Holland
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IFS SERIES

MAINTENANCE MANUAL

Holland NEWAY

IFS Series

Independent Front Air-Ride Suspension Maintenance Manual

Table of Contents

Introduction

You must read and understand all of the safety procedures presented in this manual before starting any work on the IFS suspension.

Proper tools must be used to perform the maintenance and repair procedures described in this manual. Many of these procedures require special tools.

Failure to use the proper equipment could result in personal injury and/or damage to the suspension.

Safety glasses must be worn at all times when performing the procedures covered in this manual.

Throughout this manual, you will notice the terms "NOTE, " "IMPORTANT," "CAUTION" and "WARNING" followed by important product information. So that you may better understand the manual, those terms are as follows:

NOTE: Includes additional information to enable accurate and easy performance of procedures.

IMPORTANT: Includes additional information that if not followed could lead to hindered product performance and/or product failure.

CAUTION

Used without the safety alert symbol, indicates a potentially hazardous situation which, if not avoided, may result in property damage.

⚠ CAUTION

Indicates a potentially hazardous situation which, if not avoided, may result in minor or moderate injury.

⚠ WARNING

Indicates a potentially hazardous situation which, if not avoided, could result in death or serious injury.

Table 1 - Maintenance Schedule

General Maintenance	Service to be performed	Mileage in the Thousands (X 1,000)							
		12	24	36	48	60	72	84	96
Control Arm Bushings	Check for proper torque on bolts		X		X		X		X[2]
Upper and Control Lower Arms	Inspect for contact between Control Arm and Mount Brkts	X	X	X	X	X	X	X	X[2]
	Inspect for bushing wear	X	X	X	X	X	X	X	X[2]
Tie Rod Ends	Inspect ball socket end play	X	X	X	X	X	X	X	X[2]
	Check for looseness of taper connection	X	X	X	X	X	X	X	X[2]
	Check that cotter pin is installed	X	X	X	X	X	X	X	X[2]
Brake System	Inspect slack adjuster for correct stroke	X	X	X	X	X	X	X	X[2]
	Inspect for air leaks using soapy water solution	X							
Air Springs	Inspect for proper clearance (1" minimum all around)	X							
	Check upper mount nut and lower mount bolt torque	X							
	Inspect for signs of chafing or wear	X	X	X	X	X	X	X	X[2]
	Check for air line fitting torque	X							
	Inspect for air leaks using soapy water solution	X							
Height Control Valve Linkage	Inspect for signs of bending, binding, or slippage	X	X	X	X	X	X	X	X[2]
Shock Absorbers	Check stud mount and lock nut torque	X							
	Inspect shocks for signs of fluid leak, broken eye ends, loose fasteners, or worn bushings	X	X	X	X	X	X	X	X[2]
Steering Arms	Check for proper torque on nuts	X							
	Inspect bearings for excessive radial play	X	X	X	X	X	X	X	X[2]
Wheels	Check bearing end play				X				X[2]
	Check for proper torque on wheel nuts[1]	X	X	X	X	X	X	X	X[2]
Front Alignment	Inspect toe-in[3]		X		X		X		X[2]
Air Fittings and Air Lines	Inspect for air leaks using soapy water solutions	X							
	Inspect airlines for signs of chafing, cracking, or wear	X	X	X	X	X	X	X	X[2]

1. Wheel nuts must be re-tightened to proper torque specifications as per the vehicle or chassis manufacturer's Owner Guide.
2. Continue to perform specified maintenance every 12,000 miles.
3. Toe-in should be inspected after vehicle completion by final stage manufacturer.

Serial Number Tag Location

The IFS Series Suspension Serial Tag is attached to the forward front subframe bulkhead (Fig.1). Stamped on this tag are the suspension model and serial number and parts list number (Fig.2).

The serial number is used by Holland Neway for control purposes and should be referred to when servicing the suspension.

NOTE: This manual applies to the suspension series shown on front cover. However, we urge you to reference your specific parts lists number, write that information below and use it when obtaining information or replacement parts. Holland Neway reserves the right to modify or change the suspension described in this manual, its specifications and its repair and maintenance procedures at any time without notice or incurring any obligation.

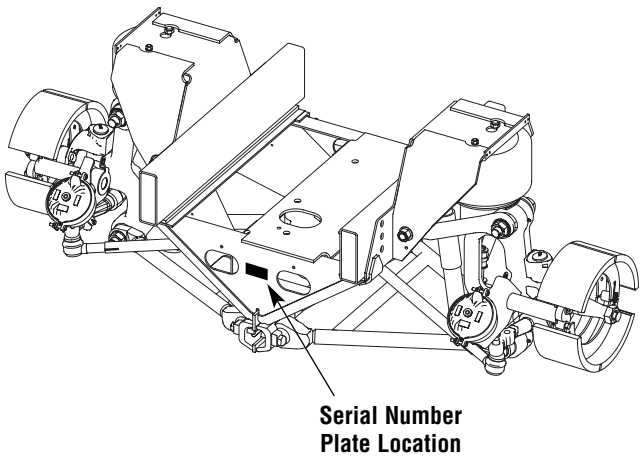
MODEL NUMBER: _____

SERIAL NUMBER: _____

PARTS LISTS NUMBER: _____

IN SERVICE DATE: _____

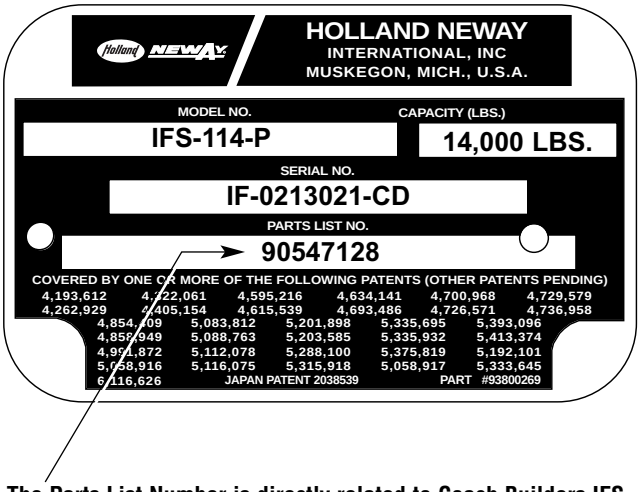
Figure 1. - Serial Number Tag Location



Serial Number Tag Description

The sample tag shown below will help you interpret the information on the Holland Neway Serial Tag. The model number is on the first line along with the suspension capacity. The second line contains the serial number and the third line has the parts list numbers (Fig. 2). This information will aid you when contacting the chassis manufacturer or Holland Neway.

Figure 2. - Holland Neway Serial Number Tag Example



The Parts List Number is directly related to Coach Builders IFS Bill of Material and will be most useful in determining proper replacement parts.

Vehicle Towing Information

BEFORE attempting any type of towing procedures the OEM/Coach Builder must be referred to for the recommended towing methods.

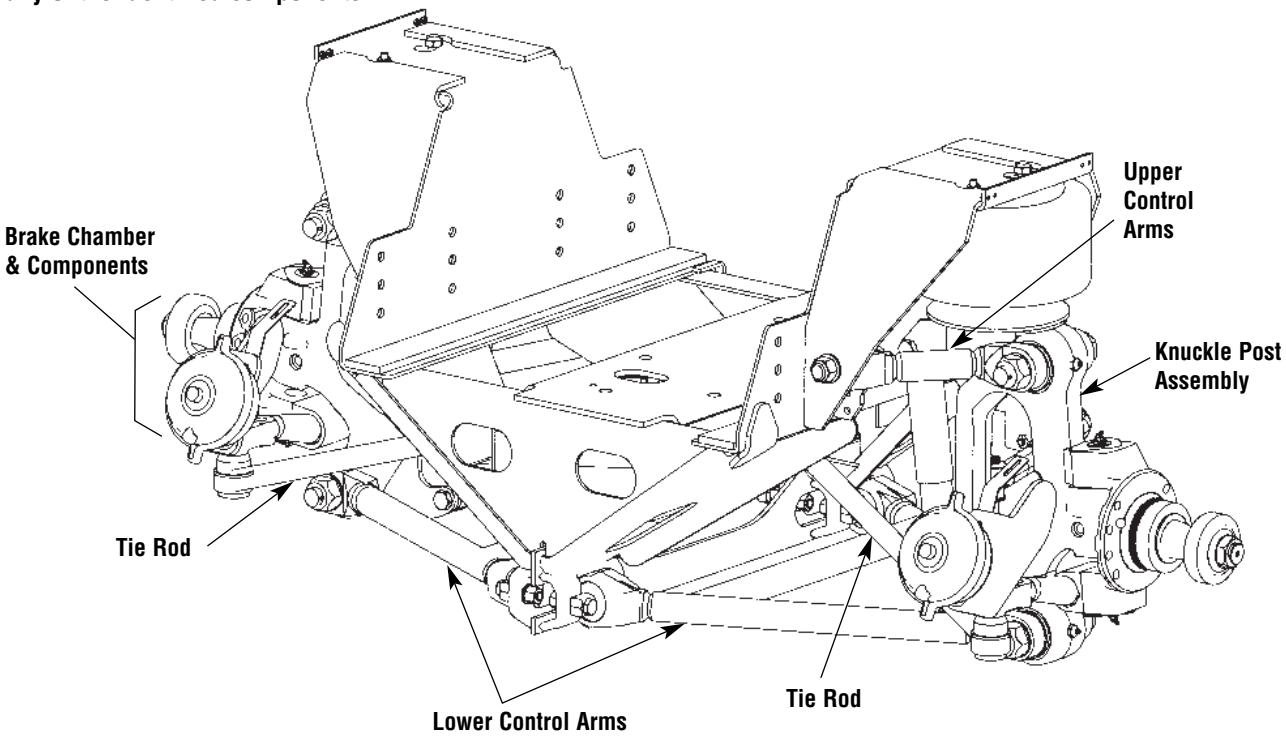
NOTE: Before towing vehicle check with local authorities (Department Of Transportation) for permissible towing methods. Some States DO NOT permit towing vehicles by chains or towing straps.

DO NOT attach tow apparatus (hooks, chains, straps, etc.) to Control Arms (upper or lower), Sway Bar, Brake Components, Tie Rods or Knuckle Post Assemblies (Fig. 4).

⚠WARNING

Attaching towing equipment to improper locations and failure to utilize OEM/Coach Builder recommended towing methods could result in one or more of the following:
- **Damage to the suspension and/or vehicle.**
- **Loss of vehicle control.**
- **Possible disconnect from the vehicle.**

Figure 4. - Improper Tow Equipment Attachment Locations, DO NOT attach towing equipment to any of the identified components.



Torque Specifications

IMPORTANT: Most of the fasteners used in this suspension are graded fasteners. These fasteners have the strength and hardness properties required for their particular function. When replaced, they must be replaced with fasteners of the same grade, size and form as the original in order to prevent failure.

Figure 4. - IFS Pre-Operational Torque Checklist

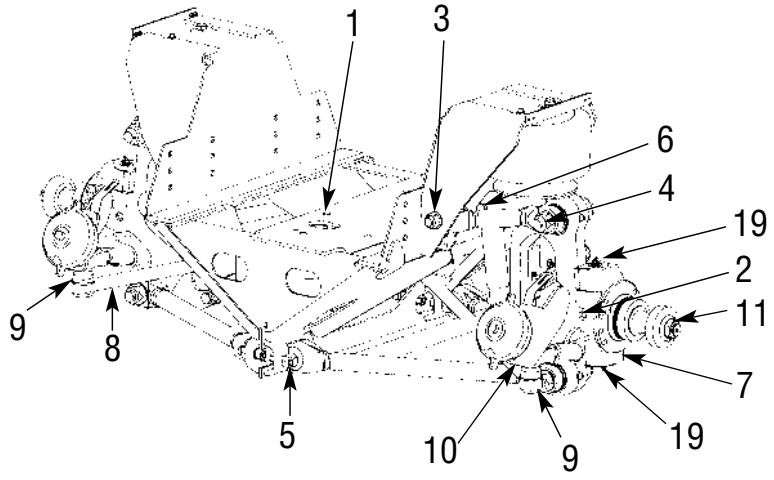


Table 2 - Torque Chart

Item	Application	Fastener Size Bolt - (Dia. x Thd./Inch x Length) Nut - (Dia. - Thd./Inch)	Fastener Grade	Torque Specification Clean, Dry Threads** (Ft. Lb.)
1	Steering Gear Attachment	7/8" - 9 x 3.5"	Gr 5	400 - 450
2	Knuckle Post/Spindle Tapered Lock Pin			55 - 60
3	Upper Control Arm Inner Sub-Frame Connection	1" - 8 x 5"	Gr 8	450 - 550
4	Knuckle Post/Control Arm Connections	1 1/4" - 12 x 8.5"	Gr B	630 - 770*
5	Lower Control Arm Inner Sub-Frame Connection	5/8" - 11 x 3.5"	Gr 8	150 - 200
6	Shock Absorber Connections	3/4" - 10 x 3.5"	Gr 5	90 - 110
7	Steer Arm to Spindle Connections	1 3/8" - 12		680 - 740*
8	Tie Rod Assembly Clamp Bolts	5/8" - 11		50 minimum
9	Steer Arm to Tie Rod Assembly	7/8" - 14		125 - 135*
10	Brake Chamber to Brake Bracket	5/8" - 11 x 1.5"	Gr 5	130 - 170
11	*Wheel Spindle Nut/Wheel Bearing Adjustment	1 1/2" - 18	Gr 5	See Wheel Bearing Adj.
12	Pitman Arm Retaining Bolt (TRW Gear Only)	3/4" - 10 x 4"	Gr 5	125 - 150
13 N/S	Pitman Arm Retaining Tab Lock (Sheppard Gear Only)			430 - 470
14 N/S	Pitman Arm to Tie Rod Assembly	7/8" - 14		125 - 135*
15 N/S	Foundation S-cam Brake Assembly to Spindle	5/8" - 18 x 2.25"	Gr 8	220 - 260
16 N/S	Air Spring Upper Mounting Nut (Air Inlet)	3/4" - 16	Gr 8	30 - 40
17 N/S	Air Spring Upper Mounting Nut	1/2" - 13	Gr 8	30 - 40
18 N/S	Air Spring Lower Attachment Nut	1/2" - 13	Gr B	30 - 40
19	King Pin Caps w/Grease Fittings			68 - 82
20 N/S	Steering Stop Jam Nut	5/8" - 18	Gr 5	90 - 110
21 N/S	Sway Bar Attachments (Country Coach Models Only)	1/2" - 13	Gr 5	40 - 50
22 N/S	Height Control Valve Bracket to Sub-Frame	1/2" - 13 x 1.5"	Gr 5	70 - 80
23 N/S	Height Control Valve to Bracket (if applicable)	3/8" - 16	Gr 5	20 - 30
24 N/S	Height Control Valve Linkage	1/4" - 20		5 - 10

