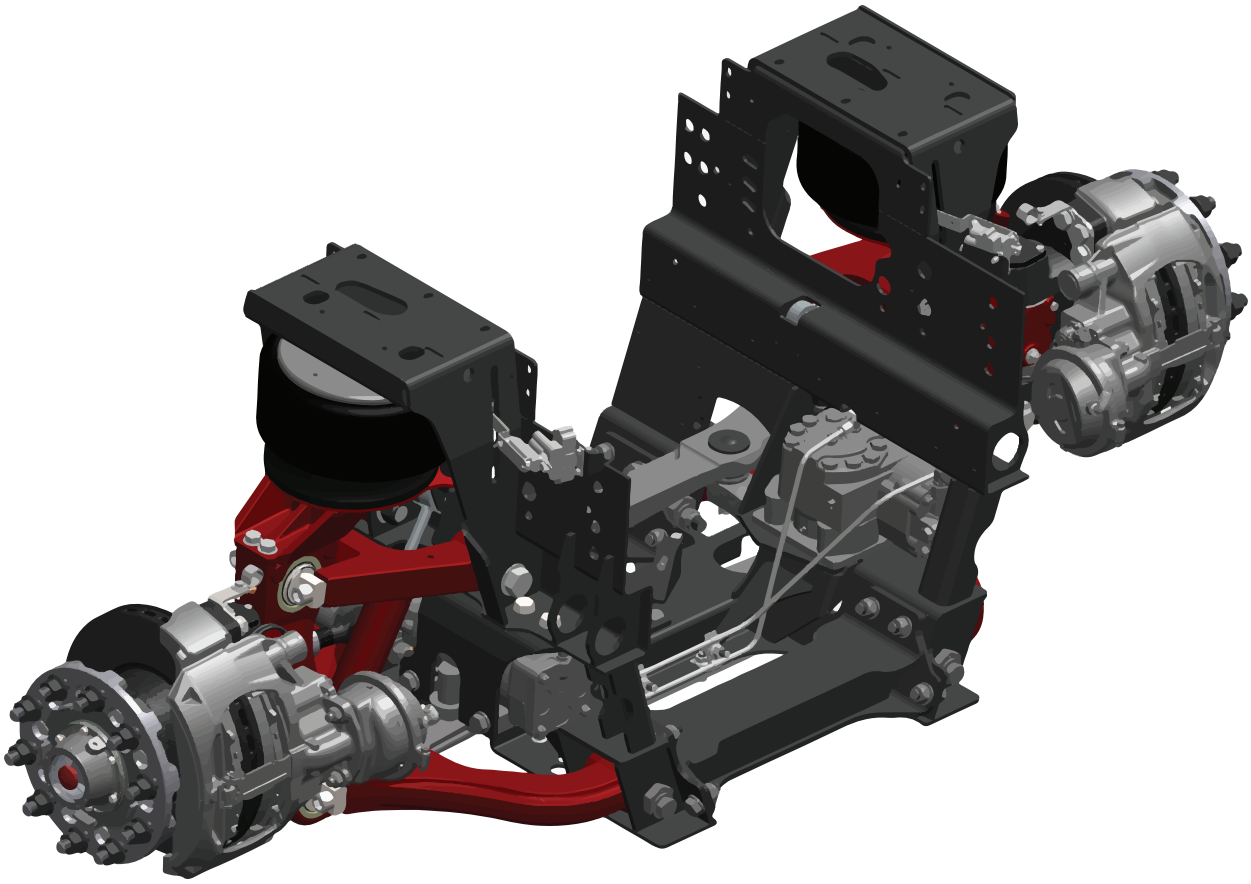
Reyco Granning SUSPENSIONS

Fire Apparatus Suspensions Owner's Manual

IFS2000S-FT|IFS2200S-FT|IFS2400S-FT

Independent Front Suspension



Document #: D710023
Revision: K
Revision Date: 10/2024

Reyco Granning Suspensions
1205 Industrial Park Drive
Mount Vernon, MO 65712
Phone: 800.750.0053 Fax: 833.896.6997
www.reycogranning.com

Page Left Blank Intentionally

TABLE OF CONTENTS

TABLE OF CONTENTS

TABLE OF CONTENTS

REV	ECR #	DATE	CHANGE DESCRIPTION	BY	CHK	APV
K	22962	10/8/24	General updates and corrections	STM	KMH	JAH
H	22078	6/15/22	Format Update, Add IFS2200S-FT info. Added unit updates that have occurred since the revision	STM	GMC	JAH
G		11/22/17	Caster angle specification change from 3°+/-1/2° to 4°+/-1/2° on page 51	RS	-	-
F		5/5/16	Added Height Control Valve Installation for front and rear of air spring tower mount and corresponding parts table modified. Optional Kit Upper Crossmember K710040-09 added.	RS	-	-
E		10/7/14	Add Brake Rotor to Service, Add Wheel & Tire Information, Add Eccentric Wrench Add Upper Crossmember variations, Replace shock absorber with KONI	ERL	-	-

INTRODUCTION

Service Notes

This Service Manual describes the correct service and repair procedures for the **Reyco Granning**® IFS2000S-FT/ IFS2200S-FT/IFS2400S-FT Independent Front Suspension model with 20,000/22,000/24,000 lbs. Gross Axle Weight Rating (GAWR). Overloading the suspension may result in adverse ride and handling characteristics.

You must read and understand all procedures and safety precautions presented in this manual before conducting any service work on the suspension.

Proper tools must be used to perform the maintenance and repair procedures in this manual. Some procedures require the use of special tools for safe and correct service. Failure to use the proper and/or special tools when required can cause personal injury and/or damage to suspension components.

You must follow your company safety procedures and use proper safety equipment when you service or repair the suspension.

The information contained in this manual was current at the time of printing and is subject to change without notice or liability. **Reyco Granning**® reserves the right to modify the suspension and/or procedures and to change specifications at any time without notice and without incurring obligation.

Reyco Granning® uses the following types of notices for potential safety problems and to give information that will prevent damage to equipment.

WARNING

A warning indicates procedures that must be followed exactly. Serious personal injury can occur if the procedure is not followed.

CAUTION

A caution indicates procedures that must be followed exactly. Damage to equipment or suspension components and personal injury can occur if the procedure is not followed.

NOTE

A note indicates an operation, procedure or instruction that is important for correct service.

IDENTIFICATIONS

The suspension model and serial number are stamped on an aluminum tag that is riveted to the front of the suspension sub-frame assembly (Figure 1). The serial number is used by **Reyco Granning**® for control purposes and should be referred to when servicing the suspension or requesting technical support (Figure 2).

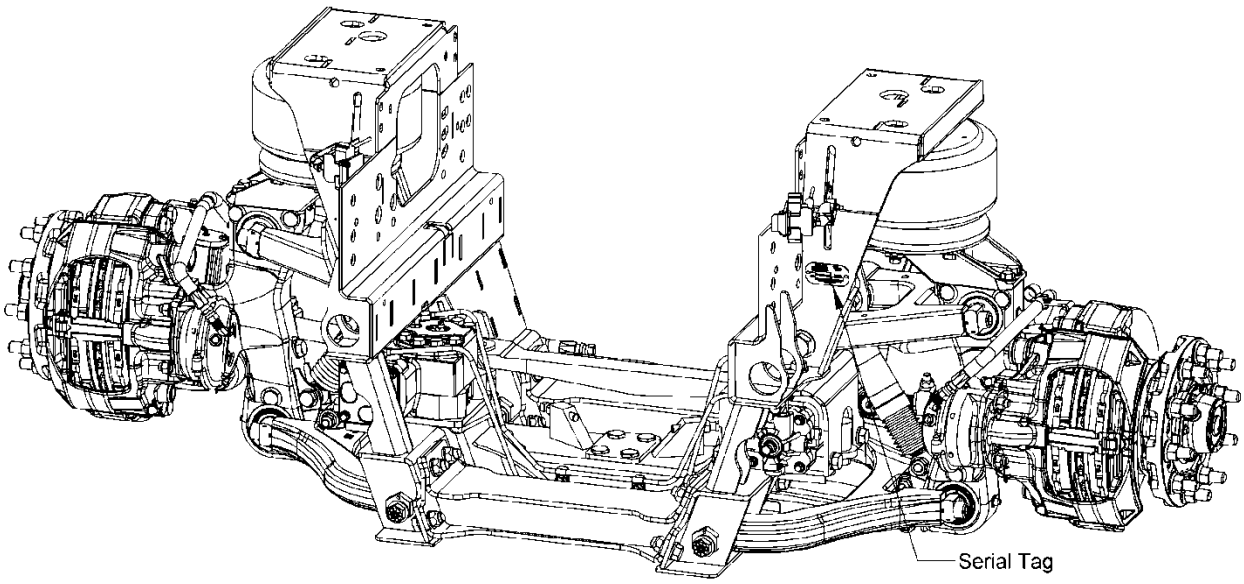


Figure 1- Suspension Identification Location

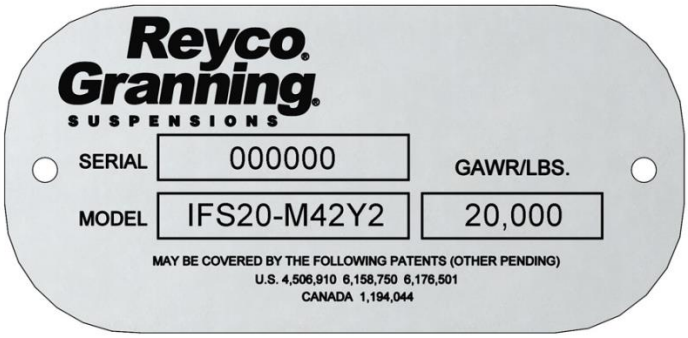


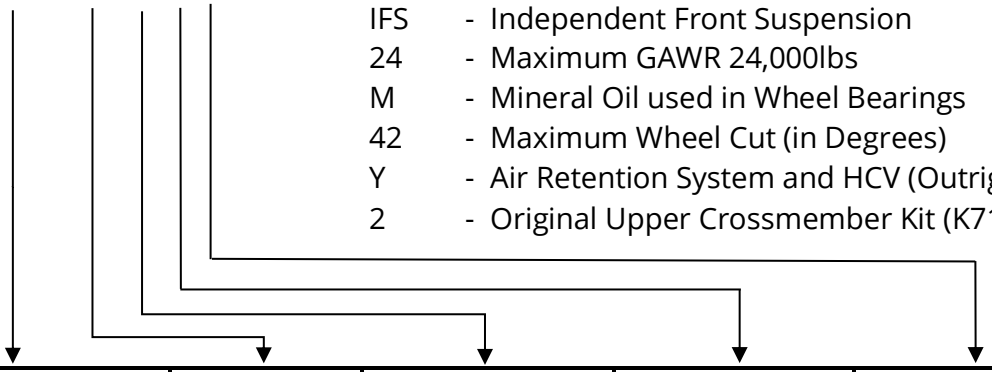
Figure 2- Suspension Serial Number Tag

MODEL OPTIONS

Model Number Key

Example:

IFS 24 – M 42 Y 2



IFS - Independent Front Suspension
24 - Maximum GAWR 24,000lbs
M - Mineral Oil used in Wheel Bearings
42 - Maximum Wheel Cut (in Degrees)
Y - Air Retention System and HCV (Outrigger)
2 - Original Upper Crossmember Kit (K710040-02)

GAWR		Hub Oil		Wheel Cut		HCV Position & ARK/ARB Installation		Xmem	
Code	Model Max Capacity	Code	Hub Oil Type	Code	Steering Stop Adjustment Number	Code	HCV Installation	Code	Upper Cross Member Kit Number
24	IFS2400S-FT 24,0000 lbs	M	Mineral	42	710826-01	A	715901-01	2	K710040-02
				48	710826-02	B	715901-02	3	K710040-03
		S	Synthetic	53	Not Available	C	715901-03	4	K710040-04
				55	Not Available	D	715901-04	5	K710040-05
20	IFS2200S-FT 22,0000 lbs	M	Mineral	42	710826-01	Y	713762-02	6	Reserved
				48	710826-02	N	713762-01	7	K710040-07
		S	Synthetic	53	Not Available	S	713762-02 & 715796-01	8	K710040-08
				55	Not Available			9	K710040-09
20	IFS2000S-FT 20,0000 lbs	M	Mineral	42	710826-01	X	713762-01 & 715796-01	A	K710040-10
				48	710826-02			B	K710040-11
		S	Synthetic	53	710826-03	Z	713763-02	C	K710040-12
				55	710826-04	O	713763-01	D	K710040-13
								E	K710040-14

Notes:
Wheel Cut is limited on 22/24K Units by tire requirements and component interference
HCV Position & ARK/ARB Installation:
A - Installation High Mounted HCV (Hi-Temp) without Air Retention Valve
B - Installation High Mounted HCV (Hi-Temp) with Air Retention Valve
C - Installation High Mounted HCV (Hi-Temp) with Anti-Roll bar
D - Installation High Mounted HCV (Hi-Temp) with Air Retention Valve & Anti-Roll bar
Y - Installation High Mounted HCV with Air Retention Valve
N - Installation High Mounted HCV without Air Retention Valve
S - Installation High Mounted HCV with Air Retention Valve & Anti-Roll bar
X - Installation High Mounted HCV without Air Retention Valve & Anti-Roll bar
Z - Installation Low Mounted HCV with Air Retention Valve
O - Installation Low Mounted HCV without Air Retention Valve

MODEL OPTIONS

Wheel and Tire Combination Ratings

Tire Size	Rim Width	Wheel Inset (in)		Wheel Cut Max	Inflation[4] (psi)	Max Axle Load[4] (lbs)
		Min[1,2]	Max[3]			
385/65 R22.5	12.25"	3.96	5.13	55°	120	18,600
					130	19,840
425/65 R22.5	12.25 – 13.00"	4.50	4.69	53°	105	20,400
			5.30	48°	120	22,800
			5.75	42°		
445/65 R22.5	12.25 – 13.00"	5.30	5.30	42°	120	24,000
					130	25,600

Notes:

1. Wheel and tire combinations presented will maintain Federal Width Limit of 102 3/8"
2. Decreasing Wheel Inset will Decrease Spindle Load Capacity and de-rate Unit Capacity
3. Wheel Inset is a Maximum of 5.3inches for 22/24K applications
4. Tire inflation and load information presented for reference only, consult Tire Manufacturer for Actual or Emergency Vehicle Ratings

Wheel and Tire Examples

Tire Size	Rim Width	Wheel Inset	Wheel Cut[1]	Up to 20K GAWR	22K to 24K GAWR
385/65 R22.5	12.25"	4.68"	Max 55°	IFS20-*55**	N/A[2]
425/65 R22.5	12.25"	4.68"	Max 53°	IFS20-*53**	N/A[2]
	12.25"	4.75"	Max < 53°	IFS20-*53**[3]	N/A[2]
	12.25"	4.75"	Max 48°	IFS20-*48**[3]	IFS24-*48**
	13.00"	5.30"	Max 48°	IFS20-*48**	IFS24-*48**
445/65 R22.5	13.00"	5.30"	Max 42°	IFS20-*42**	IFS24-*42**

Notes:

1. Stated Maximum Wheel Cut is as limited by the suspension components, other installed equipment may limit available Wheel Cut.
2. 22/24K IFS Wheel Cut limited to maintain suspension component clearance and cannot be adjusted above 48° Nominal
3. Steering Stops should never be adjusted above Maximum

Wheel Clearance to Brake Calipers

Selected wheel must have a valve stem assembly that will maintain a minimum spacing of 7mm to the Brake Caliper.

VEHICLE TOWING INFORMATION

If a vehicle is disabled and needs to be towed by the front end to service center, check the OEM/Coach Builder towing procedures for the recommended method. Check with local authorities and Department of Transportation (DOT) for permissible towing methods before towing. Some states do not permit towing by chains and/or straps.

The preferred towing apparatus is the type that cradles the front tires. If the towing apparatus cannot be attached to the front tires or directly to the chassis frame rails, then the suspension sub frame may be used for attachment.

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:

- **Loss of vehicle control.**
- **Possible disconnection from tow vehicle.**
- **Damage to the suspension and/or vehicle.**

Do NOT attach tow apparatus (hooks, chains, straps, etc.) to suspension upper and lower control arms, sway bar and brackets, brake components, tie rods, steering arms, or steering knuckle carrier assemblies **(Figure 3)**.

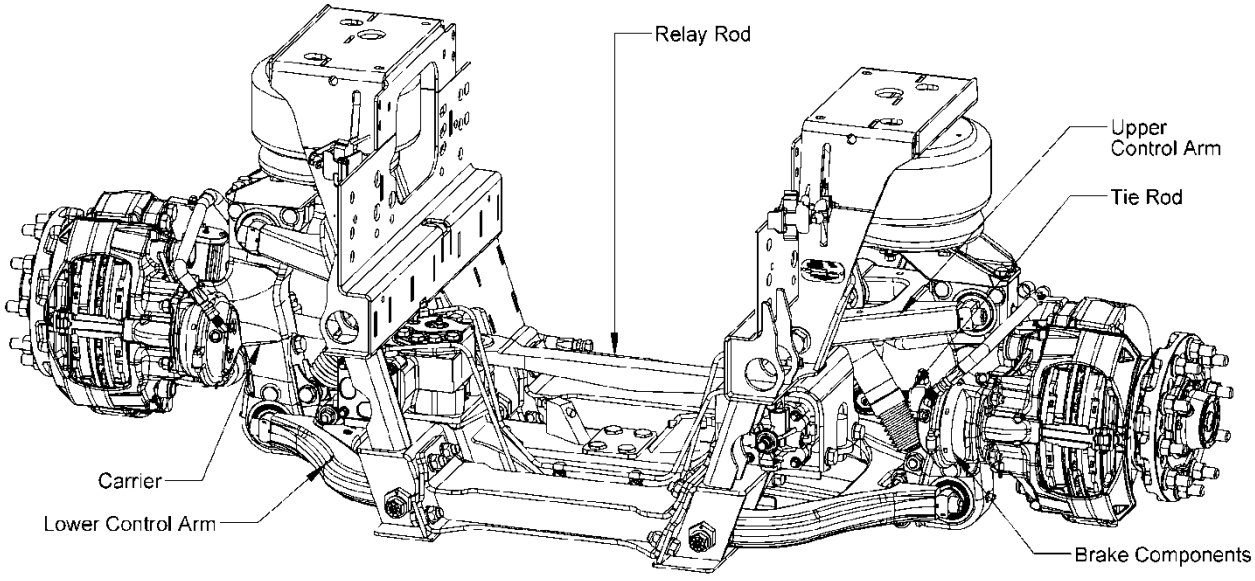


Figure 3 – Improper Tow Equipment Attachment Locations

MAINTENANCE SCHEDULE

GENERAL MAINTENANCE	SERVICE TO BE PERFORMED	MILEAGE IN THOUSANDS							
		12	24	36	48	60	72	84	96
Relay Rod Ball Joints	Check axial endplay				X				X[2]
	Inspect for ruptured seals	X	X	X	X	X	X	X	X[2]
	Check that cotter pin is installed	X	X	X	X	X	X	X	X[2]
Control Arm Bushings	Check bolt torque				X				X[2]
	Inspect for contact between control arm and mount	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 endplay	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 brake caliper for correct stroke	X	X	X	X	X	X	X	X[2]
	Inspect for air leaks using soapy water solution	X							
	Replace Brake Hub/Rotor (250,000 Miles)[4]								
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]
	Inspect for air leaks using soapy water solution	X							
Shock Absorbers	Check mounting 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]
Kingpins	Check for wear				X				X[2]
	Inspect vertical endplay				X				X[2]
Carrier Bearings	Check axial endplay								X[2]
Wheels	Check bearing endplay				X				X[2]
	Check wheel nut torque[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 solution	X							
	Inspect 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 or at previous interval.
3. Final stage manufacturer should complete toe-in inspection and adjustment after completion of vehicle
4. Manufacturer's required replacement schedule

MAINTENANCE SCHEDULE

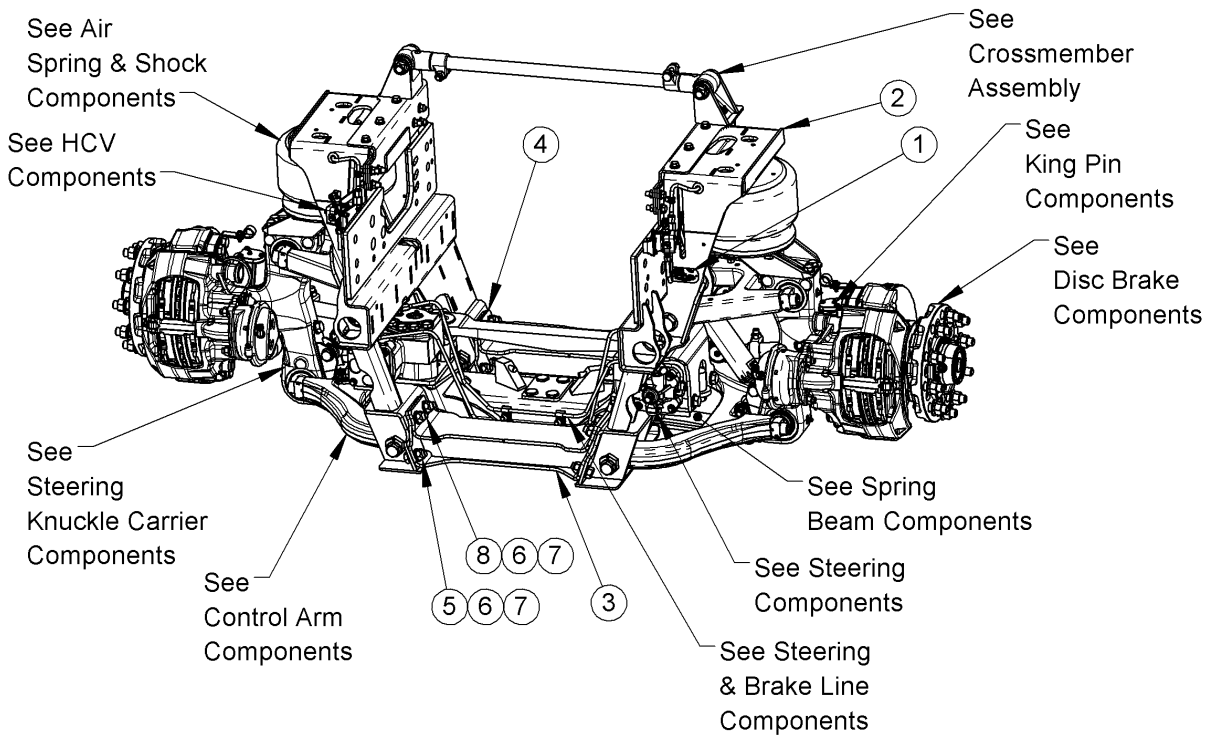
Name of Owner	Address of Owner
Date of Purchase	Name and Address of Dealer
Model of Vehicle	Vehicle Identification Number
Suspension Model Number: **IFS24 -** _ __ _ _ **IFS22 -** _ __ _ _ **IFS20 -** _ __ _ _	Suspension Serial Number:

Inspection and Maintenance Item	Date	Mileage	Service Performed

PARTS LIST

Unit Assembly IFS2000/2200/2400S-FT

Item	Part No.	Description	Item	Part No.	Description
1	2617	Serial Tag	5	710464-01	HHB 3/4-10 X 2.00
2	709086-01	Cradle, Weldment	6	103003	HFW 3/4
3	710408-01	Weldment, Crossmember, Front	7	710466-01	LN 3/4-10
4	710408-03	Weldment, Crossmember, Rear	8	710465-01	HHB 3/4-10 X 2.50

