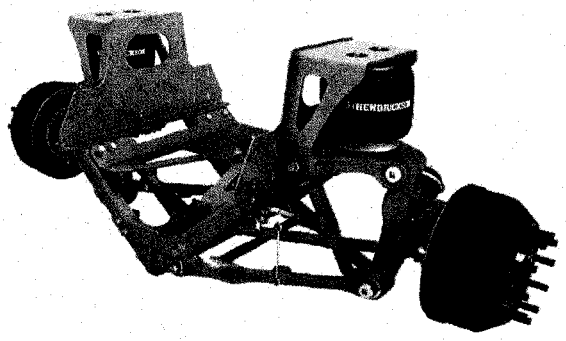


TECHNICAL PROCEDURE

Hendrickson IFS Independent Front Suspension for Spartan Motorhome Chassis

SUBJECT: Service Instructions
LIT NO: 17730-260
DATE: July 2013 **REVISION:** B

TABLE OF CONTENTS

HENDRICKSON
The World Rides On Us®

SECTION 1
Introduction

This publication is intended to acquaint and assist maintenance personnel in the preventive maintenance, service, repair and rebuild of the following Hendrickson equipment as installed on applicable Spartan motorhome chassis:

- **Hendrickson IFS** — Independent front suspension designed for premium ride and handling for motorhome chassis.

NOTE Use only Hendrickson Genuine parts for servicing this suspension system.

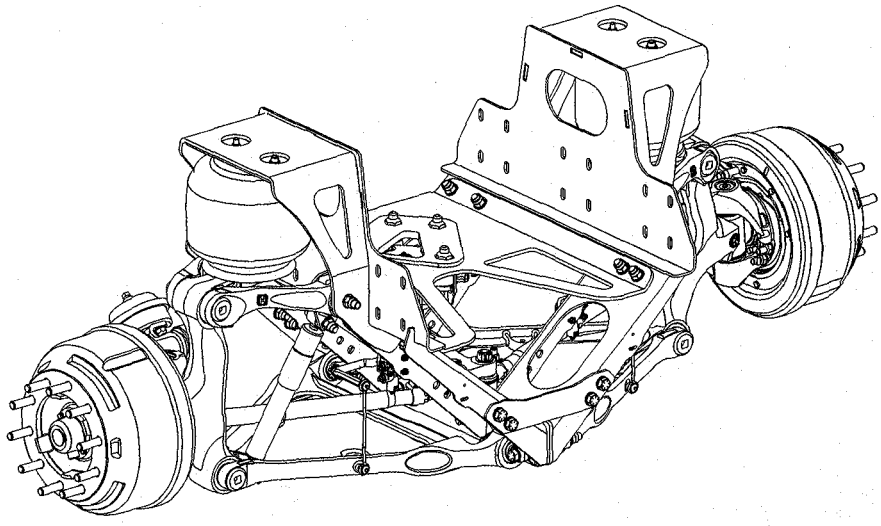
It is important to read and understand the entire Technical Procedure publication prior to performing any maintenance, service, repair, or rebuild of the product. The information in this publication contains parts lists, safety information, product specifications, features, proper maintenance, service, repair and rebuild instructions for the Hendrickson IFS Suspension.

Hendrickson reserves the right to make changes and improvements to its products and publications at any time. Contact Hendrickson Tech Services for information on the latest version of this manual at 1-866-755-5968 (toll-free U.S. and Canada), 1-630-910-2800 (outside U.S. and Canada) or e-mail: techservices@hendrickson-intl.com.

The latest revision of this publication is also available online at www.hendrickson-intl.com.

SECTION 2
Product Description

FIGURE 2-1
Hendrickson IFS
Capacity: 12,600 and 14,600 pounds
Suspension Weight: 12.6K capacity – 1,560 pounds, 14.6K capacity – 1,760 pounds



The Hendrickson IFS delivers superior ride and handling compared to standard front mechanical and air suspensions. The best-in-class short-long arm (SLA) design keeps tires in better contact with the road surface throughout suspension travel by reducing the camber change. The design also reduces bump steer for better handling over rough roads.

In addition, the Hendrickson IFS delivers improved steering feel and ride comfort by reducing friction with the introduction of a kingpin design instead of ball joints. The two-piece knuckle, a technology shared with AIRTEK and SOFTEK, also reduces maintenance hassles.

- Up to 57 degrees of wheel cut for exceptional maneuverability
- Shock and air spring travel directly proportional to wheel travel, resulting in superior ride and handling

Air Springs — Exclusive to Hendrickson, the lightweight air springs deliver an extremely soft ride. The air springs are engineered to support 100% of the vertical load while providing very low spring rate.

Shock Absorbers — Hendrickson IFS utilizes premium shocks that have been tested and tuned specifically for the Hendrickson IFS system.

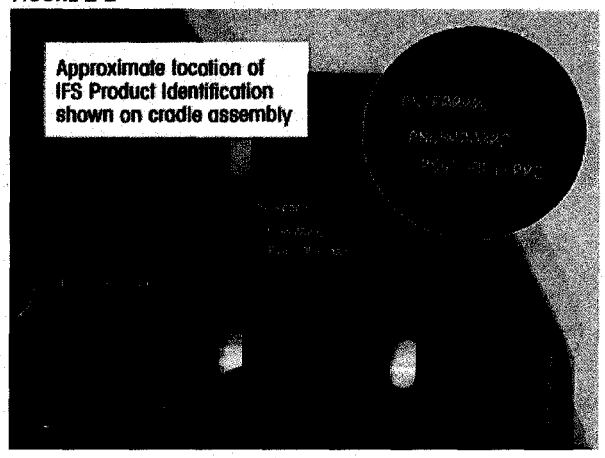
Steering Knuckles — The steering and tie rod arms are integrated for increased strength and reduced weight. The unique steering knuckle packaging delivers a maximum of 57° wheel cut. The two piece knuckle design makes replacing the kingpin bushings easier by eliminating the need to remove the kingpins.

Hub and Drum Assembly — The Hendrickson IFS hub and drum assembly provides consistent performance and durability.

TECHNICAL NOTES

1. The Hendrickson IFS is approved for on-highway usage
2. The Hendrickson IFS product identification is etched on the right hand cradle assembly; this identifies the complete product assembly and the suspension capacity rating, see Figure 2-2.

FIGURE 2-2



SECTION 3

Important Safety Notice

Proper maintenance, service and repair are important to the reliable operation of the suspension. The procedures recommended by Hendrickson and described in this technical publication are methods of performing such maintenance, service and repair.

The warnings and cautions should be read carefully to help prevent personal injury and to assure that proper methods are used. Improper maintenance, service or repair may damage the vehicle, cause personal injury, render the vehicle unsafe in operation, or void the manufacturer's warranty.

Failure to follow the safety precautions in this manual can result in personal injury and/or property damage. Carefully read and understand all safety related information within this publication, on all decals and in all such materials provided by the vehicle manufacturer before conducting any maintenance, service or repair.

■ EXPLANATION OF SIGNAL WORDS

Hazard "Signal Words" (Danger-Warning-Caution) appear in various locations throughout this publication. Information accented by one of these signal words must be observed to help minimize the risk of personal injury to service personnel, or possibility of improper service methods which may damage the vehicle or render it unsafe.

This is the safety alert symbol. It is used to alert you to potential personal injury hazards. Obey all safety messages that follow this symbol to avoid possible injury or death.

Additional 'Notes' or 'Service Hints' are utilized to emphasize areas of procedural importance and provide suggestions for ease of repair. The following definitions indicate the use of these signal words as they appear throughout the publication.

⚠ DANGER — INDICATES AN IMMINENTLY HAZARDOUS SITUATION WHICH, IF NOT AVOIDED, WILL RESULT IN SERIOUS INJURY OR DEATH.

⚠ WARNING — INDICATES A POTENTIAL HAZARDOUS SITUATION WHICH, IF NOT AVOIDED, CAN RESULT IN SERIOUS INJURY OR DEATH.

⚠ CAUTION — INDICATES A POTENTIAL HAZARDOUS SITUATION WHICH, IF NOT AVOIDED, MAY RESULT IN MINOR OR MODERATE INJURY, OR PROPERTY DAMAGE.

NOTE — An operating procedure, practice condition, etc. which is essential to emphasize.

SERVICE HINT — A helpful suggestion, which will make the servicing being performed a little easier and/or faster.

Also note that particular service operations may require the use of special tools designed for specific purposes. These special tools can be found in the Special Tools Section of this publication.

The torque symbol alerts you to tighten fasteners to a specified torque value. Refer to Torque Specifications Section of this publication.

■ SAFETY PRECAUTIONS

⚠ WARNING

FASTENERS

DISCARD USED FASTENERS. ALWAYS USE NEW FASTENERS TO COMPLETE A REPAIR. FAILURE TO DO SO COULD RESULT IN FAILURE OF THE PART, OR MATING COMPONENTS, LOSS OF VEHICLE CONTROL, PERSONAL INJURY, OR PROPERTY DAMAGE.

LOOSE OR OVER TORQUED FASTENERS CAN CAUSE COMPONENT DAMAGE, LOSS OF VEHICLE CONTROL, PROPERTY DAMAGE, OR SEVERE PERSONAL INJURY. MAINTAIN CORRECT TORQUE VALUE AT ALL TIMES. CHECK TORQUE VALUES ON A REGULAR BASIS AS SPECIFIED, USING A REGULARLY CALIBRATED TORQUE WRENCH. TORQUE VALUES SPECIFIED IN THIS TECHNICAL PUBLICATION ARE FOR HENDRICKSON SUPPLIED FASTENERS ONLY. IF NON HENDRICKSON FASTENERS ARE USED, FOLLOW TORQUE SPECIFICATION LISTED IN THE VEHICLE MANUFACTURER'S SERVICE MANUAL.

⚠ DANGER

AIR SPRINGS

AIR SPRING ASSEMBLIES MUST BE DEFLATED PRIOR TO LOOSENING ANY SUSPENSION COMPONENTS. UNRESTRICTED AIR SPRING ASSEMBLIES CAN VIOLENTLY SHIFT. DO NOT INFLATE AIR SPRING ASSEMBLIES WHEN THEY ARE UNRESTRICTED. AIR SPRING ASSEMBLIES MUST BE RESTRICTED BY SUSPENSION OR OTHER ADEQUATE STRUCTURE. DO NOT INFLATE BEYOND PRESSURES RECOMMENDED BY AIR SPRING MANUFACTURER, CONTACT HENDRICKSON TECHNICAL SERVICES FOR DETAILS. IMPROPER USE OR OVER INFLATION MAY CAUSE AIR SPRING ASSEMBLIES TO BURST, CAUSING PROPERTY DAMAGE AND/OR SEVERE PERSONAL INJURY.

⚠ WARNING

WHEN SERVICING THE VEHICLE OR ATTACHING AN AIR SPRING AND THE VEHICLE IS ON THE GROUND, PRIOR TO AIRING THE SUSPENSION SYSTEM MAKE CERTAIN THE AIR SPRING LOCATOR IS PROPERLY INDEXED INTO THE CRADLE ASSEMBLY, AND THE AIR SPRING IS FULLY SEATED ON THE UPRIGHT KINGPIN ASSEMBLY. FAILURE TO FOLLOW THESE INSTRUCTIONS CAN RESULT IN PREMATURE AIR SPRING FAILURE, CAUSE PERSONAL INJURY, OR PROPERTY DAMAGE.

⚠ WARNING

PRIOR TO AND DURING DEFLATION AND INFLATION OF THE FRONT AIR SUSPENSION SYSTEM, ENSURE THAT ALL PERSONNEL AND EQUIPMENT ARE CLEAR FROM UNDER THE VEHICLE AND AROUND THE SERVICE AREA, FAILURE TO DO SO CAN CAUSE SERIOUS PERSONAL INJURY, DEATH, OR PROPERTY DAMAGE.

⚠ WARNING

LOAD CAPACITY

ADHERE TO THE PUBLISHED CAPACITY RATINGS FOR THE SUSPENSIONS. ADD-ON COMPONENTS, ATTACHMENTS, AND OTHER LOAD TRANSFERRING DEVICES CAN INCREASE THE SUSPENSION LOAD ABOVE THE RATED AND APPROVED CAPACITIES WHICH CAN RESULT IN FAILURE AND LOSS OF VEHICLE CONTROL, POSSIBLY CAUSING PERSONAL INJURY OR PROPERTY DAMAGE.

⚠ WARNING

MODIFYING COMPONENTS

DO NOT MODIFY OR REWORK PARTS WITHOUT AUTHORIZATION FROM HENDRICKSON. DO NOT SUBSTITUTE REPLACEMENT COMPONENTS NOT AUTHORIZED BY HENDRICKSON. USE OF MODIFIED, REWORKED, SUBSTITUTE OR REPLACEMENT PARTS NOT AUTHORIZED BY HENDRICKSON MAY NOT MEET HENDRICKSON'S SPECIFICATIONS, AND CAN RESULT IN FAILURE OF THE PART, LOSS OF VEHICLE CONTROL, POSSIBLE PERSONAL INJURY OR PROPERTY DAMAGE, AND WILL VOID ANY APPLICABLE WARRANTIES. USE ONLY HENDRICKSON AUTHORIZED REPLACEMENT PARTS.

⚠ WARNING

SHOCK ABSORBERS

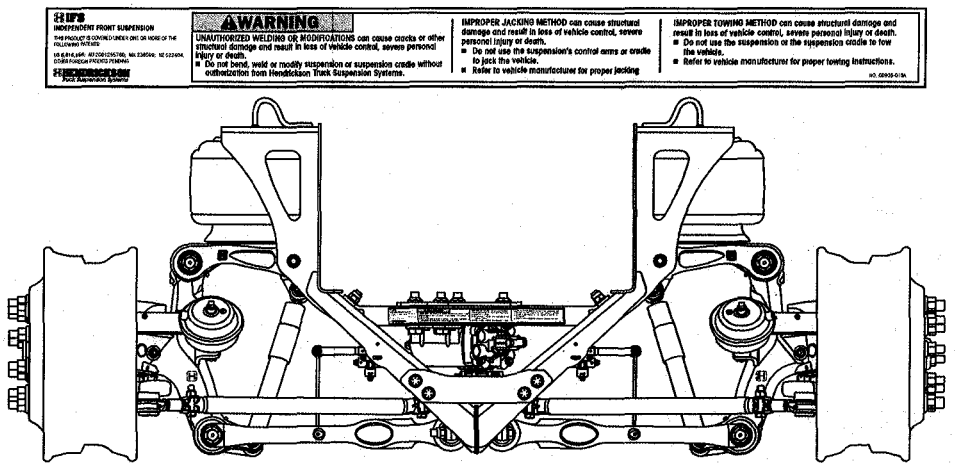
THE SHOCK ABSORBERS ARE THE REBOUND TRAVEL STOPS FOR THE AIR SPRINGS. ANYTIME THE WHEELS ON A HENDRICKSON IFS SUSPENSION ARE SUSPENDED, IT IS MANDATORY THAT THE SHOCK ABSORBERS REMAIN CONNECTED. FAILURE TO DO SO CAN CAUSE THE AIR SPRINGS TO EXCEED THEIR MAXIMUM LENGTH, POSSIBLY CAUSING THE AIR SPRINGS TO SEPARATE FROM THE PISTON.

⚠ WARNING

HENDRICKSON IFS

FIGURE 3-1

REPLACE ANY SAFETY DECALS THAT ARE FADED, TORN, MISSING, ILLEGIBLE, OR OTHERWISE DAMAGED. CONTACT HENDRICKSON TO ORDER REPLACEMENT LABELS.



⚠ WARNING

AXLE KINGPINS

THE HENDRICKSON IFS IS UNIQUE IN THAT THE KINGPIN IS CRYOGENICALLY INSTALLED IN THE UPRIGHT. THE KINGPIN IS A NON-REPLACEABLE COMPONENT OF THE UPRIGHT ASSEMBLY. DO NOT TRY TO REMOVE THE KINGPIN. IF THE KINGPIN SHOWS SIGNS OF MOVEMENT, CONTACT THE HENDRICKSON TECH SERVICES DEPARTMENT.

⚠ WARNING

REPAIR OR RECONDITIONING

THE REPAIR OR RECONDITIONING OF SUSPENSION COMPONENTS IS NOT ALLOWED, AS SHOWN ON LABEL IN FIGURE 3-1. ANY COMPONENTS THAT MAY BE FOUND TO BE DAMAGED OR OUT OF SPECIFICATIONS MUST BE REPLACED. ALL MAJOR HENDRICKSON COMPONENTS ARE HEAT TREATED AND TEMPERED. HENDRICKSON IFS COMPONENTS CANNOT BE BENT, WELDED, HEATED, OR REPAIRED WITHOUT REDUCING THE STRENGTH OR LIFE OF THE COMPONENT. FAILURE TO FOLLOW THESE GUIDELINES CAN CAUSE LOSS OF VEHICLE CONTROL, POSSIBLE PERSONAL INJURY, DEATH, OR PROPERTY DAMAGE AND WILL VOID APPLICABLE WARRANTIES.

⚠ WARNING

DAMAGED COMPONENTS

IF A VEHICLE EQUIPPED WITH A HENDRICKSON IFS SUSPENSION IS INVOLVED IN A CRASH, A THOROUGH INSPECTION OF ALL COMPONENTS ON THE SUSPENSION MUST BE PERFORMED WITH PARTICULAR ATTENTION TO THE UPRIGHT, KINGPINS, AND KNUCKLE ASSEMBLIES. IF ANY COMPONENT APPEARS DAMAGED, THE SUSPECT COMPONENTS MUST BE REPLACED. IN THE EVENT THE CRASH RESULTED IN EXCESSIVE SIDE LOAD, SUCH AS A BLOWN TIRE, BENT WHEEL, HUB, OR SPINDLE, IT IS STRONGLY RECOMMENDED TO REPLACE THE CONTROL ARMS, THE UPRIGHT, HUB, AND KNUCKLE ASSEMBLIES, CONTACT HENDRICKSON TECHNICAL SERVICES WITH ANY QUESTIONS. FAILURE TO REPLACE ANY DAMAGED COMPONENTS CAN CAUSE LOSS OF VEHICLE CONTROL, POSSIBLE PERSONAL INJURY, DEATH, OR PROPERTY DAMAGE AND WILL VOID APPLICABLE WARRANTIES.

⚠ WARNING

SUPPORT THE VEHICLE PRIOR TO SERVICING

PLACE THE VEHICLE ON A LEVEL FLOOR AND CHOCK THE WHEELS TO HELP PREVENT THE VEHICLE FROM MOVING. SUPPORT A RAISED VEHICLE WITH SAFETY STANDS. DO NOT WORK UNDER A RAISED VEHICLE SUPPORTED ONLY BY A FLOOR JACK. A JACK CAN SLIP OR FALL OVER. SERIOUS PERSONAL INJURY CAN RESULT.

⚠ WARNING

OFF ROADWAY TOWING

WHEN A VEHICLE IS DISABLED AND EQUIPPED WITH HENDRICKSON IFS SUSPENSION, CARE MUST BE TAKEN TO ENSURE THERE IS NO DAMAGE TO THE SUSPENSION WHEN TOWING THE VEHICLE. DO NOT WRAP TOW STRAPS OR A TOW CHAIN AROUND THE SUSPENSION, FAILURE TO DO SO WILL CAUSE DAMAGE TO THE SUSPENSION SYSTEM, LOSS OF VEHICLE CONTROL, POSSIBLY CAUSING PERSONAL INJURY OR PROPERTY DAMAGE.

⚠ WARNING

PERSONNEL PROTECTIVE EQUIPMENT

ALWAYS WEAR PROPER EYE PROTECTION AND OTHER REQUIRED PERSONAL PROTECTIVE EQUIPMENT TO HELP PREVENT PERSONAL INJURY WHEN PERFORMING VEHICLE MAINTENANCE, REPAIR OR SERVICE.

⚠ WARNING

TORCH/WELDING

DO NOT USE A CUTTING TORCH TO REMOVE ANY FASTENERS. THE USE OF HEAT ON SUSPENSION COMPONENTS WILL ADVERSELY AFFECT THE STRENGTH OF THESE PARTS. A COMPONENT DAMAGED IN THIS MANNER CAN RESULT IN THE LOSS OF VEHICLE CONTROL AND POSSIBLE PERSONAL INJURY OR PROPERTY DAMAGE.

EXERCISE EXTREME CARE WHEN HANDLING OR PERFORMING MAINTENANCE IN THE AREA OF THE SUSPENSION SYSTEM. DO NOT CONNECT ARC WELDING GROUND LINE TO ANY COMPONENTS ON THE SUSPENSION SYSTEM. DO NOT STRIKE AN ARC WITH THE ELECTRODE ON THE SUSPENSION SYSTEM. DO NOT USE HEAT NEAR THE SUSPENSION SYSTEM. DO NOT NICK OR GOUGE THE SUSPENSION SYSTEM. SUCH IMPROPER ACTIONS CAN DAMAGE THE SUSPENSION SYSTEM, AND CAN CAUSE LOSS OF VEHICLE CONTROL AND POSSIBLE PERSONAL INJURY OR PROPERTY DAMAGE.

⚠ CAUTION

PROCEDURES AND TOOLS

A MECHANIC USING A SERVICE PROCEDURE OR TOOL WHICH HAS NOT BEEN RECOMMENDED BY HENDRICKSON MUST FIRST SATISFY HIMSELF THAT NEITHER HIS SAFETY NOR THE VEHICLE'S SAFETY WILL BE JEOPARDIZED BY THE METHOD OR TOOL SELECTED. INDIVIDUALS DEVIATING IN ANY MANNER FROM THE INSTRUCTIONS PROVIDED ASSUME ALL RISKS OF CONSEQUENTIAL PERSONAL INJURY OR DAMAGE TO EQUIPMENT INVOLVED.

⚠ WARNING

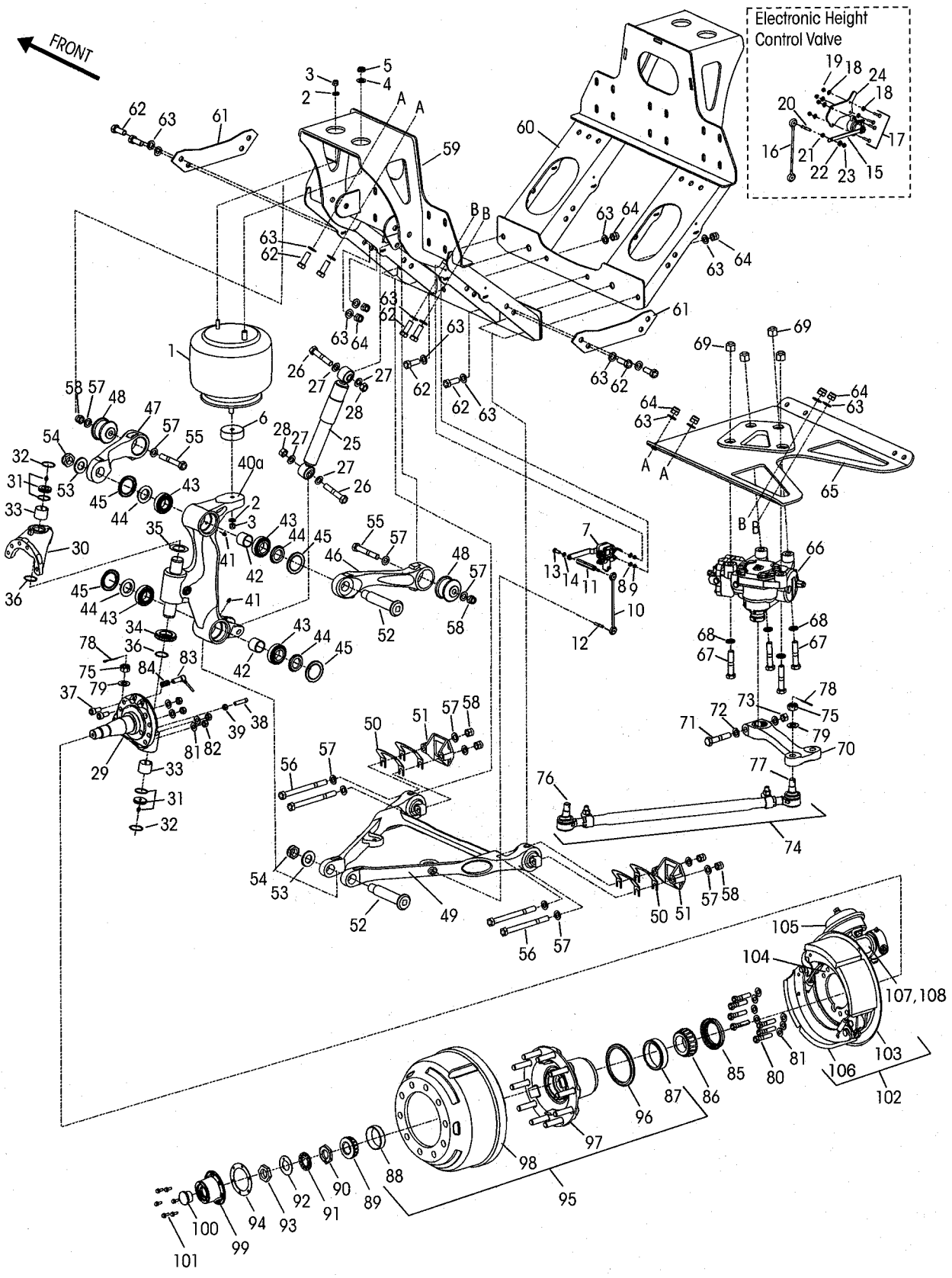
PARTS CLEANING

SOLVENT CLEANERS CAN BE FLAMMABLE, POISONOUS AND CAUSE BURNS. TO HELP AVOID SERIOUS PERSONAL INJURY, CAREFULLY FOLLOW THE MANUFACTURER'S PRODUCT INSTRUCTIONS AND GUIDELINES AND THE FOLLOWING PROCEDURE:

1. WEAR PROPER EYE PROTECTION
2. WEAR CLOTHING THAT PROTECTS YOUR SKIN
3. WORK IN A WELL VENTILATED AREA
4. DO NOT USE GASOLINE, OR SOLVENTS THAT CONTAIN GASOLINE. GASOLINE CAN EXPLODE
5. HOT SOLUTION TANKS OR ALKALINE SOLUTIONS MUST BE USED CORRECTLY. FOLLOW THE MANUFACTURER'S RECOMMENDED INSTRUCTIONS AND GUIDELINES CAREFULLY TO HELP PREVENT PERSONAL ACCIDENT OR INJURY

DO NOT USE HOT SOLUTION TANKS OR WATER AND ALKALINE SOLUTIONS TO CLEAN GROUND OR POLISHED PARTS. DOING SO WILL CAUSE DAMAGE TO THE PARTS AND VOID WARRANTY.

