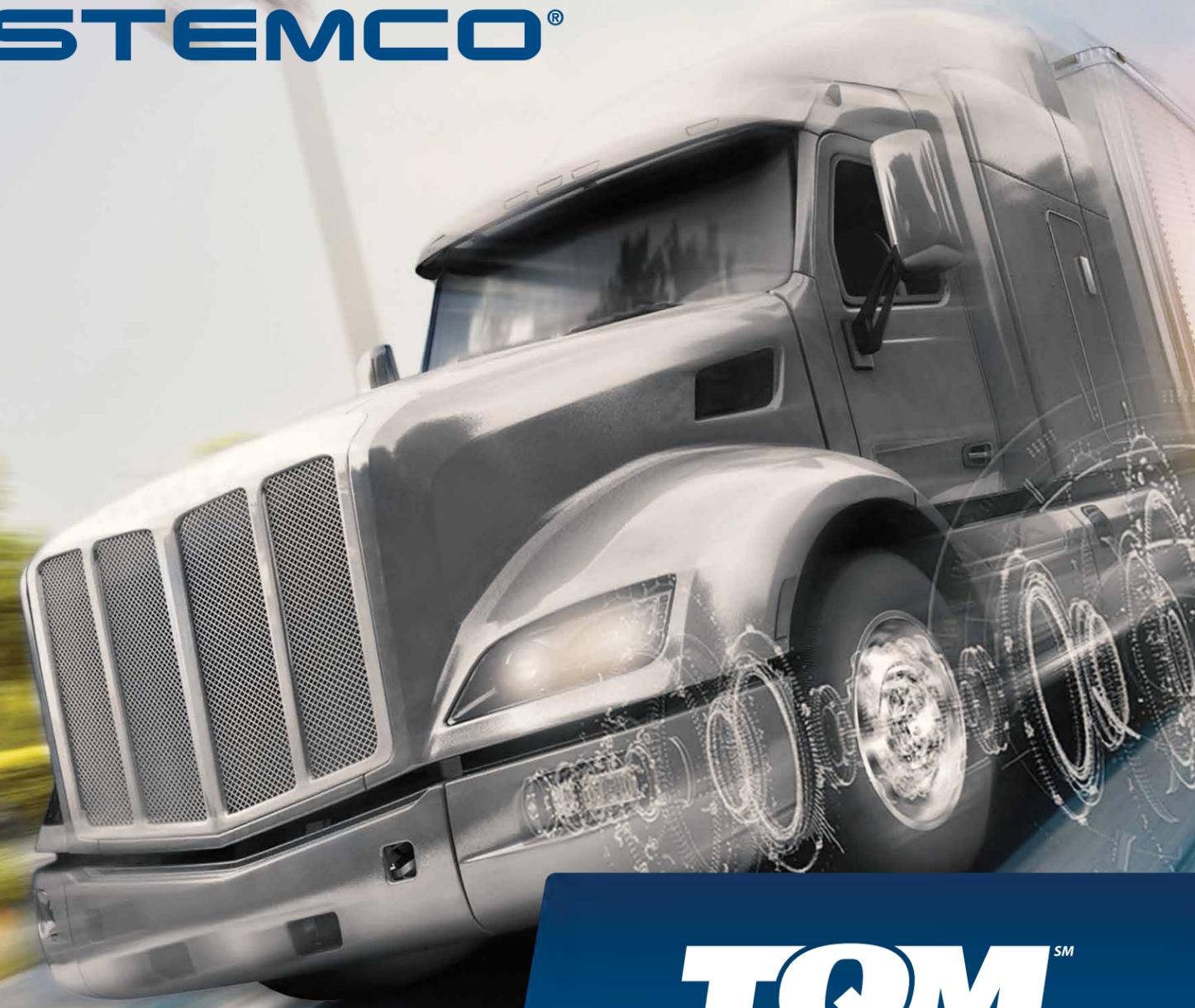


# STEMCO®



## TQM<sup>SM</sup>

TOTAL QUALITY MAINTENANCE<sup>SM</sup>



**STEMCO®**  
A Higher Standard of Performance.™

**Making the Roadways Safer®**

an EnPro Industries company

### Making the Roadways Safer®

**United States | 800-527-8492 | 903-758-9981**  
300 Industrial Drive  
Longview, Texas 75602 | US

**Canada | 877-232-9111 | 905-206-9700**  
5775 McLaughlin Road  
Mississauga, Ontario L5R 3P7 | Canada

**Mexico | 444-804-1736**  
Eje Central Sahop No 215, Zona Ind  
San Luis Potosi SLP 78395 | Mexico

**Australia | 011-61-2-9793-2599**  
Unit 6 CNR Rookwood & Muir Roads  
Yagoona NSW 2199 | Australia

TMC is a trademark of the Technology Maintenance Council and CVSA is a trademark of Commercial Vehicle Safety Alliance. The GOODYEAR trademark is utilized by STEMCO Products Inc. under license from The Goodyear Tire & Rubber Company. STEMCO, Aeris, BatRF, DataTrac Pro, Defender ESP, Discover, Discover XR, Glidelock, Guardian HP, Hubodometer, Platinum Performance System, Pro-Torq, Sentinel, STEMCO Brake Products, STEMCO Crewson, STEMCO GAFF, STEMCO Motor Wheel, Trifecta, and Voyager, Zip-Torq are all trademarks of STEMCO Products Inc. © 2018 STEMCO Products Inc. Printed in the USA. Part No. 574-0139 | Rev. 10/18

  
**STEMCO®**  
A Higher Standard of Performance.™

an EnPro Industries company

stemco.com



**An all encompassing look at maintaining top quality wheel ends in your fleet**

**Component Decisions:**

Hub Seal Selection ..... 2  
 Hub Cap Selection ..... 3

**System Solutions:**

Platinum Performance Systems ..... 4-5  
 Unitized Pinion Seal ..... 6  
 DataTrac® Pro ..... 7  
 Trifecta™ ..... 8-9

**Installation:**

**Seal Installation**

Trifecta™ ..... 10-11  
 Guardian®/Guardian® HP ..... 12  
 Voyager®/Discover® ..... 13  
 Standard/Grit Guard® ..... 14  
 DataTrac® Pro Installation ..... 15  
 Hub Cap Installation and Troubleshooting ..... 16-17  
 PRO-TORQ® Installation ..... 18-19  
 ZIP-TORQ® Installation ..... 20-21

**Bearing Adjustment:**

Bearing Features and Benefits ..... 22  
 Bearing Removal/Installation ..... 23  
 TMC's Recommended Wheel Bearing Adjustment Procedures ..... 24  
 Acceptable End Play and How to Measure It ..... 25

**Failure Analysis:**

Oil Analysis ..... 26  
 Identifying Seal Failure Modes ..... 27-32  
 Tech Tip #11 ..... 33-35  
 Limited Warranty ..... 36

**TQM™ Training Clinics/Certification ..... 37**



USA - P.O. Box 1989 • Longview, TX 75606-1989 • PHONE: 903-758-9981 • 1-800-527-8492 • FAX: 1-800-874-4297

DISTRIBUTION - 159 Glades Road • Berea, KY 40503 • PHONE: 859-986-9381

CANADA - 5650 Timberlea Blvd. Unit B • Mississauga, ON L4W 4M6 • PHONE: 905-206-9922 • 1-877-232-9111 • FAX: 905-206-0120

AUSTRALIA - Unit 6 CNR Rookwood & Muir Roads • Yagoona NSW 2199 • PHONE: 011-61-2-9793-2599 • FAX: 011-61-2-9793-2544

CHINA - Rm D307 • Shang-Mira Commercial Center • No. 2633 West YanAn Road • Shanghai 200336 P.R. China • PHONE: 86 21 6278 7250 • FAX: 86 21 6278 2210

MEXICO - Poniente 116 No. Ext. 571 No. Int. 8 • Col. Industrial Vallejo, México D.F. • México C.P. 02300 • PHONE: 1-800-527-8492 • FAX: 1-800-874-4297



STEMCO is committed to "Making the Roadways Safer" and increased customer value. We recognize the importance of providing customers with detailed product information, installation procedures and failure analysis.

- Reduced Maintenance Cost
- Less Equipment Down Time
- Reduced Liability Exposure
- Reduced Rework Cost
- Safer Operating Equipment
- Process Control
- Repeatable Quality

This TQM™ Manual was designed for this purpose, to assist in achieving a higher standard of performance within your operation.

**What can TQM provide for your company?**

A wheel end is not a collection of parts functioning independently; it is a system of interacting components. Specifically, the hub seal, axle fastener, hub cap, bearings, and lubricant play an important role in the overall performance of the wheel end. Each component is interrelated and its performance affects the total system. Using STEMCO parts with fluid lubrication, your wheel end components will not only provide optimum individual performance, they will, together, form a world-class wheel end system.

**Quality Components Working as an Integral Unit Supported by Trained Professionals.**

As a result of more than five decades of experience in the trucking industry, STEMCO has accumulated product and process knowledge of wheel end systems that will benefit all maintenance professionals. TQM demonstrates how STEMCO products, designed to perform with standard hub and axle configurations combined with sound assembly procedures, can result in exceptional wheel end performance.

As trucking technology has advanced, STEMCO has responded to the needs of the industry. At STEMCO, state-of-the-art equipment duplicates exact road conditions to test seal products and to insure their durability and performance. This TQM™ Manual is designed to maximize your investment in today's technologically advanced components, thereby helping the transportation industry achieve the goal of Total Quality Maintenance.

