

Spicer® Wheel Ends



SPICER®

Drivetrain Products

Service Manual

Steer and Drive Wheel Ends

WESM0060

September 2013

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.

Always use genuine Spicer replacement parts.

Spicer recommends following all manufacturers recommendations for the proper handling and disposal of lubricants and solvents. For further information contact the supplier of lubricants and solvents.

⚠ CAUTION

Welding or machining on any axle component is prohibited unless noted otherwise in this document or other Spicer service literature.

Every effort has been made to ensure the accuracy of all information in this guide. However, Spicer makes no expressed or implied warranty or representation based on the enclosed information.

Table of Contents

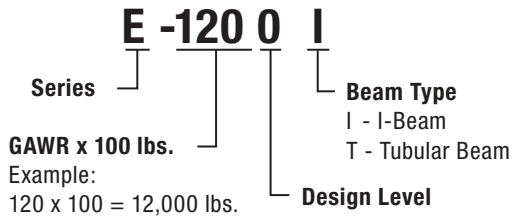
Steer Axle Identification.....	2
Drive Axle Identification.....	4
Vehicle Application Definitions	6
Drive Axle Shaft to Drive Hub Gasketed Joint Failure.....	7
Wheel End Inspection - Oil Bath.....	8
Wheel End Inspection - Grease Pack.....	8
Steer Axle Lubrication Procedure.....	10
Approved Lubricants.....	13
Lubrication Change Intervals	15
LMS Steer - Parts Exploded View	16
LMS Steer Axle - Removal.....	17
LMS Wheel End - Assembly.....	19
LMS Stamped Locking Nut System.....	21
LMS Spindle Nut Assembly	22
Pro-Torq Locking Nut System with LMS.....	23
LMS Wheel End - Verify Wheel End-play	25
LMS Wheel End - Lubrication	25
Standard Hub Steer Axles - Lubrication	26
LMS Hub Drive Axle - Parts Exploded View.....	27
LMS Drive Axle - Removal	28
LMS Wheel End - Assembly.....	30
LMS Drive Axle Assembly	30
LMS Drive Axle Spindle Nut Installation Procedure.....	32
LMS Assembly.....	34
Pro-Torq Locking Nut System with LMS.....	35
LMS Drive Axle - Lubrication	37
Standard Hub Steer Axle - Parts Exploded View	38
Standard Hub Steer Axle - Removal.....	39
Standard Hub and Spindle Nut - Assembly.....	40
Pro-Torq Spindle Nut Service	42
Verify Wheel End-play (Standard Axles).....	44
Standard Hub Steer Axles - Lubrication	45
Standard Hub Drive Axle - Parts Exploded View.....	46
Standard Hub Drive Axle - Removal	47
Standard Hub Drive Axle - Assembly	48
Verify Wheel End-play (Standard Axles).....	50
Standard Hub Drive Axle - Lubrication	51
Appendix	52

Model Information Identification

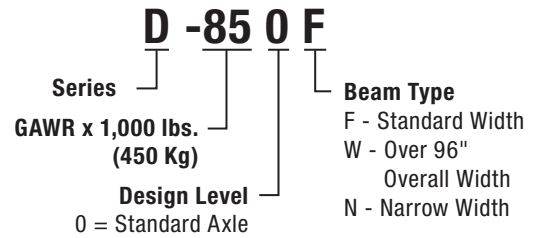
Steer Axle Identification

Model Number Information

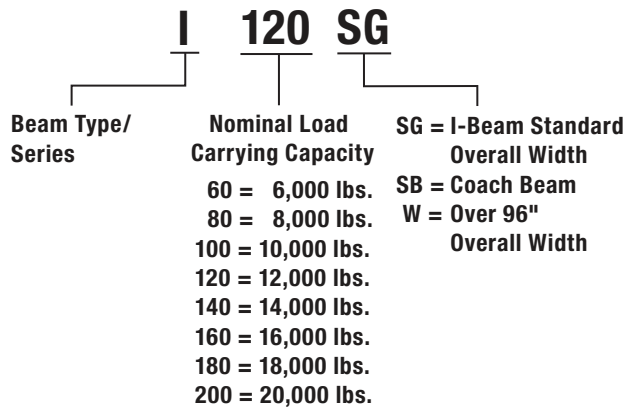
E Family Numbering System



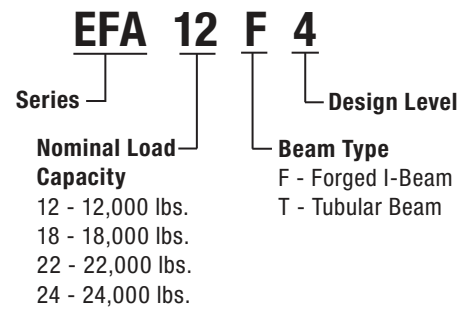
D Family Numbering System



I Family Numbering System



EFA Family Numbering System



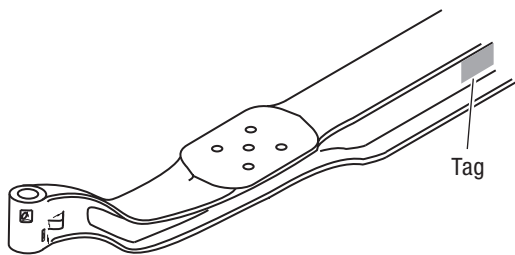
Model Number Location

The Spicer front non-drive steering axles are identified with a tag located between the spring pads, on the front side of the center beam section.

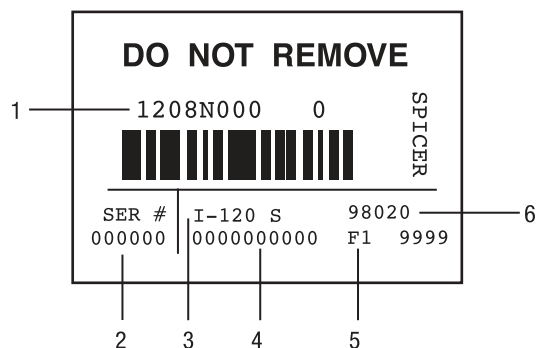
The axle tag contains the serial number, the model number, and the assembly number.

If Steer Axle is LMS™ as shown on the hub, see page 30 for removal and assembly procedures.

If Steer Axle is Standard, see page 39 for removal and page 21 for assembly procedures.

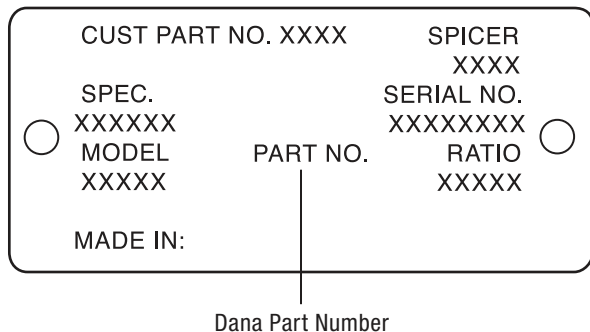


I Family Tag



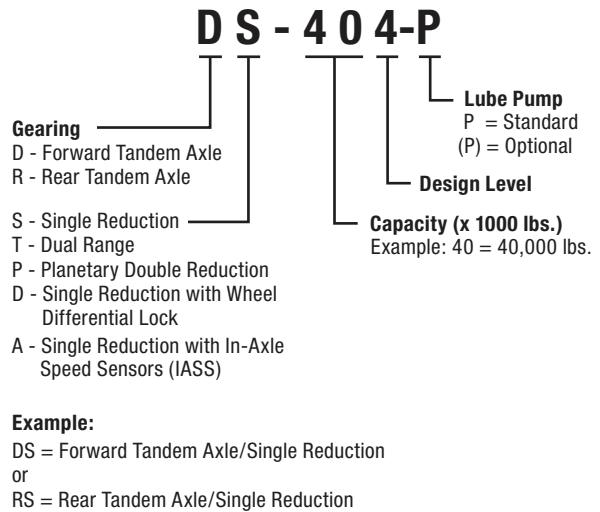
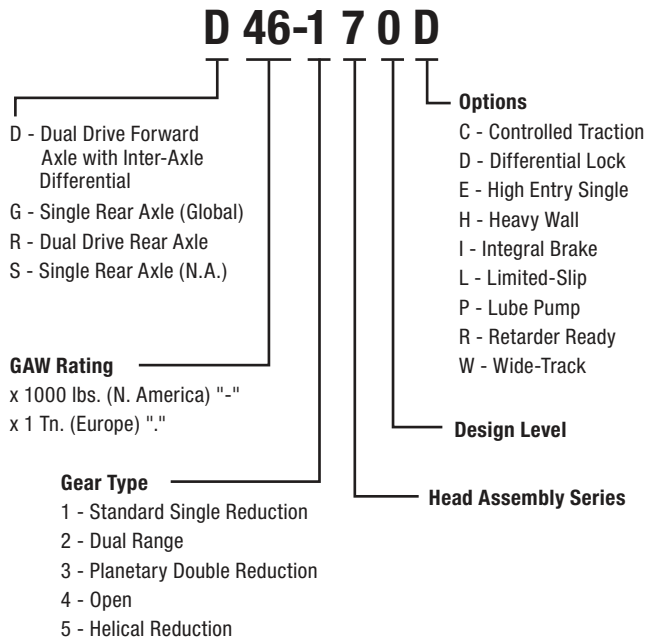
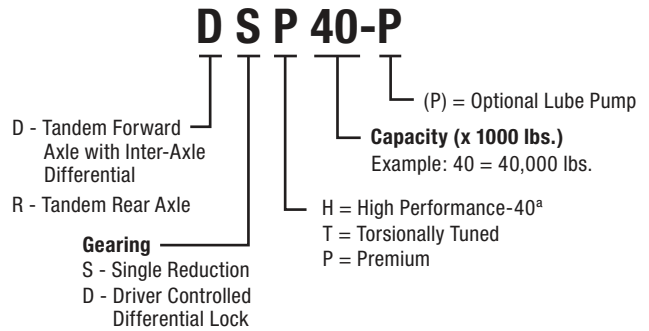
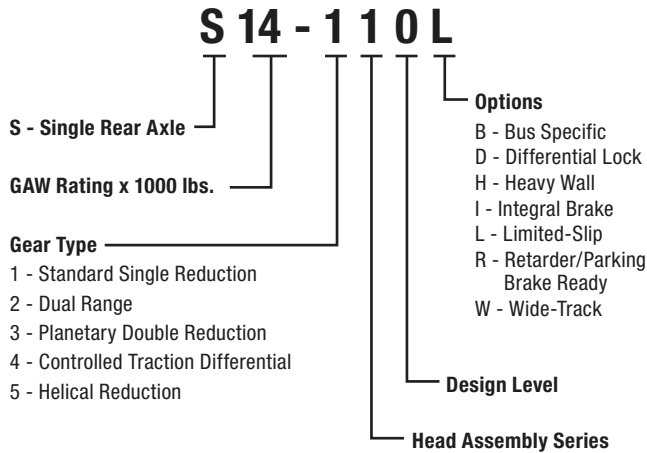
- 1 - Dana Part Number
- 2 - Serial Number
- 3 - Model Number
- 4 - Customer Part Number
- 5 - Line Set Number
- 6 - Julian Date

E Family Tag



Drive Axle Identification

Model Number Information

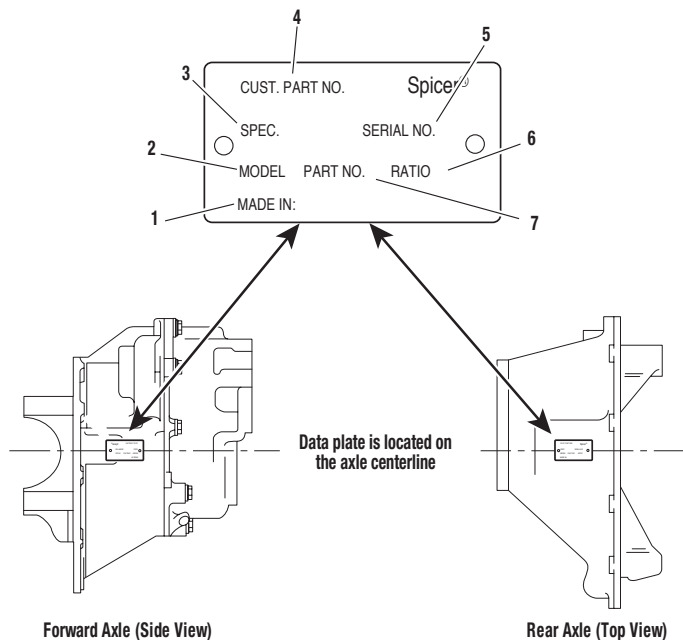


Model Number Location

If Drive Axle is LMS™, as shown on the hub, see page 28-30 for removal and assembly procedures.
 If Drive Axle is Standard, see page 47 for removal and page 48 for assembly procedures.

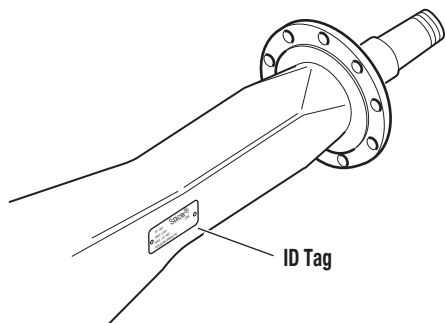
Axle Data Plate

Note: Tags that do not include all the information shown here are older models (before May 1987).

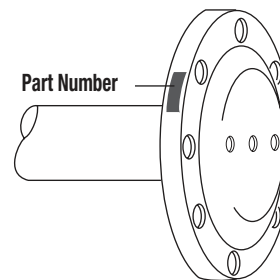


- 1 - Country or origin
- 2 - Axle model identification
- 3 - Specification number assigned to the axle built by Spicer. Identifies all component parts of the axle including special OEM requirements such as yokes or flanges
- 4 - OEM part number assigned to the axle build
- 5 - Carrier assembly serial number assigned by the manufacturing plant
- 6 - Axle gear ratio
- 7 - Carrier assembly production or service part number

Axle Housing ID Tag



Axle Shaft Part Number



Vehicle Application Definitions

Line Haul (On-highway)

- High mileage operation (over 60,000 miles [96,500 Km] per year).
- On-highway or good to excellent concrete or asphalt.
- More than 30 miles [48 Km] between starting and stopping.
- 4x2, 6x2, 6x4 tractor/trailer combinations and straight trucks.
- Check fluid levels and inspect for leaks at regular PM maintenance intervals, not to exceed 12,000 miles.

Vocational (Off-highway)

- Low mileage operation (under 60,000 miles [96,500 Km] per year).
- Off-highway or areas of unstable or loose unimproved road surfaces.
- Less than 30 miles [48 Km] between starting and stopping.
- Heavy-Duty, off-road or specialized application type vehicles.
- Check fluid levels and inspect for leaks every 50 hours.

Severe Duty Service

- Consistent operation at or near maximum GCW or GVW ratings.
- Dirty or wet environments.
- Consistent operation on grades greater than 8%.

Maintenance and Inspection Requirements

Drive Axle Shaft to Drive Hub Gasketed Joint Failure

High torque applications can cause field failures of the drive axle shaft to hub joint. This joint has two major functions. One function is to seal the joint so the lubricant in the drive axle and hub does not leak. The second function is to transfer the drive torque from the drive axle shaft to the drive hub.

The requirement of the first function (stop oil leak) is currently being met by U.S. original equipment truck manufacturers with a gasket.