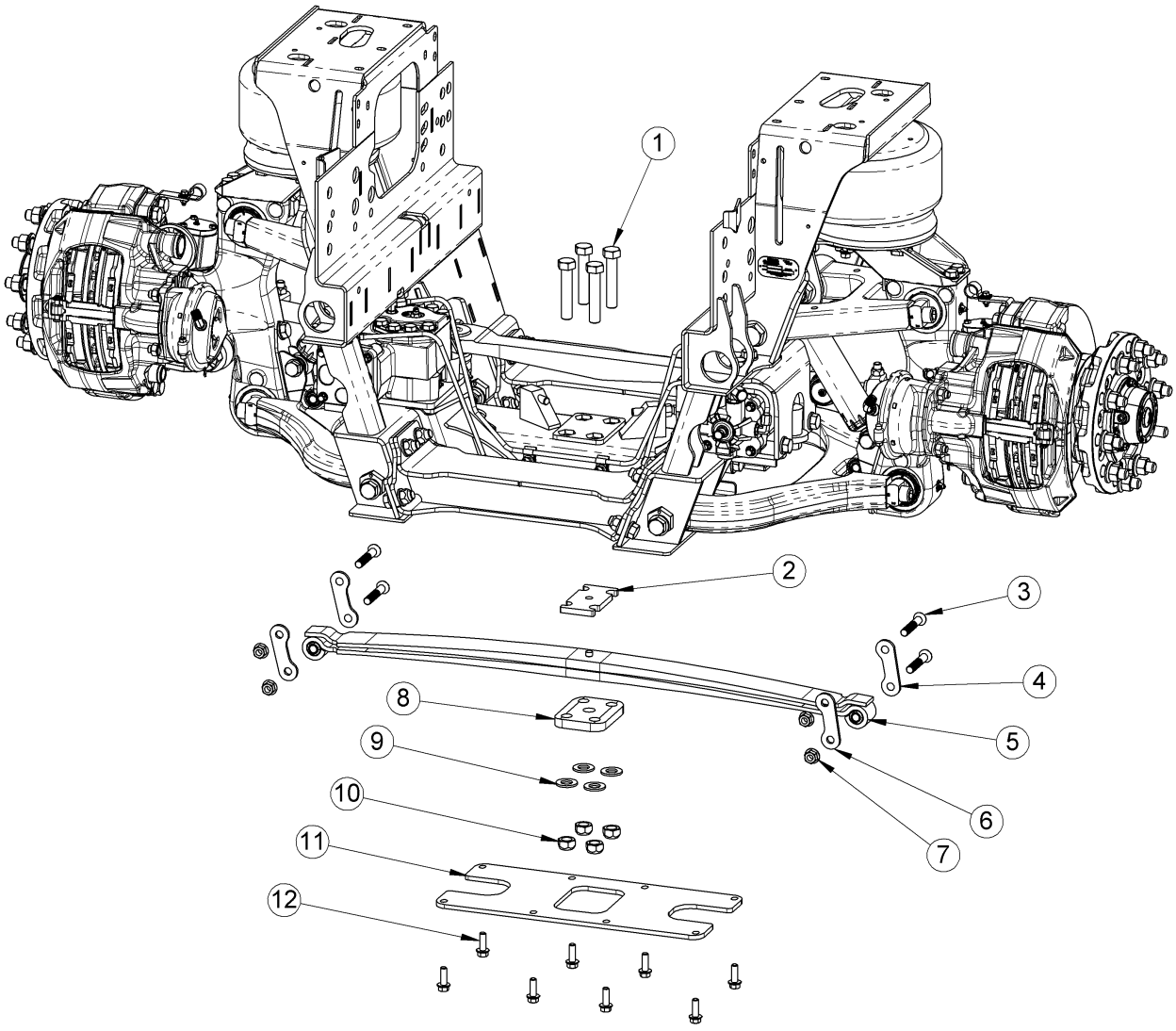


(Suspension as viewed from Front of Vehicle)

PARTS LIST

Spring Beam Components

Item	Part No.	Description	Item	Part No.	Description
1	8223550	HHB 7/8-9 x 4.50	7	184	LFN 5/8-11
2	709281-01	Spacer Plate	8	709282-01	Plate, Spring Clamp
3	709716-01	SFHCS 5/8-11 X 3 3/4	9	104098	HFW 7/8
4	709641-02	Shackle Strap	10	100122-P1	LN 7/8-9 UNC STOVER
5	709207-01	Leaf Spring, Double	11	709245-01	Brace, Lower Crossmember
	709207-02	Leaf Spring, Single	12	307	FHB 1/2-13 x 1.50,
6	709641-01	Shackle Strap			

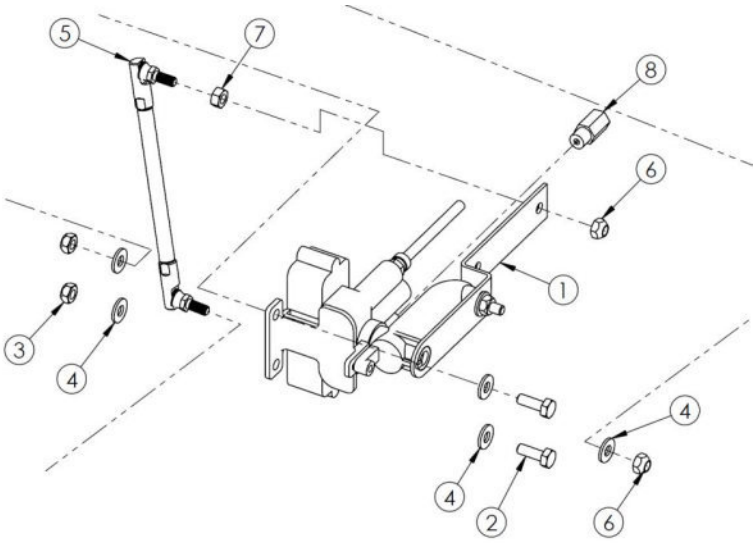


(Suspension as viewed from Front of Vehicle)

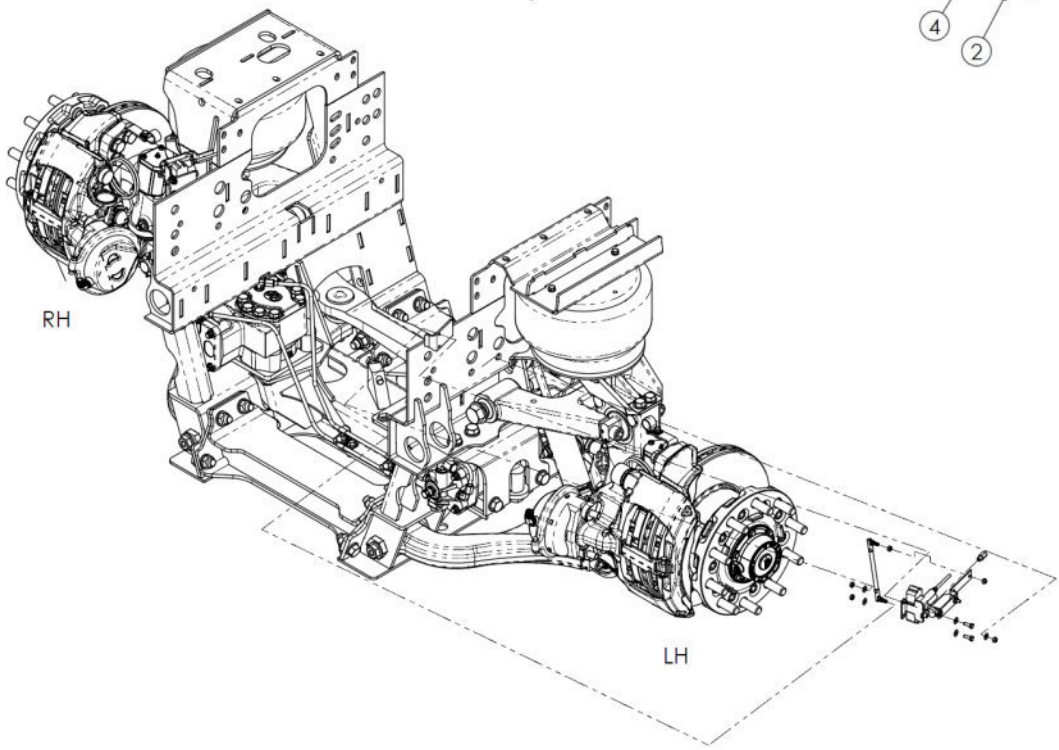
Height Control Valve Components - High Mounted

Item	Part No.	Description	Item	Part No.	Description
1	5608	Height Control Valve	5	710094-01	Height Control Valve Link
2	100679-P1	Bolt 1/4-20 x .75	6	8454750	Nut, Lock 1/4-28
3	100703-P1	Nut, Lock Stover 1/4-20	7	8120367	Nut 1/4-28
4	8120392	Washer 1/4	8	712350-01	Check Valve Assembly

Check valve installed in supply (Bottom) Port of the Height Control Valve



Height Control Valve



(Suspension as viewed from Front of Vehicle)
(High Mounted Type)

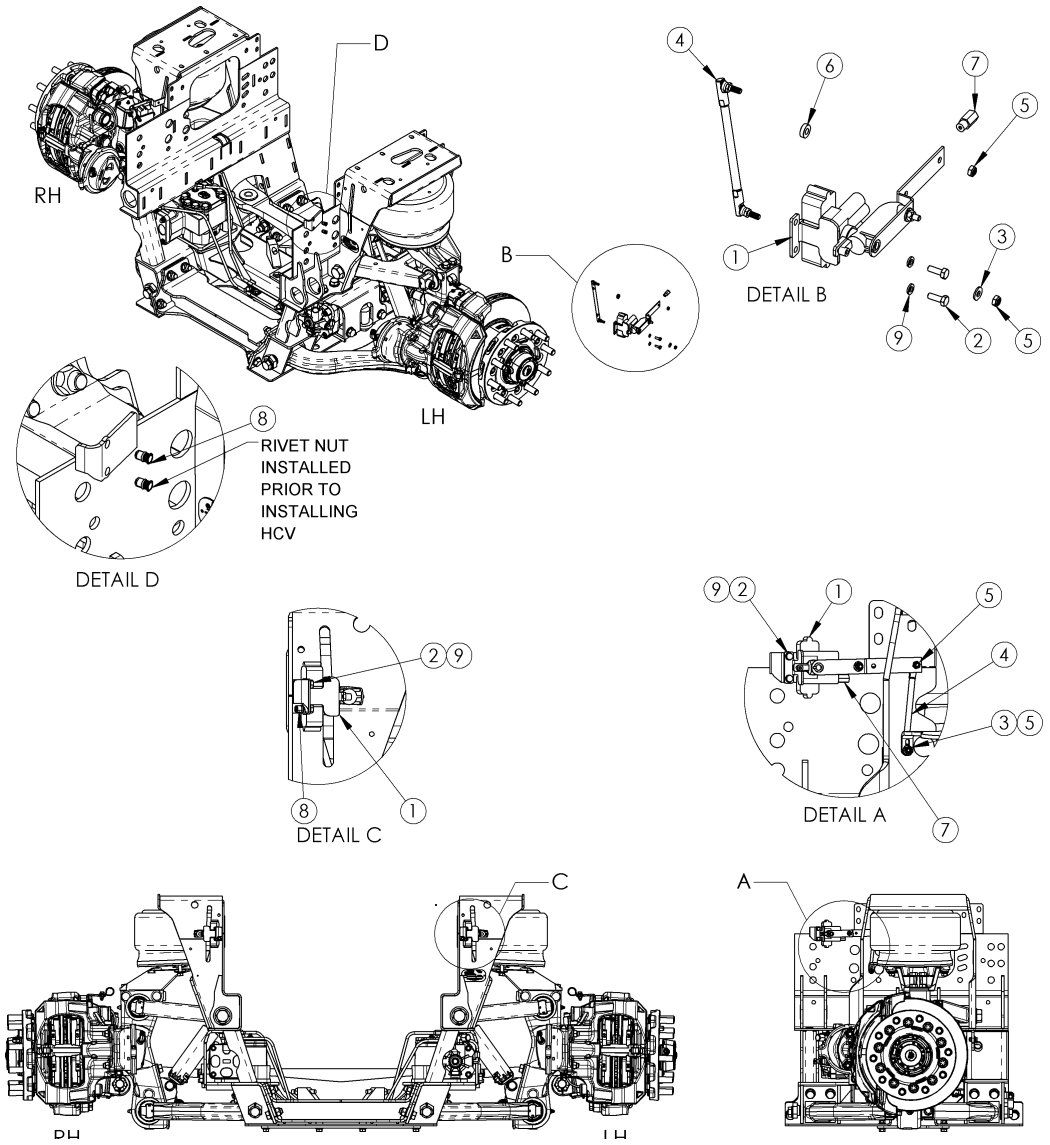
Height Control Valve Components - High Mounted (Updated)

Started in production approx. (08/2021). Refer to your unit/model # for identification of correct HCV Setup

Item	Part No.	Description	Item	Part No.	Description
1	5608	Height Control Valve	6	715855-01	Spacer 1/4 x .188
2	100679-P1	Bolt 1/4-20 x .75	7	712350-01	Check Valve Assembly
3	8120392	Washer 1/4	8	712350-01	Rivet Nut, 1/4 -20 UNC, (Installed)
4	710094-01	Fixed HCV Linkage, 6.00”	9	8120380	SLW 1/4
5	715856-01	Locknut, ¼-28 Nylock - Low	10	710665-01	Air Retention Regulator (Not Shown)**

Check valve installed in supply (Bottom) Port of the Height Control Valve

**Only when unit equipped with Air Retention Kit

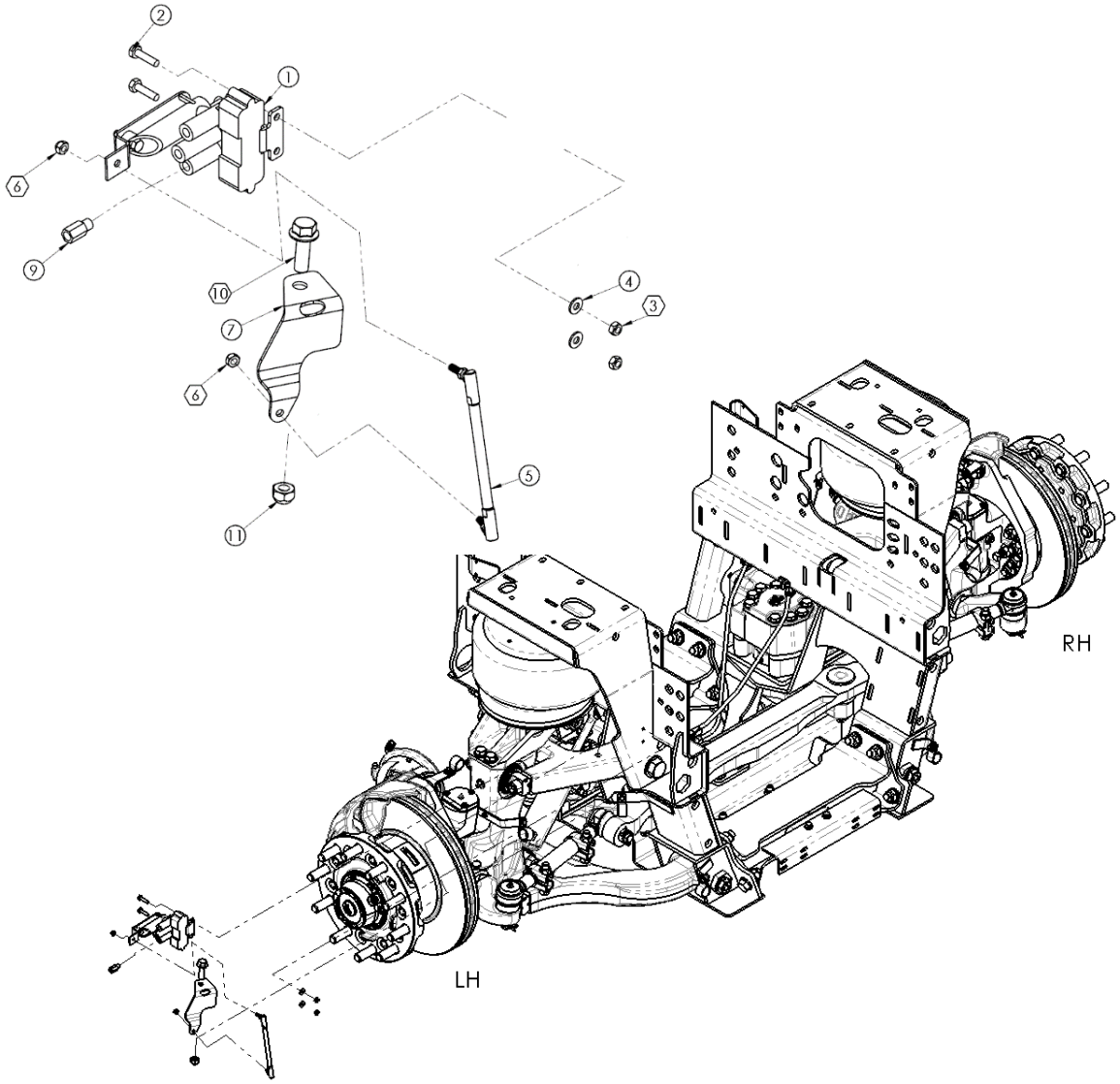


(Suspension as viewed from Front of Vehicle)

(High Mounted Type)

Height Control Valve Components - Low Mounted

NOTE: Use updated parts list on next page for ordering replacement parts



(Suspension as viewed from Rear of Vehicle)
(Low Mounted Type)

Height Control Valve Components - Low Mounted (Updated)

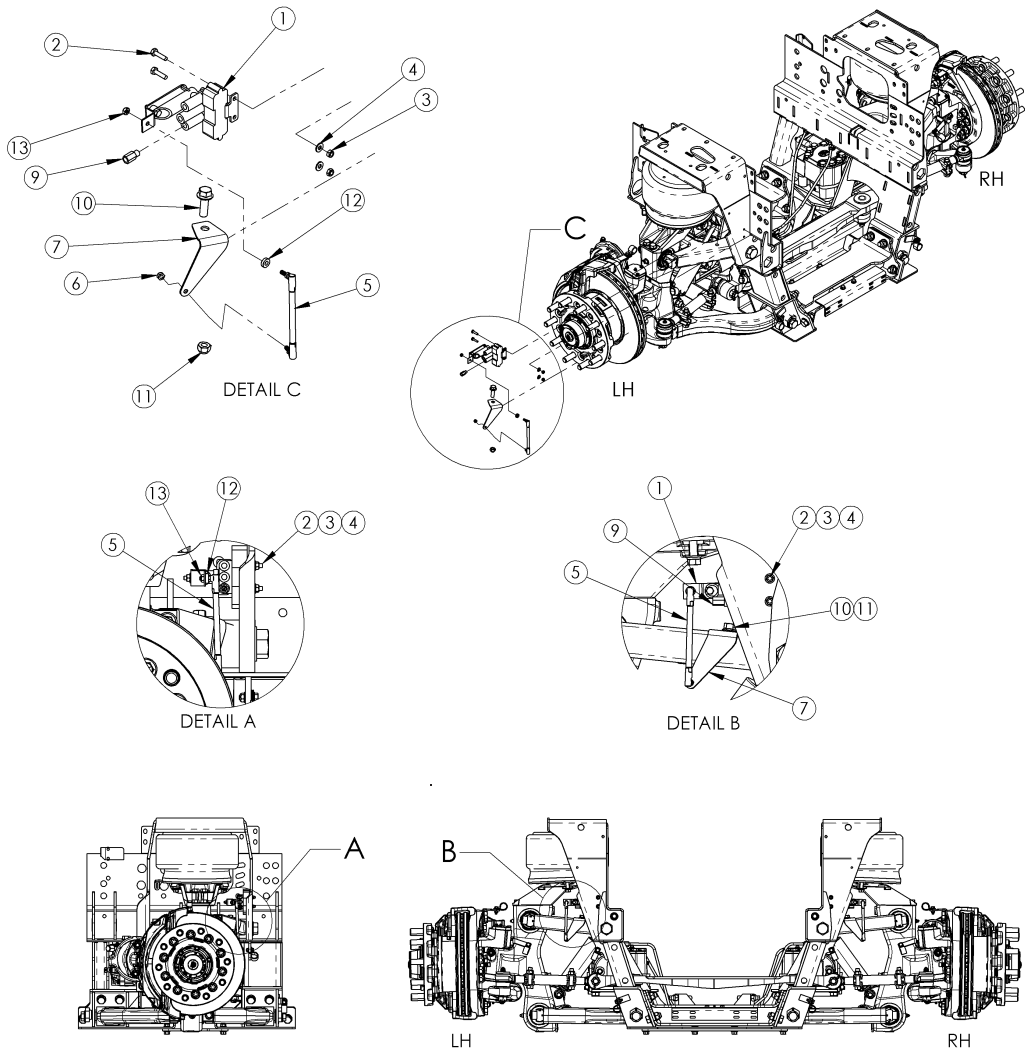
Started in production approx. (08/2021). Refer to your unit/model # for identification of correct HCV Setup

Item	Part No.	Description	Item	Part No.	Description
1	8718	Height Control Valve	8	715838-02	Bracket, Link HCV Mounting(R)***
2	100702-P1	Bolt 1/4-20	9	712350-01	Check Valve Assembly
3	100703-P1	Nut, Lock Stover 1/4-20	10	307	Bolt 1/2-13 x 1.50
4	8120392	Washer 1/4	11	89422301	Nut 1/2-13
5	710094-01	Height Control Valve Link	12	715855-01	Spacer 1/4 x .188
6	8454750	Nut, Lock 1/4-28	13	715856-01	Locknut, ¼-28 Nylock - Low
7	715838-01	Bracket, Link HCV Mounting(L)***	14	710665-01	Air Retention Regulator (Not Shown)**

Check valve installed in supply (Bottom) Port of the Height Control Valve

**Only when unit equipped with Air Retention Kit

*** Updated Replacement HCV Bracket



(Suspension as viewed from Rear of Vehicle)
(Low Mounted Type)

Height Control Valve Components - High Mounted/High Heat

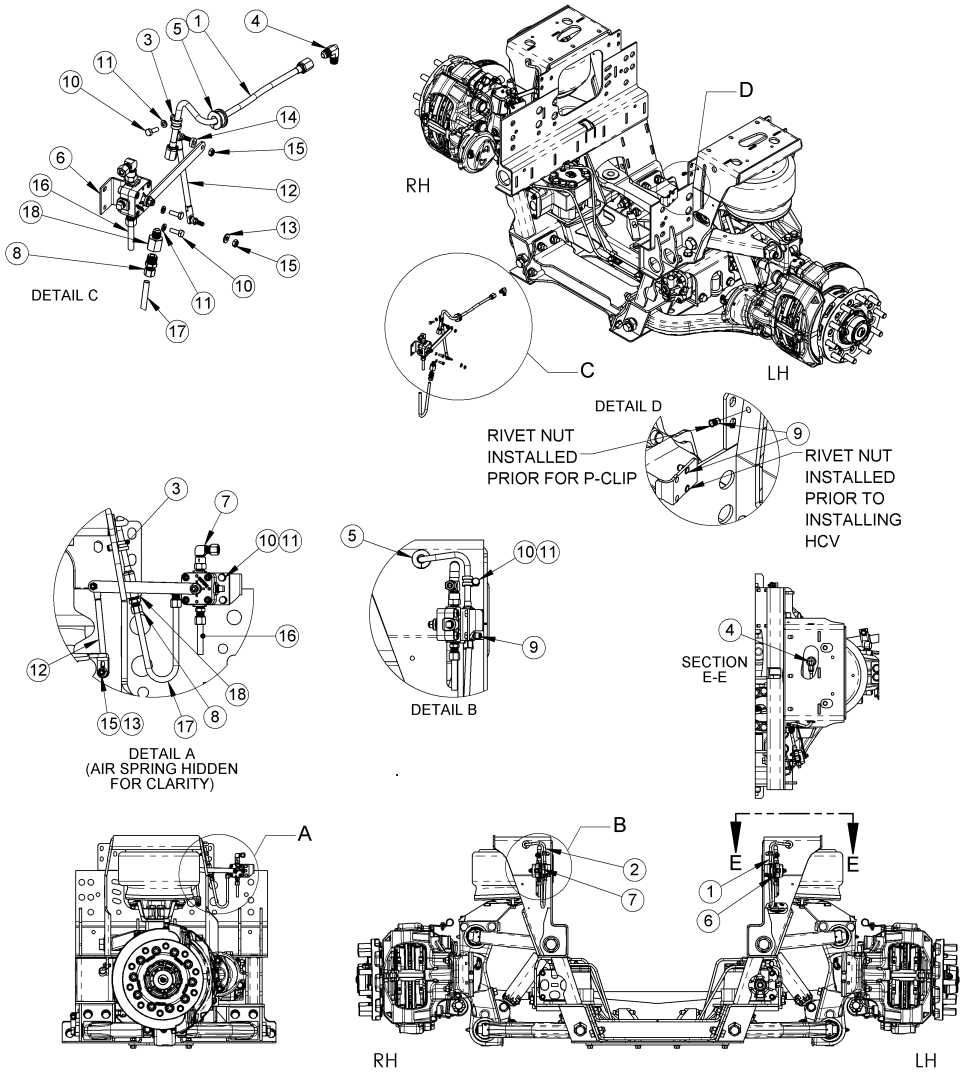
Started in production approx. (07/2021). Refer to your unit/model # for identification of correct HCV, Swaybar, Air Retention Kit

