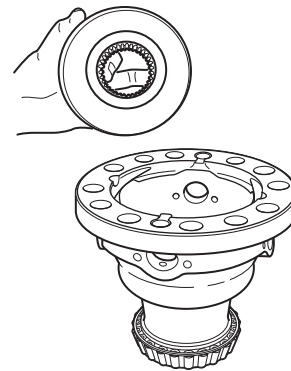
1. Press new bearing cone on the differential case.



2. Place thrust washer on the side gear. Lubricate both sides of the thrust washer before installing.

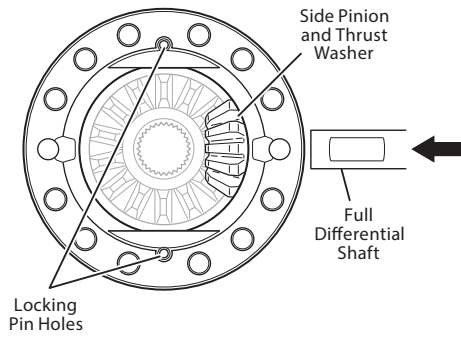


3. Install the side gear and thrust washer in the differential case.

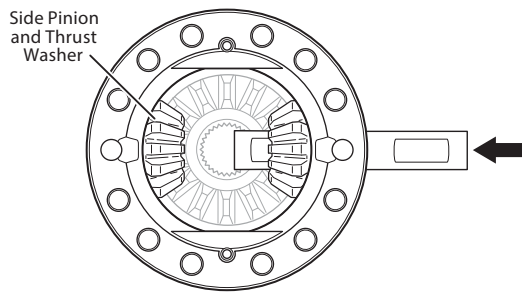


Wheel Differential

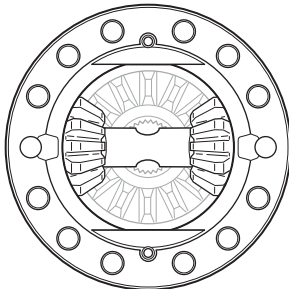
4. Start the full differential shaft into the shaft bores in the case that does not have a locking pin hole.



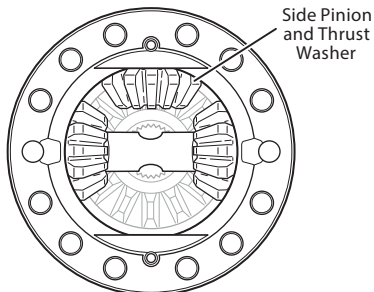
5. Install a side pinion and thrust washer and push the shaft through the side pinion.



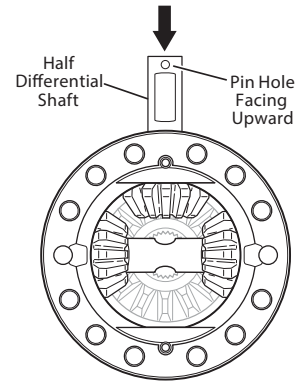
6. Install the side pinion and thrust washer to the other side of the full shaft.



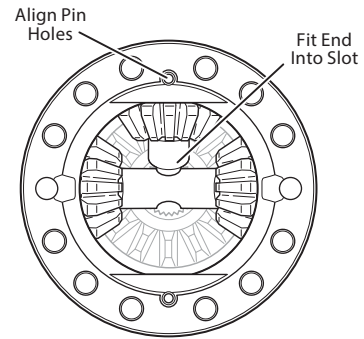
7. Install a side pinion and thrust washer on the half shaft side.



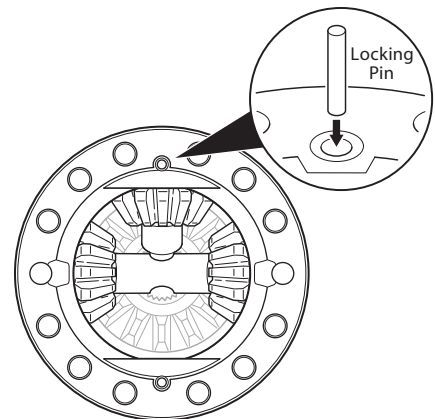
8. Install the half shaft so that the pin is facing upward and push it in until it stops.



9. The end of the half shaft should fit into the hole of the full shaft at the same time as the hole in the case lines up with the hole in the half shaft.

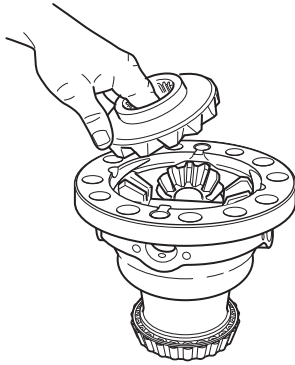


10. Install the locking pins to both sides of the differential case.

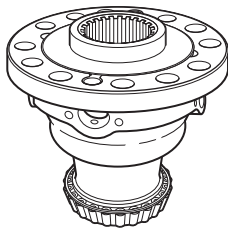


11. Install outer side gear.

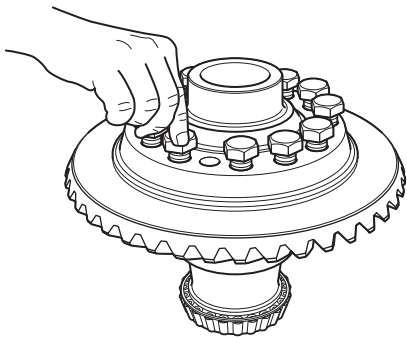
Note: No thrust washer is used at this location.



12. Lower the ring gear onto the case assembly aligning the locking dowels.

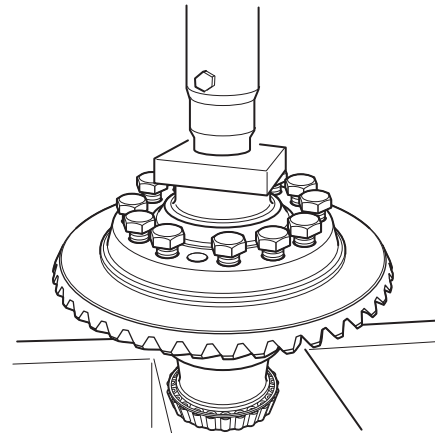


13. Install and hand-tighten all new ring gear capscrews.



14. The interface of the ring gear to differential case is a press fit. Put the assembly in a press with the ring gear facing upward. Make certain that the ring gear is flush and square to the differential case before pressing. Press until ring gear bottoms out on the case.

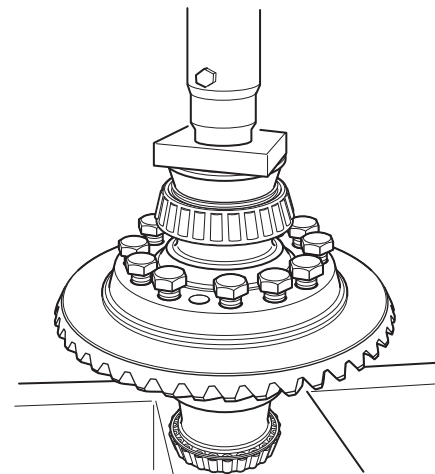
⚠ IMPORTANT: DO NOT use the capscrews to draw the ring gear into place. Only use a press.



15. Press new ring gear bearing cone.

16. While the ring gear and differential assembly are in the press, the ring gear bolts can be torqued to specification. Apply enough press pressure to keep the differential assembly from rotating during the torquing process. Torque ring gear bolts to 635 ft lbs \pm 25 ft lbs (860 \pm 10 N•m).

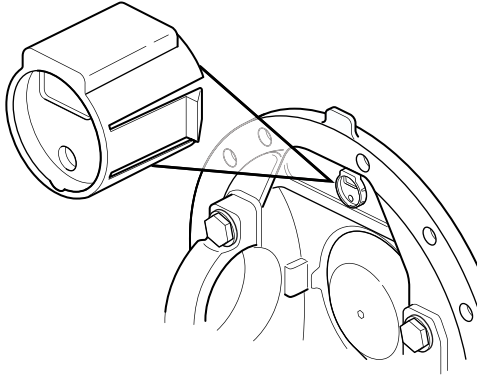
⚠ IMPORTANT: When pressing differential case bearing cones, note that the bearing is beyond flush with the top of the case. The cone must be fully seated. To prevent bearing damage, use suitable sleeve that only contacts the inner race of the cone. A used bearing race would be a suitable tool. This tool should have a slit cut if the ID is the same as the bearing boss OD.



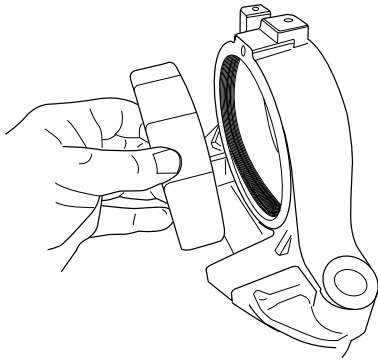
Wheel Differential

Carrier – Assembly

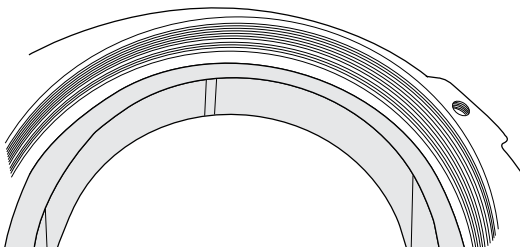
! IMPORTANT: Before installing the the wheel differential assembly, inspect the oil regulator plug for obstructions. The regulator plug should NEVER be reused. If the plug is damaged or missing, ALWAYS replace with a new part.



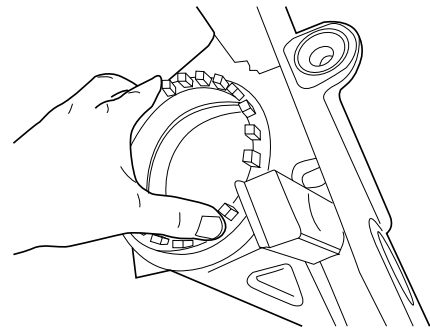
1. Install the plain half bearing cup into the threaded or outboard side of the pedestal support.