# STEMCO® Hub Seal Selection

STEMCO has provided the trucking industry with reliable hub seals for more than 40 years. Throughout our history, we have recognized the need for tougher, longer life seals that meet the performance, design and price requirements related to selecting the right seal for any fleet. To meet that need, STEMCO has engineered a menu of sealing options designed to meet the varying performance expectations of each fleet, all in an effort to maximize performance and value.

## Selecting the right STEMCO seal for the right application.

**Discover®** is designed for the long haul carrier seeking high performance components. The Discover seal is an excellent choice for fleets running outboard-mounted drums that allow brake changes without seal replacement. The long life characteristics of this seal, proven in testing that exceeds competitive products' performance by five times, make it the industry choice for performance driven fleet managers.



**The Voyager® seal** is designed for regional route trucks, city delivery and coach applications. Rugged design, simple installation and proven performance make Voyager the right choice for fleets looking for a superior brake job-to-brake job seal. In the everyday stop-and-go traffic environment these vehicles experience, the Voyager seal is the best value.



**The Guardian® HP** is the standard seal for trailer and axle original equipment manufacturers. The axle installation is durable and unique, and has proven successful for more than 40 years. Today, its enhanced features offer improved cost-per-mile performance. With simple one-step axle installation, Guardian HP is the seal of choice in the trailer industry.



**Grit Guard®** is always rough and ready and has endured more than forty years of dirty, unfriendly road environments that destroy wheel end components. So with this sixty year plus track record of performance, Grit Guard endures where others fail, and is still the choice for fleets working in grueling environments.



# STEMCO® Hub Cap Selection

STEMCO, the industry leader in hub caps, has developed a comprehensive offering of hub caps for all applications. To meet the performance, design and price requirements of today's national and international fleets, STEMCO has developed a menu of hub cap options for both oil and grease applications. The product line has evolved into product specific technology developed to eliminate contaminants in abusive environments.

**The traditional aluminum series 340 and 343** provide durability with the trademark red plug to allow venting of the hub cap. Using cast aluminum for constructing the hub cap body prevents warpage and provides superior durability and heat dissipation properties. The trucking industry recognizes STEMCO hub caps as the benchmark.



**For grease applications**, the 342 series Dirt Exclusion Hub Caps provide the same 340 casting without a side fill plug, plus a solid window with a sintered metal vent for venting purposes. To further support grease wheel ends, STEMCO developed the 352 series Solid Aluminum Hub Caps with a duckbill vent inserted in the face of a solid hub cap.



**STEMCO Stamped Steel grease hub caps** are manufactured from 14 gage steel and have a protective yellow chromate plating with a clear lacquer coating for additional protection from corrosion. For synthetic base grease like Mobilith SHC™ 007, use the vented 340-5096 version cap. For petroleum base grease use the non-vented 340-5097 cap.



**STEMCO PSI hub caps** are available in both oil and grease for several popular applications. The oil hub caps have a side fill plug and a standard window with oil fill lines. The grease hub caps do not have a side fill plug and incorporate a gray opaque window with no markings. The PSI tee fitting and flapper valve are to be installed in the center of the hub cap and are available from PSI as a part of the PSI System.



**Sentinel® Technology** provides an unmatched filtering system to eliminate contamination of lubricant from grime, dirt or water. STEMCO provides four options to put Sentinel Technology to work for you: The Sentinel Hub Cap provides tamper-proof system for maximum protection and maintenance-free performance.



**Integrated Sentinel® hub caps** integrate the Sentinel features into the window with fewer components and greater wheel end visibility. The Sentinel ESP (Extended Service Plug) and Sentinel ESP Filtered Vent allows economical retrofitting of wheel ends and drive axles with the benefits of STEMCO's exclusive Sentinel Technology.



**Defender™ composite hub caps** offer superior corrosion protection and are available in oil and grease applications. Defender™ comes in a wide variety of vent options from our trademark red plug, to our Sentinel® ESP plug, or our Integrated Sentinel® Technology. For applications running in the most grueling conditions use the Defender™ to defend your wheel end.



# STEMCO® Platinum Performance System™

- Lower your operating costs, reduce downtime and increase revenue.
- STEMCO Platinum Performance System Plus 7 Light Weight removes up to 150 pounds of trailer weight, dramatically increasing payload.
- Light Weight and Tire Inflation Platinum Performance Systems help improve fuel efficiency performance.

**Industry's Best Parts and Labor Warranty**

PLATINUM PERFORMANCE SYSTEM™	AFTERMARKET PLATINUM PERFORMANCE SYSTEM™	PLATINUM PLUS PERFORMANCE SYSTEM™	PLATINUM PLUS PERFORMANCE SYSTEM™ TIRE INFLATION	PLATINUM PLUS PERFORMANCE SYSTEM™ LIGHT WEIGHT
<ul style="list-style-type: none"> <li>▪ Guardian® HP or Discover® Seal</li> <li>▪ PRO-TORQ® Axle Fastener</li> <li>▪ Sentinel® Hub Cap</li> <li>▪ STEMCO® Bearings (Optional)</li> <li>▪ Available for Aftermarket</li> </ul>	<ul style="list-style-type: none"> <li>▪ Guardian® HP or Discover® Seal</li> <li>▪ PRO-TORQ® Axle Fastener</li> <li>▪ Defender Sentinel® Hub Cap</li> <li>▪ STEMCO® Bearings (Optional)</li> </ul>	<ul style="list-style-type: none"> <li>▪ Guardian® HP or Discover® Seal</li> <li>▪ PRO-TORQ® Axle Fastener</li> <li>▪ Sentinel® Hub Cap</li> <li>▪ STEMCO® Bearings</li> </ul>	<ul style="list-style-type: none"> <li>▪ Aeris™ Automatic Tire Inflation System</li> <li>▪ Guardian® HP or Discover® Seal</li> <li>▪ PRO-TORQ® Axle Fastener</li> <li>▪ Sentinel® Hub Cap</li> <li>▪ STEMCO® Bearings</li> </ul>	<ul style="list-style-type: none"> <li>▪ STEMCO® CentriFuse® Drum and Hub Assembly</li> <li>▪ STEMCO Crewson™ Automatic Brake Adjuster</li> <li>▪ Guardian® HP or Discover® Seal</li> <li>▪ PRO-TORQ® Axle Fastener</li> <li>▪ Sentinel® Hub Cap</li> <li>▪ STEMCO® Bearings</li> </ul>
<b>3 Year</b>	<b>3 Year</b>	<b>5 Year †</b>	<b>7 Year †</b>	<b>7 Year †</b>

† Platinum Performance Plus, Platinum Performance Plus 7: Tire Inflation, and Platinum Performance Plus 7: Light Weight are for OEM Distributors only.

## Industry's Best Parts and Labor Warranty

When you specify the Platinum Performance System™, you are assured of performance that will protect your fleet and your maintenance costs by reducing down-time and protecting your wheel end investment. Available on both tapered and parallel axles.

The newly redesigned Guardian® HP seal, and STEMCO manufactured precision bearings allow us to confidently move from a five to a seven year warranty on wheel end components based on major improvements in reliability and durability.

## Extend Your Wheel End Performance in the Aftermarket

With the Platinum Performance System, you can gain a three year Aftermarket limited wheel end warranty.

Extend Your Aftermarket Wheel End Performance To Three Additional Years	
Retrofit	Refurbishment
<b>Replace components with:</b> <ul style="list-style-type: none"> <li>▪ Discover or Guardian HP Oil Seal</li> <li>▪ Sentinel Hub Cap</li> <li>▪ PRO-TORQ Spindle Nut</li> </ul>	<b>Replace components with:</b> <ul style="list-style-type: none"> <li>▪ Discover or Guardian HP Oil Seal</li> <li>▪ Sentinel Hub Cap</li> <li>▪ PRO-TORQ Keeper</li> </ul>
<b>Receive:</b> Three Year Limited Parts Warranty on components stated above. Wheel ends already equipped with PRO-TORQ can refurbish the axle fastener by replacing the PRO-TORQ Keeper and receive limited warranty coverage.	
<b>Additional Warranty Coverage:</b> <ul style="list-style-type: none"> <li>▪ Add STEMCO New Brake Shoes</li> <li>▪ Add Aeris® Automatic Tire Inflation System</li> </ul>	

# STEMCO® Platinum Performance System™



## Flexible Options to Fit Your Installation Preferences

STEMCO's Platinum Performance System™ an integrated system of products and performance. With the Platinum Performance System, you can extend your wheel end to a three-year or five year limited warranty.

## Simply The Best

Benefit from unprecedented product performance with STEMCO's exclusive patented Guardian® HP or Discover® Seal; PRO-TORQ® Advanced Axle Spindle Nut; and the tamper-proof Sentinel Hub Cap. Receive extended bearing warranty by adding STEMCO Heavy Duty Bearings.

## Higher Performance Equals Less Maintenance

When you specify the Platinum Performance System, you are assured of performance that will protect your fleet and maintenance budget. The unprecedented performance of this STEMCO system will lower your maintenance costs by reducing down-time and protecting your wheel end investment.

## Two Seven-Year Wheel End Offerings

The Tire Inflation package guarantees the life of the Aeris® Automatic Tire Inflation System, Guardian® HP or Discover Seal, PRO-TORQ axle fastener, Sentinel hub cap, and STEMCO bearings for up to seven years. The Light Weight Performance package guarantees the life of the STEMCO CentriFuse® Drum and Hub Assembly, STEMCO Crewson Automatic Brake Adjustor, as well as the wheel end products stated above for up to seven years. These long-life systems provide a seven year limited parts and labor warranty by simply adding select components to the industry leading five year Platinum Performance System Plus offering. STEMCO's Platinum Performance System is an integrated system of product and performance.