Item	Part No.	Description	Item	Part No.	Description
1	715895-01	IFS-FT Air Spring Hard Line, LH	11	8120380	SLW 1/4 .263 X .489 X .072 ZP
2	715895-02	IFS FT Air Spring Hard Line, RH	12	710094-01	Fixed HCV Linkage, 6.00"
3	715899-01	P-Clip, Cushioned, Ø.38 ID	13	8120392	FW 1/4 .281X.625X.065 ZP
4	715897-01	Elbow, 3/8" OD Male X 1/4 NPTF Male,	14	715855-01	Spacer, 1/4 X .188 WASHER
5	715898-01	Grommet, 9/16 ID, 1 1/4 OD	15	715856-01	Locknut, 1/4-28 Nylock - LOW,
6	715896-01	HCV, Barksdale, W Fittings, LH	16	715992-01	Airline, HCV Exhaust
7	715896-02	HCV, Barksdale, W Fittings, RH	17	715992-02	Airline, HCV to Hardline
8	716116-01	Adapter, 3/8" Tube OD x 3/8 NPTF Male	18	716117-01	Adapter, 3/8" OD Male x 3/8 NPTF Female
9	715918-01	Rivet Nut, 1/4-20 UNC, HEAVY DUTY	19	710665-01	Air Retention Regulator (Not Shown)**
10	100679-P1	HHB 1/4-20X.75 GR.8 ZN	20	715796-01	Kit, IFS-FT-ARB, OE***

Check valve installed in supply (Bottom) Port of the Height Control Valve

**Only when unit equipped with Air Retention Kit

***Only when unit equipped with Anti-Rollbar Kit



(Suspension as viewed from Front of Vehicle)
(High Mounted/High Heat Type)

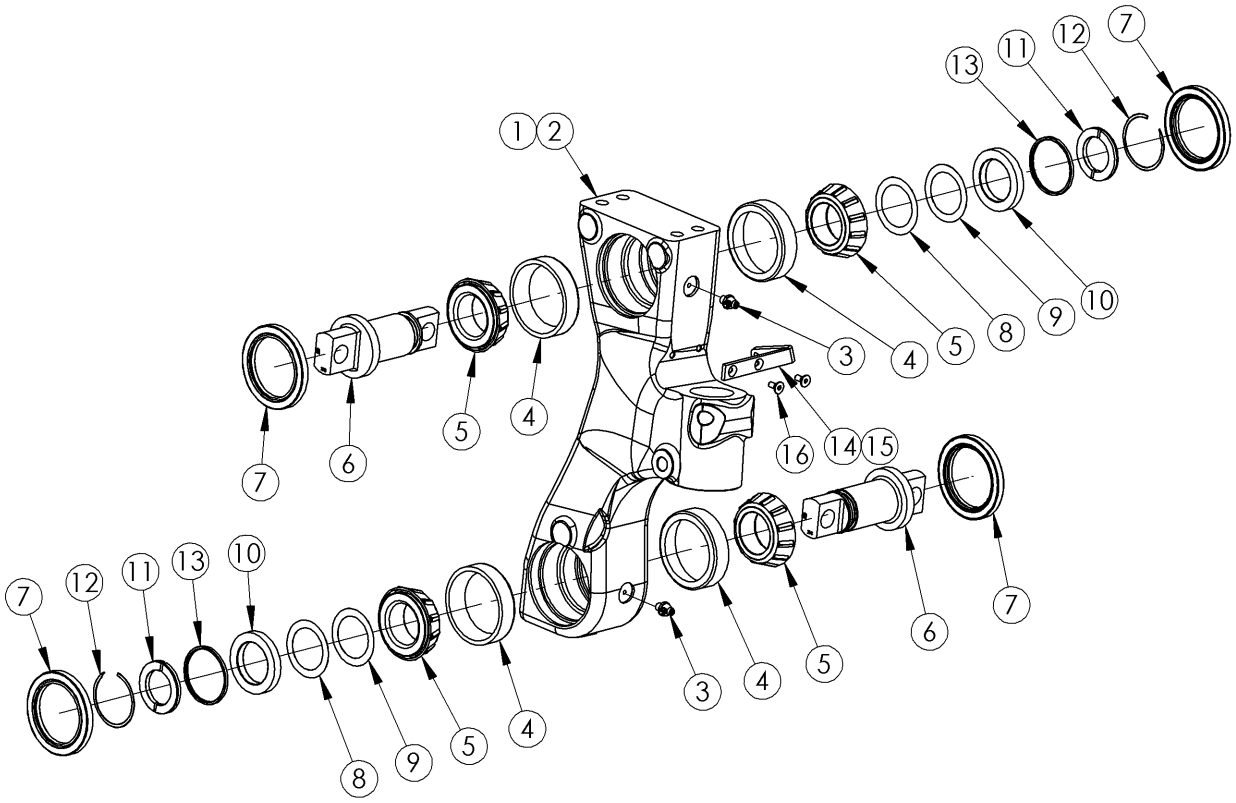
PARTS LIST

Steering Knuckle Carrier Components

Item	Part No.	Description	Item	Part No.	Description
1	709105-01	Carrier Machined, LH**	8	702623-01	Shim, .004
	709105-03	Carrier Machined, LH***	9	702623-02	Shim, .010
2	709105-02	Carrier Machined, RH**	10	702622-01	Spacer
	709105-04	Carrier Machined, RH***	11	702618-01	Collar
3	7352	Grease Zerk, Hydraulic Shutoff	12	702620-01	Retaining Clip
4	702835-01	Cup	13	702619-01	Outer Collar
5	702834-01	Bearing – Taper 1 3/4 (3782)	14	710506-01	Bracket, Brake Hose LH
6	705854-03	Pin	15	710506-02	Bracket, Brake Hose RH
7	702836-01	Seal	16	710567-01	SFCS 1/4-28 x 1.00

** Installed on IFS2400S-FT

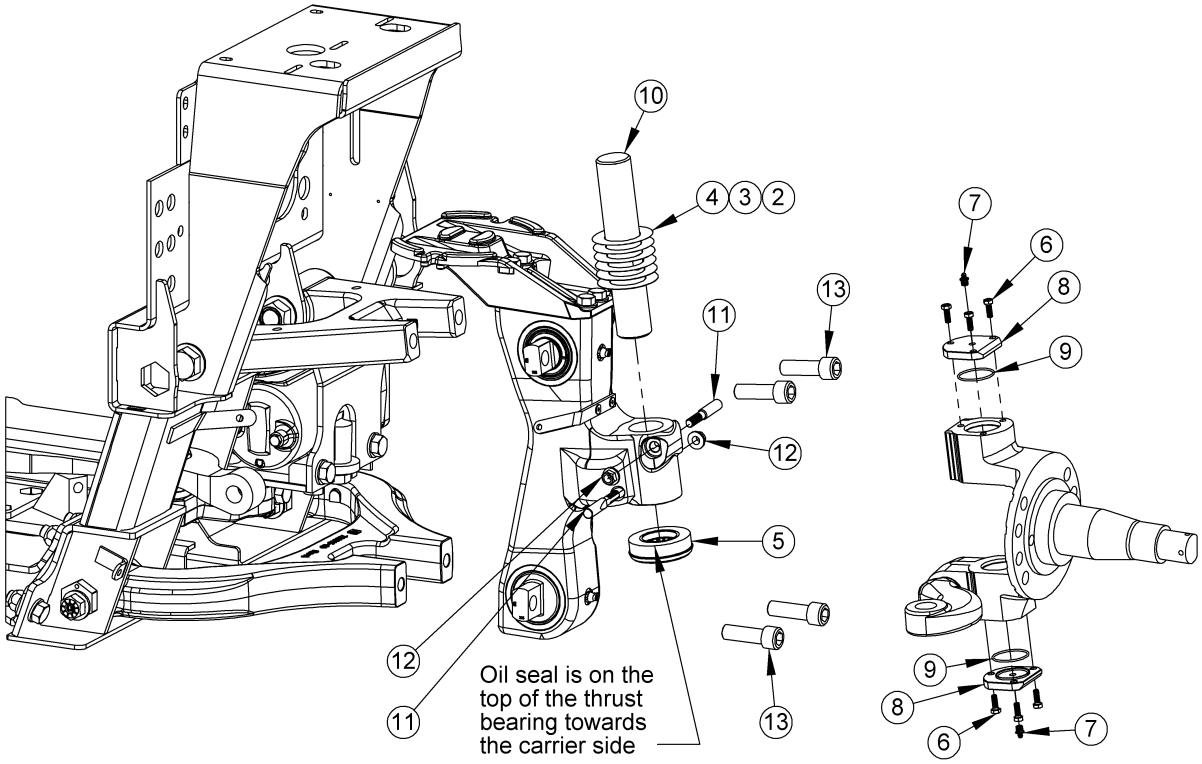
*** Installed on IFS2000S-FT



(LH Assembly Shown)

King Pin Components

Item	Part No.	Description	Item	Part No.	Description
2	705011-07	Shim, .005" Thick	9	705011-18	O-Ring
3	705011-08	Shim, .010" Thick	10	705011-19	King Pin
4	705011-09	Shim, .020" Thick	11	705315-01	Draw Key (Long 3.80)
5	705011-14	Thrust Bearing Assembly	12	705316-01	Draw Key Nut
6	705011-15	King Pin Cap Bolt	13	705829-01	SHCS 7/8-9 x 2.75
7	705011-16	Straight Grease Fitting	14	705011-05	Bushing (installed in knuckle bores)
8	705011-17	King Pin Cap			



NOTE: "B" MARKINGS ON THE BAR PINS TO BE POINTED TOWARDS THE CONTROL ARMS

(Suspension as viewed from Rear of Vehicle)

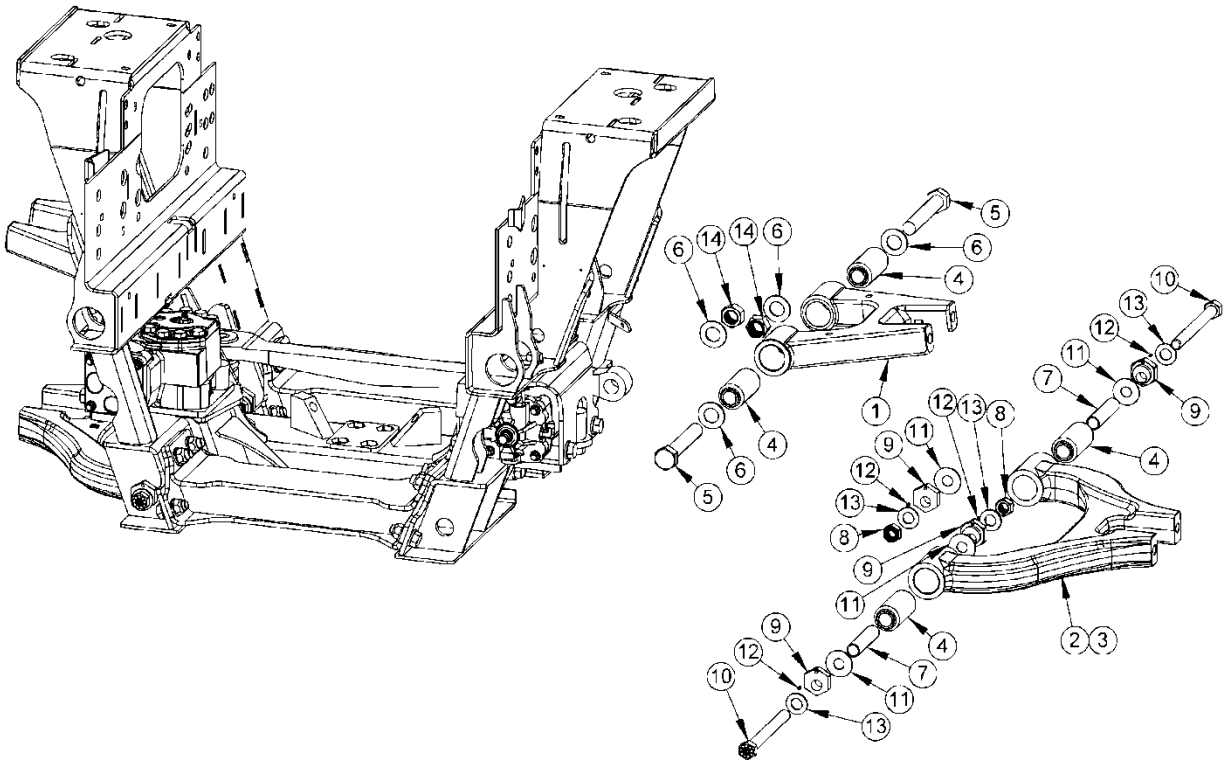
Control Arm Components

Item	Part No.	Description	Item	Part No.	Description
1	705849-02	Upper Control Arm w/bushings	7	8490	Spacer, UCA
2	709103-01	Asy, Lower Control Arm w/bushings, LH**	8	710245-01	Nut 7/8-9
	709618-01	Asy, Lower Control Arm w/bushings, LH***	9	700245-01	Boss, Eccentric
3	709103-02	Asy, Lower Control Arm w/bushings, RH**	10	710244-01	Bolt 7/8-9 x 9.00
	709618-02	Asy, Lower Control Arm w/bushings, RH***	11	701683-04	Washer 7/8"
4	8382	Bushing	12	293	SSS 10-24 x .38, Cone Point
5	702516-01	Bolt 1.125 - 12 x 7	13	104098	Washer 7/8 .968 x 1.780 x .160
6	168	Washer 1 1/8	14	166	Nut 1 1/8-12

NOTE: For ease of installation use item #1, 2 and 3 when replacing control arms (control arms include bushings already installed)

** Installed on IFS2200/IFS2400S-FT

*** Installed on IFS2000S-FT



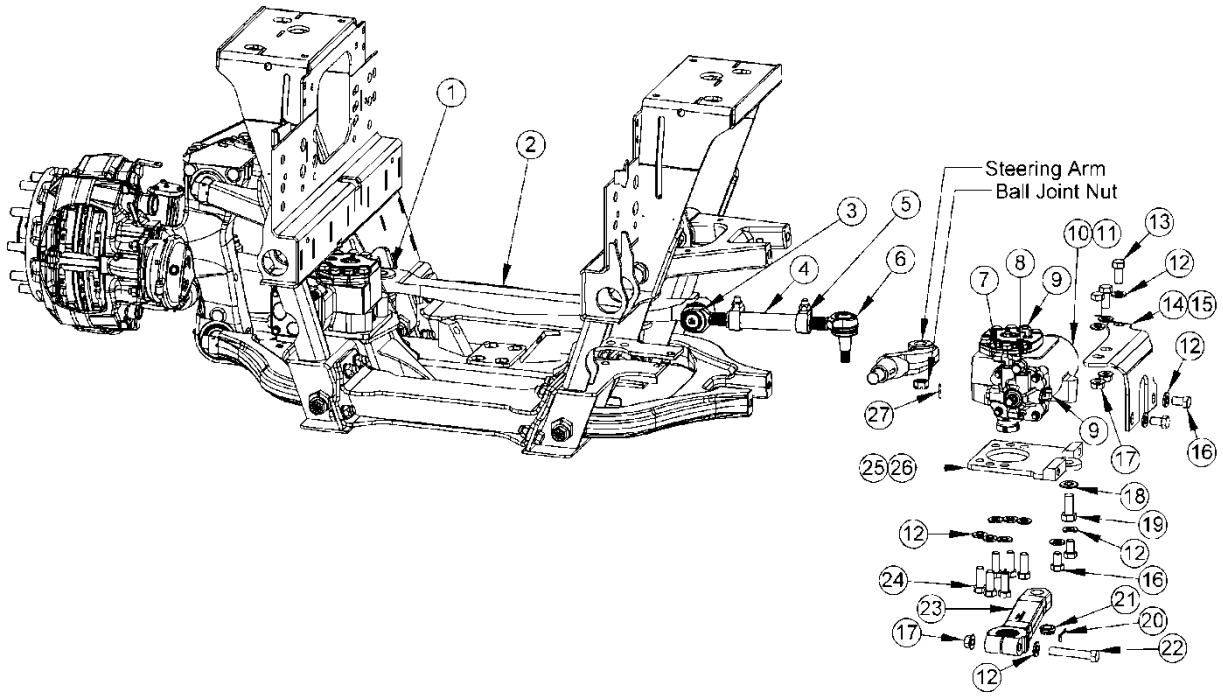
(Suspension as viewed from Front of Vehicle)

PARTS LIST

Steering Components

Item	Part No.	Description	Item	Part No.	Description
1	705381-01	Ball Joint 50mm	14	709237-01	Lower Side Plate LH
2	709120-01	Asy, Relay Rod	15	709237-02	Lower Side Plate RH
SEE	709271-01	Asy, Tie Rod (LH)	16	709388-03	Bolt 3/4-16 x 1.25
NOTE	709271-02	Asy, Tie Rod (RH)	17	208	Nut 3/4-10
*3	710671-02	Tie Rod End	18	713454-17	Nord-Lock® Washer 7/8
*4	709270-01	Tie Rod Tube	19	709386-01	Bolt 7/8-14 x 2.00
*5	6632	Tie Rod Clamp	20	705381-03	Cotter Pin 3/16 x 1.58
*6	710671-01	Tie Rod End	21	705381-02	Castle Nut M24 x 1.5
7	710345-01	90 Deg Elbow – 08 ORBM x 08 JIC-M (LH only)	22	701671-01	Bolt 3/4-10 x 4.50
8	710346-01	90 Deg Elbow – 08 ORBM x 10 JIC-M (LH only)	23	709123-01	Pitman Arm
9	710377-01	90 Deg Elbow – 06 ORB x 06 JIC	24	8223752	Bolt 3/4-16 x 2.00
10	709121-01	Steering Gear Box LH	25	709309-01	Gear Plate Weldment LH
11	714650-01	Steering Gear Box RH	26	709309-02	Gear Plate Weldment RH
12	713454-14	Nord-Lock® Washer 3/4	27	101445-P1	Cotter Pin 1/8 x 1 1/2
13	709388-02	Bolt 3/4-10 x 1.75			

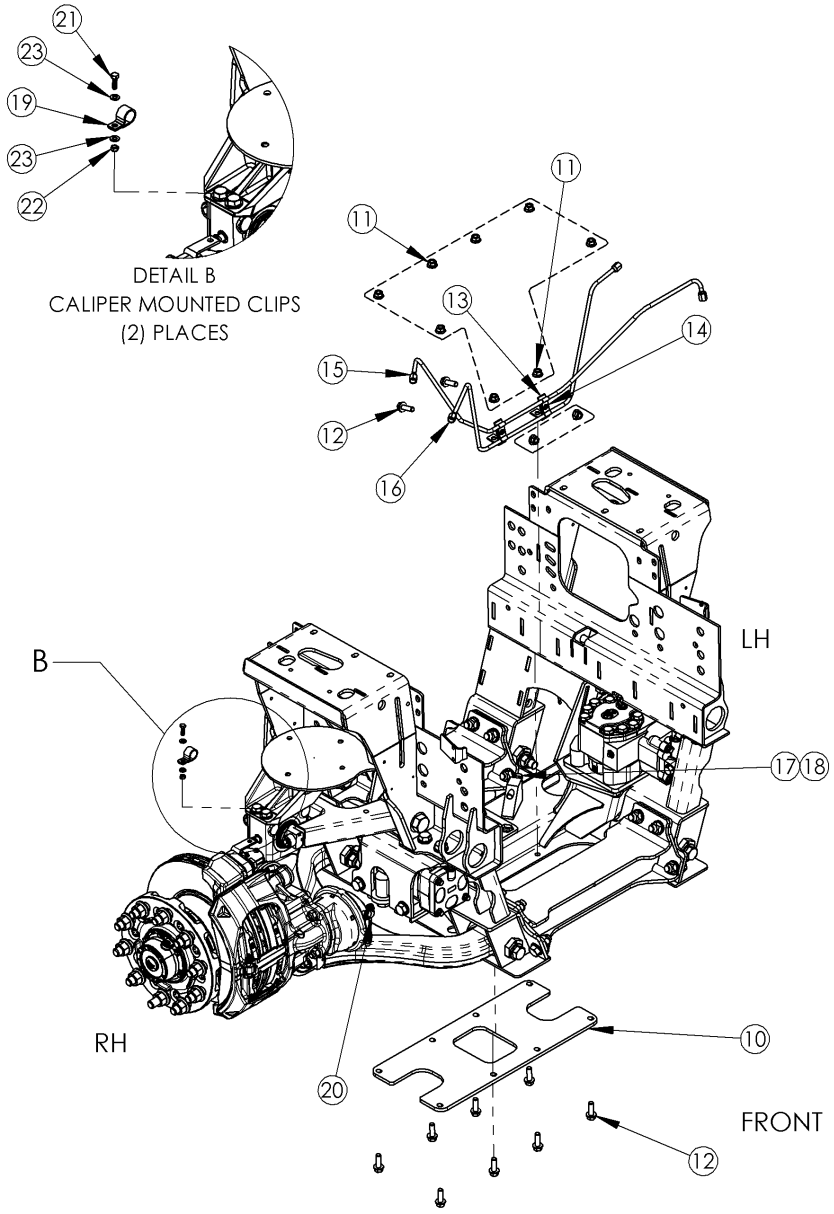
NOTE: Item #3, 4, 5 and 6 are part of 709271-01 & 709271-02 full assemblies



(Suspension as viewed from Front of Vehicle)

Steering and Brake Line Components

Item	Part No.	Description	Item	Part No.	Description
10	709245-01	Brace, Lower Crossmember	18	710469-01	HN 5/8-11
11	308	LFN 1/2-13	19	710534-01	Tube Clamp
12	307	FHB 1/2-13 X 1.50	20	710524-01	90° Elbow
13	709751-01	Bracket, Steering Line	21	100507-P1	HHB 5/16-18 X 1
14	104221	Tube Clamp 3/8	22	89422275	HLN 5/16-18
15	709606-01	Steering Line	23	8120393	FW 5/16
16	709605-01	Steering Line	24	710523-01	Air Brake Hose Assembly (Not Shown)
17	710468-01	5/8-11 X 3-1/2" Stop Bolt			



(Suspension as viewed from Front of Vehicle)