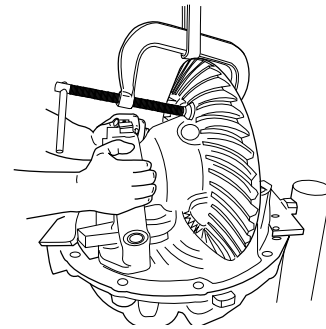
2. Install the cup so that it is just beyond the threads in the bore.



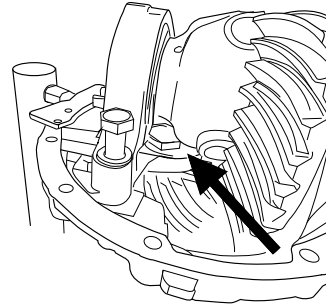
3. Install the bearing adjuster. Turn it until the threads are fully engaged.



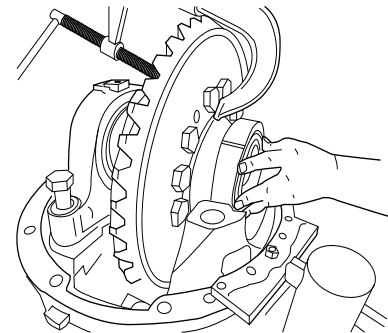
4. With the wheel differential and ring gear assembly suspended above the carrier, install the plain half pedestal support assembly over the plain half bearing cone.



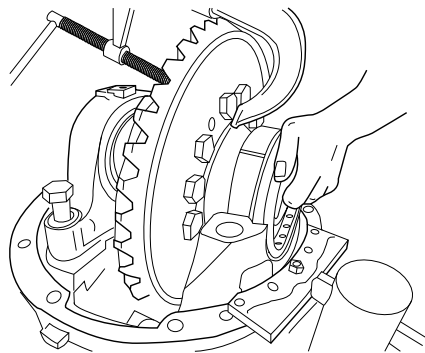
5. Lower the differential assembly slowly while aligning the pinion pilot bearing and alignment dowel of the pedestal.



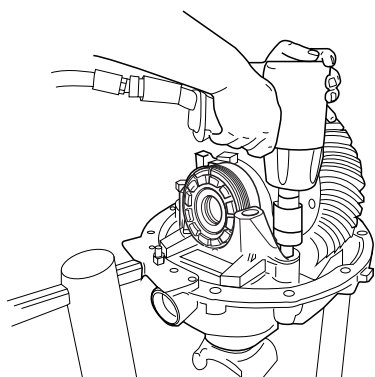
6. Again using the hoist, position the wheel differential so you can install the flange half bearing cup to the cone. Lower the differential until the cup is seated in the carrier.



7. Install the flange bearing adjuster.

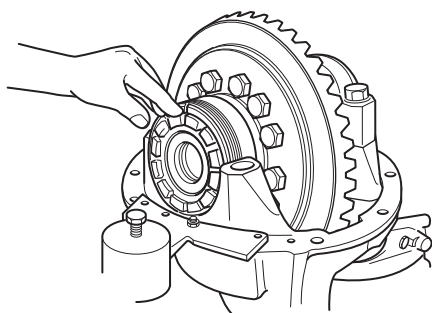


8. Now install and torque the plain half pedestal support bolts to specification.



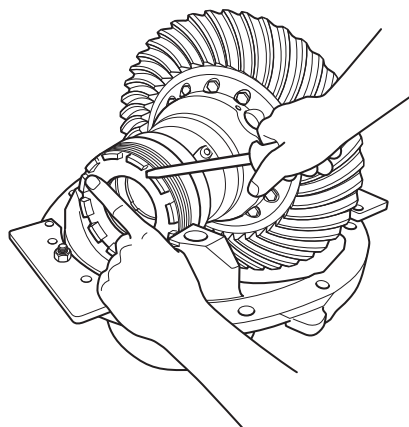
9. Now set a "rough" backlash. Turn the flange half adjust so that the ring gear is moving in the direction of the pinion gear. Keep adjusting the flange half adjuster until the ring gear contacts the pinion gear.

10. Now back the flange half adjuster off three notches.



11. Now turn the plain half adjuster inward until you feel resistance on the adjuster. This is your "zero" bearing preload setting.

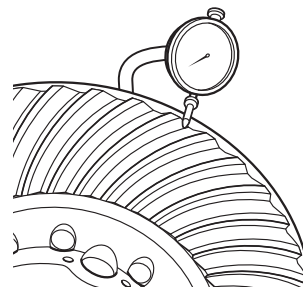
12. Tighten the bearing adjuster two additional notches to create the proper bearing preload.



13. With a dead blow hammer seat the flange half bearing adjusters.

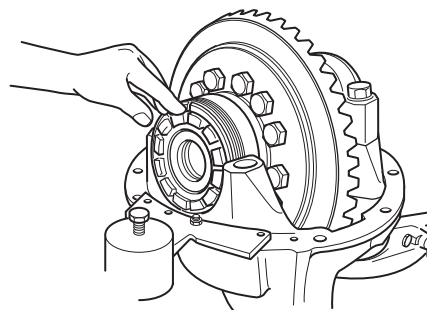
14. Mount the base of a dial indicator to the flange of the carrier.

15. Place the tip of the indicator to the drive side heel of a ring gear tooth.



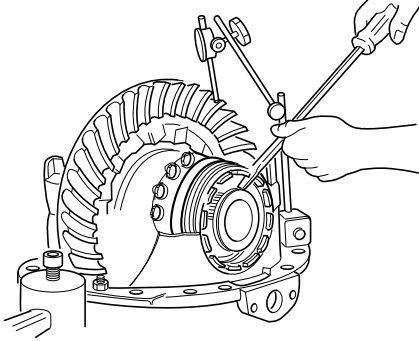
16. Record the actual backlash. Remember this is a rough backlash.

17. Now make the final backlash adjustments. The backlash specification for this axle model is 0.0008" - 0.018". Set the backlash at 0.012" - 0.013" for new gearing. If the backlash has to increase in size the ring gearing must move away from the pinion. Each notch in the adjusters equals 0.003" - 0.004" of backlash.



Rear Carrier

18. Start by backing off the bearing adjuster on the side that the gear set needs to move. Example: To increase the backlash, back off the flange half adjuster first. To decrease the amount of backlash, back off the plain half bearing adjuster first.

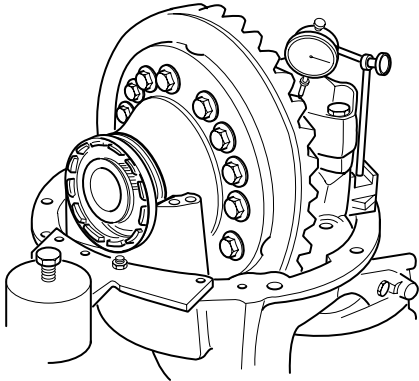


! IMPORTANT: Remember we just set the bearing preload at two notches. When you back off one of the adjusters you must tighten the opposite adjuster the same number of notches.

19. With the backlash set at 0.012" - 0.013", install the flange half bearing cup.

20. Snug the bolts down with an impact gun.

21. The backlash must be remeasured at this time. If the backlash did not remain at 0.012" - 0.013" the cups should be removed and the backlash must be readjusted. This process must be repeated until the specified backlash is achieved with the bearing cups installed and torqued to Dana specifications.

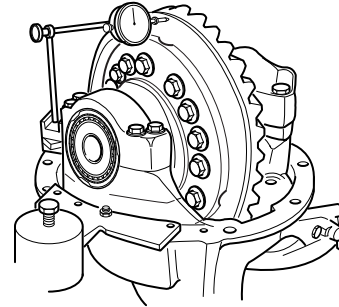


Note: For used gearing, the backlash should be reset to what it was at the time of disassembly.

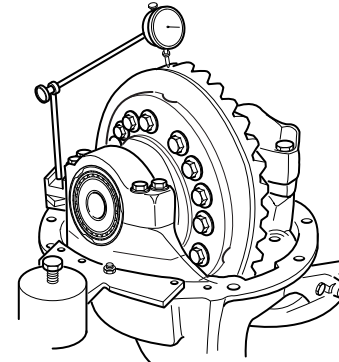
Note: If you have too much backlash, move the ring gear closer to the pinion. Count the number of notches you back off the plain half threaded cup. Each notch equals about 0.003" (0.08 mm) of backlash.

! IMPORTANT: In order to maintain the differential bearing preload, you will need to turn the flange half threaded cup the same amount in the same direction. If you need more backlash, reverse this procedure.

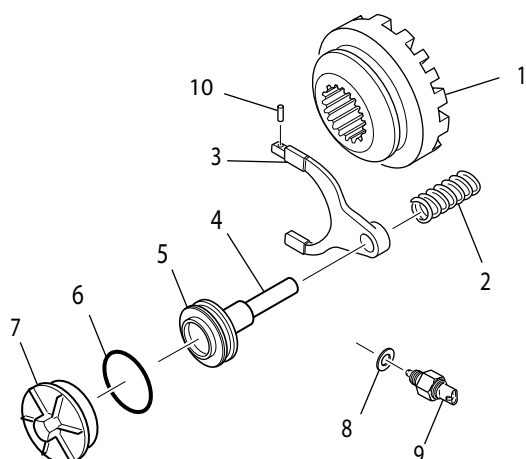
22. Measure the ring gear total radial runout. Indicator reading should not exceed 0.010" (0.25 mm).