SECTION 4
Parts List



KEY NO.	PART NO.	DESCRIPTION	NO.REQ.
1	68348-002L	Air Spring	2
2	22962-011	½" Hardened Washer	4
3	17700-010	½"-13 UNC Locknut	4
4	22962-001	¾" Hardened Washer	2
5	17700-031	¾"-16 UNF Locknut	2
6	70645-002	Air Spring Spacer	2
7		Mechanical Height Control Valve, Includes Key Nos. 8-9	
	66414-003	LH – 12.6K/14.6K	1
Not Shown	66414-004	RH – 12.6K/14.6K (if equipped)	1
8	22962-028	¼" Hardened Washer	*4
9	49983-000	¼"-20 UNC Locknut	*4
10	59428-006	HCV Linkage	*2
11	59429-002	Link Mount	*2
12	59169-000	Link Mount Stud	*2
13	58035-001	⅜"-16 UNC Bolt - 1.0"	*2
14	22962-015	⅜" Hardened Washer	*2
15	66414-006	Electronic Height Control Valve (if equipped), • Available for 14.6K Dual Capacity Only	2
16	59428-004	HCV Linkage	2
17	56935-001	¼"-20 UNC Hex Cap Screw	8
18	22962-028	¼" Hardened Washer	12
19	49983-000	¼"-20 UNC Locknut	8
20	59169-000	5/16"-18 UNC Link Mount Stud	2
21	17491-011	5/16"-18 UNC Nut	2
22	22962-029	5/16" Hardened Washer	2
23	59016-000	5/16"-18 UNC Locknut	2
24	68352-001	Electronic Height Control Valve Bracket	2
25	66153-003L	Shock Absorber	2
26	50764-016	¾"-10 UNC Bolt - 4.0"	4
27	22962-001	¾" Hardened Washer	8
28	17700-033	¾"-10 UNC Locknut	4
		Lower Steering Knuckle Assembly	
29	58900-084	LH	1
Not Shown	58900-083	RH	1
		Upper Steering Knuckle Assembly	
30	60904-002	LH	1
Not Shown	60904-001	RH	1
	60961-039	**Kingpin Bushing and Bearing Service Kit,** Includes Key Nos. 31-37 and Loctite	
31	59156-000	Grease Cap Assembly	4
32	58937-000	Retaining Ring	4
33	58909-000	Kingpin Bushing	4
	60961-042	**Roller Thrust Bearing Service Kit, One Side** Includes Key Nos. 34-37 and Loctite	
34	64256-000	Roller Thrust Bearing	2
35	60259-002	Kingpin Shim - 0.047"	2
Not Shown	60259-001	Kingpin Shim - 0.005", As needed for service	
36	58910-001	Kingpin Seal, *Replaces 58910-000*	4
37	60236-001	⅝"-11 UNC Socket Head Cap Screw	4
Not Shown	60937-000	Loctite® (Red) Compound Tube	1
38	60238-001	½"-13 UNC Square Head Bolt	2
39	67102-000	½"-13 UNC Hex Nut	2
		Upright Assembly	
	68370-001	LH, Includes Key Nos. 40a, 41-45	1
	68370-002	RH, Includes Key Nos. 40b-45	1
40		Upright Kingpin Assembly	
a	68365-001	LH	1
b	68365-002	RH, not shown	1
41	33117-000	Grease Fitting	4
42	68367-000	Bearing Preload Spacer	4
43	68363-000	Tapered Roller Bearing	8
44	68369-000	Seal Spacer	8
45	68368-000	Seal Wiper	8
		Upper Control Arm Assembly, Includes Key No. 48	
46	68362-001	RH Front/LH Rear	2
47	68362-002	LH Front/RH Rear	2
48	68361-000	Upper Control Arm Bushing	4
49	68360-000	Lower Control Arm Assembly	2
50	68387-000	Camber Shim	8
51	30828-000	Lower Control Arm Bracket	4
52	68364-000	Upright Pin	4
53	22962-019	Washer	4
54	29749-000	1¼"-12 UNF Nylon Locknut	4
55	50764-002	¾"-10 UNC Bolt - 5.5"	4
56	50764-014	¾"-10 UNC Bolt - 8.5"	4
57	22962-001	¾" Hardened Washer	16
58	17700-033	¾"-10 UNC Locknut	8
		Cradle Assembly	
59	68335-001	LH	1
60	68335-002	RH	1
61	68339-000	Cradle Gusset	2
62	50764-006	¾"-10 UNC Bolt - 2.0"	18
63	22962-001	¾" Hardened Washer	36
64	17700-033	¾"-10 UNC Locknut	18
65	66913-000	Cradle Belly Plate	1
66	68389-001	***Steering Gear, *Replaces 68389-000*	1
67	58705-007	⅞"- 9 UNC Bolt - 4.0"	4
68	22962-007	⅞" Hardened Washer	4
69	60266-000	⅞"- 9 UNC Locknut	4
70	68388-000	Pitman Arm	1
71	50764-008	¾"-10 UNC Bolt - 5.0"	1
72	22962-001	¾" Hardened Washer	2
73	17700-033	¾"-10 UNC Locknut	1
74	64006-004	Tie Rod Assembly, Includes Key Nos. 75-77	2
75		**Tie Rod Castle Nut	4
	60961-181	**Tie Rod End Axle Service Kit** Includes Kit Nos. 60961-178 & -179	
		Tie Rod End Service Kit, One Side	
	60961-178	LH, Includes Key Nos. 76, 78-79	
	60961-179	RH, Includes Key Nos. 77-79	
		Tie Rod End	
76	64002-003	LH	2
77	64002-004	RH	2
78	17800-004	Cotter Pin	4
79	22962-007	⅞" Hardened Washer	4
80	32043-002	⅝"-11 UNC Bolt - 2.75"	14
81	22962-036	⅝" Hardened Washer	22
82	47764-000	⅝"-11 UNC Locknut	8
	64627-001	**ABS Sensor Service Kit**, Includes Key Nos. 83-84	
83	64547-000	ABS Sensor	2
84	64550-000	ABS Sensor Clip	2
	64626-008	**Front Wheel End Bearing Service Kit,** Includes Key Nos. 85-94	
85	64531-000	Wheel Seal	2
86	64529-000	Inner Bearing Cone	2
87	66810-001	Inner Bearing Cup	2
88	66811-001	Outer Bearing Cup	2
89	64530-000	Outer Bearing Cone	2
90	64671-000	1½"-12 UNF Inner Wheel Bearing Adj. Nut	2
91	64672-000	1½"-12 UNF Pierced Lock Ring	2
92	64673-000	1½" Lock Washer	2
93	64674-000	1½"-12 UNF Wheel Bearing Outer Nut	2
94	64546-000	Hubcap Gasket	2
95		Hub & Drum Assembly Includes Key Nos. 87-88, 96-98	2
	66238-001	15.0" x 4.0" - 12.6K (Not Shown)	
	66239-001	16.5" x 5.0" - 14.6K	
96		**ABS Tone Ring	2
97		**Hub	2
98		**Drum	2
99	64532-000	Hubcap Assembly, Includes Key No. 100	2
100		**Rubber Plug	2
101	64545-002	5/16"-18 UNC Bolt - 0.75"	12

KEY NO.	PART NO.	DESCRIPTION	NO.REQ.
102		****Brake Assembly	
	68333-005	LH 15.0" x 4.0" - 12.6K, *Replaces 68333-001*	1
	68333-006	RH 15.0" x 4.0" - 12.6K, *Replaces 68333-002*	1
	68333-007	LH 16.5" x 5.0" - 14.6K, *Replaces 68333-003*	1
	68333-008	RH 16.5" x 5.0" - 14.6K, *Replaces 68333-004*	1
103		Dust Shield	
	69437-002	12.6K	
	69437-003	14.6K	
104		Brake Spider	
	69437-011	LH, 12.6K	
	69437-012	RH, 12.6K	
	69437-013	LH, 14.6K	
	69437-014	RH, 14.6K	
105	69437-020	Brake Chamber, *Replaces 69437-001*	
106	69437-008	Single Lined Shoe	
107		Camshaft Bracket	
	69437-004	RH, 12.6K	
	69437-005	LH, 12.6K	
	69437-006	RH, 14.6K	
	69437-007	LH, 14.6K	
108		Camshaft	
	69437-015	LH, 12.6K	
	69437-016	RH, 12.6K	
	69437-017	LH, 14.6K	
	69437-018	RH, 14.6K	

NOTE: * Quantity shown for vehicles equipped with dual height control valves, divide quantity in half for vehicles equipped with a single height control valve.

** Item included in assembly only, part not sold separately.

*** For preventive maintenance, service, repair and rebuild of the steering gear, contact TRW at 800.879.0899, or see their website www.trw.com/commercialsteering.

**** For preventive maintenance, service and repair of the brake assembly, reference Meritor Maintenance Manual 4 for Q-plus brake service information.

SECTION 5
Special Tools

UPPER CONTROL ARM BUSHING REPLACEMENT TOOLS

The following diagrams are for reference to create shop made tools designed to install and remove the upper control arm bushing. Bushing tools are made from cold rolled steel or equivalent.

FIGURE 5-1

Upper Control Arm Bushing Remover

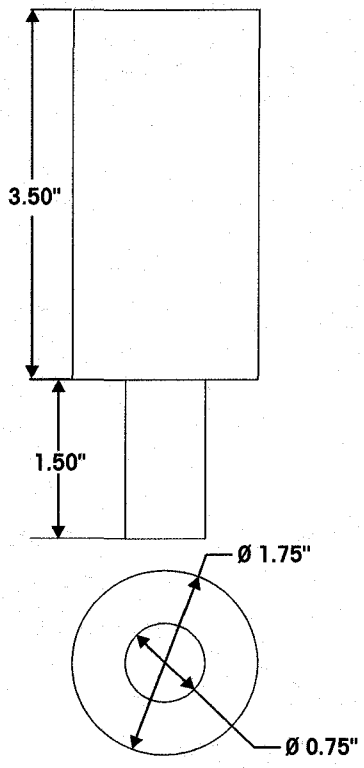
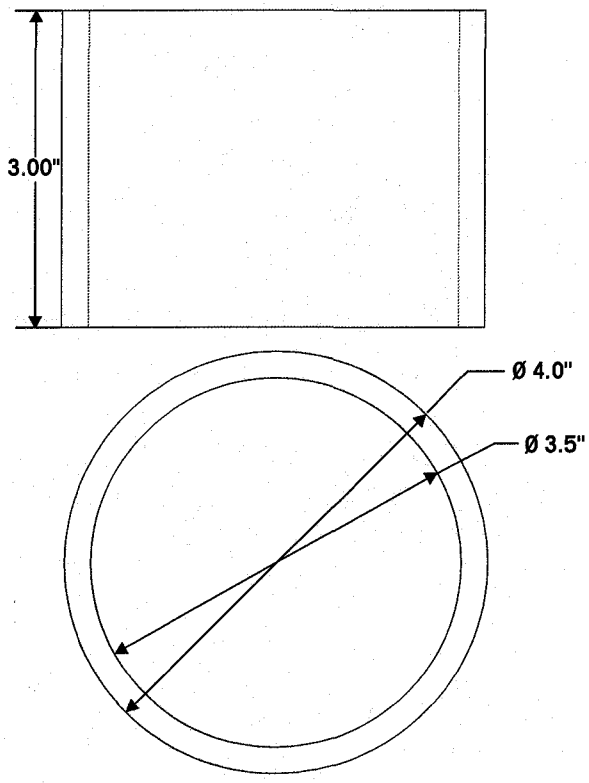


FIGURE 5-2

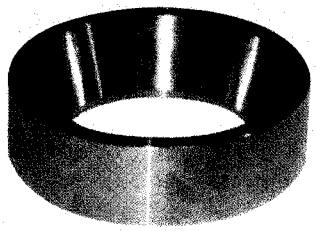
Upper Control Arm Receiver



BUSHING FUNNEL TOOL

FIGURE 5-3

Contact your authorized Hendrickson distributor to order the bushing funnel tool, Hendrickson part number 66086-000.



KINGPIN BUSHING TOOLS

The following diagrams are for reference to create shop made tools designed to install and remove the kingpin bushing. Bushing tools are made from cold rolled steel or equivalent.

FIGURE 5-4

Kingpin Bushing Driver Tool

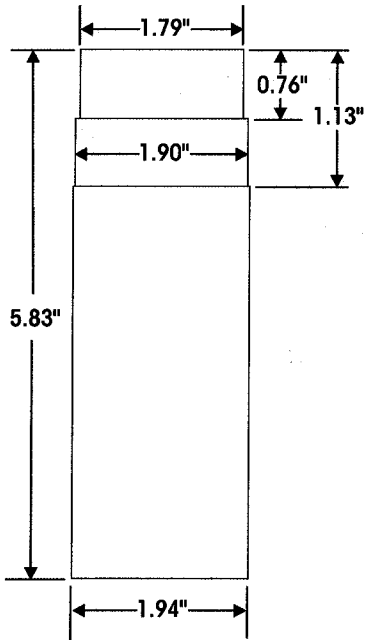


FIGURE 5-5

Kingpin Bushing Push-Out Tool

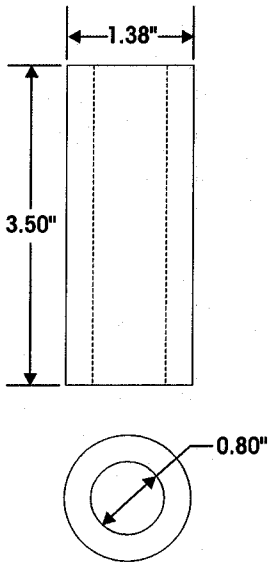
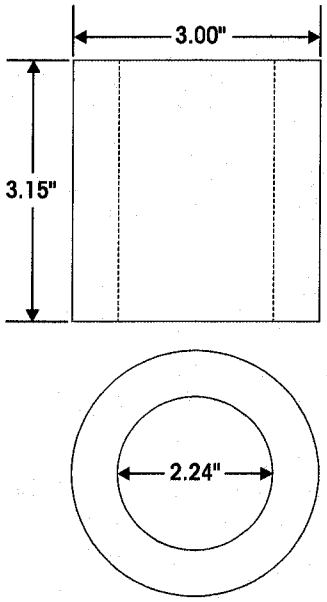


FIGURE 5-6

Steering Knuckle Receiving Tool



ADJUSTABLE STRAIGHT FLUTE REAMER

FIGURE 5-7

The dimension of cutting diameter must facilitate a range of 1.802" – 1.812"

HUB WHEEL SEAL TOOLS

FIGURE 5-8

HUB WHEEL SEAL REMOVAL TOOL

SKF SRT-1

Contact SKF customer service 1-800-882-0008 for a local distributor in your area.

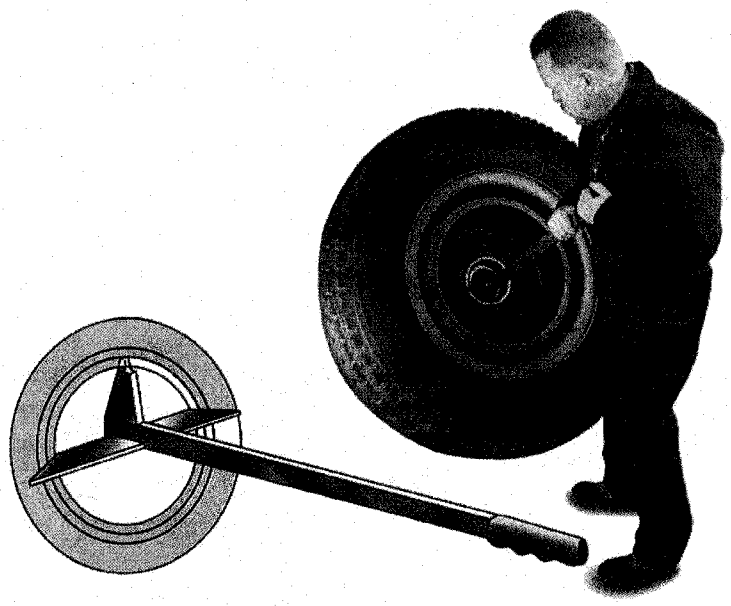
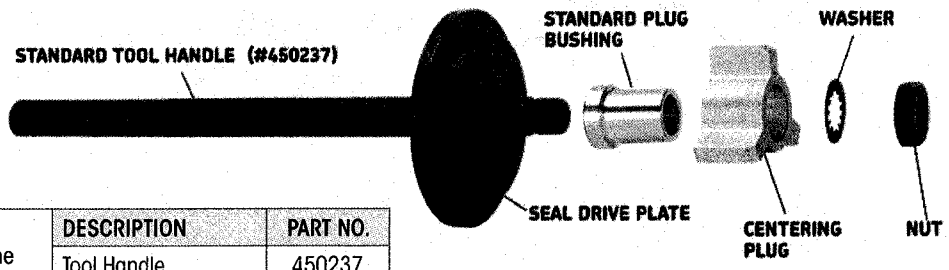


FIGURE 5-9

HUB WHEEL SEAL INSTALLATION TOOL

SKF Scotseal® *Classic* / Scotseal® *Longlife*

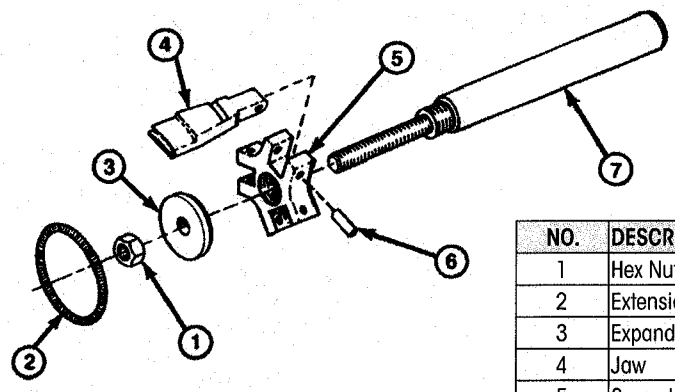


The seal drive plates and centering plug that fit on the end of the tool handle come in different sizes. Refer to these part nos. while ordering.	DESCRIPTION	PART NO.
	Tool Handle	450237
	Seal Drive Plate	436
	Centering Plate	706

BEARING CUP INSTALLATION TOOL

FIGURE 5-10

OTC Tool No. 7180
Capacity: 3⅝" O.D. – 6½" O.D.
To order contact OTC,
Owatonna Tool Company
800-533-6127
www.otctools.com



NO.	DESCRIPTION
1	Hex Nut (⅝"-18)
2	Extension Spring
3	Expander
4	Jaw
5	3 way Head
6	Pin
7	Handle

SECTION 6
Towing Procedure

ON HIGHWAY AND ON ROADWAY

Hendrickson recommends that a vehicle equipped with IFS be towed by the Wheel lift method for ON HIGHWAY or ON ROADWAY applications.

Please read, understand and comply with any additional towing instructions and safety precautions that may be provided by the vehicle manufacturer.

Hendrickson will not be responsible for any damage to the suspension or other vehicle components resulting from any towing method or fixture not authorized by Hendrickson.

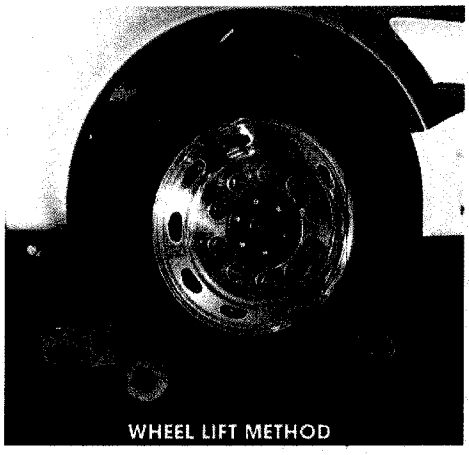
Please contact Hendrickson Tech Services toll-free at 1-866-755-5968 (U.S. and Canada) or send e-mail to: techservices@hendrickson-intl.com with any questions regarding proper towing procedures for vehicles equipped with IFS.

WHEEL LIFT METHOD

This method provides the greatest ease for towing the vehicle. Lifting at the tires helps reduce the risk of possible damage to the suspension and engine components during towing operations, see Figure 6-1.

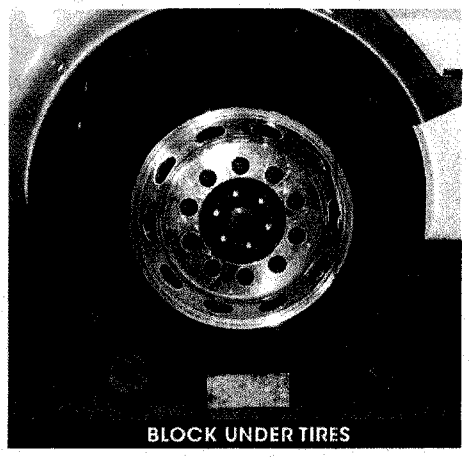
It may be necessary to raise the vehicle and place a block of wood under the tires to provide adequate clearance below the suspension to locate the wheel lift equipment for towing, see Figure 6-2.

FIGURES 6-1



WHEEL LIFT METHOD

FIGURE 6-2



BLOCK UNDER TIRES

SECTION 7

Preventive Maintenance

COMPONENT INSPECTION

The Hendrickson IFS is a low maintenance suspension. However it is necessary to visually inspect the following items every six months or 25,000 miles (40,225 km), whichever comes first, to help ensure all such components function to their highest efficiency. Visual Inspection must include the following items and other components referenced in this section.

- **Air Spring** — Look for chaffing or any signs of spring or component damage.
- **Cradle Assembly** — Inspect loose, damaged or missing fasteners. Check all mounting hardware for proper tightening torque. Correct the torque as necessary. Replace fasteners if loose, and inspect mating components for wear or damage due to loose fasteners. Check if cracked, bent or damaged. Replace if cracked, bent or damaged.
- **Fasteners** — Look for any loose or damaged fasteners on the entire suspension. Make sure all fasteners are tightened to the specified torque. Refer to Torque Specifications Section of this publication. Use a calibrated torque wrench to check torque in a tightening direction. As soon as the fastener starts to move, record the torque. Correct the torque if necessary. Replace any worn or damaged fasteners.
- **Hub** — Visually inspect the hubcap and any signs of leakage and proper fluid level. Visually inspect the wheel seal for any signs of leakage. Replace if necessary, see Component Replacement Section of this publication for replacement procedure.
- **Operation** — All steering components must move freely through the full range of motion from axle stop to axle stop.
- **Pitman Arm** — Check for proper alignment of the timing marks on the Pitman arm and the steering gear sector shaft. If timing marks are not aligned, it will be necessary to re-clock the Pitman arm on the sector shaft. See Pitman Arm Replacement in the Component Replacement Section of this publication.
- **Shock Absorber** — Look for any signs of dents or leakage, misting is not considered a leak. See Shock Absorber Inspection in this section.
- **Steering Gear** — Check for leaks, repair or replace per TRW. For preventive maintenance, service, repair and rebuild of the steering gear contact TRW at 800.879.0899, or see their website www.trw.com/commercial steering.
- **Steering Pivot Points** — Check for looseness at all pivot points. Inspect and lubricate all pivot points. Refer to the Troubleshooting Guide Section of this publication.
- **Tire Wear** — Inspect tires for wear patterns that may indicate suspension damage or misalignment. See Tire Inspection in this section.
- **Upper and Lower Control Arms** — Look for damaged, bent, gouged or cracks to the upper and lower control arms. Replace as necessary. Inspect loose, damaged or missing fasteners. Check all mounting hardware for proper tightening torque. Correct the torque as necessary. Replace fasteners if loose, and inspect mating components for wear or damage due to loose fasteners. Any mating surface that is compromised due to movement caused by loose fasteners, will not maintain torque and proper clamp force.
- **Upper and Lower Control Arm Bushings** — Check for worn, torn, shredded, or excessive movement. See Upper and Lower Control Arm Bushing Inspection in this section.
- **Upright Kingpin Assembly** — Look for damaged, bent, gouged, or cracks to the upright kingpin assembly. Replace if damaged; see Upright Kingpin Assembly in the Component Replacement Section of this publication.

- **Wear and Damage** — Inspect all parts of suspension for wear and damage. Look for bent or cracked parts. Replace all worn or damaged parts.

See the vehicle manufacturer's (OEM's) applicable publications for other preventive maintenance requirements.

LUBRICATION INTERVALS

For vehicles equipped with the Hendrickson IFS, regular lubrication intervals should be followed to help prevent premature wear to the kingpin bushings and tie rod ends, see lubrication chart below.

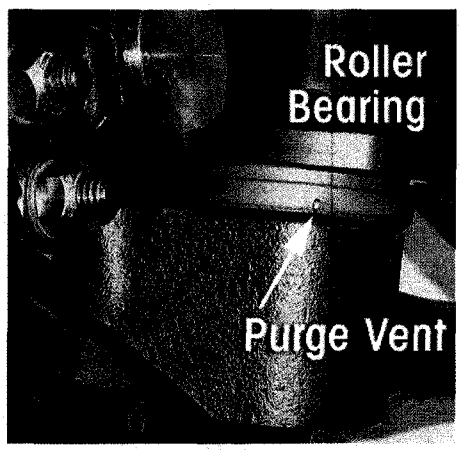
IFS GREASING AND LUBRICATION SPECIFICATIONS				
Component	**Greasing Interval**	**Grease**	**NLGI Grade**	**Outside Temperature**
Kingpin Bushings	Maximum of 25,000 miles (40,225 kilometers) or 90 days, whichever comes first.	Multipurpose Grease	2	Refer to the lubricant manufacturer's specifications for the temperature service limits applicable to your area.
Tie Rod Ends				
Brakes	See brake manufacturer for lubrication requirement and service intervals.			
Front Wheel Bearing	15,000 miles (24,000 kilometers)	SAE 80W-90 GL-5		Refer to the lubricant manufacturer's specifications for the temperature service limits applicable to your area.
NOTE: Lubrication greases acceptable for use on the IFS will carry a designation of NLGI #2 EP and rated GC-LB or equivalent.				

KINGPIN LUBRICATION

On the Hendrickson IFS the kingpin grease fittings are located on the top and bottom of the kingpin grease caps.

1. Place vehicle on the ground.
2. Prior to greasing the kingpins on the wheels must be on the ground.
3. Clean off all the grease fittings and grease gun tip with a clean shop towel prior to lubrication.
4. Lubricate the kingpins through the grease fittings on the top and bottom of the steering knuckle, see Lubrication Specification chart above.

FIGURE 7-1



5. Force the required lubricant into the upper and lower kingpin grease fittings, until new lubricant flows from between the upper kingpin connection and upright kingpin assembly and the thrust bearing purge location, see Figure 7-1.

NOTE Greasing at the lower zerk should purge grease from the thrust bearing shell.

TIE ROD END LUBRICATION

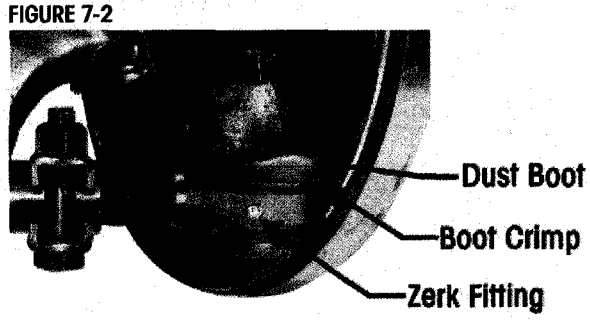
LUBRICATION PROCEDURE

1. Turn the vehicle wheels straight ahead.
2. Wipe the zerk fitting and grease gun tip with clean shop towels.
3. Wipe the seal/boot clean with shop towels.
4. Attach a grease gun to the zerk fitting. Either a hand or pneumatic grease gun is acceptable. If air operated grease gun is used, system air pressure should not exceed 150 psi (1035 kPa).

⚠ CAUTION

EXCEEDING THE MAXIMUM AIR PRESSURE TO THE ZERK FITTING CAN CAUSE DAMAGE TO THE DUST BOOT AND COMPONENT FAILURE.

FIGURE 7-2



5. Dirt, water, and discolored old grease should flow from the relief vents or purge holes near the boot crimp or bellows area, see Figure 7-2. Continue to purge grease until fresh grease flows from the purge area.
6. If the tie rod end is designed for lube service and it will not accept grease proceed as follows:
   a. Remove the zerk fitting.
   b. Inspect the threaded zerk fitting hole in the tie rod end and remove any obstructions.
   c. Install a new zerk fitting.
   d. Continue the lubrication procedure.
   e. If the tie rod end will not accept grease following this procedure it will be necessary to replace the tie rod end, (see Tie Rod End Replacement in the Component Replacement Section of this publication)
7. Apply grease until all the old grease is purged from the boot.

TIE ROD END INSPECTION

INSPECTION PROCEDURE

Before beginning this inspection procedure, the entire system must be unloaded (i.e., the front end of the vehicle must be raised and supported with safety stands).

⚠ CAUTION

DO NOT GREASE THE TIE ROD ASSEMBLY BEFORE PERFORMING THE INSPECTION. DOING SO CAN INHIBIT EFFORTS TO DETERMINE ACTUAL WEAR.

⚠ CAUTION

REPLACE THE ENTIRE TIE ROD END IF THE BOOT IS TORN OR MISSING, FAILURE TO DO SO CAN CAUSE PREMATURE WEAR OF THE TIE ROD END.

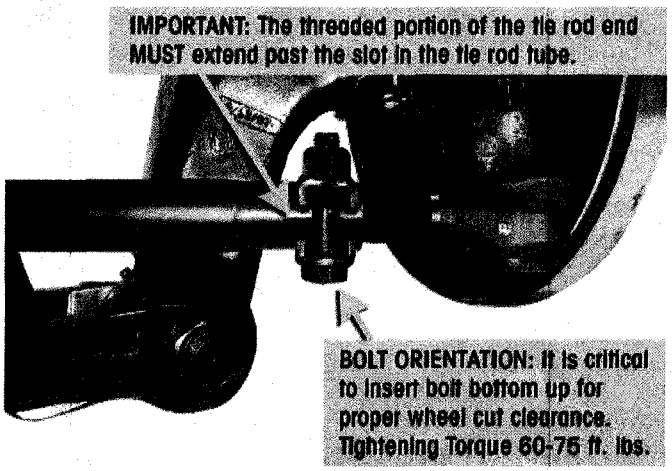
1. Block rear wheels of vehicle. Raise the front end of the vehicle off the ground and support with stands.
2. With the engine off, turn the wheels from full left to full right and then return to the straight-ahead position.
3. Check that the boots are in place and completely installed over the tie rod ends.
4. Check for cracking or tears in the boots. Also check the boot seals for damage. Replace the entire tie rod end if the boot is damaged.

⚠ WARNING

THE CORRECT COTTER PIN MUST BE INSTALLED THROUGH THE TIE ROD END WITH THE CASTLE NUT TIGHTENED TO THE PROPER TORQUE SPECIFICATION IN ORDER TO SECURELY ATTACH THE TIE ROD. LOSS OF THE COTTER PIN CAN CAUSE THE TIE ROD END NUT TO BECOME LOOSE AND ADVERSELY AFFECT VEHICLE STEERING AND POSSIBLY RESULT IN TOTAL LOSS OF STEERING CONTROL.

5. Check that the tie rod end nut is installed and secured with a cotter pin. If the cotter pin is missing, check the nut torque specification and then install a new cotter pin. Always tighten the castle nut to specified torque when setting the cotter pin. **DO NOT** back off the nut to insert cotter pin.

FIGURE 7-3



6. Check that the tie rod end is threaded correctly into the cross tube and is engaged deeper than the end of the cross tube slot. The tie rod end must be visible the entire length of the cross tube slot, see Figure 7-3.
7. Check that zerk fittings are installed. Replace a damaged zerk fitting with a new one.

⚠ CAUTION

DO NOT USE THE FOLLOWING ITEMS OR METHODS TO CHECK FOR MOVEMENT OF THE TIE ROD ASSEMBLY. DAMAGE TO COMPONENTS CAN RESULT IF:

- A CROW BAR, PICKLE FORK OR 2 X 4 IS USED.
- ANYTHING OTHER THAN HANDS ARE USED TO GRASP THE CROSS TUBE ASSEMBLY (CAN RESULT IN DAMAGE TO THE CROSS TUBE).
- EXCESSIVE PRESSURE OR FORCE IS APPLIED TO THE TIE ROD ENDS OR THE JOINTS OF THE ASSEMBLY.

8. By hand or using a pipe wrench, with jaw protectors to avoid gouging the cross tube, rotate the cross tube toward the front of the vehicle and then toward the rear. After rotating, center the cross tube. If the cross tube will not rotate in either direction, replace both tie rod ends, see Figures 7-4 and 7-5.

FIGURE 7-4

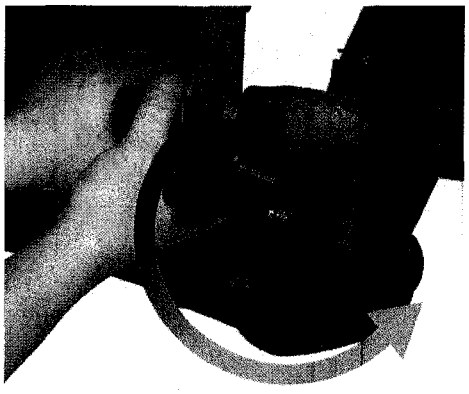
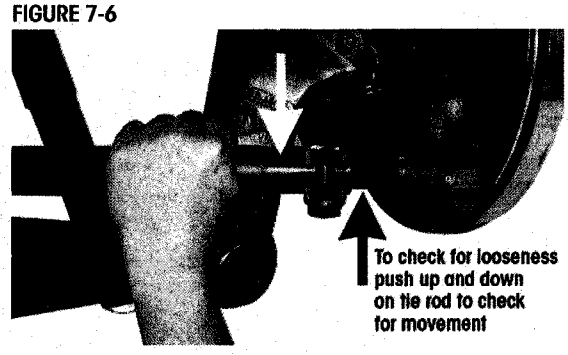


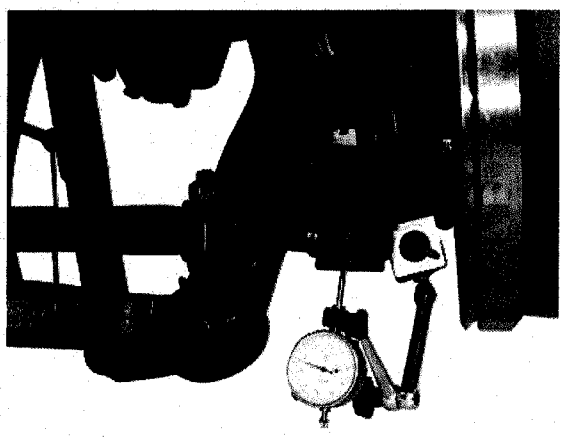
FIGURE 7-5

FIGURE 7-6



9. Position yourself directly below the tie rod end. Using both hands, grab the assembly end as close to the tie rod end as possible (no more than 6" or 152.4 mm). Apply hand pressure with reasonable human effort vertically up and down in a push-pull motion several times (using approximately 50-100 lbs. of force). Check for any movement or looseness at both tie rod end locations, see Figure 7-6.