The second requirement (transfer of torque) is met by the clamp force that is created by the eight each 5/8" or 3/4" drive studs and nuts that are used to hold the hub and drive axle shaft together. Holes in the drive axle shaft have clearance around the stud to accommodate the tolerance of hole size and location and stud size and location. Thus, all the drive torque is transferred from the drive axle shaft to the hub by the "friction" created by the clamp force on the joint. There are two significant factors that affect the ability of the joint to function under high torque applications.

1. Higher clamp forces create higher friction between the drive axle and gasket and between the gasket and the hub. Higher friction can transfer higher torque. Thus, clamp force is a significant factor in the ability of the joint to transfer torque.
2. The torque is transferred by friction from the drive axle to the contacting side of the gasket, then through the thickness of the gasket to the other side of the gasket, and then the friction at that surface transfers the torque to the hub. Clamp force creates the friction that transfers torque from one surface to the next, however, the gasket material itself must transfer the torque through the thickness of the gasket. Thus, gasket material is the other significant factor in the ability of these joints to transfer torque.

Field Service Proposal

1. Joints that have failed may have rotated the drive axle shaft against the drive stud when the friction and/or gasket strength was overcome. The pounding of the drive axle against the stud can cause the drive stud to come loose (this is like wiggling a fence post back and forth so you can pull it out of the ground.) Use a stud driver and torque wrench to reinstall the

stud into the hub with 40 lbs. ft. Severe cases may require replacement of the hub and/or stud.

2. Use gaskets made from material that is appropriate for the application. Not all original equipment truck manufacturers are using gaskets that meet these requirements. Cured Armstrong N-8092, or equivalent, has proven to be adequate for most applications.
3. Use SAE Grade 8 nuts and hard washers. If hard washers are difficult to find, use Caterpillar 5/8" hard washer 5P-8247, or the equivalent, in 3/4" diameter.
4. Assemble the joint with 200 - 230 lbs. ft. of torque on 5/8" studs and 250 - 290 lbs. ft. of torque on 3/4" studs.
5. If the studs or hubs fail during assembly, it may be that they were badly damaged when the joint originally failed. Replace parts that fail during assembly.
6. Re-torque drive flange nuts after one day of use.

Inspection Requirements

The following inspection criteria are intended for units whose vocation is strictly on-highway use only. The inspection criteria are not intended for unitized or pre-set wheel ends, refer to systems manufacturer for inspection and service recommendations.

These recommendations depend on the proper assembly of the system, including the proper lubricant fill level.

Damaged Spacer - LMS™

There is little likelihood of damage to the spacer in operation. If these components are damaged during a hub removal, replace with Dana supplied spacer. In the interim, the wheel end can be reassembled without the spacer, using standard bearing setting procedures (Reference TMC RP-618).

Damaged Hub Cap - LMS™ Steer and Trailer

(Broken window, stripped pipe plug, etc.) Replace broken component and refill to proper level with approved synthetic lubricant. For warranty continuance, the replacement hub cap must be Spicer branded. If the hub cap is removed from the hub, a new gasket is required.

Damaged Hub

(Broken flange, stud replacement, stripped hub cap bolt hole, etc.) If the hub is damaged and needs to be replaced, replacement of entire Spicer branded hub unit assembly is required for warranty continuance.

Seal Replacement

If service is required on the seal or if the oil is contaminated, the hub unit must be disassembled and serviced. Seal replacement is required in **all** cases when the hub is removed from the axle.

Wheel End Inspection - Oil Bath

Simple Inspection (Pre-Trip/In-Service)

Walk around vehicle and check wheel-ends for obvious signs of lubricant leakage, such as hubcap gasket and wheel seal areas, oil soaked brake linings. Check for broken or missing components. Any seepage is reason for further inspection and appropriate action.

Take appropriate action if leaks or oil soaked brake linings are noted.

Note For Drivers:

After making an enroute stop, walk around the unit and feel the hubs. If there is any significant differences in temperatures or excessive temperature, contact your maintenance department. When feeling hubs for temperature, seasonal influences should be taken into consideration.

If wheel-ends are equipped with a sight glass on the hubcaps, check to ensure the oil is at the proper fill level.

Note: Oil residue may be present at the vent area. This is an indicator that the system is venting properly. This should not be construed as system leakage.

100,000 Miles or Annual Inspection

For non-driven axles check lubricant level and condition. If lubricant is contaminated replace old lubricant with the same type lubricant. If lubricant condition is good and level is low, fill to the proper level. Check for any signs of leakage at the seal or hubcap gasket areas. Check for oil soaked brake linings.

For driven axles, check for any signs of leakage at the seal or axle flange gasket areas. Also check for leaks at hub fill hole if so equipped. Check for oil soaked brake linings.

Take appropriate action if leaks or oil soaked brake linings are noted.

Wheel End Inspection - Grease Pack

Simple Inspection (Pre-Trip/In-Service)

Walk around vehicle and check wheel-ends for obvious signs of lubricant leakage, such as hubcap gasket and wheel seal areas, grease soaked brake linings. Check for broken or missing components. Any seepage is reason for further inspection and appropriate action.

Note For Drivers:

After making an enroute stop, walk around the unit and feel the hubs. If there is any significant differences in temperatures or excessive temperature, contact your maintenance department. When feeling hubs for temperature, seasonal influences should be taken into consideration.

Detailed External Inspection (Conducted at PM or at least annually)

Check wheel-ends for obvious signs of lubricant leakage, such as hubcap gasket and wheel seal areas, grease soaked brake linings. Any seepage is reason for further inspection and appropriate action.

Raise the vehicle and check for smooth rolling of wheels. Check for signs of excessive endplay in the wheel-end. This does not include removal of the hubcap.

Note: Leaking grease may not spread over the hub and brake components as with hubs filled with oil. When inspecting for grease leaks the inspection must be done very carefully with the aid of a bright beam of light from a flashlight or droplight.

Note: Some grease seals will purge very small amounts of grease in normal operation.

If there is seepage around the hubcap flange area, take appropriate action to eliminate seepage as directed by your maintenance instructions.

If leakage in the seal area is found, remove the wheel end and replace the hubcap gasket, seal and lubricant. Inspect the spindle and bearings for damage and replace if needed. Anything abnormal requires more detailed inspection of hub components.

 CAUTION

A clogged vent can damage the wheel seal allowing internal pressure build up in the wheel end.

 CAUTION

Failure to remove the outer bearing may provide a false lubricant level reading.

To verify proper lube level, the following procedures need to be preformed.

1. Before performing any maintenance on the vehicle, take appropriate action to ensure the vehicle is safely secured.
2. Remove hubcap, hubcap gasket and inspect hubcap for adequate venting capabilities.
3. Verify wheel-bearing end-play for conformance to TMC RP-618.
4. Record end-play measurements.

 CAUTION

Care should be taken so the wheel-end assembly is properly supported.

5. Remove spindle nuts.
6. Remove outer bearing.
7. While maintaining proper support to the wheel-end or hub, visually check lube level. In a semi-fluid grease system, if the lubricant flows out of the hub cavity, the hub cavity should be refilled to the 3 o'clock and 9 o'clock level. This represents 50 percent hub cavity fill.

In a semi-fluid grease system, if the grease doesn't flow, inspect lubricant condition in the hub cavity. Go to next section. Inspect if abnormal conditions are noted. If no abnormal conditions are noted, add grease until it flows out of the hub cavity.

Note: If changing grease types or brands, contact your lubricant supplier to insure compatibility.

8. Clean bearing and inspect for wear and damage. When reassembling industry standard wheel-ends, assemble per TMC RP-618.

Note: Manufacturer is defined as the final assembler of the product or the particular system supplier.

Steer Axle Lubrication Procedure

Check Oil Level

1. Check lubricant at each greasing interval.
2. Check the lubricant level on flat ground.
3. Maintain lubricant level to centerline of axle or fill line on hubcap.

Lubricate Wheel Bearings

 CAUTION

Do not pack bearings with grease when using an oil bath system. It can restrict the flow of lubricant to the wheel seal.

Visually identify the type of lubrication system (grease or oil) and follow the appropriate procedure.

Grease Procedure (Grease Packed)

1. Clean bearings, spindle, hubcap, and hub cavity with suitable commercial solvent.
2. Make sure parts are clean and dry.
3. Fill the wheel hub with grease to the inside diameter of the bearing cups.
4. Fill the hubcap.
5. Grease bearing cones by forcing grease between the rollers, cones, and cage.

Oil Procedure (Oil Bath)

 CAUTION

Never mix oil bath and grease packed wheel ends.

Note: If wheel ends were removed, use the same lubricant as the axle sump.

1. Wipe clean the internal cavities of the hubs.
2. Lubricate the wheel bearings using the same lubricant as in the housing.

Note: Do not use wheel bearing grease.

3. Fill the inner hub cavities before installing onto the axle housing spindles.
4. If the hub has a fill hole, add 1.5 pints (0.7 liters.)
5. If hub does not have a fill hole, raise the opposite axle end 8 in. (13 mm) for at least 1 minute.
6. If the wheel ends were filled by jacking up the axle ends, recheck the main sump and top off if necessary until oil reaches the bottom of the fill hole.

Wheel-end Disassembly Inspection (Complete System Tear-down)

If any abnormal conditions are found during inspection, remove wheel-end for inspection.

Lube change intervals as determined by the manufacturer dictate when service is performed.

Note: Manufacturer is defined as the final assembler of the product or the particular system supplier.

When reassembling industry standard wheel-ends, assemble per TMC RP-622, TMC RP-618, and TMC RP-631. Seals and gaskets must be replaced.

Failed Component Analysis

Save prematurely failed parts and lube samples for analysis. The lubricant sample collected should be at least four ounces. A similarly sized new lubricant sample (not previously used) is also required. This will aid in supplier assisted detection and prevention of premature failures. The components' history of usage should also be provided (i.e., vehicle's vocation, mileage, maintenance records, and history of inspection and repair/replacement of components such as seals, seal wear rings, lubricant, bearings, etc.).

Service Intervals

Service interval ranges from 12,000 miles to 100,000 miles in over-the-road service, depending on axle type, manufacturer recommendations, and lubricant performance. Mineral oil based lubricants have lower initial costs than synthetic lubricants, but need to be changed more frequently in some equipment. When choosing a lubricant, the fleet needs to consider:

- The manufacturer's recommendation for the axle make and model in service
- The fleet savings associated with extended service intervals
- The total cost of the lubricant

Note: Because seal performance may vary when switching lubricants, consult your seal supplier for compatibility concerns.

Lubrication Requirements

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 the Commercial Vehicle Systems Division of Dana Corporation.

Approved Lubricants

General - Gear lubrications acceptable under military specification (MILSPEC) MIL-L-2105D (Lubricating Oils, Gear, Multipurpose) are approved for use in Dana 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 Dana 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 Dana Roadranger[®] gear lubricants represents a premium quality synthetic lube which fully meets or exceeds the requirements of MIL-L-2105E. These products, available in both 75W-90 and 80/W-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 Roadranger[®] approved synthetic lubricants contact your local Dana representative. See back cover of this manual for appropriate phone number.



Makeup lube of different brands and manufacturers is not recommended.

Recommendations for Viscosity/Ambient Temperature

The following chart lists the various SAE Grades covered by MIL-L-2105E and the associated ambient temperature range from each. Those SAE grades shown with an asterisk (*) are available in the Roadranger 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 Corporation by contacting your local Dana representative.

Grade	Ambient Temperature Range
75W	40°F to -15°F (-40°C to -26°C)
75W-80	40°F to 80°F (-40°C to 21°C)
75W-90*	40°F to 100°F (-40°C to 38°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 Roadranger family of synthetic gear lubricants.	

Approved Lubricants

Heavy-Duty Drive Axle

Synthetic or Mineral	Lubricant	SAE	Change Interval for Line Haul	Change Interval for Vocational
Synthetic ¹	SHAES-256 Rev C	SAE 75W-90	500,000 miles [800,000 Km] or 5 years	N/A
Synthetic ²	SHAES-429	SAE 75W-90 SAE 80W-140	N/A	180,000 miles [288,000 Km] or 3 years
Mineral Base*	SAE J2360	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

Medium-Duty Drive Axle

Synthetic or Mineral	Lubricant	SAE	Change Interval for Line Haul	Change Interval for Vocational
Synthetic	SHAES-256 Rev C	SAE 75W-90	250,000 miles [400,000 Km] or 3 years	N/A
Synthetic	SHAES-429	SAE 75W-90 SAE 80W-140	N/A	180,000 miles [288,000 Km] or 3 years
Mineral Base ¹	SAE J2360	75W, 75W-90, 80W-90, 85W-140	100,000 miles [160,000 Km] or 1 year	60,000 miles [96,500 Km] or 1 year

¹ Axles using LMS wheel end system

² Axles using adjustable wheel bearing system

Steer Axle

Type of Lubricant System	Lubricant	SAE	Change Interval for Line Haul	Change Interval for Vocational
Wheel End	Mineral Oil	SAE 75W-90	100,000 miles [161,000 km] or 1 year	30,000 miles [48,000 km] or 6 months
Wheel End	Mineral Grease - NLGI #2	#2 grade	100,000 miles [161,000 km] or 1 year	30,000 miles [48,000 km] or 6 months
LMS-Low Lube ¹	Synthetic Oil	SAE 50 PS-164 Rev 7	250,000 miles [400,000 km] or 1 year	250,000 miles [400,000 km] or 1 year
LMS-Lube Free ¹	Synthetic Oil	SAE 50 PS-164 Rev 7	None (only needed if tear down)	None (only needed if tear down)
LMS-Low Lube ¹	Semi-Fluid Synthetic Grease	Chevron Delo SF	50,000 miles [800,000 km] or 3 years	50,000 miles [800,000 km] or 3 years
LMS-Low Lube ¹	Semi-Fluid Synthetic Grease	Mobilith SHC 007	50,000 miles [800,000 km] or 3 years	50,000 miles [800,000 km] or 3 years
King Pin Joint Grease / Tie Rod Ends	Heavy-Duty, multipurpose lithium based	#1 grade or #2 grade	25,000 miles [40,000 Km] or 6 months	Every 50 hours

¹ For easy identification, note that the Dana LMS-Low Lube brake uses a special “button head” grease fitting and the Dana LMS-Lube Free brake does not have a grease fitting.