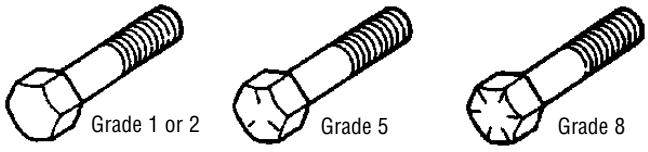
Numbered items are called out in Figure 4. - IFS Pre-Operational Torque Check list.
Item number plus N/S equals "Not Shown".

* Indicates cotter pin installation necessary after torque attainment.

** Torque spec's do not take into consideration the utilization of anti-friction or anti-seize compounds.

*** All torques listed are for tightening of the nuts unless otherwise noted.

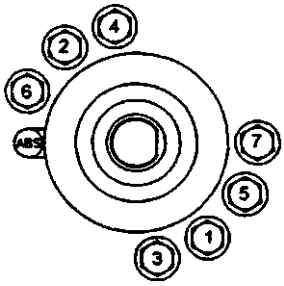
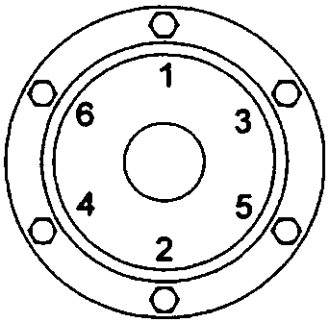
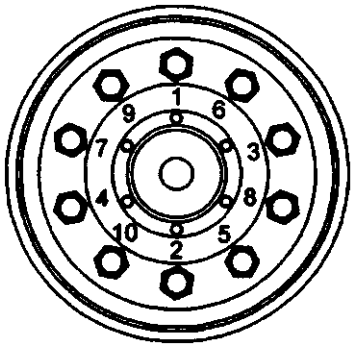
Figure 5. - Bolt Grade Markings & Lock Nut Grade Markings



Grade	Lock Nut Grade B	Lock Nut Grade C
Identification		
	3 Dots	6 Dots

Torque Specifications

Table 3 - Torque Chart

Applications	Fastener Size	Torque Sequence	Torque Specifications FT. LB. (Clean & Dry)
Brake Spider Mount	5/8" - 18	 Driver Side	170 - 190 (1 & 2)
Hub Cap Bolt	5/16" - 18 Grade 5		20 - 30 (1)
Wheel Nut	1 1/8" - 16 (Stud Piloted) M22 x 1.5 (Hub Piloted)		450 - 500 (3) (Dry Threads)

Introduction

IMPORTANT: Safety glasses must be worn at all times when performing the procedures covered in this manual.

A thorough visual inspection of the suspension is necessary to ensure proper assembly and identify problem parts and loose fasteners before servicing.

Perform all of the following during the inspection.

- **Operation -** All components must be checked to assure that they move freely through the complete turning arch of the steering.
- **Wheel Alignment -** See page 3 for inspection intervals. See Wheel Alignment guidelines (page 18) if excessive steering effort, vehicle wander, or abnormal tire wear is evident.
- **Fasteners -** Use a calibrated torque wrench to check that all fasteners are tightened to the torque specifications listed in Table 2 & 3 on pages 6 & 7.
- **Wear and Damage -** Visually check suspension for broken or bent parts. All worn, damaged or out-of-spec components must be replaced.

⚠WARNING

Altering or attempting to repair or modify a component can adversely effect the suspension strength and performance and could result in the loss of vehicle control.

IMPORTANT: Repair or reconditioning of suspension components is prohibited. Most parts are heat treated and tempered and can not be welded, bent, heated or repaired in any way without reducing the strength or the life of the component thus voiding the warranty. Genuine component replacement only is allowed.

Refer to Part Replacement Instructions, pages 20-25.

Refer to Parts List on pages 28 - 31 for identification of suspension components.

Most parts are heat treated and tempered and cannot be welded, bent, heated or repaired in any way without reducing the strength or the life of the component thus voiding the warranty.

Control Arm Bushings & Connections

The control arm bushings must be inspected for wear.

⚠WARNING

Always use safety stands. Never work under a vehicle supported by a jack(s) only. Jacks can slip or fall over and cause serious personal injury. DO NOT place jacks or safety stands under the lower control arms to support the vehicle. Lower control arms are not stationary components and could move allowing the vehicle to drop causing serious personal injury.

Inspection Procedures

1. Secure the vehicle by setting the parking brake and blocking the drive wheels.
2. Jack the vehicle up to raise the front wheels off from the ground.
3. Support the vehicle with safety stands.
4. Remove the tires.
5. Look for bushing bulge between the upper and lower control arms and the sub-frame mounting brackets. Look for small rubber particles near the sub-frame mounting brackets (Fig. 6 & 7). If either condition is found, replace bushings.
6. Look for loose mounting bolts (8 places) in the upper and lower control arms (Fig. 6 & 7). Make sure that the mounting bolts are tight. A loose joint will result in wear between the bushing inner sleeve and the subframe mounting brackets. *See Torque Specs on pages 6 & 7.*

NOTE: It is recommended that if one bushing is found to be worn, all control arm bushings must be replaced. See page 20 for bushing replacement.

Figure 6. - Upper Control Arm to Sub-Frame Connection

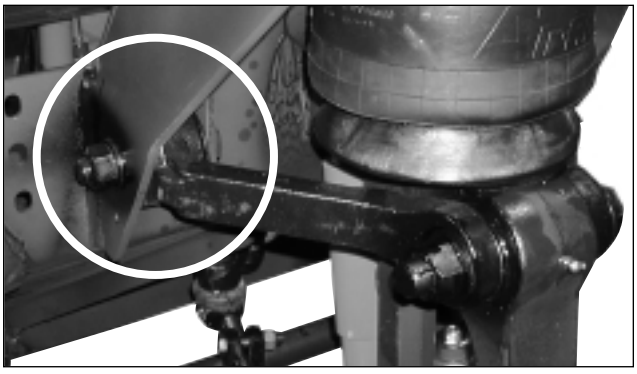
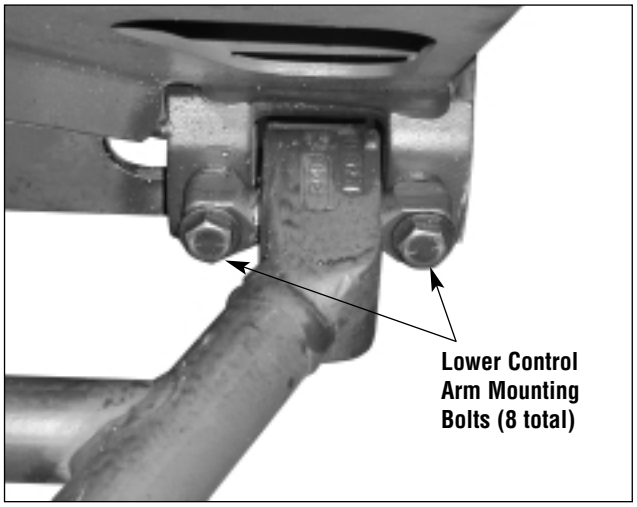


Figure 7. - Lower Control Arm to Sub-Frame Connection



Tie Rod Ends

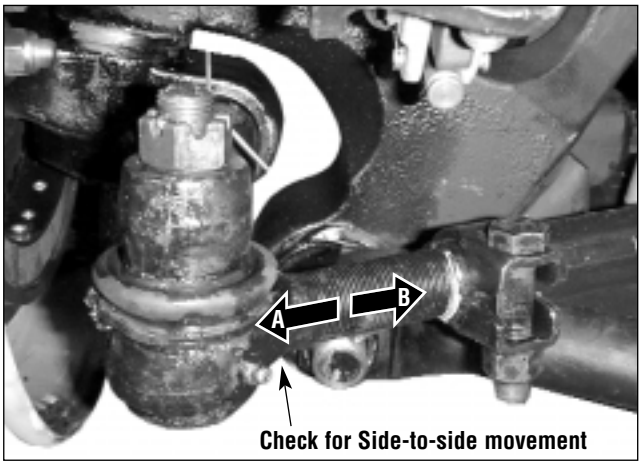
⚠WARNING

DO NOT use wrenches or other similar objects to apply leverage when inspecting tie rod sockets. This could cause incorrect results and damage components leading to loss of steering control.

Inspection Procedure

1. Secure the vehicle by setting the parking brake and blocking the drive wheels.
2. Turn the engine on and rock the steering wheel lightly. Observe any looseness in the mating tapers or movement of the stud nuts at both ends of the tie rod (Fig. 8). If looseness is found, go to step 3, otherwise move forward to step 4.

Figure 8. - Tie Rod End Inspection



3. With the engine off remove the tie rod end ball stud from the taper mount and visually inspect both. If either of the mating tapers show distortion or wear, then both components must be replaced. *See Torque Specs on pages 6 & 7.*
4. With the engine off and the wheels straight ahead, grasp the tie rod near its end (Fig. 8) and try to move the socket in all directions. Be sure to only apply hand pressure to the tie rod.
5. The side-to-side movement (Arrows A & B - Fig. 8) of the socket must be measured with a scale. If it moves more than 1/8 inch (3mm) then replace the tie rod end immediately. If there is detectable movement, but it is less than 1/8 inch (3mm) then the tie rod end should be replaced before it gets worse.
6. Check dust boot for damage and replace if necessary.

Automatic Slack Adjusters and Brake System

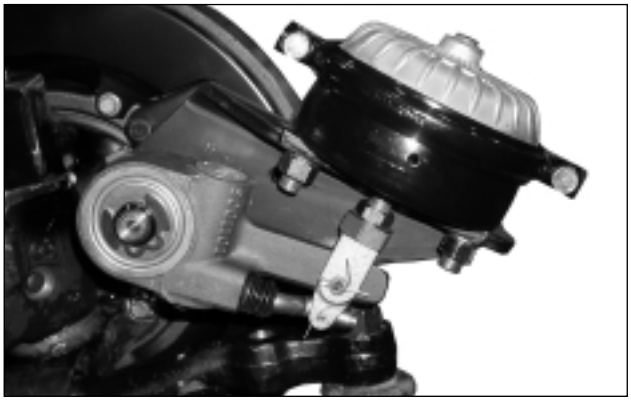
Automatic Slack Adjusters

The suspension system is equipped with slack adjusters for steer axles. For inspection and adjustment procedures refer to the slack adjuster manufacturers technical service guidelines.

Brake System

The suspension system comes equipped with Eaton 15 x 4 or 16 1/2 x 5 S-cam brake assemblies (Fig. 9). For service procedures refer to Eaton maintenance manual #BRSM-0033.

Figure 9. - Brake System



ABS Sensor and Tone Ring

Please refer to Coach Manufacturer's Manual for sensor type and proper maintenance guidelines.

Shock Absorbers

Inspection Procedure

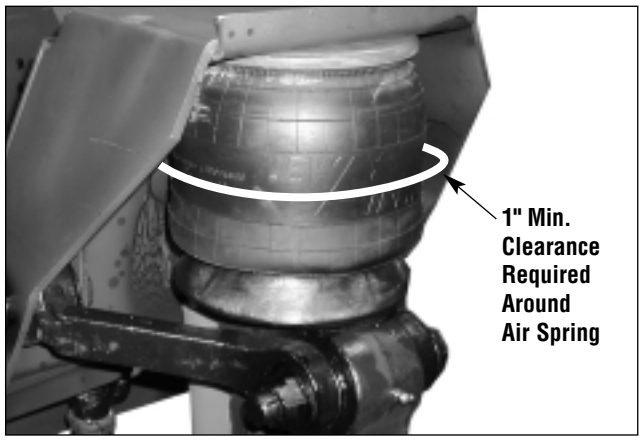
Visually check for shock absorber oil leakage, bent, missing or broken components, excessive corrosion, or worn bushings. If you find any of the above problems replace the shock.