23. Measure the ring gear total backface runout. Indicator reading should not exceed 0.010" (0.25 mm).



Wheel Differential Lock - Parts Exploded View

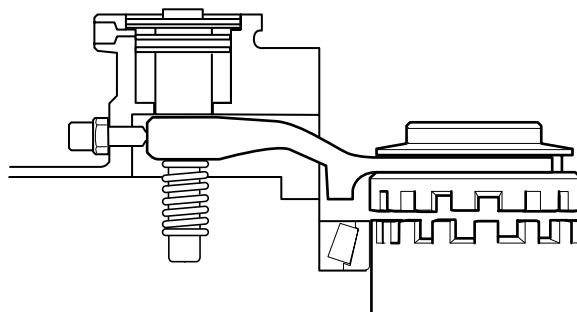


- | | |
|--------------------|------------------|
| 1 — Sliding clutch | 7 — Piston cover |
| 2 — Spring | 8 — Washer |
| 3 — Shift Fork | 9 — Switch |
| 4 — Push rod | 10 — Roll pin |
| 5 — Piston | |
| 6 — O-ring | |

Install Wheel Differential Lock

Note: With differential carrier completely assembled and adjusted, install differential lock as follows:

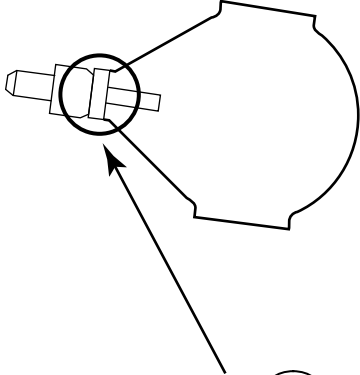
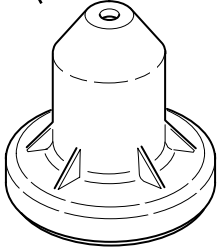
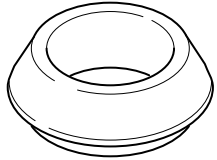
1. If shift fork and sliding clutch are disassembled, engage fork with the clutch hub and install spring pin in the fork leg. See illustration below for fork mounting position on clutch.
2. Position compression spring, shift fork, and clutch in shift opening of the carrier. Align the pilot hole of shift fork with the pilot hole of the carrier.
3. Install pushrod through shift fork, compression spring and carrier pilot hole.



4. Lubricate piston and o-ring with silicone grease. Install shift piston assembly into cylinder. Position piston with small diameter hub toward closed end of cylinder.
5. Install piston cover o-ring.
6. Install piston cover and torque to 50–75 lbs. ft. (68–102 N•m).
7. Install selector switch and torque to 10–12 lbs. ft. (14–16 N•m).
8. Check selector switch operation. Check switch electrically with an ohmmeter. Switch should be closed when clutches are engaged and open when disengaged.

Wheel Differential Lock

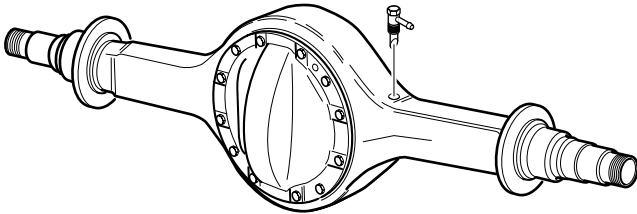
Pinion Seal Driver Part Numbers

	R-Pinion
Location	
Tool	 210749  10095470

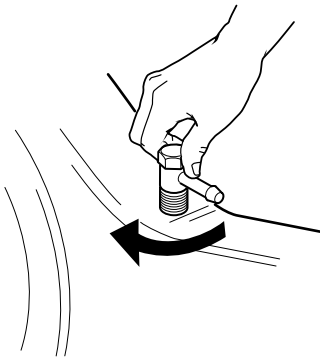
Housing Breather

Spicer has an axle breather that consists of a fitting, hose and clamp assembly. This breather design has improved resistance to water ingestion, clogging caused by dirt, ice or snow buildup around the base of the breather. See installation instructions below (all views from rear).

1. Install fitting in breather hole.

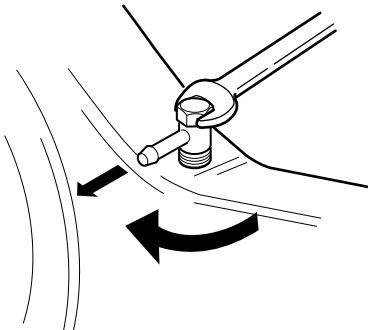


2. Tighten fitting finger tight.

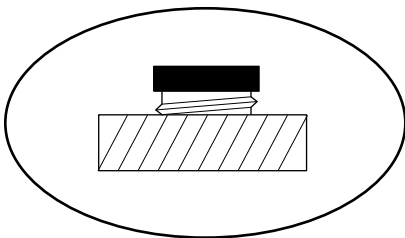


3. Using a 3/4" wrench:

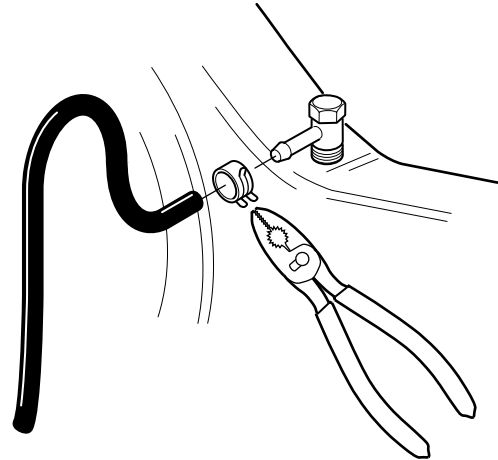
Metal only: Rotate the fitting at least 1/2 turn until nipple points to rear.



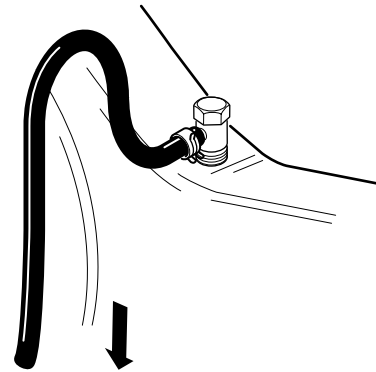
Plastic only: Tighten until one thread is showing.



4. Insert hose onto fitting, long end down.

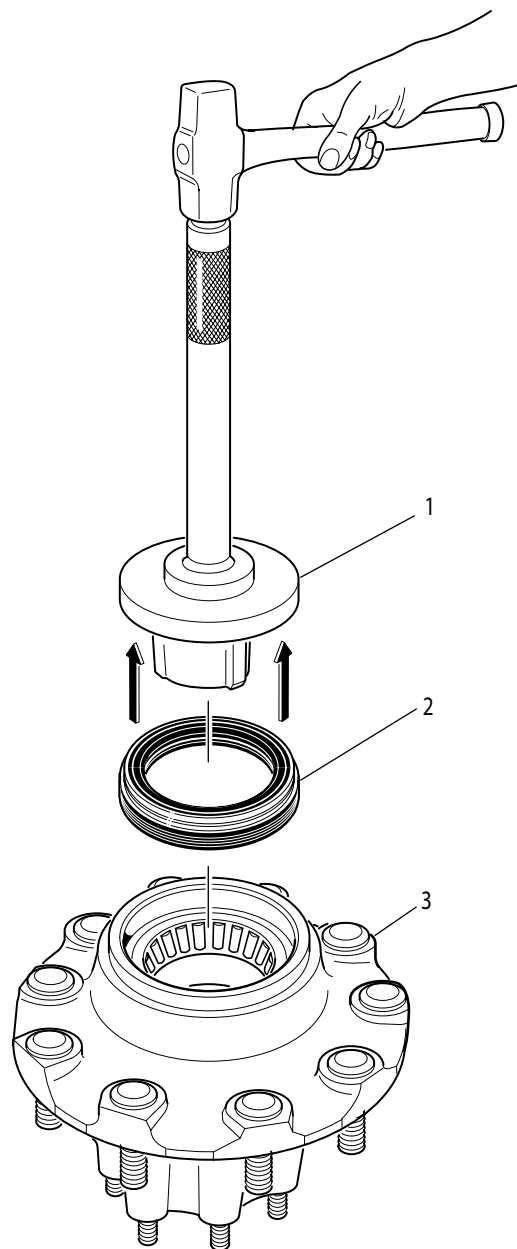


5. Push hose firmly against fitting. Rotate hose to point down.




Housing Breather


Wheel End Seal - Parts Exploded View



- 1 — Installation tool
- 2 — Seal
- 3 — Rear hub

Remove and Overhaul Wheel End Seal

 **WARNING:** Never work under a vehicle supported by only a jack. Always support vehicle with stands. Block the wheels and make sure the vehicle will not roll before releasing the brakes.

 **IMPORTANT:** Wheel end seals can be easily damaged during handling. Leave the seal in its package until installation to prevent damage or contamination.


1. Remove outer bearing and wheel.
2. Remove oil seal.
3. Remove inner bearing.
4. Remove old wear sleeve (2-piece design only) with a ball peen hammer and discard.

IMPORTANT: Do not cut through the old wear sleeve. Damage to the housing may result.

5. Inspect spindle journal and hub bore for scratches or burrs. Recondition with an emery cloth as required.

Note: Deep gouges can be repaired by filling gouge with hardening gasket cement and smoothing with emery cloth.

6. Clean hub cavity and bearing bores before reassembly. Be sure to remove contaminants from all recesses and corners.
7. Clean bearings thoroughly with solvent and examine for damage. Replace damaged or worn bearings.

 **IMPORTANT:** Always use the seal installation tool specified by the seal manufacturer. Using an improper tool can distort or damage the seal and cause premature seal failure.

Install Wheel End Seal

1. Before installation, lubricate the following with the same lubricant used in the axle sump:

- Inner bearing
- Wheel seal (follow the directions provided by the seal supplier)

2. Place seal on installation tool.
3. Drive seal with installation tool onto hub.

Wheel End Seal

Adjust Wheel Bearing

WARNING: Do not mix spindle nuts and lock washers from different systems. Mixing spindle nuts and lock washers can cause wheel separation.

Note: The lock washer for a four-piece tang/dowel-type wheel nut system is thinner than the lock washer for a three-piece tang-type wheel nut system and is not designed to bear against the inner nut.

1. Inspect the spindle and nut threads for corrosion and clean thoroughly or replace as required.

Note: Proper assembly and adjustment is not possible if the spindle or nut threads are corroded.

2. Inspect the tang-type washer (if used). Replace the washer if the tangs are broken, cracked or damaged.

3. Install the hub and drum on the spindle with care to prevent damage or distortion to the wheel seal.

CAUTION: A wheel dolly is recommended during installation to make sure that the wheel seal is not damaged by the weight of the hub and drum. Never support the hub on the spindle with just the inner bearing and seal. This can damage the seal and cause premature failure.