FIGURE 7-7



10. If there is any movement in the tie rod assembly, install a magnetic based dial indicator on the Ackermann arm, see Figure 7-7.
11. Set the dial indicator to zero.
12. Apply hand pressure with reasonable human effort vertically up and down in a push-pull motion several times (using approximately 50-100 lbs. of force). Observe the reading on the dial indicator.
13. If the reading is more than 0.060", replace both tie rod ends at the next service interval.
14. If a tie rod end exhibits 0.125" of movement by hand, the vehicle should be removed immediately from use and the tie rod end be replaced.

NOTE

According to the Commercial Vehicle Safety Alliance (CVSA), the vehicle "out of service" criteria is: Any motion other than rotational between any linkage member and its attachment point of more than 1/8" (3 mm) measured with hand pressure only. (393.209(d), published in the North American Standard Out-of-Service Criteria Handbook, April 1, 2006.)

TIRE INSPECTION

The leading causes of tire wear are the following, in order of importance:

1. Tire Pressure
2. Toe Setting
3. Thrust Angle
4. Camber

The following tire Inspection guidelines are based upon TMC (Technology & Maintenance Council) recommended practices. Any issues regarding irregular tire wear where Hendrickson is asked for assistance, will require tire and alignment maintenance records, reference TMC's literature numbers RP 219A, RP 230, or RP 642.

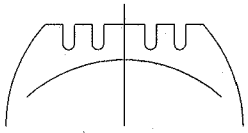
Tire wear is normally the best indicator of vehicle alignment condition. If tires are wearing too rapidly or irregularly, alignment corrections may be needed. The tire wear patterns described below can help isolate specific alignment problems.

The most common conditions of concern are:

- Overall Fast Wear (Miles per 32nd)
- Feather Wear
- Cupping
- Diagonal Wear
- Rapid Shoulder Wear (One Shoulder Only)
- One-Sided Wear

FIGURE 7-8

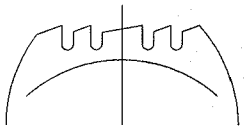
OVERALL FAST WEAR (Miles per 32nd)



Overall Fast Wear — Fast wear can be described as exhibiting a good, but accelerated wear pattern. It is typically caused by operating conditions, such as mountainous terrain, frequency and severity of turning, abrasive road surfaces in combination with vehicle configurations and their attributes-such as power steering, heavy axle loads, high wheel cuts, setback axles, short wheel base tractors, long wheel base straight trucks. To correct this problem, consult with vehicle and tire manufacturers when specifying equipment or replacing tires. For more information, see TMC RP 219A publication, page 11. For information on how to accurately measure and record tire rates, see TMC RP 230 publication.

FIGURE 7-9

FEATHER WEAR



Feather wear — Tread ribs or blocks worn so that one side is higher than the other resulting in step-offs across the tread face. Generally, ribs or blocks exhibit this wear. To spot this problem, do the following:

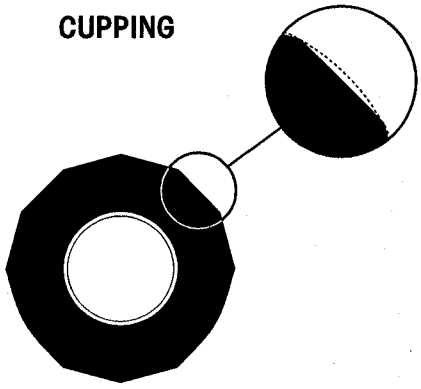
With one hand flat on the tread of the tire and a firm down pressure, slide your hand across the tread of the tire. In one direction, the tire will feel smooth and in the opposite direction there will be a sharp edge to the tread. Typical causes of feather wear include: excessive side force scrubbing, resulting from conditions of misalignment such as excessive toe, drive axle misalignment, worn, missing or damaged suspension components, bent tie rods or other chassis misalignment.

To correct this problem, tires can be rotated to another axle for maximum utilization of remaining tread. Additionally, diagnose the vehicle itself and correct misalignment condition as required. If steer tire feathers are in opposite directions, an improper toe condition is most likely the cause. For more information, see TMC RP 219A publication, page 5.

If feather wear on both steer tires is in the same direction, drive axle or other chassis misalignment is indicated. If one steer tire shows feather wear and the other steer tire has normal wear, a combination of toe and drive axle or chassis misalignment is indicated.

FIGURE 7-10

CUPPING



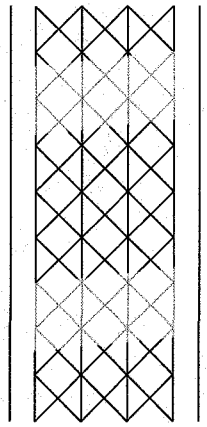
Cupping — Localized, dished out areas of fast wear creating a scalloped appearance around the tire. Cupping, which appears around the tire on the shoulder ribs, may also progress to adjoining ribs, see TMC RP 219A publication, page 7.

Cupping is usually a result of moderate-to-severe imbalance, improper rim/wheel mounting, excessive wheel end play or other assembly non-uniformity. It can also be due to lack of shock absorber control on some suspension types.

To solve cupping problems:

- *Tires* – Correct mismount or balance problem. If ride complaints arise, steer tires may be rotated to drive or trailer axle.
- *Vehicle* – Diagnose component imbalance condition, i.e., wheel, rim, hub, brake, drum. Correct as necessary.

FIGURE 7-11
DIAGONAL WEAR

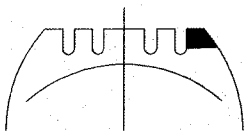


Diagonal Wear — Can be described as localized flat spots worn diagonally across the tread at approximately 25-35° angles, often repeating around the tread circumference. For more information, see TMC RP 219A publication, page 20.

Diagonal wear is usually caused by bad wheel bearings, toe out, mismounting of tire and wheel assembly to axle, and mismatched duals for size and/or inflation pressures. It may start as brake skid. Diagonal wear is aggravated by high speed empty or light load hauls.

To correct diagonal wear, reverse direction of rotation of the tire. If wear is excessive, true tire. If the source of trouble is the vehicle, diagnose cause and correct as needed.

FIGURE 7-12
RAPID SHOULDER WEAR (One Shoulder Only)



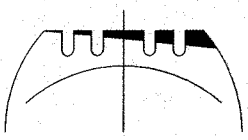
Rapid Shoulder Wear (One Shoulder Only) — Is defined as a tire worn on the edge of one shoulder, sometimes extending to inner ribs. It can progress to diagonal wipeout. For more information, see TMC RP 219A publication, page 22.

This wear condition is usually caused by excessive toe or excessive camber. These conditions can be created by a misaligned or bent axle and can also be caused by loose or worn wheel bearings.

To correct this type of rapid shoulder wear:

- *Tires* – Change direction of rotation of tire. If shoulder wear is severe, remove and retread.
- *Vehicle* – Diagnose misalignment and/or mechanical condition and correct.

FIGURE 7-13
ONE-SIDED WEAR



One-sided wear — Is excessive wear on one side of tire extending from the shoulder towards the center of the tread. For more information, see TMC RP 219A, page 26.

One-sided wear is usually caused by improper alignment, worn kingpins, loose wheel bearings, excessive camber, excessive axle loads, non-parallel axles, or non-uniform tire and wheel assembly caused by improper bead seating or bent wheel.

To correct one-sided wear:

- *Tires* – Depending on severity, rotate tires to another axle position or, if worn to minimum tread depths, submit for possible retreading.
- *Vehicle* – Diagnose mechanical problem and correct.

SHOCK ABSORBER INSPECTION

Hendrickson uses a long service life, premium shock absorber on all IFS suspensions. When the shock absorber replacement is necessary, Hendrickson recommends that the shock absorbers be replaced with identical Hendrickson Genuine parts for servicing. Failure to do so will affect the suspension performance, durability, and will void the warranty.

Inspection of the shock absorber can be performed by doing a heat test, and a visual inspection. For instructions on shock absorber replacement see the Component Replacement Section of this publication. It is not necessary to replace shock absorbers in pairs if one shock absorber requires replacement.

HEAT TEST

1. Drive the vehicle at moderate speeds on rough road for minimum of fifteen minutes.

⚠ WARNING

DO NOT GRAB THE SHOCK AS IT CAN POSSIBLY CAUSE PERSONAL INJURY.

2. Lightly touch the shock body carefully below the dust cover, see Figure 7-14.

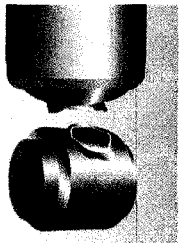
3. Touch the frame to get an ambient reference. A warm shock absorber is acceptable; a cold shock absorber should be replaced.
4. To inspect for an internal failure, remove and shake the suspected shock. Listen for the sound of metal parts rattling inside. Rattling of metal parts can indicate that the shock has an internal failure.

FIGURE 7-14

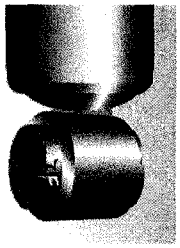
VISUAL INSPECTION

Look for these potential problems when doing a visual inspection. Inspect the shock absorbers fully extended. Replace as necessary.

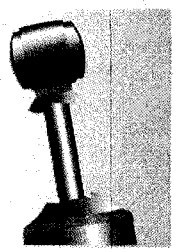
FIGURE 7-15



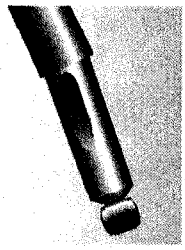
Damaged upper or lower mount



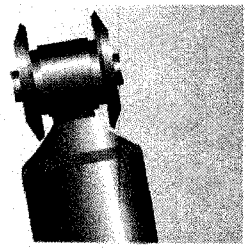
Damaged upper or lower bushing



Damaged dust cover and / or shock body



Bent or dented shock

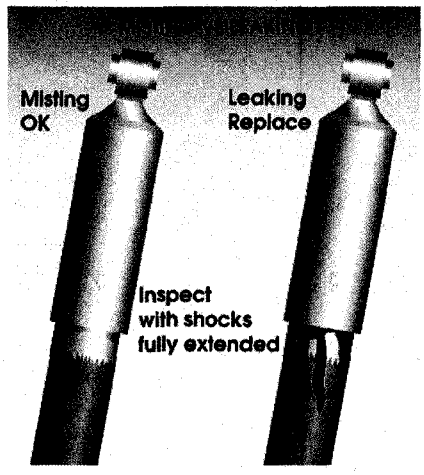


Improper installation Example: washers (if equipped) installed backwards.

LEAKING VS. MISTING SHOCK VISUAL INSPECTION

The inspection must not be conducted after driving in wet weather or a vehicle wash. Shocks needs to be free from water. Many shocks are often misdiagnosed as failures. Misting is the process whereby very small amounts of shock fluid evaporate at a high operating temperature through the upper seal of the shock. When the "mist" reaches the cooler outside air, it condenses and forms a film on the outside of the shock body. Misting is perfectly normal and necessary function of the shock. The fluid which evaporates through the seal area helps to lubricate and prolong the life of the seal.

FIGURE 7-16



A shock that is truly leaking and needs to be replaced will show signs of fluid leaking in streams from the upper seal. These streams can easily be seen when the shock is fully extended, underneath the main body (dust cover) of the shock. Look for these potential problems when doing a visual inspection. Inspect the shock absorbers fully extended. Replace as necessary.

NOTE

The ⊞ IFS suspension is equipped with a premium seal on the shock, however this seal will allow for misting to appear on the shock body (misting is not a leak and is considered acceptable).

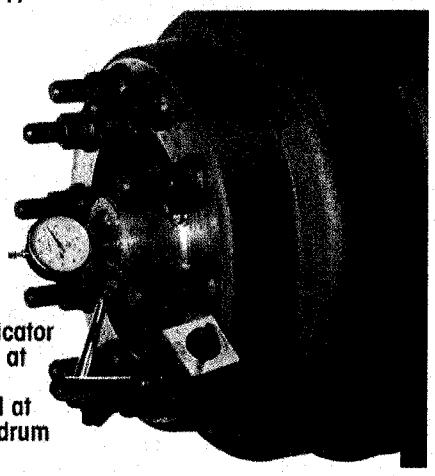
If the shock is damaged install new shock absorber as detailed in the Component Replacement Section of this publication.

WHEEL BEARING END PLAY INSPECTION

This inspection can be made with or without the wheel and brake drum on the vehicle.

NOTE The correct specification to allow the wheel to rotate freely is 0.001" to 0.005" end play.

FIGURE 7-17



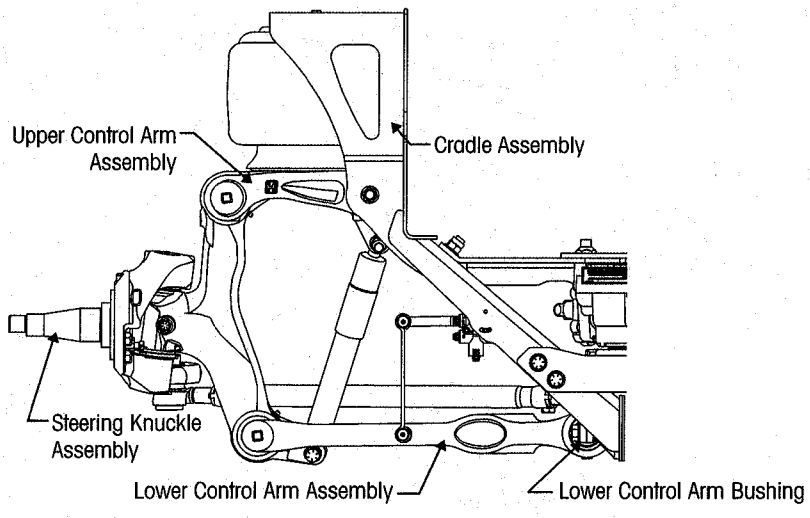
5. Verify end play with a dial indicator, see Figure 7-17. Wheel end play is the free movement of the wheel assembly along the spindle axis.
   a. Attach a dial indicator with its magnetic base to the hub.
   b. Remove hub cap plug.
   c. Adjust the dial indicator so that its plunger or pointer is against the end of the spindle with its line of action parallel to the axis of the spindle.
   d. Grasp the hub assembly at the 3 o'clock and 9 o'clock positions. Push the hub in and out while oscillating it to seat the bearings. Read bearing end play as the total indicator movement.

NOTE If end play is not within specification, wheel bearing adjustment is required, see Wheel Bearing Adjustment in the Alignment & Adjustments Section of this publication.

UPPER AND LOWER CONTROL ARM BUSHING INSPECTION

Visually inspect upper and lower control arm bushings for torn or shredded rubber, inspect for bent, cracked, or broken bushings and also for end hubs that have an elongated "oval" shape, see Figure 7-18. Any of these conditions require component replacement. Visually inspect for any metal to metal contact between the mounting surfaces and control arms.

FIGURE 7-18



KINGPIN BUSHING INSPECTION

INSPECTION PROCEDURE

1. Chock the wheels to help prevent the vehicle from moving. Set the parking brake.
2. Use a jack to raise the vehicle until the wheels are off the ground. Support the vehicle with safety stands.
3. Checking the upper kingpin bushing. Install the base of a dial indicator onto the upright kingpin assembly, see Figure 7-19.
4. Set the dial indicator to "0" zero.
5. Move the top of the tire in and out by applying reasonable constant pressure and then release, see Figure 7-20.
6. Check the reading on the dial indicator. If the dial indicator moves more than 0.015", the upper bushing is worn or damaged, replace both kingpin bushings. Refer to the Kingpin Bushing replacement procedure in the Component Replacement Section of this publication.

FIGURE 7-19

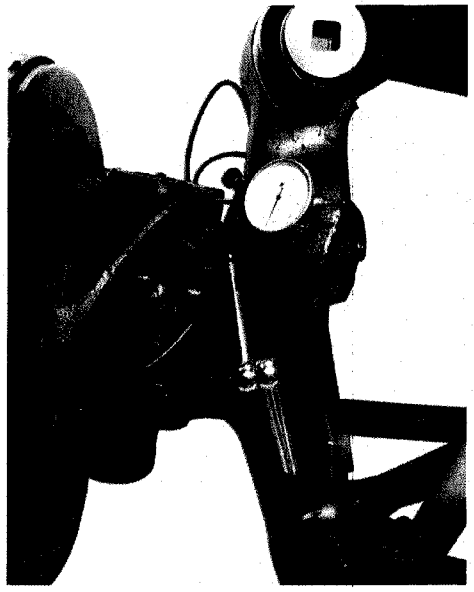


FIGURE 7-20

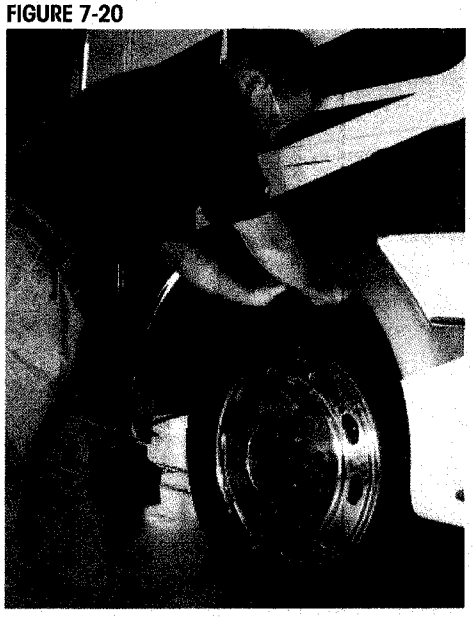
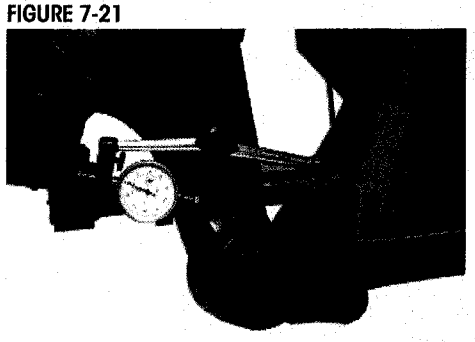


FIGURE 7-21



7. **Checking the lower kingpin bushing.** Install a dial indicator so that the base is on the upright kingpin assembly and the indicator tip is against the inside of the bottom of the knuckle, see Figure 7-21.
8. Set the dial indicator to "0" zero.
9. Move the bottom of the tire in and out. If the dial indicator moves more than 0.015", the lower bushing is worn or damaged, replace both kingpin bushings. Refer to the Component Replacement Section of this publication.

NOTE If one bushing is worn or damaged, it is mandatory to replace both the top and bottom bushings on that knuckle assembly.

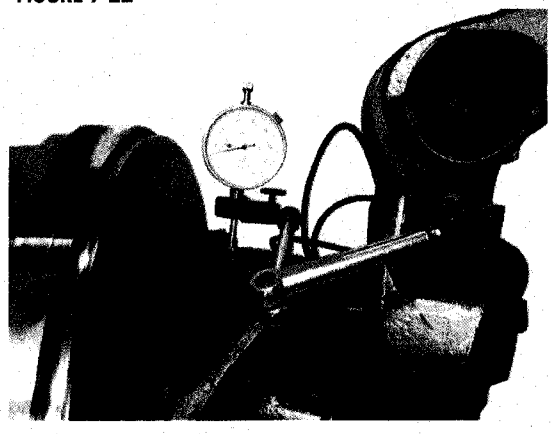
STEERING KNUCKLE INSPECTION

CHECKING VERTICAL END PLAY (UP AND DOWN MOVEMENT)

The operating spec for vertical clearance on the steering knuckle is 0.008" to 0.030".

1. Chock the rear tires to help prevent the vehicle from moving.
2. Set the parking brakes.
3. Use a jack to raise the vehicle until both tires are 1" off the ground.

FIGURE 7-22

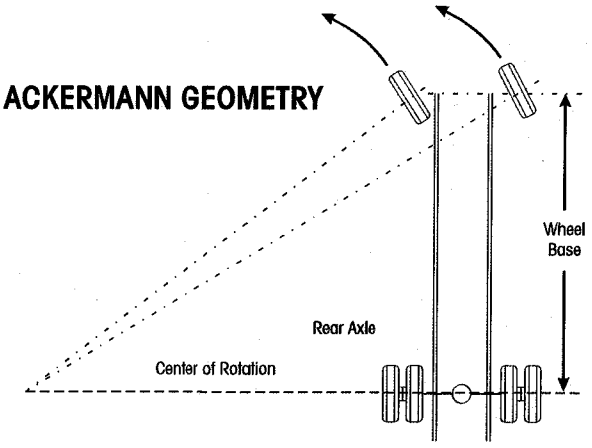


4. Place a dial indicator on each side of the upright kingpin assembly as follows:
   a. Place the magnetic dial indicator base on the upright kingpin assembly, see Figure 7-22.
   b. Place the tip of the dial indicator on the top of the upper steering knuckle (not on the grease cap).
5. Set the dial indicator to "0" (zero).
6. Lower the jack.
7. If vertical end play is greater than 0.030", or below 0.008" an adjustment of the upper knuckle is necessary.
   - If vertical end play is greater than 0.030", install shims (Hendrickson Part No. 60259-002) between the top of the axle and the bottom of the upper steering knuckle to obtain the proper vertical end play specification.
   - If the vertical end play is less than 0.008", remove shims (Hendrickson Part No. 60259-002) between the top of the axle and the bottom of the upper steering knuckle to obtain the proper vertical end play specification.

SECTION 8
Alignment & Adjustments

ALIGNMENT DEFINITIONS

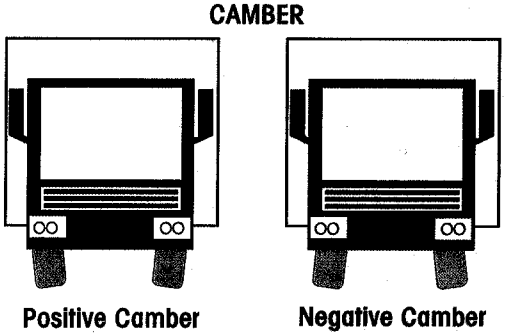
FIGURE 8-1



Ackermann Steering Geometry — The Hendrickson IFS steering system geometry attempts to provide free rolling of front tires in a turn. Ackermann geometry is dependent upon the steering system track-width and wheelbase of the vehicle. Improper geometry results in wheel scrub in turns which generally appears as toe wear on the tire. Usually more wear is present on one side of the vehicle than the other due to the operational route of the vehicle.

Bump Steer (Feedback) — The feedback felt through the steering linkage to the steering wheel when a steer axle tire hits a bump in the road. This occurs because the axle-end of the drag link and the axle attachment point of the spring do not travel in parallel circular arcs as the suspension moves up and down. This condition can also be caused by trapped air in the power steering system.

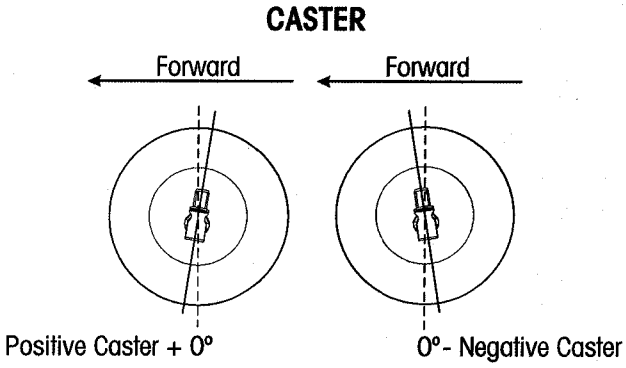
FIGURE 8-2



Camber — The angle formed by the inward or outward tilt of the wheel reference to a vertical line. Camber is positive when the wheel is tilted outward at the top and is negative when the wheel is tilted inward at the top.

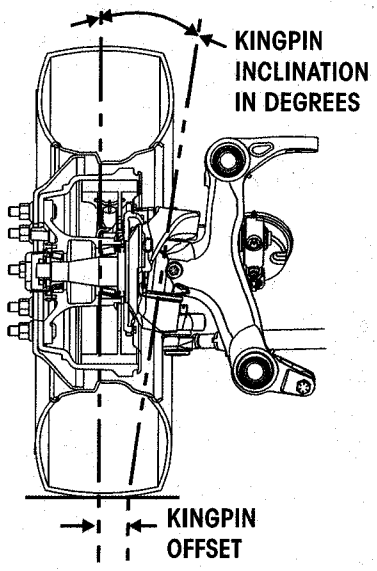
Excessive positive camber may cause smooth wear on the outer half of the tire tread. Excessive negative camber may cause wear on the inner half of the tread. Static-unloaded camber angles are built into the axle to put the loaded tire perpendicular to the road.

FIGURE 8-3



Caster — The forward or rearward tilt of the steering axle kingpin in reference to a vertical line. The angle is measured in degrees. Caster is positive when the top of the steering axis is titled rearward and is negative when the tilt is forward. Proper caster is important for directional stability and returnability. Too much positive caster can cause shimmy, excessive steering effort and is normally a vehicle performance and handling consideration. Uneven positive caster may create a steering pull toward the side with the lower caster. This attribute may be used to compensate for crowned roads.

FIGURE 8-4



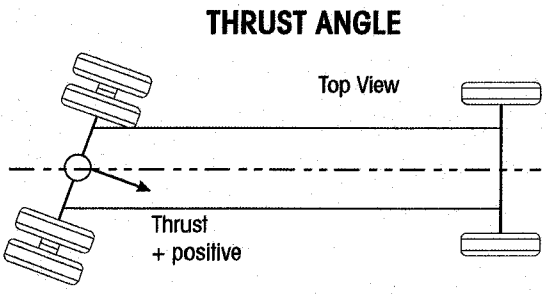
Kingpin Inclination (KPI) — The inward tilt of the kingpin from the vertical. This front suspension parameter has a pronounced effect on steering effort and returnability. As the front wheels are turned around an inclined kingpin, the front of the truck is lifted. This lifting of the vehicle is experienced as steering effort when the turn is executed and exhibits itself as recovery force when the steering wheel is released.

Kingpin Offset — The distance between the center of the tire patch and intersection of the kingpin axis with the ground. This parameter of front end geometry is important in vehicles without power steering and has a major effect on static steering. If there is no kingpin offset, the tires must scrub around the center of the pin patch when turned in a static condition, resulting in higher static steering efforts.

Steering Arm — The component that connects the drag link to the axle knuckle assembly.

Tie Rod Arm (Ackermann-Arm, Cross Tube Arm) — The component that transmits steering forces between left and right axle knuckle assemblies through the cross tube assembly.

FIGURE 8-5

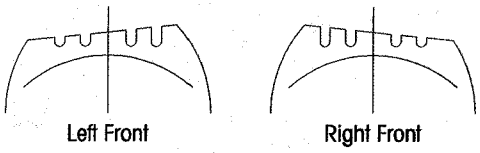


Thrust Angle, Tracking, or Square

The angle formed by the centerline of the vehicle frame (geometric centerline) and the direction that an axle points. As indicated by the term "square", the ideal value for the angle is 0° or when the axle centerline is at 90° or perpendicular to the geometric centerline. Thrust or tracking to the right is positive, and to the left is negative.

A steering correction is required to offset the effect of the thrust angles and keeps the vehicle traveling in a straight line. It results in a lateral offset between the steer and drive axle tires commonly referred to as "dog tracking."

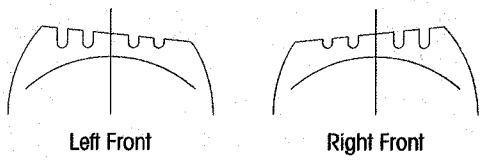
FIGURE 8-6



TOE-IN

Toe-in — is when the horizontal line intersects in front of the wheels, or the wheels are closer together in front than in the back. Toe-in is commonly designated as positive, toe-out as negative. Excessive toe-in wears the outside edge of the tires. Steer axle toe is adjustable to reduce wear to the leading edge of the tire and also to avoid road wander. Toe is adjusted in a static, unloaded condition so that the tires will run in a straight line under a dynamic, loaded condition.

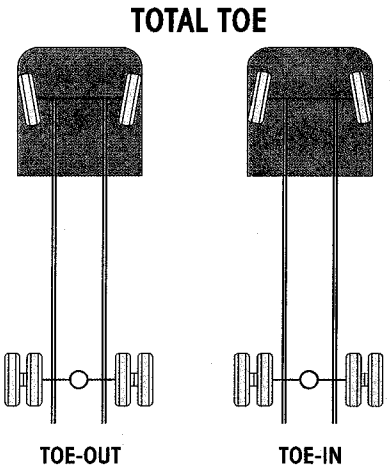
FIGURE 8-7



TOE-OUT

Toe-out — Is when the horizontal lines intersect behind the wheels, or the wheels are closer together in back than in front. Toe-in is commonly designated as positive, toe-out as negative. Excessive toe-out wears the inside edge of the tires. Steer axle toe is adjustable to reduce wear to the leading edge of the tire and also to avoid road wander. Toe is adjusted in a static, unloaded condition so that the tires will run in a straight line under a dynamic, loaded condition.

FIGURE 8-8



Toe-Out on Turns — (See Ackermann Geometry). Excessive turning angles such as those encountered in pickup and delivery operations may contribute to premature tire wear. Be advised that the greater the turning angles, the more that toe and camber change. If you have any doubt regarding the optimum turning angles for your operation, contact the vehicle's manufacturer, axle OEM, tire OEM and alignment equipment manufacturer for advice.