Air Spring

Air Spring Inspection Procedures

1. Secure the vehicle by setting the parking brake and blocking the drive wheels.
2. Remove any build-up of foreign material present around the air spring piston. The air spring should be checked (externally) for irregular wear, over extension or cracking.
3. Make sure contact does not exist between the air lines and the outside diameter of the air spring. Re-secure air lines to prevent contact as needed. Check for leaks along the air line and fittings with soapy water solution. If leaks are found replace air line and/or fittings.
4. Make sure the air spring, while energized with air, has a minimum of 1 inch clearance around its circumference (Fig. 10).
5. Refer to Air Spring Manufacturers Preventative Maintenance Checklist for additional formation.

Figure 10. - Air Spring Check



Height Control Valve

Inspection Procedures

1. Check the height control valve and linkage assembly for damaged parts and replace them (Fig. 11).
2. Measure the ride height of the suspension (Fig.12). Measure the distance from the bottom of the chassis frame rail to the center of the wheel. An alternate measurement may be taken between the center of the shock mounts. See Chassis builder manufacturer for correct ride height. The vehicle can be empty or loaded while taking these measurements.

NOTE: An alternate way to measure ride height is to measure from centerline ℄ of spindle to ground "A" dim. and from frame rail to ground "B" dim. Then subtract "A" from "B" to establish ride height measurement (Fig. 12).

Figure 11. - Height Control Valve Linkage Assy. (Type IR HCV Shown)

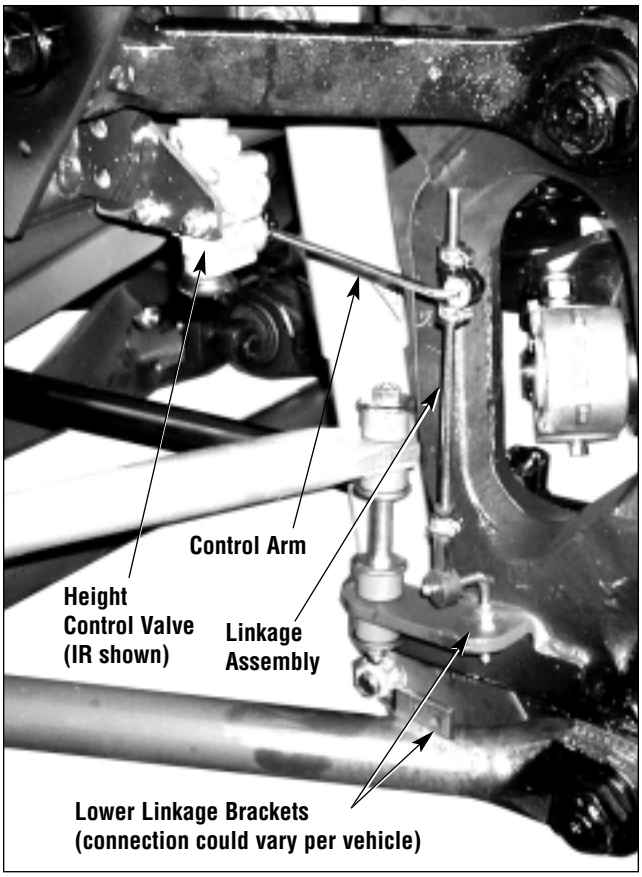
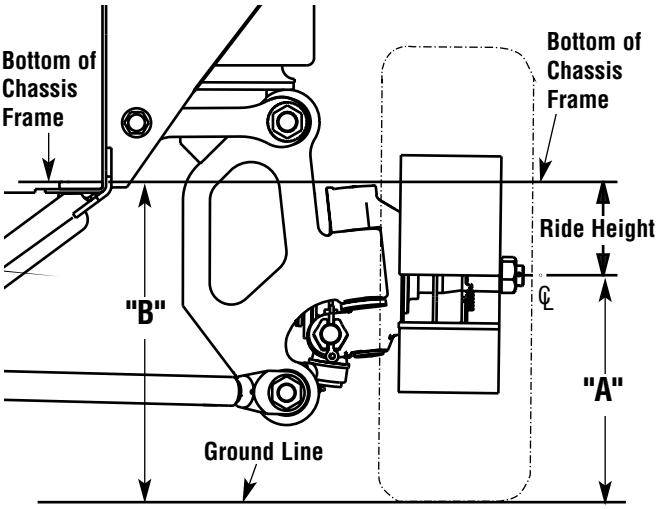


Figure 12. - Ride Height Measurement



Adjusting Suspension Ride Height

NOTE: Before performing any adjustment or maintenance, identify the style of the height control valve. The IFS suspension can be equipped with either a Holland Neway Type CR (Controlled Response) or a Type IR (Immediate Response) height control valve. Follow the proper adjustment procedures for your height control valve.

The height control valve and linkage should be checked frequently for proper clearance, operation and adjustment.

NOTE: Improperly adjusted ride height will result in incorrect alignment measurements and may result in poor ride quality and abnormal tire wear. Check ride height prior to front suspension alignment.

The front suspension ride height is the distance between the bottom of the chassis frame rail to the center of the wheel spindle (Fig.12). Properly adjusted ride height results in correct suspension travel and alignment. **DO NOT** adjust the ride height to adjust chassis rake angle.

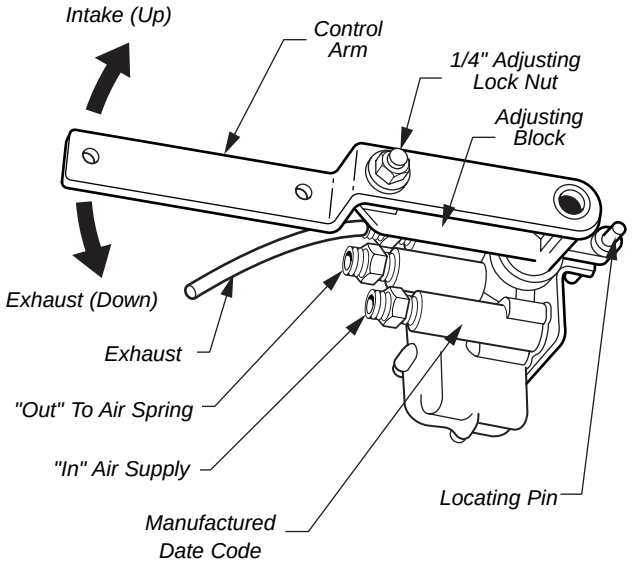
Adjustment Procedure (Type CR Valve)

1. Park the vehicle on a level surface and secure the vehicle by setting the parking brake and blocking the drive wheels.
2. Pressurize the air system with a constant supply of air in excess of 105 P.S.I.G. All air springs should inflate and be set to the chassis manufacturers ride height.
3. Make sure the rear suspension is adjusted to the correct ride height per the vehicle manufacturers specifications.
4. Check the height control valve plumbing for air leaks using a water/liquid soap solution.
5. Make sure shock absorbers are mounted securely and mounting connections are not bent.
6. If ride height is incorrect, adjust ride height by the adjusting lock nut (Fig.13). Loosen the 1/4" nut, push up adjusting block to increase ride height and pull down to decrease ride height. Re-tighten 1/4" lock nut to 15-25 in. lbs.

NOTE: Valve has a built in time delay feature; therefore, several seconds may elapse prior to air flow.

NOTE: If proper ride height is not obtained or air springs do not inflate properly, check air pressure and pressure protection valve, check for proper piping and check Type CR height control valve (Fig.13) and repeat above steps. Then if not functioning properly, contact Chassis Manufacturer or Holland Neway Service Department.

Figure 13. - Type CR Height Control Valve Adjustment.



Adjustment Procedure (Type IR Valve)

1. Prior to adjustment, the vehicle must be in an unloaded condition and on a level floor.

2. Pressurize the air system with a constant supply of air in excess of 105 P.S.I.G. (5.5 Bar) All air springs should inflate and be a proper ride height.

3. If ride height is off, adjust height control valve by loosening the hose clamps (Fig. 14) on the universal connection fitting. Push up to raise ride height and push down to lower ride height (Retighten hose clamps after adjustment).

NOTE: If proper ride height is not obtained or air springs do not inflate properly, check air pressure and pressure protection valve, check for proper piping and repeat above steps. Then if not functioning properly, contact the chassis manufacturer or Holland Neway Service Department.

NOTE: The Type IR-HCV can be installed with the control arm in either left-hand or right-hand position. Refer to Form 94100535 or contact Holland Neway Service Dept. for information.

Figure 14. - Type IR Height Control Valve Adjustment

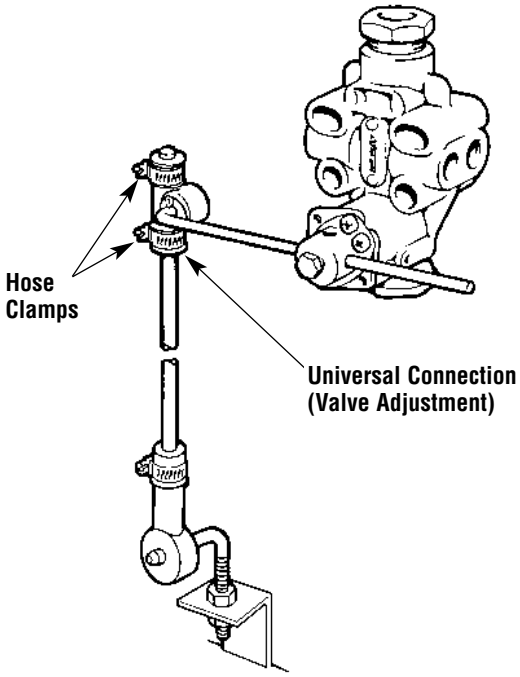


Figure 14A. - Type IR Height Control Valve Adjustment

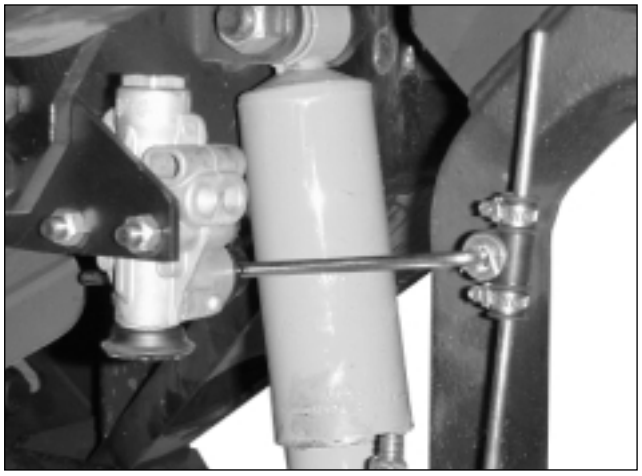


Table 4. - Lubrication Specification and Intervals

Component	Service Interval	Change Interval	Lubricant Specification
On Ends of Tie Rods, Relay Rod, Drag Link	Which ever comes first: 50,000 miles (80,000 kilometers) or once a year.	N/A	Multi-Purpose Chassis Grease NLGI Grade 1 or 2 Lithium Base
Brake S-Cam Tube and Automatic Slack Adjuster[1]	Which ever comes first: Brakes relined. 50,000 miles (80,000 kilometers) or once a Year.	N/A	Multi-Purpose Chassis Grease NLGI Grade 1 or 2 Lithium Base
Wheel End	1000 miles (1600 kilometers) Check fluid level	Which ever comes first: Seals replaced, brakes relined, 100,000 miles (160,000 km), or once a year.	Gear Oil SAE 80W/90 or equivalent

[1] Moly-disulfide type grease is not recommended since it may lower friction capabilities in the adjusting clutch parts of the automatic slack adjuster.

General Lubrication

It's important to use proper lubrication practices to gain maximum service life for your Holland Neway Independent Front Suspension.

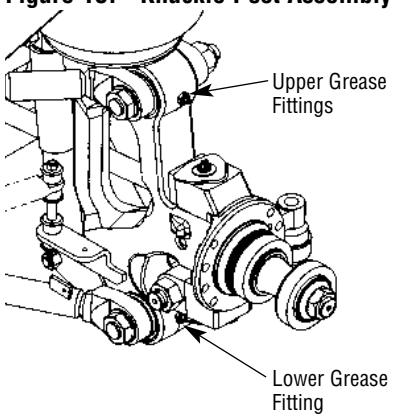
IMPORTANT: DO NOT mix 2 lubricants of different grades. DO NOT mix mineral and synthetic lubricants. Parts may experience premature failure. Different brands of the same grade may be mixed.

IMPORTANT: Never mix oil bath and grease packed wheel ends. Parts may experience premature failure.

Greasing Knuckle Post Assembly

The knuckle post assembly (Fig. 15) is designed to be a factory installed assembly that is permanently greased for the life of the vehicle. The joints are sealed by four (4) O-rings on each knuckle post assembly designed to hold in grease, under pressure, while preventing outside contamination. Although greased at the factory, two (2) Zerk style grease fittings have been installed on each knuckle post assembly, (Fig. 15). This allows re-application of grease after maintenance or replacing components.