4. Completely fill the hub cavity between the inner and outer bearing races with the same lubricant used in the axle sump.

5. Before installation, lubricate the outer bearing with the same lubricant used in the axle sump.

Note: Lubricate only with clean axle lubricant of the same type used in the axle sump. Do not pack the bearings with grease before installation. Grease will prevent the proper circulation of axle lubricant and may cause wheel seal failure.

6. Install the outer bearing on the spindle.

7. Install the inner nut on the spindle. Tighten the inner nut to 200 lbs. ft. (271 N•m) while rotating the wheel hub.

CAUTION: Never use an impact wrench to adjust wheel bearings. A torque wrench is required to assure that the nuts are properly tightened.

8. Back off the inner nut one full turn. Rotate the wheel hub.

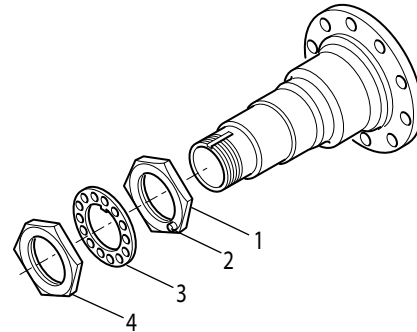
9. Retighten the inner nut to 50 lbs. ft. (68 N•m) while rotating the wheel hub.

10. Back off the inner nut exactly 1/4 turn.

Note: This adjustment procedure allows the wheel to rotate freely with 0.001"–0.005" (0.025 mm–0.127 mm) endplay.

11. Install the correct lock washer for the wheel nut system being used.

Three-piece Dowel-type Lock Washer System



- 1 — Inner Nut
- 2 — Dowel Pin
- 3 — Dowel-type Lock Washer
- 4 — Outer Nut

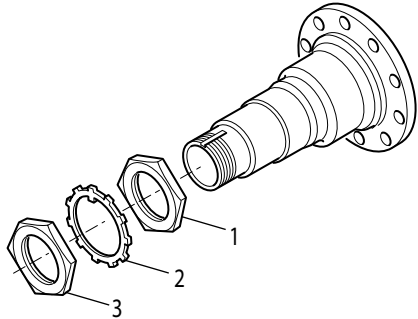
a. Install the Dowel-type lock washer on the spindle.

Note: If the dowel pin and washer are not aligned, remove washer, turn it over and reinsert all. If required, loosen the inner nut just enough for alignment.

CAUTION: Never tighten the inner nut for alignment. This can preload the bearing and cause premature failure.

- b. Install the outer nut on the spindle and tighten to 350 lbs. ft. (475 N•m).
- c. Verify endplay.

Three-piece Tang-type Lock Washer System



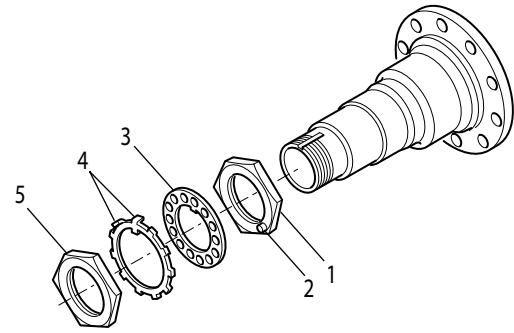
- 1 — Inner Nut
- 2 — Tang-type Lock Washer 0.123" (3.124 mm) thick
- 3 — Outer Nut

- a. Install the Tang-type lock washer on the spindle.

⚠ CAUTION: Never tighten the inner nut for alignment. This can preload the bearing and cause premature failure.

- b. Install the outer nut on the spindle and tighten to 250 lbs. ft. (339 N•m).
- c. Verify endplay.
- d. After verifying endplay, secure wheel nuts by bending one of the locking washer tangs over the outer wheel nut and another tang over the inner wheel nut.
- e. Go to step 12.

Four-piece Tang/Dowel-type Lock Washer System



- 1 — Inner Nut
- 2 — Dowel Pin
- 3 — Dowel-type Lock Washer
- 4 — Tang-type Lock Washer 0.0478" (1.2065 mm) thick
- 5 — Outer Nut

- a. Install the Dowel-type lock washer on the spindle.

Note: If the dowel pin and washer are not aligned, remove washer, turn it over and reinsert all. If required, loosen the inner nut just enough for alignment.

⚠ IMPORTANT: Never tighten the inner nut for alignment. This can preload the bearing and cause premature failure.

- b. Install the Tang-type lock washer on the spindle.
- c. Install the outer nut on the spindle and tighten to 250 lbs. ft. (339 N•m).
- d. Verify endplay.
- e. After verifying endplay, secure the outer nut by bending (180° apart) two opposing tangs of the locking washer over the outer nut.

- 12. Install the following:

- New gasket at axle shaft flange
- Axle shaft
- Axle flange nuts and tighten to specified torque

- 13. Lubricate axle wheel ends.

Wheel Bearing

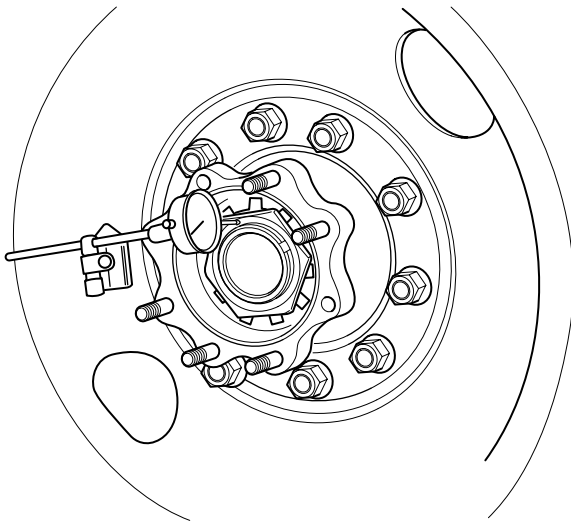
Verify Wheel Endplay Procedure

Verify that endplay meets specification using a dial indicator. An indicator with 0.001" (0.03 mm) resolution is required. Wheel endplay is the free movement of the tire and wheel assembly along the spindle axis.

Correct endplay is 0.001"–0.005" (0.025–0.125 mm).

1. Attach a dial indicator with its magnetic base to the hub or brake drum as shown below.
2. Adjust the dial indicator so that its plunger or pointer is against the end of the spindle with its line of action approximately parallel to the axis of the spindle.
3. Grasp the wheel assembly at the 3 o'clock and 9 o'clock positions. Push the wheel assembly in and out while oscillating it to seat the bearings. Read bearing endplay as the total indicator movement.

⚠ CAUTION: If endplay is not within specification, readjustment is required.



Readjust Wheel Endplay Procedure

Excessive Endplay: If end-play is greater than 0.005" (.127 mm), remove the outer nut and pull the lock washer away from the inner nut, but not off the spindle. Tighten the inner nut to the next alignment hole of the dowel-type washer (if used). Reassemble the washer and re-torque the outer nut.

Verify endplay with a dial indicator

Insufficient Endplay: If endplay is not present, remove the outer nut and pull the lock washer away from the inner nut, but not off the spindle. Loosen the inner nut to the next adjustment hole of the dowel-type washer (if used). Reassemble the washer and re-torque the outer nut. Verify endplay with a dial indicator.

Fine Tuning the Endplay: If, after performing the readjustment procedures, endplay is still not within the 0.001"–0.005" (0.025–0.127 mm) range, disassemble and inspect the components. If parts are found to be defective, replace the defective parts, reassemble and repeat wheel bearing adjustment procedure. Verify endplay with a dial indicator.

Lubricate Wheel End

⚠ CAUTION: Before operating the axle, the wheel hub cavities and bearings must be lubricated to prevent failure.

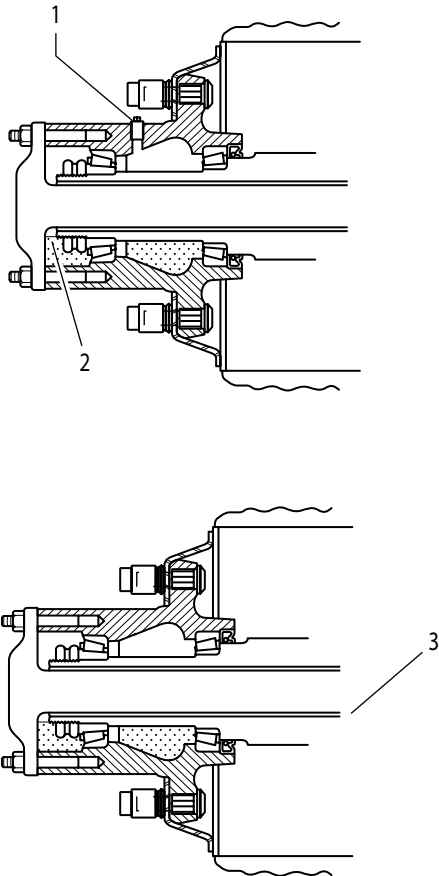
When wheel ends are serviced, follow Spicer's wheel end lubrication procedure before operating the axle.

Spicer axles may be equipped with either of two wheel end designs:

- Wheel ends with an oil fill hole
- Wheel ends without an oil fill hole

Wheel Ends with an Oil Fill Hole

1. Rotate the wheel end hub until the oil fill hole is up.
2. Remove the oil fill plug.
3. Pour 2.5 pints of axle sump lubricant into each hub through the wheel end fill hole.
4. Install oil fill plug and tighten to specified torque.