Total Toe — The angle formed by two horizontal lines through the planes of two wheels. Steer axle toe Is adjustable to reduce wear to the leading edge of the tire and also to avoid road wander. Toe is adjusted in a static, unloaded condition so that the tires will run in a straight line under a dynamic, loaded condition.

INSPECTION PRIOR TO ALIGNMENT

WHEELS AND TIRES

Examine the following items:

- The tires are inflated to the manufacturer's specified tire pressure.
- The steer axle tires are the same size and type.
- The lug nuts are tightened to manufacturer's specified torque.
- The wheels are balanced and check for tire to rim runout.
- The wheels and tires are free of excessive wear and damage.
- Wheel bearing end play is within OEM specification.

FRONT SUSPENSION

Inspect the following:

- All fasteners are installed and tightened to the specified torque. See Torque Specification Section of this publication.
- Air springs are free of wear or damage (if equipped).
- Shock absorbers are free of wear and damage.
- Vehicle ride height for both the front and rear are within specification. Follow manufacturer's guidelines (if equipped).

INSPECT TIE ROD ENDS

Perform "Tie Rod Inspection" procedure, refer to the Preventive Maintenance Section of this publication.

REAR AXLE AND REAR SUSPENSION

Rear axle misalignment can cause front tire wear. If the outer edge of one front tire is worn and the inner edge of the other front tire is worn, check the following:

- Make sure the rear axle is correctly aligned. Refer to the procedure from the manufacturer of the vehicle or the suspension.
- All fasteners including U-bolts (if applicable) are installed and tightened to the specified torque.
- The leaf or air springs are not worn or damaged.

- The bushings in the suspension system are not worn or damaged.
- The torque rods (if used) are correctly adjusted (if adjustable).
- The frame is not bent or twisted.
- Refer to any additional recommendations and specifications from the manufacturer of vehicle on rear axles and suspensions. Reference the TMC (The Technology & Maintenance Council) Guidelines for Total Vehicle Alignment.

FRONT WHEEL ALIGNMENT

Hendrickson recommends technicians review TMC's publication TMC (Technology & Maintenance Council) "Guidelines for Total Vehicle Alignment".

The Hendrickson IFS front wheel alignment specification can be found in the Front Wheel Alignment Specification Section of this technical publication.

Check the total vehicle wheel alignment when the following occur:

- Every 80,000 to 100,000 miles, or 12-18 months (normal maintenance).
- When the vehicle does not steer correctly.
- To correct a tire wear condition.
- There are two types of front wheel alignment:
  a. *Minor alignment* – a minor front wheel alignment is done **for all** normal maintenance conditions, see below.
  b. *Major alignment* – a major alignment is done when uneven or excessive tire wear is evident, or response at the steering wheel is sluggish, or the need for major wheel alignment check and adjustment is required, see below.

MINOR FRONT WHEEL ALIGNMENT

Perform the minor front wheel alignment in the following sequence:

1. Inspect all systems that affect wheel alignment. Refer to "Inspection Prior to Alignment" in this section.
2. Check the wheel bearing end play.
3. Check and adjust the vehicle ride height as specified in the Preventive Maintenance Section of this publication.
4. Check toe and adjust if necessary.

MAJOR FRONT WHEEL ALIGNMENT

Be certain to follow wheel alignment inspection intervals as specified by the original equipment manufacturer. Before performing a major front wheel alignment it is recommended that alignment equipment calibration be checked to ensure proper vehicle alignment.

Major wheel alignment is accomplished in the following sequence of operation:

1. Inspect all the systems that influence the wheel alignment. Refer to the "Inspection Prior to Alignment" in this section.
2. Check and adjust the maximum turn angle, (see "Steering Stop Procedure" in this section), see Figures 8-9 and 8-10.

FIGURE 8-9

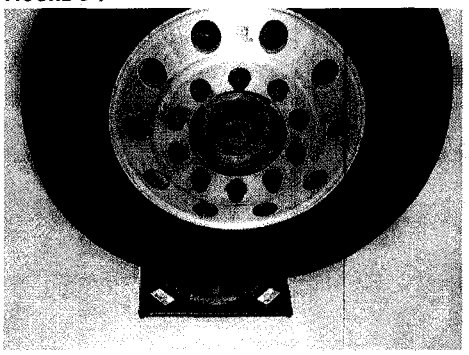
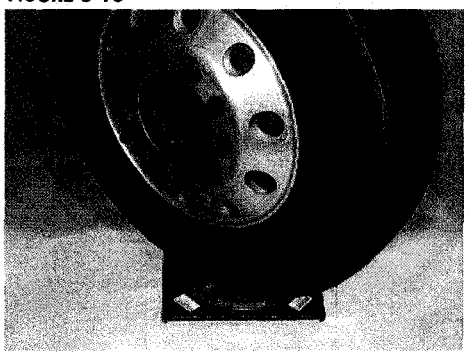


FIGURE 8-10



3. If the vehicle has power steering, check and adjust, if necessary, the pressure relief in the power steering system. Refer to vehicle manufacturer's specifications See Steer Stops in the Alignment & Adjustments Section of this publication.
4. Verify the turning angle per step 2, (toe-out during vehicle turns or the Ackermann angle). Refer to OEM specifications.
5. Check the kingpin (or steering axis) inclination (the kingpin inclination is not adjustable). Refer to "Kingpin Inclination", in the Definitions under the Alignment & Adjustments Section of this publication.
6. Check the camber angle. **DO NOT** attempt to adjust. Refer to "Camber" in the Definitions under the Alignment & Adjustments Section of this publication.
7. Check caster angle. Refer to "Caster" in the Definitions under the Alignment & Adjustments Section of this publication. Cross caster is the difference between the caster readings for left and right side of the vehicle.

SERVICE HINT

Prior to checking caster confirm that the vehicle is at its proper ride height front and rear. The front and rear ride height must be correct to achieve proper caster.

8. Check and adjust toe, refer to adjusting the Toe-In under "Definitions" in the Alignment & Adjustments Section of this publication.

CAMBER ADJUSTMENT

Perform the camber adjustment after alignment readings are completed that includes:

- Height control valve ride height as specified in the Preventive Maintenance Section of this publication.
- Tire pressure to the manufacturer's specifications.

ADJUSTMENT PROCEDURE

1. Place the vehicle on a level floor.
2. Chock the wheels.
3. Raise and support the frame.

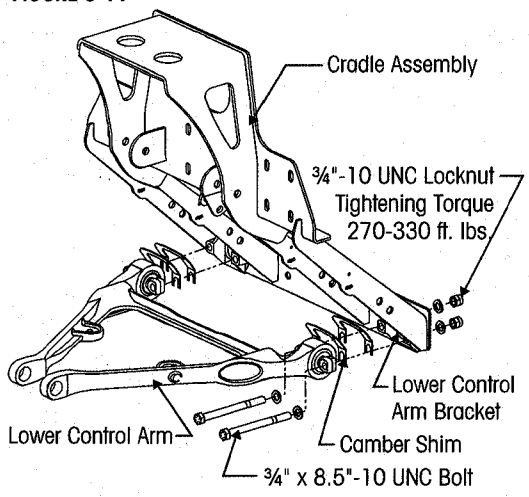
⚠ WARNING

PRIOR TO AND DURING DEFLATION AND INFLATION OF THE AIR SUSPENSION SYSTEM, ENSURE THAT ALL PERSONNEL AND EQUIPMENT ARE CLEAR FROM UNDER THE VEHICLE AND AROUND THE SERVICE AREA, FAILURE TO DO SO CAN CAUSE SERIOUS PERSONAL INJURY, DEATH, OR PROPERTY DAMAGE.

4. See additional Air Spring Warnings and Instructions in the Important Safety Notice Section of this publication prior to deflating or inflating the suspension system.
5. Disconnect the height control valve linkage and allow the suspension to fully deflate.
6. Loosen the lower control arm to cradle assembly fasteners, **DO NOT** remove.
7. Add lower control arm camber shim(s) to increase camber (–).
8. Remove lower control arm camber shim(s) to decrease camber (+).

9. Tighten the lower control arm fasteners to 270-330 foot pounds torque, see Figure 8-11.
10. See additional Air Spring Warnings and Instructions in the Important Safety Notice Section of this publication prior to deflating or inflating the suspension system.
11. Connect the height control valve linkage and allow the suspension to fully inflate.
12. Remove wheel chocks.

FIGURE 8-11



SINGLE RIDE HEIGHT VERIFICATION

1. Drive the vehicle onto a level surface.
2. Free and center all suspension joints by slowly moving vehicle back and forth several times without using the brakes. It is **IMPORTANT** when coming to a complete stop to verify the brakes are released.
3. Chock drive wheels.
4. Verify that the air system is at full operating pressure.

⚠ WARNING

PRIOR TO AND DURING DEFLATION AND INFLATION OF THE AIR SUSPENSION SYSTEM, ENSURE THAT ALL PERSONNEL AND EQUIPMENT ARE CLEAR FROM UNDER THE VEHICLE AND AROUND THE SERVICE AREA, FAILURE TO DO SO CAN CAUSE SERIOUS PERSONAL INJURY, DEATH, OR PROPERTY DAMAGE.

5. See additional Air Spring Warnings and Instructions in the Important Safety Notice Section of this publication prior to deflating or inflating the suspension system.
6. Detach the lower rubber grommet of the height control valve linkage from the lower stud and exhaust the suspension system air by lowering the height control valve linkage arm.
7. Re-attach the lower grommet of the height control valve linkage onto the lower stud to fill the suspension system with air. Wait until the airflow to front air springs has stopped.
8. Measure the suspension reference ride height using **Method A or B**. If reference ride height is out of specification, it will be necessary to adjust the ride height.

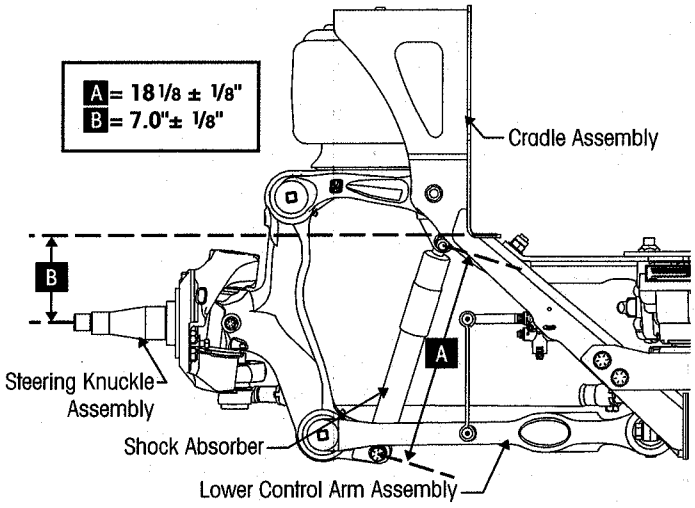
   METHOD A — Reference ride height measuring shock absorber length.

   a. Using a tape measure, measure the referenced vertical ride height on the drive axle from the centerline of the upper shock mounting bolt to the centerline of the lower shock mounting bolt.
   b. The referenced ride height measurement should be 18⅛" ± ⅛" (See dimension **"A"** in Figure 8-12).
   c. If the ride height is not within this range it will be necessary to adjust the ride height. See Adjustment Procedure in this section.

   METHOD B — Design ride height

   a. Measure from the bottom of the frame rail to the axle centerline.
   b. The ride height dimension should be 7.0" ± ⅛". (See dimension **"B"** in Figure 8-12)
   c. If the ride height is not within this range it will be necessary to adjust the ride height. See Adjustment Procedure in this section.

FIGURE 8-12



ADJUSTMENT PROCEDURE

1. Verify that the air system is at full operating pressure.

SERVICE HINT

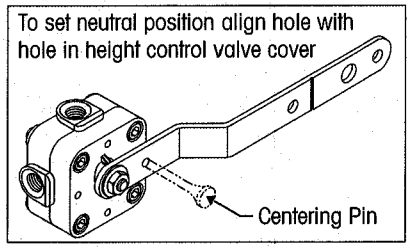
It is very important that the leveling valve be cycled completely before and after any ride height adjustments. Cycling of the leveling valve will help make the adjustment more accurate.

⚠ WARNING

PRIOR TO AND DURING DEFLATION AND INFLATION OF THE AIR SUSPENSION SYSTEM, ENSURE THAT ALL PERSONNEL AND EQUIPMENT ARE CLEAR FROM UNDER THE VEHICLE AND AROUND THE SERVICE AREA, FAILURE TO DO SO CAN CAUSE SERIOUS PERSONAL INJURY, DEATH, OR PROPERTY DAMAGE.

2. See additional Air Spring Warnings and Instructions in the Important Safety Notice Section of this publication prior to deflating or inflating the suspension system.
3. Cycle the air system. Detach the lower rubber grommet of the height control valve linkage from the lower stud and exhaust the suspension system air by lowering the height control valve linkage arm.
4. Refill the suspension by raising the height control valve arm by hand, so that the air springs are above the proper ride height.
5. Lower the leveling valve arm to exhaust the air system until the suspension is at the proper ride height.
6. Use a 1/8" wooden dowel rod (golf tee) to set the neutral position for the height control valve by aligning the hole in the leveling arm with the hole in the height control valve cover, as shown in Figure 8-13. **DO NOT** use a metal rod or nail as this may cause damage to the height control valve.

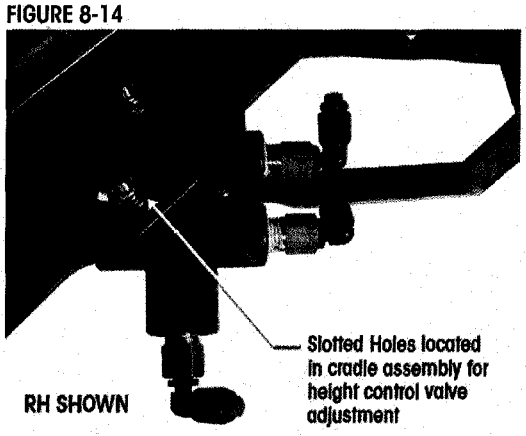
FIGURE 8-13



NOTE

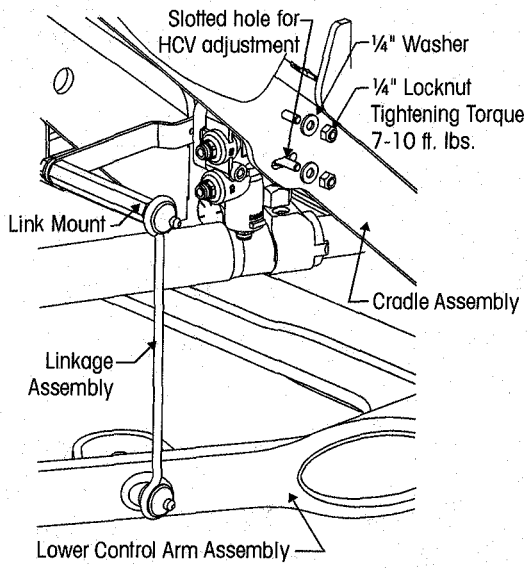
Hendrickson recommends the following be performed during any type of ride height adjustment to help prevent socket head cap screws from loosening from the height control valve housing, potentially causing subsequent air leaks from the height control valve.

FIGURE 8-14



7. Prior to adjusting the height control valve, clean the threads of the mounting fasteners of any debris and corrosion.
8. To adjust the height control valve, loosen the mounting locknuts.
9. From the rear of the vehicle looking forward, pivot the valve body counter clockwise to decrease the ride height and clockwise to increase the ride height, see Figure 8-14.
10. Pivot the valve body around the mounting bolt until the link mount stud inserts directly into the center hole of the rubber grommet at the proper height. Check the rubber grommet for any tearing or damage, replace as necessary.

FIGURE 8-15



11. Tighten the mounting locknuts to 7-10 foot pounds torque after the adjustment is made, see Figure 8-15. Install a (5 mm) Allen wrench in the inboard socket head cap screws to prevent the screws from turning while re-tightening the locknuts.
12. Remove the dowel from the height control valve.
13. Cycle the air from the system by lowering the height control valve arm.
14. Reconnect the height control valve linkage rubber grommet to the link mount. Allow the air suspension system to completely fill with air.
15. Recheck the ride height after adjustment.
16. Repeat steps 2 through 11 until the ride height is within specification.

DUAL RIDE HEIGHT VERIFICATION (If equipped)

1. Drive the vehicle onto a level surface.
2. Free and center all suspension joints by slowly moving vehicle back and forth several times without using the brakes. It is **IMPORTANT** when coming to a complete stop to verify the brakes are released.
3. Chock drive wheels.
4. Verify that the air system is at full operating pressure.

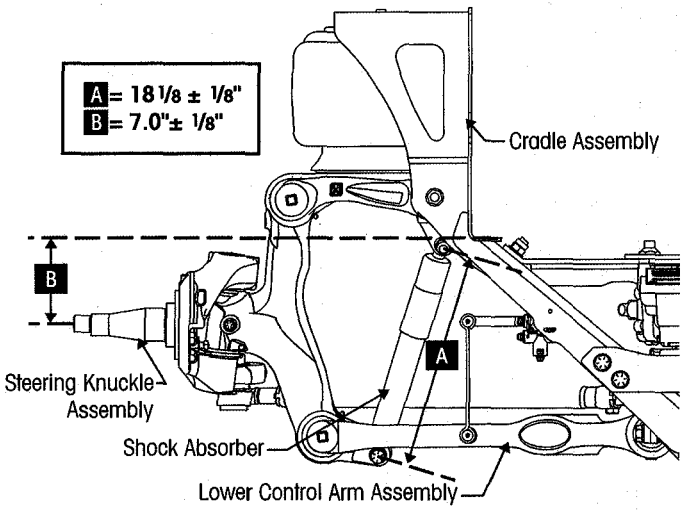
⚠ WARNING

PRIOR TO AND DURING DEFLATION AND INFLATION OF THE AIR SUSPENSION SYSTEM, ENSURE THAT ALL PERSONNEL AND EQUIPMENT ARE CLEAR FROM UNDER THE VEHICLE AND AROUND THE SERVICE AREA, FAILURE TO DO SO CAN CAUSE SERIOUS PERSONAL INJURY, DEATH, OR PROPERTY DAMAGE.

5. See additional Air Spring Warnings and Instructions in the Important Safety Notice Section of this publication prior to deflating or inflating the suspension system.
6. Detach the lower rubber grommet of the height control valve linkage from the lower studs on the lower control arm and exhaust the suspension system air by lowering the height control valve linkage arms.

7. Re-attach the lower grommet of the height control valve linkages onto the lower studs to fill the suspension system with air. Wait until the airflow to the front air springs has stopped.
8. Measure the suspension reference ride height using **Method A or B.** If reference ride height is out of specification, it will be necessary to adjust the ride height.

FIGURE 8-16



METHOD A – Reference ride height measuring shock absorber length.

a. Using a tape measure, measure the referenced vertical ride height on the drive axle from the centerline of the upper shock mounting bolt to the centerline of the lower shock mounting bolt.
b. The referenced ride height measurement should be 18 1/8" ± 1/8" (See dimension **"A"** in Figure 8-16).
c. If the ride height is not within this range it will be necessary to adjust the ride height. See Adjustment Procedure in this section.

METHOD B — Design ride height

a. Measure from the bottom of the frame rail to the axle centerline.
b. The ride height dimension should be 7.0" ± 1/8". (See dimension **"B"** in Figure 8-16)
c. If the ride height is not within this range it will be necessary to adjust the ride height. See Adjustment Procedure in this section.

ADJUSTMENT PROCEDURE

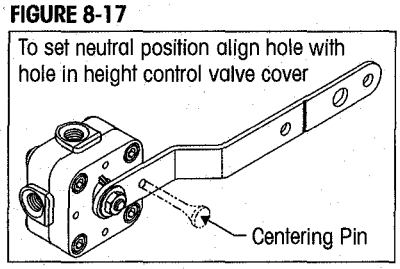
1. Verify that the air system is at full operating pressure.

SERVICE HINT It is very important that the leveling valve be cycled completely before and after any ride height adjustments. Cycling of the leveling valve will help make the adjustment more accurate.

⚠ WARNING PRIOR TO AND DURING DEFLATION AND INFLATION OF THE AIR SUSPENSION SYSTEM, ENSURE THAT ALL PERSONNEL AND EQUIPMENT ARE CLEAR FROM UNDER THE VEHICLE AND AROUND THE SERVICE AREA, FAILURE TO DO SO CAN CAUSE SERIOUS PERSONAL INJURY, DEATH, OR PROPERTY DAMAGE.

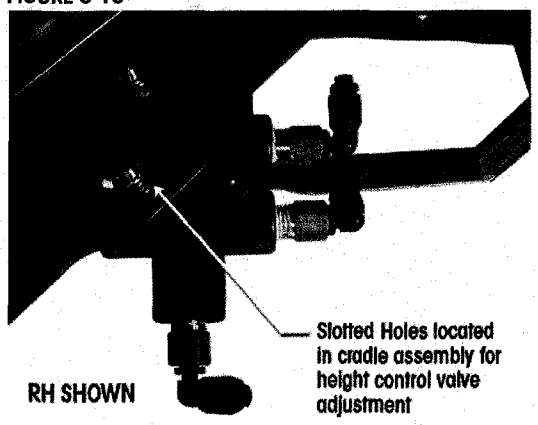
2. See additional Air Spring Warnings and Instructions in the Important Safety Notice Section of this publication prior to deflating or inflating the suspension system.
3. Cycle the air system. Detach the lower rubber grommet(s) of the height control valve linkage(s) from the lower stud and exhaust the suspension system air by lowering the height control valve linkage arm.
4. Refill the suspension by raising the height control valve arm(s) by hand, so that the air springs are above the proper ride height.
5. Lower the leveling valve arm(s) to exhaust the air system until the suspension is at the proper ride height.
6. Use a 1/8" wooden dowel rod (golf tee) to set the neutral position for the height control valve(s) by aligning the hole in the leveling arm(s) with the hole in the height control valve cover, as shown in Figure 8-17. **DO NOT** use a metal rod or nail as this may cause damage to the height control valve.

FIGURE 8-17



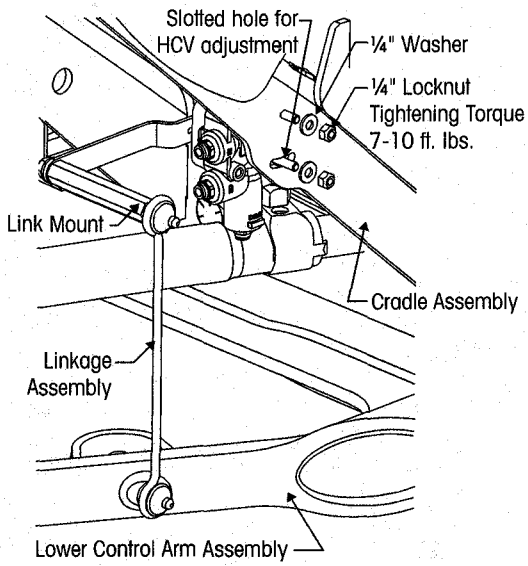
NOTE Hendrickson recommends the following be performed during any type of ride height adjustment to help prevent socket head cap screws from loosening from the height control valve housing, potentially causing subsequent air leaks from the height control valve.

FIGURE 8-18



7. Prior to adjusting the height control valves, clean the threads of the mounting fasteners of any debris and corrosion.
8. To adjust the height control valve, loosen the mounting locknuts.
9. Adjust the height control valves by loosening the mounting locknuts and pivoting the valve body about the mounting bolt so the link mount stud inserts directly into the center hole of the rubber grommet at the proper height, see Figure 8-18. Check the rubber grommet for any tearing or damage, replace as necessary.

FIGURE 8-19



10. From the rear of the vehicle looking forward, pivot the LH valve body clockwise to decrease the ride height and counter clockwise to increase the ride height. For the right side of the vehicle, pivot the valve body counter clockwise to decrease the ride height and clockwise to increase the ride height.
11. Tighten the mounting locknuts to 7-10 foot pounds torque after the adjustment is made, see Figure 8-19. Install a (5 mm) Allen wrench in the inboard socket head cap screws to prevent the screws from turning while re-tightening the locknuts. Remove the dowel from the height control valves.
12. Cycle the air from the system by lowering the height control valve arm.
13. Reconnect the height control valve linkage rubber grommet to the link mounts. Allow the air suspension system to completely fill with air.
14. Recheck the ride height after adjustment, (if equipped with dual height control valves check both sides of the vehicle).
15. Repeat steps 2 through 11 until the ride height is within specification.

STEERING STOP

ADJUSTMENT PROCEDURE

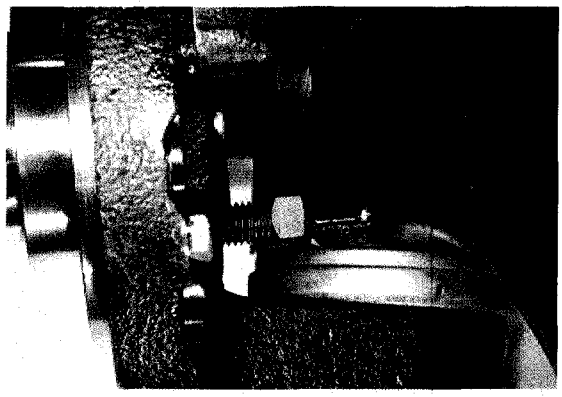
When the axle or lower steering knuckle is replaced, the steering stop adjustment must be checked.

The steering stop adjustment procedure is as follows:

1. Drive truck onto turntables and chock the rear wheels.

2. Measure the wheel cut. The wheel cut is determined by steering the tires. Wheel cut is measured at the inside wheel only, therefore the tires must be turned to the full lock position for each right hand and left hand direction. Refer to the vehicle manufacturer for exact specifications.
3. Increase the wheel cut by loosening the jam nuts and screw the axle stops in clockwise.
4. Tighten the jam nuts.

FIGURE 8-20



NOTE

It is very important that the sides of the square head axle stops are set parallel to the axle beam to ensure a good contact point on the axle, see Figure 8-20.

5. Decrease the wheel cut by loosening the jam nuts and screw the axle stops out counter-clockwise.
6. Tighten the jam nuts to 40-60 foot pounds torque.
7. Measure the wheel cut and check for any interference with related steering components.

⚠ WARNING

ALWAYS CHECK/RESET THE STEERING GEAR BOX POPPETS WHEN THE WHEEL CUT IS DECREASED. FOLLOW MANUFACTURER'S GUIDELINES FOR THE GEAR BOX POPPET RESETTING PROCEDURE. FAILURE TO DO SO CAN RESULT IN PREMATURE FAILURE OF THE AXLE OR STEERING KNUCKLE. THIS CONDITION CAN CAUSE LOSS OF VEHICLE CONTROL, PERSONAL INJURY OR PROPERTY DAMAGE AND VOID WARRANTY.

WHEEL BEARING ADJUSTMENT

This procedure follows the guidelines of TMC RP 618.

1. Lubricate the bearing with clean axle lubricant of the same type used in the hub assembly.
2. After the wheel hub and bearings are assembled on the spindle, tighten the inner wheel bearing adjusting nut to 200 foot pounds torque while rotating the wheel hub assembly.
3. Back off the inner wheel bearing adjusting nut one full turn. Rotate the wheel.
4. Re-tighten the inner wheel bearing adjusting nut to 50 foot pounds torque while rotating the wheel hub assembly.
5. Back off the inner wheel bearing adjusting nut one third turn.
6. Install the locking washer. If dowel pin and washer are not aligned, remove the washer and turn it over and reinstall. If required, loosen the inner wheel bearing adjusting nut just enough for alignment.

⚠ CAUTION

NEVER TIGHTEN THE INNER WHEEL BEARING ADJUSTING NUT FOR ALIGNMENT AT THIS POINT OF THE PROCEDURE. THIS CAN PRE-LOAD THE BEARING AND CAUSE PREMATURE FAILURE.

7. Install and tighten the outer (jam) nut to 240-260 foot pounds torque.

NOTE

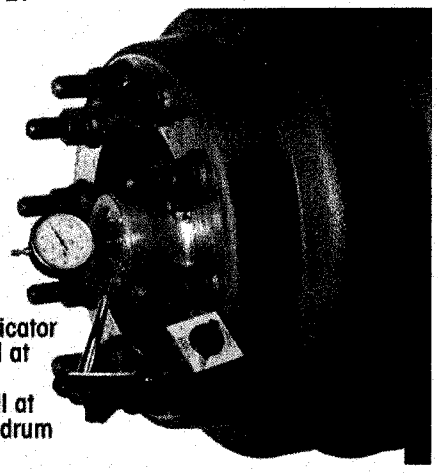
This adjustment allows the wheel to rotate freely with 0.001" to 0.005" end play.

8. Verify end play with a dial indicator, see Figure 8-21. Wheel end play is the free movement of the wheel assembly along the spindle axis.
   a. Attach a dial indicator with its magnetic base to the hub.
   b. Remove hub cap plug.

c. Adjust the dial indicator so that its plunger or pointer is against the end of the spindle with its line of action parallel to the axis of the spindle.

d. Grasp the hub assembly at the 3 o'clock and 9 o'clock positions. Push the hub in and pull out while oscillating it to seat the bearings. Care must be taken not to rotate the hub assembly. Read bearing end play as the total indicator movement.

FIGURE 8-21



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

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

9. Re-adjustment Procedure

- **Excessive End Play** — If the end play is too loose, remove the outer (jam) nut and pull the washer away from the inner wheel bearing adjusting nut, but not off the spindle. Tighten the inner wheel bearing adjusting nut to the next alignment hole of the washer. Reassemble the washer and re-tighten the outer (jam) nut to 240-260 foot pounds torque. Verify end play with a dial indicator.
- **Insufficient End Play** — If end play is not present, remove the outer (jam) nut and pull the washer away from the inner wheel bearing adjusting nut, but not off the spindle. Loosen the inner wheel bearing adjusting nut to the next alignment hole of the washer. Re-assemble the washer and re-tighten the outer (jam) nut to 240-260 foot pounds torque. Verify end play with a dial indicator.
- **Fine Tuning Adjustment** — If after performing the readjustment procedures, end play is 0.001"-0.005" range, if less play is desired, repeat the appropriate procedures, removing the washer from the spindle, tighten or loosen the inner wheel bearing adjusting nut the equivalent of one half of an alignment hole, or reversing the alignment washer, and re-installing it onto the spindle. Reassemble and re-tighten the outer (jam) nut to 240-260 foot pounds torque. Verify end play with a dial indicator.