Lubrication Change Intervals

Wheel Ends

Product	Lubricant Type	SAE	Change Interval for Line Haul	Change Interval for Vocational
Drive Axle LMS	Synthetic*	SAE 75W-90	500,000 miles [800,000 Km] or 5 years	120,000 miles [193,000 Km] or 2 years
Drive Axle (Adjusted)	Synthetic	SAE 75W-90, 75W-140	250,000 miles [400,000 Km] or 3 years	60,000 miles [96,500 Km] or 6 months
Drive Axle (Adjusted)	Mineral Base	SAE 75W-90, 75W-140, 80W-90, 85W-140	120,000 miles [193,000 Km] or 1 year	60,000 miles [96,500 Km] or 6 months
Steer Axle Oil Bath LMS	Synthetic*	SAE 75W-90	500,000 miles [800,000 Km] or 5 years	120,000 miles [193,000 Km] or 2 years
Steer Axle Oil Bath (Adjusted)	Synthetic	SAE 75W-140, 75W-50	120,000 miles [193,000 Km] or 1 year	60,000 miles [96,500 Km] or 6 months
Steer Axle Oil Bath (Adjusted)	Mineral Base	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 6 months
Steer Axle Semi-fluid (Adjusted)	Semi-fluid Synthetic Grease	Delo SF, Mobil SHC 007***	120,000 miles [193,000 Km] or 1 year	60,000 miles [96,500 Km] or 6 months
Steer Axle Grease Pack (Adjusted)	Heavy-Duty Multipurpose Lithium Based***	#2 Grade	120,000 miles [193,000 Km] or 1 year	60,000 miles [96,500 Km] or 6 months

* Only approved lubricant for LMS wheel ends

** Use of this grease requires a signed waiver from the customer

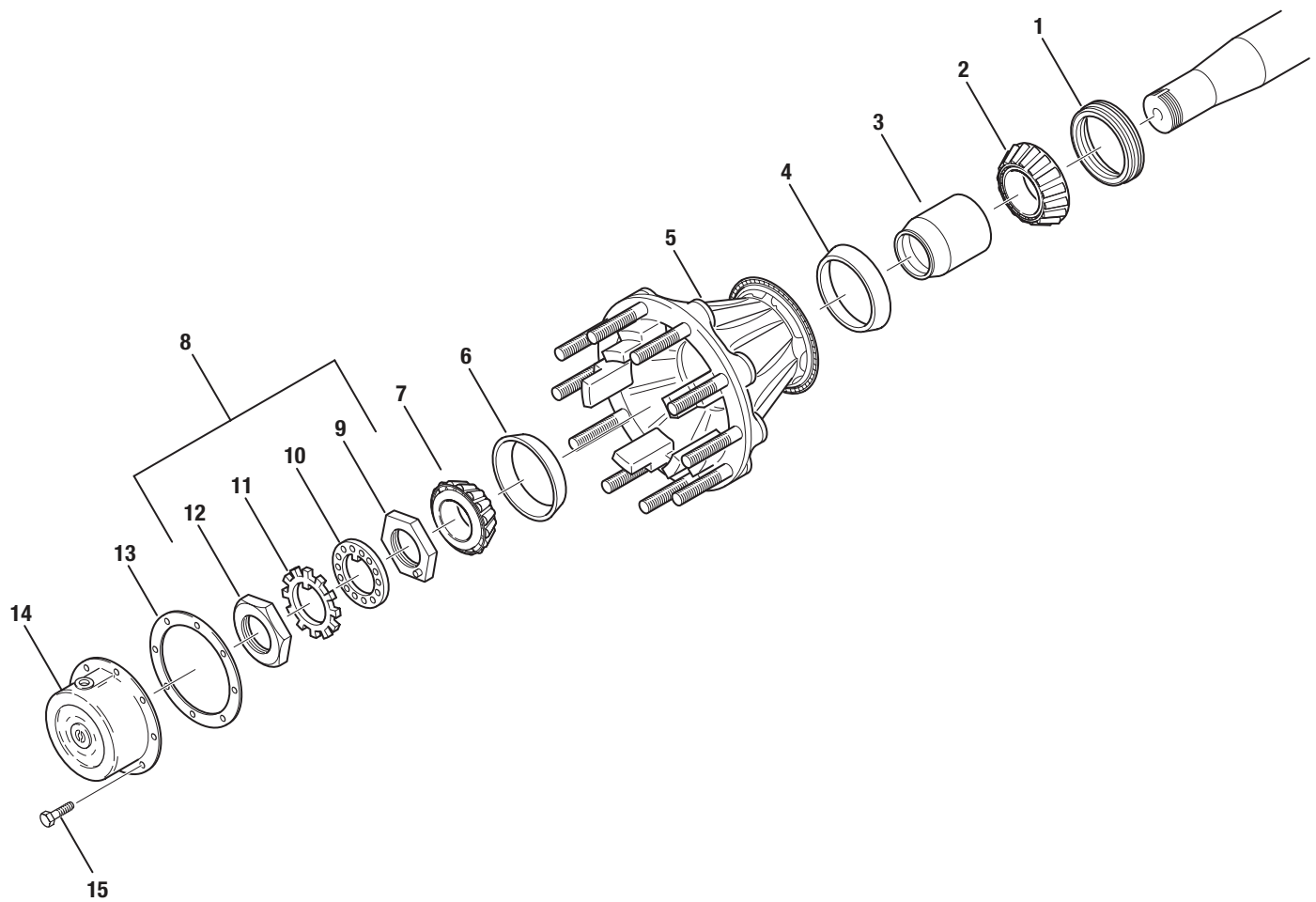
***Do not mix with sodium base grease

****Specified by MGM-113 as only approved lubricants for LMS trailer axles

For additional lubrication information, see TCMT0021 or call 1-800-826-HELP (4357).

LMS Steer

Parts Exploded View



- 1 - Hub oil seal
- 2 - Inner bearing cone
- 3 - Spacer
- 4 - Inner bearing cup
- 5 - Steer hub
- 6 - Outer bearing cup

- 7 - Outer bearing cone
- 8 - Spindle nut and locking system
- 9 - Inner jam nut
- 10 - Spindle washer
- 11 - Lock ring

- 12 - Outer jam nut
- 13 - Gasket
- 14 - Hub cap
- 15 - Hub cap bolt

LMS Steer Axle - Removal

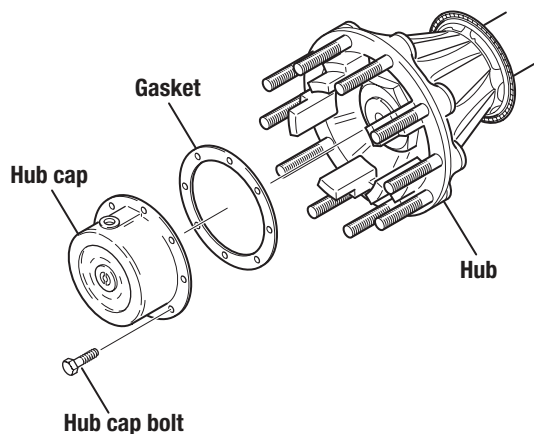
⚠ WARNING

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.

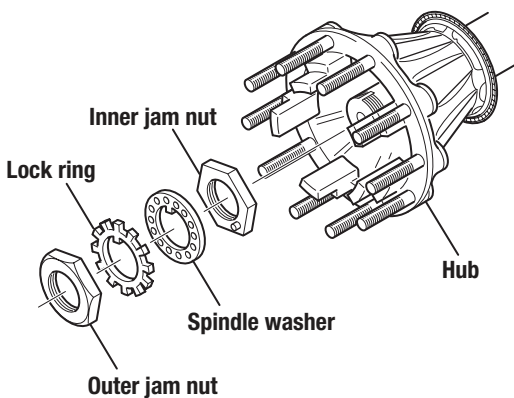
⚠ IMPORTANT

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

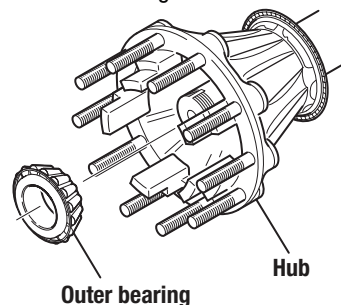
1. Jack up vehicle. Place drain pan under wheel end.
2. Remove hubcap bolts, hubcaps and gasket.



3. Remove locking tabs (if present).
4. Remove outer spindle nut and locking system.

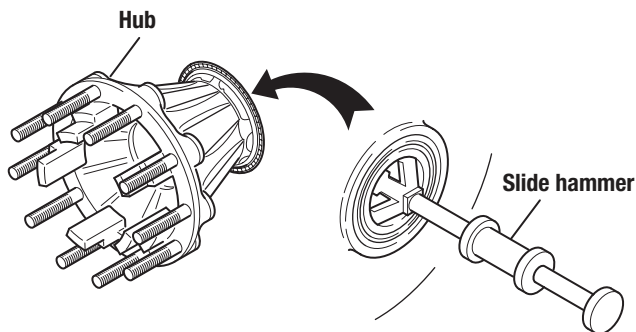


5. Remove outer bearing.

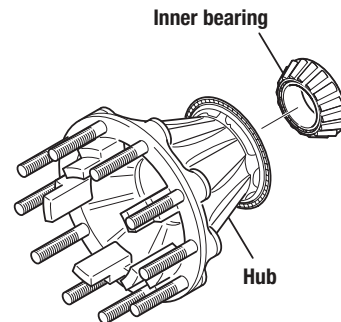


6. Clean spindle.

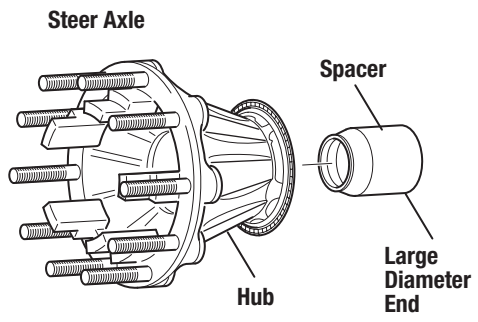
7. Remove seal from hub.



8. Remove inner bearing.



9. Remove LMS spacer.



LMS Wheel End - Assembly

LMS Steer

Follow these service and assembly procedures carefully to obtain proper wheel bearing adjustment and to increase service life.

WARNING

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

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

1. Inspect/Clean the hub cavity, spacer, and bearing bores for any contaminants.

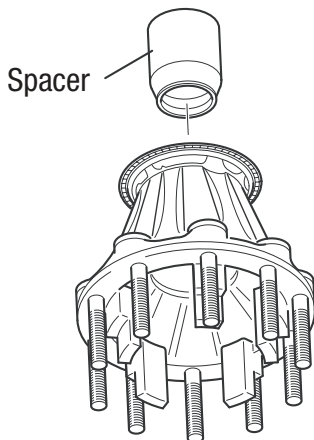
IMPORTANT

Lubricate the inner and outer bearing cones with the same lubricant used in the axle sump for drive wheel ends or lubricant to be used in hub for steer axles.

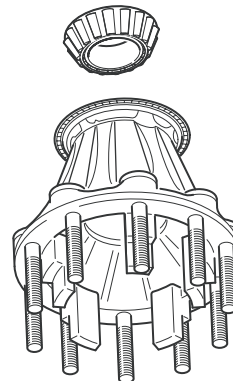
CAUTION

When using an oil bath system, do not pack the bearings with grease. Grease will prevent the proper circulation of axle lubricant and may cause wheel seal failure.

2. Install the bearing spacer into the hub assembly with large diameter end facing the inner bearing cup. This must be done before bearing and seal are installed.

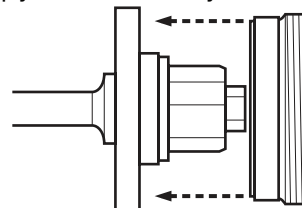


3. With hub or wheel end assembly placed in a flat position, lubricate the inner bearing and install cone into the inner cup of the hub.



4. Place the seal on installation tool facing the proper direction.

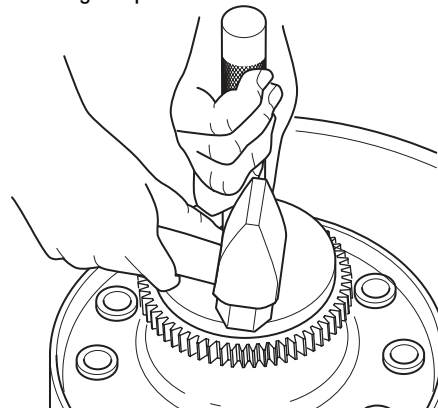
Note: Do not apply RTV sealant of any kind to seal O.D. or I.D.



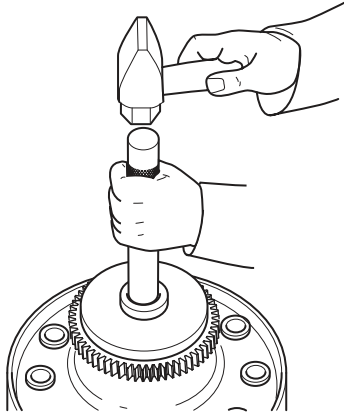
CAUTION

The use of improper seal installation tools can distort or damage the seal, cause premature seal failure and void the warranty.

5. Position seal in hub bore. Tap adapter plate around outer edge to position seal.

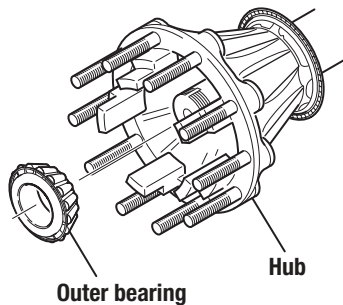


6. Drive the seal into the hub by using a press or a hammer. The installation tool will bottom out on the hub when the seal is correctly installed. Check to be sure the seal is not "cocked" and that unitized seal I.D. and inner bearing turn freely.



10. Inspect the spindle and nut threads for corrosion and debris, clean thoroughly or replace as required.
11. Mount the hub assembly onto the axle spindle with a smooth, firm motion. Use care to maintain alignment between the bearing cones and spindle and to avoid seal damage.

7. When installing a unitized seal, lubricate the outer diameter of the seal with a light film of clean wheel end lubricant.
8. Lubricate the outer bearing cone with the same lube as used in the hub and install into the outer cup of the hub assembly.



9. Install an approved installation tool to the hub cap mounting surface of the hub assembly with two existing nuts/studs or bolts. Hand tighten the nuts/bolts until the installation tool presses against the outer bearing cone.

CAUTION

Failure to use all required LMS components will increase wheel end-play and reduce seal performance.

LMS Stamped Locking Nut System

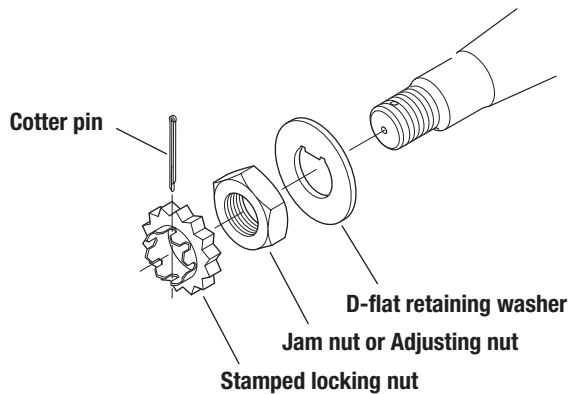
Proper wheel bearing adjustment maximizes wheel bearing and seal life. Proper adjustment can also extend brake lining life by preventing lining contamination caused by seal leaks.

1. Inspect the spindle threads and spindle nut for corrosion and clean thoroughly or replace as required.
2. Pre-Lubricate all bearings.
3. Install the inner bearing into the hub and install the wheel seal.
4. If grease lubricant is used, fill the hub cavity with the appropriate lubricant.
5. Install the hub on the spindle with care, to prevent damage or distortion to the wheel seal.

CAUTION

Never mix grease and oil lubricants.

6. Install the outer bearing on the spindle.
7. Install the retaining washer and adjusting nut.
8. Torque the inner nut to 250 - 300 lbs. ft. while rotating the hub.



9. Install the stamped locking nut and cotter pin.

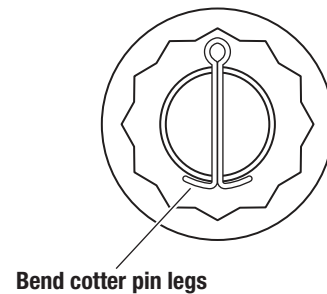
CAUTION

Never tighten the adjusting nut to align the cotter pin slot. This can pre-load the bearings and cause a premature bearing failure.