- 1 — Wheel End Oil Fill Hole
2 — Proper Lubricant Level
3 — Lubricant Flow from Sump

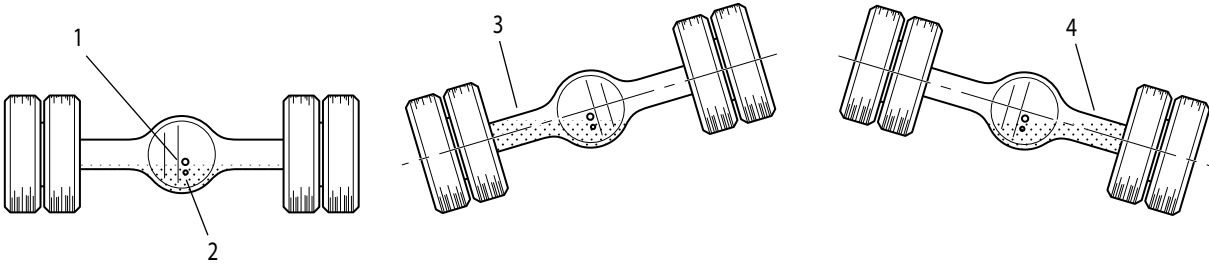
Lubrication

Wheel Ends Without Oil Fill Hole

1. With axle level and wheel ends assembled, add lubricant through filler hole in axle housing cover until fluid is level with the bottom of filler hole.
2. Raise the right side of the axle 12" or more. Hold axle in this position for one minute.
3. Lower the right side.

4. Raise the left side of the axle 12" or more. Hold axle in this position for one minute.
5. Lower the left side.
6. With axle on a level surface, add lubricant through housing cover oil filler hole until fluid is level with the bottom of the hole.

Note: Axles without wheel end fill holes will require approximately 2.5 additional pints of lubricant to bring the lube level even with the bottom of fill hole.



- 1 — With axle on level surface, fill housing with oil to bottom of plug
- 2 — Temperature sensor mounting hole
- 3 — Oil will run into wheel end
- 4 — Oil will run into wheel end
- 5 — Tilt housing side to side (1 minute per side)
- 6 — Recheck oil level in axle

General Lubrication Information

The ability of a drive axle to deliver quiet, trouble-free operation over a period of years is largely dependent upon the use of good quality gear lubrication in the correct quantity. The most satisfactory results can be obtained by following the directions contained in this manual.

The following lubrication instructions represent the most current recommendations from Dana.

Approved Lubricants

General: Gear lubrications acceptable under military specification (MILSPEC) MIL-L-2105D (Lubricating Oils, Gear, Multipurpose) are approved for use in Spicer Drive Axles.

The MIL-L-2105D specification defines performance and viscosity requirements for multigrade oils. It supersedes both MIL-L-2105B, MIL-L-2105C and cold weather specification MIL-L-10324A. This specification applies to both petroleum-based and synthetic-based gear lubricants if they appear on the most current "Qualified Products List" (QPL-2105) for MIL-L-2105D.

Note: The use of separate oil additives and/or friction modifiers are not approved in Spicer Drive Axles.

Synthetic based: Synthetic-based gear lubricants exhibit superior thermal and oxidation stability, and generally degrade at a lower rate when compared to petroleum-based lubricants. The performance characteristics of these lubricants include extended change intervals, improved fuel economy, better extreme temperature operation, reduced wear, and cleaner component appearance. The family of Spicer gear lubricants represents a premium quality synthetic lube which fully meets or exceeds the requirements of MIL-L-2105D. These products, available in both 75W-90 and 80W-140 have demonstrated superior performance in comparison to others qualified under the MILSPEC, as demonstrated by extensive laboratory and field testing. For a complete list of Spicer approved synthetic lubricants contact your local Dana representative. See back cover of this manual for the appropriate phone number.

Makeup Lube: Maximum amount of non-synthetic makeup lube is 10%. For additional lubrication information, see TCMT-0021.

Recommendations for Viscosity/Ambient Temperature

The following chart lists the various SAE Grades covered by MIL-L-2105D and the associated ambient temperature range from each. Those SAE grades shown with an asterisk (*) are available in the Spicer family of synthetic gear lubricants.

The lowest ambient temperatures covered by this chart are -40°F and -40°C. Lubrication recommendations for those applications which consistently operate below this temperature range must be obtained through Dana by contacting your local Dana representative.

Grade	Ambient Temperature Range
75W	-40°F to -15°F (-40°C to -26°C)
75W-90*	-40°F to 100°F (-40°C to 38°C)
75W-80	-40°F to 80°F (-40°C to 21°C)
75W-140	-40°F and above (-40°C and above)
80W-90	-15°F to 100°F (-26°C to 38°C)
80W-140*	-15°F and above (-26°C and above)
85W-140	10°F and above (-12°C and above)
* Available in the Spicer family of synthetic gear lubricants.	

Lubrication

Lube Change Intervals

This product combines the latest manufacturing and part washing technology. When filled with a Spicer approved synthetic lubricant at the factory, the initial drain is not required.

Change the lubricant within the first 5,000 miles of operation when not using a Spicer approved synthetic lubricant in either a new axle or after a carrier head replacement.

Base subsequent lubricant changes on a combination of the following chart and user assessment of the application and operating environment.

Severe Service Lubrication Change Intervals: Severe service applications are those where the vehicle consistently operates at or near its maximum GCW or GVW ratings, dusty or wet environments or consistent operation on grades greater than 8%. For these applications, the ON/OFF HIGHWAY portion of the chart should be used. Typical applications are construction, logging, mining, and refuse removal.

Note: Clean metallic particles from the magnetic filler plug and drain plugs. Clean or replace the breather yearly to avoid lube contamination due to water ingestion.

Synthetic or Mineral	Lubricant	SAE	Change Interval for Line Haul	Change Interval for Vocational
Synthetic*	SHAES-256	SAE 75W-90	500,000 miles (800,000 Km) or 5 years	120,000 miles (193,000 Km) or 1 year
Synthetic**	SHAES-256	SAE 75W-90, 75W-140	250,000 miles (400,000 Km) or 3 years	60,000 miles (96,500 Km) or 1 year
Mineral Base	MIL-L-2105E/ J02360, API GL-5 Gear Oil, MIL-PRF- 2105E	75W, 75W-90, 75W-140, 80W-90, 85W-140	120,000 miles (193,000 Km) or 1 year	60,000 miles (96,500 Km) or 1 year

* Axles using LMS wheel end system

** Axles using adjustable wheel bearing system

For additional lubrication information, see TCMT-0021.

Change Lube

Drain

Drain when the lube is at normal operating temperature (150°–200°F). It will run freely and minimize the time necessary to fully drain the axle. This insures the axle is flushed.

Unscrew the magnetic drain plug on the underside of the axle housing and allow the lube to drain into a suitable container.

Note: Dispose of all used lubricants properly by following disposal methods approved for mineral or synthetic based oils.

After initial oil change, inspect drain plug for large quantities of metal particles. These are signs of damage or extreme wear in the axle. Clean the drain plug and replace it after the lube has drained completely. Inspect breather for clogging or corrosion.

Clean or replace as necessary.

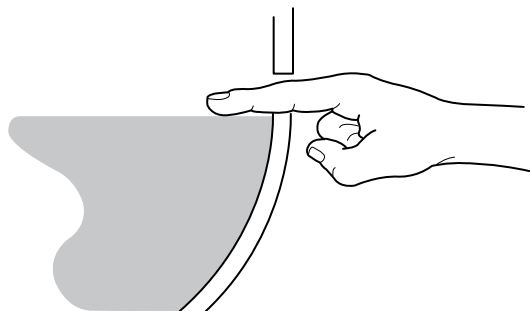
Fill

Front Axle

- a. With vehicle on level ground, remove the filler hole plug from the axle housing cover and fill the axle with approved lubricant until level with the bottom of the hole.

Rear Axle

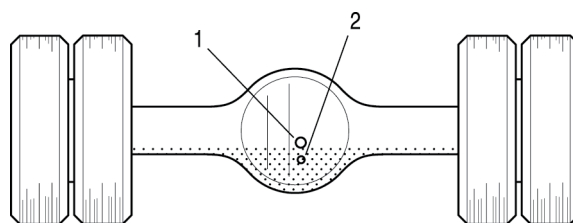
- a. Remove the filler hole plug from the axle housing cover and fill the axle with the approved lubricant until level with the bottom of the hole.
- b. If wheel ends were removed, follow instructions in wheel end servicing.



Correct lube level at bottom of filler hole

Always use the filler hole as the final reference. If lube is level with the bottom of the hole, the axle is properly filled.

TIP: The axle can be filled through the axle housing breather hole. Fill until lube level is even with the bottom of filler hole in axle housing rear cover.



- 1 — With axle on level surface, fill housing with oil to bottom of plug
- 2 — Temperature sensor mounting hole

Lubrication

Standpipes

Drive axles are lubricated with oil drawn from a large sump integral to the assembly. Most axle designs attempt to position vital components such as pinion bearings in close proximity to this sump, keeping them bathed in a generous supply of oil at all times.

When drive axles are installed at severe angles in vehicle chassis, the position of these components is changed relative to the oil sump. The same effect is present when the vehicle travels up a steep grade. Oil in the sump remains level while the axle itself tilts up or down. This makes it possible for bearings and gears located well forward in the assembly to “starve” for lubrication even though the axle is filled to the base of the fill plug hole as recommended by the manufacturer.

Axles should be modified with standpipes to raise lube levels whenever chassis installation angles exceed 10° and when the vehicle must negotiate continuous or lengthy grades on a routine basis.

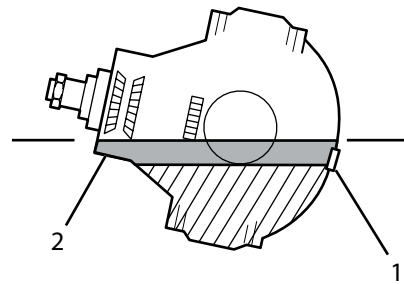
The chart gives standpipe recommendations for vehicles operating in consistently mountainous areas.