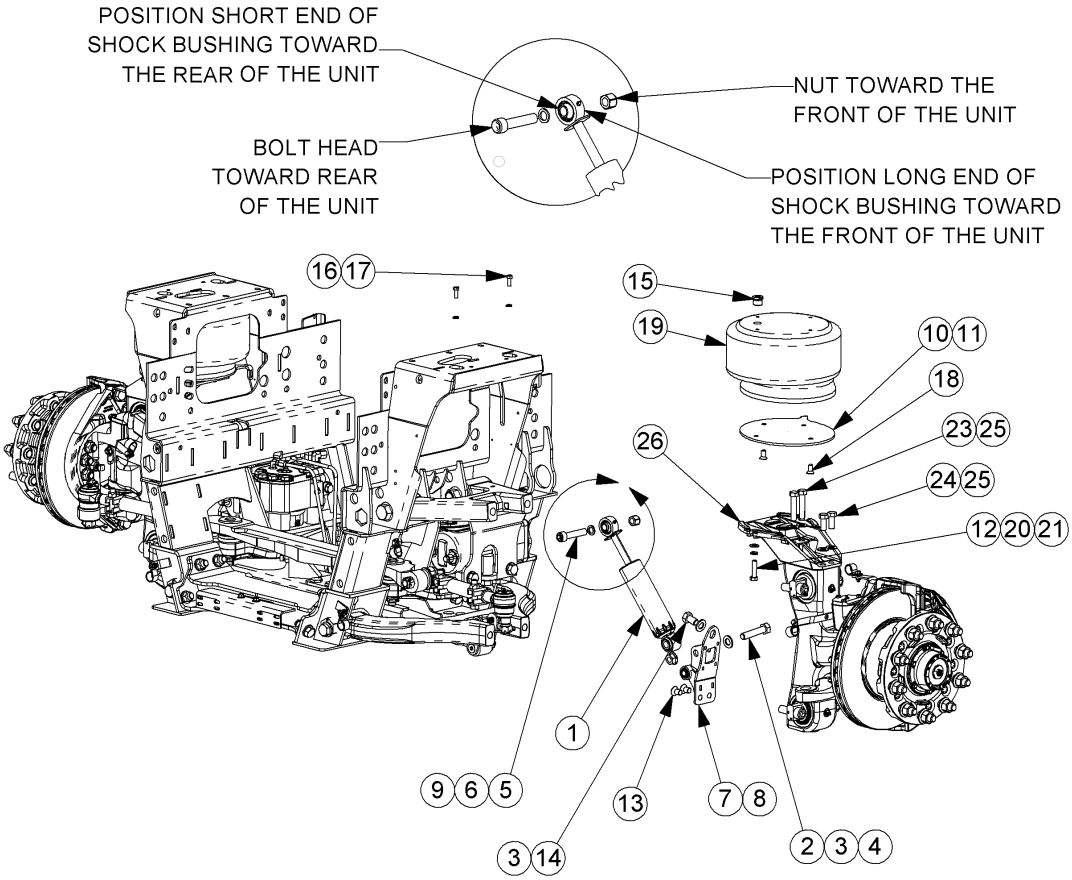
Air Spring and Shock Components

IFS2000S-FT Units with 55 & 53 wheel cut may require clearance grinding on relay rod reference Technical Service Bulletin KS0714

Item	Part No.	Description	Item	Part No.	Description
1	716106-01	**Standard** Shock Absorber	13	709919-01	SFCS 5/8-18 x 1.50
	716105-01	**High CG** Shock Absorber	14	709388-03	Bolt 3/4-16 x 1.25
2	100678-P1	Bolt 3/4-10 x 3.50**	15	0607	Bushing 1/4 FPT x 3/4 MPT
	709716-01	SFHCS 5/8-11 X 3 3/4 GR8 PH***	16	8120382	SLW 3/8" .393 x .683 x .104
3	103003	Washer 3/4	17	100263-P1	Bolt 3/8-16 x 1.00
4	208	Nut 3/4-10**	18	709640-02	SFCS 1/2-13 x 1.00
	184	LFN 5/8-11 G PH***	19	709828-01	Air Spring Assembly
5	715176-01	SHCS 3/4-10 x 3.50 MAGNI565	20	118	Washer .531 x 1.062 x .095
6	714201-01	Shim .125 Thk	21	8120384	SLW 1/2 .523 x .873 x .135
7	716024-01	Asy, Lower Shock Mount, LH	22	713169-01	Lower Air Spring Mount
8	716024-02	Asy, Lower Shock Mount, RH	23	149	Bolt 5/8-18 x 3
9	710356-01	Nut, Nylock 3/4-10	24	287	Bolt 5/8-18 x 1 1/2
10	709256-01	Lower Air Spring Pad LH	25	89422850	Washer 5/8 .656 x 1.312 x .095
11	709256-02	Lower Air Spring Pad RH	26	713169-01	Air Spring Mount, Lower
12	701389-03	Bolt 1/2-20 x 2.00			

** Installed on IFS2000S-FT

*** Installed on IFS2200/IFS2400S-FT



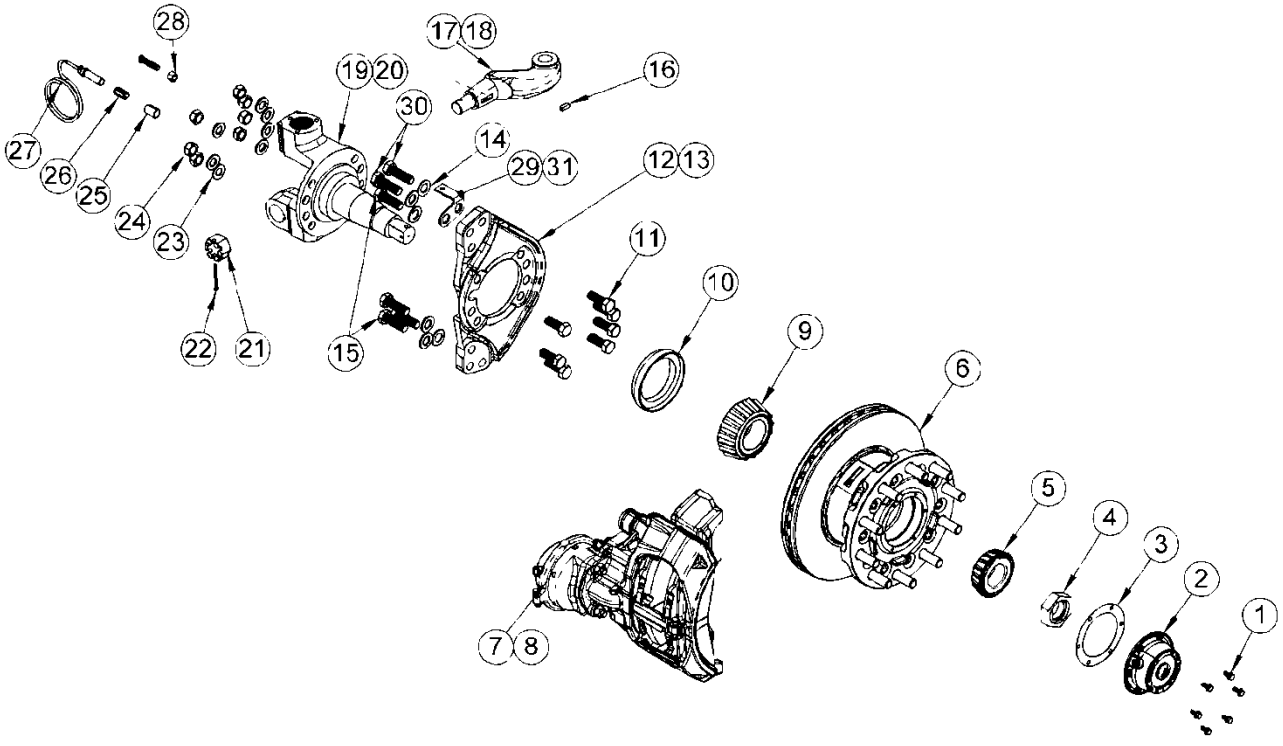
(Suspension as viewed from Rear of Vehicle)

Disc Brake Components (ProTorq® Spindle Nut)

Item	Part No.	Description	Item	Part No.	Description
1	266	Bolt 5/16-18 x .75	16	705011-26	Key
2	709226-01	Hub Cap	17	712910-01	Steering Arm LH
3	714147-01	Hub Cap Gasket Stemco	18	712910-02	Steering Arm RH
4	708181-01	Nut, Spindle, Pro-Torq	19	705011-01	Steering Knuckle Assy, LH
5	705052-01	Bearing - Taper 1-3/4 (3782)	20	705011-02	Steering Knuckle Assy, RH
6	707819-01	Hub & Rotor Assembly	21	705011-21	Castle Nut 1 1/4 - 12
7	705013-29	Caliper Assy, LH**	22	705011-20	Cotter Pin 3/16 x 2-1/2
	709837-01	Caliper Assy, LH***	23	103003	Washer 3/4
8	705013-28	Caliper Assy, RH**	24	89422308	Locking Flange Nut 5/8-18x.75
	709837-02	Caliper Assy, RH***	25	705011-27	ABS Sensor Bushing
9	705051-01	Bearing - Taper 2-5/8 (HM212049)	26	6946	ABS Sensor Spring Retainer
10	705084-01	Oil Seal Assy – Guardian	27	7328	ABS Sensor (Straight w/Lead)
11	8223752	Bolt 3/4-16 x 2.00	28	705011-22	Assy, Steering Stop
12	705013-21	Torque Plate LH**	29	710507-01	Bracket, Brake Hose LH
	709735-01	Torque Plate LH***	30	700690-11	Bolt M20 x2.50 x 65 CL10.9 Full Thread**
13	705013-20	Torque Plate RH**		709838-02	Bolt M20 x 1.50 x 65 CL10.9 Full Thread***
	709735-02	Torque Plate RH***	31	710507-02	Bracket, Brake Hose RH
14	703553-02	Washer M20			
15	700690-04	Bolt M20 x 2.50 x 60 CL10.9**			
	709838-01	Bolt M20 x 1.50 x 60 CL10.9***			

** Installed on IFS2000S-FT

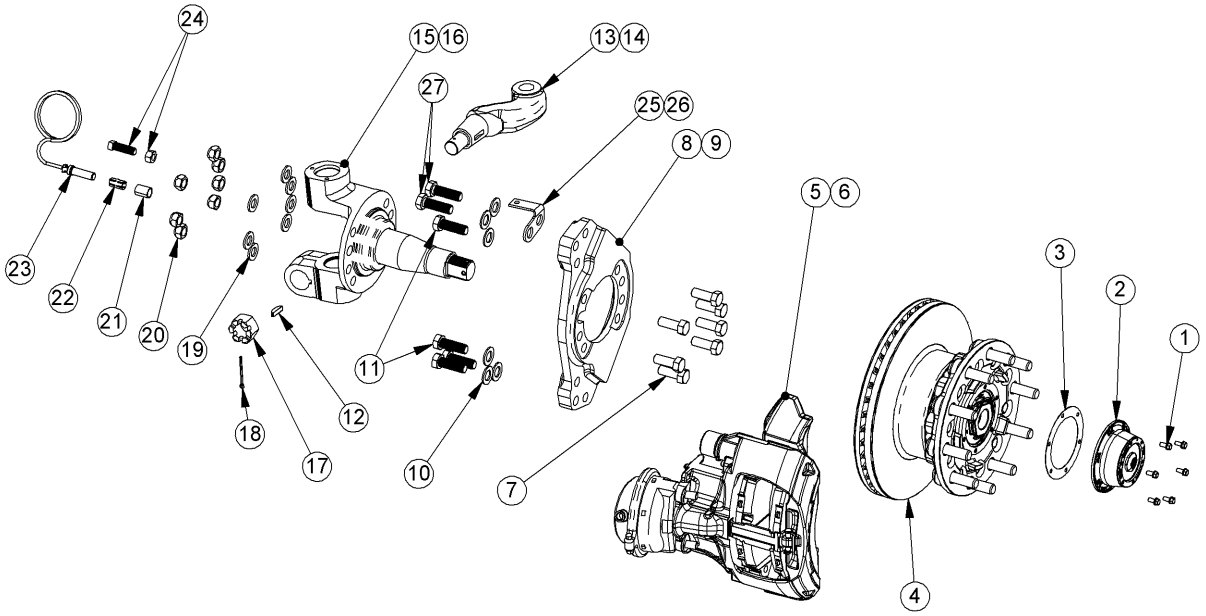
*** Installed on IFS2200/IFS2400S-FT



Disc Brake Components (Integral Spindle Nut/IFS2000S-FT only)

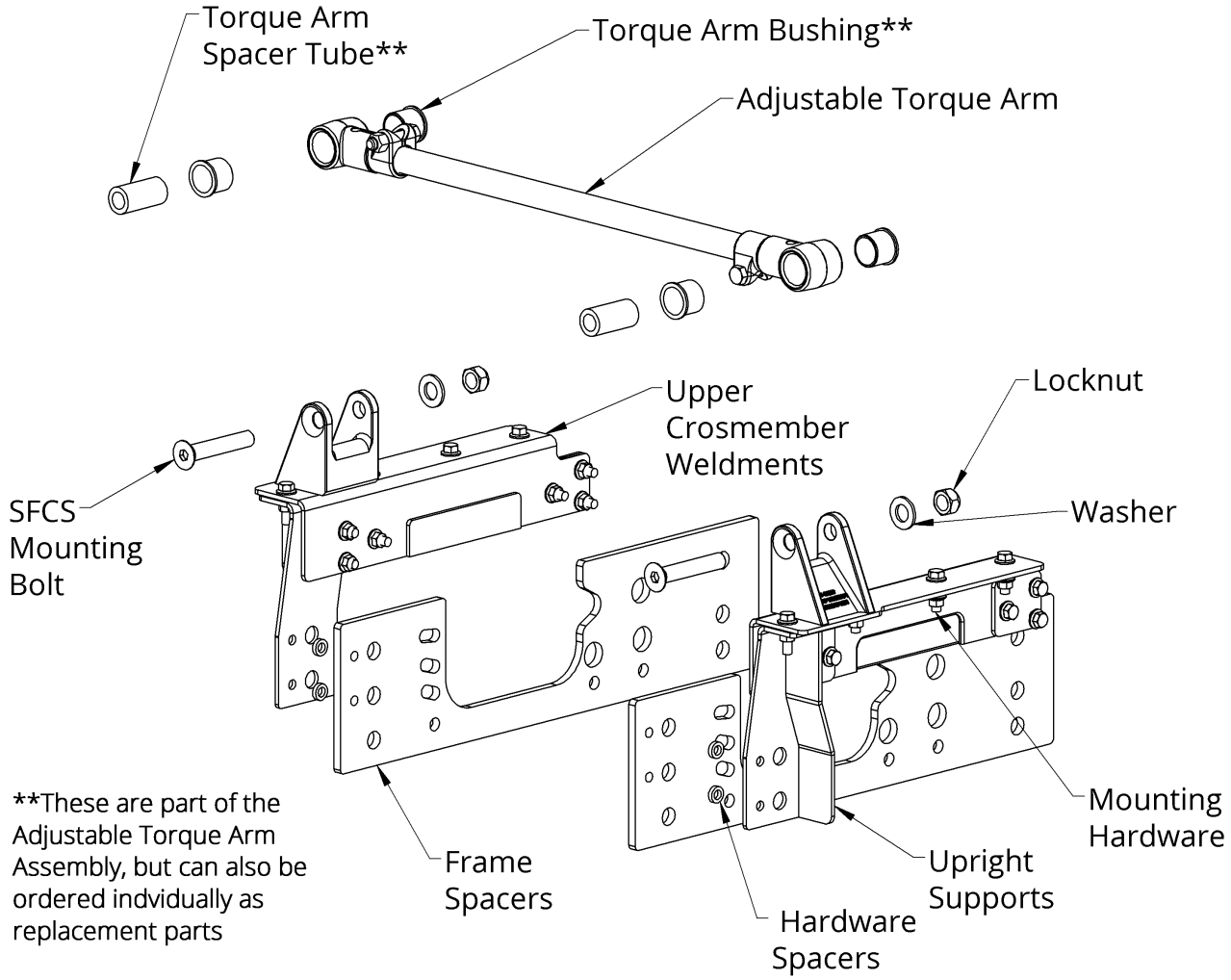
Started in production approx. (02/2020). Refer to your unit/model # for identification/verification of correct wheel end

Item	Part No.	Description	Item	Part No.	Description
1	266	Bolt 5/16-18 x .75	15	705011-01	Steering Knuckle Assy, LH
2	709226-01	Hub Cap	16	705011-02	Steering Knuckle Assy, RH
3	714147-01	Hub Cap Gasket Stemco	17	705011-21	Castle Nut 1 1/4 - 12
4	714781-01	Hub & Rotor Assembly	18	705011-20	Cotter Pin 3/16 x 2-1/2
5	705013-29	Caliper Assy, LH	19	103003	Washer 3/4
6	705013-28	Caliper Assy, RH	20	89422308	Locking Flange Nut 5/8-18x.75
7	8223752	Bolt 3/4-16 x 2.00	21	---	ABS Sensor Bushing (N/A with knuckle above)
8	705013-21	Torque Plate LH	22	6946	ABS Sensor Spring Retainer
9	705013-20	Torque Plate RH	23	7328	ABS Sensor (Straight w/Lead)
10	703553-02	Washer M20	24	705011-22	Assy, Steering Stop
11	700690-04	Bolt M20 x 2.50 x 60 CL10.9	25	710507-01	Bracket, Brake Hose LH
12	705011-26	Key	26	710507-02	Bracket, Brake Hose RH
13	712910-01	Steering Arm LH	27	700690-11	Bolt M20 x2.50 x 65 CL10.9 Full Thread
14	712910-02	Steering Arm RH			



Upper Crossmember Assembly

Shown below is a general overall view of all the various parts contained within the Upper Crossmember Assembly. Each unit may vary and not contain all the parts shown. Using the unit/model number on your serial tag for identification, you can contact **Reyco Granning**® customer service and provide them with that information to order replacement parts, as needed. You can also refer to the **Reyco Granning**® interface drawing D709396.



(Suspension as viewed from Front of Vehicle)

LUBRICATION

Lubricant Specifications and Intervals

COMPONENT	SERVICE INTERVAL	CHANGE INTERVAL	LUBRICANT SPECIFICATION
Tie Rod Ends	Whichever comes first: Every oil change or every 6 months	N/A	Multi-Purpose Chassis Grease NLGI Grade 1 or 2 Lithium Base
Kingpin	Whichever comes first: Every oil change or every 6 months	N/A	Multi-Purpose Chassis Grease NLGI Grade 1 or 2 Lithium Base
Carrier Bearings (1)(2)	Whichever comes first: 50,000 miles (80,000 kilometers) or once a year	N/A	Mobillith AW2 Amoco L Industrial 861 Exxon Ronex MP
Steering Gearbox Trunnion (1) (3)	Whichever comes first: Every oil change or every 6 months	N/A	Multipurpose EP Chassis Lube NLGI Grade 2 or 3
Wheel End	1000 miles (1600 kilometers) Check fluid level	Whichever comes first: Seals replaced, brakes relined, 100,000 miles (160,000 km), or once a year	Gear Oil (Mineral) API GL-5 Gear Oil (Synthetic) API GL-5 MT1 **DO NOT MIX MINERAL AND SYNTHETIC GEAR OIL** See Table Below for recommended gear oil

(1) Use manual grease gun only

(2) Grease Zerk will hydraulically lock when cavity is filled

(3) Reference TRW Service Bulletin #TAS-103

Description	Manufacturer	Specification
Mineral Oil Pantonic MPX 80W 90	Fina	API GL-5
Mineral Oil Artic Fire 80W 90	Sinclair	API GL-5
Synthetic Oil 80W 140	Citgo	API GL-5 MT1
Synthetic Oil 80W 140	Castrol	API GL-5 MT1

Note: Model Number IFS20-M53N1: "M" in the suffix Specifies Mineral Oil for this example

General Lubrication

Proper lubrication practices are important in maximizing the service life of your Reyco Granning® Independent Front Suspension.

CAUTION

Do not mix lubricants of different grades. Do not mix mineral and synthetic lubricants. Different brands of the same grade may be mixed.

CAUTION

Never mix oil bath and grease packed wheel ends.

Ball Joints

The ball joints are lubricated and sealed for their service life and do not require lubrication. Check for oil or grease marks on the exterior of the seal and if found verify that the seal has not been ruptured. If the seal has been ruptured, then the ball joint must be replaced because it cannot be re-lubricated.

Tie Rod Ends on the Tie Rods

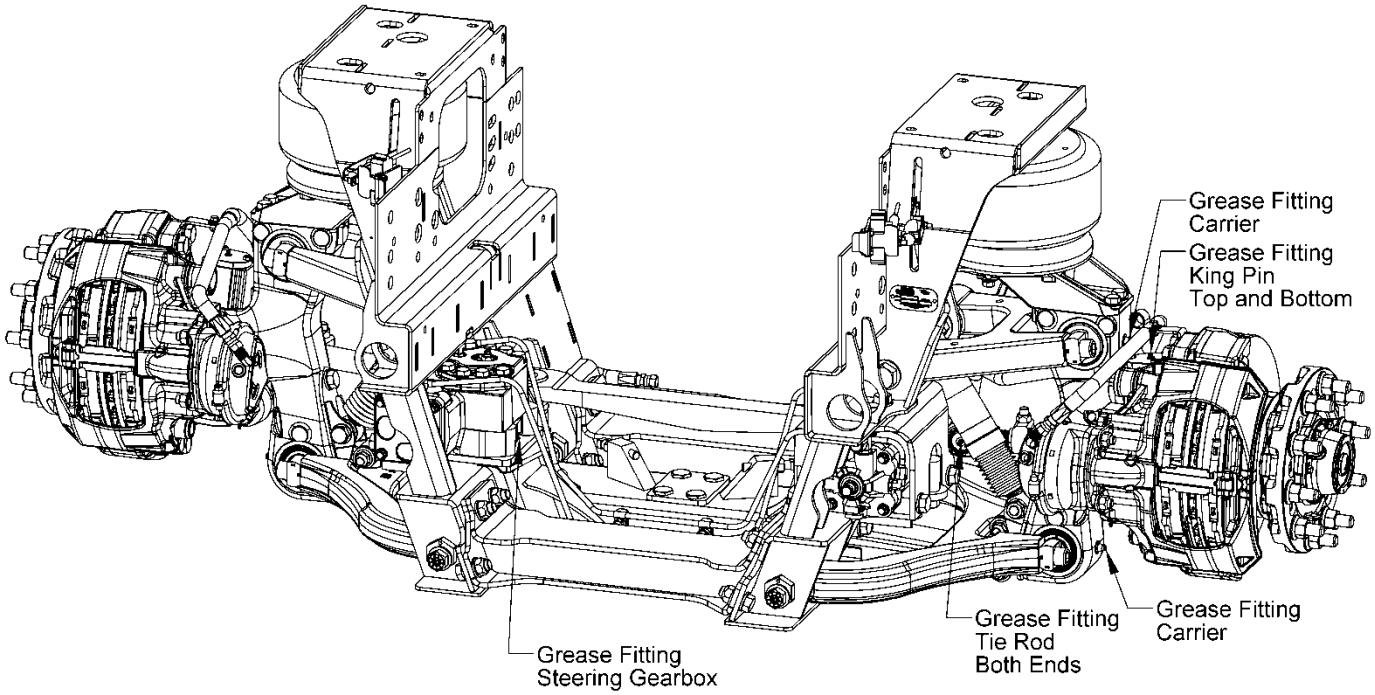
Review lubricant specification and interval requirements before servicing.

Apply lubricant to grease fitting until new lubricant discharges from the dust boot **(Grease Fitting notes Apply to Both Sides of Unit) (Figure 4)**

Kingpins & Thrust Bearings

The suspension should be under vehicle load while lubricating the Kingpins to properly cycle grease through the Thrust Bearings.

1. Apply lubricant to the zerk fittings on top and bottom of the kingpin bushings until new lubricant discharges from between the steering knuckle kingpin housing and the carrier.



(Grease Fitting Notes Apply to Both Sides of Unit)
Figure 4– Location of lubrication fittings

LUBRICATION

Carrier Bearings

Lifting the chassis to a point where the tires no longer contact the ground will apply lubricant to the bearings and bushings where load is applied. This practice will increase the life of the bearings.

1. Using a manual grease gun, apply lubricant to both upper and lower carrier bearings via the zerk fittings on the outward face of the carriers until a small amount of lubricant discharges from the carrier bearing seals.
2. The Carrier Bearing Grease Zerk will hydraulically lock out when the cavity is filled with grease.