WARNING

Attempts to measure wheel endplay of the LMS hub system may result in false readings. If endplay measurements are attempted, use a precision dial indicator. Apply a strong push on the hub while rotating the hub back and forth. Work the hub until the dial indicator shows no additional movement. Then apply a strong pull while rotating the hub back and forth. Work the hub until the dial indicator shows no additional movement. Endplay measurements greater than 0.005" may indicate a need to verify the correct components were used and the spindle nut was installed per the specifications.

10. Bend cotter pin legs around the stamped locking nut.



11. Attach the hub cap.
12. If oil lubricant is used, fill the hub cap cavity with the appropriate lube. Install oil fill plug and tighten to specified torque.

LMS Spindle Nut Assembly

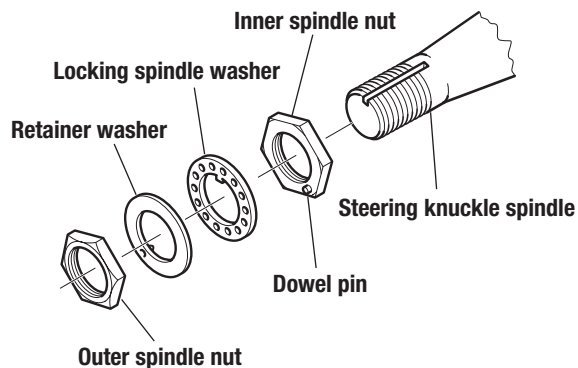
Proper wheel bearing adjustment maximizes wheel bearing and seal life. Proper adjustment can also extend brake lining life by preventing lining contamination caused by seal leaks.

Four-Piece Locking Nut System

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

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

2. Pre-lubricate all bearings.
3. LMS spacer must be installed before the inner bearing and wheel seal.
4. If grease lubricant is used, fill the hub cavity with the appropriate lubricant.
5. Install the hub on the spindle with care, to prevent damage or distortion to the wheel seal.



CAUTION

Never mix grease and oil lubricants.

6. Install:
 - The outer bearing on the spindle
 - The inner spindle nut onto the spindle
7. Torque the inner nut to 250 - 300 lbs. ft. while rotating the hub.
8. Install the locking spindle washer.

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

CAUTION

Never tighten inner nut to align dowel pin hole. This can pre-load the bearing and cause premature bearing failure.

9. Install:
 - The retainer washer
 - The outer spindle nut.
10. Tighten the outer nut to 250 ±50 lbs. ft. (271-407 N•m).
11. Secure outer nut by bending the retainer washer over one flat hex on the outer spindle nut.

WARNING

Attempts to measure wheel end-play of the LMS hub system may result in false readings. If end-play measurements are attempted, use a precision dial indicator. Apply a strong push on the hub while rotating the hub back and forth. Work the hub until the dial indicator shows no additional movement. Then apply a strong pull while rotating the hub back and forth. Work the hub until the dial indicator shows no additional movement. End-play measurements greater than 0.005" may indicate a need to verify the correct components were used and the spindle nut was installed per the specifications.

12. Attach hub cap.
13. If oil lubricant is used, fill the hub cavity with the appropriate lubricant. Install oil fill plug and tighten to specified torque.

CAUTION

Never mix grease and oil lubricants.

Note: For steer axles with Spicer in-axle speed sensors, see AXSM0034 for service and adjustment.

Pro-Torq Locking Nut System with LMS

CAUTION

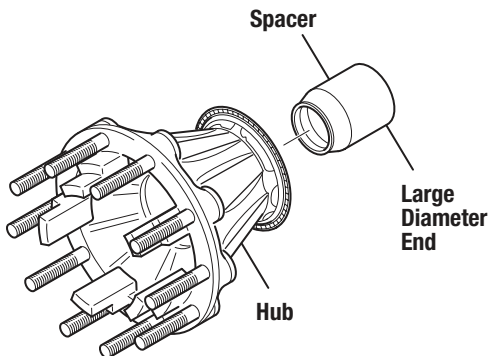
Do not attach, loosen, or tighten the Pro-Torq spindle nut with the keeper ring in place. The keeper ring is a locking device and must be removed before any adjustment of the nut.

WARNING

Care must be taken when removing the keeper ring from the spindle nut due to the spring like properties of the ring. Use appropriate eye protection and shielding when servicing this part.

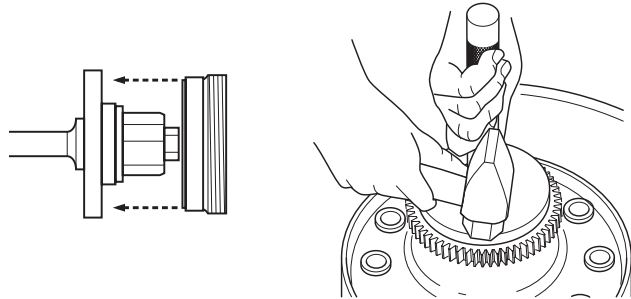
Installation Procedure

1. Install the LMS bearing spacer into the hub assembly with the large diameter end facing the inner bearing cup. This must be done before the bearing cone and seal are installed.



2. Lubricate the inner bearing cone and install into the hub.
3. Install the wheel seal using the proper installation tools.

Note: The user of improper seal installation tools can distort or damage the seal, causing premature seal failure and void the warranty.



4. Install the hub assembly onto the spindle.
5. Install the outer wheel bearing cone.
6. Install D-Flat washer.

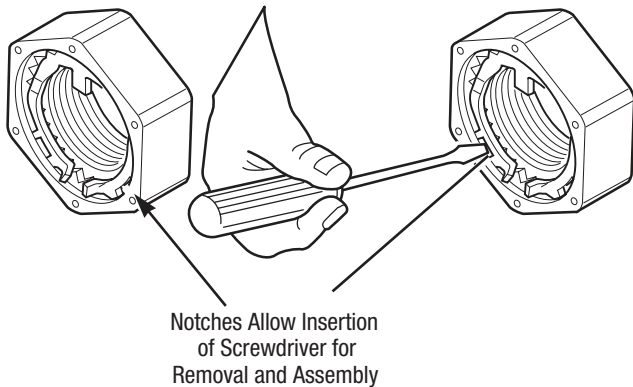
CAUTION

Do not attach, loosen, or tighten the Pro-Torq spindle nut with the keeper ring in place. The keeper ring is a locking device and must be removed before any adjustment of the nut.

WARNING

Care must be taken when removing the keeper ring from the spindle nut due to the spring like properties of the ring. Use appropriate eye protection and shielding when servicing this part.

7. Remove the keeper ring from the Pro-Torque nut before installing the nut.
8. Use a screwdriver-like device to pry the keeper ring from the undercut groove on either side of the nut until the keeper ring is released.



9. Install the Pro-Torque Nut.
10. While rotating the wheel end, torque the nut to 250 lbs. ft. **Do not back the nut off after torquing.**
11. With a dial indicator, measure the wheel bearing endplay to verify that it is not greater than .005".
12. Install the keeper ring into the milled slot of the nut so that the flat of the ring lines up with the flat of the spindle end.



Note: If keeper ring can not be engaged, rotate the spindle nut in a **clockwise / tighten direction only** until it can be engaged. **Do not back the nut off.**

LMS Wheel End - Verify Wheel End-play

⚠ WARNING

Attempts to measure wheel end-play of the completed LMS hub system may result in false readings. If end-play measurements are attempted, use a precision dial indicator. Apply a strong push on the hub while rotating the hub back and forth. Work the hub until the dial indicator shows no additional movement. Then apply a strong pull while rotating the hub back and forth. Work the hub until the dial indicator shows no additional movement. Endplay measurements greater than .005" may indicate a need to verify the correct components were used and the spindle nut was installed per the specifications.

Note: Wheel end-play and spindle nut torque should be checked every 12 months.

LMS Wheel End - Lubrication

⚠ CAUTION

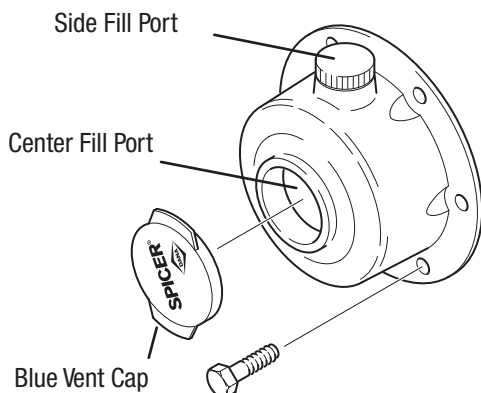
Before operating the axle, the wheel hub cavities and bearings must be lubricated to prevent failure. When wheel ends are serviced, follow Dana's wheel end lubrication procedure before operating the axle.

For LMS Steer Axles

Lubrication fill - Oil type wheel ends

Note: Wheel hub configurations vary, allowing different amounts of oil to be added depending on design. Allow for the oil to seep through the outer bearing and fill the hub cavity.

Note: During this fill operation, do not allow the oil to go above the centerline or weep hole. This may result in a weeping condition that may be perceived as a leaking hubcap. Continue to add oil until the oil reaches the oil level line as indicated on the hubcap.



Center Fill Port

1. Hub mating surface must be free of dirt, burrs, and radial score lines.
2. Hub mating surface, hubcap flange, and gasket should not be greased or oiled.
3. Always install and reinstall a hubcap with a new gasket.
4. Install the hubcap and tighten hubcap bolts to the specified torque.
5. Fill the hubcap through the center fill port to the proper level (between add and full).
6. Rotate the hub several times then verify the lube is at the proper level. Use only Dana approved synthetic lube.

Side Fill Port

1. Fill wheel end assembly through side fill port with the specified grade of oil
2. Install side fill hubcap plug and torque to 15- 25 lbs. in.
3. Clean up any overspills that would give the appearance of a leaky hubcap.

Lubrication fill - Semi-fluid wheel ends

1. Fill the hub cavity until the lube exits at the 3 o'clock and 9 o'clock positions of the outer bearing. This represents a 50% hub cavity fill.
2. Coat the spindle nut and spindle with lube.
3. Place 2 oz. of lube on the inner surface of the hubcap.
4. Hub mating surface must be free of dirt, burrs, and radial score lines.
5. Hub mating surface, hubcap flange, and gasket should not be greased or oiled.
6. Always install and reinstall a hubcap with a new gasket.
7. Install the hubcap and tighten hubcap bolts to the specified torque.

Standard Hub Steer Axles - Lubrication

Proper lubrication practices are important in maximizing the service life of your steer axle hub assembly.

Wheel Bearings

Lubricate wheel bearings with an approved drive axle lubricant (oil bath) or heavy duty grease (grease packed) depending on the type of axle lube system. Identify the type of lubrication system on your vehicle before servicing wheel bearings. Improper lubrication can result in reduced seal life and potential damage to bearings and spindles.

Oil Bath – Lubricate wheel end assembly with a drive axle lubricant that meets MIL-L-2105E specifications. Either 80W-90 mineral based or 75W-90 synthetic lube is acceptable. Check lubricant level at each greasing interval. Maintain lube level to centerline of axle or fill line on hub cap. Always check lube level on flat ground.

 CAUTION

Do not mix lubricants of different grades. Do not mix mineral and synthetic lubes. Different brands of same grade may be mixed. Do not pack bearings with grease when using an oil bath system. This practice can restrict the flow of lubricant to the wheel seal.

Grease Packed – Thoroughly clean bearings, spindle, hub cap, and hub cavity. Parts may be washed in a suitable commercial solvent. Be certain parts are free of moisture or other contaminants. Refer to vehicle and/or wheel seal manufacturer's recommendations when using grease.

1. Grease bearing cones by forcing grease between rollers, cones, and cage.
2. Coat spindle and spindle nut with lube.
3. Fill wheel hub with grease to inside diameter of bearing cups.
4. Coat inside of hub cap with grease.

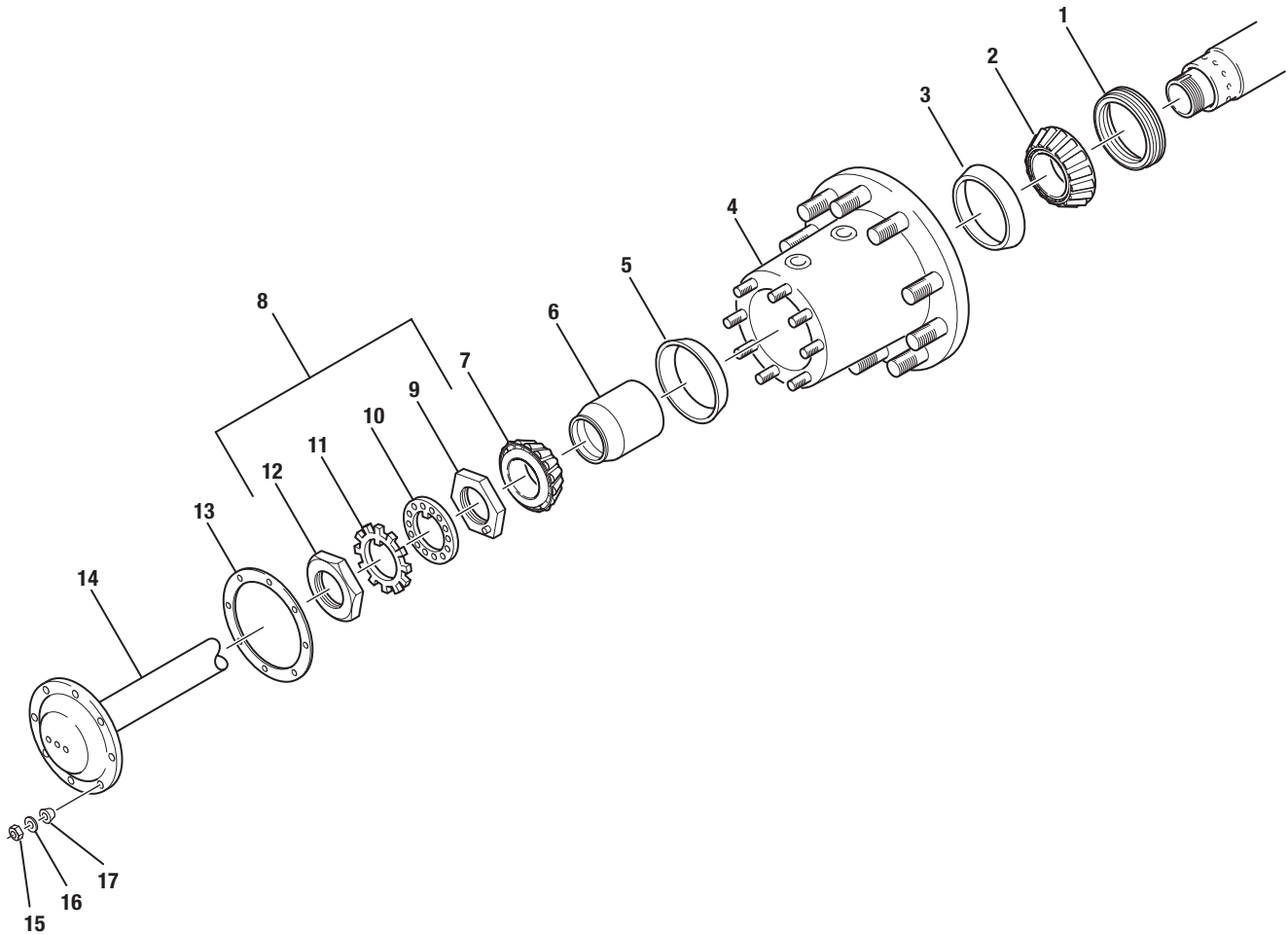
 CAUTION

Never mix oil bath and grease packed wheel ends.