Rear Axles

Installation Angle*	5-10% Grade	10-15% Grade	15-20% Grade
0°	—	—	—
3°	—	—	1.00”
5°	—	1.00”	1.75”
7°	—	1.75”	2.00”
10°	—	2.00”	2.25”
13°	1.00”	2.25”	2.75”
15°	2.00”	2.50”	3.25”

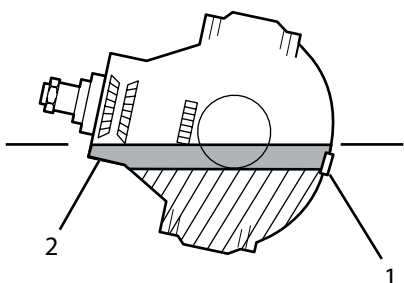
* Pinion pointing upward

Horizontal Mounting



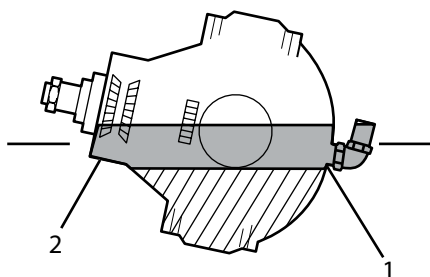
- 1 — Oil Filler Hole
- 2 — Lost Oil Capacity

12° Installation



- 1 — Oil Filler Hole
- 2 — Lost Oil Capacity

12° Installation with Standpipe



- 1 — Oil Filler Hole
- 2 — Additional Oil Capacity

Note: Grades must be continuous or lengthy in nature. Monitor oil temperatures before installing standpipes. Axles should operate at approximately 100°F (38°C) over ambient temperature and not exceed 275°F (135°C).

Final Check

Prior to putting vehicle back into service, run the vehicle to bring axle lube up to temperature. Check filler and drain plugs and axle joint for leakage. Re-tighten to specifications as necessary.

Proper Vehicle Towing

Without Wheel Differential Lock

Lift the drive wheels completely off of the ground or damage will occur.

⚠ WARNING: Do not lift the front wheels (non-drive wheels). This alters the oil's position in the drive axle, draining it away from the drive pinion and its bearings. If the pinion is rotated under these conditions for any period of time, bearings will overheat resulting in axle damage or failure.

If it is impossible to lift the drive wheels, remove all axle shafts to prevent gear rotation and cap the wheel hubs to prevent loss of lubricant and a possible road hazard. See the following section Proper Vehicle Towing with Wheel Differential Lock for removal procedure.

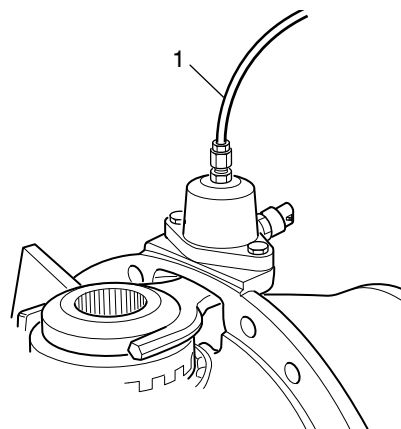
With Wheel Differential Lock

1. Diff-Lock Models

For removal of the locking wheel differential carrier assembly, the differential lock must be engaged and held in the engaged position. This can be accomplished by one of two methods; either engage via air pressure or engage manually.

Engage via Air Pressure

- a. Using an auxiliary air line, apply 80–120 PSI air pressure to shift cylinder air port to engage clutch.



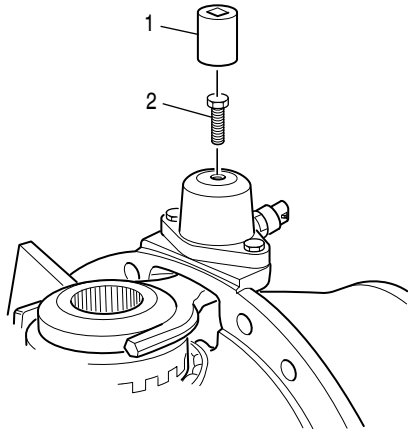
- 1 — Connect 80-120 PSI air line to cylinder port

Engage Manually

- b. Install a .250 – 18 NPTF bolt over 1.5" long in the cylinder air port to manually engage the clutches. GM models require a M12 X 1.5 X 38mm bolt.

Lubrication

Note: Hand-tighten the bolt, over-torquing may cause damage to the shift unit. To facilitate hand-tightening, coat bolt threads with axle lube.



- 1 — Hand tighten with socket
- 2 — M12 x 1.5 x 38mm bolt – GM only .250 – 18 NPTF – all models except GM

Note: With either method, the axle shaft may have to be rotated to permit the clutch to become engaged.

⚠ WARNING: Do not lie under carrier after fasteners are removed. Use transmission jack to support differential carrier assembly prior to loosening fasteners.

- 2. To remove axle shaft, remove axle stud nuts. (If sed, remove lock washers and taper dowels.)
- 3. Remove axle shafts.

Note: All models in this publication use axle shafts with unequal lengths. Axle shafts may also be location specific with various wheel equipment. Do not misplace axle shafts from their intended location. Identify left and right shafts for reference during reassembly.

Operate Wheel Differential Assembly

The Spicer wheel differential lock is driver-controlled and operated by a carrier mounted air-actuated shift unit.

In operation, it positively locks the wheel differential to provide improved traction under adverse road conditions.

Control Systems for Differential Lock

Two systems may be used to control the differential lock operation.

Transmission Low Range Interlock Control System

The wheel differential is locked manually with the transmission in Low Range. It is unlocked by the driver or unlocked when the transmission is shifted out of Low Range.

Note: The interlock system is preferred for vehicles equipped with an air-shifted, Low Range transmission. It is designed to ensure the differential lock is not left engaged (and to prevent accidental engagement) when transmission is in high range.

Direct Driver-Controlled System

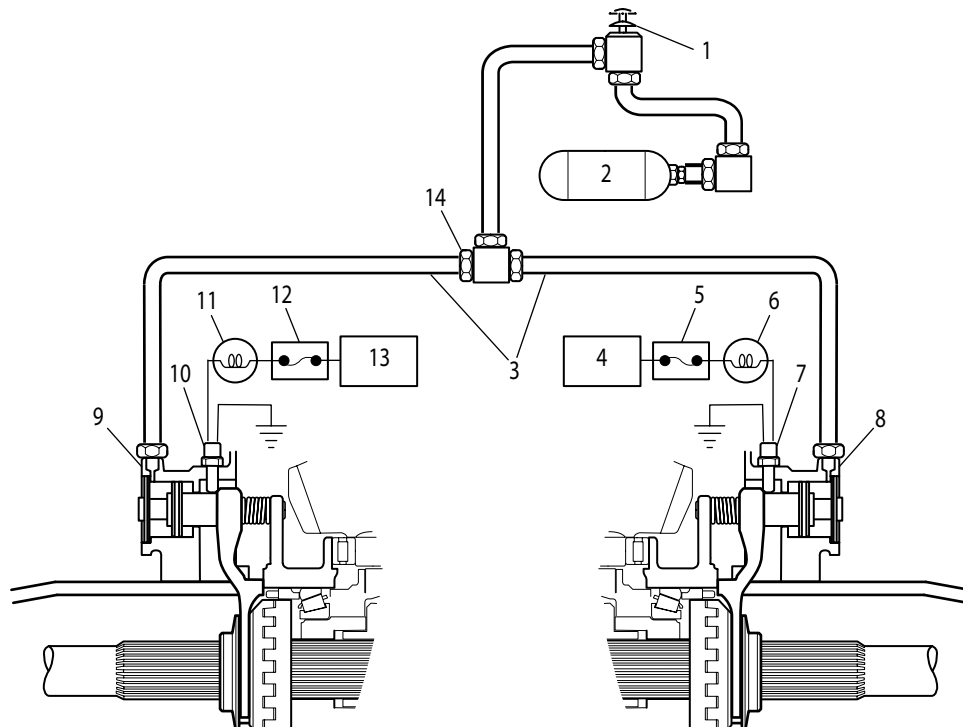
The driver manually locks and unlocks the wheel differential, using a cab-mounted electric switch (or air valve). The following description assumes the system includes a cab-mounted electric switch and a solenoid valve as shown in the illustration. An air valve may be substituted for these components.

Operation is as follows:

1. With control switch in the “unlock” position, the wheel differential functions normally.
2. When the control switch is placed in the “lock” position, the air supply solenoid valve opens and air pressure activates the shift cylinder. The shift fork is moved to engage the curvic clutches, which, in turn, lock the wheel differential.
3. When the control switch is placed in the “unlock” position, air pressure supply to the shift cylinder is shut off and air pressure is released from the cylinder. A compression spring moves the shift fork to disengage the curvic clutch and unlock the wheel differential.

Theory of Operation

Direct Driver-Controlled System

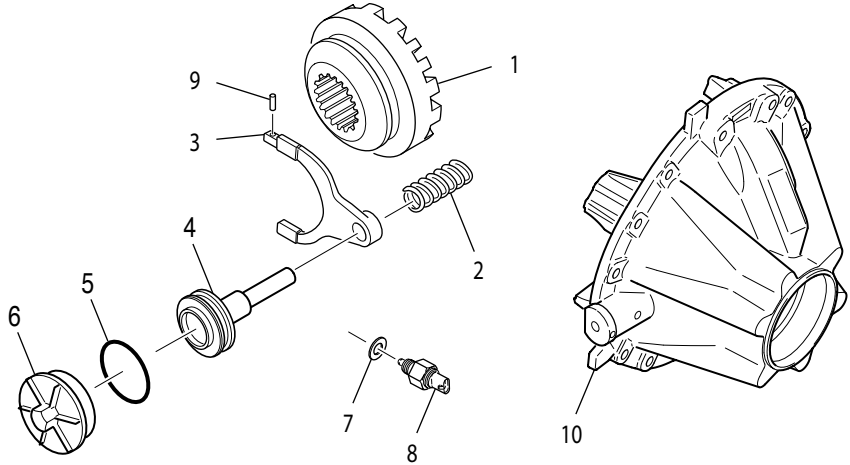


- 1** — Cab-mounted control valve (plunger in—valve open)
- 2** — Dry air supply tank 80–120 PSI
- 3** — Preferably equal in length
- 4** — Power supply
- 5** — Fuse or circuit breaker
- 6** — Indicator light or audible signal
- 7** — Wheel differential lock indicator switch (part of axle assembly)
- 8** — Rear axle wheel differential lock air shift cylinder (part of axle assembly)
- 9** — Forward rear axle wheel differential lock air shift cylinder (part of axle assembly)
- 10** — Wheel differential lock indicator switch (part of axle assembly)
- 11** — Indicator light of audible signal
- 12** — Fuse or circuit breaker
- 13** — Power supply
- 14** — 66468 Quick release valve (optional) located on frame rail and within 10 feet of tubing from control valve

Wheel Differential Lock

The Spicer Wheel Differential Lock is an optional feature for Spicer Axles. In operation, it positively locks the wheel differential to provide improved traction under adverse road conditions.