Wheel Bearings

Review lubricant specification and interval requirements before servicing.

Vehicle suspension should be at ride height when checking the hub oil level. Check oil level through hub cap window. If level is below the “add” level line then remove the pipe plug and fill with recommended oil until “full” level is achieved **(Figure 5)**. Add oil slowly since the heavy weight oil will settle slowly in the hub. (Note: The hub cap window can only be cleaned with mild soap and water. Aromatic solvents should not be used, as they will impair the transparency of the window.)

Check the hub cap for external oil marks. The vent plug will normally weep a small amount of oil. Oil marks in other locations should be addressed by replacing the hub cap seal, window gasket, or tightening the pipe fill plug.

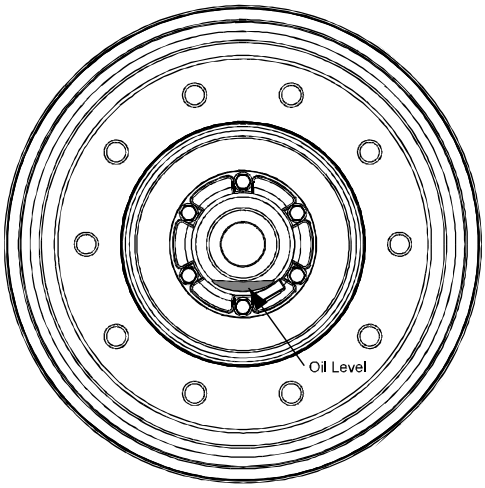


Figure 5- Wheel Bearing Oil Level with Suspension at Ride Height

TROUBLESHOOTING

SYMPTOMS	POSSIBLE CAUSES	REMEDIES
Tires wear out quickly or have uneven tire tread wear. **Note:** *Wear pattern will indicate possible cause(s). Consult tire manufacturer for guidance.*	Tires have incorrect pressure	Inflate tires to specified air pressure
	Tires out of balance	Balance or replace tires
	Incorrect toe-in setting	Adjust toe-in to specified setting
	Incorrect ride height or camber setting	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. **Note:** *Engine must be running for power steering to be active and able to provide steering assist.*	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
	Pitman Arms binding	Check Relay Rod ball joint
	Tie Rod Ends binding	Inspect Tie Rod Ends for wear and lubricate as needed
	Kingpin binding	Inspect, lubricate, and repair as required
	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 relief valve binding	Inspect, repair or replace as required
	Steering wheel to column interference	Align or adjust as required
	Power steering pump fluid level low and/or 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 and bleed system. Note: By steering the vehicle lock to lock the steering gears are blead automatically when engaging the steering gear poppet valves
	Contaminated or incorrect fluid	Replace with correctly specified fluid
	Obstruction with steering gear Pitman Arm or within hydraulic lines	Inspect, remove obstruction(s) and repair or replace as required
	Obstruction within wheelhouse	Inspect, remove obstruction(s) as required
	Excessive internal steering gear leakage	Inspect, repair or replace as required

TROUBLESHOOTING

SYMPTOMS	POSSIBLE CAUSES	REMEDIES
Vehicle wanders side-to-side...loose steering. **Steering wheel has large amplitude, rotational oscillations when hitting large bumps.**	Vehicle overloaded or unevenly loaded driver side to passenger side	Check wheel loads and correct as needed
	Improper (mismatched) tires and wheels	Install correct tire and wheel combination
	Tires have incorrect pressure	Put correct air pressure in tires based on wheel load
	Incorrect toe-in setting	Adjust toe-in to specified setting
	Incorrect wheel caster setting	Adjust wheel caster to specified setting
	Tie Rod End connection loose or ball stud worn	Inspect ball stud connections and wear
	Steering arm mounts loose	Check and tighten to specification
	Relay Rod ball joints binding or worn	Inspect ball joints for wear or contamination and replace as required
	Kingpin worn	Check and replace as required
	Wheel bearings out of adjustment	Check wheel bearing end play and adjust as required
	Loose steering gear mounting	Check mounting and secure as needed
	Loose Pitman Arm	Check Pitman Arm and tighten as required
	Steering column linkage worn	Check for wear and repair or replace as needed
	Steering gear adjustment	Check and adjust the steering gear lash adjustment to specification
	Steering column mis-aligned	Realign steering column as required
	Worn knuckle carrier bearings	Check, adjust, or replace as needed
	Loose knuckle carrier mounting bolts	Check and tighten as needed
	Loose wheel nuts	Check and tighten to specification
Vehicle pulls to one side without the brakes applied.	Vehicle overloaded or unevenly loaded driver side to passenger side	Check wheel loads and correct as needed
	Improper (mismatched) tires and wheels	Install correct tire and wheel combination
	Tires have incorrect pressure	Put correct air pressure in tires based on wheel load
	Unequal ride height side to side	Inspect ride height and adjust to specified setting
	Improper brake adjustment	Inspect and adjust calipers as required
	Incorrect rear axle alignment	Align rear axle to specified thrust angle
	Incorrect caster and/or camber setting	Check and adjust as required
	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
	Excessive water puddling on road	Avoid water puddles on road

TROUBLESHOOTING

SYMPTOMS	POSSIBLE CAUSES	REMEDIES
Vehicle pulls to one side with the brakes applied.	Grease, oil or dirt on brake pads	Replace brake pads as required
	Brake pads are glazed	Deglaze brake pads by burnishing or replace as required
	Brake pads are not a balanced set, different friction codes or pad brand	Replace brake pads as required
	Loose or broken brake pads	Replace brake pads as required
	Brake rotor warped	Re-machine or replace brake rotor as required
	Defective brake rotor	Inspect for defects and replace as required
	Uneven brake adjustment side to side	Adjust caliper as required
	Different brake air chamber size	Replace with same size brake air chambers
	Brake chambers air pressure uneven side to side	Check side-to-side air pressure and correct as needed
	Rear axle brakes mis-adjusted or contaminated	Check, adjust, or replace as required
	ABS system malfunction	Check ABS system for proper function
	Air leak or obstruction in air brake lines	Check fittings with soapy water solution and remove obstructions
	Brake air chamber air leak or diaphragm damaged	Check chamber for air leak and damaged diaphragm
	Excessive water puddling on road	Avoid water puddles on road
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
Front tires lock up during hard braking or ABS malfunction light remains lit.	ABS sensor malfunction	Inspect ABS sensor installation and replace sensor as required
	ABS CPU or system malfunction	Check and repair or replace as required
	ABS sensor electrical connection faulty	Check ABS sensor connection and lead wire
	Tone ring on hub damaged	Check for damage and replace as required

TROUBLESHOOTING

SYMPTOMS	POSSIBLE CAUSES	REMEDIES
Vehicle ride is too harsh and/or suspension contacts stops excessively.	Front shock absorbers worn	Replace shock absorbers as needed
	Incorrect ride height	Adjust ride height to specified setting
	Vehicle overloaded	Check wheel loads and correct as needed
	Air spring supply lines leaking or obstructed	Check air line connections and remove obstructions
	Vehicle system air pressure below specification	Check air pressure and correct as needed
	Jounce bumper in air spring worn or broken	Check and replace air spring as required
	Broken transverse spring (22/24K Only)	Check and replace transverse spring as required
Vehicle ride is too soft.	Front shock absorbers worn	Replace shock absorbers as needed
	Incorrect ride height	Adjust ride height to specified setting
Vehicle has unequal turning radius right to left.	Incorrect steering arm geometry	Adjust Tie Rod lengths as required
	Steering gear not centered	Inspect and adjust as required
	Steering stops mis-aligned	Adjust as necessary
	Tie Rod Clamps positioned improperly	Check orientation and adjust as needed
Suspension does not maintain ride height.	Air leak	Check connections with soapy water solution and repair or replace as needed
	Internal leak in height control valve	Check height control valve and replace as required
	Height control valve linkage loose	Check and tighten linkage as needed
	Air spring chafed or worn	Check air spring and replace as needed
	Vehicle system pressure too low	Check air pressure and correct as needed
Brakes are noisy.	Grease, oil or dirt on brake pads	Replace brake pads as required
	Brake pads are glazed	Deglaze brake pads by burnishing or replace as required
	Brake pads are not a balanced set, different friction codes or pad brand	Replace brake pads as required
	Loose or broken brake pads	Replace brake pads as required
	Brake rotor warped	Re-machine brake rotor as required
	Defective brake rotor	Inspect for defects and replace as required

Refer to Bendix Disc Brakes manual Y006471 for troubleshooting of the disc brakes or contact Customer service at 1-800-247-2725.

General Inspection

Perform a thorough visual inspection of the suspension to ensure proper assembly and to identify broken parts and loose fasteners each time the vehicle suspension is serviced. Do the following during an inspection.

- **Wheel Alignment** - Follow the guidelines in the Front Wheel Alignment section for wheel alignment inspection intervals. Check wheel alignment if excessive steering effort, vehicle wander, or abnormal tire wear is evident.
- **Fasteners** - Check that all the fasteners are tightened to the proper tightening torque. Use a calibrated torque wrench to check torque.
- **Wear and Damage** - Inspect components of the suspension for wear and damage. Look for bent or broken components. Replace all worn or damaged components.
- **Operation** - Check that all components move freely through the complete wheel turning arc.

CAUTION

Reyco Granning® recommends replacing any damaged or out-of-specification components. Reconditioning or field repairs of front suspension components is prohibited. Some cast components are heat-treated. These components as well as other non-heat treated castings cannot be bent, welded, heated, or repaired in any way without reducing the strength or life of the component thus voiding the warranty. Only genuine ReycoGranning® replacement components are allowed.

WARNING

Never work under a vehicle supported by only a jack(s). Jacks can slip or fall over and cause serious personal injury. Always use safety stands. 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 drop causing serious personal injury.

The vehicle may be supported on safety stands by the suspension sub frame or chassis frame for inspections that require removal of the wheel and tires or deflation of the air springs. Always secure the vehicle by setting the parking brake and block the drive wheels to prevent vehicle movement before inspections.

Inspecting the Control Arm Bushings

NOTE It is recommended that the bushings in all of the control arms be replaced at the same time if one is found worn.

1. Check clearance between each control arm and sub frame-bushing mount. Look for contact pattern as evidence of bushing wear. Replace worn bushings in both control arm housings as needed.
2. Check for bushing bulging between the control arm and sub frame mount or presence of small rubber particles near sub frame bushing mount.
3. Check that the control arm mounting bolts are tight. Recommended torque is **465-485 lb-ft** for Lower Control Arms and **950-1050 lb-ft** for Upper Control Arms (See Torque Table). A loose joint will result in wear between the bushing inner sleeve and sub frame mount.

Inspecting the Tie Rod Ends

WARNING

Do not use a wrench or other object to apply leverage when inspecting tie rod end sockets. Applying leverage can yield incorrect results and damage components. Component damage can lead to the loss of steering control.

1. With the engine on, lightly rock the steering wheel and have an assistant observe any looseness in the two mating tapers or any movement of the stud nut at both ends of the Tie Rod (**Figure 6**). If looseness is found in either place go to step 2, otherwise skip to step 3.
2. Remove the Tie Rod End ball stud from the taper mount and visually inspect both. If either of the mating tapers shows distortion or wear, then both components must be replaced. Torque Tie Rod castle nuts to **90-100 lb-ft** (See Torque Table).
3. With the engine off and the wheels steered straight ahead, grab the Tie Rod near its end and try to move the socket in a direction parallel to the ball stud axis (**Figure 6**). Be sure to only apply hand pressure to the Tie Rod.
4. Measure the axial movement with a scale. If the movement is greater than 1/8 inch (3mm) replace the Tie Rod End immediately. If the socket moves but the movement is less than 1/8 inch (3mm) then the Tie Rod End should be replaced before 1/8” (3mm) movement occurs.
5. Check Dust Boot for damage. Replace as needed.
6. Check Tie Rod Clamp orientation (**Figure 6**). Clamp bolts need to be on the rear head down with the nut on the top side of the clamp. Insure clamps are installed within 1/16” from end of Tie Rod Tube.

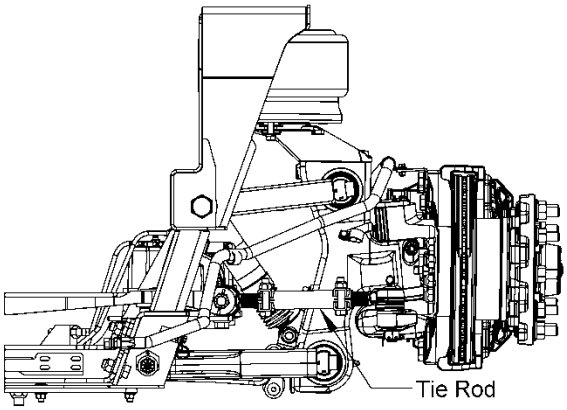


Figure 6- Tie Rod

Inspecting the ABS Sensor and Tone Ring

1. The tires and brake drums may be removed if needed to ease inspection of tone ring and sensor.
2. Disconnect the ABS sensor lead from the chassis connector.
3. The ABS sensor test will require a voltmeter that can measure AC voltage on a mill volt scale.
4. Connect the voltmeter to the connector pins of the ABS sensor lead.
5. Set the voltmeter scale to millivolts and the voltage source to AC volts.
6. Rotate the wheel hub by hand and record the voltage output from the ABS sensor. A minimum output of 800 millivolts (0.8 Volts) is required.
7. If the minimum voltage output is not achieved, check lead wire connections and repeat Step 3. Otherwise, if the minimum voltage output is not achieved after repeating Step 3 then go to Step 5.
8. Check physical gap between the sensor and tone ring (Figure 7). The brake drum must be removed to inspect gap. The maximum allowable gap is .027 inch. If the gap is greater than .027 inch, press on the wire lead end of the sensor and push the sensor into contact with the tone ring. Check that the ABS spring retainer and bushing are not unseated. Re-seat components as needed.
9. Inspect the tone ring on the hub for physical damage and proper installation onto the hub. The tone ring should have a maximum run out of .008 inch relative to the hub/spindle centerline.
10. Repeat Step 3. If voltage output is less than 800 millivolts (0.8 Volts) then replace the ABS sensor.

NOTE: Check voltage output of new sensor

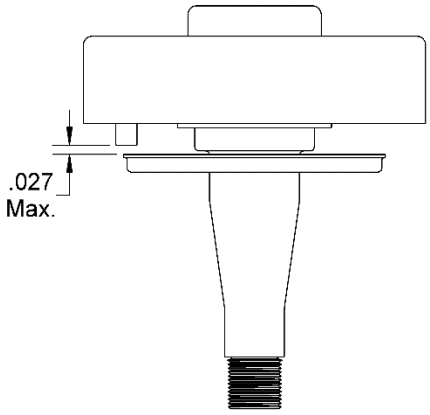


Figure 7 – ABS Sensor & Tone Ring Gap

Inspecting the Shock Absorber

1. Check shock absorbers for oil leakage, bent components, missing or broken components, excessive corrosion, or worn bushings.

2. Replace shock absorbers if any of the above items are present.

NOTE: A slight film of oil on the body (known as misting) is normal.

Inspecting the Air Spring and Height Control Valve

Air Spring Inspection

1. Refer to Firestone's Preventative Maintenance Checklist for additional air spring information.
2. Check the outside diameter of the air spring for irregular wear or heat checking.
3. Check air lines to 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 air line and fitting leaks with soapy water solution.
4. Check to see that there is a minimum of 1-inch clearance between the circumference of the pressurized air spring and any moving components.
5. Check the air spring piston for buildup of foreign material. Remove any foreign material that is present.

Height Control Valve Inspection

1. Check the height control valve and linkage for damage. Replace components as needed.
2. Dump and re-inflate the air suspension.
3. Verify the ride height by measuring from wheel center to the bottom of the frame ("A") or air spring height ("B"). If the dimensions are not within +/- .125" (**Figure 8**), readjust.
4. The actuation arm of the height control valve should be horizontal at ride height (**Figure 8**). See section for adjusting to correct ride height.

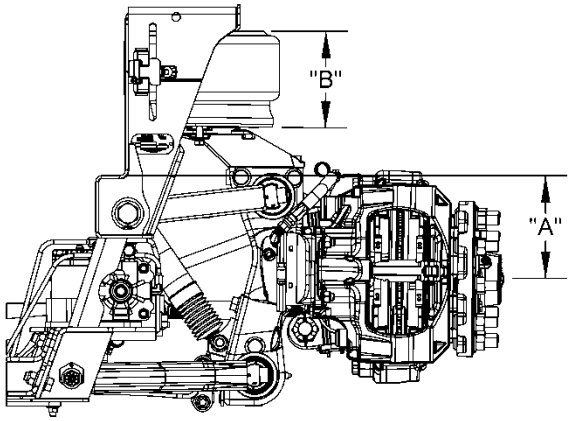


Figure 8 – Ride Height Measurement

Unit	Ride Height "A"	Air Spring "B"
IFS2400S-FT IFS2000S-FT	9.00"	8.28"

Inspecting the Relay Rod Ball Joints

Seal Inspection

1. Inspect the ball joint seal outer surface for presence of oil "wetting". The entire outer seal surface should be dry. Use a mechanics mirror and flashlight to inspect the entire seal. Use a blunt object as needed to inspect between seal convolutes.
2. If oil "wetting" is found, then inspect the entire wet area to confirm the seal has a rupture(s) and oil source is from internal grease leaking from the ball joint. If seal is ruptured, then the ball joint must be replaced.
3. Skip ball joint endplay measurement.

NOTE Care must be taken to not damage ball joint seals during inspection. Seals that are ruptured during inspection must be replaced. Do not apply excessive force to pry ball joints.

Endplay Inspection

1. Install a dial indicator with a magnetic base so that the base is fixed to the Pitman Arm. Place the indicator tip on the flat area of the Relay Rod adjacent the castle nut.
2. Using a C-clamp, squeeze the Relay Rod and the Pitman Arm together to seat the ball joint. Do not apply excessive clamp load.
3. Set the dial indicator on “zero”.
4. Release the clamp. Place the pry bar between the Pitman Arm and Relay Rod. **Do not allow the pry bar to contact the ball joint seal.** Firmly pry upward using the Pitman Arm as a fulcrum to lift the Relay Rod. The pry load must not cause the relay arm to rotate thus causing the relay to change orientation.
5. Record the dial indicator reading. A reading greater than .040” will require ball joint replacement.
6. Inspect ball joint seal for damage and replace the ball joint if damaged during measurement process.

Inspecting Wheel Bearing Endplay

1. Remove the hubcap, tire and wheel.
2. Attach a dial indicator with a magnetic base to the face of the wheel, hub, or brake drum. The dial indicator may also be attached to the bottom of the brake drum if the wheel is removed.
3. Place the tip of the dial indicator on the center of the steering knuckle spindle. Set the dial indicator on zero (**Figure 9**).

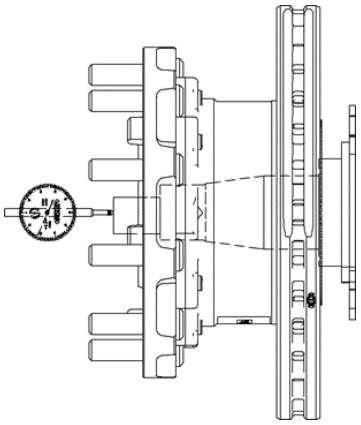


Figure 9 - Wheel End Play Measurement

NOTE: Do not push/pull at the top and the bottom of the tire, rotor, or hub. Pushing or pulling at the top and the bottom will not yield a true measurement of the endplay.

4. Measure the endplay by simultaneously pushing/pulling on each side of the tire, drum, or hub while observing the dial indicator. The endplay is the total travel observed. If the endplay is not within .001-.005”, see the section on adjusting the wheel bearing endplay.
5. Install the wheel and tire with wheel nuts tightened to the specified torque of **450-500 lb-ft** (See Torque Table)

Inspecting the Knuckle Carrier Bearing and Seal

1. Inspect the seals for damage.
2. Place the magnetic base of a dial indicator on the knuckle carrier and position the tip of the dial on the end of the bar pin such that axial movement can be measured.
3. Set the dial indicator to “0” (zero).
4. Place a pry bar between the control arm and carrier and pry to measure axial movement of the bar pin. Do not pry on seal. Measure and record the dial indicator reading.
5. If the axial endplay is more than “0” inch, then replace the carrier bearings. See repair section on knuckle carrier.

Inspecting the Kingpin Vertical Endplay

1. Turn the tire straight ahead.
2. Place the magnetic base of a dial indicator on the knuckle carrier and position the tip of the dial on top of the king pin bearing cap such that vertical movement can be measured.
3. Place a portable jack and a suitable block (one with clearance for the grease fitting) under the lower king pin grease cap area.
4. Set the dial indicator to “0” (zero).
5. Raise the jack until the dial indicator shows the end of vertical travel. Measure and record the dial indicator reading. Vertical inspection clearance must be .002-.012 inches.
6. If the steering knuckle binds or less than .001 inch endplay is measured, remove shims from the shim pack. See repair section for kingpin.
7. If the vertical endplay measurement is more than .012 inches, then install shims. See repair section for kingpin.

NOTE: Vertical endplay is not associated with King Pin wear. Refer to Dana specifications for King Pin wear inspection.

Adjusting Suspension Ride Height

The height control valve (HCV) and linkage should be checked regularly for proper clearance, operation and adjustment.

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

The ride height of the front suspension is the distance from the bottom of the chassis frame rail to the center of the wheel spindle. An alternate measurement may be taken as the height of the air spring (**Figure 10**).

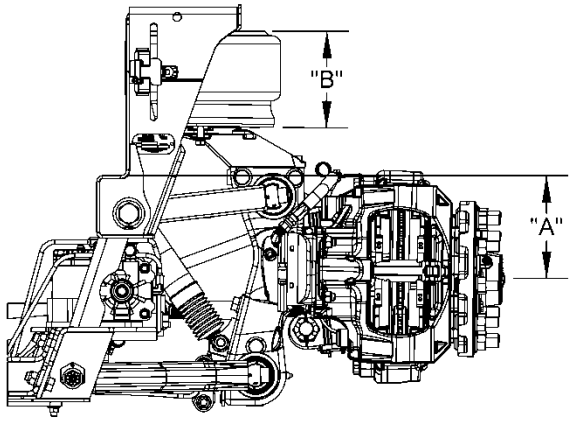


Figure 10 – Measurement at Ride Height

Unit	Ride Height "A"	Air Spring "B"
IFS2400S-FT IFS2000S-FT	9.00"	8.28"

Properly adjusted ride height results in correct suspension travel and alignment. The ride height should not be adjusted to adjust chassis rake angle.

CAUTION

Adjusting the ride height can cause the front end to raise or lower unexpectedly due to vertical movements at the connection of the vertical link and the horizontal arm of the height control valve.

1. Park the vehicle on a level surface.
2. Exhaust or "dump" and re-inflate the air suspension. Allow the suspension to settle.
3. Check ride height of rear suspension before checking or making adjustments to the front suspension.
4. Measure either the wheel center to bottom of frame ("A") or air spring height ("B"). If the dimensions are not within ±1/8" of measurements in **(Figure 10)**, adjust as follows.
   a. Loosen the height control valve linkage rod end at the air spring support pad flange.
   b. Reposition the height control valve linkage rod end as necessary.
   c. Tighten the height control valve linkage rod end nut. Torque to **8-12 lb-ft**.
5. After adjusting the height control linkage, it is recommended to dump and re-inflate the air suspension to obtain the ride height. Allow the suspension to settle.
6. Verify at each axle that the side-to-side ride heights are within .25" of each other.

Adjusting Wheel End Play

WARNING

Never work under a vehicle supported by only a jack(s). Jacks can slip or fall over and cause serious personal injury. Always use safety stands. 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.