These new packages are designed to lower operating costs, reduce downtime, and increase revenue by keeping tires properly inflated and reducing weight up to 150 pounds per tandem axle trailer. The Platinum Performance Plus, Platinum Performance Plus 7 Tire Inflation and Platinum Performance Plus 7 Light Weight are for OEM Distributors only.



# Technologically Advanced Sealing Solutions



## Unitized Pinion Seals

### Easy Installation

The single piece, unitized design is installed in one step using the yoke bolt to install the press-fit OD.

### Repair Sleeves Not Required

The unitized design incorporates a wear ring to provide an ideal running surface for the sealing lip, thus eliminating the need for repair sleeves that often change the seal lip angle during operation, resulting in reduced life.

### Eliminate Yoke Wear

Sealing lips are contained in a manner that prevents yoke surface contact from the lip. New yokes will remain new at the sealing point.

### Repair 'Grooved' Yokes

STEMCO's patented anti-rotation "SMART" features lock the ID surface in place while a wider contact area on the rubber ID makes most yokes reusable.

### Eliminate Leak Paths

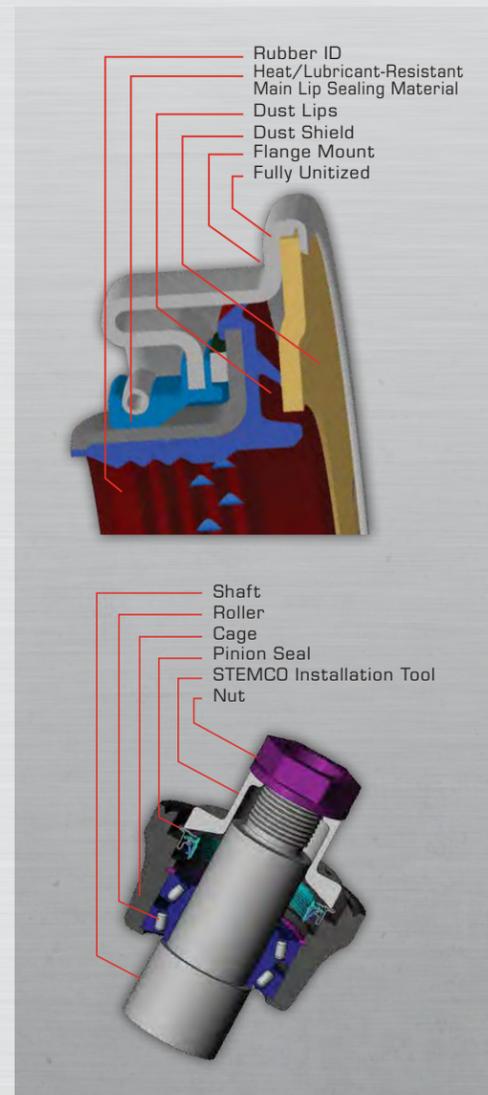
Bore sealant on the OD and a wider contact area on the rubber ID eliminate leak paths to avoid premature failures.

### Reduce Contamination Failures

To promote long life, a labyrinth path with multiple dust lips prevents contamination ingress into the sealing lip and oil.

### Long-Life Performance

Fluoroelastomer rubber on the main sealing lip withstands the high heat consistent with pinion seal applications.



# Programmable for Any Tire Size



DataTrac Pro  
Shown Actual Size

## DataTrac<sup>®</sup> PRO

### Always Have The Part Number

Stock only one part number with the programmable DataTrac<sup>®</sup> Pro and program the customer's specific requirement for any tire. With DataTrac Pro you can also pre-set your own mileage and eliminate lead-time and pre-set charges.

### Schedule Maintenance

The DataTrac Pro is an indispensable tool for scheduling maintenance based on actual mileage rather than time.

### Large, Easy-to-Read LCD Display

The display makes data retrieval simple and accurate. Optional flexibility of trip and life readings for precise data collection and management. Numbers automatically position upright for easy verification of mileage.

### Compact Size

The compact size makes it easy to mount and dismount tires without removing the DataTrac Pro from the wheel.

### No Moving Parts

Provides improved reliability and durability for the most demanding vocational applications. Each unit is marked with a unique serial number providing additional security and data control.



Program over 2500 specific tire models and sizes ensuring customer gets reliable mileage information.

# Raising the Standard for World-Class Wheel Ends



**STEMCO's Trifecta™ Pre-Adjusted Hub Assembly** combines premiere STEMCO wheel end technologies with the trusted Webb® hub in a single, pre-adjusted assembly, ensuring a faster and more secure installation. Trifecta eliminates the need to purchase, install and adjust separate wheel end components and fasteners while guaranteeing reliability.

## Safety

Provides quick, easy installation with a simple torque-down procedure and no bearing adjustment. Includes Zip-Torq® axle fastener featuring a unitized design with no additional clips, keepers, snap rings or screws, increasing simplicity for technicians.

## Performance

Trifecta includes the Discover® XR, a high-performance seal with patentpending GlideLock™ technology which essentially eliminates installation issues by reducing installation force by 50% with no prelube required—an industry first. Discover XR and the Defender ESP™ hub cap combine to set a new standard for contamination exclusion and raise the bar for long-life wheel end systems.

## Confidence

Features industry-standard components manufactured by STEMCO & Webb Wheel. Backed by STEMCO support nationwide, including on-site training and certification, TMC-approved procedures and a 5-year/500,000 mile parts and labor OEM warranty.



# Simple Installation. Total Peace of Mind.

Designed for fleets that value component longevity between service intervals and keeping time in the service bay as brief as possible, the Trifecta™ hub assembly represents the peak of durability and simplicity—the toughest, most resilient wheel end components united in an easy-to-install package.

## STEMCO Manufactured Bearings

- Exceed ABMA performance and durability standards
- Included in OEM long-life wheel end systems

## Defender ESP™ Hub Cap

- Made from high-strength composite material
- 100% corrosion-free
- ESP (Extended Service Plug) prevents contamination from entering, protects lubricant integrity

## Zip-Torq® Axle Fastener

- Simplified, one-piece advanced axle fastener provides fast and simple installation
- Self-ratcheting feature prevents back-off
- No clips, keepers or set screws to install
- Easy removal

## STEMCO Spacer (patent-pending)

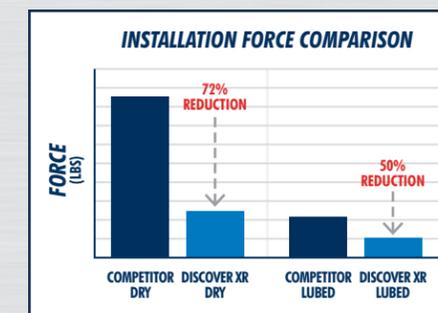
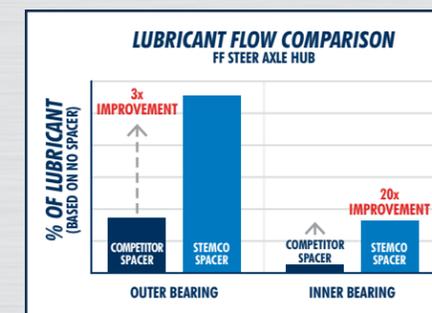
- Designed for optimized lubricant flow
- Reduces fretting corrosion between spindle and bearing mating surfaces
- Extends spindle, bearing and seal life

## Webb® Wheel Hub

- Industry-standard hubs
- Precision machined for Trifecta™
- Ductile iron & aluminum options available
- Over 70 years of hub expertise

## Discover® XR Wheel Seal

- High-temperature, long-life seal
- 4-zone labyrinth and slinger provide unmatched contamination prevention
- GlideLock™ patent-pending technology reduces installation force by 50%—no prelube required
- Addresses industry's leading seal failure modes—cocked seals and excessive heat generation



# Trifecta™ Pre-Adjusted Hub Assembly Installation



## Tools Needed For Installation

- Torque wrench
- Sockets for all applications
- Towel and/or emery cloth to clean spindle

Follow the installation procedure and experience the safety, performance and confidence of having the Trifecta™ Pre-Adjusted Hub Assembly on your truck. By combining premiere Stemco® wheel end technologies with the trusted Webb® hub in a single, pre-adjusted assembly, installation is faster and more secure. Plus, there is no need to purchase, install and adjust separate wheel end components and fasteners.

**STEP 1** To begin the Trifecta installation, start by cleaning the spindle and removing all burrs.

**STEP 2** Apply a light coat of lubricant to the spindle surfaces.



**NOTE:** The Discover® XR seal includes Stemco's patented GlideLock™ technology, eliminating the requirement for seal ID pre-lubrication.

**STEP 3** Align the Trifecta assembly with the keyway and slide the hub on to the spindle.

**STEP 4** Rotate the hub clockwise to engage the Zip-Torq® axle fastener and continue rotating manually until it stops.

# Trifecta™ Pre-Adjusted Hub Assembly Installation

**STEP 5** Unscrew and remove the axle fastener retainer.

**STEP 6** Use a torque wrench to tighten Zip-Torq to 200-250 lbs./ft. Rotate the hub one full rotation. Repeat this procedure two more times. Torque spec is the same for steer, drive and trailer applications.

## For Applications Requiring Hubcaps

**STEP 7** To complete installation, install the Defender ESP™ hubcap. Torque the hub cap bolts to 12 to 16-foot pounds using a star pattern sequence. Add oil to the fill line on hub cap window.

**STEP 8** Reinstall the plug.



# Guardian® and Guardian® HP Seal Installation



**STEP 1** Remove all burrs from the hub bore and spindle. Thoroughly clean the entire wheel cavity. Apply a thin layer of No. 2 sealant to the OD of the spindle shoulder. Place the seal assembly on the spindle so the words "Oil Bearing Side" are exposed to the oil. **[Photo 1]**  
**Warning:** Do not install the seal into the hub bore.