Figure 15. - Knuckle Post Assembly



Recommended Procedure

NOTE: The specified grease is lithium based NLGI Grade 2.

IMPORTANT: While injecting grease always maintain visual sight of O-rings. At first sign of O-ring movement stop pumping grease. Slight movement indicates a "full" grease cavity.

IMPORTANT : DO NOT over pump grease into grease fittings. The grease gun type must not exceed 250 psi max. If a high-pressure grease gun is used it could cause an O-ring to extrude out of the groove and degrade its function. This is usually indicated by a large amount of grease extruding from the O-ring joints and the O-rings being visually distorted or damaged.

1. Using a proper grease gun (250 psi max.), pump grease into grease fitting until slight O-ring movement has occurred.
2. Look to ensure O-rings are not distorted or damaged.

   a. If distorted or damaged replace rubber O-ring seals.

   b. If not distorted or damaged, knuckle post assembly is properly lubed.
3. Repeat for both upper & lower fittings on each knuckle post assembly.

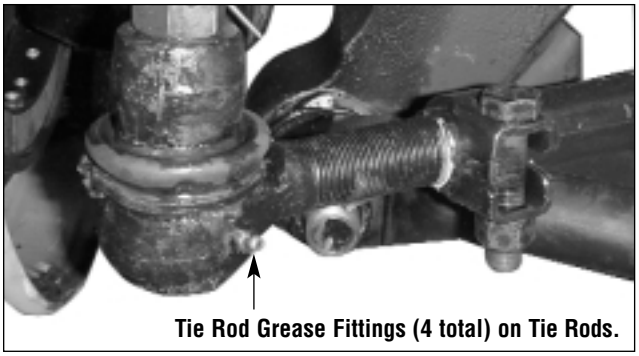
Grease Fittings

Tie Rods Ends

NOTE: Before servicing, review lubricant specifications and interval requirements, Table 4.

1. Ensure grease gun is filled with proper lube.
2. Apply lubricant to grease fittings until new lubricant discharges from the dust boot (Fig. 16).

Figure 16 . - Lubricate Grease Fittings



Brake S-Cam Tube and Automatic Slack Adjuster

1. Apply lubricant to the S-cam tube until new lubricant discharges from the S-cam bushing seal next to the automatic slack adjuster (Fig.17).
2. Apply lubricant to the automatic slack adjuster until new lubricant discharges from the cone clutch adjacent the adjusting hex nut (Fig. 18).

Figure 17. - Lubricate S-Cam Tube

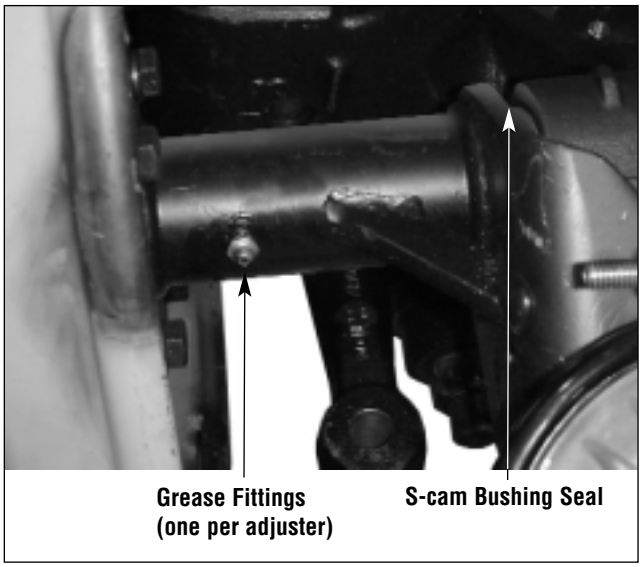
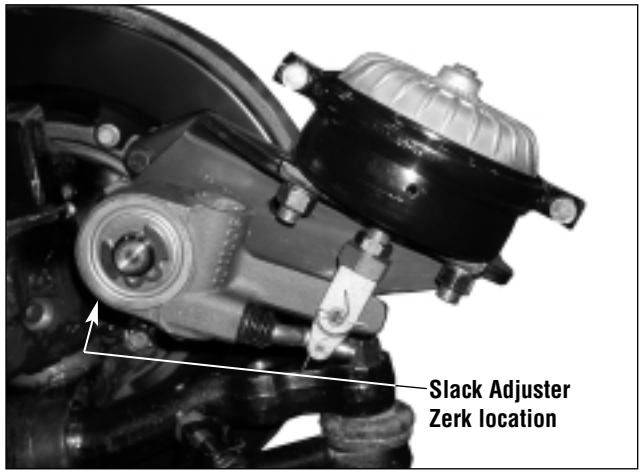


Figure 18. - Lubricate Automatic Slack Adjuster



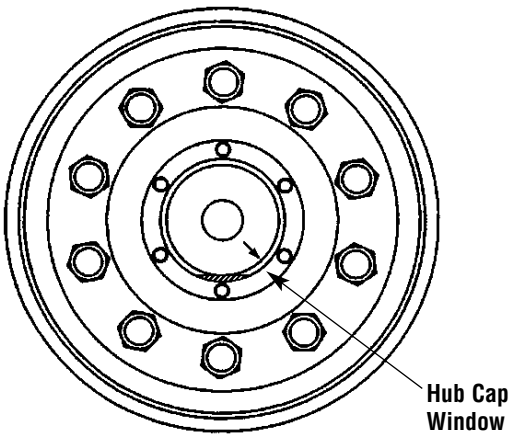
Wheel Bearings and Hub Cap

NOTE: Before servicing. Review lubricant specifications and interval requirements, Table 4 page 13. Clean the hub cap window with mild soap and water only. Aromatic solvents will impair the transparency of the window.

1. Check oil level through the hub cap window. If below the “add” level line remove the pipe plug and fill with recommended oil to the “full” level (Fig. 19). Add oil slowly since the heavy weight oil will settle slowly.

2. Visually check the hub cap for external oil leaks. Usually the vent plug will drip a small amount of oil. Oil leaks in other places should be fixed by replacing either the hub cap seal, window gasket, or tightening the pipe fill plug.

Figure 19. Wheel Bearing Oil Level



Wheel Bearings

Preparation

1. To prevent vehicle movement. Set the parking brake and block the drive wheels.

⚠WARNING

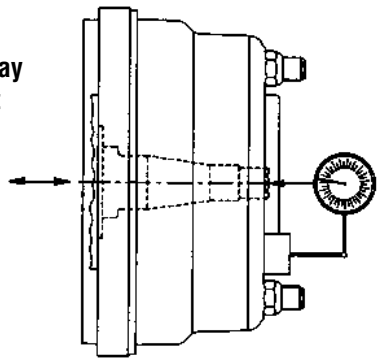
Always use safety stands. Never work under a vehicle supported by a jack only. Jacks can slip or fall over and cause serious personal injury. DO NOT place jacks or safety stands under the lower control arms to support the vehicle. Lower control arms are not stationary components and could move allowing the vehicle to drop causing serious personal injury.

2. Raise the vehicle until the front wheels are off the ground. Then support the vehicle with safety stands.
3. Remove the vent plug from the hub cap.

Adjustment

1. Attach a dial indicator with a magnetic base to the face of the hub, wheel, or brake drum. If the wheel is removed, the dial indicator may also be attached to the bottom of the brake drum.
2. Place the tip of the dial indicator on the center of the steering knuckle spindle. Then set the dial indicator on zero (Fig. 20).

Figure 20. - Wheel End Play Measurement



NOTE: Do not push/pull at the top/bottom of the tire, drum, or hub. This will not yield a true measurement of the end play.

3. Measure the end play by pushing/pulling on each side of the tire, drum, or hub at the same time while observing the dial indicator. The end play is the total travel observed. If the end play is not within .001-.005 inch adjust the wheel bearings per steps 4-10. Otherwise no adjustment required. Go to step 17.
4. Place a pail beneath the hub to catch the oil. Rotate the hub so that the hubcap drain plug is facing upwards. Remove the drain plug from the hubcap and store it for installation later.
5. Turn hub so that the drain hole faces downward and drain the oil from the hub cavity. Wait for most of the oil to drain before continuing to the next step.
6. Remove the hub cap, hub cap bolts, and gasket. If not damaged the gasket can be re-installed later. To prevent component contamination place them in a clean container. Note that solvents could damage the hub cap window.

CAUTION

To avoid damage removing or installing the inner and outer spindle nuts DO NOT use an impact driver. Use a torque wrench with the proper socket.

7. Screw wheel bearing adjusting nut against the thrust washer while wheel is rotated. Be sure there is sufficient clearance between brake shoe and drum so that there will be no brake drag.
8. Tighten nut to 200 ft.-lbs. of torque while rotating wheel in both directions.
9. Back off nut one full turn.
10. Tighten nut to 50 ft.-lbs. of torque while rotating wheel in both directions.
11. Back off nut 1/6 to 1/4 turn.
12. Check adjustment, making sure wheel rotates freely. With a dial indicator, place magnetic base on wheel and pointer on end of spindle. Grasp wheel of hub and drum, and with a push/pull action, record amount of axial movement.
13. If movement is greater than .005, repeat adjustment procedure. If no movement is recorded, repeat adjustment.
14. If movement is between .001 - .005 inch, secure with new cotter pin. Replace hub cap, refer to Table 3 on page 7 for proper torque specifications.
15. Fill the hub cavity with the prescribed amount and type of lubricant. See Table 4 on page 13. for lubricant specifications.
16. Install drain plug.
17. Repeat for other wheel.

Maximum Turn Angle Adjustment

IMPORTANT: DO NOT adjust angle more than 50º. An over adjustment of the turn angle can cause damage to system components.

1. Check the turn angle if the front tires rub against the frame, suspension, body, or if the steering gear has been serviced. Use an alignment machine to check the angle.

NOTE: Follow the alignment machine manufacturers alignment procedure.

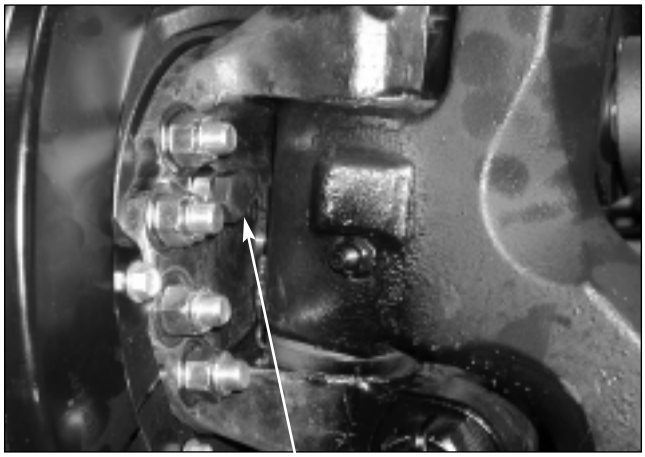
2. The maximum turn angle is controlled by the steering stop bolt located on the spindle assembly, (Fig. 21). If the stop bolt is bent, broken or missing, replace the stop bolt(s) or jam nut(s) and follow the procedure below for adjustment. Inspect other suspension components for damage.
3. While adjusting the steering stop(s), the steering gear poppet valves may also need readjustment. Refer to Steering Gear Manufacturers Service Manual for readjusting the poppets.

IMPORTANT: In power steering systems, hydraulic pressure should relieve or "drop off" when the turned wheels approach the steering stops in either direction. The front suspension components may be damaged if the pressure does not relieve.

⚠WARNING

Always use safety stands. Never work under a vehicle supported by a jack only. Jacks can slip or fall over and cause serious personal injury. DO NOT place jacks or safety stands under the lower control arms to support the vehicle. Lower control arms are not stationary components and could move allowing the vehicle to drop causing serious personal injury.

Figure 21. - Steering Arm Stop Bolt



Steering Arm Stop Bolt

IMPORTANT: Unequal toe-in side to side or an off-center steering gear can result in unequal turn angles and steering pull while steering straight ahead. The drag link length may be adjusted to attain steering gear on center condition while maintaining equal toe-in side to side. Failure to obtain equal toe-in or on-center steering gear may result in premature tire wear.

IMPORTANT: DO NOT adjust the length of the drag link or tie rods to center the steering wheel. This can cause the steering gear to become off center and result in premature tire wear.

Adjustment

1. Turn the steering wheel until the steering arm contacts the stop bolt or stops turning (Fig.21). Measure the turn angle of the wheel on the same side as the turn (i.e. inside wheel).
2. If the wheel turn angle differs from the chassis manufacturer guidelines, adjust as follows.
3. Loosen the stop bolt jam nut.
4. Rotate the stop bolt until the correct wheel turn angle is achieved and the bolt head contacts the steering arm.
5. Tighten the jam nut to 90-110 ft. lbs. *See Torque Specs on pages 6 & 7.*

NOTE: Refer to OEM Chassis Manufacturer for proper alignment procedures.

IMPORTANT: After readjustment of the steering stop(s) make sure the steering poppets are reset properly and the front tires DO NOT contact the frame, suspension, or body. A 1/2" minimum clearance between the air spring and brake dust cover is required. Failure to maintain 1/2" clearance may result in air spring and/or tire damage.