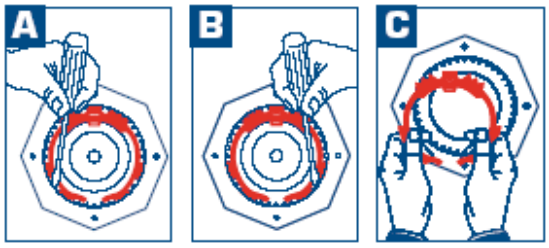
WARNING

Failure to follow this instruction could cause the wheel to come off and cause bodily injury. The PRO-TORQ® Spindle Nut is sold as an assembly with the keeper in place. DO NOT attempt to place the nut on the spindle or tighten or loosen the nut on the spindle while the keeper is locked inside the nut. Doing so may deform the keeper and allow the nut to unthread during operation.

1. Secure the vehicle by setting the parking brake and block the drive wheels to prevent vehicle movement.
2. Raise the vehicle until the front wheels are off the ground. Support the raised vehicle with safety stands. Remove the wheels.
3. Place an oil drip tub beneath the hub to catch oil. Rotate the hub such that the hubcap drain plug is facing upwards. Remove the drain plug from the hubcap and place it in a container for re-installation.
4. Rotate the hub such that the drain hole faces downward and drain the oil from hub cavity. Wait a few minutes for most of the oil to drain before continuing to the next step.
5. Remove the hubcap bolts, hubcap, and gasket. Take care not to damage the gasket for re-installation. Place the components in a location to prevent contamination. Note that solvents may damage the hubcap window.

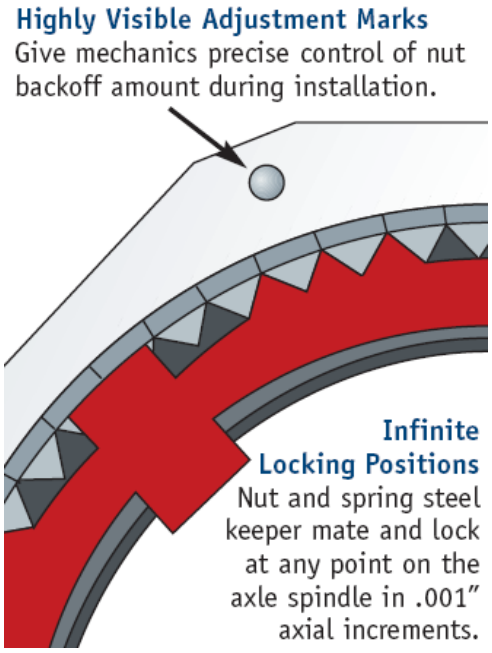
NOTE: When removing or installing the spindle nut, use the correct wrench sockets to avoid damaging the nut. Do not use an impact driver to tighten the spindle nut. Only use a torque wrench to tighten the spindle nut.

6. Remove the keeper from the nut.

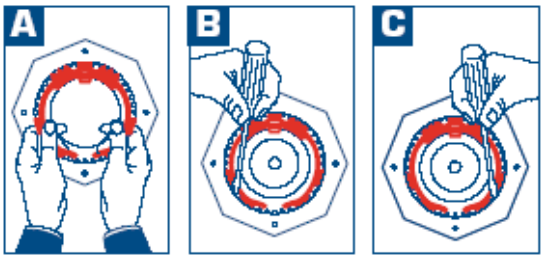


7. A, B, C, Use a small screwdriver to carefully pry the keeper arm from the undercut groove on each side until the keeper is released.
8. Using a torque wrench, seat the bearing, with the hub or hub and rotor only without the wheel.

9. Tighten the nut to **200 lb-ft**. Spin the wheel at least one full rotation
10. Repeat step #9 two more times.
11. Back the nut off until it is loose.
12. Adjust the bearing by tightening the nut to **100 lb-ft** Spin the hub at least one full rotation.
13. Repeat step #12 two more times
14. Back the nut off one raised face mark (1/4 turn).



15. Install the keeper with the orange side facing out.
16. Align the flat of the keeper with the milled flat on the spindle and insert the single keeper tab into the undercut groove of the nut. Install the keeper with the orange side facing out.
17. Engage the mating teeth



18. Compress and insert the keeper arms, one at a time, into the undercut groove with a small screwdriver.
19. Verify the end play
20. Attach a dial indicator with a magnetic base to the face of the wheel, hub, or brake drum. The dial indicator may also be attached to the bottom of the brake drum if the wheel is removed.
21. Place the tip of the dial indicator on the center of the steering knuckle spindle. Set the dial indicator on zero.
22. Measure the endplay by simultaneously pushing/pulling on each side of the tire, drum, or hub while observing the dial indicator. The endplay is the total travel observed. If the endplay is not within .001-.005", a readjustment will be required.
23. Install hubcap gasket and hubcap. Tighten the cap screws to **20-30 lb-ft** (See Torque Table). Replace the hubcap vent plug if removed.
24. Install the wheels.
25. Fill the hub cavity with the appropriate amount and type of lubricant and secure drain plug.

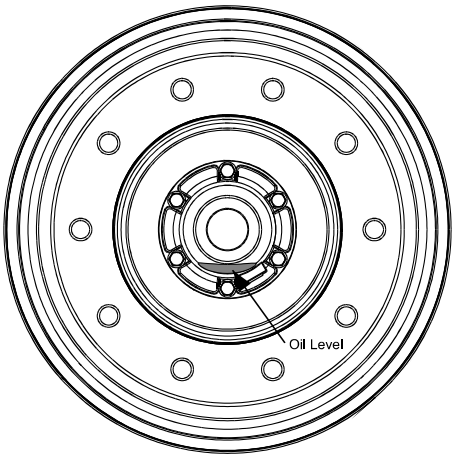


Figure 11 - Wheel Bearing Oil Level

26. Vehicle suspension should be at ride height when checking hub oil level. Check oil level through the hubcap window **(Figure 11)**. If level is below the "add" level line, then fill with recommended oil until "full" level is achieved. Add oil slowly since the heavy weight oil will settle slowly in the hub.

NOTE: The hubcap window can only be cleaned with mild soap and water. Aromatic solvents should not be used, as they will impair the transparency of the window.)

27. Check the hubcap for external oil leakage at the drain plug or gasket. For leaks at the drain plug check for application of thread sealant to threads and tightness. For leaks at the gasket, replace the gasket. The vent plug will normally weep a small amount of oil.

Adjusting the Maximum Wheel Turn Angle

CAUTION

Do not adjust maximum wheel turn angle greater than 55°. Mis-adjustment of the wheel turn angle can cause damage to steering system components.

The turn angle may require adjustment if the front tires rub against the frame, suspension, or body, or the steering gear has been serviced/replaced. Use an alignment machine to check the wheel turn angle. See the measurement procedure of the alignment machine manufacturer.

The steering stop bolt on the steering knuckle controls the maximum turn angle. If the stop bolt is missing, bent, or broken; replace the stop bolt(s) or jam nut(s) and follow the procedure below for adjustment. Inspect other suspension components for damage.

CAUTION

In power steering systems, the hydraulic pressure should relieve or "drop off" when the steered wheels approach the steering stops in either direction. If the pressure does not relieve, the components of the front suspension may be damaged

If the steering stop bolts are adjusted to reduce wheel turn angle, the steering gear poppet valves will require readjustment. If the poppets are not re-adjusted properly, then the steering gear will not reduce power assist properly and steering components will be damaged. Refer to TRW's TAS Steering Gear Service Manual for readjusting the poppets.

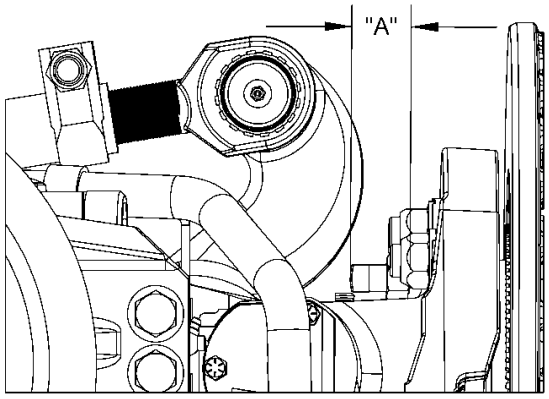


Figure 12 - Steering Stop Bolt

When steering stop bolts are adjusted to reduce wheel turn angle the auxiliary steering stops will need to be readjusted.

1. Drive the front tires on a suitable device that allows the front wheels to turn and measures the wheel turn angle.
2. Secure the vehicle by setting the parking brake and block the drive wheels to prevent vehicle movement.

NOTE: Unequal toe-in side to side or an out-of-center steering gear can result in unequal turn angles and steering pull while steering straight ahead. Improper tie rod adjustment will affect steering wheel centering and restrict wheel cut limit.

3. Check that the steering gear is centered and the tires are steered straight ahead with equal toe-in side to side. If either of these two conditions is not met, then adjust toe-in first before centering the steering gear (See Adjusting the Toe-In Section).
4. Check that the lengths of the outer tie rods are equal to each other within 1/8 inch. If not, adjust lengths according to the adjusting the toe-in section before adjusting the steering stops.
5. Turn the steering wheel until the steering stop bolt contacts the knuckle carrier or the steering wheel stops turning. Measure the turn angle of the wheel on the same side as the direction of turn.
6. If the wheel turn angle differs from guidelines then adjust as follows.
7. Loosen the jam nut on the stop bolt.
8. Turn the stop bolt until the specified wheel turn angle is achieved and the bolt head contacts the knuckle carrier.

Unit	Steering Stop Length "A"
IFS2400S-FT	42° 1.66"
IFS2400S-FT	48° 1.37"
IFS2000S-FT	53° 1.16"
IFS2000S-FT	55° 1.02"

9. Tighten the jam nut to **50-75 lb-ft**. (See Torque Table).

CAUTION

After readjusting the steering stop(s) check that the steering poppets are reset properly and that the front tires do not contact the frame, suspension, or body. Also check that other components are not abnormally contacting one another.

10. Repeat checking and adjustment for turning in the opposite direction.

11. The auxiliary turn stops now can be adjusted. This adjustment must be made when the suspension is at ride height only. Turn the wheel until the outer wheel stop has made contact with the carrier casting. Using a wrench, loosen the stop bolt jam nut and adjust auxiliary stop bolt until the head of the bolt contacts the side of the Pitman Arm (Figure). The Relay Rod was hidden for illustration purposes only. Tighten jam nut to **50-75 lb-ft**. Repeat process turning in the opposite direction.

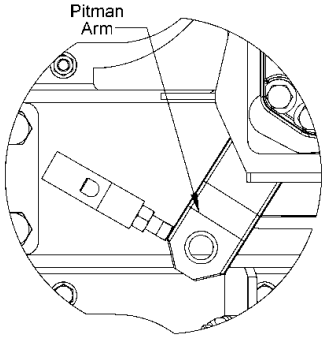


Figure 13 - Auxiliary Steering Stop Adjustment

Inspection before Alignment

See the General Inspection section and check the following before conducting front wheel alignment measurements.

Wheels and Tires

1. Check that the front tires are inflated to the appropriate pressure based on the tire loading.
2. Check that the front tires are the same size and type.
3. Check that all the wheel nuts are tightened to the specified torque of **450-500 lb-ft** (See Torque Table).
4. Check that the wheel and tire assemblies are balanced.

Front Suspension

1. Check that all fasteners are tightened to the specified torque.
2. Check the suspension ride height and adjust as needed to the specified height.
3. Check for worn ball joints, tie rod ends, steering arm bearings, control arm bushings, knuckle carrier bearings, and damaged suspension components. Replace worn components as needed.
4. Check for loose ball joint and tie rod end tapered connections, tie rod assembly clamps, steering arm mounts, and chassis steering system components. Inspect connections for wear and replace as needed. Tighten connections as needed.
5. Check the wheel bearing adjustment and adjust as needed.
6. Inspect the shock absorbers for wear and damage.

Rear Axle and Suspension

Front tire wear and incorrect steering can be caused by the rear axle and/or suspension.

1. Check that all fasteners are tightened to the specified torque.
2. Check the suspension ride height and adjust as needed to specified height.
3. Check that all connection joints between the suspension and axle are secure.
4. Check for worn suspension bushings or damaged suspension components.
5. Check that the rear axle is correctly aligned.
6. Check that the frame is not bent.
7. Refer to any additional recommendations and specifications from the manufacturer of the chassis on rear axles and suspensions.

NOTE: Total vehicle alignment is recommended when aligning the front suspension

Front Wheel Alignment Equipment

Reyco Granning® recommends that suitable alignment equipment be used to measure the wheel alignment characteristics: camber, caster, and toe-in. The alignment equipment must be properly calibrated for accurate measurements. Only qualified personnel should conduct the wheel alignment measurements.

General

The overall toe-in of the front wheels should be checked every 24,000 miles or 2 years. When the vehicle does not steer correctly or the front tires develop an abnormal tire wear pattern, the camber, caster, and toe-in should be measured and adjusted as needed. Toe-in typically has the largest effect on tire wear.

The maximum wheel turn angle should be checked and adjusted as needed.

Eccentric adapters are installed in the lower control arm mounts. The purpose of the adapters is to provide additional adjustment of camber and caster to minimize vehicle drifts or pulls to one side of the road.

The lower bar pin of the knuckle carrier bearing marked with a "B" may also be used to provide additional camber adjustment.

Preparation

1. Follow the alignment equipment manufacturer's procedures for preparing the vehicle for front and rear wheel alignment measurements.
2. Secure the vehicle by setting the parking brake and block the drive wheels to prevent vehicle movement.

NOTE: An out-of-center steering gear can result in unequal wheel turn angles. The steering gear should remain centered during toe-in adjustment. Improper tie rod adjustment will affect steering wheel centering and restrict wheel cut limit.

3. Tilt the truck cab. Measure the frame width as shown in **(Figure 14)**. Adjust if not within specified range of between 33.94" to 34.06". Once the width is within the range torque both clamp bolts to **125-145 lb-ft**. Lower the truck cab.

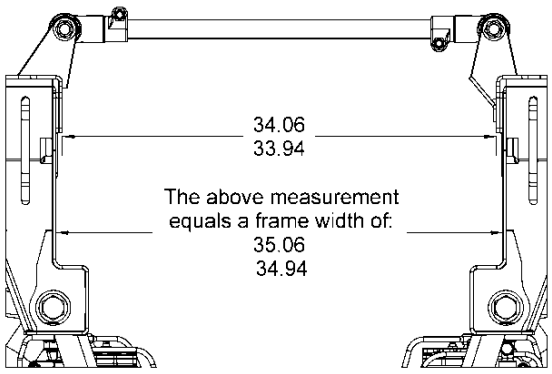


Figure 14 – Frame Width Measurement

4. Check that the steering gear is centered when the tires are steered straight ahead (i.e. equal toe-in side to side). Center the steering gear according to guidelines.
5. Measure and record the individual wheel camber, caster, and toe-in of the front suspension. Also measure and record the cross camber, cross caster, and overall toe-in.
6. If adjustment to camber and caster is required, then follow the steps below. Otherwise, go to the "Adjusting the Toe-In" section to adjust the toe-in as needed.

WARNING

Never work under a vehicle supported by only a jack(s). Jacks can slip or fall over and cause serious personal injury. Always use safety stands. 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. NO SHIMS ARE TO BE ADDED FOR ADJUSTING ALIGNMENT

Adjusting the Camber Angle

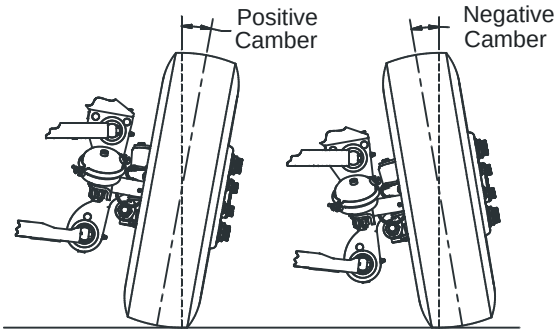


Figure 7 – Camber Angle

CAUTION

Do not alter components to adjust the camber.

Camber is the angle of the wheel with respect to the ground as viewed from the front or rear of the vehicle **(Figure 15)**. Camber is positive when the distance between centers of the front wheels at the top is greater than the distance at the ground.

The wheel camber angle 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. See the inspecting and adjusting suspension ride height sections before measuring camber. The table below lists the recommended camber angles.

Nominal Camber Values-Degrees		
	Unloaded	Loaded
Left	+1/4°(±1/4°)	+1/4°(±1/4°)
Right	+1/4°(±1/4°)	+1/4°(±1/4°)

Camber Adjustment Eccentric

The set screw in the eccentric indicates the amount of eccentric adjustment for the control arm bushing. When the set screw is in the 12 o'clock position, then the eccentric is in the "neutral" position. There are two eccentrics at each lower control arm mount. Both eccentrics must be rotated the same amount in the same direction.

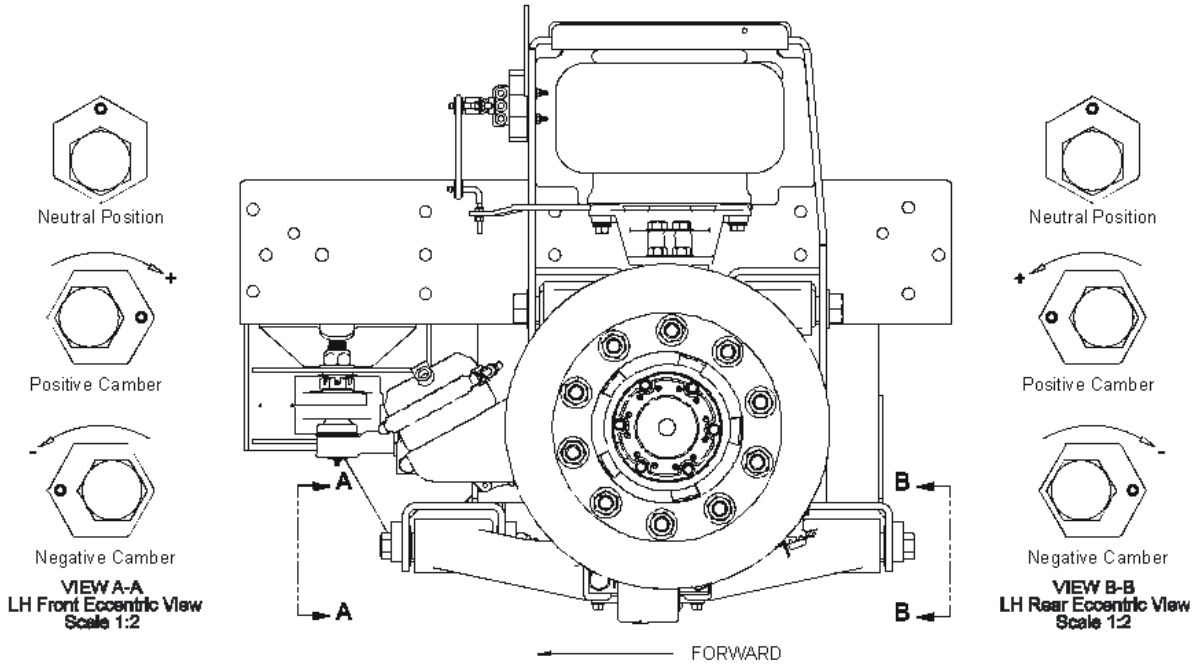


Figure 16 - Eccentric Camber Adjustment

When the setscrews in both lower control arm mounts are oriented closer to the suspension centerline, the tire camber becomes more negative. When the setscrews in both control arm mounts are oriented farther from the suspension centerline, the tire camber becomes more positive (**Figure 16**). The eccentric adapters at both lower control arm mounts must be oriented the same to affect only camber.

1. Loosen both lower control arm mounting bolts at the eccentric adapters. Do not remove the bolts because the adapters must remain engaged in control arm mounting plate for adjustment.
2. Using Reyco Granning® Alignment Wrench 711024-00 or 711024-00, Rotate each eccentric adapter to the same orientation as needed based on measured wheel camber.

NOTE: Eccentric adapters at each control arm mount must have the same orientation

3. Tighten the adapter locknuts to **465-485 lb-ft** (See Torque Table).
4. Remove the jack stands and lower vehicle completely. Check that the suspension is at the proper ride height.
5. Re-measure the camber and readjust as needed.

Bar Pin Camber Adjustment

The lower bar pin of the knuckle carrier bearing marked with a “B” on the end is configured such that it can be re-oriented to provide camber adjustment. Both top and bottom bar pins are factory installed with the “B” located closest to the control arms. The wheel camber becomes more positive when the lower bar pin is re-oriented such that the “B” is located farthest from the lower control arm. (see **Figure 17**)

1. Place a portable jack under the tire to secure and support it.

CAUTION

Do not remove both upper and lower knuckle carrier mounting bolts at the same time. The knuckle carrier must be secured and supported properly if both upper and lower mounting bolts are removed.

NOTE: Lower control arm may move downward due to the internal gas charge in the shock absorber. A portable jack may be needed to align the lower control arm with the knuckle carrier bar pin.

2. Remove the bottom knuckle carrier mounting bolts from the lower control arm. Heat may need to be applied to the control arm to loosen the thread adhesive. The control arm temperature must not exceed 300°F. Do not apply heat directly to the bar pin or mounting bolts.
3. Raise the jack to separate the bar pin from the control arm and re-orient it.
4. Lower the jack to align the bar pin with the control arm. Apply Loctite #242 to mounting bolt threads and tighten to **545 lb-ft** (See Torque Table).

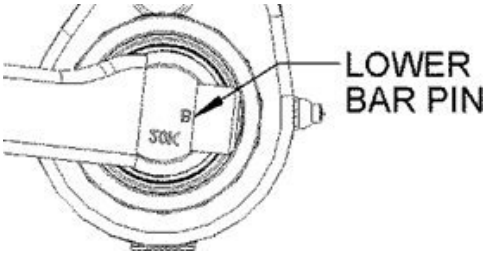


Figure 17 – Bar Pin

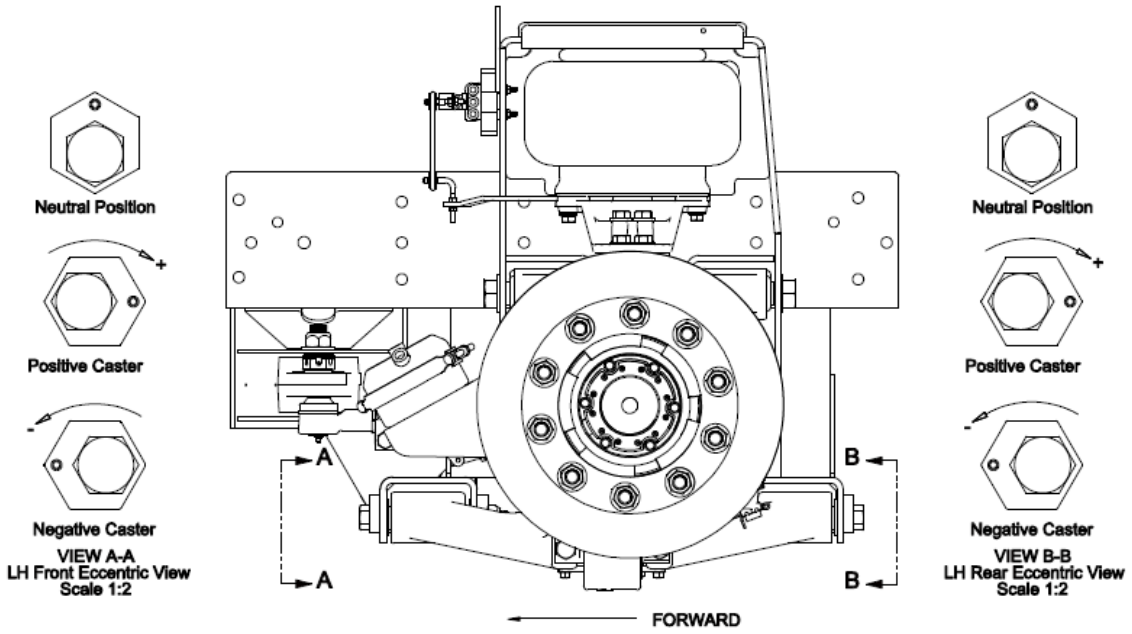


Figure 8 - Eccentric Caster Adjustment

Adjusting the Caster Angle

1. Loosen both lower control arm mounting bolts at the eccentric adapters. Do not remove the bolts because the adapters must remain engaged in control arm mounting plate for adjustment.
2. Using Reyco Granning® Alignment Wrench 711024-00 or 711024-00, Rotate the eccentric adapters at the forward and rearward control arm mounts opposite one another as needed based on measured wheel caster.