The differential lock is driver-controlled through an electric switch or air valve mounted in the cab. The locking mechanism is air-operated to engage a mechanical clutch and lock the wheel differential. It is spring-operated to disengage the lock and permit the wheel differential to function normally.



- 1 — Sliding clutch
- 2 — Spring
- 3 — Clutch fork
- 4 — Piston and rod
- 5 — O-ring
- 6 — Piston cover
- 7 — Washer
- 8 — Switch
- 9 — Pin
- 10 — Carrier

Theory of Operation

The wheel differential lock consists of three major assemblies:

- **Shift Cylinder Assembly:** Operates a shift fork and push rod assembly
- **Shift Fork and Push Rod Assembly:** Engages and disengages the differential lock curvic clutch assembly
- **Curvic Clutch Assembly:** Consists of a sliding clutch splined to a axle shaft and a fixed clutch which is splined to the differential case hub

The differential lock also includes a selector switch (electric) which senses clutch engagement and sends an electrical signal to a cab mounted indicator light (or an audible signal device).

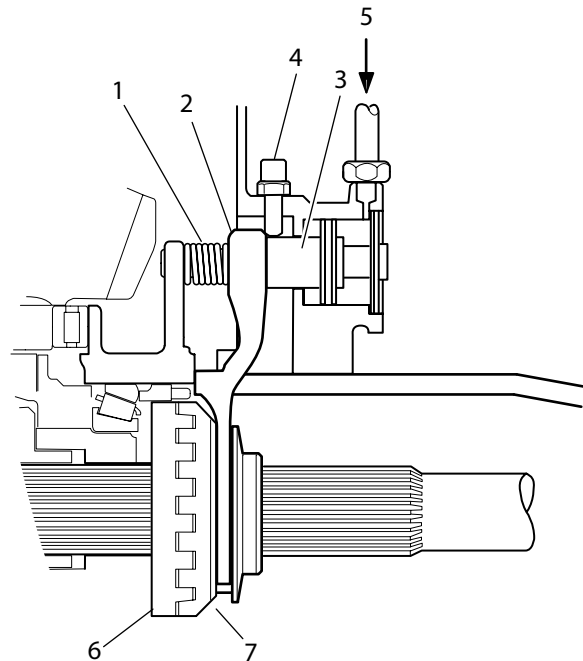
Differential Lock Engaged

Air pressure applied to the shift cylinder moves the piston, push rod, shift fork, and the sliding curvic clutch engages the fixed curvic clutch.

The sliding clutch is splined to the axle shaft. The fixed clutch is splined to the differential case hub. Engaging the two clutches locks the wheel differential thus preventing wheel differential action.

Differential Lock Disengaged

When air pressure at the shift cylinder is released, a compression spring (mounted on the push rod) moves the push rod, shift fork, and sliding clutch as an assembly. The sliding clutch moves out of engagement with the fixed clutch. The wheel differential is unlocked and operates normally.



Differential Lock Engaged

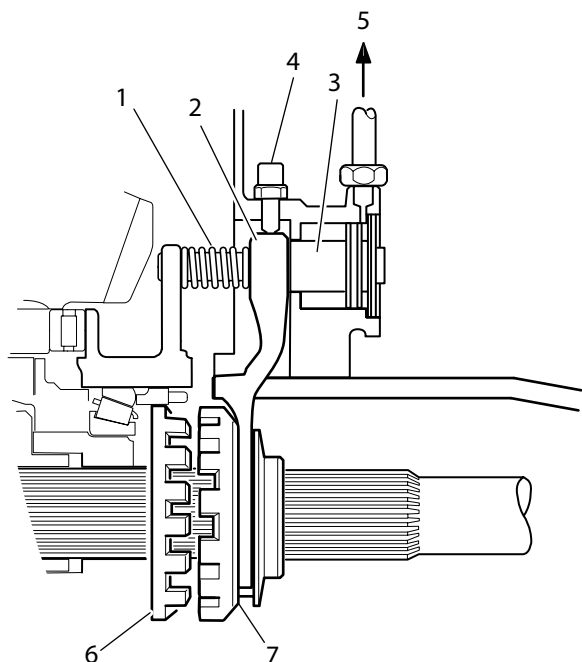
- 1 — Spring is compressed
- 2 — Shift fork
- 3 — Piston and rod
- 4 — Selector switch
- 5 — Air pressure applied engages clutches
- 6 — Fixed clutch splined to differential case
- 7 — Sliding clutch splined to axle shaft and engaged with fixed clutch

Differential Lock Engagement Indicator

Differential lock engagement is detected by a switch (electric) mounted on the differential carrier. An actuator, mounted in the piston cover, operates the switch.

When the shift fork moves to engage the differential lock, the push rod actuator moves away from the switch, allows the switch to close, and send an electrical signal to turn on a cab-mounted indicator light (or an audible signal).

When the shift fork moves to disengage the differential lock, the compression spring also moves the push rod actuator to contact the switch. The switch is opened and turns off the cab-mounted indicator light (or the audible signal).

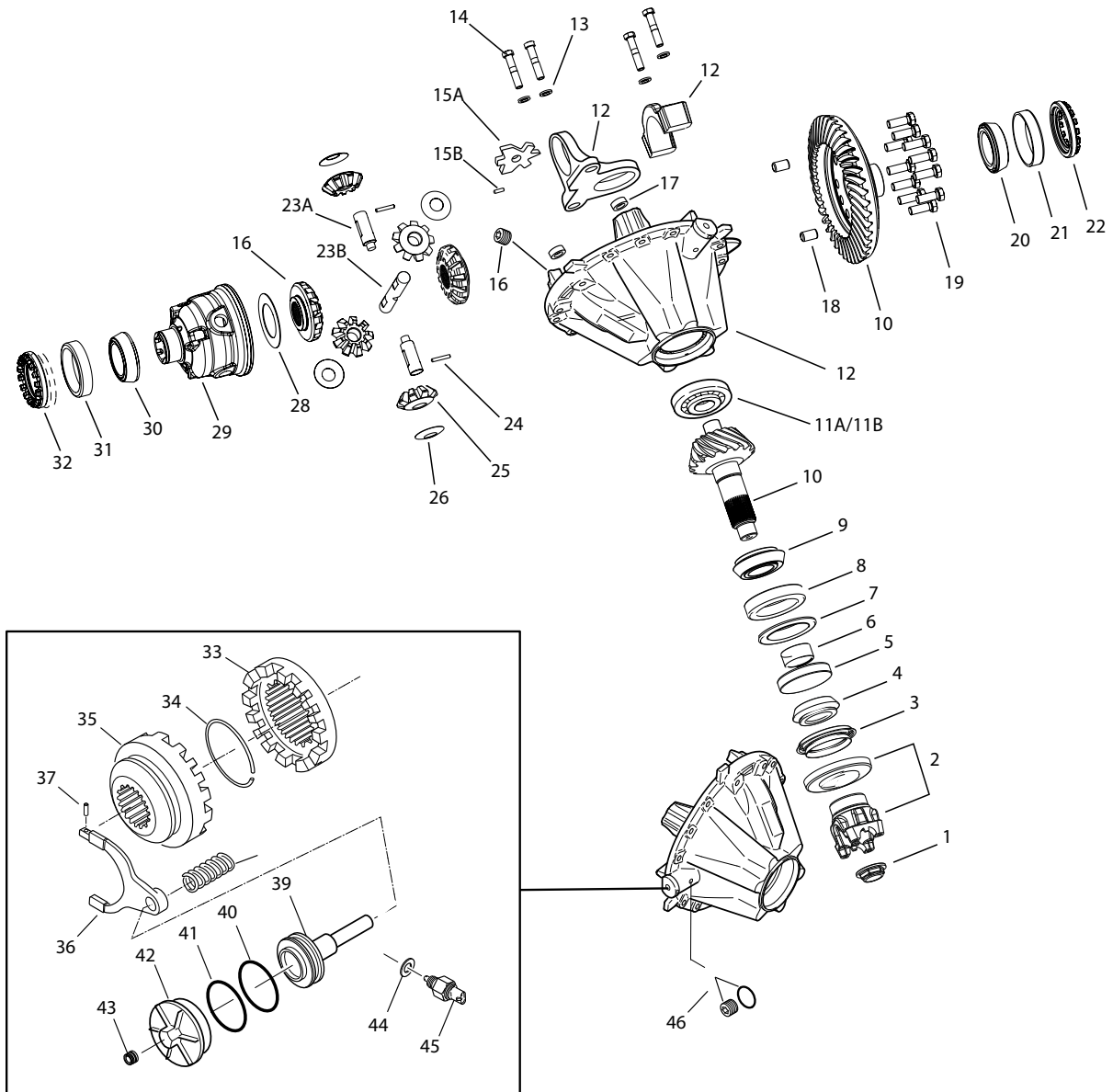


Differential Lock Disengaged

- 1 — Spring is decompressed
- 2 — Shift fork
- 3 — Piston and rod
- 4 — Selector switch
- 5 — Air pressure applied disengages clutches
- 6 — Fixed clutch splined to differential case
- 7 — Sliding clutch splined to axle shaft