For additional information, refer to the Roadranger Products Lubrication Manual TCMT0021.

LMS Hub Drive Axle

Parts Exploded View



- 1 - Hub oil seal
- 2 - Inner bearing cone
- 3 - Inner bearing cup
- 4 - Drive hub
- 5 - Outer bearing cup
- 6 - Spacer

- 7 - Outer bearing cone
- 8 - Spindle nut and locking system
- 9 - Inner jam nut
- 10 - Spindle washer
- 11 - Lock ring
- 12 - Outer jam nut

- 13 - Gasket
- 14 - Drive axle shaft
- 15 - Stud nut
- 16 - Lock washer
- 17 - Taper dowel

LMS Drive Axle - Removal

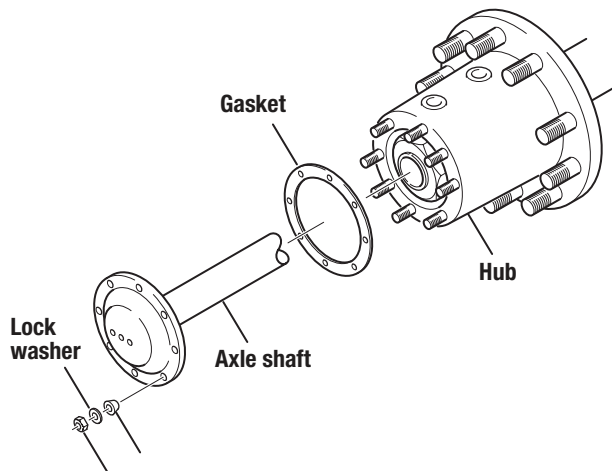
⚠ WARNING

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.

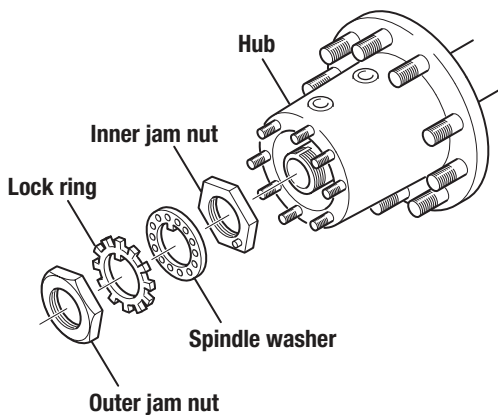
⚠ IMPORTANT

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

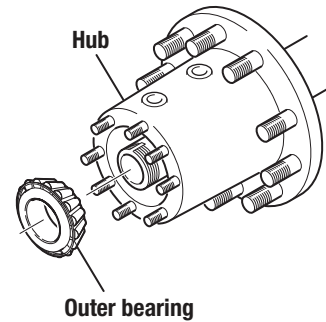
1. Jack up vehicle. Place drain pan under wheel end.
2. Remove stud nuts, lock washers and taper dowels (if present), drive axle shaft and gasket.



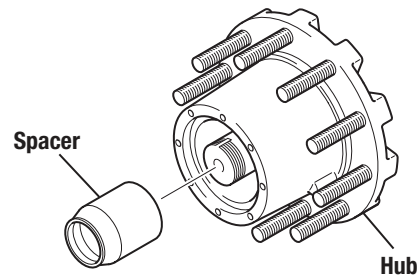
3. Remove spindle nut and locking system.



4. If tires on, use a dolly and pull wheel end outward to loosen outer bearing and hub.
5. Remove outer bearing.

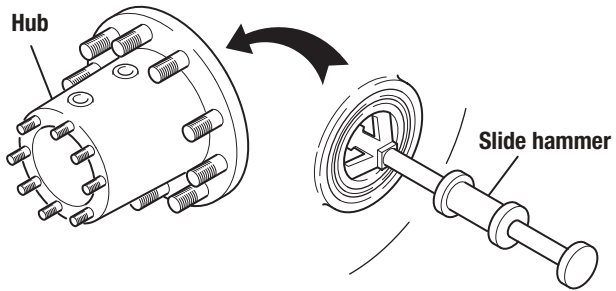


6. Remove Spacer.

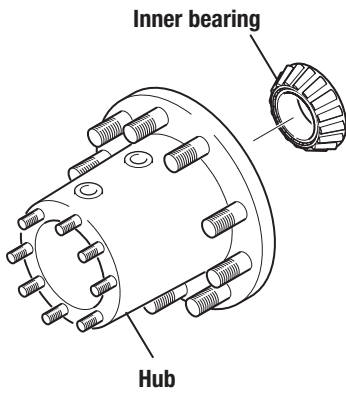


7. Remove hub assembly.

8. Remove seal from hub.



9. Remove inner bearing.



10. Clean and inspect wheel components before reassembly.

LMS Wheel End - Assembly

LMS Drive Axle Assembly

Follow these service and assembly procedures carefully to obtain proper wheel bearing adjustment and to increase service life.

WARNING

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

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

1. Inspect/Clean the hub cavity, spacer, and bearing bores for any contaminants.

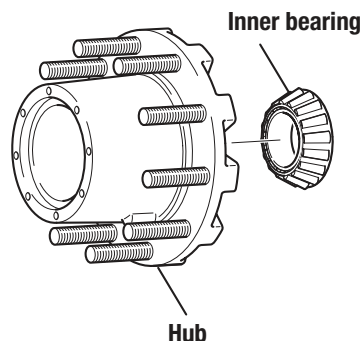
IMPORTANT

Lubricate the inner and outer bearing cones with the same lubricant used in the axle sump for drive wheel ends or lubricant to be used in hub for steer axles.

CAUTION

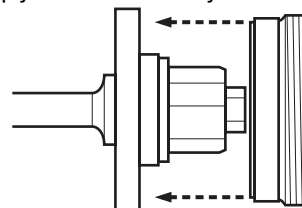
When using an oil bath system, do not pack the bearings with grease. Grease will prevent the proper circulation of axle lubricant and may cause wheel seal failure.

2. With hub or wheel end assembly placed in a flat position, lubricate the inner bearing and install cone into the inner cup of the hub.



3. Place the seal on installation tool facing the proper direction.

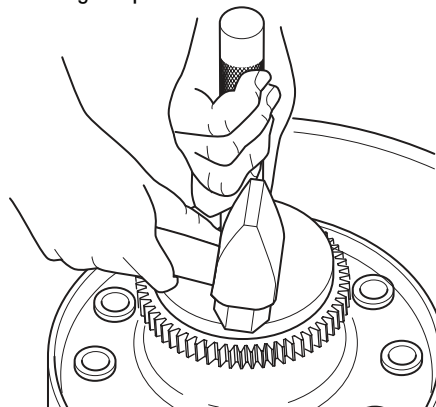
Note: Do not apply RTV sealant of any kind to seal O.D. or I.D.



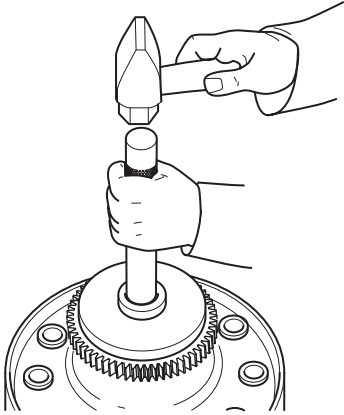
CAUTION

The use of improper seal installation tools can distort or damage the seal, cause premature seal failure and void the warranty.

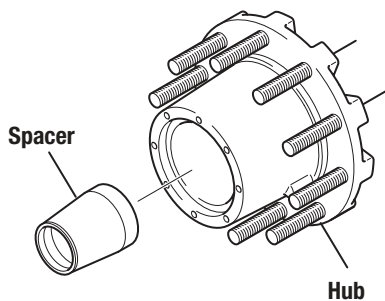
4. Position seal in hub bore. Tap adapter plate around outer edge to position seal.



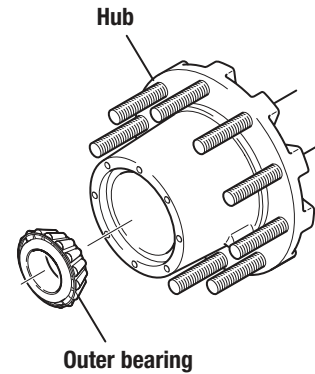
5. Drive the seal into the hub by using a press or a hammer. The installation tool will bottom out on the hub when the seal is correctly installed. Check to be sure the seal is not "cocked" and that unitized seal I.D. and inner bearing turn freely.



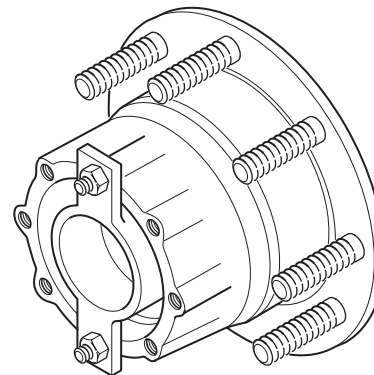
6. When installing a unitized seal, lubricate the outer diameter of the seal with a light film of clean wheel end lubricant
7. **Drive Axle Only:** Install the bearing spacer into the hub assembly, large diameter end against the inner bearing cone.



8. Lubricate the outer bearing cone with the same lube as used in the hub and install into the outer cup of the hub assembly.



9. Install an approved installation tool to the hub cap mounting surface of the hub assembly with two existing nuts/studs or bolts. Hand tighten the nuts/bolts until the installation tool presses against the outer bearing cone.



10. The LMS Hub assembly is complete and ready for installation on the spindle.

CAUTION

Failure to use all required LMS components will increase wheel endplay and reduce seal performance.

11. Inspect the spindle and nut threads for corrosion and debris, clean thoroughly or replace as required.
12. Mount the hub assembly onto the axle spindle with a smooth, firm motion. Use care to maintain alignment

between the bearing cones and spindle and to avoid seal damage.

CAUTION

Never support the hub on the spindle with just the inner bearing and seal. This can damage the seal and cause premature failure.

13. Remove the installation tool from the hub assembly.

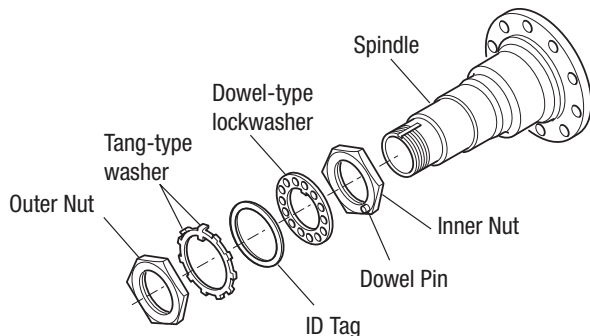
LMS Drive Axle Spindle Nut Installation Procedure

WARNING

Four-Piece Spindle Nut System

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

1. Install the inner spindle nut with dowel pin outward and tighten.



Note: Optional 3 piece nut system is available

2. While rotating wheel end, torque the inner nut:
 - Drive Hubs 300-350 lb. ft. **Do not back off.**
3. Install the dowel type washer onto the axle spindle aligning tab with keyway. If washer does not align with dowel pin on inner nut, remove washer and turn over and reinstall. If after this, washer still does not align with dowel pin, tighten inner nut just enough for alignment. Never tighten the nut more than half the distance between the holes.

CAUTION

NEVER back off the spindle nut to align dowel pin with dowel washer.

When using LMS Hub, always install the identification tag.

4. Install the identification tag onto the spindle over the outside diameter of the dowel-type lock washer, with the anti-rotation bosses inboard and over the flats of the inner spindle nut.

Note: The identification tag is retained between the tang-type lock washer and the inner nut.

5. Install the outer wheel nut on the spindle and tighten.
6. Torque the outer spindle nut to 200 ± 50 lb. ft.

Note: If the washer tang and nut flat are not aligned, remove washer, turn it over and reinstall. If required, tighten the outer nut just enough for alignment.

CAUTION

NEVER back off the spindle nut to align tang-type washer with spindle nut flats.

7. Secure the outer nut by bending two opposing (180 degrees apart) tangs of the tang-type washer over two flats of the outer nut.

WARNING

Attempts to measure wheel endplay of the LMS hub system may result in false readings. If endplay measurements are attempted, use a precision dial indicator. Apply a strong push on the hub while rotating the hub back and forth. Work the hub until the dial indicator shows no additional movement. Then apply a strong pull while rotating the hub back and forth. Work the hub until the dial indicator shows no additional movement. Endplay measurements greater than 0.005" may indicate a need to verify the correct components were used and the spindle nut was installed per the specifications.

CAUTION

LMS hub components are made to special tight tolerances. Installation and/or servicing with other components will increase wheel endplay reducing bearing and seal life.

-
8. Install new gasket on axle shaft flange for drive axles or install new gasket on hub cap for steer axles.
 9. Fill and lubricate axle and wheel ends with Dana approved synthetic lubes. (See Wheel End Lubrication Procedure.)

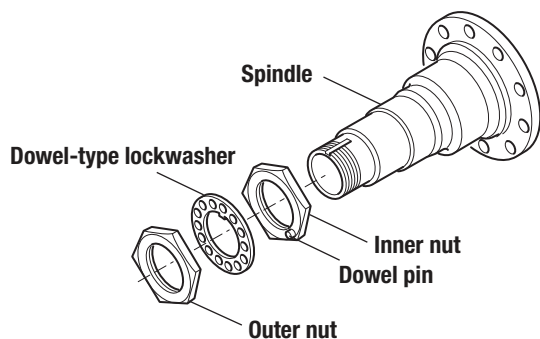
Note: Purchase Genuine replacement Hub and Cup Assemblies through O.E.M.

LMS Assembly

Two-Piece Spindle Nut with Dowel and / or Tang Washer

1. Install the inner spindle nut with dowel pin outward. While rotating the hub, torque the nut to 300 ft lbs. **DO NOT BACK OFF.**

Three-Piece Dowel-Type Lockwasher System



- a. Install the Dowel-type lockwasher on the spindle.

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

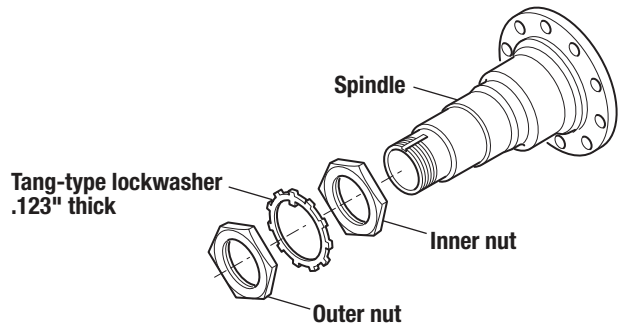
CAUTION

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 wheel endplay.

Three-Piece and Tang-Type Lockwasher System

1. Install the inner spindle nut with dowel pin outward. While rotating the hub, torque the nut to 300 ft lbs. **DO NOT BACK OFF.**



- a. Install the Tang-Type lockwasher 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. Check endplay using a dial indicator. Endplay should be within 0.001 - 0.005 in (0.025 - 0.127 mm). See "Verify Wheel Endplay" section.
- 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 2.