6. Repeat Adjustment Steps 1 thru 5 for turning the opposite direction.

Inspection Before Alignment

Before conducting front wheel alignment measurements check the following requirements.

Wheels and Tires

1. Inflate the front tires to the appropriate pressure based on the wheel loading.
2. The front tires need to be the same size and type.
3. Make sure the wheel nuts are tightened to the specified torque of 450-500 ft.-lbs. *See Torque Specs on pages 6 & 7.*

NOTE: Refer to OEM Chassis Manufacturer for proper alignment procedures.

4. Check if the wheels are balanced. Use standard procedures.

Front Suspension

1. Torque all fasteners to the right specifications.
2. Check the suspension ride height and adjust as needed to the specified height.
3. All worn ball joints, tie rod ends, steering arm bearings, control arm bushings, and damaged suspension components need to be replaced.
4. Inspect for wear and replace and tighten all loose ball joint and tie rod end tapered connections, tie rod end jam nuts, steering arm mounts, and chassis steering system components.
5. Check the wheel bearings and adjust as needed.
6. Inspect all shock absorbers for possible wear and damage.

Front Wheel Alignment

⚠WARNING

Always use safety stands. Never work under a vehicle supported by a jack only. Jacks can slip or fall over and cause serious personal injury. DO NOT place jacks or safety stands under the lower control arms to support the vehicle. Lower control arms are not stationary components and could move allowing the vehicle to drop causing serious personal injury.

NOTE: Refer to OEM Chassis Manufacturer for proper alignment procedures. Follow the manufacturer's procedures to prepare the vehicle for front and rear wheel alignment measurements.

IMPORTANT: Holland Neway recommends that professional alignment equipment be used to measure the wheel alignment characteristics: caster, camber, and toe-in. The equipment must also be properly calibrated. Only qualified personnel should conduct the wheel alignment measurements.

IMPORTANT: Toe-in of the front wheels should be checked every 24,000 miles or 2 years. If the vehicle does not steer correctly or the front tires develop an abnormal tire wear pattern, the caster, camber, and toe-in should be measured and adjusted. Toe-in usually has the largest effect on tire wear. See Maintenance Schedule Chart on page 3.

NOTE: Maximum wheel turn angle should also be checked and adjusted (refer to page 16).

NOTE: Adjusting the length of the drag link or tie rods to center the steering wheel could cause the steering gear to become off center.

Caster Angle Adjustment

⚠WARNING

Adjusting the ride height or altering components to adjust the suspension caster is strictly prohibited. Alteration of components could result in loss of vehicle control.

NOTE: Caster is preset at the factory and should not need to be adjusted. If adjusting is needed, the camber adjuster shims can be used for caster adjustment.

By offsetting the number of shims on the front lower control arm connection to the number of shims on the rear lower control arm connection (Fig. 22 & 24), a change in caster will occur.

Figure 22. - Caster Angle Adjustment

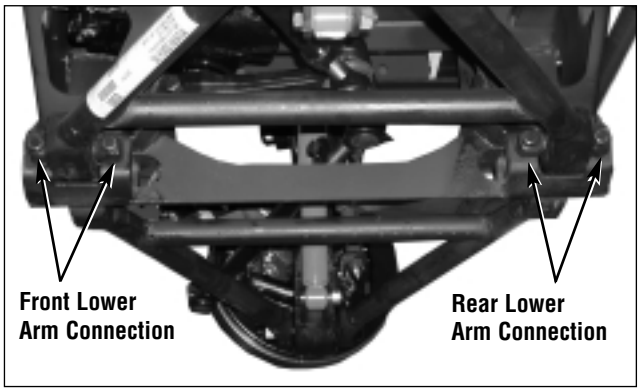


Table 5 - Nominal Caster Values

Suspension Parts List No.	Degrees
90546687	3.0° ± 1°
90547128	4.5° ± 1°
90547129	4.5° ± 1°
90547183	4.5° ± 1°
90547185	4.5° ± 1°

Caster is pre-set at the factory.

NOTE: The knuckle post casting has a large embossed number near the king pin hole. This number designates the pre-set caster angle (Fig. 23).

Figure 23. - Embossed Number

Camber Angle Adjustment

⚠WARNING

Adjusting the ride height or altering components to adjust the suspension camber is strictly prohibited. Alteration of components could result in loss of vehicle control.

Camber is the angle of the tire with respect to the ground. Camber is “positive” when the distance between the top of both wheels is more than the distance at the ground.

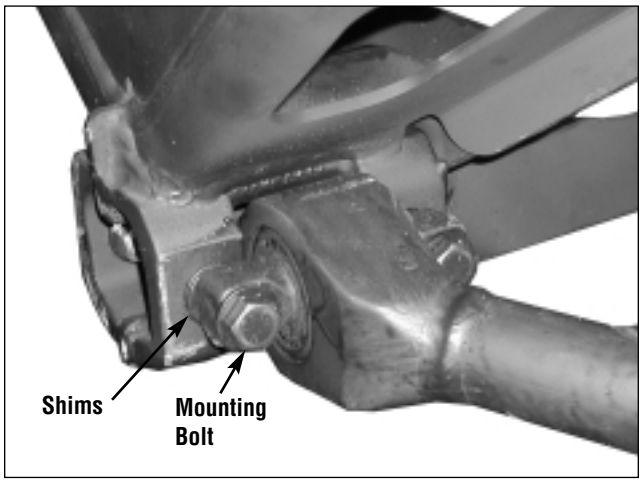
NOTE: A small amount of positive camber is built into the suspension because camber changes with load and chassis roll.

NOTE: The camber of the suspension is affected by the ride height of the suspension. If the ride height is set too high then the camber measurement will be more positive.

Table 6 - Nominal Camber Values

	Unloaded	Loaded
Left	+1/4°(±1/4°)	+1/4°(±1/4°)
Right	+1/4°(±1/4°)	+1/4°(±1/4°)

Figure 24. - Camber Angle Adjustment



1. Set park brake and block rear tires.
2. Raise front of vehicle off ground and support with safety stands.
3. Support front tires with safety stands.
4. Loosen all lower control arm mounting bolts (4) at the sub-frame. (2) bolts per lower control arm bushing (Fig. 24).
5. Add/remove shims between bushing bar pin and subframe. One .06" shim per bolt 4 places = .1° of camber adjustment. Add to increase camber and remove to reduce camber (Fig. 24).
6. Tighten bolts to 150-200 ft. lbs. *See Torque Specs on pages 6 & 7.*
7. Remove safety stands and lower vehicle. Make sure the suspension is at the proper ride height (refer to manufacturers ride specification).
8. Remeasure the camber and readjust as needed.

Adjusting the Tire Toe-In

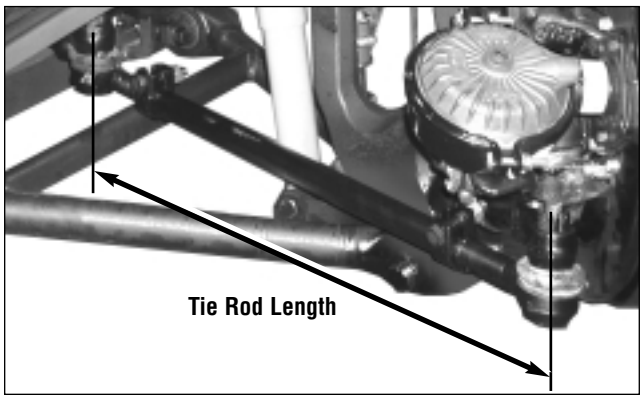
IMPORTANT: Nearly all tire wear is caused by incorrect toe-in settings. Holland Neway does not recommend altering components to adjust the suspension toe-in. Toe-in must be set by adjusting the tie rod lengths only.

⚠WARNING

Adjusting the ride height or altering components to adjust the tire toe-in is strictly prohibited. Alteration of components could result in loss of vehicle control.

NOTE: Toe-in is the measurement of the distance between the front and the rear of the two front tires. When the front distance is less than the rear distance, the wheels are "toed-in”. Toe-in is designed into the suspension to stop the tendency of the tires to “toe-out” when the vehicle is driven straight ahead.

Figure 25. - Tie Rod Measurement



Toe-in Specifications = 1/32" ± 1/32"

1. Use a professional alignment system to determine if toe-in adjustment is needed. If adjustment is needed follow Steps 2 through 6.
2. Measure the length of both tie rods (Fig. 25). If the lengths are not within 1/8" of each other the tie rods must be adjusted. Tie rods are properly adjusted if found to be within the 1/8" measurement.
3. Block rear wheels.
4. Raise front end of suspension and support with safety stands.
5. Loosen tie rod clamps bolts and adjust tie rod length as needed.
6. Re-tighten tie rod clamp bolts to torque specs listed on page 6.
7. Lower vehicle and remeasure (Fig. 25). Repeat procedures as necessary.

PARTS REPLACEMENT

⚠ WARNING

Altering or attempting to repair or modify a component can adversely effect the suspension strength and performance and could result in the loss of vehicle control.

IMPORTANT: Repair or reconditioning of suspension components is prohibited. Most parts are heat treated and tempered and can not be welded, bent, heated or repaired in any way without reducing the strength or the life of the component thus voiding the warranty. Genuine component replacement only is allowed.

IMPORTANT: The following repair methods and actions are NOT allowed on IFS suspension components; including rod assemblies, ball joints, and subframe.

- **NO** welding that involves the steering knuckles, steering arms, lower control arms, tie rod assemblies, hubs, brakes, or brake drums.
- **NO** bending (hot or cold) of the spindle assembly, steering arms, upper and lower control arms and tie rod assemblies.
- **NO** drilling out of the control arm and steering arm mounting holes and/or the ball stud tapered holes.
- **NO** spray welding of bearing diameters on the spindle assembly, steering arm bores and pivot tube. Spray welding of tapered holes or ball studs for ball joint and tie rod ends.
- **NO** milling/machining of any component is not allowed. The only exception is the honing of the control arm bushing bores to remove any burrs.

IMPORTANT: DO NOT apply oil or corrosion preventative to the brake linings, brake drums or bushings.

⚠ CAUTION

Vehicle air supply system must be completely exhausted (dumped). Failure to exhaust before servicing vehicle could result in sudden component movement resulting in personal injury.

Upper and Lower Control Arm Bushing Replacement

Inspect the control arms and mounts for damage. If damage is found replace the complete control arm bushing assembly.

NOTE: Holland Neway recommends replacing the bushings and mounting fasteners in all of the control arms at the same time.

CAUTION

Using a cutting torch to remove the control arm bolts will permanently damage control arm bushings and could result in subframe damage.

Preparation

1. Apply the parking brake and block the drive wheels to prevent vehicle movement.

⚠ WARNING

Always use safety stands. Never work under a vehicle supported by a jack only. Jacks can slip or fall over and cause serious personal injury. DO NOT place jacks or safety stands under the lower control arms to support the vehicle. Lower control arms are not stationary components and could move allowing the vehicle to drop causing serious personal injury.

2. Raise the vehicle front wheels off the ground and support with safety stands.
3. Remove the front tires. Disconnect the Height Control Valve (HCV) linkage from the lower bracket (Fig. 11 - page 10).

Upper Control Arm

1. Use a portable crane or jack and support the steering knuckle prior to disconnecting it from the control arm or removing the control arm with the steering knuckle attached. The knuckle post assembly is heavy and unbalanced and must be supported properly.

⚠ CAUTION

Failure to properly support the knuckle post assembly could result in personal injury to hands or feet.

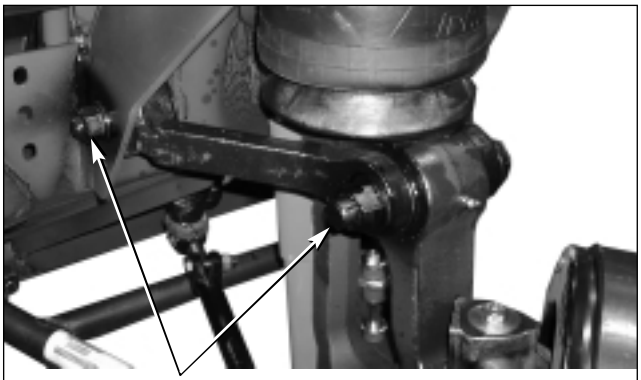
2. Detach the upper control arm from the knuckle post.

NOTE: DO NOT press on center metal core of bushing; apply load to outer metal casing of the bushing.

3. Remove the upper control arm mount bolts and remove the upper control arm (Fig. 26).
4. Support the control arm properly during bushing removal and replacement. Bushing hole of the control arms should be free of any burrs before replacing new bushings.
5. Using a hydraulic press with a 15 ton capacity, push bushing out of the control arm housing while supporting it securely.
6. Using the same hydraulic press from Step 5, push new bushing back into the control arm housing while supporting it securely.
7. Set control arm into its mount location. Place the control arm mount bolts into subframe snug tight.
8. Reconnect knuckle post to the outer end of the upper control arm.
9. Reconnect the height control valve linkage to the knuckle post bracket.
10. Set Suspension to proper ride height.
11. Torque the upper control arm bolts to 450-550 ft. lbs. *See Torque Specs on pages 6 & 7.*

IMPORTANT: IFS suspension must be realigned after control arm/bushing replacement.