Secure outer nut by bending one washer tang over the outer nut.

⚠ CAUTION BEFORE OPERATING THE VEHICLE, THE WHEEL HUB CAVITIES AND BEARINGS MUST BE LUBRICATED TO HELP PREVENT FAILURE.

TOE SETTING

The Hendrickson IFS system is equipped with two (2) tie rod assemblies to set toe, it is necessary to use calibrated electronic alignment equipment to ensure that the optimal toe setting is achieved on both wheel assemblies.

1. Place the vehicle on a level floor with the wheels in a straight ahead position.
2. Raise the vehicle and support the front axle with jack stands.
3. Use paint and mark the center area of tread on both steer axle tires around the complete outer diameter of the tires.
4. Scribe a line through both steer axle tires in the painted area around the complete outer diameter of the tires.
5. Raise the vehicle and remove the jack stands.
6. Set the vehicle on the ground.

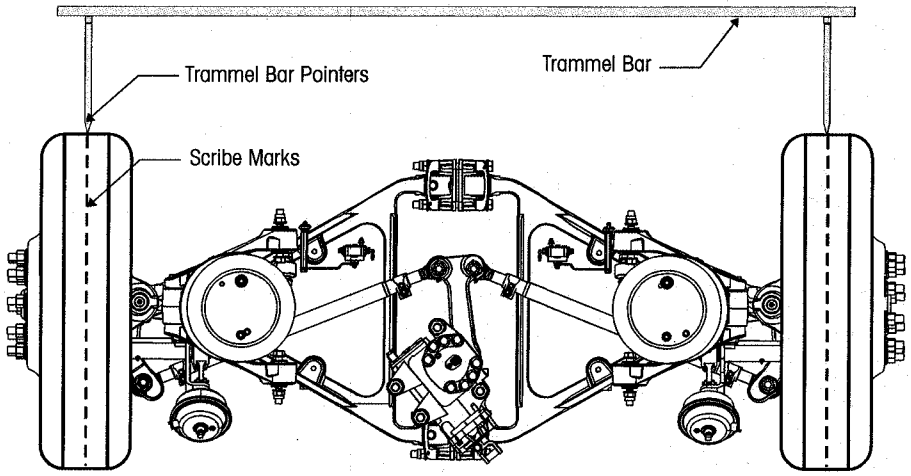
NOTE Do not measure toe-in with the front axle off the ground. The weight of the vehicle must be on the front axle when toe-in is measured.

7. Use a trammel bar and measure the distance between the scribe marks at the rear of the steer axle tires. Record the measurement.
8. Install the trammel bar and measure the distance between the scribe marks at the front of the steer axle tires. Record the measurement, see Figure 8-22.

NOTE When setting up the trammel bar the pointers should be level with the spindles at the front and rear of the steer axle tires.

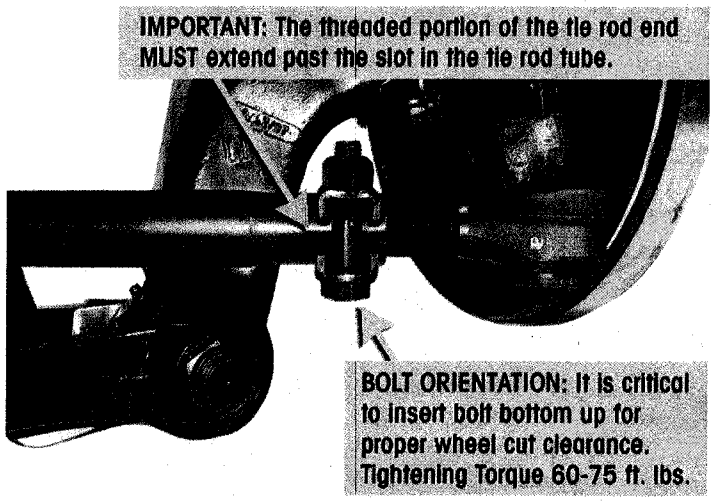
9. To calculate the toe setting subtract the front measurement from the rear measurement, the difference between the two will equal the toe-in/toe-out measurement.
10. If the toe measurement is not within the specifications of 1/16" ± 1/32" (0.06" ± 0.03"), it will be necessary to adjust the toe setting.

FIGURE 8-22



⚠ WARNING THE THREADED PORTION OF THE TIE ROD END MUST EXTEND PAST THE SLOTS INTO THE TIE ROD CROSS TUBE, SEE FIGURE 8-23. FAILURE TO DO SO CAN CAUSE COMPONENT TO FAIL CAUSING LOSS OF VEHICLE CONTROL AND POSSIBLE PERSONAL INJURY OR PROPERTY DAMAGE.

FIGURE 8-23



SECTION 9
Component Replacement

FASTENERS

Hendrickson recommends that when servicing the vehicle, replace the removed fasteners with new equivalent fasteners. Maintain correct torque values at all times. Check torque values as specified. Refer to Hendrickson's Torque Specifications Section of this publication. If non-Hendrickson fasteners are used, follow torque specifications listed in the vehicle manufacturer's service manual.

AIR SPRING

DISASSEMBLY

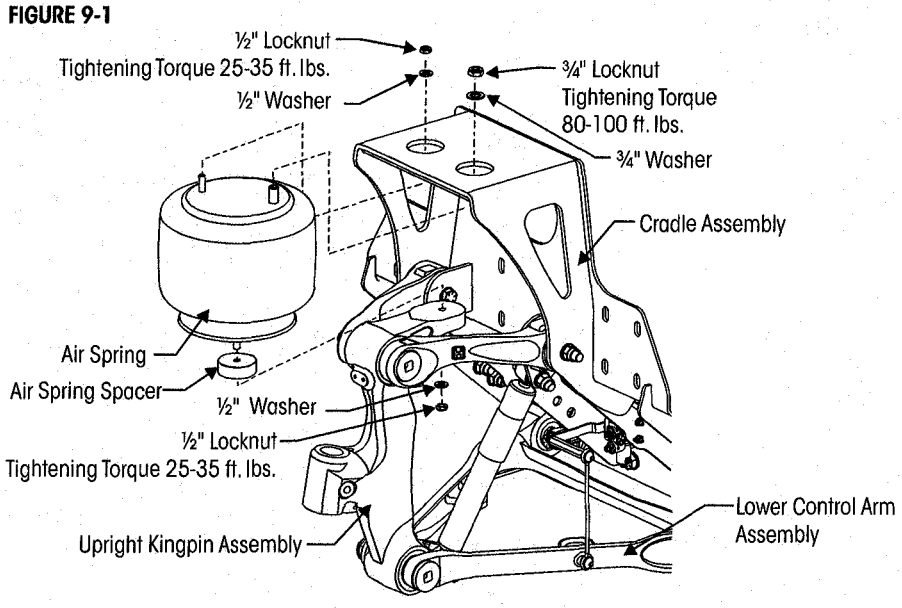
1. Place the vehicle on a level floor.
2. Chock the wheels.
3. Raise and support the frame.

⚠ WARNING

PRIOR TO AND DURING DEFLATION AND INFLATION OF THE AIR SUSPENSION SYSTEM, ENSURE THAT ALL PERSONNEL AND EQUIPMENT ARE CLEAR FROM UNDER THE VEHICLE AND AROUND THE SERVICE AREA, FAILURE TO DO SO CAN CAUSE SERIOUS PERSONAL INJURY, DEATH, OR PROPERTY DAMAGE.

4. See additional Air Spring Warnings and Instructions in the Important Safety Notice Section of this publication prior to deflating or inflating the suspension system.
5. Disconnect the height control valve linkage and allow the suspension to fully deflate.
6. Remove the air spring spacer (if equipped), lower stud locknut and washer, see Figure 9-1.
7. Disconnect the airline from the air spring.
8. Remove airline fitting.
9. Remove upper stud locknuts and washers.
10. Compress the air spring and remove from the suspension.

FIGURE 9-1



ASSEMBLY

1. Compress the air spring and slide into vertical position.
2. Guide the upper studs through the cradle assembly mounting bores and lower stud through upright kingpin assembly mounting bore.
3. Install the washers and locknuts on the upper mounting studs.
4. Install the air spring spacer (if equipped), washers and locknuts on the lower mounting studs.
5. Tighten the upper and lower air spring ½" locknuts to 25-35 foot pounds torque. Tighten the upper ¾" locknuts to 45-55 foot pounds torque.
6. Install Teflon tape on 90° air fittings.
7. Install air fitting and tighten to vehicle manufacturer's specifications.
8. Install the air line into the air spring.
9. Raise vehicle and remove the frame stands.
10. Lower the vehicle.

⚠ WARNING

PRIOR TO AND DURING DEFLATION AND INFLATION OF THE AIR SUSPENSION SYSTEM, ENSURE THAT ALL PERSONNEL AND EQUIPMENT ARE CLEAR FROM UNDER THE VEHICLE AND AROUND THE SERVICE AREA, FAILURE TO DO SO CAN CAUSE SERIOUS PERSONAL INJURY, DEATH, OR PROPERTY DAMAGE.

11. See additional Air Spring Warnings and Instructions in the Important Safety Notice Section of this publication prior to deflating or inflating the suspension system.
12. Reconnect the height control valve linkage and allow the suspension to fully inflate to ride height.
13. Check the air spring for leaks.
14. Check the ride height and adjust if necessary, see the Alignment & Adjustments Section of this publication for the proper ride height adjustment.
15. Sweep the steering knuckle assembly from left to right and check for any rub or interference points on the air spring.
16. Remove the wheel chocks.

MECHANICAL HEIGHT CONTROL VALVE

DISASSEMBLY

1. Drain the air from the secondary air tank.

⚠ WARNING

PRIOR TO AND DURING DEFLATION AND INFLATION OF THE AIR SUSPENSION SYSTEM, ENSURE THAT ALL PERSONNEL AND EQUIPMENT ARE CLEAR FROM UNDER THE VEHICLE AND AROUND THE SERVICE AREA, FAILURE TO DO SO CAN CAUSE SERIOUS PERSONAL INJURY, DEATH, OR PROPERTY DAMAGE.

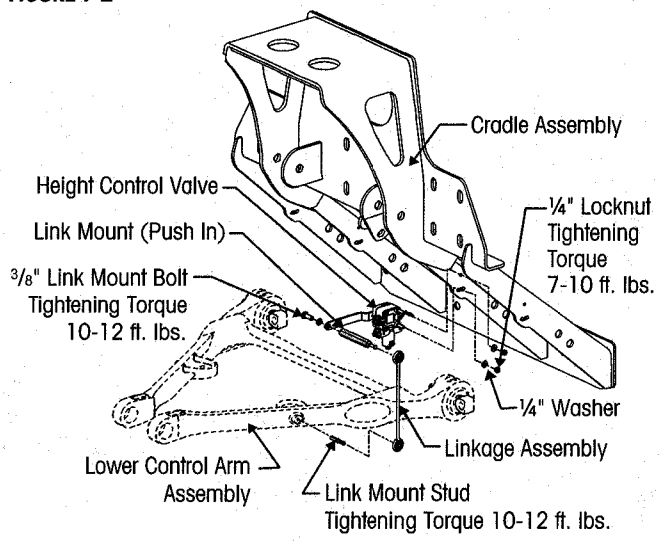
2. See additional Air Spring Warnings and Instructions in the Important Safety Notice Section of this publication prior to deflating or inflating the suspension system.
3. Deflate the air spring(s) by removing the height control valve linkage(s) at the rubber grommet(s) and lowering the height control linkage arm. This will exhaust the air pressure in the air springs.

⚠ CAUTION

THE HEIGHT CONTROL VALVE FITTINGS ARE NON-SERVICEABLE. IF THE HEIGHT CONTROL VALVE IS TO BE RE-INSTALLED; CARE MUST BE TAKEN TO REMOVE DIRT AND DEBRIS FORM THE PUSH-TO-CONNECT FITTINGS. FAILURE TO DO SO CAN RESULT IN THE PUSH-TO-CONNECT FITTINGS FAILING TO SEAL PROPERLY WITH THE AIR LINE.

4. Disconnect the air line(s) from the height control valve(s).
5. Remove the mounting locknuts and washers, see Figure 9-2.
6. Remove the height control valve.

FIGURE 9-2



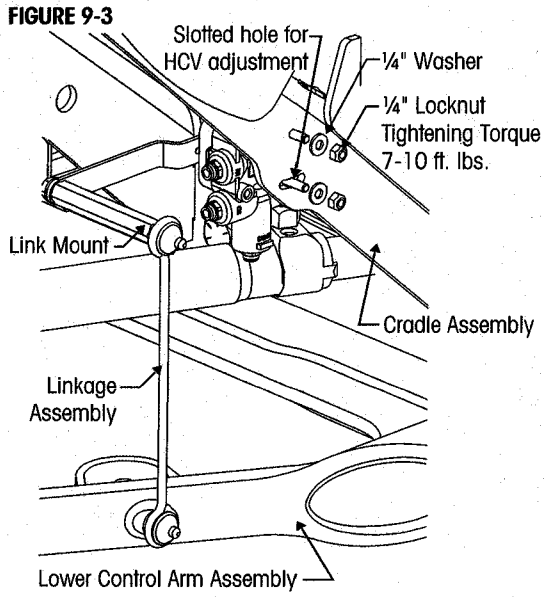
ASSEMBLY

1. Attach the height control valve(s) and locknuts on the cradle assembly as shown in Figure 9-2. Snug the locknuts. **DO NOT** tighten the locknuts to specified torque until after the proper ride height is attained.

SERVICE HINT

When replacing or installing nylon air line tubing into quick-connect fittings it is critical that the end of the air line is cut square. Improper cut of the end of the air line tubing can cause the air line to seat improperly in the quick connect fitting causing air leakage.

FIGURE 9-3



2. Attach the 1/4" washers
3. Attach the air lines to the height control valve(s), refer to Plumbing Diagram Section of this publication.
4. Install the height control valve linkage assembly(s).
5. Adjust the height control valve(s) to proper specifications, see the Alignment & Adjustments Section of this publication for proper ride height adjustment.
6. After the adjustment is made, install a 3/16" Allen wrench in the inboard socket head cap screws to prevent the screws from turning while tightening the 1/4" locknuts to torque.
7. Tighten the 1/4" locknuts to 7-10 foot pounds torque, see Figure 9-3.

SHOCK ABSORBER

It is not necessary to replace the shock absorber in pairs if only one shock requires replacement.

⚠ WARNING

THE SHOCK ABSORBERS ARE THE REBOUND TRAVEL STOPS FOR THE AIR SPRINGS. ANYTIME THE WHEELS ON A HENDRICKSON IFS SUSPENSION ARE SUSPENDED, IT IS MANDATORY THAT THE SHOCK ABSORBERS REMAIN CONNECTED. FAILURE TO DO SO CAN CAUSE THE AIR SPRINGS TO EXCEED THEIR MAXIMUM LENGTH, POSSIBLY CAUSING THE AIR SPRINGS TO SEPARATE FROM THE PISTON.

DISASSEMBLY

1. Place the vehicle on a level floor.

2. Chock the wheels.
3. Remove the lower mounting bolts and fasteners.
4. Remove the upper mounting bolts and fasteners.
5. Slide out the shock absorber.
6. Inspect the shock absorber and hardware for damage or wear, replace as necessary.

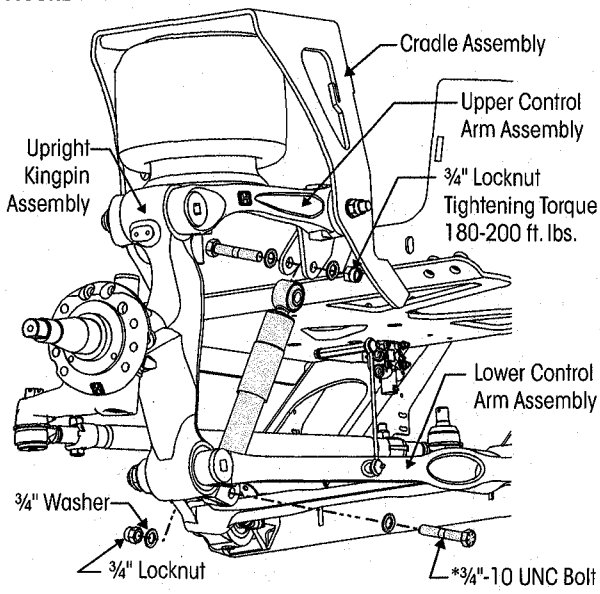
ASSEMBLY

SERVICE HINT

Install upper shocks and keep banded (factory compressed) and then install upper shock bolt. When installing the lower shock mount into cradle assembly, remove the band and line up shock with upright attachment as shock extends. Shock gas pressure while shock is extending makes shock compression difficult.

1. Install the upper shock absorber into the cradle assembly.
2. Install the upper shock mounting bolts and fasteners.
3. Install the lower shock absorber into the upright kingpin assembly.
4. Install the lower shock mounting bolts and fasteners.
5. Tighten upper shock eye locknuts and lower shock mounting bolts to 180-200 foot pounds torque, see Figure 9-4.
6. Remove the wheel chocks.

FIGURE 9-4



***NOTE:** Tighten at the bolt head due to wrench access

HUB ASSEMBLY

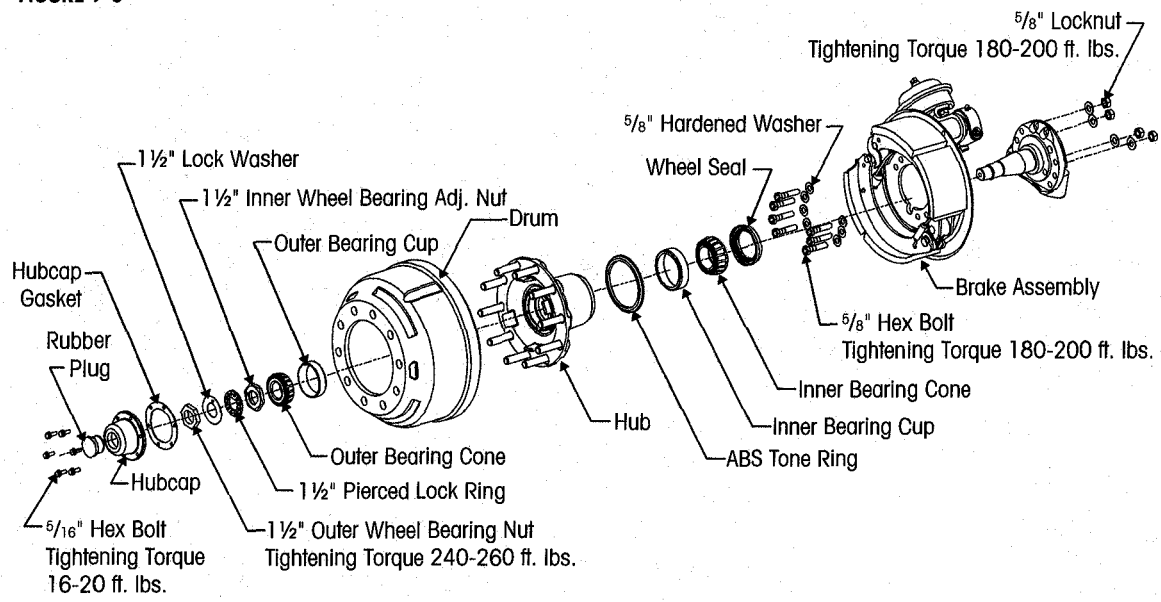
⚠ WARNING

NEVER WORK UNDER A RAISED VEHICLE SUPPORTED BY ONLY A JACK. ALWAYS SUPPORT A RAISED VEHICLE WITH STANDS. BLOCK THE WHEELS AND MAKE SURE THE UNIT WILL NOT ROLL BEFORE RELEASING BRAKES. ALWAYS WEAR EYE PROTECTION. FAILURE TO DO SO CAN CAUSE POSSIBLE PERSONAL INJURY OR PROPERTY DAMAGE.

DISASSEMBLY

1. Place the vehicle on a level floor.
2. Chock the wheels.
3. Raise the frame.
4. Support the frame with frame stands.
5. Remove the tire, wheel and brake drum.
6. Install a suitable drain pan under hubcap.
7. Remove the hubcap and drain the lube oil.
8. Remove the outer wheel bearing nut, lock washers, inner wheel bearing adjusting nut, and outer wheel bearing, see Figure 9-5.
9. Slide the hub assembly off the spindle.

FIGURE 9-5



HUB WHEEL SEAL REMOVAL AND INSPECTION OF THE HUB

You will need:

- SKF part number – SRT-1 Seal Removal Tool, see Special Tool Section of this publication.

1. Remove wheel seal. Wheel seal removal is best done with a specifically designed tool. Hendrickson recommends the use of SKF tooling and instructions to remove the wheel seal from the hub.

⚠ CAUTION

HAMMERS, CHISELS AND IMPROPER PRYING TOOLS CAUSE DAMAGE TO BEARINGS AND HUBS AND CAN LEAD TO COMPONENT DAMAGE. USE ONLY SPECIFIED TOOLS.

2. After removal of the wheel seal, remove the inner wheel bearing.
3. Clean and inspect wheel bearings, replace if damaged.
4. Clean residual oil from hub and any remaining hubcap gasket material.

⚠ WARNING

A LOOSE OR DAMAGED HUB OR HUB COMPONENT REQUIRES IMMEDIATE REPLACEMENT, FAILURE TO DO SO CAN RESULT IN COMPONENT FAILURE AND LOSS OF VEHICLE CONTROL, POSSIBLY CAUSING PERSONAL INJURY OR PROPERTY DAMAGE.

5. Inspect the hub for broken fasteners, cracks in the hub, and damage to the hub and bore, replace if cracked, broken, or damaged.

BEARING CUP REMOVAL

1. Use a mild steel drift or cup driver to drive out the bearing cup. Alternate the location of impact on the cup by 180° and/or 90°.
2. Inspect the bearing bores and bearing cup stop for damage. If there is evidence of cup spinning, the hub must be replaced.
3. Use an emery cloth to remove any minor burrs or raised areas.

BEARING CUP INSTALLATION

You will need:

- OTC part number – OTC 7180 installation tool, see Special Tool Section of this publication.

1. Install bearing cup. Bearing cup installation is best done with a specifically designed tool. Hendrickson recommends the use of OTC tooling and instructions to install the bearing cup in the hub.

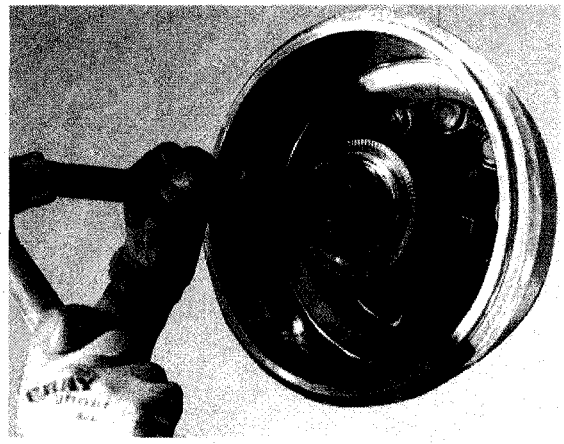
2. Use a 0.004" feeler gauge to check for a gap between the cup and the bearing cup stop. The feeler gauge should not fit between the cup and the bearing cup stop.
3. Inspect the bearing surface for any damage, which might have occurred during installation. There should be no scoring of the new bearing cup surface.

HUB WHEEL SEAL INSTALLATION

You will need:

- SKF Scotseal® Classic and Scotseal® Longlife Installation Tools, see the Special Tools Section of this publication.

FIGURE 9-6

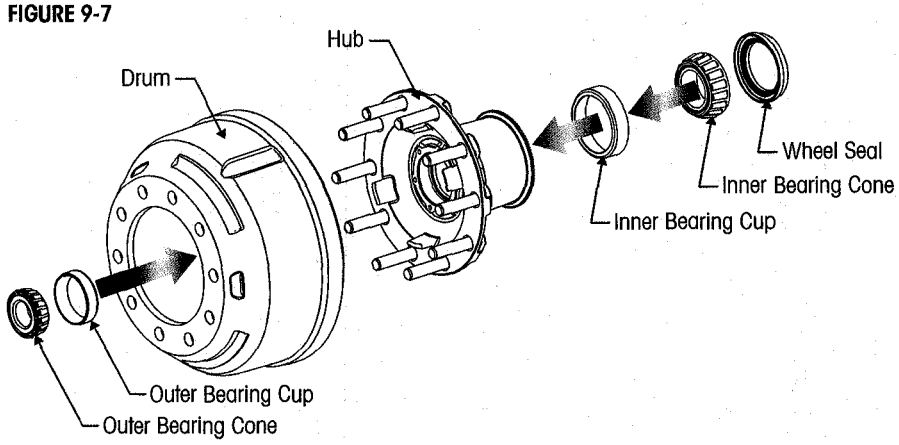


1. Install the wheel seal, see Figure 9-6. Seal installation is best done with specifically designed tools. Hendrickson recommends the use of SKF tooling and instructions to install the wheel seal in the hub.
2. Position the hub on the wheel studs facing down.
3. Pre-lube the inner wheel bearing and install in the hub.
4. Position a new wheel seal into the hub bore and insert the tool assembly with centering plug into the seal.
5. Hold the tool handle firmly and straight, drive the seal with firm hammer strokes until the seal is squarely seated. Continue driving the seal the hub until the sound of impact changes.
6. After the seal is bottomed in the bore, check for freedom of movement by manually moving the packing of the seal up and down. Ensure that the inner bearing rotates freely.

CLEANING AND INSPECTION

1. Clean the face of the steering knuckle and spindle.
2. Inspect the spindle for any damage or fretting. Remove any light fretting with a fine grit emery cloth (220 and higher).
3. Check the spindle threads for any damage.

FIGURE 9-7



ASSEMBLY

1. Carefully slide the hub assembly onto the spindle.
2. Pre-lube the lube oil reservoir in the hub, see Lubrication Specifications in the Preventive Maintenance Section of this publication.
3. Pre-lube and install the outer wheel bearing.
4. Adjust the wheel bearing end play to specification, see Wheel Bearing instructions in the Alignment & Adjustments Section of this publication.

NOTE Always install and re-install a hubcap with a **NEW** gasket.

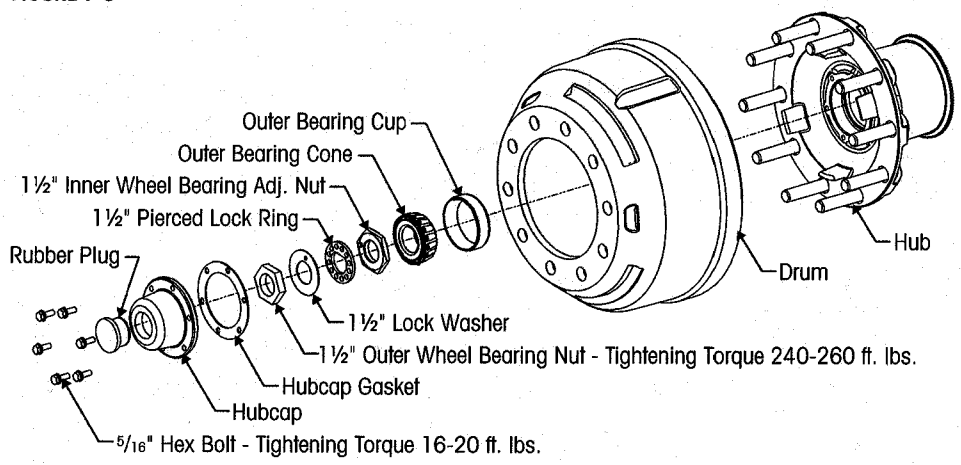
5. Install the **NEW** hubcap gasket.
6. Loosely install hubcap bolts, see Figure 9-8.
7. Uniformly tighten hubcap bolts in a star pattern to 16-20 foot pounds torque.
8. Fill wheel end assembly through the center fill port with the Grade 2 oil (SAE-80W-90, GL-5). Allow the oil to seep through the outer bearing and fill the hub cavity. Continue to add oil until the oil reaches the oil level fill line as indicated on the hubcap.
9. Install the brake drum and wheel and tighten lug nuts to the required torque specification per the vehicle manufacturer.
10. Remove safety stands and lower vehicle to ground.
11. Remove wheel chocks.

HUBCAP

DISASSEMBLY

1. Install suitable drain pan under hubcap.
2. Remove hubcap mounting fasteners, see Figure 9-8.
3. Remove hubcap.
4. Remove hubcap gasket from hub assembly.
5. Clean any residual gasket material from hub.

FIGURE 9-8



ASSEMBLY

NOTE Always install and re-install a hubcap with a **NEW** gasket.

1. Install hubcap and **NEW** gasket.
2. Loosely install hubcap bolts.
3. Uniformly tighten hubcap bolts in a star pattern to 16-20 foot pounds torque.

4. Fill wheel end assembly through the center fill port with the Grade 2 oil (SAE-80W-90, GL-5). Allow the oil to seep through the outer bearing and fill the hub cavity. Continue to add oil until the oil reaches the oil level fill line as indicated on the hubcap.
5. Install center fill hubcap plug.
6. Remove wheel chocks.

STEERING KNUCKLE

DISASSEMBLY

See tools needed to remove and install kingpin bushing under the Special Tools Section of this publication.

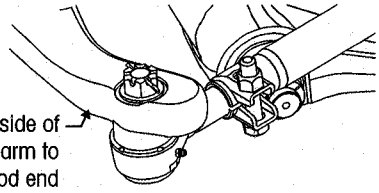
The steering knuckle disassembly and assembly includes the Kingpin Preparation and Measurement and Kingpin Bushing Removal process.

1. Place the vehicle on level floor.
2. Chock the wheels.
3. Support the vehicle with frame stands.
4. Remove the wheel and hub assembly.
5. Remove the brake and spider components from the steering knuckle.
6. Remove the tie rod assembly.

SERVICE HINT

Lightly tap the side of the Ackermann arm with a mallet to separate the tie rod end from the Ackermann arm, see Figure 9-9.