Pro-Torq Locking Nut System with LMS

CAUTION

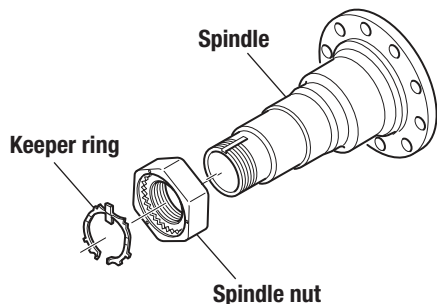
Do not attach, loosen, or tighten the Pro-Torq spindle nut with the keeper ring in place. The keeper ring is a locking device and must be removed before any adjustment of the nut.

WARNING

Care must be taken when removing the keeper ring from the spindle nut due to the spring like properties of the ring. Use appropriate eye protection and shielding when servicing this part.

Installation Procedure

1. Install the LMS bearing spacer into the hub assembly with the large diameter end facing the inner bearing cup. This must be done before the bearing cone and seal are installed.



2. Lubricate the inner bearing cone and install into the hub.
3. Install the wheel seal using the proper installation tools.

Note: The user of improper seal installation tools can distort or damage the seal, causing premature seal failure and void the warranty.

4. Install the hub assembly onto the spindle.
5. Install the outer wheel bearing cone.
6. Install D-Flat washer.

CAUTION

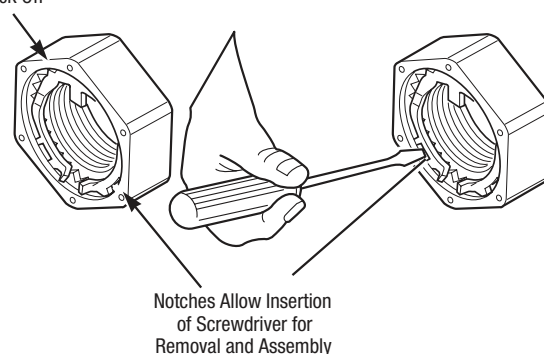
Do not attach, loosen, or tighten the Pro-Torq spindle nut with the keeper ring in place. The keeper ring is a locking device and must be removed before any adjustment of the nut.

WARNING

Care must be taken when removing the keeper ring from the spindle nut due to the spring like properties of the ring. Use appropriate eye protection and shielding when servicing this part.

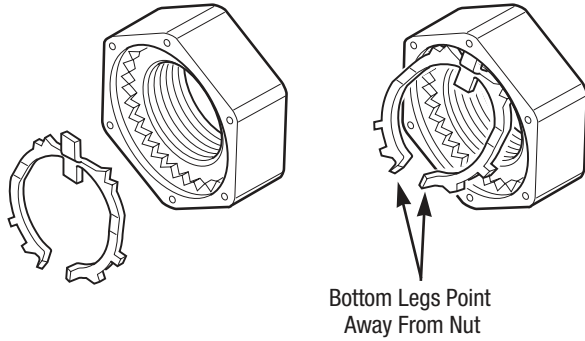
7. Remove the keeper ring from the Pro-Torque nut before installing the nut.

Use Raised Nubs to Indicate 1/4 Turn Back Off



8. Use a screwdriver-like device to pry the keeper ring from the undercut groove on either side of the nut until the keeper ring is released.
9. Install the Pro-Torque Nut.
10. While rotating the wheel end, torque the nut to 250 lbs. ft. **Do not back the nut off after torquing.**

11. With a dial indicator, measure the wheel bearing endplay to verify that it is not greater than .005".
12. Install the keeper ring into the milled slot of the nut so that the flat of the ring lines up with the flat of the spindle end.



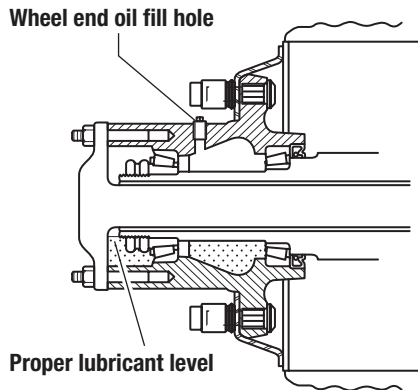
Note: If keeper ring can not be engaged, rotate the spindle nut in a **clockwise / tighten direction only** until it can be engaged. **Do not back the nut off.**

LMS Drive Axle - Lubrication

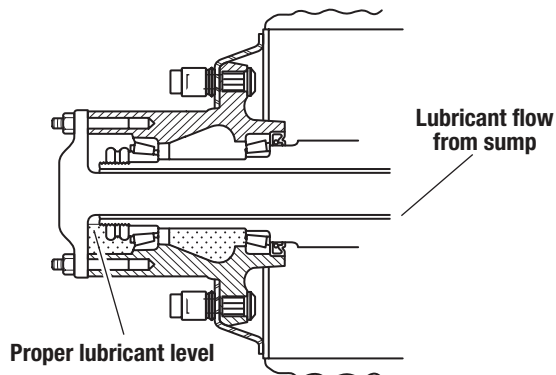
Wheel Ends with an Oil Fill Hole

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

Wheel End with Oil Fill Hole

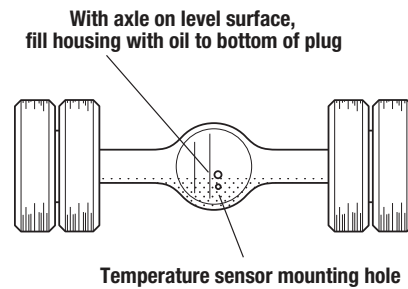


Wheel End without Oil Fill Hole

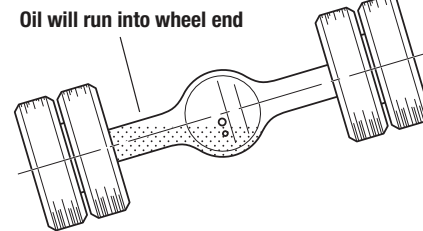


Wheel Ends without Oil Fill Hole

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.

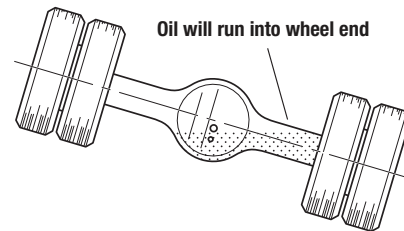


2. Raise the right side of the axle 6 inches or more. Hold axle in this position for one minute.



3. Lower the right side.

4. Raise the left side of the axle 6 inches or more. Hold axle in this position for one minute.



5. Lower the left side.

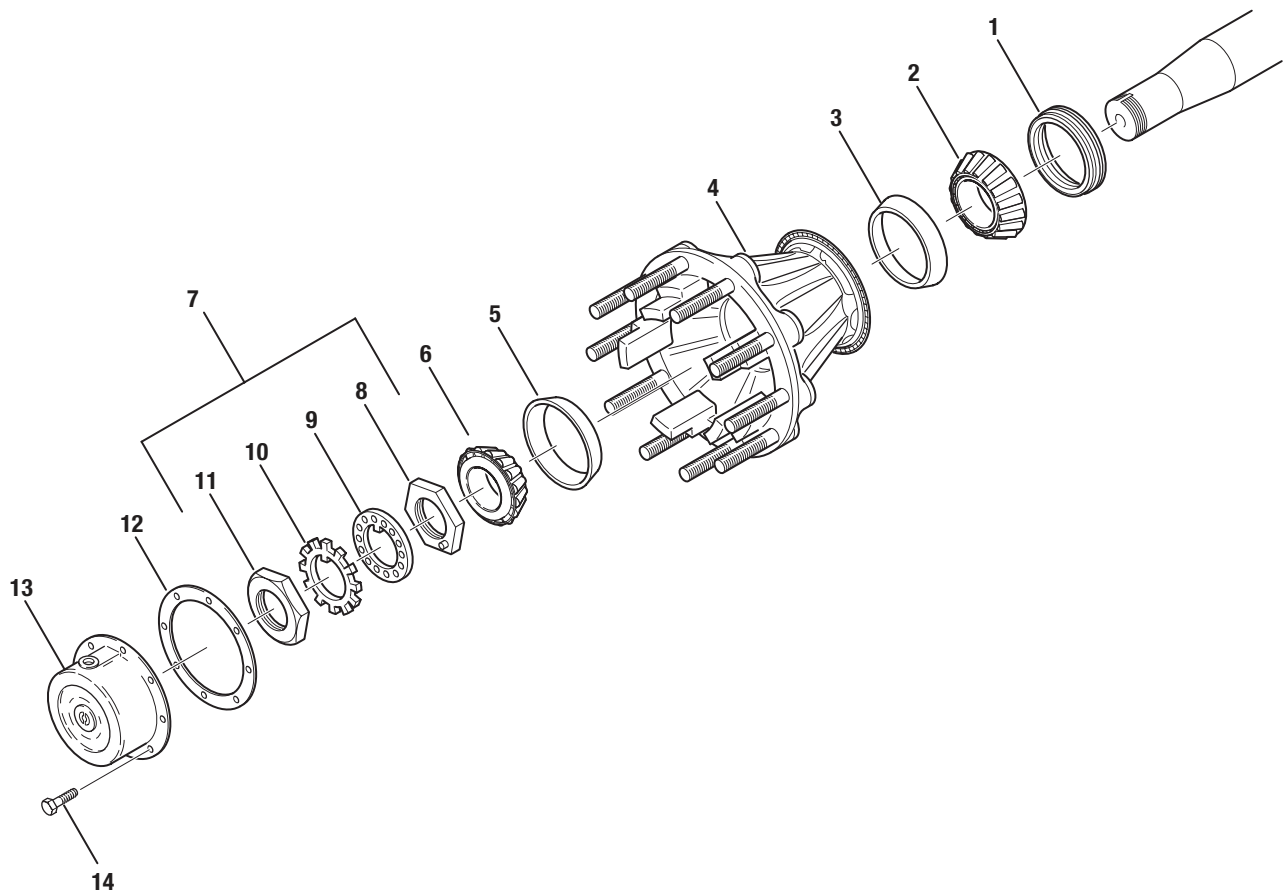
6. With axle on a level surface, add lubricant through housing cover oil filler hole until fluid is level with the bottom of the hole.

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.

For additional information, refer to the Roadranger Products Lubrication Manual TCMT0021.

Standard Hub Steer Axle

Parts Exploded View



- 1 - Unitized hub oil seal
- 2 - Inner bearing cone
- 3 - Inner bearing cup
- 4 - Steer hub
- 5 - Outer bearing cup
- 6 - Outer bearing cone

- 7 - Spindle nut and locking system
- 8 - Inner jam nut
- 9 - Spindle washer
- 10 - Lock ring
- 11 - Outer jam nut
- 12 - Gasket

- 13 - Hub cap
- 14 - Hub cap bolt

Standard Hub Steer Axle - Removal

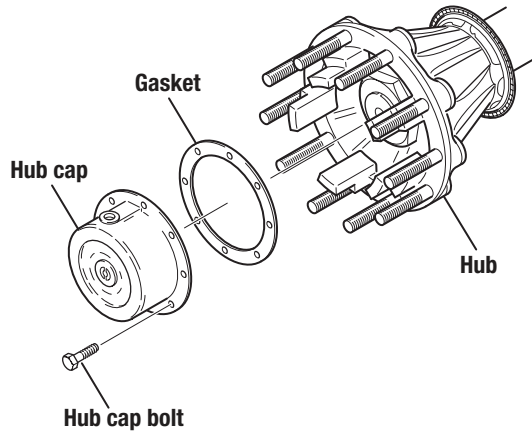
⚠ WARNING

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.

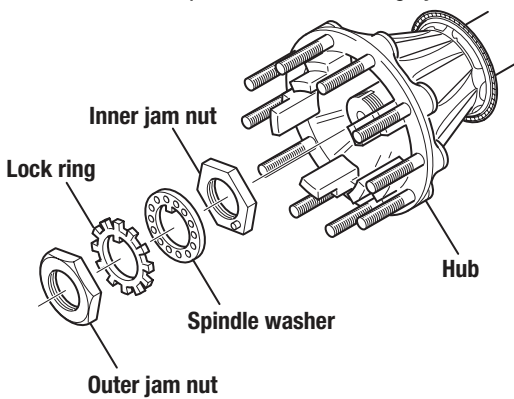
⚠ IMPORTANT

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

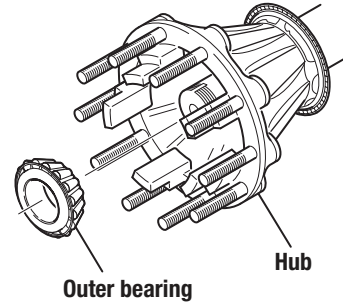
1. Jack up vehicle. Place drain pan under wheel end.
2. Remove hubcap bolts, hubcaps and gasket.



3. Remove locking tabs (if present).
4. Remove outer spindle nut and locking system.

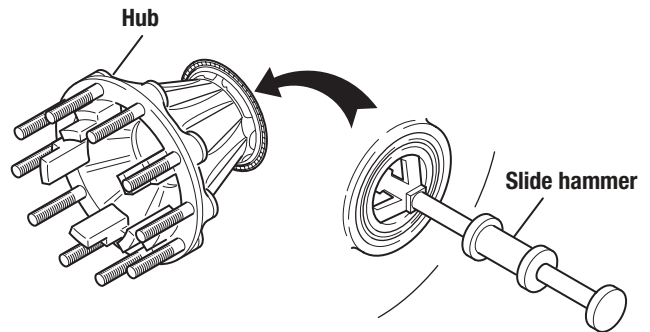


5. Remove outer bearing.

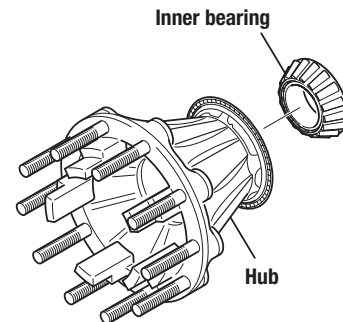


6. Clean spindle.

7. Remove seal from hub.



8. Remove inner bearing.



Standard Hub and Spindle Nut - Assembly

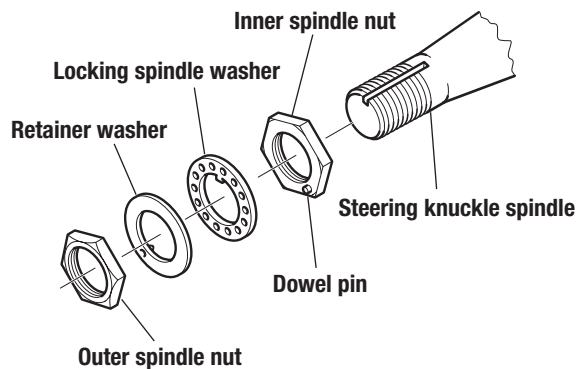
Proper wheel bearing adjustment maximizes wheel bearing and seal life. Proper adjustment can also extend brake lining life by preventing lining contamination caused by seal leaks.

Four-Piece Locking System

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

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

2. Pre-lubricate all bearings.
3. Install the inner bearing into the hub and install the wheel seal.
4. If grease lubricant is used, fill the hub cavity with the appropriate lubricant.
5. Install the hub on the spindle with care, to prevent damage or distortion to the wheel seal.



CAUTION

Never mix grease and oil lubricants.

6. Install:
 - The outer bearing on the spindle
 - The inner spindle nut onto the spindle
7. Seat the bearings by tightening the inner nut to 200 lbs. ft. (271 N•m) while rotating the hub assembly.
8. Loosen the inner nut one full turn.
9. Re-tighten the inner nut to 50 lbs. ft. (68 N•m) while rotating the hub.
10. Again loosen the inner nut one third turn (to one half turn maximum - three to five hub studs for a ten stud pattern.)
11. Install the locking spindle washer.