Figure 26. - Upper Control Arm Removal



Upper Control Arm Bolts

Lower Control Arm

1. Use a portable crane or jack and support the steering knuckle prior to disconnecting it from the control arm or removing the control arm with the steering knuckle attached. The knuckle post assembly is heavy and unbalanced and must be supported properly.

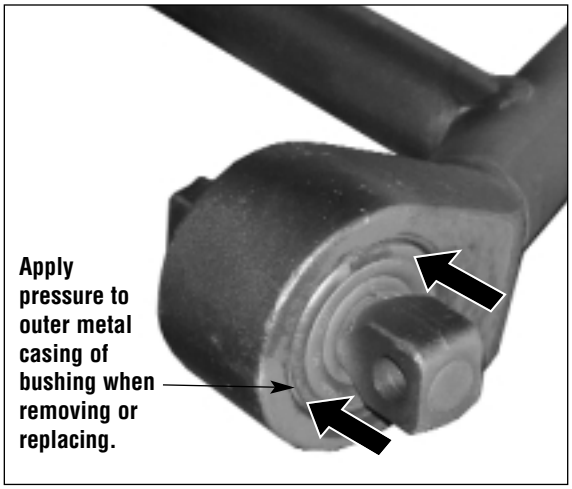
⚠ CAUTION

Failure to properly support the knuckle post assembly could result in personal injury to hands or feet.

2. Detach the lower control arm from the knuckle post assembly.
3. Remove the sub-frame control arm assembly mounting bolts.

NOTE: DO NOT press on center of bushing; apply load to metal casing of bushing.

Figure 27. - Lower Control Arm Bushings



4. Using a hydraulic press with 15 ton capacity, support and secure control arm and push bushing out of the control arm housing (Fig. 27).

NOTE: Be certain to apply pressure to outer metal casing of bushing when removing or replacing (Fig. 27).

5. Bushing hole of the control arms should be free of any burrs before replacing new bushings.
6. Using the same hydraulic press from step 3, push new bushing back into the control arm housing while supporting it securely.
7. Place the control arm in its mount location and install the control arm mount bolts into sub-frame snug tight.
8. Reconnect lower control arm to the knuckle post assembly.
9. The control arm should be supported in such a way such that it is at ride height, then torque the bolts to the recommended torque specs. *See Torque Specs on pages 6 & 7.*

NOTE: Improperly adjusted ride height will result in incorrect alignment measurements and may result in abnormal tire wear. Check ride height prior to front suspension alignment, see pages 10 - 12.

Wheel Bearing, Oil Seal, and Hub Cap Replacement

See Coach Manufacturer's Service Manual for replacement guidelines.

Shock Absorber Replacement

⚠WARNING

Shock absorber is "gas pressurized" DO NOT puncture of expose to excessive heat, serious personal injury can result.

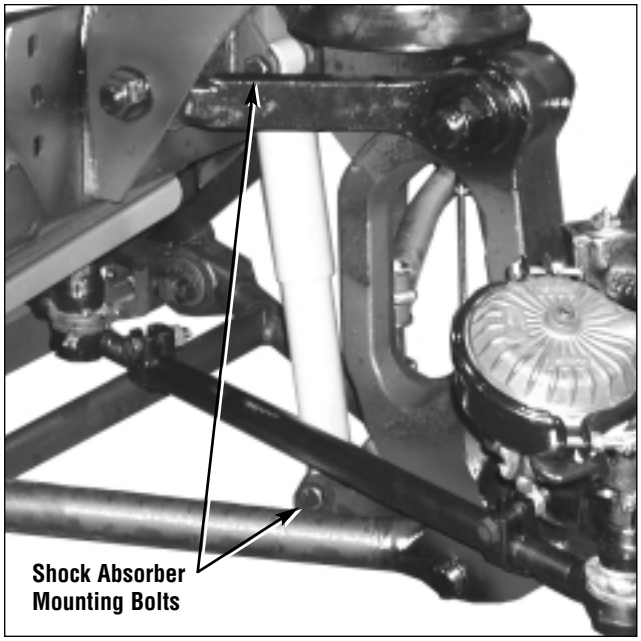
Preparation

1. Apply the parking brake and block the drive wheels to prevent vehicle movement.

Removal

1. Remove the 3/4-10 lower shock absorber mounting bolt from the Knuckle Post Shock Bracket (Fig. 28).

Figure 28. - Shock Absorber



2. Remove the 3/4-10 upper shock absorber mount bolt (Fig. 28).

Installation

1. Install the shock absorber into the upper mounting bracket and secure with mounting bolt.
2. Place the shock absorber into lower mounting bracket and secure with mounting bolt.
3. Torque bolts to recommended specifications. *See Torque Specs on pages 6 & 7.*

Air Spring Replacement

IMPORTANT: When replacing the air spring, make sure you use the correct replacement. Using an air spring that is not recommended by Holland Neway may be detrimental to vehicle ride and handling.

Preparation

1. Apply the parking brake and block the drive wheels to prevent vehicle movement.
2. Raise the vehicle until the front wheels are off the ground. Then support the vehicle with safety stands. **DO NOT** place jacks or safety stands under the lower control arms to support the vehicle.

⚠WARNING

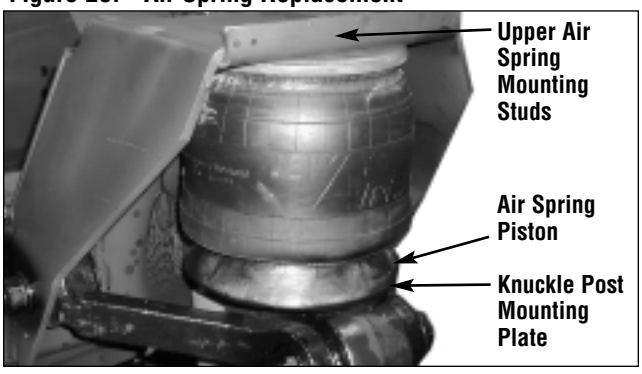
Always use safety stands. Never work under a vehicle supported by a jack only. Jacks can slip or fall over and cause serious personal injury. DO NOT place jacks or safety stands under the lower control arms to support the vehicle. Lower control arms are not stationary components and could move allowing the vehicle to drop causing serious personal injury.

3. Remove the front tires. Disconnect the Height Control Valve (HCV) linkage from the lower connection bracket (Fig. 11 - page 10).

Removal

1. Remove air line at the air spring, then remove the connection fitting.
2. Remove all nuts and washers from the upper air spring mounting studs.
3. Remove bolts that secure the air spring piston to the knuckle post mounting plate (Fig. 29).
4. Remove the air spring.

Figure 29. - Air Spring Replacement



Installation

1. Mount the air spring to the knuckle post mounting plate. Torque the bolts to 30-40 ft.-lbs. *See Torque Specs on pages 6 & 7.*
2. Assemble the nuts and washers that connect the air spring to the upper air spring mount on the subframe. Torque the nuts to 30-40 ft. lbs. *See Torque Specs on pages 6 & 7.*
3. Install connection fitting into the air spring. Use Permatex or equivalent thread sealant.
4. Connect air line to the air spring.
5. Lower vehicle frame and inflate the air springs.
6. Use water/liquid soap spray to check air fittings for leaks.

Knuckle Post Connection Replacement

IMPORTANT: The Holland Neway IFS utilizes precision roller bearings at each (upper and lower) knuckle post connection. This connection is very robust and tightly toleranced for ease of assembly and repair. Care should be taken to insure the machined surfaces of the control arms and bearing races are protected from damage. If a bearing element needs replacement, it is strongly suggested the outer bearing race be replaced at the same time.

Removal

1. Apply the parking brake and block the drive wheels to prevent vehicle movement.
2. Raise the front wheels off the ground and support with safety stands. **DO NOT** support the vehicle with jacks or stands under the control arms.

⚠WARNING

Always use safety stands. Never work under a vehicle supported by a jack only. Jacks can slip or fall over and cause serious personal injury. DO NOT place jacks or safety stands under the lower control arms to support the vehicle. Lower control arms are not stationary components and could move allowing the vehicle to drop causing serious personal injury.

3. Remove the front tires. Disconnect the Height Control Valve (HCV) linkage from the lower connection bracket (Fig. 11 - page 10).
4. Remove bolts that secure the air spring piston to the knuckle post mounting plate.

5. Use a portable crane or jack and support the steering knuckle post assembly at its lowest position prior to disconnecting it from the control arm or removing the control arm with the steering knuckle attached. The knuckle post assembly is heavy and unbalanced and must be properly supported.

⚠ CAUTION

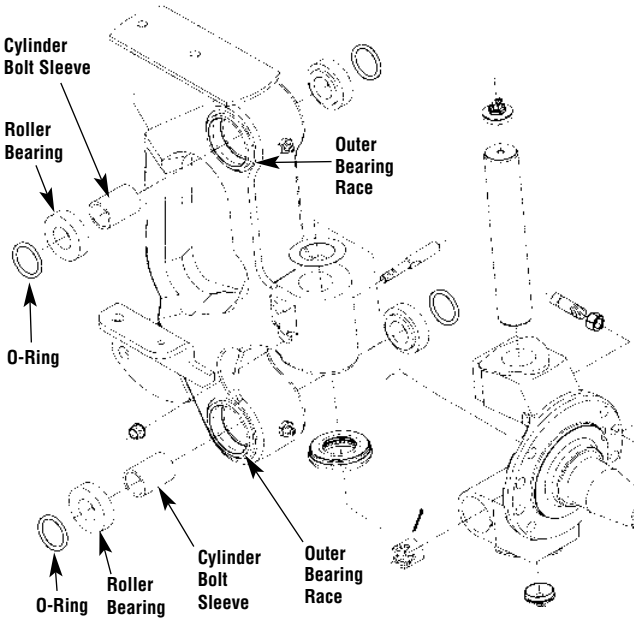
Failure to properly support the knuckle post assembly could result in personal injury to hands or feet.

6. Remove knuckle bolt cotter pins. Loosen the knuckle bolt nuts and remove.
7. Pull the knuckle post bolt assemblies from the upper and lower control arm connections and completely remove it.
8. Swing the knuckle post outward or swing the control arms (upper or lower) aside until full access is available to the upper and lower bearings.

NOTE: Care should be taken to insure the roller bearing elements do not fall out by slowly moving the knuckle post or control arms aside.

9. Remove the roller bearing elements and the O-rings from both sides of the knuckle post opening (Fig. 30).

Figure 30. - Knuckle Post Connection Replacement



10. If the outer bearing race needs to be removed; a long flat nosed punch will be required to gently tap out the outer race from the back side of the race.

NOTE: The area will likely be filled with grease and the grease will need to be removed to allow a clear view of the inside inner edge of the bearing cups.

11. Remove the cylindrical bolt sleeve.

Installation

1. Place the cylindrical bolt sleeve(s) in the knuckle post opening.
2. If removed, install new outer bearing races into the knuckle post opening(s) by gently tapping in the race with a block of wood placed between the race and the hammer (Fig. 30).

NOTE: It is very important to completely seat the bearing race in the knuckle post receptacle. A 0.002" feeler gage should not fit between the backside of the race and the mating shoulder in the knuckle post.

IMPORTANT: Care should be taken to insure the bearing race surface is not damaged.

3. Prepack the roller bearing elements with grease and apply grease to the outer bearing races and machined faces of the control arms.
4. Place the roller bearing elements and O-ring in each side. Typically, the grease will hold the roller elements in place until the control arms are moved into place.
5. Swing the knuckle post or control arm ends into alignment with the bore of the tapered roller elements.

NOTE: Care should be taken to insure the O-ring does not get pinched between the knuckle post, control arm, and roller element bore.

6. Insert the knuckle post bolt assembly through the connection.
7. Install nut and torque to 630-770 ft. lbs. Install cotter pin. *See Torque Specs on pages 6 & 7.*
8. Re-lubricate connection per lubrication instructions on page 15.
9. Replace bolts that secure the air spring piston to the knuckle post mounting plate.

Steering Gear Replacement Procedure

NOTE: Not all IFS units are fitted with a steering gear supplied by Holland Neway. The approximate weight of each gear with fluid is between 80 and 100 lbs. and may require some external means to support it during removal. See chassis manufacturer for detailed steering gear information.

IMPORTANT: Steering gear case is very heavy and a proper support device should be used during removal.

⚠ CAUTION

Failure to properly support the steering gear could result in personal injury to hands or feet.

Removal

1. Apply the parking brake and block the drive wheels to prevent vehicle movement.
2. Raise the front wheels off the ground and support vehicle with safety stands. **DO NOT** support the vehicle with jacks or stands under the control arms.

⚠ WARNING

Always use safety stands. Never work under a vehicle supported by a jack only. Jacks can slip or fall over and cause serious personal injury. DO NOT place jacks or safety stands under the lower control arms to support the vehicle. Lower control arms are not stationary components and could move allowing the vehicle to drop causing serious personal injury.

3. Disconnect the tie rod assembly from the pitman arm at the tapered ball joint connection by removing the cotter pin and nut.
4. Loosen and remove the 3/4" retainer fastener from the pitman arm. The pitman arm can be lowered from the output shaft drive spline and removed.