**STEP 2** Using the recommended STEMCO Universal Axle Tool, drive the seal assembly on until the tool bottoms against the shoulder. **[Photo 2]** Make sure the ring is flush with the axle shoulder. Ensure seal fully contacts the wear ring flange. Wipe away any excess sealant.



**STEP 3** Dip the inner bearing in oil and place on the spindle. **NOTE: The OD of the seal must be coated with a thin coat of lubricant. NOTE: When using grease, pre-pack the inner bearing before placement into the hub.**

**STEP 4** With the wheel mounted on a wheel dolly, carefully push the wheel onto the spindle until it contacts the seal. **[Photo 3]** Dip the outer bearing in oil and place it on the spindle. **NOTE: When using grease, pre-pack the outer bearing before placement into the hub. Tighten the inner spindle nut hand tight and remove the wheel dolly.**



**STEP 5** Tighten the inner nut to 200 ft./lbs. **[Photo 4]** Rotate the wheel several times and then back-off nut one full turn. Make final bearing adjustment according to TMC recommended bearing adjustment procedure. Install the appropriate axle fastener.

**STEP 6** Install the hub cap with a new gasket and fill the cavity with lubricant to the proper level. On drive axles, be sure the differential oil level is high enough (manufacturer's recommended level) to ensure oil flow through the tube to the wheels. It is recommended to jack-up one side and then the other until flow starts. Make certain the breather plug is clear. Recheck steers and trailers to insure proper fill levels.

# Voyager® and Discover® Installation

**STEP 1** Remove all burrs from the hub bore and spindle. Thoroughly clean hub cavity and spindle. **Note: Do not apply any sealant to the spindle shoulder. Apply a light coat of lubricant to spindle surfaces.**

**STEP 2** With the wheel in horizontal position, pre-lube the inner bearing and place it into the bearing cup. **[Photo 1]**  
**Note: When using grease, pre-pack the inner bearing before placement into the hub.**

**STEP 3** Place the seal on the recommended STEMCO Installation Tool, with the correct head, so that the words "Air Side" face into the tool. Place the tool (with the seal correctly mounted in the tool head) over the hub bore. Use a heavy hammer to drive against the end of the tool. Drive seal into bore until complete bottoming is assured. **[Photo 2]** Remove Tool. Apply a thin layer of lubricant on the ID surface of the seal. **Note: Do not apply lubricant to the OD of the seal.**

**STEP 4** With the wheel mounted on a dolly, carefully align the bore with the spindle. **[Photo 3]** Gently push the wheel assembly onto the spindle to the proper position. Be careful not to bump the top of the seal against the axle. Fill the hub cavity with lubricant until it runs over the outer bearing cup. Coat the outer bearing with lubricant and place it on the spindle and into the bearing cup. **Note: When using grease, pre-pack the outer bearing before placement into the hub. Note: Support the hub with the lifting device until the outer bearing and wheel-end fastener have been installed to a hand tight condition to prevent cocking of the hub/seal.**

**STEP 5** Assemble the inner nut and tighten it to 200 ft./lbs. **[Photo 4]** Rotate the wheel several times and then back-off nut one full turn. Make final bearing adjustment according to TMC recommended bearing adjustment procedure. Install the appropriate axle fastener.

**STEP 6** Install the hub cap with a new gasket and fill the cavity with lubricant to the proper level. On drive axles, be sure the differential oil level is high enough (manufacturer's recommended level) to ensure oil flow through the tube to the wheels. It is recommended to jack-up one side and then the other until flow starts. Make certain the breather plug is clear. Recheck steers and trailers to insure proper fill levels.



# Standard/Grit Guard® Seal Installation



**STEP 1** Remove all burrs and thoroughly clean the spindle. Apply a thin layer of No. 2 sealant to the OD of the spindle shoulder. Place the axle ring on the spindle.



**STEP 2** Using the recommended STEMCO Universal Axle Tool, drive the axle ring on until the tool bottoms against the spindle shoulder. **[Photo 1]** Make certain the axle ring is flush with the shoulder. Wipe away any excess sealant.



**STEP 3** Remove all burrs from the hub bore and thoroughly clean the entire wheel cavity.

**STEP 4** With the wheel in horizontal position, pre-lube the inner bearing and place it into the bearing cup. **[Photo 2]** Note: When using grease, pre-pack the inner bearing before placement into the hub.



**STEP 5** Apply a thin layer of No. 2 sealant to the OD of the seal and position the seal in the hub. Using the recommended STEMCO Universal Hub Tool held in a vertical position, drive the seal into the seal bore until it is bottomed-out. **[Photo 3]** Check the clearance between the bearing cone and seal (at least 1/32" is required).

**STEP 6** With the wheel mounted on a dolly, carefully align the bore with the spindle. **[Photo 4]** Gently push the wheel assembly onto the spindle to the proper position. Pre-lube the outer bearing and push it into the bearing cup. Note: When using grease, pre-pack the outer bearing before placement into the hub.



**STEP 7** Assemble the inner nut and tighten it to 200 ft./lbs. **[Photo 5]** Rotate the wheel several times and then back-off nut one full turn. Make final bearing adjustment according to TMC recommended bearing adjustment procedure. Install the appropriate axle fastener.

**STEP 8** Install the hub cap with a new gasket and fill the cavity with lubricant to the proper level. On drive axles, be sure the differential oil level is high enough (manufacturer's recommended level) to ensure oil flow through the tube to the wheels. It is recommended to jack-up one side and then the other until flow starts. Make certain the breather plug is clear. Recheck steers and trailers to insure proper fill levels.

# DataTrac® Pro Installation Instructions

## How It Works

DataTrac Pro is an advanced mileage counter that relies on Earth's gravity for counting wheel revolutions. The DataTrac® Pro unit monitors its orientation to Earth's gravitational pull and uses this reference to recognize and count revolutions.

## Programming The Unit

### Distribution or End User with a Programmer

The unit is shipped from the factory with a Revs/Mile value of zero. Dashes (- - -) on the display indicate that the unit has NOT been programmed. It MUST be programmed before it is installed on a wheel end (The DataTrac Pro distributor should have a programmer or can sell you a programmer).

### The programmer can set the DataTrac PRO's:

- 1) Revolutions/Mile (or per Km) - Use Stemco's catalog to determine the Revolutions/Mile for each Tire Make/Model.
- 2) Distance Unit of Measure - Miles or Km (Life miles only or including Trip Miles)
- 3) Mileage Preset - Set the mileage to match the current mileage of the vehicle the unit will be mounted to.

When programming is complete, (as indicated on the programmer screen) immediately lift the DataTrac PRO up and confirm the display shows the correct Tire Revolutions (shown as "REV###" on the screen). If not, repeat the programming. The DataTrac Pro can be programmed/reprogrammed as many times as desired until there is approximately 2 miles on the unit.

## Installing The Unit

Install the DataTrac PRO unit using the appropriate STEMCO bracket and hardware. The nut furnished with the unit is a locking nut and must not be torqued over 15-ft lbs.

## Reading The Display

The display will turn on when the vehicle is at rest. Numbers will automatically orient to read upright. This is also indicated by the icon display, e.g. mile, km, acre. The mileage reading is always in the same direction as the icon. In order to conserve power the display turns off at any time a vibration is detected. This means that the display will be off while the vehicle is moving. As soon as all vibration or motion stops the display will reactivate in about 5 seconds.

## Display Modes

The DataTrac Pro unit comes equipped with three display modes: LIFE and TRIP (if programmed), and REV. To toggle the display between LIFE, TRIP and REV Modes, use the palm of your hand to cover the round bubble on the face of the unit for at least 1 second, and then uncover it. If the unit is in bright sunlight, the bubble may have to be covered with your palm to block more light from reaching the sensor. TRIP mode is displayed with tenths resolution and is indicated by display of the TRIP icon (only if unit is programmed for TRIP).

To reset the TRIP display, toggle between LIFE, TRIP and REV Modes 5 times, quickly. Note that the unit cannot toggle faster than every 1.5 seconds. To view the revolutions of the unit simply repeat the process that is used to view trip and then a screen that shows (REV XXX) will show up. The XXX is the number of revolutions per KM or MILE that the unit is programmed for. On units without TRIP there are only two screens, all others have three screens (LIFE, TRIP, and REV). As with the TRIP mode the unit will return to the mileage after 10 seconds if left in the revolutions screen.

# DataTrac® PRO



Install DataTrac Pro on wheel end.



Display turns on when the vehicle is at rest.



Display turns off when vibration is detected (vehicle moving) to conserve energy.



LIFE mode shows mileage without tenths.



TRIP mode shows mileage with tenths and TRIP icon.



REV Mode shows RPM or RPK unit Programmed for.

# Hub Cap Installation and Troubleshooting

The hub cap endures constant physical abuse from the elements and internal factors that can affect its characteristics both visually and functionally. The TQM<sup>SM</sup> Manual will provide helpful information about installation and lubrication, as well as help in troubleshooting problems. Additionally, examples of potential hub cap failures are pictured in the Failure Analysis section.