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

CAUTION

Never tighten inner nut to align dowel pin hole. This can pre-load the bearing and cause premature bearing failure.

12. Install:
 - The retainer washer
 - The outer spindle nut
13. Tighten the outer nut to 200 ± 50 lbs. ft. (271 - 407 N•m).
14. Secure outer nut by bending the retainer washer over one flat hex on the outer spindle nut.
15. Verify that the wheel endplay is between 0.001" and 0.005" (0.025 and 0.127 mm) using a dial indicator. If reading does not fall within this range, repeat this procedure. See "Verify Wheel Endplay" section.
16. Attach hub cap.
17. If oil lubrication is used, fill the hub cavity with the appropriate lubricant. Install oil fill plug and tighten to specified torque.

CAUTION

Never mix grease and oil lubricants.

Note: For steer axles with Spicer in-axle speed sensors, see AXSM0034 for service and adjustment.

Stamped Locking Nut System

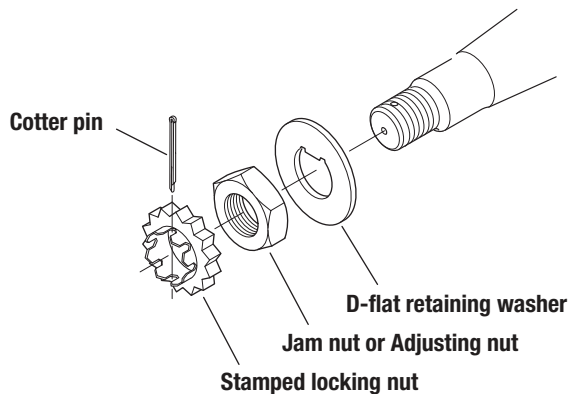
Proper wheel bearing adjustment maximizes wheel bearing and seal life. Proper adjustment can also extend brake lining life by preventing lining contamination caused by seal leaks.

1. Inspect the spindle threads and spindle nut for corrosion and clean thoroughly or replace as required.
2. Pre-lubricate all bearings.
3. Install the inner bearing into the hub and install the wheel seal.
4. If grease lubricant is used, fill the hub cavity with the appropriate lubricant.
5. Install the hub on the spindle with care, to prevent damage or distortion to the wheel seal.

CAUTION

Never mix grease and oil lubricants.

6. Install the outer bearing on the spindle.
7. Install the retaining washer and adjusting nut.
8. Seat the bearing by tightening the adjusting nut to 200 lbs. ft (271 N•m) while rotating the hub.

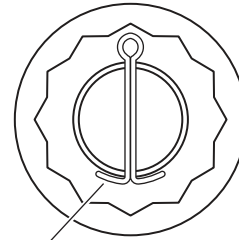


9. Loosen the adjusting nut one full turn.
10. Re-tighten the adjusting nut to 50 lbs. ft (68 N•m) while rotating the hub.
11. Back off the adjusting nut 1/8 turn.
12. Install the stamped locking nut and cotter pin.

CAUTION

Never tighten the adjusting nut to align the cotter pin slot. This can pre-load the bearings and cause a premature bearing failure.

13. Verify that the wheel endplay is between 0.001" and 0.005" (0.025 and 0.127 mm) using a dial indicator. If reading does not fall within the range, repeat this procedure. See "Verify Wheel End-play" section.
14. Bend cotter pin legs around the stamped locking nut.



15. Attach the hub cap.
16. If oil lubricant is used, fill the hub cap cavity with the appropriate lube. Install oil fill plus and tighten to specified torque.

Pro-Torq Spindle Nut Service

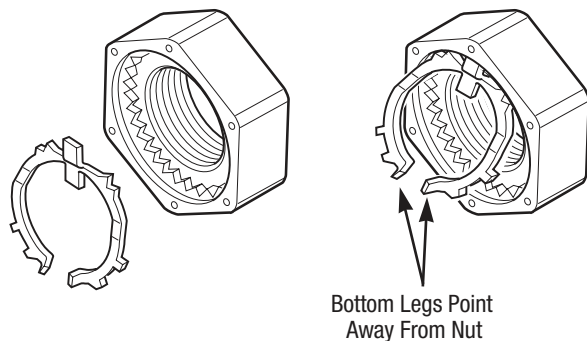
Removing Pro-Torque Spindle Nut

CAUTION

Do not attach, loosen, or tighten the Pro-Torq spindle nut with the keeper ring in place. The keeper ring is a locking device and must be removed before any adjustment of the nut.

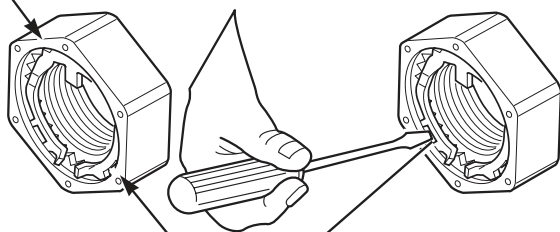
WARNING

Care must be taken when removing the keeper ring from the spindle nut due to the spring like properties of the ring. Use appropriate eye protection and shielding when servicing this part.



To remove Pro-Torq spindle nut, first remove the keeper ring. Use a screwdriver-like device to carefully pry the keeper ring from the undercut groove on either side of the spindle nut until the keeper ring is released.

Use Raised Nubs to Indicate 1/4 Turn Back Off



Notches Allow Insertion of Screwdriver for Removal and Assembly

Installing Pro-Torque Spindle Nut

Install spindle nut as follows:

1. Remove the keeper ring from the nut as described in the Removing Pro-Torq Spindle Nut section.

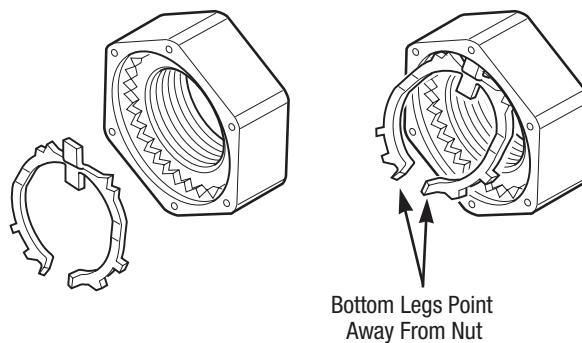
CAUTION

Do not attach, loosen, or tighten the Pro-Torq spindle nut with the keeper ring in place. The keeper ring is a locking device and must be removed before any adjustment of the nut.

WARNING

Care must be taken when removing the keeper ring from the spindle nut due to the spring like properties of the ring. Use appropriate eye protection and shielding when servicing this part.

2. To seat the trailer axle bearing, thread the Pro-Torq nut onto the axle spindle. While rotating the wheel, torque the nut to 200 lbs. ft. (271 N•m).
3. After seating the bearing, back the nut off one full turn.
4. To achieve the proper endplay, re-thread the Pro-Torq nut until hand tight. Torque to 100 lbs. ft. (136 N•m).



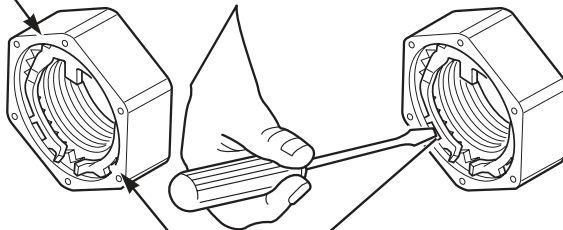
5. Back off 1/4 turn, or one raised face mark on surface of the Pro-Torq nut. Wheel should turn freely.
6. Check endplay using a dial indicator. Endplay should be within 0.001"–0.003" (0.025–0.076 mm). See Verify Wheel End-play on page 44.

CAUTION

After seating bearing at 200 lbs. ft. (271 N•m), Pro-Torq spindle nut must be backed off. Failure to back off the nut will cause the bearing to run hot and fail prematurely or to be damaged. The final adjustment of 100 lbs. ft. (136 N•m) of adjusting torque with a 1/4 turn backoff will ensure the necessary 0.001"–0.003" (0.025–0.076 mm) endplay.

7. Insert the keeper ring into the undercut groove of the spindle nut as shown.
8. Engage the mating teeth of the keeper and the nut.
9. Compress and insert the keeper arms one at a time into the undercut groove of the nut.
10. Position the keeper ring as required to align teeth.
11. Do not turn the spindle nut to align teeth.

Use Raised Nubs
to Indicate 1/4 Turn
Back Off



Notches Allow Insertion
of Screwdriver for
Removal and Assembly

Verify Wheel End-play (Standard Axles)

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

Correct end-play is 0.001"–0.005" (0.025–0.127 mm).

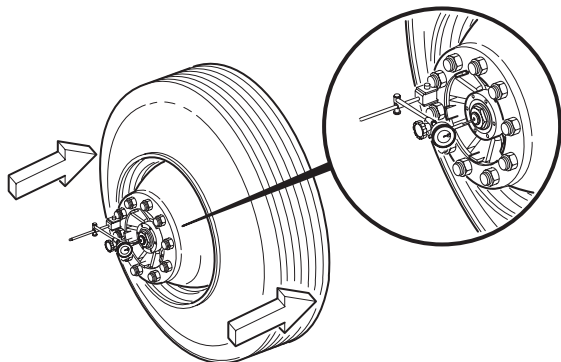
Note: Endplay when using a Pro-Torq Nut is 0.001"–0.003" (0.025–0.076 mm).

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.

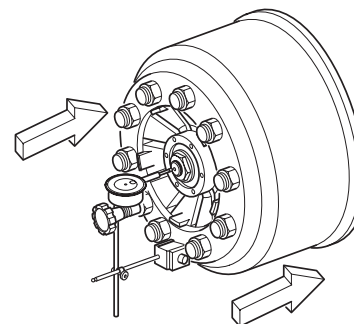
CAUTION

If end-play is not within specification, readjustment is required.

Adjust End-play with Tire and Wheel Assembly



Adjust End-play with Wheel Hub



With indicator mounted at bottom, push/pull at sides of drum

Readjust Wheel End-play Procedure

Excessive End-play: If end-play is greater than 0.005" (0.127 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 retorque the outer nut. Verify end-play with a dial indicator.

Insufficient End-play: If end-play 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 retorque the outer nut. Verify end-play with a dial indicator.

Fine Tuning the End-play: If, after performing the readjustment procedures, end-play 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 end-play with a dial indicator.

Standard Hub Steer Axles - Lubrication

Proper lubrication practices are important in maximizing the service life of your steer axle hub assembly.

Wheel Bearings

Lubricate wheel bearings with an approved drive axle lubricant (oil bath) or heavy duty grease (grease packed) depending on the type of axle lube system. Identify the type of lubrication system on your vehicle before servicing wheel bearings. Improper lubrication can result in reduced seal life and potential damage to bearings and spindles.

Oil Bath – Lubricate wheel end assembly with a drive axle lubricant that meets MIL-L-2105E specifications. Either 80W-90 mineral based or 75W-90 synthetic lube is acceptable. Check lubricant level at each greasing interval. Maintain lube level to centerline of axle or fill line on hub cap. Always check lube level on flat ground.

 CAUTION

Do not mix lubricants of different grades. Do not mix mineral and synthetic lubes. Different brands of same grade may be mixed. Do not pack bearings with grease when using an oil bath system. This practice can restrict the flow of lubricant to the wheel seal.

Grease Packed – Thoroughly clean bearings, spindle, hub cap, and hub cavity. Parts may be washed in a suitable commercial solvent. Be certain parts are free of moisture or other contaminants. Refer to vehicle and/or wheel seal manufacturer's recommendations when using grease.

1. Grease bearing cones by forcing grease between rollers, cones, and cage.
2. Coat spindle and spindle nut with lube.
3. Fill wheel hub with grease to inside diameter of bearing cups.
4. Coat inside of hub cap with grease.

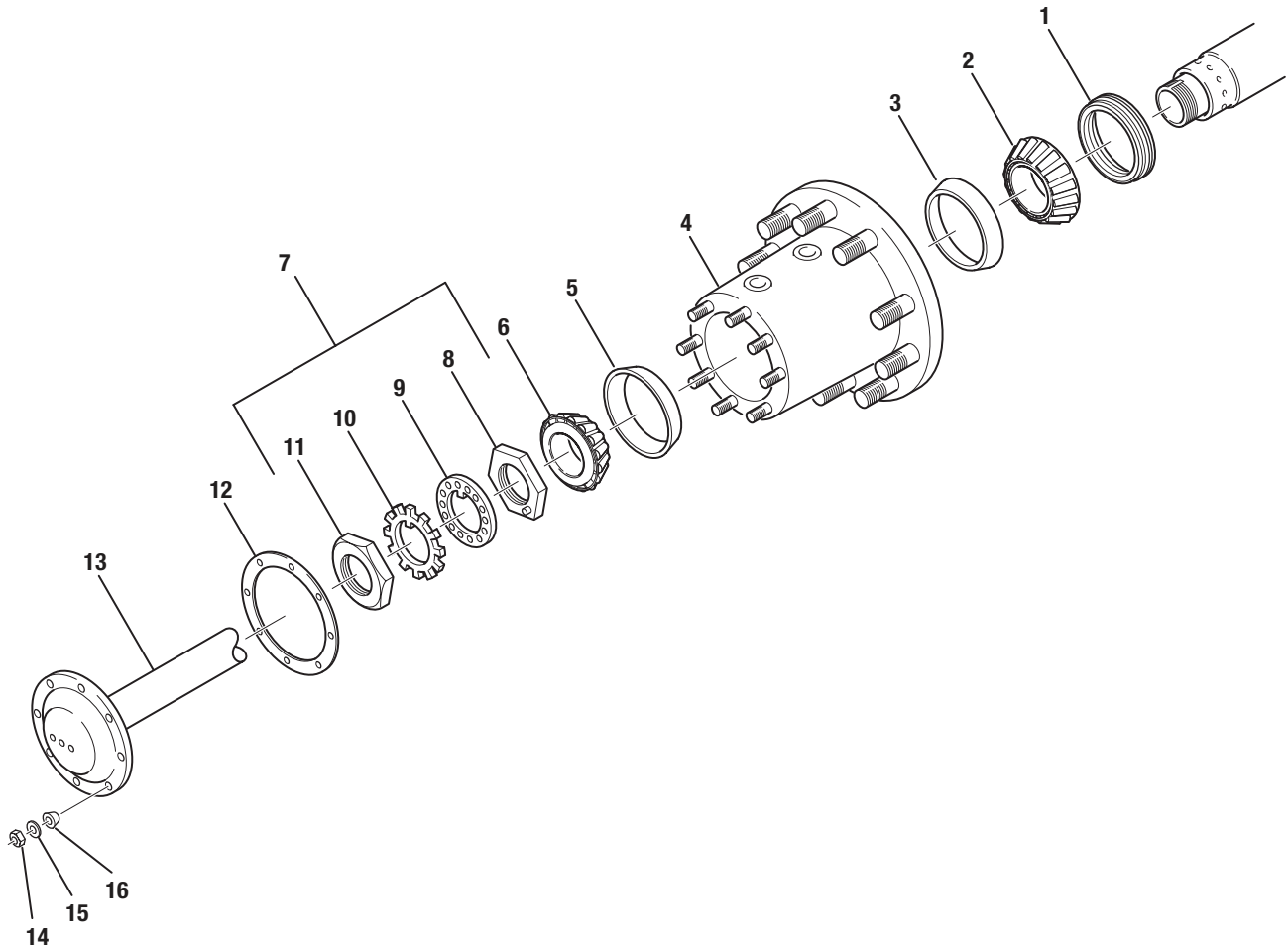
 CAUTION

Never mix oil bath and grease packed wheel ends.