NOTE: Depending upon clearances, it may be necessary to loosen and remove the steering gear case 7/8" attachment fasteners to allow the gear to be moved backward. This will allow easier access to the pitman arm/gear output shaft connection.

5. Disconnect all hydraulic lines and the steering input shaft to the gear case and remove the 7/8" attaching fasteners. It is necessary to support the steering gear case with a support device due to its weight.
6. Remove the steering gear case.

Installation

1. Install and support the steering gear case in position on the underside of the sub-frame mounting plate.
2. Install the 7/8" fasteners and torque to 400-450 ft. lbs. *See Torque Specs on pages 6 & 7.*
3. Connect the steering input shaft to the steering gear case input spline.
4. Connect the hydraulic fluid supply lines.
5. Install the pitman arm to the steering gear output splined shaft. A timing mark is provided on the bottom of the pitman arm which is intended to line up with the steering gear timing marks on the gear case and output shaft. When all three timing marks are aligned, the pitman arm and gear are in the straight-ahead position.
6. With the pitman arm in place, tighten the retaining fastener to the following torque level depending upon the manufacturer:

   TRW-(3/4" fastener) 125 to 150 ft. lbs.

   See Torque Specs on pages 6 & 7.
7. Connect the tie rod arm tapered ball joint ends to the mating end of the pitman arm and tighten the nut to 125 to 135 ft.-lb. Install cotter pin. *See Torque Specs on pages 6 & 7.*
8. Bleed gear case per manufacturers recommendations.

NOTE: Refer to Steering Gear Manufacturer's service manual for other detailed information.

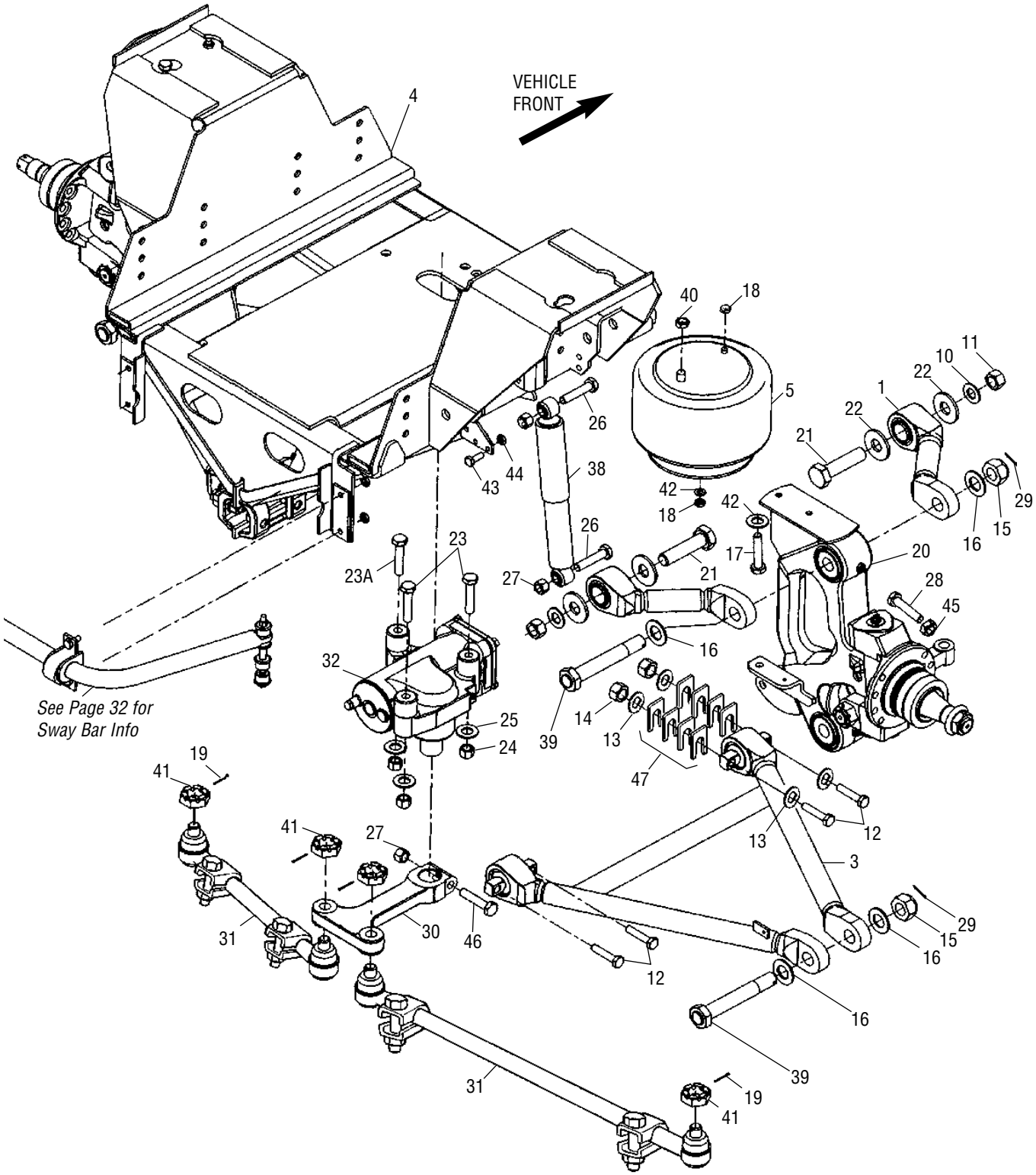
9. Realign the vehicle per manufacturer's specifications or the wheel alignment section of this manual (page 18).

Troubleshooting - Suspension System

SYMPTOMS	POSSIBLE CAUSES	REMEDIES
Tires wear out quickly or have uneven tire tread wear. ***NOTE:*** *Wear pattern will indicate possible cause(s). Consult with tire manufacturer for guidance.*	Tires have incorrect pressure.	Put specified air pressure in tires.
	Tires out of balance.	Balance or replace tires.
	Incorrect toe-in setting.	Adjust toe-in to specified setting.
	Incorrect ride height.	Adjust ride height to specified setting.
	Incorrect rear axle alignment.	Align rear axle to specified thrust angle.
	Incorrect steering arm geometry.	Adjust tie rod lengths as required.
	Improper (mismatched) tires and wheels.	Install correct tire and wheel combination.
Vehicle is difficult to steer.	Improper oversized tires.	Install correct tire and wheel combination.
	Tires not uniform.	Install correct tire and wheel combination.
	Tires have incorrect pressure.	Put specified air pressure in tires.
	Incorrect steering arm geometry.	Adjust tie rod lengths as required.
	Steering arms binding.	Check steering arm bearings and lubricate as needed.
	Ball joints binding.	Inspect ball joints for wear and replace as required.
	Tie rod ends binding	Inspect tie rod ends for wear and lubricate as needed.
	Steering column linkage binding.	Align or adjust as required.
	Steering miter box binding.	Check steering miter box and repair or replace as required.
	Steering gear valve binding.	Inspect, repair or replace as required.
	Steering damper binding or malfunction.	Check and replace as needed.
	Steering wheel to column interference.	Align or adjust as required.
	Power steering pump fluid level low and possible leak in system.	Add fluid, tighten connections and correct as needed.
	Power steering pump pressure and flow below specification.	Conduct pump flow and relief pressure tests and adjust, repair or replace as needed.
	Air in power steering system.	Add fluid, tighten connections & bleed system.
	Contaminated or incorrect fluid.	Replace with correctly specified fluid.
	Obstruction within steering gear or lines.	Inspect, remove obstruction(s) and repair or replace as required.
	Excessive internal steering gear leakage.	Inspect, repair or replace as required.
Vehicle wanders side to side...*loose steering*. **Steering wheel has large amptitude, rotational oscillations when hitting large bumps.**	Vehicle overloaded or unevenly loaded.	Check wheel loads and correct as needed.
	Improper (mismatched) tires and wheels.	Install correct tire and wheel combination.
	Incorrect toe-in setting.	Adjust toe-in to specified setting.
	Tires have incorrect pressure.	Put specified air pressure in tires.
	Loose steering gear mounting.	Check mounting and secure as needed.
	Tie rod end connection loose or ball stud worn.	Inspect ball stud connections and wear.
	Loose wheel nuts.	Check and tighten to specification.
	Ball joints binding or worn.	Inspect ball joints for wear or contamination and replace as required.
	Steering column linkage worn.	Check for wear and repair or replace as needed.
	Wheel bearings out of adjustment.	Check wheel bearing end play and adjust as required.
	Steering gear adjustment.	Check and adjust to specification.
	Steering column mis-aligned.	Realign steering column as required.
	Steering arm mounts loose.	Check and tighten to specification.

SYMPTOMS	POSSIBLE CAUSES	REMEDIES
Vehicle pulls to one side without the brakes applied.	Improper (mismatched) tires and wheels.	Install correct tire and wheel combination.
	Tires have incorrect pressure.	Put specified air pressure in tires.
	Vehicle unevenly loaded.	Check wheel loads and correct as needed.
	Improper brake adjustment.	Inspect, adjust and correct as required.
	Incorrect rear axle alignment.	Align rear axle to specified thrust angle.
	Unequal ride height side to side.	Check ride height and adjust to specified setting.
	Wheel bearings out of adjustment.	Check wheel bearing end play and adjust as required.
	Loose steering gear mounting.	Check mounting and secure as needed.
	Tie rod end connection loose or ball stud worn.	Inspect ball stud connections and wear.
	Bent spindle or steering arm.	Inspect and replace as required.
	Frame or underbody out of alignment.	Inspect and correct as required.
	Incorrect toe-in setting.	Adjust toe-in to specified setting.
	Mis-aligned belts in radial tires.	Check and replace as needed.
	Steering gear valve binding.	Inspect, repair or replace as required.
	Steering gear not centered.	Inspect and adjust as required.
	Excessive internal steering gear leakage.	Inspect, repair or replace as required.
	Incorrect caster and/or caster setting.	Install and/or adjust eccentric adapters in upper control arm.
Vehicle pulls to one side with the brakes applied.	Grease, oil or dirt on brake linings.	Replace brake linings as required.
	Brake linings are glazed.	Deglaze brake linings or replace as required.
	Brake linings are not a balanced set, different friction codes or lining brand.	Replace brake linings as required.
	Loose or broken brake linings.	Replace brake linings as required.
	Brake drum out of round.	Re-machine brake drum as required.
	Defective brake drum.	Inspect for defects and replace as required.
	Brake air chamber clevis pin or camshaft binding.	Check and lubricate as needed.
	Defective slack adjuster.	Inspect for defects and replace as required.
	Uneven brake adjustment side to side.	Adjust slack adjuster as required.
	Different brake air chamber size or slack adjuster length side to side.	Replace with same size brake air chambers and length slack adjusters.
	Air pressure uneven side to side.	Check side to side air pressure and correct as needed.
	Unequal brake air chamber stroke side to side.	Check side to side stroke and adjust as required.
	Rear axle brakes mis-adjusted.	Check and adjust as required.
	Air leak or obstruction in air brake lines.	Check fittings with soapy water solution and remove obstruction
	Brake air chamber air leak or diaphragm damaged.	Check chamber for air leak and damaged diaphragm.
Vehicle rolls side to side excessively.	Front and/or rear shock absorbers worn.	Replace shock absorbers as needed.
	Shock mounting loose.	Check and tighten as required.
	Shock eye bushings worn.	Check and replace as needed.
	Control arm pivot bushings worn.	Inspect and replace as required.
	Internal leak in height control valve.	Check height control valve and replace as required.

Sub Frame Assembly



Sub Frame Assembly

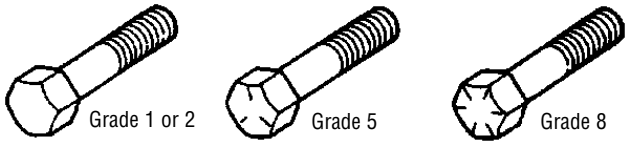
Item	Part No.	Description	Qty.
1	See OEM	Upper Arm Assembly	4
2	See OEM	Lower Arm Assembly-LH (not shown)	1
3	See OEM	Lower Arm Assembly-RH	1
4	See OEM	Suspension Sub-Frame	1
5	See OEM	Air Spring	2
6	See OEM	Spindle Hardware Kit (not shown)	1
7	See OEM	O-Ring Seal - Knuckle Post (not shown)	8
8	See OEM	Knuckle Post Bearings (not shown)	8
9	See OEM	Knuckle Bolt Sleeve (not shown)	4
10	93600168	1" Flat Washer	8
11	93400502	1" - 8 Lock Nut	4
12	93003383	5/8" -11x3.5" GR8 Hex Bolt	8
13	93600150	5/8" Flat Washer	16
14	93400490	5/8" - 11 Hex Nut GR C	8
15	93400511	1.25" - 12 Hex Nut GR B	4
16	93600180	1.37" Flat Washer	8
17	93002909	1/2" - 13x1.5 Hex Bolt GR 8	2
18	93400480	1/2" -13 Hex Lock Nut - GR B	4
19	93800069	Cotter Pin	4
20	93800292	Grease Fitting	4
21	93004277	1" -8x5" Hex Bolt GR 8	4
22	93600548	2" Flat Wear Washer	4
23	93003821	7/8" -9x4 Hex Bolt GR 8	3
23A	93003831	7/8"-9x4.5 Hex Bolt GR 5	1

Item	Part No.	Description	Qty.
24	93400498	7/8" Lock Nut	3
25	93600162	7/8" Flat Washer	3
26	93003597	3/4" - 10x3.5" Hex Bolt GR 5	4
27	93400492	3/4" - 10 Lock Nut GR B	5
28	93003330	5/8" - 18x1.25 Hex Bolt GR 8	2
29	93800303	Cotter Pin 0.156" x 1.5"	2
30	See OEM	Pitman Arm	1
31	See OEM	Tie Rod Arm	2
32	See OEM	Steering Gear	1
33	See OEM	Brake Assembly	2
34	See OEM	Slack Adjuster (not shown)	2
35	See OEM	Hub & Drum Assembly (not shown)	1
36	See OEM	Height Control Valve (not shown)	2
37	See OEM	HCV Linkage Assy. (not shown)	2
38	See OEM	Shocks	2
39	See OEM	Knuckle Post Bolt	4
40	93400417	3/4" - 16 Thin Locknut GR B	2
41	See OEM	7/8" - 14 Castlenut	4
42	93600072	1/2" Lock Washer	4
43	93002607	3/8" - 16 x 2.5 GR5 bolt	4
44	93400472	3/8" - 16 GRB Nut	4
45	93400265	5/8" - 18 Jam Nut GRB	2
46	93003621	3/4" - 10 x 4.5 GR5 Bolt	1
47	90034424	Shims	32

NOTE: Part numbers for major suspension components will vary by suspension model part number. Contact the vehicle OEM for proper component part number.