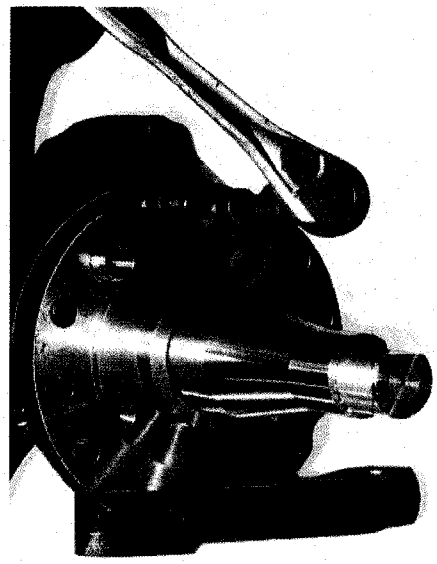
FIGURE 9-9



⚠ WARNING

REMOVAL OF THE CAP SCREWS WILL ALLOW THE STEERING KNUCKLE TO SEPARATE FROM THE UPRIGHT KINGPIN ASSEMBLY. THE STEERING KNUCKLE MUST BE SUPPORTED BEFORE REMOVAL OF THESE TWO (2) CAP SCREWS. FAILURE TO DO SO CAN CAUSE COMPONENT DAMAGE OR PERSONAL INJURY.

FIGURE 9-10



7. Remove the 2 socket head cap screws that connect upper kingpin connection to the steering knuckle, see Figure 9-10.
8. Remove the lower steering knuckle from the kingpin by sliding it down the kingpin.
9. Remove the upper steering knuckle by sliding it up off the kingpin.

■ KINGPIN PREPARATION AND MEASUREMENT

CLEANING GROUND AND POLISHED PARTS

- Use a cleaning solvent to clean ground or polished parts and surfaces. **DO NOT USE GASOLINE.**
- Do not clean ground or polished parts in a hot solution tank or with water, steam, or alkaline solutions. These solutions will cause corrosion of the parts.

DRYING THE CLEANED PARTS

- Parts must be dried immediately after cleaning. Dry the parts with clean paper towels, clean rags, or compressed air. Do not dry bearings by spinning with compressed air. Damage to the bearings will result.

PREVENTING CORROSION ON CLEANED PARTS

- Apply a light coating of oil to all cleaned and dried parts that are going to be reused. Do not apply oil to the brake lining or the brake drums. If parts are to be stored, apply an effective rust inhibitor to all surfaces.

⚠ WARNING

TO HELP PREVENT SERIOUS EYE INJURY, ALWAYS WEAR PROPER EYE PROTECTION WHEN YOU PERFORM VEHICLE MAINTENANCE OR SERVICE.

⚠ WARNING

SOLVENT CLEANERS CAN BE FLAMMABLE, POISONOUS AND CAUSE BURNS. TO HELP AVOID SERIOUS PERSONAL INJURY, CAREFULLY FOLLOW THE MANUFACTURER'S PRODUCT INSTRUCTIONS AND GUIDELINES AND THE FOLLOWING PROCEDURES:

- WEAR PROPER EYE PROTECTION.
- WEAR CLOTHING THAT PROTECTS YOUR SKIN.
- WORK IN A WELL VENTILATED AREA.
- DO NOT USE GASOLINE, SOLVENTS OR OTHER MATERIALS THAT CONTAIN GASOLINE THAT CAN EXPLODE.
- HOT SOLUTION TANKS OR ALKALINE SOLUTIONS MUST BE USED CORRECTLY. FOLLOW THE MANUFACTURER'S RECOMMENDED INSTRUCTIONS AND GUIDELINES CAREFULLY TO HELP PREVENT PERSONAL ACCIDENT OR INJURY.

⚠ CAUTION

DO NOT USE HOT SOLUTION TANKS OR WATER AND ALKALINE SOLUTIONS TO CLEAN GROUND OR POLISHED PARTS. DAMAGE TO THE PARTS WILL RESULT.

⚠ WARNING

THE HENDRICKSON IFS IS UNIQUE IN THAT THE KINGPIN IS CRYOGENICALLY INSTALLED IN THE UPRIGHT. THE KINGPIN IS A NON-REPLACEABLE COMPONENT OF THE UPRIGHT ASSEMBLY. DO NOT TRY TO REMOVE THE KINGPIN. IF THE KINGPIN SHOWS SIGNS OF MOVEMENT, CONTACT THE HENDRICKSON TECH SERVICES DEPARTMENT.

1. Prepare and polish the kingpin by removing all grease and excess debris using a fine grit (220 grit or higher) emery cloth and parts solvent, see Figures 9-11 through 9-14.

FIGURE 9-11

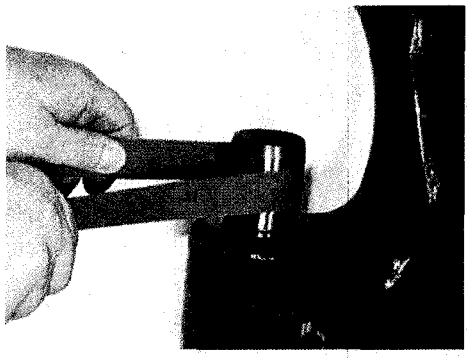


FIGURE 9-12

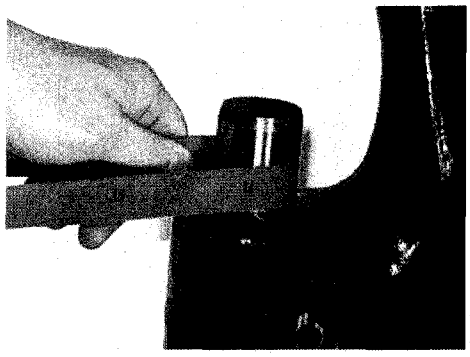


FIGURE 9-13
Kingpin Before Cleaning

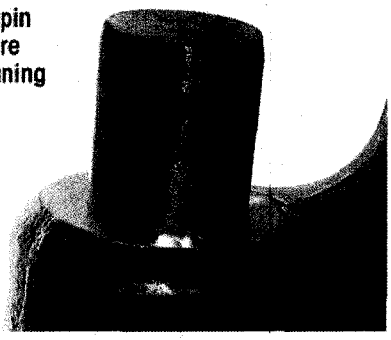
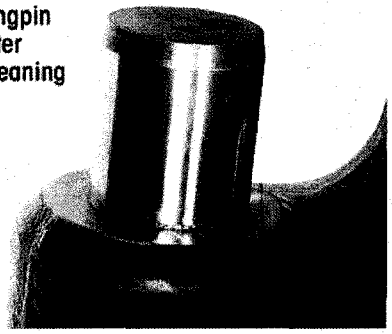


FIGURE 9-14
Kingpin After Cleaning



2. Inspect the kingpin for wear or damage. Use a micrometer and measure the upper and lower kingpin in two locations. Positions must be 90° opposed from each other. If the kingpin has less than 1.802" diameter, replacement of the upright is necessary, see Figures 9-15 through 9-18.

   Kingpin minimum dimension is 1.802"

FIGURE 9-15

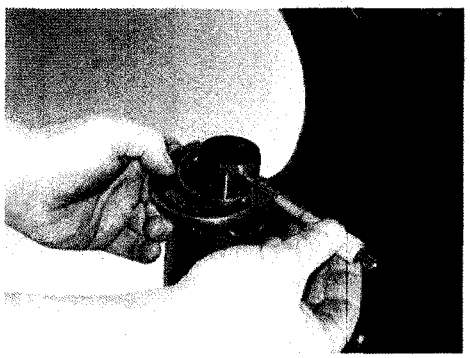


FIGURE 9-16

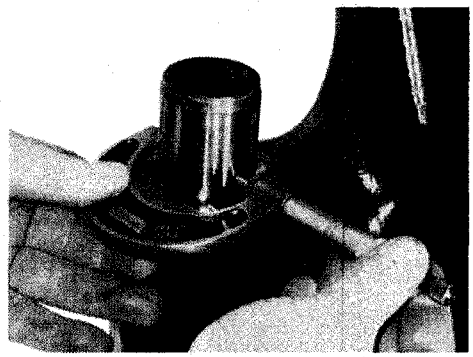


FIGURE 9-17

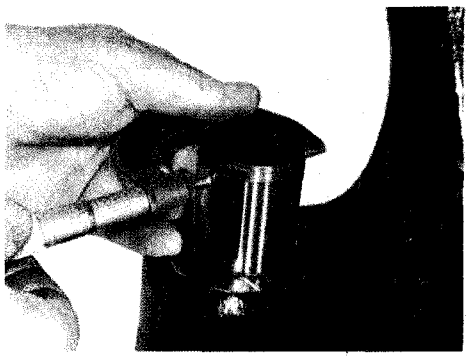
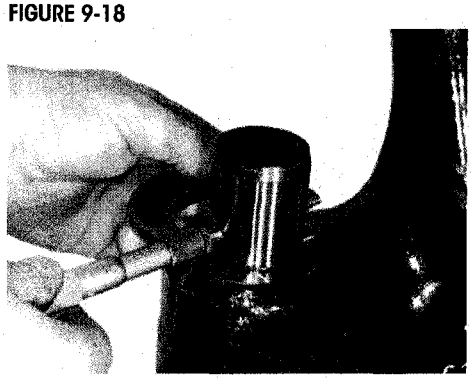


FIGURE 9-18



■ KINGPIN BUSHING REMOVAL

You will need:

- Kingpin bushing tools, see Special Tools Section of this publication
  - Push-out Tool
  - Driver Tool
  - Receiving Tool
- A hydraulic shop press with a minimum forcing capacity of 2.5 tons (or use an arbor press)

1. Remove the retaining ring for the grease cap.

⚠ WARNING

BEFORE APPLYING HYDRAULIC PRESSURE TO ANY TOOLING SET-UP, ALWAYS CHECK TO BE SURE THE PRESS PLATE, ADAPTERS, AND COMPONENTS BEING WORKED ON ARE POSITIONED PROPERLY, I.E. "IN LINE" WITH THE RAM. IMPROPER POSITIONING CAN CAUSE PERSONAL INJURY OR COMPONENT DAMAGE.

⚠ CAUTION

BEFORE APPLYING HYDRAULIC PRESSURE TO REMOVE OR INSTALL THE KINGPIN BUSHING, SUPPORT THE LOWER STEERING KNUCKLE AS SHOWN IN FIGURES 9-19 AND 9-20. IMPROPER SUPPORT TO THE STEERING KNUCKLES CAN CAUSE COMPONENT DAMAGE.

2. Use the grease cap to press out the kingpin bushing and seal. Remove the grease zerk in the grease cap or use a hollow driver, (see Figure 9-19) to press out the kingpin bushing.
3. Install the lower steering knuckle upside down in press. Be sure to support the lower steering knuckle assembly so that it sits in-line with the press, see Figure 9-20.
4. Use the same procedure to remove the kingpin bushing in the upper kingpin connection, see Figures 9-19 through 9-21.
5. Clean the parts and inspect for reassembly, see Figure 9-22.

FIGURE 9-19

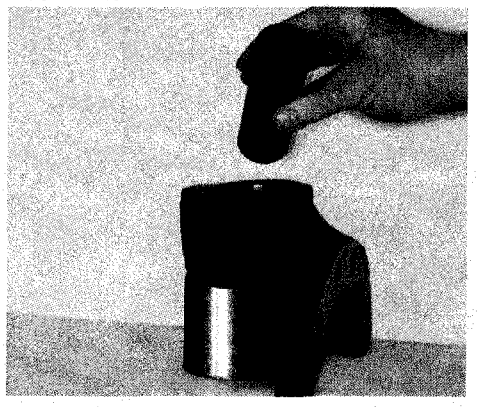


FIGURE 9-20

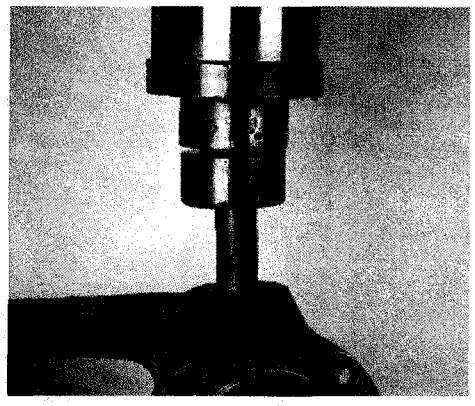


FIGURE 9-21

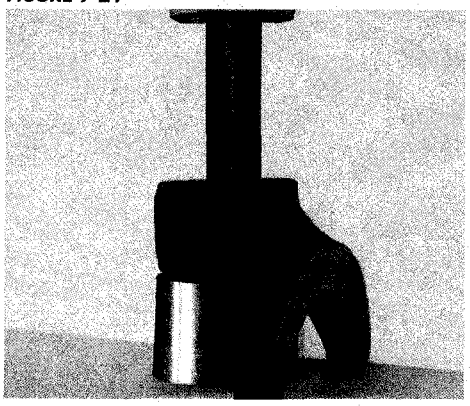
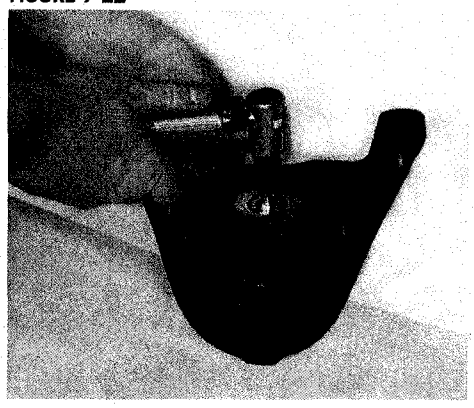


FIGURE 9-22



■ STEERING KNUCKLE BORE MEASUREMENT

Complete the following steering knuckle bore inspection and the measurement instructions prior to installing the kingpin bushing.

1. Measure the upper knuckle bore inside diameter at two locations. Always use an inside micrometer or a telescoping gauge when taking a knuckle bore measurement. Some out-of-roundness at the top and bottom of the bore edges is acceptable. Steering knuckle bore diameter is 1.938" ± 0.003"
2. Measure the upper and lower bore in two positions and at two locations. The two positions must be 90° opposed from each other, see Figures 9-23 through 9-25. If the average measurement is more than the knuckle bore maximum diameter specification, replace the knuckle.

FIGURE 9-23

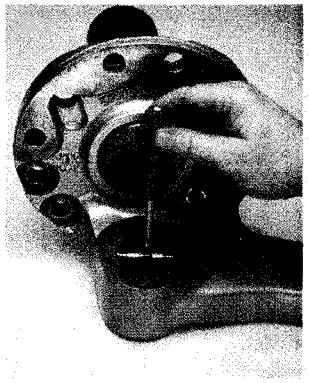
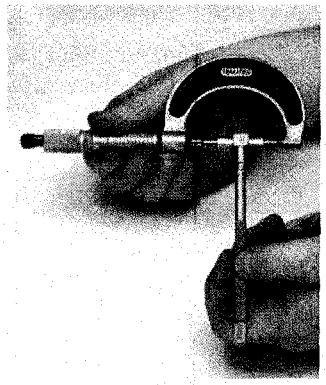


FIGURE 9-24

FIGURE 9-25



■ KINGPIN BUSHING INSTALLATION

You will need:

- A driver for kingpin bushing installation, See Special Tools Section of this publication
- A hydraulic shop press with a minimum forcing capacity of 5 tons

⚠ WARNING

BEFORE APPLYING HYDRAULIC PRESSURE TO ANY TOOLING SET-UP, ALWAYS CHECK TO BE SURE THE PRESS PLATE, ADAPTERS, AND COMPONENTS BEING WORKED ON ARE POSITIONED PROPERLY, I.E. "IN LINE" WITH THE RAM. IMPROPER POSITIONING CAN CAUSE PERSONAL INJURY OR COMPONENT DAMAGE.

1. Install the lower or upper steering knuckle in the press.
2. Install the kingpin bushing from the machined side (axle side) of the lower steering knuckle using a bushing driver, (see driver specifications in the Special Tools Section of this publication). Press in bushing to a depth of no less than 15/64" (0.236") or 6 millimeters and no more than 5/16" (0.32") or 8 millimeters, see Figures 9-26 to 9-28.
3. Following this procedure it is necessary to ream the kingpin bushings to fit the kingpins, refer to the Kingpin Bushing Reaming Instructions in this section.

FIGURE 9-26

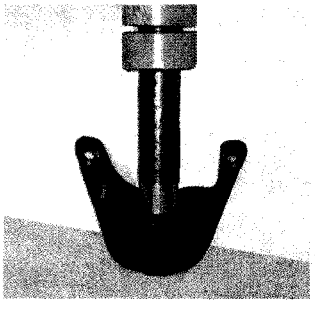


FIGURE 9-27

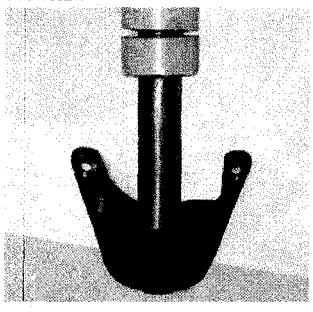
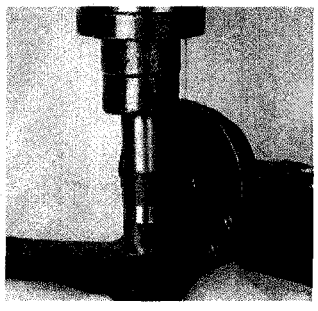


FIGURE 9-28



■ KINGPIN BUSHING REAMING

⚠ CAUTION

REAM THE KINGPIN BUSHINGS WITH AN ADJUSTABLE STRAIGHT FLUTE REAMER. (SEE SPECIAL TOOLS SECTION OF THIS PUBLICATION) DO NOT HONE OR BURNISH THE KINGPIN BUSHINGS. HONING OR BURNISHING WILL DAMAGE THE BUSHINGS AND VOID WARRANTY.

⚠ WARNING

WHEN INSTALLING STEERING KNUCKLE COMPONENTS IN A VISE IT IS NECESSARY TO PROTECT THE MACHINED SURFACES FROM GOUGES OR MARRING BY USING BRASS JAWS. FAILURE TO DO SO CAN CAUSE PREMATURE PART DAMAGE, DAMAGE TO THE STEERING KNUCKLE COMPONENTS, LOSS OF WARRANTY, LOSS OF VEHICLE CONTROL, CAUSING PERSONAL INJURY OR PROPERTY DAMAGE.

1. Install the lower steering knuckle assembly in a vise with brass jaws.

SERVICE HINT

It is acceptable to mount the knuckle components in a vise either vertically or horizontally when performing the reaming procedure.

2. Install the reamer into the lower steering knuckle until the blades touch the kingpin bushing.
3. Rotate the reamer with light downward pressure. Rotate the reamer smoothly. **DO NOT** apply too much pressure, see Figures 9-29 and 9-30.

FIGURE 9-29
Lower Steering Knuckle in Vise

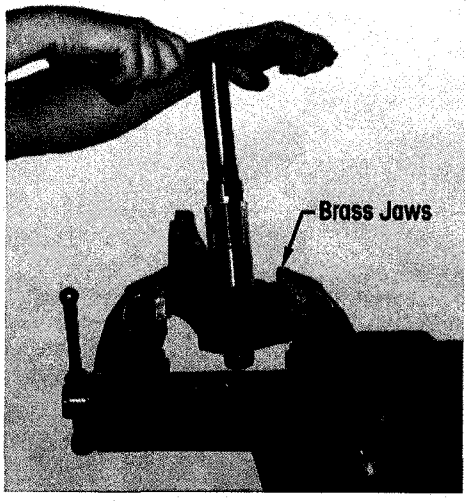
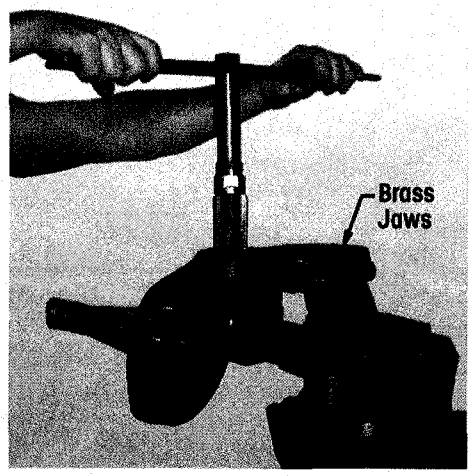


FIGURE 9-30
Upper Steering Knuckle in Vise



4. Slide the reamer out of the bottom of the steering knuckle assembly. If it is necessary to remove the reamer from the top, rotate the reamer opposite of cutting rotation.
5. Clean and remove all kingpin bushing material from the steering knuckle assembly. Take special attention to remove material from the grease channels and dimples.
6. Clean the 5/8" brake backing plate bolts with a wire wheel and run a tap through the threads of the lower steering knuckle assembly and then flush out with brake cleaner and dry with compressed air.

⚠ WARNING

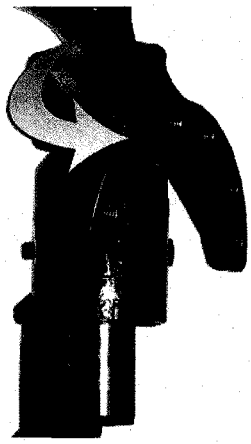
PRIOR TO INSTALLATION ENSURE THAT ALL RESIDUAL LOCTITE® MATERIAL IS REMOVED FROM THE MOUNTING BOLTS AND THE THREAD BORES IN THE UPPER STEERING KNUCKLES, AND NEW LOCTITE 277 OR EQUIVALENT IS APPLIED TO HELP ENSURE THAT THE BOLTS SUSTAIN THE PROPER TORQUE REQUIREMENT. FAILURE TO DO SO CAN CAUSE LOSS OF VEHICLE CONTROL RESULTING IN PERSONAL INJURY OR PROPERTY DAMAGE.

NOTE

The Ⓗ Hendrickson Genuine part, socket head cap screw comes with a pre-applied loctite compound.

FIGURE 9-31

FIGURE 9-32



7. Install the upper and lower steering knuckle on the kingpin.
8. Check for the proper fit by rotating the knuckle assembly back and forth to verify there is no binding on the kingpin, see Figures 9-31 and 9-32.
9. If the bushing is too tight repeat steps 1 through 8 until the proper clearance is achieved.

NOTE Bushing size is to be 0.001" larger than the kingpin size.

■ KINGPIN SEAL INSTALLATION

1. Place the steering knuckle assembly in a vise with brass jaws or place on a suitable workbench. The steering knuckle will have the machined surface facing up (axle side up).
2. Lay the kingpin seal into the bore of the steering knuckle. The seal lip should face outward or toward the axle.
3. Use a bushing driver tool and press seal firmly into the steering knuckle assembly.
4. Install the kingpin seal until it makes contact with the kingpin bushing, see Figures 9-33 and 9-34.

FIGURES 9-33

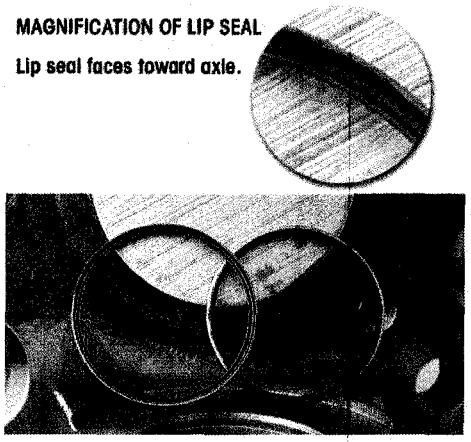


FIGURE 9-34

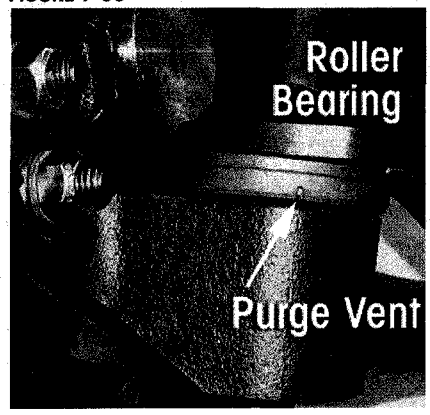
■ STEERING KNUCKLE ASSEMBLY

ASSEMBLY

After replacement of the kingpin bushings it is necessary to re-assemble the steering knuckle assemblies. **DO NOT** substitute aftermarket components when servicing.

1. Install the thrust bearing on the lower kingpin with the seal facing up toward axle (the black seal will designate the top side).
2. Install the shim on the upper kingpin.
3. Pack the bushing dimples on the upper and lower steering knuckles with multi purpose Lithium based grease (NLGI Grade 2) before installation, see Figure 9-35.

FIGURE 9-35

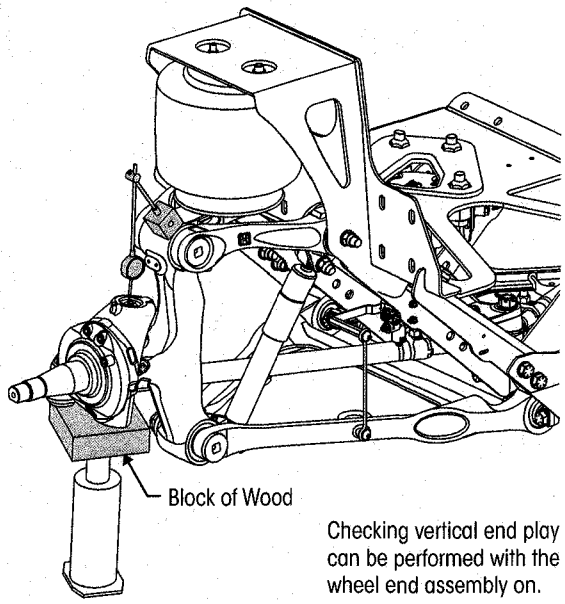


4. Install the upper steering knuckle on the upper kingpin.
5. Install the lower steering knuckle on the lower kingpin and install the old socket head cap screws loose into the top two threaded holes.

SERVICE HINT

The easiest way to achieve this is with the grease caps not installed in the knuckle assemblies. This eliminates back pressure. The assembly can then freely slide up and down on the kingpin. If the grease caps are still installed, remove the grease zerks to avoid creating back pressure. Grease zerks will be re-installed at the end of the procedure.

FIGURE 9-36



Checking vertical end play can be performed with the wheel end assembly on.

6. Install a bottle jack under the lower knuckle and slightly raise the knuckle until it is possible to thread in the (3) brake spider (torque plate) bolts by hand. These are for guide purposes only.
7. Snug the two socket head cap screws.
8. Lower the bottle jack so that all the vertical clearance is on the underside of the upright.
9. Affix a magnetic base dial indicator on the upright and place the tip of the dial indicator on top of the knuckle assembly, see Figure 9-36.
10. Zero the dial indicator.
11. Raise the bottle jack until there is no clearance between the knuckle assembly and the bottom of the upright, slightly lifting the suspension.
12. Check the reading on the dial indicator. The specification for vertical travel on the steering knuckle during assembly is 0.008" to 0.011".
13. If the clearance is above 0.011", loosen the socket head cap screws and push down on the knuckle assembly until the proper vertical clearance is achieved. Add (0.005") shim if necessary.
14. If the clearance is below the 0.008", loosen the two socket head cap screws and pull up on the knuckle assembly until the proper vertical clearance is achieved. If the 0.008" minimum clearance is unattainable it may be necessary to remove a 0.005" shim.

NOTE

The ⊞ Hendrickson Genuine part, socket head cap screw comes with a pre-applied loctite compound.

⚠ WARNING

PRIOR TO INSTALLATION ENSURE THAT ALL RESIDUAL LOCTITE MATERIAL IS REMOVED FROM THE MOUNTING BOLTS AND THE THREAD BORES IN THE UPPER STEERING KNUCKLE, AND NEW LOCTITE 277 OR EQUIVALENT IS APPLIED TO HELP ENSURE THAT THE BOLTS SUSTAIN THE PROPER TORQUE REQUIREMENT. FAILURE TO DO SO CAN CAUSE LOSS OF VEHICLE CONTROL RESULTING IN PERSONAL INJURY OR PROPERTY DAMAGE.

15. Remove one old socket head cap screw, replace with new socket head cap screw and tighten to 180-200 foot pounds torque.
16. Remove second socket head cap screw, replace with new socket head cap screw and tighten to 180-200 foot pounds torque.
17. Recheck the vertical clearance with the dial indicator or a 0.010" feeler gauge, see Figure 9-36.
18. Remove the brake spider (torque plate) bolts, they should thread out freely.
19. Remove the bottle jack and continue assembling the wheel ends.

IMPORTANT NOTE Loctite applied to the three brake spider (torque plate) bolts is a critical procedure to ensure that these bolts sustain the torque requirement of steering knuckle assembly.

20. Apply loctite to the three brake spider (torque plate) bolts prior to installation into the brake spider. Tighten bolts to 180-200 foot pounds torque.

WARNING DO NOT GREASE KNUCKLES WITHOUT THE BRAKE SPIDER (TORQUE PLATE) INSTALLED AND TIGHTENED TO PROPER TORQUE. FAILURE TO DO SO CAN CAUSE COMPONENT DAMAGE RESULTING IN FAILURE AND LOSS OF VEHICLE CONTROL, POSSIBLY CAUSING PERSONAL INJURY OR PROPERTY DAMAGE.

21. Install the tie rod end into the lower steering knuckle arm.
22. Tighten the castle nuts to 185 foot pounds torque then rotate the castle nut to the next castle slot and install cotter pin. Always rotate in tightening direction.
23. Install the drag link into the steering arm and tighten to the vehicle manufacturer's specifications.
24. Install new O-rings on the grease caps and lubricate O-rings with grease.
25. Install grease caps and new retaining rings.
26. Install brakes, drums, wheels and tires.
27. Remove jack and safety stands.
28. Grease steering knuckles with the vehicle on the floor.
29. Remove wheel chocks.