For additional information, refer to the Roadranger Products Lubrication Manual TCMT0021.

Standard Hub Drive Axle

Parts Exploded View



- 1 - Unitized hub oil seal
- 2 - Inner bearing cone
- 3 - Inner bearing cup
- 4 - Drive hub
- 5 - Outer bearing cup
- 6 - Outer bearing cone

- 7 - Spindle nut and locking system
- 8 - Inner jam nut
- 9 - Spindle washer
- 10 - Lock ring
- 11 - Outer jam nut
- 12 - Gasket

- 13 - Drive axle shaft
- 14 - Stud nut
- 15 - Lock washer
- 16 - Taper dowel

Standard Hub Drive Axle - Removal

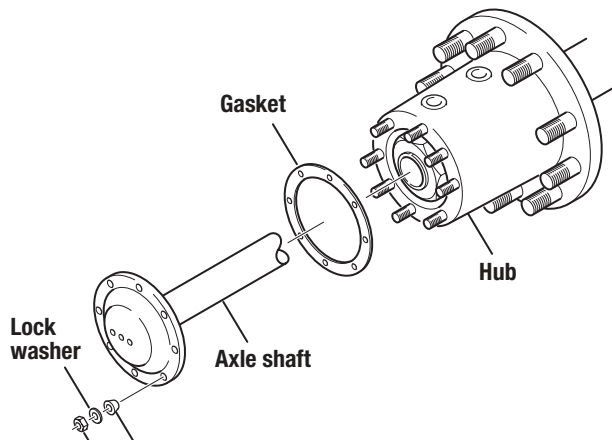
⚠ WARNING

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.

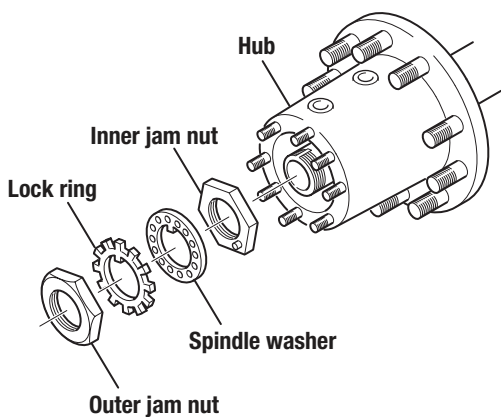
⚠ IMPORTANT

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

1. Jack up vehicle. Place drain pan under wheel end.
2. Remove stud nuts, lock washers and taper dowels (if present), drive axle shaft and gasket.

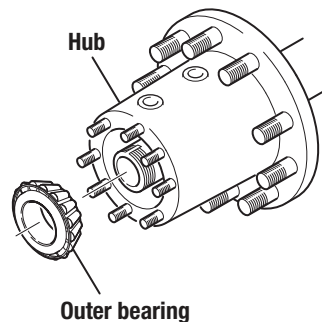


3. Remove spindle nut and locking system.

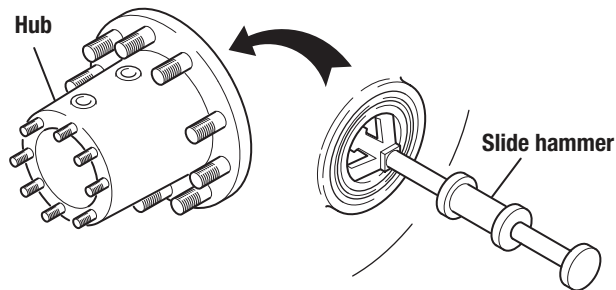


4. If tires on, use a dolly and pull wheel end outward to loosen outer bearing and hub.

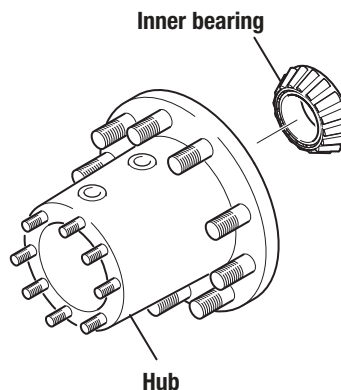
5. Remove outer bearing.



6. Clean spindle.
7. Remove seal from hub.



8. Remove inner bearing.



Standard Hub Drive Axle - Assembly

⚠ WARNING

Do not mix spindle nuts and lockwashers from different systems. Mixing spindle nuts and lockwashers can cause wheel separation.

Note: The lockwasher for a four-piece tang/dowel-type wheel nut system is thinner than the lockwasher 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.
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.

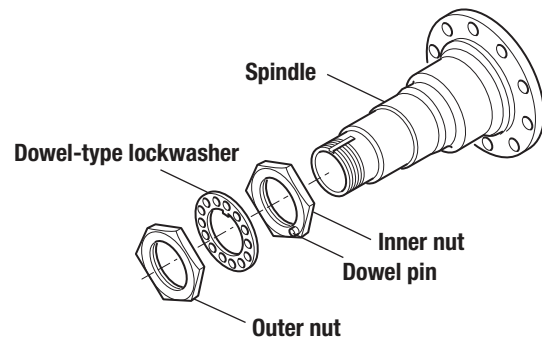
9. Retighten the inner nut to 50 lbs. ft. (68 N•m) while rotating the wheel hub.

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 lockwasher for the wheel nut system being used.

Three-piece Dowel-type Lockwasher System



- a. Install the Dowel-type lockwasher on the spindle.

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

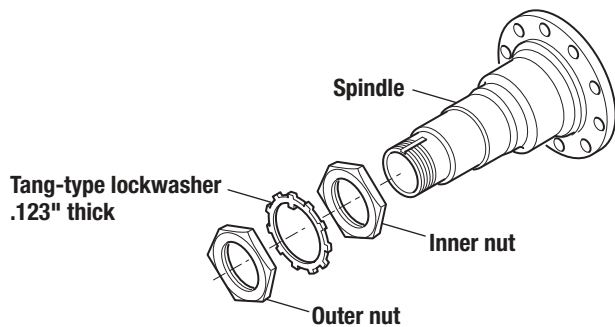
⚠ CAUTION

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 wheel endplay.

Three-piece and Tang-type Lockwasher System



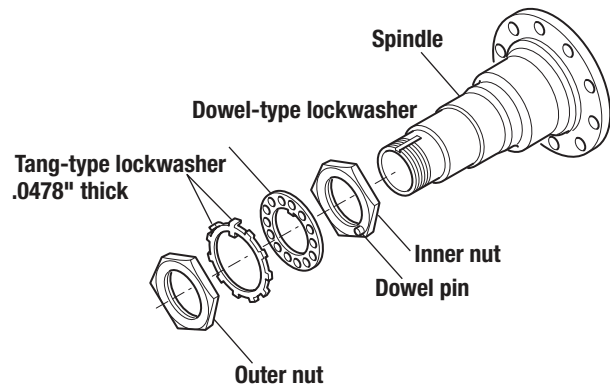
- a. Install the Tang-type lockwasher on the spindle.

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. Check endplay using a dial indicator. End-play should be within 0.001-0.005 in. (0.025-0.127 mm). See "Verify Wheel End-play" section.
- d. After verifying end-play, 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 and/Dowel-type Lockwasher System



- a. Install the Dowel-type lockwasher on the spindle.

Note: If the dowel pin and washer are not aligned, remove washer, turn it over and reinstall. 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 Tang-type lockwasher on the spindle.
 - c. Install the outer nut on the spindle and tighten to 250 lbs. ft. (339 N•m).
 - d. Set wheel end-play.
 - e. After verifying end-play, secure the outer nut by bending (180° apart) two opposing tangs of the locking washer over the outer nut.
12. Install the following and tighten to specified torque:
 - New gasket at axle shaft flange
 - Axle shaft
 - Axle flange nuts and washers
 13. Lubricate axle wheel ends.

Verify Wheel End-play (Standard Axles)

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

Correct end-play is 0.001"–0.005" (0.025–0.127 mm).

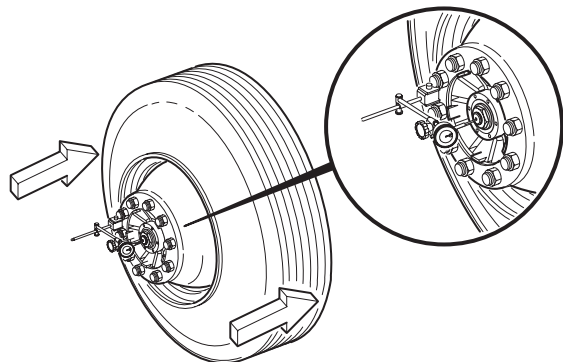
Note: Endplay when using a Pro-Torq Nut is 0.001"-0.003" (0.025-0.076 mm).

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.

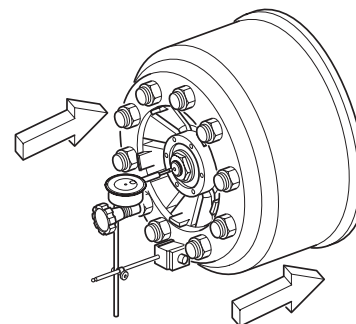
CAUTION

If end-play is not within specification, readjustment is required.

Adjust End-play with Tire and Wheel Assembly



Adjust End-play with Wheel Hub



With indicator mounted at bottom,
Push/Pull at sides of drum

Readjust Wheel End-play Procedure

Excessive End-play: If end-play is greater than 0.005" (0.127 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 retorque the outer nut. Verify end-play with a dial indicator.

Insufficient End-play: If end-play 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 retorque the outer nut. Verify end-play with a dial indicator.

Fine Tuning the End-play: If, after performing the readjustment procedures, end-play 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 end-play with a dial indicator.

Standard Hub Drive Axle - Lubrication

▲ IMPORTANT

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

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

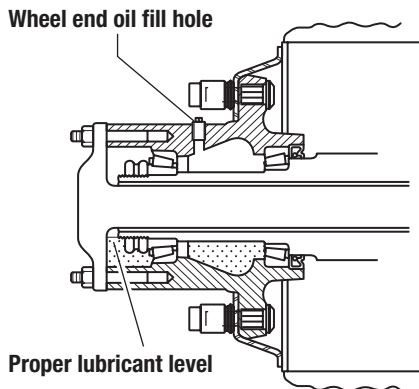
Dana axles may be equipped with either of two wheel end designs:

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

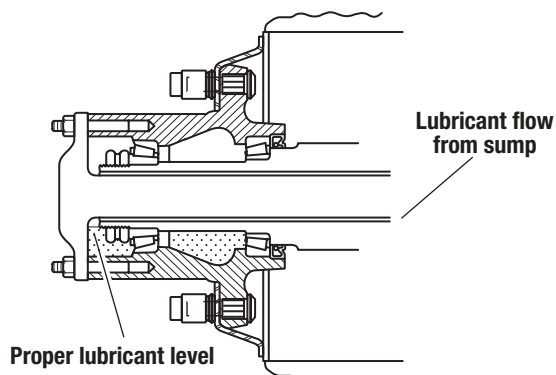
Wheel Ends with an Oil Fill Hole

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

Wheel End with Oil Fill Hole

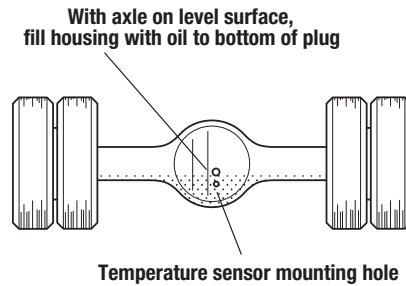


Wheel End without Oil Fill Hole

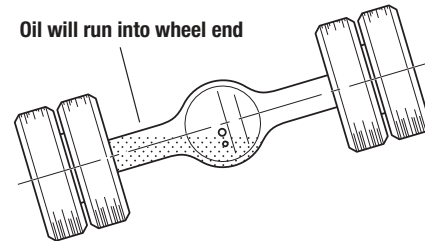


Wheel Ends without Oil Fill Hole

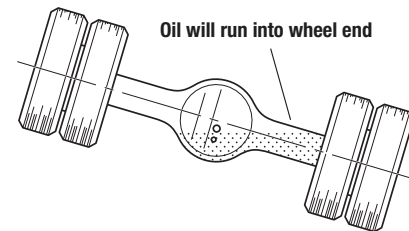
1. With axle level and wheel ends assembled, add lubricant through filler hole in axle housing cover until fluid is level with the bottom of filler hole.



2. Raise the right side of the axle 6 inches or more. Hold axle in this position for one minute.



3. Lower the right side.
4. Raise the left side of the axle 6 inches 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.

For additional information, refer to the Roadranger Products Lubrication Manual TCMT0021.

Appendix

Wheel Bearing Adjustment Procedure for Standard Hubs (Not Including Pro-Torque)

STEP 1: Lubricate the wheel bearing with clean axle lubricant of the same type used in the axle sump or hub assembly.

Note: Never use an impact wrench when tightening or loosening lug nuts or bolts during the procedure.

INITIAL ADJUSTING NUT TORQUE ft.lbs. (N•m)	INITIAL BACK OFF	FINAL ADJUSTING NUT TORQUE ft.lbs. (N•m)	BACK OFF AXLE TYPE	BACK OFF THREADS PER INCH	BACK OFF FINAL BACK OFF	JAM NUT TORQUE NUT SIZE in. (mm)	JAM NUT TORQUE TORQ. SPECS. ft.lbs. (N•m)	ACCEPTABLE END-PLAY in. (mm)
STEP 2	STEP 3	STEP 4		STEP 5	STEP 6	STEP 7		STEP 8
200 (271) while rotating wheel	One Full Turn	50 (68) while rotating wheels	Steer (Front) Non-Drive	12	1/6 Turn *	Install Cotter Pin to lock Axle Nut in position		0.001-0.005 (0.025-0.127) ***
200 (271) while rotating wheel	One Full Turn	50 (68) while rotating wheels	Steer (Front) Non-Drive	18	1/4 Turn *	Install Cotter Pin to lock Axle Nut in position		0.001-0.005 (0.025-0.127) ***
200 (271) while rotating wheel	One Full Turn	50 (68) while rotating wheels	Steer (Front) Non-Drive	14	1/2 Turn	Less than 2-5/8 (66.7)	200-300 (271-407)	0.001-0.005 (0.025-0.127) ***
200 (271) while rotating wheel	One Full Turn	50 (68) while rotating wheels	Steer (Front) Non-Drive	18	1/2 Turn	Less than 2-5/8 (66.7)	200-300 (271-407)	0.001-0.005 (0.025-0.127) ***
200 (271) while rotating wheel	One Full Turn	50 (68) while rotating wheels	Drive	12	1/4 Turn	Dowel Type Washer	200-300 (271-407)	0.001-0.005 (0.025-0.127) ***
200 (271) while rotating wheel	One Full Turn	50 (68) while rotating wheels	Drive	16	1/4 Turn	Tang Type Washer **	200-300 (271-407)	0.001-0.005 (0.025-0.127) ***
<p>* If dowel pin and washer (or washer tang and nut flat) are not aligned, remove the washer, turn it over, and reinstall. If required, loosen the inner (adjusting) nut just enough for alignment.</p> <p>** Bendable type washer lock only: Secure nuts by bending one wheel nut washer tang over the inner and outer nut. Bend the tangs over the closest flat perpendicular to the tang.</p> <p>*** As measured per procedure with Dial Indicator.</p>								

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