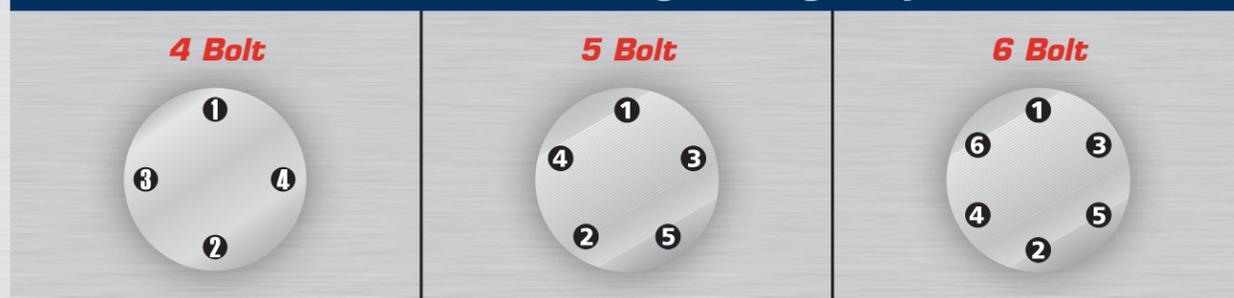
## Proper Hub Cap Installation Procedures

- STEP 1** Check the mounting surface of the hub, making sure to clean off old gaskets and sealant. Also, check for any burrs or imperfections that might prevent a proper gasket seal.
- STEP 2** Make sure all components are free of any dirt or grit.
- STEP 3** Always install the hub cap with a new gasket.
- STEP 4** Split washers are recommended to lock the flange bolts in place.
- STEP 5** Initially hand tighten the hub cap (see bolt tightening sequence below) and finally torque to the recommended specification as noted on page 15.
- STEP 6** For the threaded Pro-Par caps, lightly lubricate the threads and O-ring and install the hub cap. Refer to the torque specifications on Page 15 for the recommended torque value for threaded hub caps.
- STEP 7** For oil applications, fill to the recommended level and re-check after the lube has had adequate time to establish its final level.

## Window Kit Replacement Procedures

- STEP 1** Remove the old window ring using a #8 Torx driver.
- STEP 2** Thoroughly clean the hub cap and window ring leaving the window ledge free of oil and the mounting surface of the window ring clean and free of any old gasket material.
- STEP 3** Place the new window gasket in the hub cap casting, and insert the new window with the window ring and window ring gasket in place.
- STEP 4** It is recommended that screws be replaced with new ones. Once the screws have been started and pulled down, begin tightening with a cross hatch pattern to evenly distribute the load. Refer to the Torque Specifications chart on Page 15 for the proper torque. It is recommended that hand tools be used for this procedure, as power tools may over-torque the screws and damage the threads.
- STEP 5** The hub cap is now ready for installation.

## Recommended Bolt Tightening Sequence



# Hub Cap Installation and Troubleshooting

## Frequently Asked Questions

### Q. Should the hub cap be packed with grease?

**A.** A small amount of grease may be added to the hub cap before installation. Do not cover the vent mechanism with grease. See Page 26 for more detail. For additional information on lubrication fill procedures for hub caps, refer to TMC publication RP 631.

### Q. How tight should the flange bolts be?

**A.** Refer to the Hub Cap Torque Specifications below.

### Q. Is it OK to use an impact tool to mount the hub cap?

**A.** It is suggested that hub cap bolts be tightened with hand tools to prevent possible warping or breakage of the hub cap flange. Refer to the Torque Specifications below for the recommended torque value.

### Q. Is venting required for all applications?

**A.** It is suggested that the wheel assembly be vented to allow the hub to vent pressure and relieve vacuum when using oils and synthetic greases. Only with heavy packing grease will the wheel end properly operate without venting.

### Q. Why do my hub caps have a build-up on the inside of the sight glass?

**A.** This build-up is a slow process caused by the additives present in some lubricants. Removal is impossible; however, replacement window kits are available.

Troubleshooting Guide	
Problem	Possible Sources or Causes
Water Contaminated/ Milky Oil	High pressure washing, flooded loading docks (Note: See Oil Crackle Test on Page 13).
Bulged/Melted Windows	Check for low lube level, high heat caused from improperly adjusted bearings, high heat caused from improperly adjusted brakes.
Leaking Gaskets	Improper torque of flange bolts, gouged mounting surface (hub cap flange/hub face), no gasket, reuse of gasket.
Leakage from Red Fill Plug	Make sure the oil level is not in an overfilled condition, and check the vent hole to make certain it is not plugged. High heat and resulting pressure may also contribute to leakage.

Hub Cap Torq Specs			
Threaded Hub Caps			
Part No.			Torq
XXX-4075			100 ft/lbs
340-4975			50-60 ft/lbs
340-4976			50-60 ft/lbs
640-0003			50-60 ft/lbs
Hub Cap Components			
Part No.	Type	Torq	
359-6032	#8 Torx Screw	18-23 in/lbs	
359-5984	3/8" Mag Plug	5-9 ft/lbs	
359-5985	3/8" Pipe Plug	5-9 ft/lbs	
Hub Cap Mounting Bolts			
Size	Torq	Size	Torq
1/4"	8-12 ft/lbs	5/8"	22-26 ft/lbs
5/16"	12-16 ft/lbs	3/4"	24-28 ft/lbs
3/8"	16-20 ft/lbs	7/8"	26-30 ft/lbs
7/16"	18-22 ft/lbs	6MM	8-12 ft/lbs
1/2"	20-24 ft/lbs	8.5MM	12-16 ft/lbs

# PRO-TORQ® and Bearing Adjustment

## PRO-TORQ® Installation Procedure for Hubs with Manually Adjusted Wheel Bearings

### STEP 1 Remove The Keeper From The Nut:

Use a screwdriver to carefully pry the keeper arm from the undercut groove on each side until the keeper is released.



### STEP 2 Seat the Bearing:

#### WITH HUB OR HUB/DRUM ONLY

Using a torque wrench:

1. (A) Tighten the nut to 200 ft-lbs.  
Spin the wheel at least one full rotation.
- (B) Tighten the nut to 200 ft-lbs.  
Spin the wheel at least one full rotation.
- (C) Tighten the nut to 200 ft-lbs.

#### WITH HUB/DRUM/WHEELS:

Using a torque wrench:

1. Tighten the nut to 200 ft-lbs while the wheel is rotating.
2. Back the nut off one full turn.



### STEP 3 Adjust The Bearing:

#### WITH HUB OR HUB/DRUM ONLY

Using a torque wrench:

1. (A) Tighten the nut to 100 ft-lbs.  
Spin the wheel at least one full rotation.
- (B) Tighten the nut to 100 ft-lbs.  
Spin the wheel at least one full rotation.
- (C) Tighten the nut to 100 ft-lbs.
2. Back the nut off one raised face mark (according to chart).

#### WITH HUB/DRUM/WHEELS

Using a torque wrench:

1. Tighten the nut to 100 ft-lbs while the wheel is rotating.
2. Back the nut off one raised face mark (according to chart).



Final Backoff	
Part Numbers	Backoff
<b>Trailer Axle Nut</b> 447-4723, 447-4724, 449-4973	1/8 turn
<b>Trailer Axle Nut</b> 447-4743	1/4 turn
<b>Steering Spindle Nut</b> 448-4836, 448-4838, 448-4839, 448-4863, 448-4864, 448-4865	1/4 turn
<b>Steering Spindle Nut</b> 448-4837, 448-4840	1/3 turn
<b>Drive Axle Nut</b> 449-4904, 449-4973, 449-4974, 449-4975	1/8 turn

# PRO-TORQ® and Bearing Adjustment

### STEP 4 Install the Keeper:

#### ORANGE SIDE FACING OUT

1. Insert the keeper tab into the undercut groove of the nut and engage the keyway tang in the axle keyway. Insert keeper tab with the orange side facing out.
2. Engage the mating teeth.
3. Compress and insert the keeper arms, one at a time, into the undercut groove with a screwdriver.

#### FOR STEERING SPINDLE NUT

448-4836, 448-4839, 448-4840, 448-4863, 448-4864, and 448-4865

1. Align the flat of the keeper with the milled flat on the spindle and insert the single keeper tab into the undercut groove of the nut. Insert keeper tab with the orange side facing out.
2. Engage the mating teeth.
3. Compress and insert the keeper arms, one at a time, into the undercut groove with a screwdriver.

**Recommended practice is to replace the keeper each time the PRO-TORQ nut assembly is removed for maintenance purposes.**

### STEP 5 Inspect the Installation:

Failure to follow this instruction could cause the wheel to come off and cause bodily injury. Make sure that the keeper tab and keeper arms are fully seated into the undercut groove. Inspect keyway tang to insure it does not contact the bottom of the keyway. If contact exists, immediately notify your PRO-TORQ® representative.

**This procedure will consistently produce a bearing setting of .001" to .003" end play.**

### STEP 6 Acceptable End Play:

The dial indicator should be attached to the hub or brake drum with its magnetic base. Adjust the dial indicator so that its plunger is against the end of the spindle with its line of action approximately parallel to the axis of the spindle. Grasp the wheel or hub assembly at the 3 o'clock and 9 o'clock positions. Push and pull the wheel-end assembly in and out while oscillating the wheel approximately 45 degrees. Stop oscillating the hub so that the dial indicator tip is in the same position as it was before oscillation began. Read the bearing end-play as the total indicator movement.

\*Acceptable end-play is .001"-.005". For single nut self-locking systems, consult manufacturers' specifications. STEMCO assumes no responsibility for bearing warranty.