UPPER CONTROL ARM

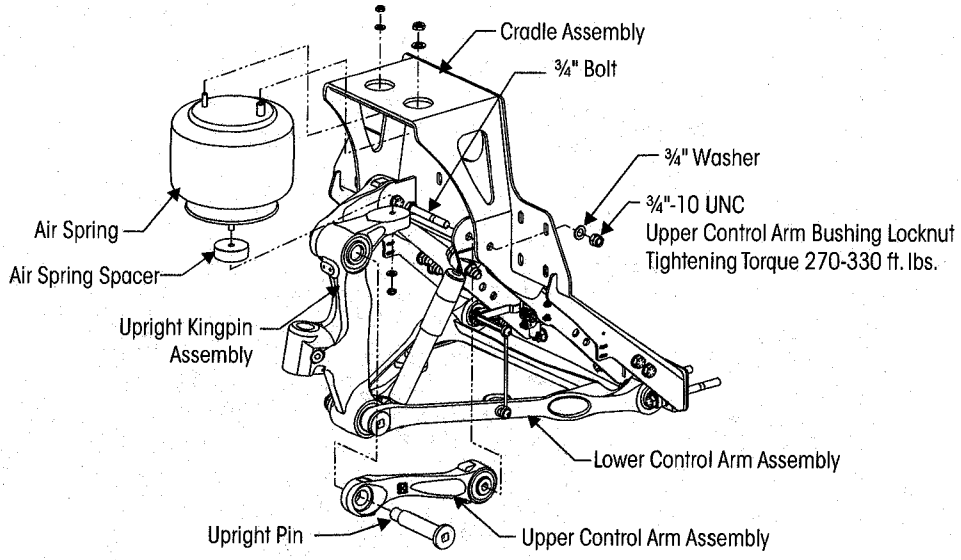
DISASSEMBLY

1. Place the vehicle on a level floor.
2. Chock the wheels.
3. Raise and support the frame.

WARNING PRIOR TO AND DURING DEFLATION AND INFLATION OF THE AIR SUSPENSION SYSTEM, ENSURE THAT ALL PERSONNEL AND EQUIPMENT ARE CLEAR FROM UNDER THE VEHICLE AND AROUND THE SERVICE AREA, FAILURE TO DO SO CAN CAUSE SERIOUS PERSONAL INJURY, DEATH, OR PROPERTY DAMAGE.

4. See additional Air Spring Warnings and Instructions in the Important Safety Notice Section of this publication prior to deflating or inflating the suspension system.
5. Disconnect the height control valve linkage and allow the suspension to fully deflate.
6. Remove the wheel and brake drum.
7. Support the hub securely with a jack stand.
8. Remove the upright pin from the upper control arm and upright kingpin assembly, see Figure 9-37.
9. Remove the upper control arm bushing mounting bolts from the cradle assembly.
10. Remove the upper control arm.

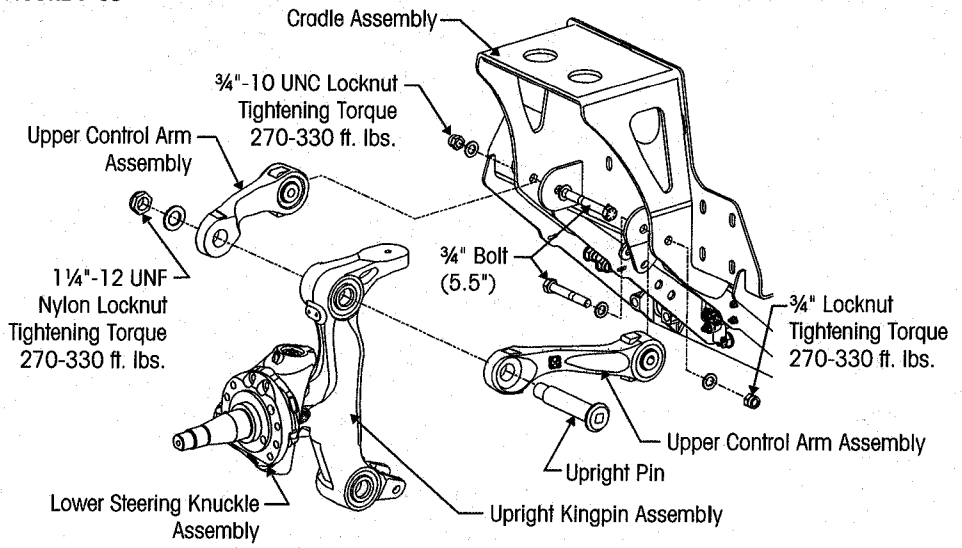
FIGURE 9-37



ASSEMBLY

1. Install the upper control arm into the cradle assembly.
2. Install the upper control arm bushing mounting bolt into the upper control arm.
3. Snug the bolts, **DO NOT** tighten at this time.
4. Position the upper control arms around the upright, see Figure 9-38.
5. Install the upright pin, snug, **DO NOT** tighten at this time.
6. Install the brake drum and wheel.
7. Raise the vehicle and remove the frame stands.

FIGURE 9-38

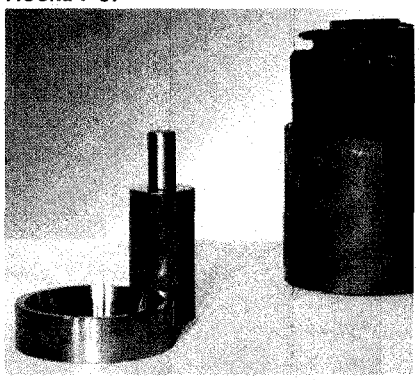


8. See additional Air Spring Warnings and Instructions in the Important Safety Notice Section of this publication prior to deflating or inflating the suspension system.
9. Connect the height control valve linkage and inflate suspension to ride height.
10. Tighten the 1¼" upright kingpin assembly to upper control arm assembly fasteners to 270-330 foot pounds torque.

11. Tighten the ¾" upper control arm to cradle assembly mounting fasteners to 270-330 foot pounds torque.
12. Remove the wheel chocks.
13. Align vehicle per the Alignment & Adjustments Section of this publication.

UPPER CONTROL ARM BUSHING REPLACEMENT

FIGURE 9-39



You will need:

- A vertical press with a capacity of at least 10 tons
- Upper control arm bushing remover tool
- Upper control arm receiver tool
- A bushing assembly tool (Funnel)

See Special Tools Section of this publication.

DISASSEMBLY

Remove the upper control arm assembly. Follow the upper control arm disassembly procedure in this section.

1. Place the upper control arm in a shop press.
2. Support the upper control arm on the receiving tool with the beam eye centered on the receiving tool. Be sure the upper control arm is squarely supported on the press bed, see Figure 9-40.
3. Center the push out tool on the inner sleeve and press out the old bushing, (these bushings are not cartridge type bushings, they do not have outer metals).

FIGURE 9-40

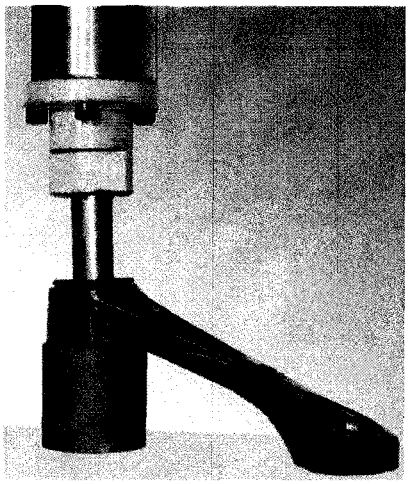


FIGURE 9-41

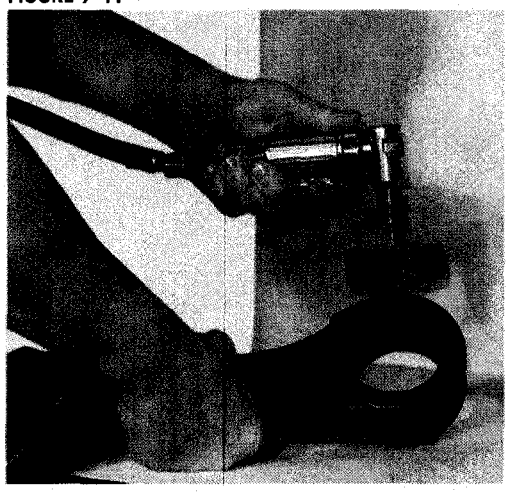
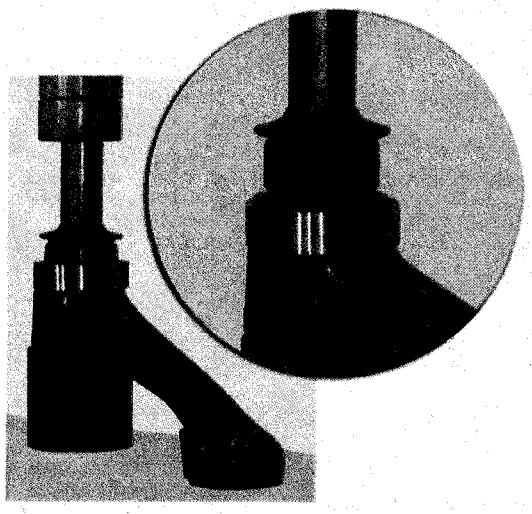


FIGURE 9-42

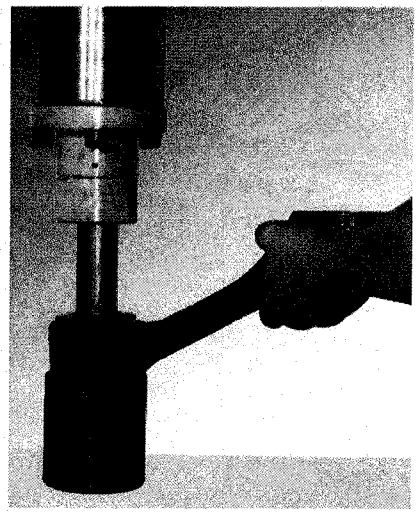
ASSEMBLY

1. Clean and inspect the I.D. of the upper control arm bushing bore, see Figure 9-41.
2. Lubricate the inner diameter of the upper control arm bushing bore with a vegetable base oil (cooking oil). **DO NOT** use petroleum or soap base lubricant, it can cause an adverse reaction with the bushing material, such as deterioration, see Figure 9-42.
3. Support the upper control arm on the receiving tool with the bushing bore centered on the tool. Be sure the support beam is squarely supported on the press bed.
4. Place the bushing installer tool (see Special Tools Section of this publication) on the upper control arm bushing, see Figure 9-43.

FIGURE 9-43



FIGURES 9-44



5. Press in the new bushing. Bushings must be centered within the support beam eye. When pressing in the new bushings over-shoot desired final position by 3/16" and press again from the opposite side to center the bushing within the upper control arm eye bore, if necessary, see Figure 9-44.
6. Install the upper control arm assembly. Follow the upper control arm assembly procedure in this section.

UPRIGHT KINGPIN ASSEMBLY

DISASSEMBLY

1. Place the vehicle on a level floor.
2. Chock the wheels.
3. Raise and support the frame.

⚠ WARNING

PRIOR TO AND DURING DEFLATION AND INFLATION OF THE AIR SUSPENSION SYSTEM, ENSURE THAT ALL PERSONNEL AND EQUIPMENT ARE CLEAR FROM UNDER THE VEHICLE AND AROUND THE SERVICE AREA, FAILURE TO DO SO CAN CAUSE SERIOUS PERSONAL INJURY, DEATH, OR PROPERTY DAMAGE.

4. See additional Air Spring Warnings and Instructions in the Important Safety Notice Section of this publication prior to deflating or inflating the suspension system.
5. Disconnect the height control valve linkage and allow the suspension to fully deflate.
6. Remove the wheel, hub, brakes, and brake torque plate.
7. Remove the two socket head cap screws and separate the steering knuckle assembly. Leave tie rod attached.
8. Remove the lower air spring fasteners and air spring spacer (if equipped).

9. Remove the lower shock absorber mounting fasteners.
10. Remove the UPPER control arm to upright mounting fastener.
11. Remove the LOWER control arm to upright mounting fastener.
12. Remove the upright kingpin assembly.

ASSEMBLY

1. Slide the upright kingpin assembly into the lower control arm.
2. Install the lower control arm to upright mounting fastener.
3. Install the upright kingpin assembly into the upper control arm.
4. Install the upper control arm to upright mounting fastener, **DO NOT** tighten at this time.
5. Tighten both the upper and lower upright mounting fasteners to 270-330 foot pounds torque.
6. Install the lower air spring mounting stud and air spring spacer (if equipped) into the upright king pin assembly.
7. Install the lower air spring mounting fasteners and tighten to 25-35 foot pounds torque.
8. Install lower shock fasteners and tighten to 180-200 foot pounds.
9. Assemble the steering knuckle as per knuckle assembly in this publication.
10. Install the brake torque plate, brakes, hub, and wheel.
11. Remove the frame supports.
12. See additional Air Spring Warnings and Instructions in the Important Safety Notice Section of this publication prior to deflating or inflating the suspension system.
13. Connect the height control valve linkage and allow the suspension to fully inflate.
14. Remove the wheel chocks.
15. Align the vehicle, refer to the Alignment & Adjustments Section of this publication.

UPRIGHT BEARING REPLACEMENT

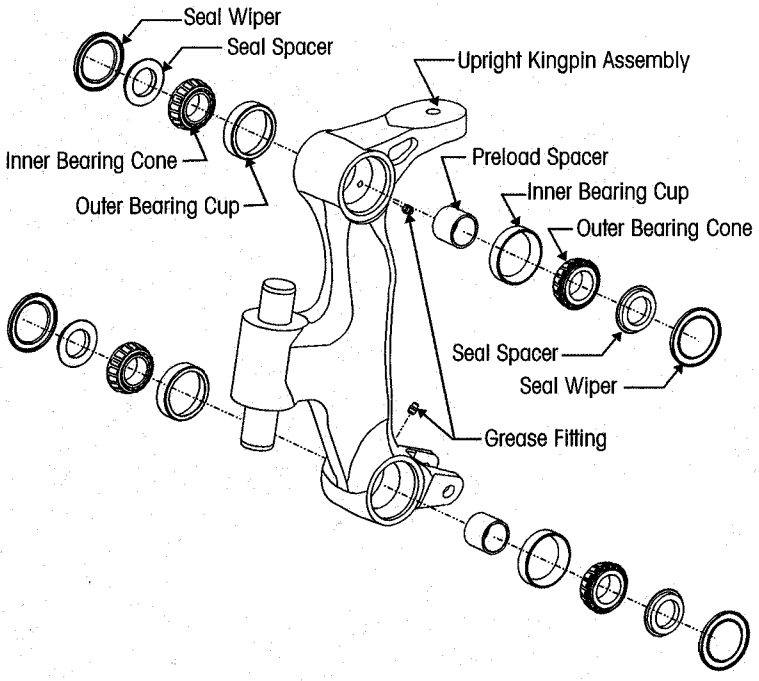
DISASSEMBLY

1. Remove the upright kingpin assembly from the upper and lower control arms per the Upright Kingpin Assembly instructions in this section.
2. Remove the bearing seal wiper and seal spacer, see Figure 9-45.
3. Remove the bearing and bearing preload spacer.
4. Inspect the bearing and bearing surfaces.
5. Inspect the bearing spacer.

ASSEMBLY

1. Pre-lube and install the bearing preload spacer.
2. Pre-lube and install the tapered roller bearing.
3. Install the seal spacer into the taper roller bearing bore on the upright kingpin assembly.
4. Position the bearing seal wiper over the bearing bore on the upright kingpin assembly.
5. Drive the tapered roller bearing seal wiper into the bore until it bottoms out against the seal spacer.
6. Install the upright kingpin assembly into the upper and lower control arms per the upright kingpin assembly instructions in this section.

FIGURE 9-45



LOWER CONTROL ARM

REMOVAL

1. Place the vehicle on a level floor.
2. Chock the wheels.
3. Raise and support the frame.

⚠ WARNING

PRIOR TO AND DURING DEFLATION AND INFLATION OF THE AIR SUSPENSION SYSTEM, ENSURE THAT ALL PERSONNEL AND EQUIPMENT ARE CLEAR FROM UNDER THE VEHICLE AND AROUND THE SERVICE AREA, FAILURE TO DO SO CAN CAUSE SERIOUS PERSONAL INJURY, DEATH, OR PROPERTY DAMAGE.

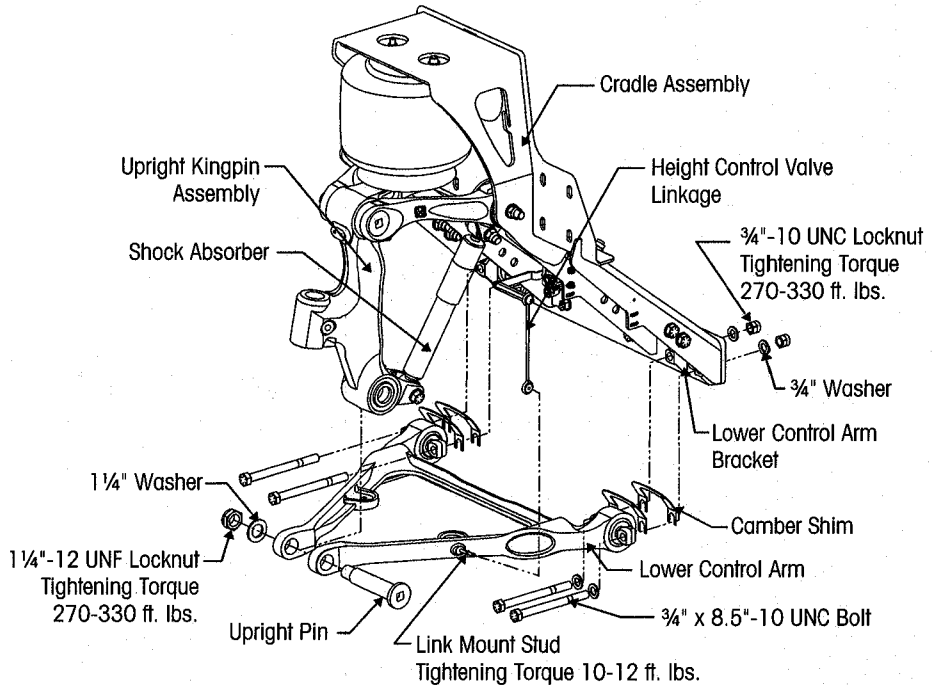
4. See additional Air Spring Warnings and Instructions in the Important Safety Notice Section of this publication prior to deflating or inflating the suspension system.
5. Disconnect the height control valve linkage and allow the suspension to fully deflate.
6. Remove the wheel and brake drum.
7. Support the hub securely with a jack stand.
8. Remove the upright pin from the lower control arm, see Figure 9-46.

NOTE

Prior to removal of the lower control arm bar pin fasteners, note the location and orientation of camber shims. It is required that the shims be installed in the same orientation and location as removed to preserve the existing camber angle.

9. Remove the camber shims from the lower control arm.
10. Remove the four bar pin bushing bolts on the lower control arm.
11. Remove the lower control arm.

FIGURE 9-46



ASSEMBLY

1. Position the lower control arm under the air spring.
2. Slide the lower control arm over the bottom of the upright king pin assembly.
3. Install the upright pin and 1¼" fasteners, **DO NOT** tighten at this time.
4. Raise the lower control arm into the bottom of the cradle assembly.

NOTE

Prior to installation of the lower control arm, note the quantity and orientation of the camber shims. It is required that the shims be installed in the same orientation and location as removed to preserve the existing camber angle.

5. Install the same amount of new shims as removed from the lower control arm during disassembly.
6. Install ¾" x 8.5" bolt and mounting fasteners to connect the lower control arm to cradle assembly.
7. Tighten all lower control arm mounting fasteners to 270-330 foot pounds torque.
8. Install the brake drum and wheel.
9. Remove the frame supports.
10. See additional Air Spring Warnings and Instructions in the Important Safety Notice Section of this publication prior to deflating or inflating the suspension system.
11. Connect the height control valve linkage and allow the suspension to fully inflate.
12. Remove the wheel chocks.
13. Align vehicle per the Alignment & Adjustments Section of this publication.

CRADLE GUSSET

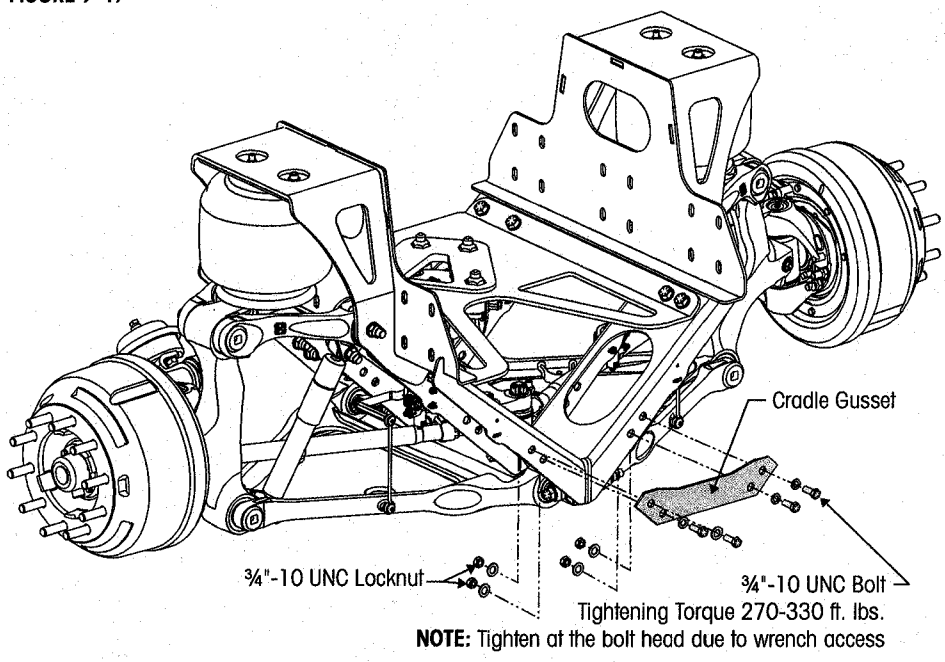
DISASSEMBLY

1. Place the vehicle on a level floor.
2. Chock the wheels.
3. Raise and support the frame.
4. Remove the four cradle gusset mounting fasteners and discard, see Figure 9-47.
5. Remove the cradle gusset.
6. Inspect the cradle gusset mounting surface for any cracks or damage, replace as necessary.

ASSEMBLY

1. Position the cradle gusset on the cradle assemblies and install new mounting fasteners.
2. Tighten the cradle mounting fasteners to 270-330 foot pounds torque.
3. Remove the frame supports.
4. Remove wheel chocks.

FIGURE 9-47



CRADLE ASSEMBLY

DISASSEMBLY

1. Place the vehicle on a level floor.
2. Chock the wheels.
3. Raise and support the frame.

⚠ WARNING

PRIOR TO AND DURING DEFLATION AND INFLATION OF THE AIR SUSPENSION SYSTEM, ENSURE THAT ALL PERSONNEL AND EQUIPMENT ARE CLEAR FROM UNDER THE VEHICLE AND AROUND THE SERVICE AREA, FAILURE TO DO SO CAN CAUSE SERIOUS PERSONAL INJURY, DEATH, OR PROPERTY DAMAGE.

4. See additional Air Spring Warnings and Instructions in the Important Safety Notice Section of this publication prior to deflating or inflating the suspension system.
5. Disconnect the height control valve linkage and allow the suspension to fully deflate.

6. Remove height control valve and air lines from the cradle assembly, see Height Control Valve disassembly in this section.
7. Remove the wheel and brake drum.
8. Disconnect the brake line.
9. Remove the ABS line from the steering knuckle.
10. Remove the air spring assembly, the upright and cradle assembly, see Air Spring Disassembly in this section.
11. Disconnect the tie rod end from the steering knuckle.
12. Remove the shock absorber from the cradle assembly, see Shock Absorber Disassembly in this section.

⚠ CAUTION

THE UPRIGHT KINGPIN AND STEERING KNUCKLE ASSEMBLY IS HEAVY (APPROXIMATELY 135 POUNDS), DO NOT REMOVE OR INSTALL WITHOUT A SUITABLE LIFTING DEVICE.

13. Support the upright and steering knuckle assembly with a suitable lifting device.
14. Disconnect, and remove the upright and steering knuckle assembly from the upper and lower control arms, see Upright Kingpin Assembly Disassembly in this section.
15. Remove the upper control arms from the cradle assembly, see Upper Control Arm Disassembly in this section.

NOTE

Prior to removal of the lower control arm bar pin fasteners, note the location and orientation of camber shims. It is required that the shims be installed in the same orientation and location as removed to preserve the existing camber angle.

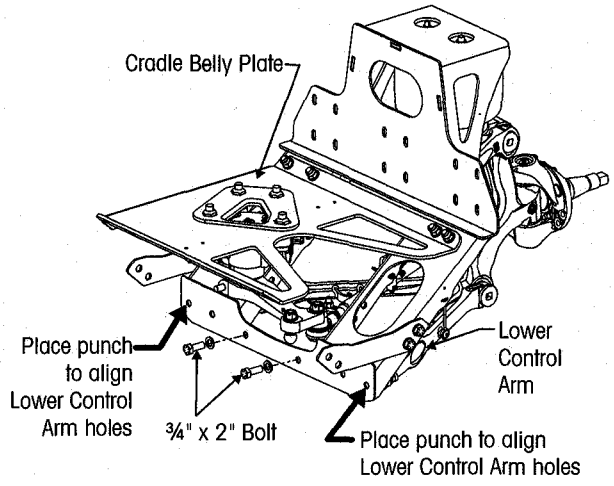
16. Remove the four bar pin bushing bolts on the lower control arm.
17. Remove the lower control arm from the cradle assembly, see Lower Control Arm disassembly in this section.
18. Remove the four bolts from the front and rear cradle gussets, see Figure 9-47.
19. Remove the four bolts from the cradle belly plate.

NOTE

Prior to removal of the cradle assembly support steering gear and Pitman arm. Place a block of wood between the cradle gusset and cradle belly plate to provide support.

20. Remove the two remaining bolts that join the bottom of the two cradle assemblies, see Figure 9-48.

FIGURE 9-48



⚠ CAUTION

THE CRADLE ASSEMBLY IS HEAVY (APPROXIMATELY 150 LBS.), DO NOT REMOVE OR INSTALL THE CRADLE ASSEMBLY WITHOUT THE SUITABLE LIFTING DEVICE.

21. Support the cradle assembly being removed.
22. Remove the frame bolts that attach the cradle assembly to the frame.
23. Lower and remove the cradle assembly.
24. Inspect the frame and any mating components for any damage, replace as necessary.
25. Clean any mating surfaces as necessary.

ASSEMBLY

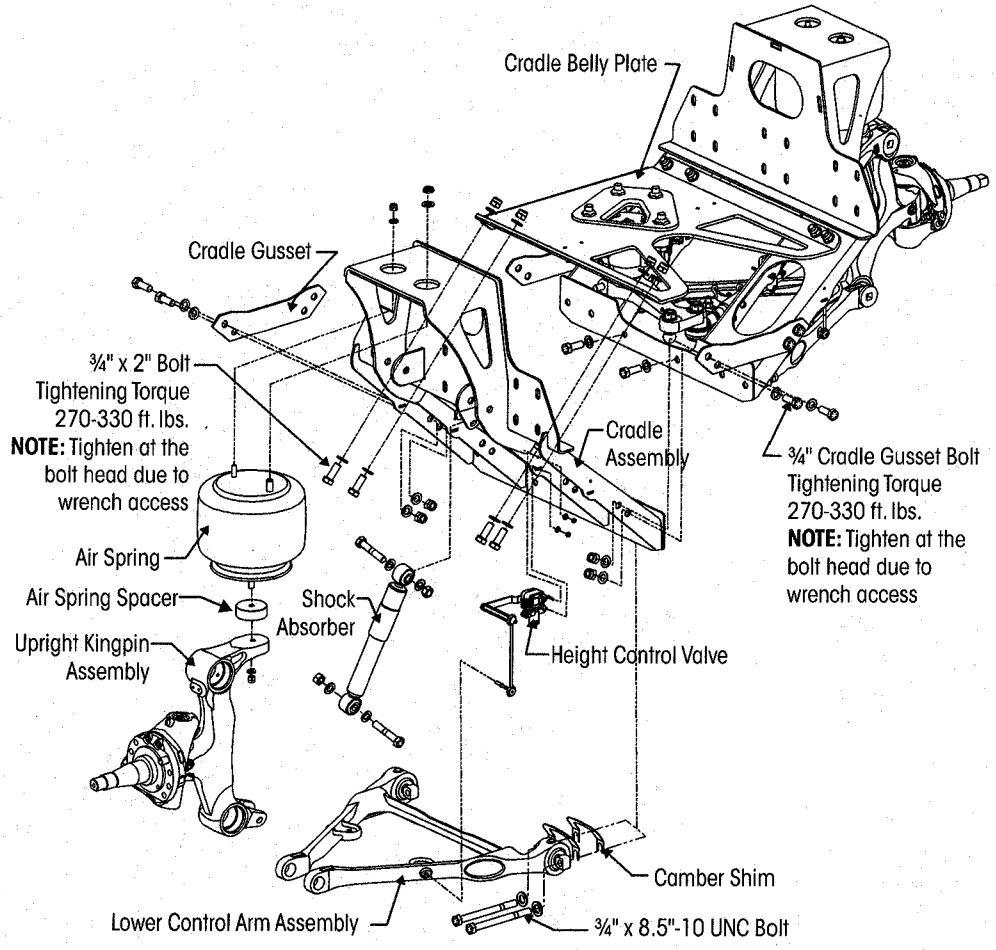
1. Secure the cradle assembly on a suitable lifting device.
2. Raise the cradle assembly in to position on the vehicle and align the bolts that hold cradle assembly to frame.
3. Install two (2) punches to align lower control arm attachment holes, see Figure 9-48.
4. Install the new cradle to frame mounting fasteners. Tighten to the vehicle manufacturer's torque specification.
5. Install the four (4) new fasteners that connect the cradle assembly to the cradle belly plate. Tighten to 270-330 foot pounds torque, see Figure 9-49.
6. Install two new (2) ¾" fasteners, the two innermost fasteners that join the bottom of the two cradle assemblies (bolt length 2"), see Figure 9-48.
7. Install the lower control arm assembly, see Lower Control Arm Assembly in this section.
8. Tighten the lower control arm mounting bolts and the two ¾" x 2" innermost fasteners, begin torque sequence with the innermost fasteners and work your way out. Tighten to 270-330 foot pounds torque.
9. Install the upper control arms, see Upper Control Arm Assembly instructions in this section.

⚠ CAUTION

THE UPRIGHT KINGPIN AND STEERING KNUCKLE ASSEMBLY IS HEAVY (APPROXIMATELY 135 POUNDS), DO NOT REMOVE OR INSTALL WITHOUT THE SUITABLE LIFTING DEVICE.