Theory of Operation

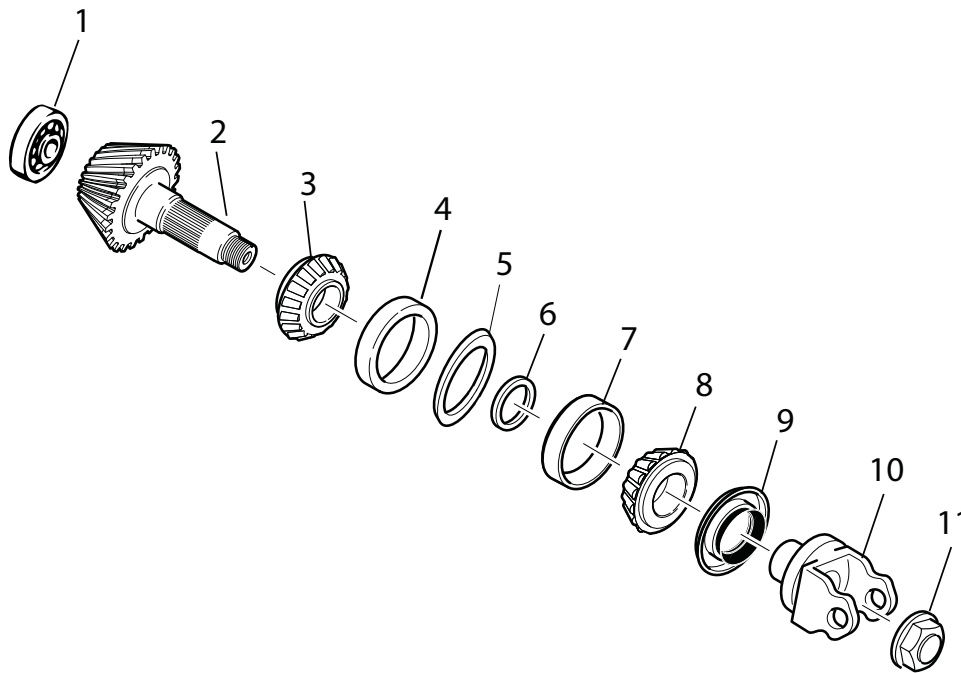
Differential Carrier Assembly - Parts Exploded View



WHEEL DIFFERENTIAL LOCK
SHIFT PARTS

- | | | |
|-------------------------------|-----------------------------------|--------------------------------------|
| 1 — Pinion nut | 16 — Alignment dowels | 31 — Plain half bearing cup |
| 2 — End yoke and slinger | 17 — Plug | 32 — Plain half bearing adjuster |
| 3 — Oil seal | 18 — Ring gear dowels | 33 — Fixed clutch |
| 4 — Outer pinion bearing cone | 19 — Ring gear bolts | 34 — Snap ring |
| 5 — Outer pinion bearing cup | 20 — Flange half bearing cone | 35 — Sliding clutch |
| 6 — Pinion spacer | 21 — Flange half bearing cup | 36 — Roll pin |
| 7 — Pinion shim | 22 — Flange half bearing adjuster | 37 — Shift fork |
| 8 — Inner pinion bearing cup | 23 — Wheel diff shafts | 38 — Compression spring |
| 9 — Inner pinion bearing cone | 24 — Diff shaft pins | 39 — Shaft piston and shaft assembly |
| 10 — Ring & pinion set | 25 — Side pinion gears | 40 — Piston o-ring |
| 11 — Pinion pilot bearing | 26 — Side pinion thrust washers | 41 — Piston cap o-ring |
| 12 — Carrier sub assembly | 27 — Wheel diff side gear | 42 — Piston cap |
| 13 — Washers | 28 — Side gear thrust washers | 43 — Shipping screw |
| 14 — Carrier cap bolts | 29 — Plain half diff case | 44 — Plastic washer |
| 15 — Adjuster lock assembly | 30 — Plain half bearing cone | 45 — Diff lock indicator switch |

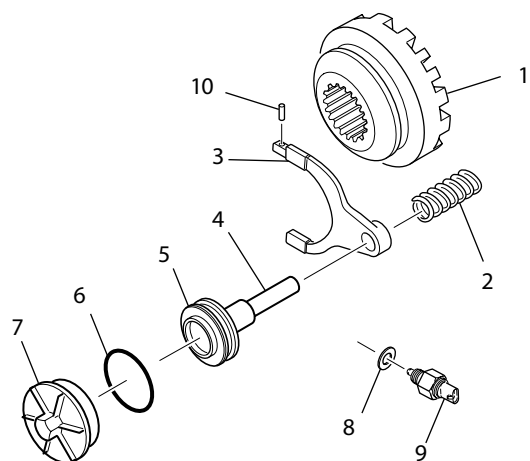
Axle Pinion Assembly - Parts Exploded View



- | | |
|---------------------------------|---------------------------------|
| 1 — Pilot bearing | 7 — Pinion bearing cup - outer |
| 2 — Pinion | 8 — Pinion bearing cone - outer |
| 3 — Pinion bearing cone - inner | 9 — Oil seal |
| 4 — Pinion bearing cup - inner | 10 — Yoke |
| 5 — Pinion shim | 11 — Pinion nut |
| 6 — Pinion bearing spacer | |

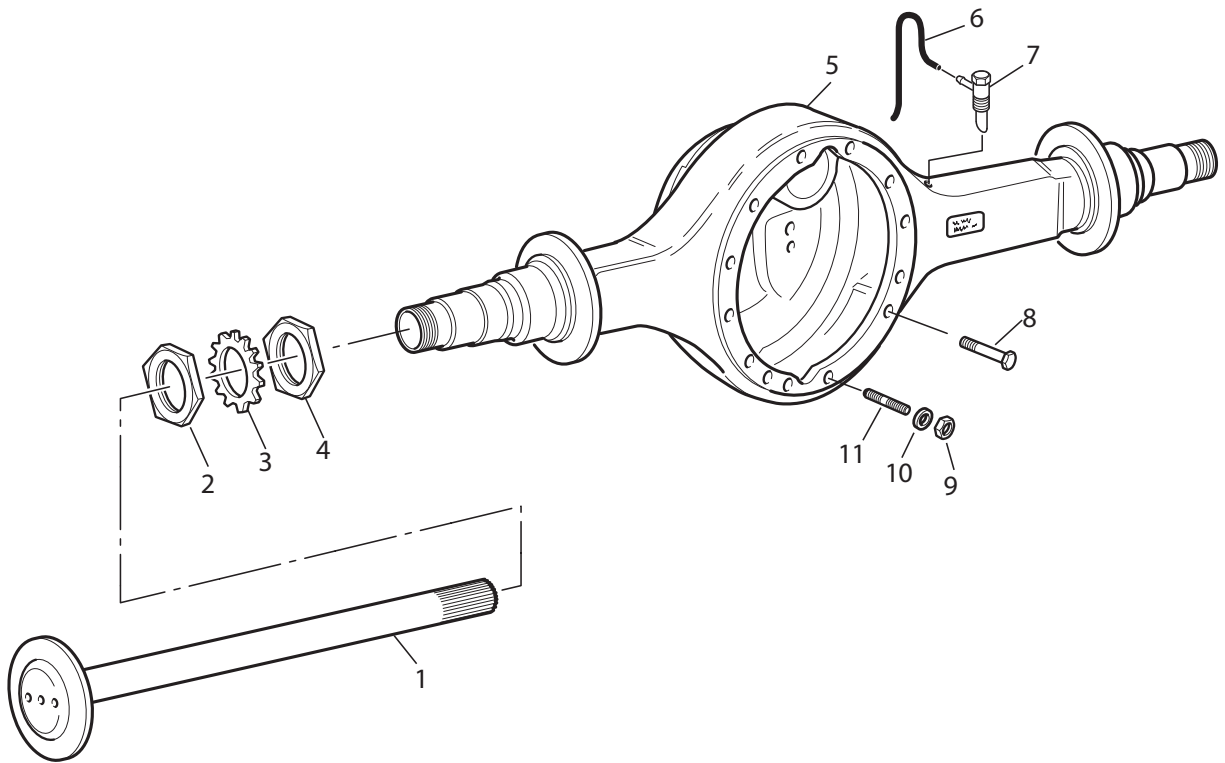
Parts Identification

Wheel Differential Lock - Parts Exploded View



- | | |
|---------------------------|-------------------------|
| 1 — Sliding clutch | 7 — Piston cover |
| 2 — Spring | 8 — Washer |
| 3 — Shift Fork | 9 — Switch |
| 4 — Push rod | 10 — Roll pin |
| 5 — Piston | |
| 6 — O-ring | |

Housing and Output Shaft Assembly - Parts Exploded View



- | | |
|-------------------------|---------------------|
| 1 — Axle shaft | 7 — Breather |
| 2 — Spindle nut - Outer | 8 — Carrier capcrew |
| 3 — Locking ring | 9 — Nut |
| 4 — Spindle nut - Inner | 10 — Washer |
| 5 — Axle housing | 11 — Stud |
| 6 — Breather hose | |

Torque Specifications

Fastener Torque Specifications

Location	Size	Lbs. Ft.	N•m
WHEEL DIFFERENTIAL AND GEARING			
Rear Pinion Nut	M48 x 1.5	900 ± 100	1220 ± 135
Ring Gear, Diff. Case Bolts	M20 x 1.5 x 55	635 ± 25	860 ± 10
CARRIER			
Carrier Diff. Bearing Cap	M24 x 30 short	265 ± 15	915 ± 60
Carrier to Housing Capscrews	M16 x 1.5 x 85	250 ± 15	335 ± 20
	M16 x 1.5 x 55	250 ± 15	335 ± 20
Carrier to Housing Nuts	M16 x 1.5	250 ± 15	335 ± 20
Differential Lock Switch	M14 x 1.5	10 ± 1	15 ± 3
Differential Lock End Cap	2.375 - 16 UN-2A	65 ± 10	85 ± 15
HOUSING			
Magnetic Plug (Fill)	1 x 11.5 NPTF	50 ± 5	72 ± 5
Drain Plug	0.750 - 14 NPTF	50 ± 5	72 ± 5
Housing Breather	0.375 - 18 NPTF	20 - 26	27 - 35
Temperature Sending Plug	0.500 - 20 NPTF	50 ± 5	72 ± 5
Axle Shaft to Wheel Hub Nut	0.625 - 18	180 ± 10	245 ± 15
	0.750 - 16	315 ± 30	425 ± 40
Diff Bearing Adjuster Lock	M8 x 1.25	26 ± 5	35 ± 5

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