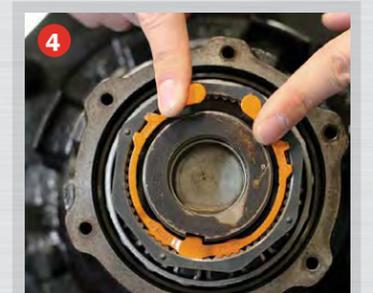
## IMPORTANT

#### PRO-TORQ Installation Procedure for PreSet® or LMS® Hubs:

PRO-TORQ spindle nuts may be used with PreSet or LMS hub assemblies. When used with these systems, it is important to follow the hub manufacturers' product specific installation instructions. For PreSet and LMS hub assemblies, torque the PRO-TORQ spindle nut to a minimum of 250 ft. lbs. Engage the keeper. If the keeper can not be engaged, advance the spindle nut until it can be engaged. **DO NOT BACK OFF THE SPINDLE NUT.**

## PRO-TORQ®

ADVANCED AXLE SPINDLE NUTS



## WARNING!

**Failure to follow this instruction could cause the wheel to come off and cause bodily injury.** The PRO-TORQ Spindle Nut is sold as an assembly with the keeper in place. **DO NOT** attempt to place the nut on the spindle or tighten or loosen the nut on the spindle while the keeper is locked inside the nut. Doing so may deform the keeper and allow the nut to unthread during operation. **DO NOT** bend or manipulate keyway tang in any way. Doing so may cause the tang to break off in service. Failure to back off the nut will cause the bearings to run hot and be damaged.

# ZIP-TORQ® and Bearing Adjustment

## ZIP-TORQ® Installation Procedure for Hubs with Manually Adjusted Wheel Bearings

### STEP 1 Thread the Nut Onto the Axle:

Thread the nut onto the axle until hand tight against the bearing.

### STEP 2 Seat the Bearing:

#### WITH WHEEL HUB ASSEMBLY:

Using a torque wrench:

1. (A) Tighten the nut to 200 ft-lb. Spin the wheel hub assembly at least one full rotation.
- (B) Tighten the nut to 200 ft-lb. Spin the wheel hub assembly at least one full rotation.
- (C) Tighten the nut to 200 ft-lb. Spin the wheel hub assembly at least one full rotation.

2. Back the nut off one face mark (according to chart).

### STEP 3 Adjust The Bearing:

#### WITH WHEEL HUB ASSEMBLY:

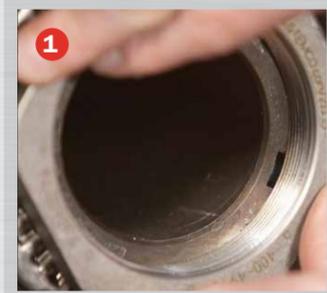
Using a torque wrench:

1. (A) Tighten the nut to 100 ft-lb. Spin the wheel hub assembly at least one full rotation.
- (B) Tighten the nut to 100 ft-lb. Spin the wheel hub assembly at least one full rotation.
- (C) Tighten the nut to 100 ft-lb. Spin the wheel hub assembly at least one full rotation.

2. Back the nut off one face mark (according to chart).

### Final Backoff

Part Numbers	Backoff
<b>Trailer Axle Nut</b> 400-4723, 400-4973	<b>1/8 turn</b>
<b>Trailer Axle Nut</b> 400-4743	<b>1/4 turn</b>
<b>Steering Spindle Nut</b> 400-4836	<b>1/4 turn</b>
<b>Steering Spindle Nut</b> 400-4837	<b>1/3 turn</b>
<b>Drive Axle Nut</b> 400-4973	<b>1/8 turn</b>



# ZIP-TORQ® and Bearing Adjustment



**STEP 4** If the inner tang does not line up with the keyway, back the nut off slightly until it does.

### STEP 5 Inspect the Installation:

Failure to follow this instruction could cause the wheel to come off and cause bodily injury.

**STEP 6** Inspect keyway tang to insure it does not contact the bottom of the keyway. If contact exists, immediately notify your STEMCO representative.

**This procedure will consistently produce a bearing setting of 0.001" to 0.003" end play.**

### STEP 7 Acceptable End Play:

The dial indicator should be attached to the hub or brake drum with its magnetic base. Adjust the dial indicator so that its plunger is against the end of the spindle with its line of action approximately parallel to the axis of the spindle.

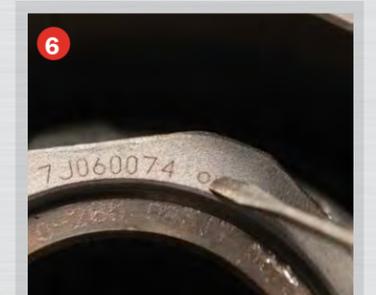
Grasp the wheel or hub assembly at the 3 o'clock and 9 o'clock positions. Push and pull the wheel-end assembly in and out while oscillating the wheel approximately 45 degrees. Stop oscillating the hub so that the dial indicator tip is in the same position as it was before oscillation began. Read the bearing end-play as the total indicator movement.

**\*Acceptable end-play is .001" - .005"**

For single nut self-locking systems, consult manufacturers' specifications. STEMCO assumes no responsibility for other manufacturers' bearing warranty.

### WARNING!

Failure to follow this instruction could cause the wheel to come off and cause bodily injury. Spindle thread damage could also occur, leaving the axle unusable. **DO NOT** bend or manipulate keyway tang in any way. Doing so may cause the tang to break off in service. Failure to back off the axle fasteners on non pre-adjusted systems will cause the bearings to run hot and be damaged.



# Performance and Value Leader



**HEAVY DUTY BEARINGS**

## Value Added Bearing Program

Through strategic alliances and strong global procurement, STEMCO bearings meet the changing needs of today's market. STEMCO bearings are the right mix of performance, convenience and value.

## Consolidated Wheel End Components Provider

The same company that provides high performance STEMCO Wheel Seals, PRO-TORQ Precision Adjusting Nuts and Hub Caps, can supply your wheel bearing needs; providing safety, reliability and performance from a single source.

## STEMCO Quality Bearings

Our worldwide network of manufacturing plants is held to the highest quality standards by STEMCO and meets the ABMA specifications for bearing life calculations.

## Expanded Bearing Coverage

The STEMCO product offering includes tapered roller bearings, radial ball bearings, clutch release bearings, individual cups and cones, and STEMCO matched bearing sets.

## Long Life Warranty

STEMCO offers a 3 or 5 year limited warranty when used in conjunction with the STEMCO Platinum Performance System or Platinum Performance System Plus.

# Bearing Removal and Installation

## Bearing Removal

- STEP 1** Remove hub/wheel assembly from vehicle in accordance with recommended practices.
- STEP 2** Remove inboard and outboard bearing cones and set aside for inspection.
- STEP 3** Using a mild steel drift or cup driver, carefully drive out the bearing cups.
  - *Caution should be used when driving bearing cups, as drifts and other tools can damage bearings.*
  - *Drifts can damage hub bearing bores. Be careful not to score bores while removing cups, especially when using aluminum hubs.*

## Bearing Inspection

- STEP 1** Inspect the hub bearing bores and shoulders for damage. The bores should be smooth and free from scoring, burrs, indications of cup spinning, or other forms of damage. Remove any burrs or raised areas using emery cloth, a file, or other appropriate tool.
- STEP 2** Measure the bearing cup bore and compare to manufacturer specifications.
- STEP 3** Inspect bearing cups and cones for damage. Bearings should be free from chips, contamination, and signs of excessive wear or excessive heat. Refer to bearing damage analysis literature for identifying possible bearing issues.
- STEP 4** Inspect axle spindle bearing journals for any signs of damage or excessive wear. Remove any raised areas or burrs using emery cloth, a file, or other appropriate tool.
- STEP 5** Journals should be measured and compared with manufacturer specifications.

## Bearing Installation

- STEP 1** Thoroughly clean bearing cups and cones prior to installation.
  - *Do not use compressed air to spin bearing rollers as injury may result if cage does not retain the rollers.*
- STEP 2** Lightly coat the outside of bearing cups with oil.
- STEP 3** Using a cup driver, carefully drive bearing cups into hub bearing bores. Be sure to drive cup firmly against cup shoulder in hub.
  - *If a cup driver is not available, a mild steel drift can be used to install bearing cups.*
  - *Caution should be used when driving bearing cups, as drifts and other tools can damage bearings.*
  - *NEVER use a bearing cone to drive a bearing cup. This can damage the bearings and cause premature failure.*
- STEP 4** Use a feeler gauge to check for gaps between cup and shoulder.
- STEP 5** Inspect bearing cups to ensure no damage occurred during installation.
- STEP 6** Lubricate bearing cones according to recommended practices and proceed with installation of wheel assembly.



# STEMCO Endorses TMC's Recommended Wheel Bearing Adjustment Procedure

**Proper wheel bearing adjustment** is critical to the performance of wheel seals and other related wheel end products. For that reason, we are proud to be a part of TMC's Wheel End Task Force. We are happy to bring these standards to you in the form of this technical guide.

Working together, in this way, STEMCO helps keep your rigs rolling. The following seven step bearing adjustment recommendation was developed by TMC's Wheel End Task Force. It represents the combined input of manufacturers of wheel end components.

For Technical Support, call: 1-800-527-8492.

## Wheel Bearing Adjustment

### STEP 1 Bearing Lubrication:

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

### STEP 2 Initial Adjusting:

Nut Torque: Tighten the adjusting nut to a torque of 200 ft-lbs. while rotating the wheel.

### STEP 3 Initial Back-Off:

Back the adjusting nut off one full turn.

### STEP 4 Re-Torque Adjustment:

Re-Torque adjusting nut to 50 ft-lbs while rotating the wheel.

### STEP 5 Final Back-Off:

See Chart A above right.

### STEP 6 Jam Nut Torque:

See Chart B below right.

### STEP 7 Acceptable End Play:

Refer to Page 21 for measuring end play.