NOTE: Eccentric adapters at each control arm mount must have the same orientation

3. Tighten the adapter locknuts to **465-485 lb-ft** (See Torque Table).
4. Remove the jack stands and lower vehicle completely. Check that the suspension is at the proper ride height.
5. Re-measure caster and readjust as needed.

Nominal Caster Values-Degrees		
	Unloaded	Loaded
Left	+4°(±1/2°)	+4°(±1/2°)
Right	+4°(±1/2°)	+4°(±1/2°)

Adjusting the Toe-In

CAUTION

Do not alter components to adjust the toe-in.

CAUTION

Improperly oriented Tie Rod Clamps can cause binding in the suspension steering system.

Wheel toe-in is the relationship of the distance between the centers of the front and rear of the front wheels. When the front distance is less than the rear distance, the wheels are “toed-in”. Toe-in is designed into the suspension to counteract the tendency of the tires to toe-out when the vehicle is driven straight ahead. Incorrect toe-in can result in rapid tire wear.

1. Measure the length of the Tie Rods. Reference length is 15.4 inches center to center.
2. If the lengths of the outer Tie Rods are not within 1/8 inch of each other, then adjust their lengths such that they are within 1/8 inch of each other. Before loosening the Tie Rod Clamps note their orientations. Loosen each clamp on each end of the Tie Rod and turn the center tube to change the length.
3. Adjust the length of both outer Tie Rods equally such that the toe-in on each side is 1/16” ± 1/32” and the overall toe-in is 1/8” ± 1/16”. Tighten Tie Rod Clamp nuts to **50-60 lb-ft** (See Torque Table). Clamp bolts need to be on the rear, head down, with the nut on the top side of the clamp. Ensure clamps are installed within 1/16” from end of Tie Rod Tube. Refer to **(Figure 19)** for Tie Rod Clamp orientation.

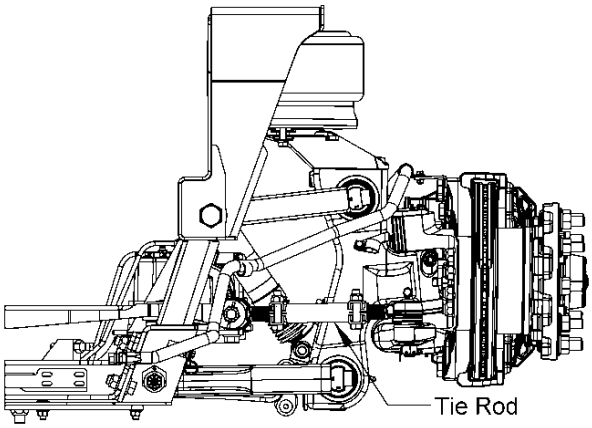


Figure 9 - Tie Rod Clamp Orientation

General Procedures

Repair or reconditioning of front suspension components is not allowed. Components that are damaged or worn must be replaced. Several major components are heat treated and tempered.

WARNING

The components cannot be bent, welded, heated altered, or repaired in any way without reducing the strength or life of the component and voiding the warranty.

The following operations are prohibited on front suspension components.

1. Welding of or to the steering knuckles, control arms, steering arms, knuckle carrier, tie rod assemblies, the brakes, the hubs, and the brake drums.
2. Hot or cold bending of the steering knuckles, control arms, steering arms, knuckle carrier, tie rod assemblies, ball joints, and the sub frame except control arm and steering arm mounts which may be cold bent to facilitate bushing and bearing replacement.
3. Drilling out control arm and steering arm mounting holes and ball stud tapered holes.
4. Spray welding of bearing diameters on the steering knuckle spindle, steering arm bores and pivot tube. Spray welding of tie rod ends or tapered holes for the ball joint and tie rod ends.
5. Milling or machining of any component except that control arm bushing bores may be honed to remove any burrs.

WARNING

Never work under a vehicle supported by only a jack(s). Jacks can slip or fall over and cause serious personal injury. Always use safety stands. 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.

The vehicle may be supported on safety stands by the suspension sub frame or chassis frame for repairs that require removal of the wheel and tires or deflation of the air springs. Always secure the vehicle by setting the parking brake and block the drive wheels to prevent vehicle movement before performing repairs.

Cleaning the Parts

WARNING

If you use cleaning solvents, hot solution tanks or alkaline solutions incorrectly, serious personal injury can occur. To prevent injury, follow the instructions supplied by the manufacturer. Do NOT use gasoline to clean parts. Gasoline can explode.

Ground or Polished Parts

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

Rough Parts

Rough parts can be cleaned with the ground and polished parts. Rough parts also can be cleaned in hot solution tanks with a weak alkaline solution. Parts should remain in the hot solution tanks until they are completely cleaned.

Drying

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

Preventing Corrosion

Apply light oil to cleaned and dried parts that are not damaged and are to be immediately assembled. Do NOT apply oil to the brake linings or the brake drums. If the parts are to be stored, apply a good corrosion preventative to all surfaces and place them inside special paper or containers that prevent corrosion. Do NOT apply corrosion preventative to the brake linings or the brake drums/rotors.

Replacing Tie Rod Ends

Removal

1. Remove the cotter pins from the Tie Rod End ball stud(s).
2. Remove the castle nuts from the Tie Rod End ball stud(s).

CAUTION

Do not strike the component mating taper directly with a steel hammer. Parts can break and cause serious personal injury. Wear eye protection.

3. Disconnect the Tie Rod End ball stud from the mating component tapered hole using a suitable tool.
4. Inspect the Tie Rod End ball stud and mating component tapered hole(s). Replace components with worn tapered hole(s). If the grease seal is damaged during removal, replace it before installation.

Installation

1. Clean the mating component tapered hole(s) of any contamination. Insert the Tie Rod End ball stud into the tapered hole and secure it with the castle nut.

CAUTION

Tighten the castle nuts to the specified torque. If the castle nuts are not tightened to the specified torque, the parts will be damaged and serious personal injury may occur.

2. Tighten the castle nut to **90-100 lb-ft** (See Torque Table).
3. Install the cotter pins. If necessary, tighten the castle nut to align the hole in the ball stud and slots in the castle nut. Do not loosen the castle nut to install the cotter pin.
4. Lubricate Tie Rod End as needed.

Replacing the Relay Rod Ball Joints

The thread-in mount type ball joints are installed with a thread adhesive and may require the threads to be warmed to ease removal. If heat is applied to the ball joint threads, the Pitman Arm temperature must not exceed 300°F and the heat should be applied at the bottom of the ball joint base only. Applying heat to the ball joint will damage the ball joint by destroying its internal components as well as the external seal permanently, degrading the lubricant, and restricting ball stud movement.

It is recommended that the appropriate tools be used to remove the ball stud taper from the Pitman Arm and to remove the ball joint base from the Relay Rod.

Removal

1. Remove the cotter pins from the ball joint ball stud(s).
2. Remove the castle nuts from the ball joint ball stud(s).

CAUTION

Do not strike the component mating taper directly with a steel hammer. Parts can break and cause serious personal injury. Wear eye protection.

3. Disconnect the ball joint ball stud from the Pitman Arm tapered hole using a suitable tool.
4. Secure the Relay Rod and remove the ball joint using a ball joint spanner wrench or similar device on the base. Pitman Arm may be removed to facilitate ball joint removal. Inspect the ball joint stud and Pitman Arm tapered hole(s). Replace Pitman Arm(s) if tapered hole(s) are worn.

Installation

1. Clean the threaded hole in the Relay Rod of any contamination.
2. Apply thread adhesive Loctite #242 to the ball joint base threads and thread it into the Relay Rod by hand.
3. Tighten the base of the ball joint to **325-375 lb-ft** (See Torque Table).
4. Clean the Pitman Arm tapered hole(s) of any contamination. Insert the ball joint stud into the tapered hole and secure it with the castle nut.

CAUTION

Tighten the castle nuts to the specified torque. If the castle nuts are not tightened to the specified torque, the parts will be damaged and serious personal injury may occur.

5. Tighten the castle nut to **225-245 lb-ft** (See Torque Table).
6. Install the cotter pins. If necessary, tighten the castle nut to align the hole in the ball stud and slots in the castle nut. Do not loosen the castle nut to install the cotter pin.

Replacing the Upper and Lower Control Arm Bushings

The sub frame control arm mounts may require widening to accommodate replacement bushings. A suitable jack may be used to increase the width of the control arm mounts by cold bending. Care must be taken to not exceed 5.00” width after widening. The control arm mounts should be inspected for damage.

Both control arm bushings and mounting hardware, except eccentric adapters, must be replaced in a control arm when bushings are serviced. It is recommended to replace the control arm bushings and mounting fasteners in all of the control arms at the same time.

The control arm housings must be properly supported during bushing removal. The bores of the control arm housings may be honed to remove any burrs.

CAUTION

Use of a cutting torch to remove control arm bolts will permanently damage control arm bushings and can result in damage to sub frame.

It is recommended that the wheel and tire be removed to provide proper accessibility. Disconnect the vertical height control valve linkage from the horizontal arm to prevent unintentional inflation of the air spring.

Upper Control Arm Removal

1. Place a portable jack under the knuckle carrier to secure and support it.

CAUTION

Do not remove both upper and lower knuckle carrier mounting bolts at the same time unless the knuckle carrier is properly secured.

2. Remove knuckle carrier mounting bolts from the control arm. Heat may need to be applied to the control arm to loosen the thread adhesive. The control arm temperature must not exceed 300°F. Do not apply heat directly to the bar pin or mounting bolts.
3. Disconnect sway bar connector at sway bar if so equipped with a sway bar.
4. Loosen and remove control arm mounting locknuts.
5. Support control arm and remove control arm mounting bolts. Remove the control arm.
6. Remove the sway bar bracket and linkage from the control arm and retain for installation.
7. Press the bushings out of the housings. Support the housing properly.

Upper Control Arm Installation

1. Inspect the housing bores and remove any burrs in the housing bores by honing.
2. Press the bushings into the housings using a suitable tool to apply pressure to only the outer metal of the bushing. Support the housing properly.
3. Re-install the sway bar bracket and linkage if removed.
4. Place the control arm in its mount location. Install the control arm mounting hardware and tighten snugly.

5. Orient the control arm at suspension ride height and tighten the bolts to **950-1050 lb-ft** (See Torque Table).

Lower Control Arm Removal

1. Place a portable jack under the knuckle carrier to secure and support it.

CAUTION

Do not remove both upper and lower knuckle carrier mounting bolts at the same time unless the knuckle carrier is properly secured.

NOTE: Lower control arm may move downward due to the internal gas charge in the shock absorber. A portable jack may be needed to align the lower control arm with the knuckle carrier bar pin.

2. Remove knuckle carrier mounting bolts from the control arm. Heat may need to be applied to the control arm to loosen the thread adhesive. The control arm temperature must not exceed 300°F. Do not apply heat directly to the bar pin or mounting bolts.
3. Note orientation of lower bar pin in carrier bearing. Raise the jack as needed to separate the bar pin from the control arm.
4. Note orientation of eccentric adapters for installation.
5. Loosen and remove control arm mounting locknuts.
6. Support control arm and remove control arm mounting bolts. Retain eccentric adapters for installation. Remove the control arm.
7. Remove spacer tubes from bushings and retain for installation.
8. Press the bushings out of the housings. Support the housing properly.

Lower Control Arm Installation

1. Inspect the housing bores and remove any burrs in the housing bores by honing.
2. Press the bushings into the housings using a suitable tool to apply pressure to only the outer metal of the bushing. Support the housing properly.
3. Install the spacer tubes in bushings.
4. Place the control arm in its mount location. Install the control arm eccentric adapters and mounting hardware and tighten snugly. Orient the eccentric adapters the same as before removal.
5. Orient the control arm at suspension ride height and tighten the bolts to **465-485 lb-ft** (See Torque Table).
6. Note orientation of bar pin in carrier bearing. Lower the jack to align the bar pin with the control arm.
7. Apply Loctite #242 to mounting bolt threads and tighten to **545 lb-ft** (See Torque Table).
8. Compress shock absorber and connect the upper shock bushing to the upper shock mount on the cradle. Install lower shock bushing into lower shock mount. Tighten the nuts to **170-180 lb-ft** (See Torque Table).

Replacing Wheel Bearings, Oil Seals, and Hub Caps (Pro-Torq® Style Nut)

If the wheel nuts have chrome covers, remove them with special pliers equipped with plastic non-marring jaws. Place them in a container to prevent damage or loss.

On aluminum wheels, place a plastic anti-scuff guard over the wheel nuts and loosen the wheel nuts. On steel wheels, remove the wheel hub cap nuts if present and the wheel hub cap before loosening the wheel nuts. Place the wheel hub cap in a safe location to prevent damage. Place the wheel and/or wheel hubcap nuts in a container to prevent contamination or loss.

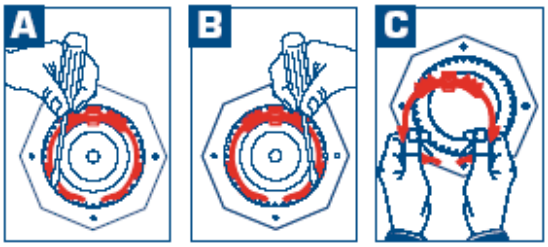
Remove the wheel and tire assembly and place it aside. Mark the tire to ensure it can be identified for installation on same side as removed. Remove the brake caliper assembly and place it aside.

Removal

1. Place an oil drip tub beneath the hub to catch oil. Rotate the hub such that the hubcap drain plug is facing upwards. Remove the drain plug from the hubcap and place it in a container for re-installation.
2. Rotate the hub such that the drain hole faces downward and drain the oil from hub cavity. Wait a few minutes for most of the oil to drain before continuing to the next step.
3. Remove the hub cap bolts, hub cap, and gasket. Take care not to damage the gasket for re-installation. Place the components in a location to prevent contamination. Note that the hub cap window may be damaged by solvents.

NOTE: When removing or installing the outer spindle nut, use the correct wrench sockets to avoid damaging the nuts. Do not use impact driver to tighten outer nut. Only use a torque wrench to tighten the nuts.

4. Remove the keeper from the nut.



5. A, B, C, Use a small screwdriver to carefully pry the keeper arm from the undercut groove on each side until the keeper is released.
6. Remove the retaining nut
7. Tug sharply on the hub to unseat the outer bearing without completely removing the hub. Wipe up any oil spilled on the brake assembly as quickly and completely as possible. Remove the outer bearing and place it in a container to prevent contamination.

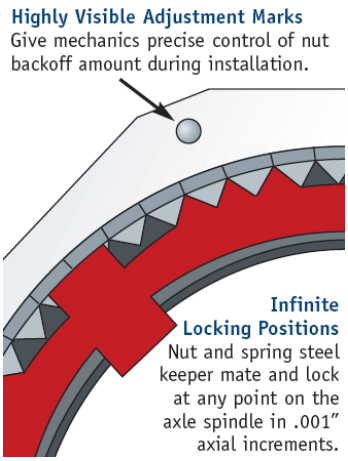
8. Remove the hub from the spindle and place it on the floor with its stud side facing downwards. Protect the wheel studs from damage. Wipe the excess oil off spindle with a clean shop towel to prevent oil dripping onto the brake assembly. If oil saturates or significantly contaminates the brake lining then replace the lining.
9. Remove the hub seal and discard it. Remove the wear ring from the spindle and discard it.
10. Inspect the inner cup (outer bearing race for the inner bearing) and outer cup in the hub for damage. Replace the bearing cups if worn or damaged.
11. Inspect the bearing areas on the spindle for wear or damage. Burrs may be removed by light application of emery cloth. Replace steering knuckle if the spindle is damaged.

Installation

1. Place the hub seal assembly with axle ring onto the spindle so the words “Oil Bearing Side” face outboard. Do not place the seal in the hub bore.
2. Drive the seal onto the spindle using the appropriate seal installation tool and a 3-5lb hammer. (Reference Stemco P/N 0155220) The wear ring is fully seated when it is square and flush with the face of the inner bearing shoulder of the spindle. Reseat the seal onto the wear ring if it becomes dislodged after seating.

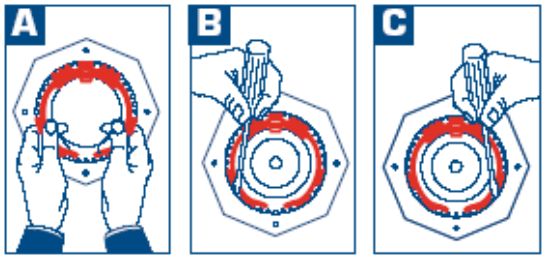
NOTE: Do not drive bearings onto the spindle with a steel hammer or similar instrument. Bearing inner race is a tight slip fit with spindle.

3. Pre-lube the inner bearing and place it onto spindle with small end of taper facing outward. Seat the inner race against the shoulder of the spindle.
4. Press the ABS sensor outward about 1/4”. Do not use a sharp tool on lead wire end of the sensor. See section for the inspection of ABS sensor as needed.
5. Place the hub onto the spindle until it seats on the inner bearing. Do not “ram” the hub onto the seal.
6. Pre-lube outer bearing and place it onto the spindle until it seats on the outer cup in the hub. The bearing retaining washer may be used to guide the bearing onto the spindle. The hub should be supported to prevent misalignment and binding.
7. Install spindle nut with smooth face toward the outer bearing.
8. Seat the bearing, with the hub or hub and drum only using a torque wrench.
9. Tighten the nut to **200 lb-ft**. Spin the wheel at least one full rotation.
10. Repeat step #8 two more times.
11. Back the nut off until it is loose.
12. Adjust the bearing by tightening the nut to **100 lb-ft**.
13. Repeat step #11 two more times.
14. Back the nut off one raised face mark (1/4 turn).



15. Install the keeper with the orange side facing out.

16. **A** Align the flat of the keeper with the milled flat on the spindle and insert the single keeper tab into the undercut groove of the nut. Install the keeper with the orange side facing out.
17. Engage the mating teeth.



18. **B**, **C** Compress and insert the keeper arms, one at a time, into the undercut groove with a small screwdriver.
19. Refer to the Wheel Bearing Endplay Adjustment section to measure and adjust the endplay to .001-.005 inch. Adjust by loosening spindle nut, re-indexing the spindle nut accordingly, and repeat Steps 8 thru 19 until proper endplay is achieved.
20. Install hub cap gasket and hub cap. Tighten the cap screws to **20-30 lb-ft** (See Torque Table). Replace the hub cap vent plug if removed.
21. Fill the hub cavity with the appropriate amount and type of lubricant and secure drain plug.
22. With Suspension at Ride Height, check oil level through the hubcap window (Figure). If level is below the “add” level line, then fill with recommended oil until “full” level is achieved. Add oil slowly since the heavy weight oil will settle slowly in the hub. (Note: The hubcap window can only be cleaned with mild soap and water. Aromatic solvents should not be used, as they will impair the transparency of the window.)

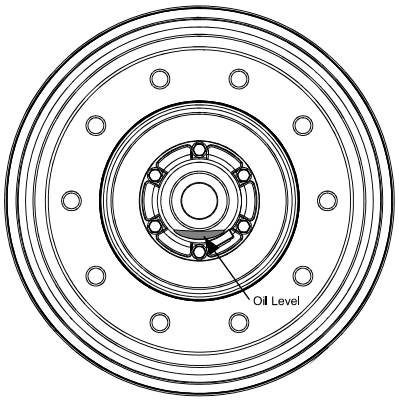


Figure 20 - Wheel Bearing Oil Level

23. Check the hub cap for external oil leakage at the drain plug or gasket. For leaks at the drain plug check for application of thread sealant to threads and tightness. For leaks at the gasket, replace the gasket. The vent plug will normally weep a small amount of oil.
24. Install the Brake Caliper.
25. Install the wheel and tire assembly and the wheel nuts.
26. On aluminum wheels, use a plastic anti-scuff guard over the wheel nuts. Tighten the wheel nuts to **450-500 lb-ft** (See Torque Table for sequence).
27. Replace the wheel hubcap nuts and hubcaps if removed to service the wheel bearings.

Pre-Adjusted with Integral Spindle Nut Wheel Hubs (20K Unit only)

Recommended Service

When inspections indicate that service is necessary on a Pre-Adjusted with Integral Spindle Nut Hub, follow the recommended service, inspection, reassembly and reinstallation instructions found in the following section. In order to ensure optimum wheel hub performance, Reyco Granning recommends that only approved Pre-Adjusted with Integral Spindle Nut service parts be used to replace all critical components of the system. Refer to the back of this section for a listing of approved parts.

WARNING

Vehicles on jacks can fall, causing serious personal injury or property damage. Never work under a vehicle supported by a jack without supporting the vehicle with stands and blocking the wheels. Wear eye protection.

1. Park the vehicle on a level surface. Block the wheels to prevent the vehicle from moving.
2. Raise the axle until the tires are off the floor.
3. Place safety stands under the vehicle as specified by the chassis manufacturer.
4. Remove the tire and wheel assembly using procedures specified by the wheel manufacturer.
5. For disc brakes, remove caliper per manufacturers' recommended procedure.
6. Place a container under the hubcap to receive the draining oil, then remove the hubcap or drive axle shaft. Do not reuse the oil. Correctly dispose of the lubricant.
7. Remove the red locking ring. Use caution not to damage the locking ring. Do not remove the spiral snap ring that holds the spindle nut in the hub.

WARNING

Never loosen the axle spindle nuts by striking them directly with a hammer or striking them with a drift or chisel placed against them. Damage to the parts will occur, causing possible loss of axle wheel-end components and serious personal injury.

8. Use a breaker bar to loosen the spindle nut. Pre-Adjusted with Integral Spindle Nut spindle nut installation torque is **300 lb-ft**.

NOTE: Use only 6-point forged sockets for installation and removal of Pre-Adjusted with Integral Spindle Nut spindle nuts.

9. After the spindle nut is initially loosened with a breaker bar, continue to unthread the spindle nut to remove the hub from the spindle. The internal snap ring will act as a hub puller and will aid in removal of the hub from the spindle. Do not exceed 50 ft-lbs of torque when removing the hub from the spindle. If the hub will not come off of the spindle without

exceeding this torque value, remove the spiral snap ring and the spindle nut assembly and use a conventional hub puller to remove the hub from the spindle.

10. Slide the hub off the spindle. Remove and save the outer bearing cone. Be careful when you remove the hub that you do not damage the outer bearing by dropping it on the floor. If the hub is difficult to remove because the seal is stuck on the spindle, use a mechanical puller to remove the hub. If part of the seal remains on the spindle, carefully remove the part of the seal that remains on the spindle.

NOTE: If the bearing does hit the floor, while removing the hub, clean and inspect bearing as stated in the section below.

11. Place the hub on its outboard end and remove the seal. Retain the seal if it needs to be returned for warranty consideration.
12. Remove the inner bearing cone and spacer.

NOTE: Component Inspection and Replacement Hazard Alert Messages

Read and observe all hazard alert messages in this publication. They provide information that can help prevent serious personal injury, damage to components, or both.

WARNING

To prevent serious eye injury, always wear safe eye protection when you perform vehicle maintenance or service.

Observe all warnings and cautions provided by the press manufacturer to avoid damage to components and serious personal injury.

Do not hit steel parts with a steel hammer. Pieces of a part can break off. Serious personal injury and damage to components can result. Use a brass or synthetic mallet for assembly and disassembly procedures.

Solvent cleaners can be flammable, poisonous and cause burns. Examples of solvent cleaners are carbon tetrachloride, and emulsion-type and petroleum-base cleaners. Read the manufacturer's instructions before using a solvent cleaner, then carefully follow the instructions. Also follow the procedures below. Wear safe eye protection.