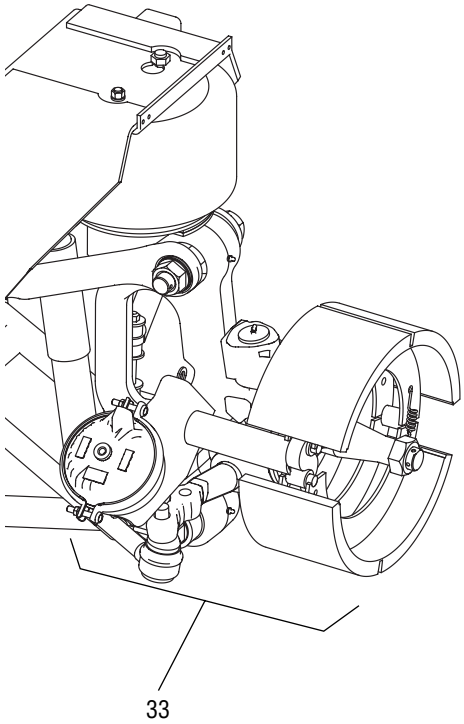
IMPORTANT: Most of the fasteners used in this suspension are graded fasteners. These fasteners have the strength and hardness properties required for their particular function. When replaced, they must be replaced with fasteners of the same grade, size and form as the original in order to prevent failure.

Bolt Grade Markings

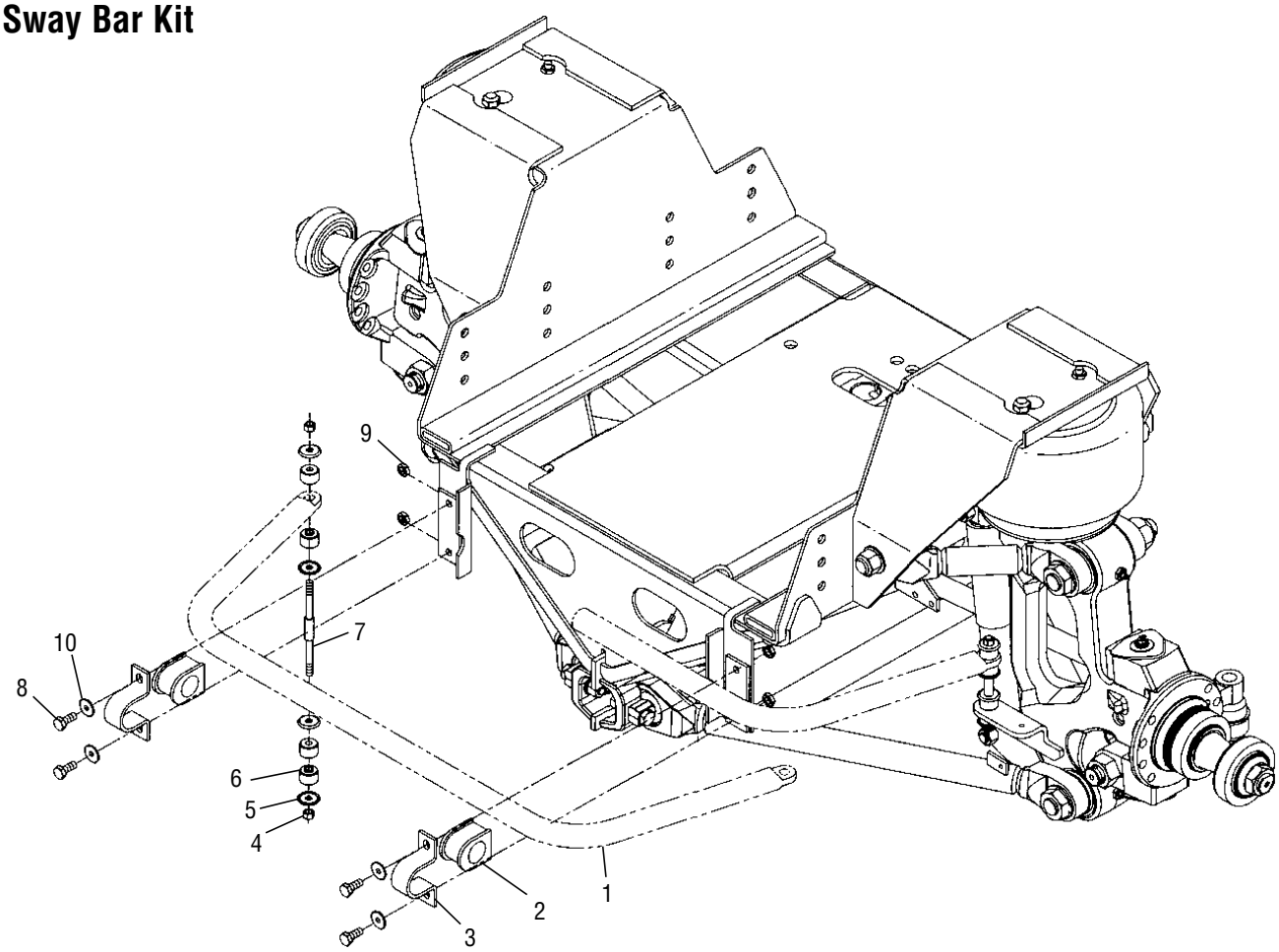


Lock Nut Grade Markings

Grade	Lock Nut Grade B	Lock Nut Grade C
Identification	 3 Dots	 6 Dots



Sway Bar Kit

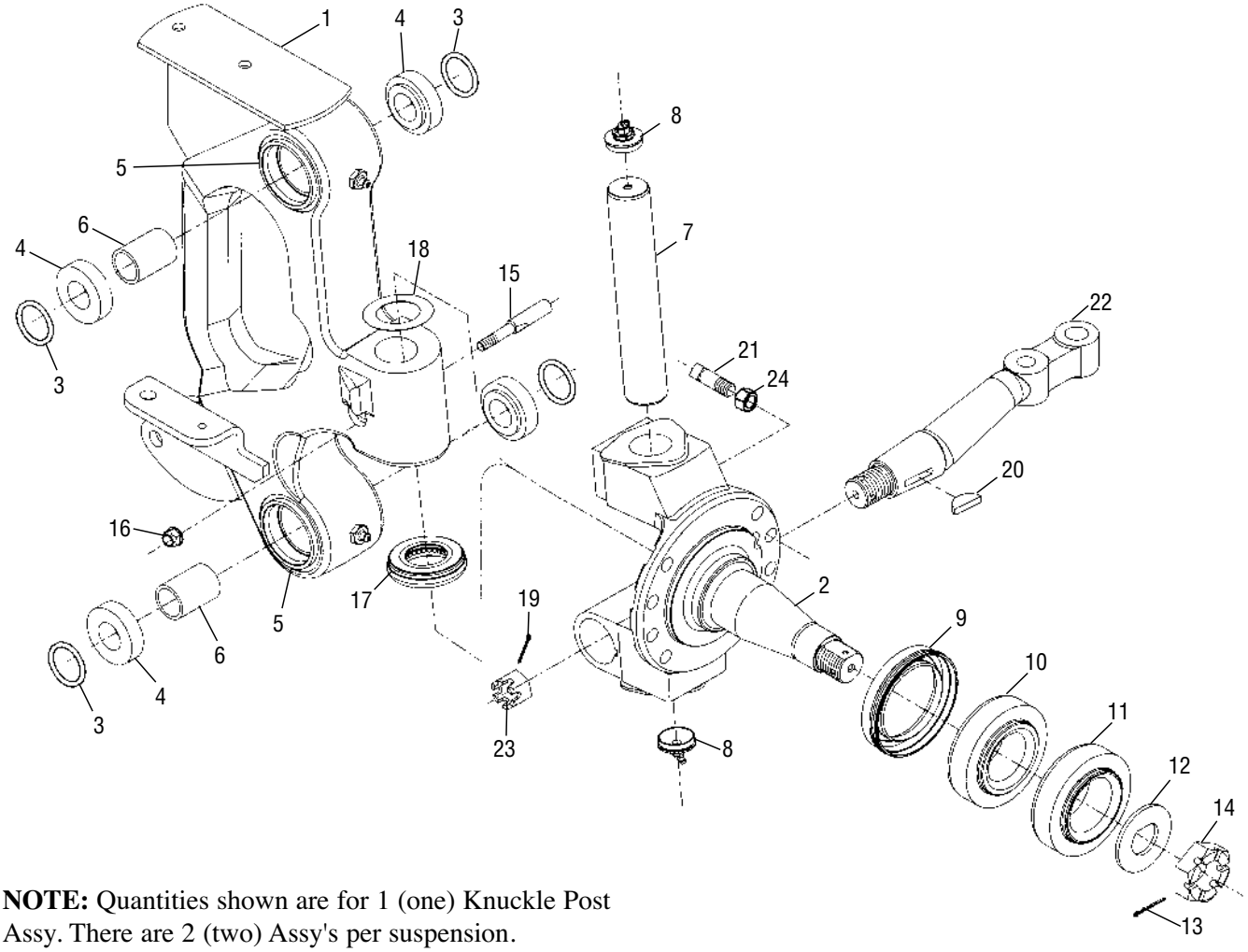


Item	Part No.	Description	Qty.
1	90045372	Sway Bar	1
2	Item Numbers 2 - 10 are available in Kit Number 90546699	Sway Bar, Bushing	2
3		Sway Bar, Bracket	2
4		7/16" - 14 Lock Nut	4
5		7/16" - Flat Washer	8
6		Grommet	8
7		Link	2
8		1/2" - 13x1.5 GR 8 Bolt	4
9		1/2" - 13 GRB Nut	4
10		Washer Flat Narrow .5	4

NOTE: Swaybar shown is NOT available with the following IFS Model Number configurations: #90547128, #90547129, #90547183 & #90547185.

IMPORTANT: Most of the fasteners used in this suspension are graded fasteners. These fasteners have the strength and hardness properties required for their particular function. When replaced, they must be replaced with fasteners of the same grade, size and form as the original in order to prevent failure.

Knuckle Post Assembly



NOTE: Quantities shown are for 1 (one) Knuckle Post Assy. There are 2 (two) Assy's per suspension.

Item	Part No.	Description	Qty.
1	See OEM	Knuckle Post Assembly - RH	1
	See OEM	Knuckle Post Assy. - LH *(Not Shown)*	1
2	90045356	Spindle - RH	1
	90045357	Spindle - LH *(Not Shown)*	1
3	See OEM	O-Ring	4
4	See OEM	Knuckle Post Bearings	4
5	See OEM	Knuckle Post Bearings Race	4
6	See OEM	Knuckle Bolt Sleeve	2
7	See OEM	King Pin	1
8	See OEM	Cap-King Pin	2
9	See OEM	Oil Seal	1
10	See OEM	Inner Bearing	1
11	See OEM	Outer Bearing	1
12	See OEM	Washer - "D" Shape	1

Item	Part No.	Description	Qty.
13	See OEM	9/64" Cotter Pin	1
14	See OEM	Nut (Wheel Bearing)	1
15	See OEM	Taper Pin	1
16	See OEM	Lock Nut - Flanged	1
17	See OEM	Thrust Bearings	1
18	See OEM	Shim - .016	*
18	See OEM	Shim - .005	*
18	See OEM	Shim - .010	*
19	See OEM	3/16" Cotter Pin	1
20	See OEM	Woodruff Key	1
21	See OEM	Steering Stop Bolt - 5/8" - 18	1
22	See OEM	Steering Arm	1
23	See OEM	Slotted Hex Nut	1
24	See OEM	5/8" Jam Nut	1

* Shim size and quantity is determined during the manufacturing process.

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