Chart A

Axle Type	Threads Per Inch	Final Back-Off
<b>Steer</b> Single Nut	12	¼ Turn*
	18	¼ Turn*
<b>Steer</b> Double Nut	14	½ Turn
	18	½ Turn
<b>Drive</b>	12	¼ Turn
	16	¼ Turn
<b>Trailer</b>	12	¼ Turn
	16	¼ Turn

\*Install cotter pin to lock axle nut in position.

Chart B

Axle Type	Nut Size & Type	Torque Specifications
<b>Steer</b> Double Nut	Less Than 2-5/8"	200 - 300 ft-lbs
<b>Drive</b>	Dowel Type Washer	300 - 400 ft-lbs
	Tang Type Washer	200 - 275 ft-lbs
<b>Trailer</b>	2-5/8" And Larger	200 - 300 ft-lbs

## Bearing Adjustment Procedure for Single Castellated Nut

**STEP 1** Torque the Castellated Nut to 200 ft/lbs.

**STEP 2** Back the nut off 1/2 to 1 full turn and rotate wheel assembly.

**STEP 3** Re-torque Castellated Nut to 75 ft/lbs while wheel assembly is rotated.

**STEP 4** Lock Castellated Nut in place with a new cotter pin through one of the two holes drilled in the axle. If at 75 ft-lbs you are not on a hole, back the nut off to the closest hole and lock in place with the cotter pin.

**STEP 5** Due to Castellated Nut configuration, variation in bearing adjustment can be significant.

**STEP 6** Always check end play after final adjustment and lock down.

\*For Single Nut Systems see 571-2994.

# Acceptable End Play and How to Measure It

## Measuring Acceptable End Play

**STEP 1** Using a magnetic base, mount the dial indicator on the spindle end, making sure the hub face is clean and free of gasket material.

**STEP 2** Adjust the arm of the dial indicator, setting the plunger tip of the indicator on the machined face of the hub at the 12 o'clock position. The plunger should be set-up so that it is parallel to the axis of the spindle. When positioning the indicator tip, ensure that the indicator has adequate range of travel for proper measurement. Set the indicator to zero.

**STEP 3** Grasp the wheel/hub assembly at the 3 o'clock and 9 o'clock positions. Pull the wheel end assembly outward while oscillating the wheel approximately 45.° While continuing to pull, stop oscillating and read the indicator.

**STEP 4** Push the wheel assembly inward while oscillating. While continuing to push, stop oscillating and read the indicator.

**STEP 5** Read bearing end play as total indicator movement.

Acceptable end play is .001" to .005" as measured with a dial indicator as per TMC's Recommended Bearing Adjustment Procedure.



## A New Twist to an Old Technique

**Purpose:** Moisture in lubricating oils is a primary contaminant that leads to degradation of lubricant base-stock and additives, and it also corrodes component surfaces and accelerates wear due to reduced fluid film strength. The visual crackle test is a simple field method to detect and roughly quantify the presence of moisture in these fluids.

**Method:** The crackle-test is a simple test to identify the presence of free and emulsified water that is suspended in oil. Water is the most harmful element to the machine as well as to the oil.

### The method is as follows:

**STEP 1** Achieve surface temperature on a hot plate of 300° F (135° C). Be sure to always use the same temperature.

**STEP 2** Violently agitate oil sample to achieve homogenous suspension of water in oil.

**STEP 3** Using a clean dropper, place a drop of oil on the hot plate.



Printed with permission from **Noria Corp.**, Tulsa, OK | [www.oilanalysis.com](http://www.oilanalysis.com)

### Observable Results:

**Fig 1.** If no crackling or vapor bubbles are produced after a few seconds, no free or emulsified water is present.

**Fig 2.** If very small bubbles (0.5 mm) are produced but disappear quickly, approximately 0.05 – 0.1% water is present.

**Fig 3.** If bubbles approximately 2 mm are produced and gather at the center of oil spot and then enlarge to about 4 mm and disappear, approximately 0.1 to 0.2% water is present.

**Fig 4.** For moisture levels above 0.2%, bubbles may originate at approximately 2-3 mm and then grow to 4 mm, with the process repeating once or twice. For even higher moisture levels, violent bubbling and audible crackling may result.

### Limitations:

1. The method is non-quantitative.
2. Hot plate temperatures above 300° F induce rapid scintillation that may be undetectable.
3. The method does not measure the presence of chemically dissolved water.

### Safety Considerations:

1. Protective eyewear is suggested.
2. Long sleeves are suggested.
3. Test should be performed in a well-ventilated area.

### Equipment Required:

1. Hot plate capable of achieving and maintaining 300° F surface temperature.
2. Paint shaker (or equivalent) for oil agitation.
3. Oil dropper tube or lab syringe.

### Applicable Standards:

### Interferences:

Refrigerants and other low boiling point suspensions may interfere. Different base stocks, viscosities, and additives will exhibit varying results. Certain synthetics, such as esters, may not produce scintillation.

## Failure Analysis is a Key Element of TQM

Determining the cause of component failure can be difficult. The following photographs and descriptions are primary failure modes and their typical causes and/or solutions. While this TQM Manual will address numerous installation procedures and recommendations, it is also important to understand why products fail in order to correct potential factors that may cause these failures.

In addition to the information which follows, STEMCO would also like to offer additional sources of product evaluation and solutions to problems:

**STEP 1** Contact STEMCO Customer Service to request Technical Support at **1-800-527-8492**.

**STEP 2** Contact the District Sales Manager in your area.

**STEP 3** Ship failed parts to STEMCO's Warranty Department for evaluation.

- A. Select a representative sample of mated seals and rings or other products.
- B. **DO NOT** wash the parts in solvent.
- C. Attach a tag if parts are mates, showing vehicle mileage, component mileage, wheel position, oil type, vehicle ID and installation date/removal dates.
- D. Ship parts to:  
**STEMCO**  
**300 Industrial Blvd.**  
**Longview, Texas 75602**  
**Attn: Warranty Department**
- E. STEMCO will provide you a written report of the analysis.

## Failure Analysis



### ***Burr in Hub***

Deep axial cuts on the OD of this seal created a leak path for oil. Proper inspection and clean-up of the hub can eliminate this problem.



### ***Burr on Spindle***

Deep axial cuts on the ID of this axle ring created a leak path for oil. Proper inspection and clean-up of the spindle can eliminate this problem.



### ***Cocked Seal***

The high friction area shown on the left in one position on the seal face and the gouged metal in the axle ring are indicators of a seal being installed in a cocked position. The result can be increased heat and pumping of oil caused by the eccentric run out of the seal.



### ***Bumped Spindle***

Heavy facial damage is an indication that the seal incurred a hard impact with the spindle during the docking procedure. The result is damaged internal components that prevent proper sealing. The docking procedure is very important, as the critical elements of the seal are in close proximity to the spindle.

## Failure Analysis



### ***Incorrect Installation Tool***

The seal on the right was installed with an incorrect tool, causing the outer case to bend. Note the clearance gap on the seal to the left and the lack of this critical characteristic on the right. This damage is detrimental to the proper function of the seal.



### ***Ring with Rust in Groove***

This axle ring shows signs of rust, indicating that water was present in the lubricant. Investigation to determine the source of the water will prevent this occurrence in the future.



### ***Rubber Peeled Back***

The condition of the rubber OD of this Guardian® Seal was caused by a hub being improperly docked. The misalignment of the hub and seal caused the rubber OD to be peeled back. Follow Guardian installation instructions to prevent this problem. A clean, rust free seal bore is also necessary.

## Failure Analysis



### Poor Lip

Normal performance of seals will not destroy the seal lip as seen here. This condition occurs as a result of excessive and abrasive contaminants in the wheel end. Proper clean-up and inspection of bearings will prevent this.



### Damaged Hubodometer® Face

Facial impact or damage caused when changing tires can result in a cracked cover and potential internal damage.



### Hubodometer® with Bent Stud

This condition is the result of a tire/rim assembly being dropped or resting on the Hubodometer. The resulting damage destroys the ability of the Hubodometer to perform properly.



### Hubodometer® with Ridge at Base of Stud

A ridge or groove at the base of the stud indicates the Hubodometer was not tight on the bracket and was spinning in the mounting hole of the bracket.

## Failure Analysis



### Bulged Window on Hub Cap

The bulged, discolored appearance of this hub cap window is an indication that the wheel has experienced high temperatures resulting from improperly adjusted bearings, low lubrication or possibly brake problems.



### Impact to Hub Cap

Damage to hub caps such as this is due to heavy impact and can cause leakage under the window.



### Overtorque of Flange Nuts

Damage to the flange of this hub cap occurred when the flange nuts were overtightened and proper tightening procedure was not used to evenly fasten the hub cap in place. Use of air impacts with excessive torque settings may also contribute to this problem.

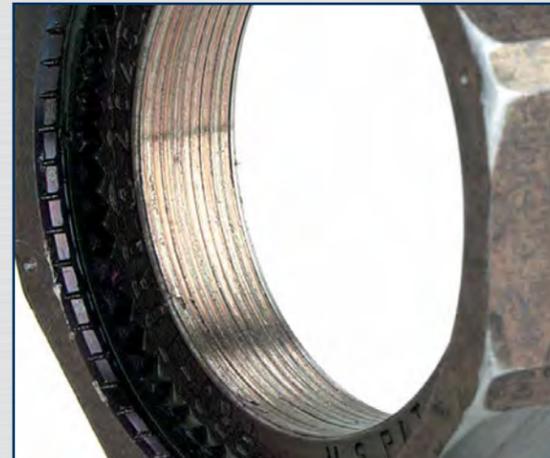


# Failure Analysis



## Punctured Hub Cap Casting

This damage is most often caused by tire/wheel assemblies being dropped on the hub cap during removal. The result is heavy loss of oil.



