

Hazard Warning Definitions

⚠ DANGER	Immediate hazards which WILL result in severe personal injury or death.
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⚠ WARNING	Hazards or unsafe practices which COULD result in severe personal injury or death.
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⚠ CAUTION	Hazards or unsafe practices which COULD result in minor personal injury or product or property damage.
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NOTE	A note gives key information to make following a procedure easier or quicker.
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Disclaimer

This Service Manual has been prepared by TRW Commercial Steering Systems for reference and use by mechanics who have been trained to repair and service steering components and systems on heavy commercial vehicles. TRW Commercial Steering Systems has exercised reasonable care and diligence to present accurate, clear and complete information and instructions regarding TRW Commercial Steering linkage components. Since this is a general service manual, the photographs and illustrations may not look exactly like the components being serviced. The procedures, therefore, must be carefully read and understood before servicing.

If inspection or testing reveals evidence of abnormal wear or damage to TRW linkage components or if you encounter circumstances not covered in the manual, **STOP - CONSULT THE VEHICLE MANUFACTURER'S SERVICE MANUAL AND WARRANTY. DO NOT TRY TO REPAIR OR SERVICE ANY LINKAGE COMPONENT WHICH HAS BEEN DAMAGED OR INCLUDES ANY PART THAT SHOWS EXCESSIVE WEAR UNLESS THE DAMAGED AND WORN PARTS ARE REPLACED WITH ORIGINAL TRW REPLACEMENT AND SERVICE PARTS AND THE UNIT IS RESTORED TO TRW'S SPECIFICATIONS FOR THAT SPECIFIC COMPONENT.**

It is the responsibility of the mechanic performing the maintenance, repairs or service on a particular TRW linkage component to (a) inspect components for abnormal wear and damage, (b) choose a repair procedure which will not endanger his/her safety, the safety of others, the vehicle, or the safe operation of the vehicle, and (c) fully inspect and test the linkage components and the vehicle steering system to ensure that the repair or service of the component has been properly performed and that the component and system will function properly.

Patents

TRW Commercial Steering Systems linkage components are covered by several United States and foreign patents, either issued or pending.

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Introduction

This TRW Linkage Service Manual was written as a guide to help you install, maintain, inspect and service TRW linkage components.

Material in this manual is organized so you can work on TRW linkage components and get results without wasting time or being confused. To get these results, you should review the contents of this manual before you begin work on any TRW linkage component.

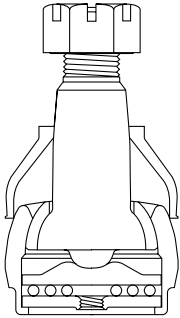
The three-column format used in this service manual will help make it easy for you to service steering linkages. Column 1 illustrates the procedure with photographs, column 2 gives a brief key as well as tools (if required) to be used for each procedure, and column 3 explains in detail the procedure you should follow. **Pay special attention to the notes, cautions and warnings.**

As you gain experience in servicing TRW linkage components, you may find that some information in this service manual could be clearer and more complete. If so, let us know about it. Don't try to second-guess the service manual; if you do not understand a procedure, or are stuck, contact a TRW Technical Service Representative at 1-800-TRW-0899.

General Operation

Tie rod ends, as used in automotive steering linkage systems, are essentially pivot joints that provide universal motion. They must be rugged enough to withstand severe under-vehicle environments, while at the same time be refined to provide precise movement with minimal lash. Wheel turn and jounce envelopes often require steering linkage capable of high angle oscillations. Certain applications demand restricted movement tie rod ends that offer little or no oscillation.

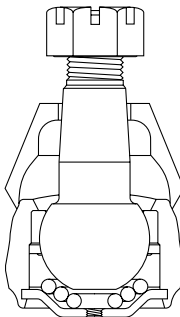
General Design



**5000 Series
L.E.M. Tie Rod End**

L.E.M. (Low End Movement) tie rod ends use proven all-steel dual bearing construction and an integral pre-load spring that limits ball stud end movement and continuously compensates for ball and spherical bearing surface wear. Applications include both medium and heavy duty trucks, as well as off highway vehicles.

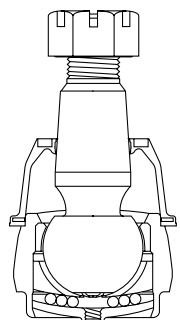
The L.E.M. tie rod end has a half ball stud and one bearing. On the outside you can use the flat cap and vertical closure to identify the design.



**7000 Series
Dual Seat Tie Rod
End**

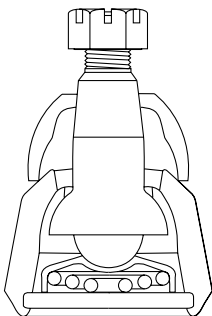
Dual seat tie rod ends are used on both medium and heavy duty trucks, as well as off highway vehicles.

This tie rod features a full ball stud and two bearings (one plastic, one steel). On the outside you can use the domed cap and rolled-over closure to identify the design. End movement is controlled with a pre-loaded spring as in the L.E.M. design, but due to the "fixed cap", axial movement is significantly greater under load than the L.E.M. tie rod end.



**8000 Series
DL Tie Rod End**

Each 8000 series tie rod end features a hardened steel spherical ball stud captured between a hardened steel upper bearing and a spring pre-loaded thermoplastic lower bearing. Ball stud radial and axial movement is extremely limited by constant compression of the dual bearings around the ball. 8000 Series tie rod ends are used on medium and heavy duty trucks, as well as off highway vehicles. This tie rod combines the full ball, dual seat design with the low end movement feature of the L.E.M. design.



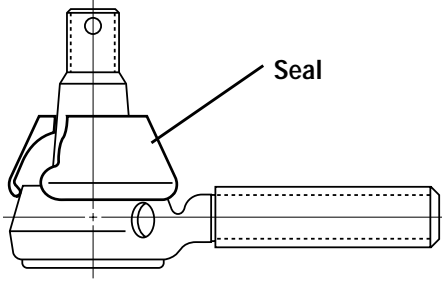
**Designer Series
Tie Rod End**

Designer series tie rod ends are used on such applications as snowmobiles, golf carts, lawn and garden tractors and agriculture implements as well as clutch and throttle linkage systems on medium and heavy trucks.

Available Seal Types

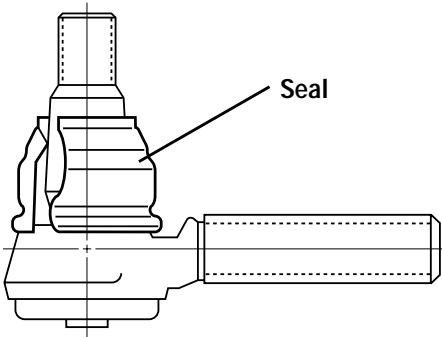
Sliding Seal

The most common seal for vertical ball sockets is the sliding seal. When rocking motion of the ball stud occurs the seal slides over the socket body.



Boot Seal

A boot seal securely attaches around the circumference of the socket body. Rocking motion of the ball stud is accommodated by flexing of the convoluted part of the seal. A metal reinforcing ring molded into the seal aperture snaps over the socket body, holding it in position as the stud oscillates. This seal is well suited to permanently lubricated ball socket assemblies, extended lube assemblies and severe service environments.



Anti-Tilt Seal

This seal configuration consists of a molded polymer element, and may include a steel side washer. The rigid seal assembly presses down over the ball stud and seats firmly over the socket body shoulder. Angular movement of the ball stud is restricted, while stud rotation is accommodated. Anti-tilt seals are particularly useful in applications where long drag links or shift rods must maintain a defined travel path.