10. Support the steering knuckle, upright kingpin, on a suitable lifting device.

FIGURE 9-49



11. Install the steering knuckle and upright kingpin assembly into the upper and lower control arm assemblies, see Upper and Lower Control Arm Assembly instructions in this section.
12. Install four new (4) bolts from the cradle gussets to the cradle assembly and tighten to 270-330 foot pounds torque.
13. Install the brake line.
14. Install the ABS line into the steering knuckle.
15. Install the air spring, see Air Spring Assembly in this section.
16. Install height control valve and air lines to the cradle assembly, see HCV assembly in this section.
17. Install the tie rod end on the steering knuckle.
18. Install the shock absorber into the cradle assembly.
19. Install the wheel and brake drum assembly.
20. Raise the vehicle and remove the frame stands.
21. See additional Air Spring Warnings and Instructions in the Important Safety Notice Section of this publication prior to deflating or inflating the suspension system.
22. Connect the height control valve linkage and allow the suspension to fully inflate to ride height.
23. Tighten the upper control arm to cradle mounting bolts to 270-330 foot pounds torque.
24. Remove the wheel chocks.
25. Align the vehicle, refer to the Alignment & Adjustments Section of this publication.

CRADLE BELLY PLATE

DISASSEMBLY

1. See Cradle Disassembly procedure in this section to remove the cradle, see Figure 9-48.
2. Remove the four mounting bolts that hold the steering gear to the cradle belly plate.
3. Lower the steering gear down from the cradle belly plate.
4. Remove the remaining four cradle assembly belly plate mounting bolts and discard.
5. Slide the cradle belly plate out the side that the cradle assembly was removed from.
6. Inspect all cradle belly plate mounting surfaces for any cracks or damage, replace as necessary.

ASSEMBLY

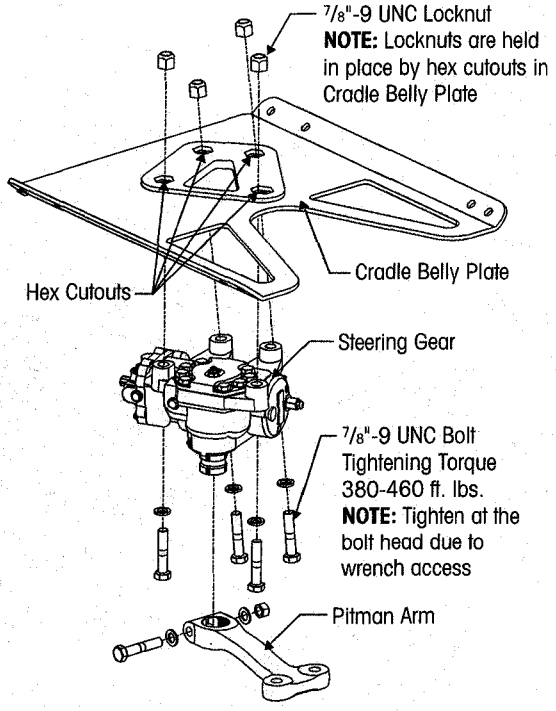
1. Install cradle belly plate locknuts.
2. Slide the cradle belly plate into position between the cradle assemblies.
3. Install four new cradle belly plate to cradle assembly mounting bolts, but **DO NOT** tighten at this time.
4. Install the four steering gear mounting bolts, but **DO NOT** tighten at this time.
5. Install the cradle assembly that was removed. Follow the Cradle Assembly procedure in this section.
6. Tighten the eight new cradle belly plate to cradle assembly mounting bolts to 270-330 foot pounds torque.
7. Tighten the four steering gear mounting bolts to 380-460 foot pounds torque.
8. Remove the wheel chocks.

STEERING GEAR

DISASSEMBLY

1. Place the vehicle on a level floor.
2. Chock the wheels.
3. Raise and support the frame.
4. Disconnect the tie rod ends from the Pitman arm.
5. Disconnect all power steering lines to the steering gear, be sure to cap any lines removed to prevent dirt contamination into the power steering system.
6. Disconnect the steering shaft from the steering gear box.
7. Remove the four mounting bolts from the steering gear box, see Figure 9-50.
8. Remove the steering gear box from the chassis.
9. Note timing mark locations and remove Pitman arm, see Figure 9-51.

FIGURE 9-50



ASSEMBLY

1. Verify the correct timing of Pitman arm and install on steering gear box.
2. Tighten the pinch bolt and nut to 270-330 foot pounds torque prior to installing the steering gear.
3. Install the steering gear into the cradle assembly.
4. Raise steering gear into position and install the four mounting bolts.
5. Tighten the steering gear mounting bolts to 380-460 foot pounds torque.
6. Connect the tie rod ends to the Pitman arm.
7. Install the steering shaft on the input shaft of the steering gear. Install the pinch bolt and torque to the required specification.
8. Install all power steering lines that were removed.
9. Fill power steering reservoir to the required specification.
10. Bleed the power steering system. Follow manufacturer's specifications.
11. Check for leaks and top off power steering fluid level.

PITMAN ARM

DISASSEMBLY

1. Disconnect the tie rod ends from the Pitman arm.
2. Prior to disassembly of the Pitman arm mark the location of the timing marks.
3. Remove the Pitman arm pinch bolt.
4. Lightly tap on the Pitman arm and slide down the steering gear output shaft.

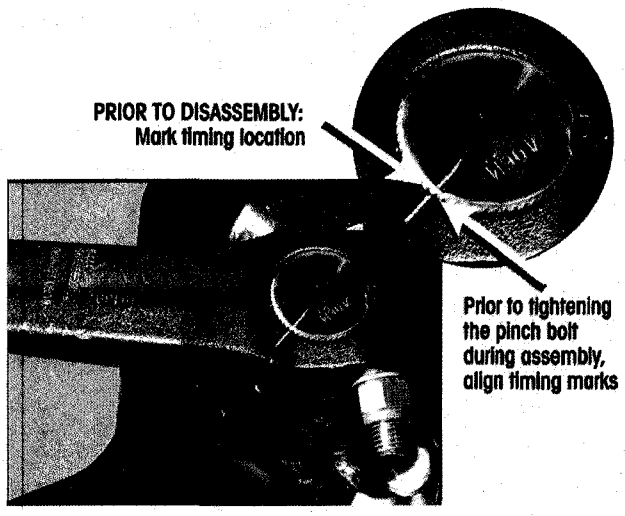
5. Remove Pitman arm from chassis.
6. Inspect splines on steering gear output shaft for; severe wear, corrosion, fretting, twisted or missing splines. Replace steering gear if necessary.
7. Inspect splines on Pitman arm for; severe wear, corrosion, fretting, twisted or missing splines. Replace Pitman arm if necessary.

ASSEMBLY

1. Align the timing marks on the Pitman arm and the steering gear output shaft. Ensure the correct timing mark is used, see Figure 9-51.

SERVICE HINT If necessary use a suitable device to spread open the split on the Pitman arm.

FIGURE 9-51



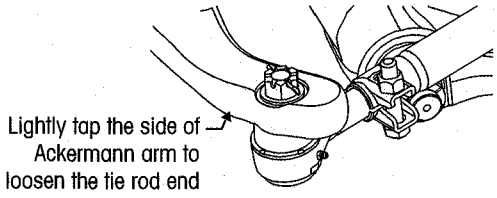
2. Slide the Pitman arm over the steering gear output shaft.
3. Install the pinch bolt. Prior to tightening the pinch bolt during assembly, align timing marks. Tighten to 270-330 foot pounds torque.
4. Reconnect the tie rod ends into the Pitman arm.
5. Tighten the castle nuts to 185 foot pounds torque and install the cotter pins.
6. Check wheel cuts.

TIE ROD END AND CROSS TUBE

DISASSEMBLY

1. Place the vehicle on a level floor.
2. Chock the wheels.
3. Position the steer axle tires straight ahead.
4. Remove the cotter pin and castle nut.

FIGURE 9-52



5. Lightly tap the side of the Ackermann arm to loosen the tie rod end from the Ackermann arm, see Figure 9-52.
6. Lightly tap the side of the Pitman arm to loosen the tie rod end from the Pitman arm.
7. Remove the cross tube and tie rod ends from the vehicle.
8. Mount the cross tube in a soft jaw vice.
9. Remove the hardware from the clamp on the cross tube.
10. Count the exposed threads on the tie rod end being replaced.
11. Remove the tie rod end from the cross tube.

⚠ WARNING

DO NOT HEAT THE CROSS TUBE WITH A TORCH TO FACILITATE THE REMOVAL OF THE TIE ROD END. THE USE OF SUCH HEAT CAN ADVERSELY AFFECT THE STRENGTH OF THE CROSS TUBE. A COMPONENT DAMAGED IN THIS MANNER WILL RESULT IN LOSS OF WARRANTY, AND CAN RESULT IN THE AND LOSS OF VEHICLE CONTROL, AND POSSIBLE PERSONAL INJURY OR PROPERTY DAMAGE.

12. If the opposing tie rod end is being replaced repeat steps 8 through 10.
13. Inspect the cross tube for dents, cracks, or thread damage. Replace the cross tube if needed.

ASSEMBLY

1. Lubricate the new tie rod end threads with Anti-Seize.

NOTE

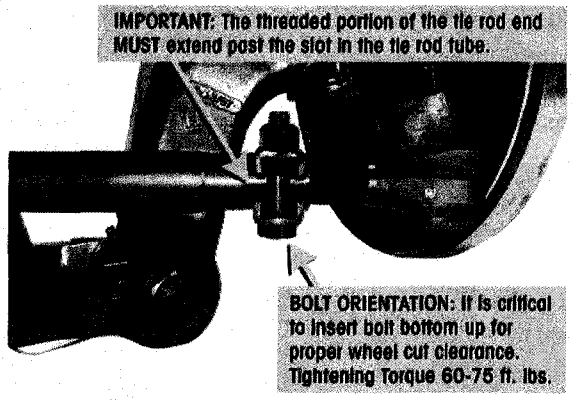
When installing the cross tube the thread direction of the tie rod ends are as follows:
- A right hand threaded tie rod end will be installed into the right side Ackermann arm.
- A left hand threaded tie rod end will be installed into the left side Ackermann arm.

2. Install the new tie rod end into the cross tube, leaving the same amount of threads exposed that were counted on the failed tie rod end prior to removal.

⚠ WARNING

THE THREADED PORTION OF THE TIE ROD END MUST EXTEND PAST THE SLOTS INTO THE TIE ROD CROSS TUBE, SEE FIGURE 9-53. FAILURE TO DO SO CAN CAUSE COMPONENT DAMAGE, LOSS OF VEHICLE CONTROL AND POSSIBLE PERSONAL INJURY OR PROPERTY DAMAGE.

FIGURE 9-53



3. Replace the opposing tie rod end if necessary by repeating steps 2 and 3.
4. If replacing opposing tie rod end, it is critical that the cross tube will rotate in the opposing tie rod end.

⚠ WARNING

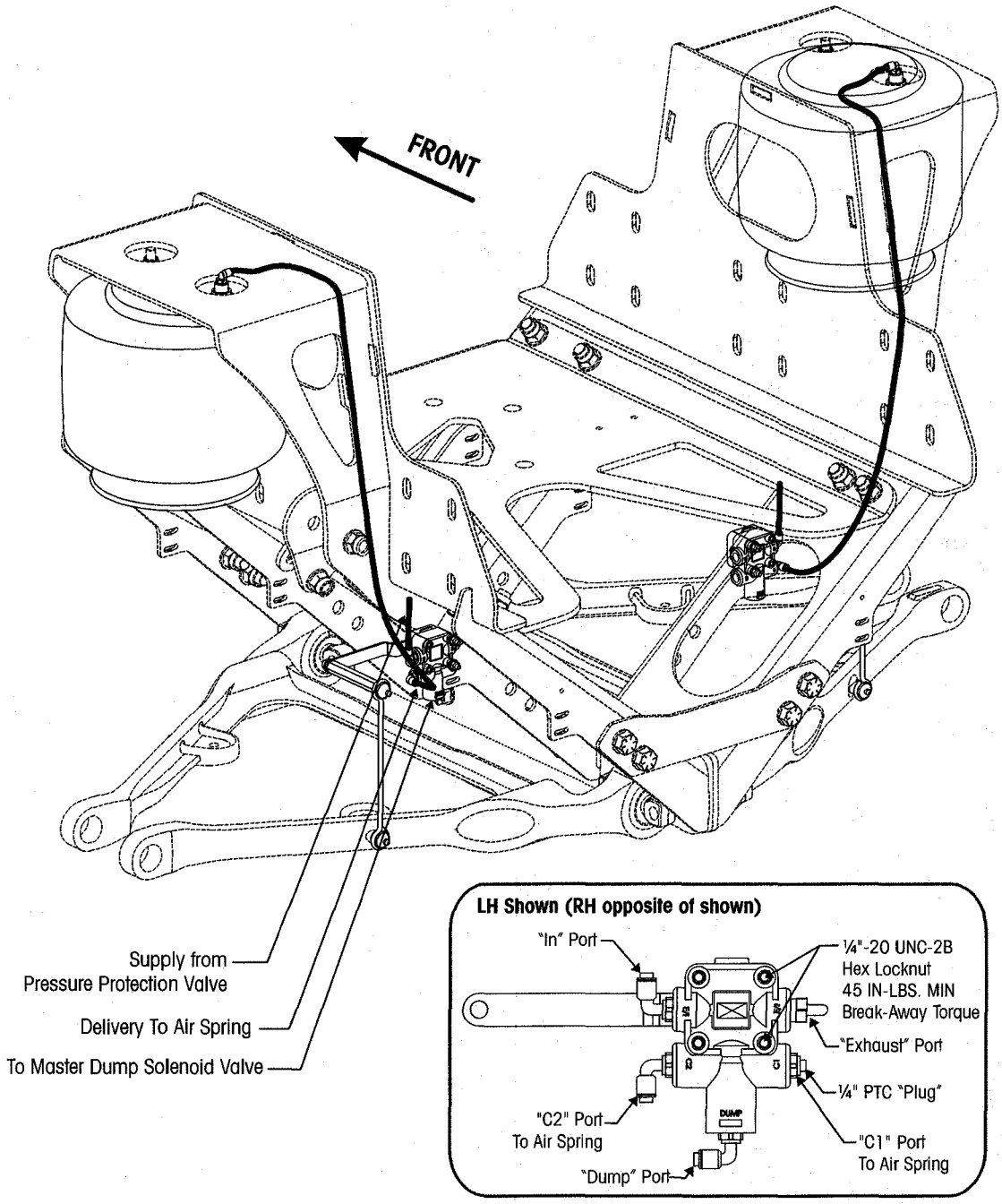
DO NOT HEAT THE CROSS TUBE WITH A TORCH TO ROTATE THE CROSS TUBE IN THE TIE ROD END. THE USE OF SUCH HEAT CAN ADVERSELY AFFECT THE STRENGTH OF THE CROSS TUBE. A COMPONENT DAMAGED IN THIS MANNER WILL RESULT IN LOSS OF WARRANTY, AND CAN RESULT IN THE LOSS OF VEHICLE CONTROL, AND POSSIBLE LOWER STEERING KNUCKLE PERSONAL INJURY OR PROPERTY DAMAGE.

5. Install the cross tube into the Ackermann arm and Pitman arm.
6. Tighten the castle nuts to 185 foot pounds torque then rotate the castle nut to the next castle slot and install cotter pin.
7. Grease tie rod ends, see Lubrication Chart for required lubricant in the Preventive Maintenance Section of this publication.
8. Set the toe, refer to the Toe Adjustment Procedure in the Alignment & Adjustments Section of this publication.

SECTION 10
Plumbing Diagram

(Originally equipped from the manufacturer)

When replacing or installing nylon air line tubing into quick-connect fittings it is critical that the end of the air line is cut square. Improper cut of the end of the air line tubing can cause the air line to seat improperly in the quick connect fitting causing air leakage.



SECTION 11

Front Wheel Alignment Specifications

HENDRICKSON IFS FOR SPARTAN MOTORHOME CHASSIS

FRONT AIR MODULE SUSPENSION ALIGNMENT SPECIFICATION			
CAMBER	DESIGN SPECIFICATION	RANGE	
		MINIMUM	MAXIMUM
LEFT	0.0° ± 1.0°	-1.0°	+1.0°
RIGHT	0.0° ± 1.0°	-1.0°	+1.0°
CROSS	0.0°	—	+2.0°

CAMBER NOTES:

To increase negative camber add shim part no. 68387-000.
To remove negative camber remove shim part no. 68387-000.

CASTER[1,2]	DESIGN SPECIFICATION	RANGE	
		MINIMUM	MAXIMUM
LEFT	4.0° ± 1.0°	+3.0°	+5.0°
RIGHT	4.5° ± 1.0°	+3.5°	+5.5°
CROSS[3]	0.5°	—	+2.0°

CASTER NOTES:

1. Caster is determined with the vehicle at specified ride height for air suspension. It is critical that the vehicle front and rear ride height is within specifications prior to performing a caster measurement or adjustment. See Hendrickson ride height specifications and procedure.
2. In most cases actual vehicle caster is defined with the frame rails at zero slope. Refer to the vehicle manufacturer's specifications for correct frame rail slope. (Both the alignment surface and the vehicle's frame rails should be level during execution of alignment procedures). For vehicles with a positive frame rake (higher in rear) add the frame slope (in degrees) to the caster reading to determine true vehicle caster.
3. **The cross caster angle is not adjustable – DO NOT** try to adjust cross caster. If found out of specifications notify Hendrickson Tech Services for further information.

HENDRICKSON RECOMMENDS FOLLOWING TMC[2] PRACTICES:

	DESIGN SPECIFICATION[1]	RANGE	
		MINIMUM	MAXIMUM
TOTAL TOE[2]	1/16" ± 1/32" (0.06" ± 0.03")	1/32" (0.03")	3/32" (0.09")

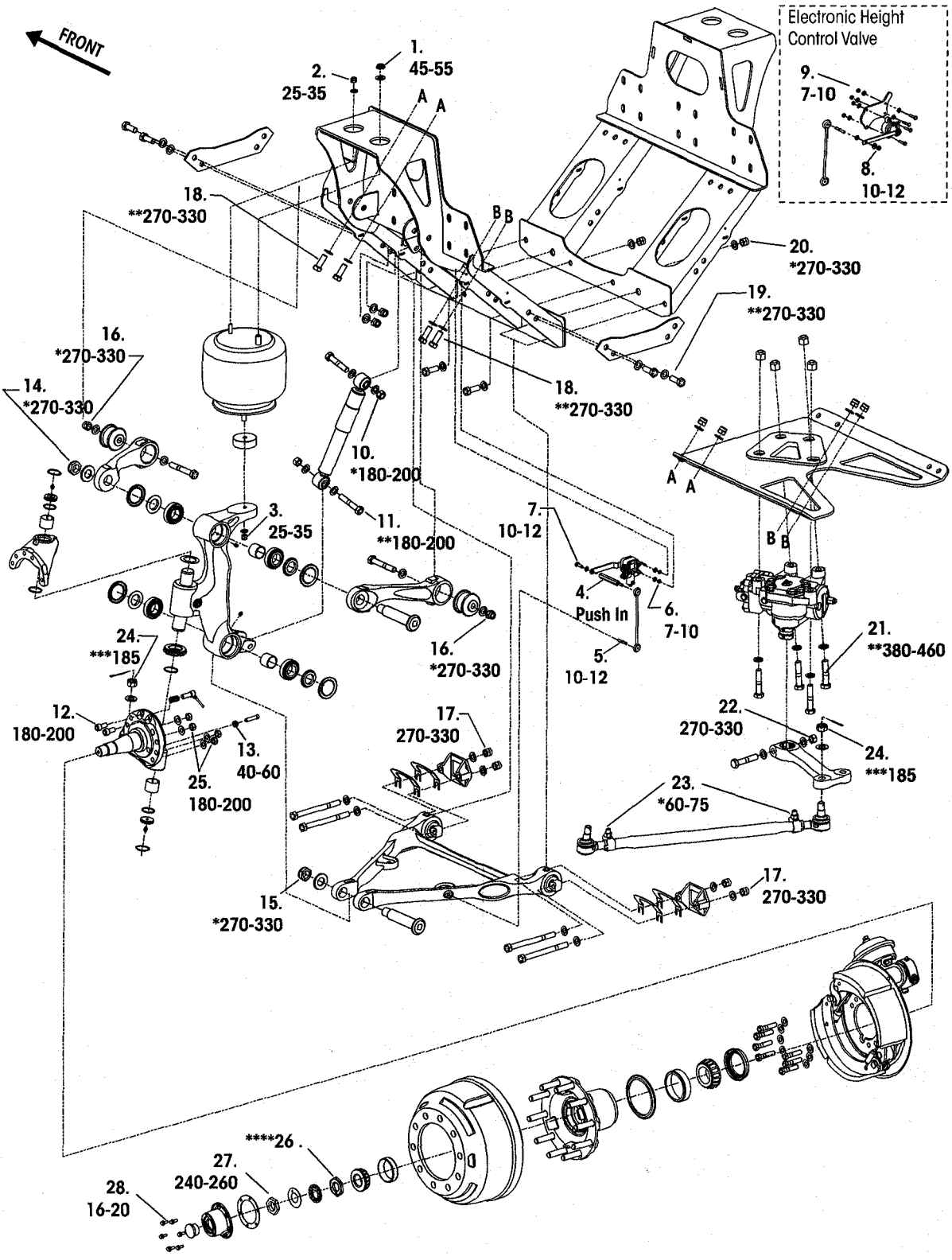
TOE-IN NOTES:

1. Toe-in is to be set and adjusted in the normal vehicle unladen configuration. Actual vehicle curb weight on the ground. Toe should be checked at the tires front and rear tread center, at a distance above ground equal to the tire's rolling radius.
2. In most instances total toe is set by the vehicle manufacturer or body builder. Consult the vehicle manufacturer for specifications.

SECTION 12

Torque Specifications

HENDRICKSON RECOMMENDED TORQUE VALUES
PROVIDED IN FOOT POUNDS



HENDRICKSON IFS FOR SPARTAN MOTORHOME CHASSIS

HENDRICKSON RECOMMENDED TORQUE SPECIFICATIONS				
NO.	**COMPONENT**	**QTY.**	**SIZE**	**TORQUE VALUE (in foot pounds)**
1	Air Spring to Cradle Assembly	2	3/4"	45-55
2	Air Spring to Cradle Assembly	2	1/2"	25-35
3	Air Spring to Upright Kingpin Assembly	2	1/2"	25-35
4	Linkage Rod to Link Mount	2	Grommet	Push In
5	Link Mount to Lower Control Arm	2	5/16"	10-12
6	Mechanical Height Control Valve to Cradle Assembly	4	1/4"	7-10
7	Link Mount to Mechanical Height Control Valve	2	3/8"	10-12
8	HCV Linkage to Electronic Height Control Valve	2	5/16"	10-12
9	Electronic Height Control Valve to Cradle Assembly	8	1/4"	7-10
10	Upper Shock Eye to Cradle Assembly	2	3/4"	*180-200
11	Lower Shock Eye to Upright Kingpin Assembly	2	3/4"	**180-200
12	Knuckle Attachment Bolt (Socket Head Cap Screw)	4	5/8"	*180-200
13	Knuckle / Axle Wheel Stop Bolt	2	1/2"	40-60
14	Upright Kingpin Assembly to Upper Control Arm Assembly	2	1 1/4"	*270-330
15	Upright Kingpin Assembly to Lower Control Arm Assembly	2	1 1/4"	*270-330
16	Upper Control Arm to Cradle	4	3/4"	*270-330
17	Lower Control Arm to Cradle (Bolt Length 8.5")	4	3/4"	270-330
18	Cradle to Cradle Belly Plate	8	3/4"	**270-330
19	Cradle to Cradle Gusset	8	3/4"	**270-330
20	Cradle to Cradle (Bolt Length 2.0")	2	3/4"	*270-330
21	Cradle Belly Plate to Steering Gear	4	7/8"	**380-460
22	Pitman Arm to Steering Gear	1	3/4"	270-330
23	Tie Rod Tube to Tie Rod Ends	2	5/8"	*60-75
24	Tie Rod Ends to Lower Steering Knuckle	2	7/8" Castle Nut	***185
25	Lower Steering Knuckle Assembly to Brake Assembly	8	5/8"	180-200
26	Inner Wheel Bearing Adjusting Nut	2	1 1/2"	****
27	Outer Wheel Bearing Nut	2	1 1/2"	240-260
28	Hubcap	12	5/16"	16-20

• All hardware 1/4" and greater is Grade 8 with no additional lubrication.

NOTE: * Note the bolt orientation due to interference or wrench access.

** Tighten at the bolt head due to wrench access.

*** Torque to 185 foot lbs., advance nut to next hex face to install cotter pin. **DO NOT** back off nut for cotter pin installation.

**** See Wheel Bearing Adjustment in the Alignment & Adjustments Section of this publication for proper torque procedure.

SECTION 13
Troubleshooting Guide

HENDRICKSON IFS

TROUBLESHOOTING GUIDE		
CONDITION	**POSSIBLE CAUSE**	**CORRECTION**
Worn or damaged kingpins and kingpin bushings	Dirt in system– contaminated lubricant	Polish and inspect kingpin, replace bushing and seals, then follow specified lubrication procedures
	Incorrect lubricant	Lubricate axle with specified lubricant
	Axle not lubricated at scheduled frequency	Lubricant axle at scheduled frequency
	Incorrect lubrication procedures	Use correct lubrication procedures
	Lubrication interval not compatible with operating conditions	Change lubrication interval to match operating conditions
	Worn or missing seals	Replace worn or missing seals
Vibration or shimmy of front axle during operation	Caster out of specification	Replace upright assembly
	Wheels and/or tires out of balance	Balance or replace wheels and/or tires
	Worn shock absorbers	Replace shock absorbers
	Worn thrust washers and rear hanger clamps	Replace thrust washers and rear hanger clamps
	Broken engine mount	Replace engine mount
	Wheel bearing adjustment	Adjust wheel bearing to the vehicle manufacturer's specifications.
Excessive wear on tires or uneven tire tread wear	Tires have incorrect air pressure	Adjust tire pressure to manufacturer's specification.
	Tires out of balance	Balance or replace tires
	Incorrect tandem axle alignment	Align tandem axles
	Incorrect toe setting	Adjust toe-in to manufacturer's specification
	Incorrect steering arm geometry	Repair steering system as necessary
	Worn kingpin bushings	Replace kingpin bushings
	Excessive wheel bearing end play	Check specified wheel nut torque, replace worn or damaged wheel bearings
	Wheel bearing adjustment	Adjust wheel bearing to the vehicle manufacturer's specifications.
Vehicle is hard to steer	Low pressure in the power steering system	Repair power steering system
	Steering linkage needs lubrication	Lubricate steering linkage
	Steering knuckles are binding	Check vertical clearance
	Incorrect steering arm geometry	Repair steering system as necessary
	Caster out of specification	Replace upright assembly
	Tie rod ends hard to move	Replace tie rod ends
	Worn thrust bearing	Replace thrust bearing
	Steering gear box internal problem	Perform steering gear trouble shooting procedures per steering gear manufacturing guidelines.

HENDRICKSON IFS

TROUBLESHOOTING GUIDE (CONTINUED)		
CONDITION	**POSSIBLE CAUSE**	**CORRECTION**
Tie rod ends are worn and require replacement	Tie rod ends need lubrication	Lubricate tie rod end. Make sure lubrication schedule is followed.
	Severe operating conditions	Increase frequency of inspection and lubrication intervals
	Damaged boot on tie rod end	Replace tie rod end
Bent or broken cross tube, tie rod end ball stud or tie rod end NOTE: Damaged components require replacement	Pump/gear relief valve pressure setting exceeds system specifications	Adjust power steering system to manufacturer's specified pressure
	Steering gear poppets improperly set or malfunctioning	Check for proper operation or adjust poppets to OEM specifications
	Steering stops improperly set	Set steering stops to OEM specifications
	Severe duty cycle service	Increase frequency of inspection and lubrication intervals
Worn or broken steering ball stud	Drag link fasteners tightened past specified torque	Tighten drag link fasteners to the specified torque
	Lack of lubrication or incorrect lubricant	Lubricate linkage with specified lubricant
	Power steering stops out of adjustment	Adjust steering stops to OEM specifications
Suspension has harsh or bumpy ride	Air spring not inflated	Check air supply to air spring, repair as necessary
	Air spring ride height out of specification	Adjust ride height to proper specification
	Front suspension overloaded	Redistribute steer axle load
Restricted steering radius	Steering stops not adjusted correctly	Adjust steering stops to achieve correct wheel cut
	Tie rod clamps contact suspension	Adjust clamps to specified orientation
Vehicle leans	Ride height incorrect	Adjust ride height to specification
	Air spring(s) are not inflated	Repair source of air pressure loss
	Suspension is not torqued correctly at installation	Perform IFS spring hanger re-torque procedure. See Tightening Torque Specification Section of this publication
	Excessive weight bias	Contact the vehicle manufacturer or Hendrickson Tech Services
Vehicle wanders	Caster out of specifications	Replace upright assembly
	Incorrect toe setting	Adjust toe to specification
	Air in the power steering system	Remove air form the power steering systems
	Rear ride height out of adjustment	Adjust ride height to specification
	Front ride height out of adjustment	Adjust ride height to specification

SECTION 14
Reference Material

This technical publication covers Hendrickson Truck Suspension's recommended procedures for our parts/products. Other components play a major role in overall performance and Hendrickson recommends you follow the specific vehicle manufacturer's recommendation for care and maintenance. Some recommended procedures have been developed by The Technology & Maintenance Council (TMC) and Hendrickson supports these recommendations. We have compiled a list of these below.

TMC

To obtain copies of the following RPs, videos, or charts, contact TMC at:

TMC/ATA
2200 Mill Road
Alexandria, VA 22314

Phone: 703-838-1763
website: tmc.truckline.com
online ordering: www.truckline.com/store

Important References

TMC RP 214B	Tire/Wheel End Balance and Runout
TMC RP 216	Radial Tire Conditions Analysis Guide
TMC RP 219A	Radial Tire Wear Conditions and Causes
TMC RP 222A	User's Guide To Wheels and Rims
TMC RP 230	Tire Test Procedures for Tread wear, Serviceability, and Fuel Economy
TMC RP 514	Pre-Alignment Inspection
TMC RP 618	Wheel Bearing Adjustment Procedure
TMC RP 620B	Front End Alignment Steering Geometry
TMC RP 642	Guidelines For Total Vehicle Alignment
TMC RP 644	Wheel End Conditions Analysis Guide
TMC RP 645	Tie Rod End Inspection and Maintenance Procedure

Videos

TMC T0326	Wheel End Maintenance
TMC T0372	Tire Pre-Trip Inspection Guidelines

Other

TMC T0400	Wheel bearing Adjustment Procedure Wall Chart

Notes

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