Wear clothing that protects your skin.

Work in a well-ventilated area.

Do not use gasoline or solvents that contain gasoline. Gasoline can explode.

You must use hot solution tanks or alkaline solutions correctly. Read the manufacturer's instructions before using hot solution tanks and alkaline solutions. Then carefully follow the instructions.

CAUTION

Do not use hot solution tanks or water and alkaline solutions to clean ground or polished parts. Damage to parts can result.

CAUTION

Clean and dry components Worn or Damaged Components

WARNING

Do not repair or recondition wheel-end components. Replace damaged, worn or out-of-specification components. Do not mill or machine any components. Using repaired, reconditioned, damaged or worn components can cause wheel end failure, which can result in serious injury and property damage.

Hub and Component Cleaning

1. Use a clean filtered solvent to clean the hub and all wheel end components.
2. Clean and inspect the wheel bearing cups and cones, race, spindle bearing and seal journals on the spindle and hub. Bearings should be cleaned with clean filtered solvent and dried with a lint-free rag.
3. Clean and inspect the spindle. Be sure to clean the full length of the seal journal on the spindle.
4. Parts must be dried immediately after cleaning. Dry parts with clean paper towels or rags. Do not dry bearings by spinning with compressed air.
5. Apply light oil to cleaned and dried parts that are not damaged and are to be immediately assembled. Use only the type of oil used by the manufacturer. Do NOT apply oil to the brake linings or the brake drums.
6. If the parts are to be stored, apply a good corrosion preventative to all surfaces. Do NOT apply the material to the brake linings or the brake drums. Store the parts inside special paper or other material that prevents corrosion.

Inspecting Bearing Cups, Cones & Bearing Spacer

NOTE: Pre-Adjusted with Integral Spindle Nut hubs use a precision-machined spacer in conjunction with specially toleranced bearings to control wheel end play. Reyco Granning recommends installing a new Pre-Adjusted with Integral Spindle Nut service kit when inspection indicates that component replacement is necessary. Pre-Adjusted with Integral Spindle Nut service kits are available from a parts dealer or distributor.

CAUTION

If you choose to reuse existing bearings at this service, they must be inspected in accordance with the bearing manufacturers recommended guidelines.

CAUTION

If this inspection indicates that existing bearing component(s) must be replaced, bearing cups and cones must be replaced as a set. Whenever new bearings are installed, replacement of the bearing spacer is also recommended.

1. After components have been properly cleaned, visually inspect the cups, cones and spacer for any wear or damage. Reference materials for proper bearing inspection procedures are available from the bearing manufacturers.

   Bearing spacers should be visually inspected for signs of wear or damage. Carefully inspect the machined ends of the bearing spacer. Wear to the bearing spacer can appear as a sharp ring of standing metal at either edge of the machined surfaces. Replace the spacer if it has visible wear evidenced by a raised edge on the machined end.

2. If removal or replacement is required, follow the steps outlined below.

Removing Cups in Iron Hubs

1. On an iron hub, remove the bearing cup using a large hammer and a mild steel bar or a hydraulic press. Take precaution to avoid damaging the bearing cup bore and shoulder.

2. Inspect the bearing cup bore for evidence of cup rotation or spun cups. If cup rotation exists, replace the hub.

Installing a New Cup in Iron Hubs

Iron hubs do not need to be heated for bearing cup installation. Press the bearing cup into the hub, being certain that it is fully seated. Use a 0.001" to 0.002" feeler gauge to ensure the cup is fully seated against the shoulder of the bearing bore.

Pre-Adjusted with Integral Spindle Nut Wheel Hubs

Reassembly

CAUTION

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

1. Place the hub, seal end up, on a clean work bench surface.
2. For steer hubs, install the tubular bearing spacer with the tapered end down
3. Lubricate the inner bearing cone with the same lubricant as will be used in the hub and install it into the inner bearing cup.

NOTE: The seal must be replaced every time the hub is removed from the spindle. Do not apply any gasket sealant to the seal outer or inner diameter. Always use the seal installation tool specified by the seal manufacturer. Using an improper tool can distort or damage the seal and cause premature seal failure.

4. Position the seal into the hub bore. Use a flat plate and a small mallet to install the seal

NOTE: Seals require the proper tool for installation. For other seals, refer to the specific manufacturers' instructions.

5. When installing the seal, tap the adapter plate of the installation tool around the outer edge to position the seal. Drive the wheel seal into place. Once the tool bottoms out, the seal is installed correctly.
6. Check to be certain the seal is not cocked and that the seal inner diameter and the inner bearing turn freely
7. Lubricate the inner diameter of the seal with a light film of the same lubricant as will be used in the hub.

CAUTION

Failure to lubricate the inner diameter of the seal may result in premature seal failure.

8. Turn the hub over, and place it seal end down on a dry clean surface. Install a bearing spacer. If the spacer has a tapered end, it should face towards the outboard end of the hub.
9. Lubricate the outer bearing cone with the same lubricant as will be used in the hub and install it into the hub assembly.

Spindle Nut and Spiral Snap Ring Reassembly

1. Seat the flat washer into the back of the spindle nut.
2. Position the spindle nut and washer against the outer bearing.
3. Install the spiral snap ring into the snap ring groove in the hub. Make sure that the snap ring is fully seated into the groove in the hub.

Installing the Pre-Adjusted with Integral Spindle Nut

Wheel Hub Assembly

WARNING

Failure to fill the hub with the correct amount of lubricant can cause premature failure of the Pre-Adjusted with Integral Spindle Nut hub assembly, which, if not avoided, could result in death or serious injury

NOTE: Use the proper hubcap for the type of lubricant intended to be used.

1. Clean the spindle to remove any lubricant, corrosion prevention coating, foreign material, or surface rust that may be present.
2. Lubricate the bearing journals on the spindle, or the inside diameter of the bearing cones with Grade 2 grease or the lubricant that will be used in the wheel end. Do not coat the seal journal on the spindle.
3. Lubricate the inside diameter of the seal with the same lubricant that will be used in the wheel end.
4. If present, remove the red locking snap ring from the spindle nut. Verify that the bearing spacer is in proper alignment. Align the key or

flat on the washer with the keyway or flat on the spindle as the hub is placed onto the spindle. Use a smooth firm motion and place the hub onto the spindle. When the threads on the nut engage the threads on the spindle, rotate the nut in a clockwise direction to fully engage the threads.

5. Torque the spindle nut to **300 lb-ft** while rotating the hub. DO NOT BACK OFF THE SPINDLE NUT.
6. Visually examine the three holes in the face of the spindle nut. One of the holes will line up with the holes in the inner washer. Install the tab of the red locking snap ring through the hole in the nut and washer that are aligned. Spread the locking ring, push it over the spindle nut and in to the machined grooves in the spindle nut. Use caution not to bend the locking ring permanently. If the locking ring is damaged or bent, replace it with a new one.
7. Install the hub cap with a new gasket. Torque the hub cap bolts in a star pattern to **12 to 16 lb-ft**.

Replacing Brake Components

Brake Chambers

The brake air chambers should be replaced if damaged or malfunctioning. Refer to manufacturer guidelines for correct function of the brake air chambers.

Other Brake Components

The brake shoe linings should be replaced when they are worn beyond the manufacturer's limits. When the brake linings are serviced, other components should also be serviced. Refer to the brake manufacturers guidelines for servicing the brakes.

Replacing the ABS Sensor and Tone Ring

The anti-lock brake system (ABS) of the vehicle should be diagnosed by a qualified technician before the anti-lock brake sensor or the tone rings are replaced. Replacement parts must be equivalent to the vehicle manufacturer's to ensure proper function of the anti-lock brake system. The anti-lock brake sensor and tone ring cannot be repaired and must be replaced if damaged or malfunctioning.

Sensor Removal

1. Gripping the body of the sensor, pull out of steering knuckle. Do not pull sensor out by its lead wire.
2. Remove tie straps that secure the sensor lead wire and disconnect the sensor lead wire from the chassis wire harness.

Sensor Installation

1. Check that the sensor bushing is properly seated in the steering knuckle and the sensor spring retainer is seated properly in the sensor bushing.
2. Press the sensor into the steering knuckle until the sensor end contacts the tone ring.

3. Connect a volt meter to the connector pins of the sensor lead wire. Set the volt meter to read AC voltage on a millivolt scale.
4. Spin the hub by hand and read the voltage output of the sensor. A minimum reading of 800mV (.8V) AC is required. Skip to Step 8 if minimum reading is obtained.
5. If the minimum reading is not obtained then check the volt meter connection and proximity of the sensor and tone ring. The air gap between the sensor and tone ring should not exceed .027”. Repeat step 4.
6. If the minimum reading is not obtained, check the tone ring for damage and its installation. The tone ring should have a maximum run out of .008”. Replace as needed and repeat step 4.
7. If the minimum reading is still not obtained, then replace the sensor and repeat the installation procedure.
8. Route and secure the sensor lead wire the same as the removed sensor.
9. Connect the sensor lead wire to the chassis. Secure wire lead to prevent damage during suspension movement.

Tone Ring Removal and Installation

Follow the hub manufacturer's guidelines for removal and installation of the tone ring.

Replacing the Shock Absorber

WARNING

Shock absorber is gas pressurized and must not be punctured or subjected to excessive heat which can result in serious personal injury. Shock will expand to full extended length if not restrained.

NOTE: Properly lift and support the vehicle if wheel removal is required to service the shock absorber.

Removal

1. Remove lower shock thru bolt mounting hardware and retain for installation. Do not remove lower shock mount bracket from lower control arm.
2. Remove upper shock thru bolt mounting hardware and retain for installation.

Installation

1. Position shock in suspension such that the thru bolt is connected to the lower shock mounting bracket tabs.
2. Attach upper shock bushing to suspension sub frame with mounting hardware. Do not tighten.
3. Tighten lower thru mounting bolt and nut to **170-180 lb-ft** (See Torque Table). Tighten nuts to 30-40 Ft-Lb (See Torque Table).
4. Tighten upper mounting nut to **245-260 lb-ft** (See Torque Table).

Replacing the Air Spring

The correct air spring must be installed. The use of a substitute air spring is not allowed and may cause unequal load sharing between the air springs and cause adverse ride and handling characteristics.

Removal

1. Deactivate Air Retention System if applicable.
2. Properly lift and support frame 2-3 inches above normal ride height.
3. Deflate the air spring by disconnecting one end of the vertical HCV linkage from the horizontal arm. Rotate the horizontal HCV arm downward and secure it in place.
4. Disconnect the air line at the air spring inlet port and remove the connection fitting from the inlet port.
5. Remove the bolts and washers from the upper air spring mount. Note location of bolts and washers.
6. Remove the bolts that secure the air spring and lower air spring pad to the lower air spring mount.

Installation

1. Attach air spring to lower air spring mount. Tighten lower mounting bolts to **20-30 lb-ft** (See Torque Table).
2. Attach air spring to upper air spring mount.
3. Tighten the upper mounting bolts to **15-20 lb-ft** (See Torque Table).
4. Apply Permatex® or equivalent thread sealant to the threads of the air connection fitting and install the fitting.
5. Connect the airline to the fitting.
6. Inflate the air spring by un-securing the HCV horizontal arm and reconnecting the vertical linkage to it.
7. Check the air line and fitting for air leaks.

Replacing the Height Control Valve

The correct height control valve (HCV) must be installed. The use of a substitute HCV is not allowed and may cause unequal load sharing between the air springs and cause adverse ride and handling characteristics.

NOTE: Some vehicles are equipped with an Air Retention System. Refer to chassis manufacturer documentation for system specifics.

Removal

1. Drain the air from the supply reservoir on the chassis connected to the front suspension.
2. Disconnect the vertical HCV linkage from the horizontal arm.
3. Mark air lines and connections for re-assembly. Disconnect the air lines from the HCV. If any other plumbing fixtures are connected to the HCV, mark them for re-assembly.
4. Remove the HCV mounting hardware from the sub frame.
5. Remove any other air fittings or plumbing fixtures from the HCV.

Installation

1. Apply Permatex® or equivalent thread sealant to the threads of the air connection fittings or plumbing fixtures and install the fittings or plumbing fixtures in the HCV.
2. Attach the HCV to the sub frame with mounting hardware. Orient the horizontal arm horizontally and tighten the mounting nuts to **10-15 lb-ft** (See Torque Table).
3. Connect air lines as marked during removal.
4. Connect the vertical linkage to the horizontal arm.
5. Recharge system with air and check for air leaks.

Check the ride height and adjust per section on adjusting the ride height as needed.

Replacing the Steering Knuckle Carrier Bearings

It is recommended to replace all the steering knuckle carrier bearings at the same time.

The wheel and tire should be removed to provide access. The steering knuckle may be removed to provide easier handling of steering knuckle carrier assembly.

CAUTION

The knuckle carrier must be secured and supported properly when upper and lower mounting bolts are removed.

Removal

CAUTION

Do not apply excessive preload to bearings.

1. Note installed orientation of the lower bar pin. All upper bar pins are factory installed with the “B” located closest to the lower control arm.

NOTE: Lower control arm may move downward due to the internal gas charge in the shock absorber. A portable jack may be needed to align the lower control arm with the knuckle carrier bar pin.

2. Remove the steering knuckle carrier mounting bolts from the upper and lower control arms. Heat may need to be applied to the control arm to loosen the thread adhesive. The control arm temperature must not exceed 300°F. Do not apply heat directly to the bar pin or mounting bolts.
3. Remove steering knuckle carrier.
4. Support fixed shoulder end of the bar pin.
5. Remove retaining clip and outer collar from the split ring.
6. Apply approximately 400 lb press load to the spacer and remove the split collar.
7. Remove spacer and shims.
8. Press bar pin out of bearing cones.
9. Remove outer seals from both sides of bearings.

10. Remove bearing raceways from the steering knuckle carrier. Do not damage bores.
11. Clean the remaining grease from the bearing cavity.

Installation

1. Inspect bearing raceway and seal bores in steering knuckle carrier for burrs or damage. Inspect the bar pin for burrs or damage. Remove burrs and replace damaged components.
2. Press a bearing race into each steering knuckle carrier bore until fully seated.
3. Pack a bearing cone with grease and place it onto the bar pin and seat the inner race on the shoulder.
4. Note the position and orientation of bar pin relative to the carrier. The shoulder end of the bar pin faces forward on the upper bar pin location. The shoulder end of the bar pin faces rearward on the lower bar pin location.
5. Insert the bar pin into the steering knuckle carrier until the bearing cone is seated in the raceway.
6. Turn the steering knuckle carrier over and support the shoulder end of the Bar Pin.
7. Pack a bearing cone with grease and place it onto the bar pin end opposite the shoulder and seat it in the raceway.
8. Place the spacer onto the Bar Pin and seat it against the inner raceway.
9. Apply approximately 400 lbs of press load to the spacer. Place the split collar into the groove of the bar pin and against the spacer.
10. Use a “feeler” gage to measure the gap between the split collar and shoulder of the groove in the bar pin. Record measurement.
11. Remove the load. Then remove the split collar and spacer.
12. Using the gap measurement from Step 10, place a number of shims equivalent to the gap measurement onto the bar pin against the inner raceway.
13. Place the spacer onto the bar pin.
14. Apply approximately 400 lbs of press load to the spacer such that the split collar can be inserted into the groove of the bar pin. Make sure the split collar is fully seated in the groove.
15. Remove the press load.
16. Place the outer collar around the split collar. Install the retaining clip around the split collar on the outside of the outside collar.
17. Press a seal into each seal bore until fully seated.
18. Check bearing preload by rotating the bar pin. Slight to medium drag should be felt. If too loose, add one shim. If too tight, remove one shim.
19. Fill bearing cavity with grease.

20. Install steering knuckle carrier mounting bolts in control arms. Note orientation of bar pin. Apply Loctite #242 to mounting bolt threads and tighten to **545 lb-ft** (See Torque Table).

Cradle Lower Crossmember

Some engine and transmission combinations will require removal of the Cradle Lower Crossmembers to gain access for routine transmission service.

Removal

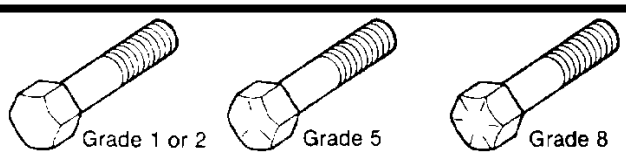
1. Secure the vehicle by setting the parking brake and block the drive wheels to prevent vehicle movement.
2. Raise the vehicle to gain sufficient access to the crossmembers. Support the raised vehicle with safety stands.
   a) Safety stands should be located on suitable frame sections per manufacturer recommendations.
   b) Alternatively, the opposing cross-member can also be utilized.
3. Never remove more than (1) crossmember at once unless the truck is supported solely by the frame.
4. Using a short 1-1/8” thin wall socket and an open end wrench, remove the (8) bolts and nuts securing the crossmember in place.
   a) A variety of breaker bars, ratchets and impacts may be needed depending on the engine configuration.
   b) Note the direction of installation for each bolt.
5. Slide the crossmember away from the suspension and out.

Installation

1. Slide crossmember back in place until holes line up.
2. Place a bar between the (2) outside portions of the cradle directly below the crossmember.
3. Clamp the crossmember down toward this bar using (2) large C-Clamps.
4. Install each of the (8) bolts in place.
   a) If interference is encountered, use the C-Clamps to draw the cross-member further down in the cradle.
   b) If necessary, use a drift to help position the crossmember longitudinally to align the bolt holes.
5. Torque nuts/bolts to **275-300 lb-ft** (See Torque Table).
6. Utilizing standard best practices, remove safety stands and lower unit.

TORQUE TABLES

Most threaded fasteners are covered by specifications that define required mechanical properties, such as tensile strength, yield strength, proof load, and hardness. These specifications are carefully considered in initial selection of fasteners for a given application. To assure continued satisfactory vehicle performance, replacement fasteners used should be of the correct strength, as well as the correct nominal diameter, thread pitch, length, and finish.



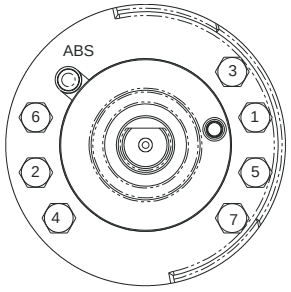
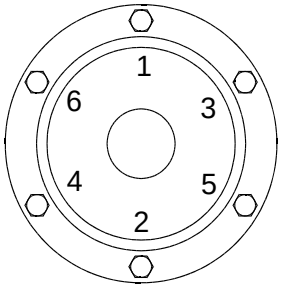
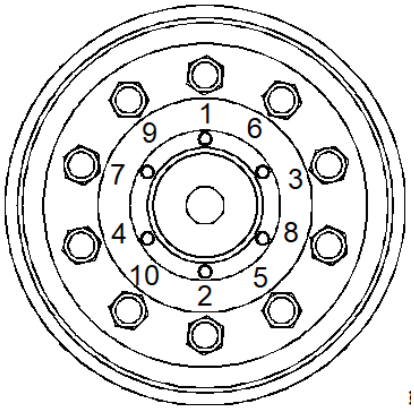
Grade Markings on Bolts

Grade Markings on Lock Nuts		
Grade	Lock Nut Grade B, F	Lock Nut: Grade C, G
Identification	 3 Dots	 6 Dots

Torque Table 1		
APPLICATIONS	**FASTENER SIZE**	**TORQUE SPECIFICATION (lb-ft) (CLEAN AND DRY)**
Upper Control Arm Bushing Pivot Bolt	1-1/8-12 Grade C	950-1050(1)
Lower Control Arm Bushing Pivot Bolt	7/8-9 Grade C	465-485(1)
Eccentric Set Screw	#10-24x3/8	30-40 **(in-lb)**
Carrier to Control Arms Mounting Bolt	7/8-9 Grade 9	545(1,2)
Lower Air Spring Mount Bolt (into carrier)	5/8-18 Grade 8	170-190(1,4)
Air Spring Upper Mount Bolt (into cradle)	3/8-16 Grade 8	15-20(1)
Air Spring Lower Mount Bolt (into air spring base)	1/2-13 Grade 8	20-30(1)
Air Spring lower support (into air spring mounting plate)	1/2-20 Grade 8	30-35(1, 2)
Air Spring lower support (into bottom of air spring)	1/2-13 Grade 8	30-35(1)
Tie Rod Castle Nut	7/8-14	90-100
Tie Rod Clamp Nut	5/8-11 Grade B	50-60
Upper Shock Eye Mount Lock Nut	3/4-10 Grade C	245-260
Lower Shock Eye Mount Lock Nut	3/4-10 Grade C	170-180
Ball Joint into Relay Rod	M70	325-375
Ball Joint Castle Nut	M24 x 1.5	225-245
Steering Stop Jam Nut	5/8-11 Grade B	50-75
Steering Arm Castle Nut	1-1/8-12 Grade C	550-1025(3)
Pitman Arm Attachment Bolt	3/4-16 Grade 8	290-310(1)
Steering Gear attachment Bolts	3/4-16 Grade 8	290-310(1)
Steering Gear attachment Bolt	7/8-14 Grade 8	490-510(1)
Steering Gear side cover to cradle (upper)	3/4-10 Grade C	290-310
Steering Gear side cover to cradle (lower)	3/4-16 Grade 8	290-310(1,2)
Lower Crossmember to cradle	3/4-10 Grade 9	275-300
Kingpin Draw Key Nut	7/16-20 Grade G	30-45
Kingpin Cap Bolt	5/16-18 Grade 8	20-30(1)
Height Control Valve Body Mount Lock Nut	1/4-20 Grade C	10-15
Height Control Valve Linkage (all nuts)	1/4-20/28 Grade B	10-15
Height Control Valve Adjuster Nut	1/4-20	24-28 **(in-lb)**
Spindle Nut (Pro Torq ©)	1-3/4-12	See Adjusting the Wheel Bearings Section
Preset Plus Nut	Integral	300
Disc Brake Caliper Mount Screw 20K	M20x1.5	325-375
Upper Crossmember Clamp Bolts	5/8-11 Grade 8	125-145
Upper Crossmember Attachment bolts	1/2-13 Grade 8	75-85
Upper crossmember to clevis	7/8-9 Grade C	465-485
Leaf Spring to cradle	7/8-9 Grade C	465-485
Upper Shackle/Shock Mount to Carrier	3/4-16 Grade 8	310-320(1,2)
Lower Shackle/Shock Mount to Carrier	5/8-18 Grade 8	175-185(1,2)
Shackle plates to leaf spring and shackle/shock mount	5/8-11 Grade C	155-165
Lower Crossmember brace to cradle	1/2-13 Grade C	75-85
Steering Line Tube Clamp to steering line bracket	1/2-13 Grade C	40-50
Brake hose bracket to carrier	1/4-28 Grade 8	7-12 **(in-lb)** (1,2)
Brake hose clamp to bracket	5/16-18 Grade 5	10-15

1) Torque applied to bolt head.
2) Apply thread adhesive Loctite #242 or equivalent to threads of fastener threaded into tapped hole.
3) Install cotter pin after tightening, never loosen nut to install cotter pin, only tight for pin alignment
4) Apply thread adhesive Loctite #271 or equivalent to threads of fastener threaded into tapped hole.

TORQUE TABLES

Torque Table 2			
APPLICATIONS	**FASTENER SIZE**	**TORQUE SPEC. (lb-ft) (CLEAN AND DRY)**	**TORQUE SEQUENCE**
Torque Plate Mount Cap Screws	3/4-16 Grade 8	290-320	Drivers Side 
Hub Cap Bolt	5/16-18 Grade 5	12-16 (1)	
Wheel Nut	M22x1.5 (Hub Piloted)	450-500(2) (Dry Threads)	

1. Torque applied to bolt head
2. Recheck wheel nut torque after first 50-100 miles.

Page Left Blank Intentionally

Reyco®
Granning®
SUSPENSIONS

Reyco Granning Suspensions
1205 Industrial Park Drive
Mount Vernon, MO 65712
Phone: 417.466.2178 Fax:
833.896.6997
www.reycogranning.com