## PRO-TORQ® - No Threads

Failure to remove the orange keeper before removing the PRO-TORQ® Nut will result in damaged threads to both the nut and the spindle.

## STEMCO Universal Tool System

Recognizing that most seal failures can be traced to improper installation, STEMCO has designed Universal Hub and Axle Tools to make the procedure simpler and precise. Compromising proper installation by using anything other than the specified STEMCO tool can be very costly.

# Failure Analysis



## 1. Contamination

- **Appearance** - Dents or impressions in rollers or raceways.
- **Causes** - Presence of foreign material in wheel.
- **Remedies** - Leave bearings in their original packages until time of installation. Install bearings in clean environment (hands, tools, etc.). Make sure hub is free from contamination.



## 2. Corrosion

- **Appearance** - Staining, rusting, and/or pitting of bearing surfaces.
- **Causes** - Moisture (water) in wheel end.
- **Remedies** - Replace lubricant. Use caution to make sure water is not introduced into the wheel end.



## 3. Inadequate or Improper Lubrication

- **Appearance** - Partial or large area welding, scoring, signs of excessive heat, metal to metal contact.
- **Causes** - Use of improper lubricant or inadequate quantity of lubricant. Overloading of bearings or excessive pre-load can exhibit similar appearance to inadequate lubrication.
- **Remedies** - Follow the manufacturer's recommendations for proper lubricant fill quantities and use of appropriate lubricants. Be sure to follow manufacturer recommendations for proper bearing adjustment.



## 4. Spalling / Fatigue

- **Appearance** - Missing material from surfaces of bearing rolling elements or raceways.
- **Causes** - Normal fatigue (life) of bearings, contamination, or excessive loading.
- **Remedies** - If due to normal life, replace bearings. If cause is other than normal life, correct per recommendations for that failure mode.

## Hub Cap Lubricant Installation Procedure for Oil, Semi-Fluid Grease and Hard Pack Grease

The purpose of this document is to inform customers of proper lubrication methods for SENTINEL® hub caps with oil, SENTINEL®, stamped steel, duckbill vented stamped steel, dirt exclusion hub caps with semi-fluid grease and stamped steel hubcaps with hard pack grease.

### Oil Lubricant

#### SENTINEL® Hub Caps

When using oil lubricants, the following procedure should be followed. Adherence to this procedure will result in longer wheel end life and improved performance.

**STEP 1** After the hub cap has been installed on hub, slowly pour oil through side fill hole. Allow the oil to flow into the hub cavity and do not fill the oil level past the bottom of the red cover or the red shaded area below. Allow two to three minutes for the oil to migrate into the hub cavity and repeat process as needed until the oil level is at the full line on the clear hub cap window. **DO NOT COVER THE VENT MECHANISM WITH LUBRICANT.**



Fig. 1: Fill Level for Oil

Sentinel® Application	Approximate Fluid Ounces of Lubricant
349-4009	3.5 fl. oz.
349-4013	3.5 fl. oz.
349-4046	2.9 fl. oz.
349-4075	7.2 fl. oz.
349-4095	2.4 fl. oz.

**NOTE:** Failure to follow the above procedure will result in “filming” or cosmetic seepage of lubricant through the center vent onto the external face of the hub cap during initial operation.

### Semi-Fluid Grease

#### SENTINEL®, Dirt Exclusion, Duckbill Vent, Solid Aluminium Grease Hub Caps

When using semi-fluid lubricants, it is recommended to add lubricant to the hub caps to provide added lubrication to the outer bearing. Adherence to this procedure will result in longer wheel end life and improved performance. Addition of semi-fluid lubricant should be completed as follows:

**STEP 1** Holding the hub cap as shown (Figure 2), fill the lower side of the hub cap until level with the inner edge of the mounting flange and the edge of the vent mechanism. **DO NOT COVER THE VENT MECHANISM WITH LUBRICANT!** Failure to follow the above procedure will result in “filming” or cosmetic seepage of lubricant from the vent onto the external face of the hub cap during initial operation.



Fig. 2: Fill Level for Semi-fluid Grease

**STEP 2** Install the hub cap quickly to prevent spilling the lubricant.

### Hard Pack Grease

#### Stamped Steel Hub Caps

STEMCO stamped steel hub caps are zinc dichromate plated to provide corrosion protection and a superior finish. While the plating provides ample protection in most instances, there are conditions which can accelerate corrosion beyond the capability of the plating. For this reason, STEMCO recommends that all stamped steel hub caps be internally coated prior to installation, except for the vent, with a thin layer of lubricant. Coating should be performed as follows:



Fig. 3: Paint in the inside of stamped steel hub cap will grease

**STEP 1** Using a clean brush or your hand (Figure 3), wipe the inner surfaces of the stamped hub cap with a thin layer of lubricant until all areas are covered as shown. **DO NOT COVER THE VENT MECHANISM WITH LUBRICANT.** Failure to follow the above procedure will result in “filming” or seepage of lubricant from the vent onto the external face of the hub cap during initial operation, and may clog the vent in some cases.

**STEP 2** For this purpose, NLGI grade 2 or 3 hard pack greases are the preferred lubricants, as they do not flow and will maintain coverage of the plating on the internal surface of the hub cap.

**STEP 3** Install the hub cap per normal installation practices.

**STEP 4** Use this procedure on all STEMCO stamped steel hub caps.

### Lubrication

With the vast array of wheel end configurations and operating variables, STEMCO recommends following manufacturer’s recommendations for lubricant selection.

Additionally, STEMCO endorses The Maintenance Council’s recommended practice RP 631 (Recommendations for Wheel End Lubrication) and RP 624 (Lubricant Fundamentals), available from TMC.

STEMCO Tech Tips are developed to provide detailed information about particular products and/or procedures. These Tech Tips are available from STEMCO by requesting the numbers noted below. Visit [www.stemco.com](http://www.stemco.com) for periodic new and updated Tech Tips.

STEMCO Tech Tips			
Tech Tip	Technical Information	Tech Tip	Technical Information
#3	Moisture Ejector Installation	#21	Inspection and Service Intervals for STEMCO Systems
#5	Guardian® HP Wheel Seals – Proper Installation	#23	PRO-TORQ® Keeper Replacement Interval
#6	Guardian® HP Wheel Seals – Lubricant Compatibility	#24	Sentinel® ESP Filtered Vent
#8	Installation for PRO-TORQ® P/N's 449-4974 & 449-4975	#26	Installation for PRO-TORQ® Part Number 448-4837
#11	Procedure for Using Semi-fluid Lubricants	#29	Leaky Seal
#12	Improved Universal Axle Tool	#34	STEMCO Approved Lubricants
#13	Sentinel® Products & Internal Vacuum	#35	Product Improvement – Sentinel® Hub Caps
#14	448-4836/448-4837 Keeper Removal Procedure	#38	Product Improvement – Guardian® HP
#15	392-9112 & 392-9130 Grit Guard® Sets Commonality	#50	ConMet Conversion

## STEMCO® Standard Components

### 1 Year Warranty

STEMCO warrants to Buyer that all components sold will be free from defects in material and workmanship. This warranty is limited to components installed on vehicles licensed for on-highway use under normal use and service. This warranty extends for a period of one year from the date of manufacture.

The Buyer's exclusive remedy under this warranty shall be the repair or replacement of STEMCO components, but not the cost of removal or installation. STEMCO reserves the right to require that all warranty claim components are available and/or returned for review and evaluation. STEMCO shall not be liable for any claim, whether arising from breach of contract or warranty or claims of negligence or negligent manufacture, in excess of the purchase price. In no event shall STEMCO be liable for special, incidental, indirect, or consequential, or collateral, losses or damages of any kind.

This limited warranty is in lieu of all other warranties or conditions, expressed or implied, including any implied warranty of merchantability or fitness for particular purpose. This is the only warranty offered by STEMCO and no STEMCO employee or representative is authorized to extend additional warranty terms on behalf of STEMCO.



## WHEN IT COMES TO TRAINING WE HOLD OURSELVES TO A HIGHER STANDARD

### 3 Year Warranty

PLATINUM  
PERFORMANCE SYSTEM™

**Trailer:**  
Unlimited  
Mileage

**Tractor:**  
Unlimited  
Mileage

### 5 Year Warranty

PLATINUM PLUS  
PERFORMANCE SYSTEM™

**Trailer:**  
Unlimited Mileage

### 7 Year Warranty

PLATINUM PLUS 7  
PERFORMANCE SYSTEM™

**Trailer:**  
Unlimited Mileage

### 500,000 Mile Warranty

HUBODOMETER®  
GUARANTEED OVER-LIFE-OF-TIRE ACCURACY

The STEMCO Hubodometer® is warranted for 500,000 miles when installed in accordance with its specifications.

### 4 Year/500,000 Mile Warranty

DataTrac®  
DataTrac®  
PRO

DataTrac® is warranted for 4 years / 500,000 miles when installed in accordance with its specifications.

### STEMCO WHEEL END PRODUCTS™

- Wheel end failure analysis and rebuild
- Proper seal and bearing installation
- Single and double nut adjustment procedures
- Oil and grease lubrication best practices

### STEMCO BRAKE PRODUCTS™

- Foundation basics
- Brake balance
- Auto Brake Adjusters

### STEMCO SUSPENSION PRODUCTS™

- King pin replacement for Qwik Kits and Plus Kits
- Complete break down and rebuild training

### STEMCO INNOVATIVE TIRE & MILEAGE SOLUTIONS | ITMS™

- Tire inflation management
- Mileage management
- Tire pressure monitoring
- Trailer aerodynamics

To request training on any or all of these products, contact your local STEMCO District Sales Manager.