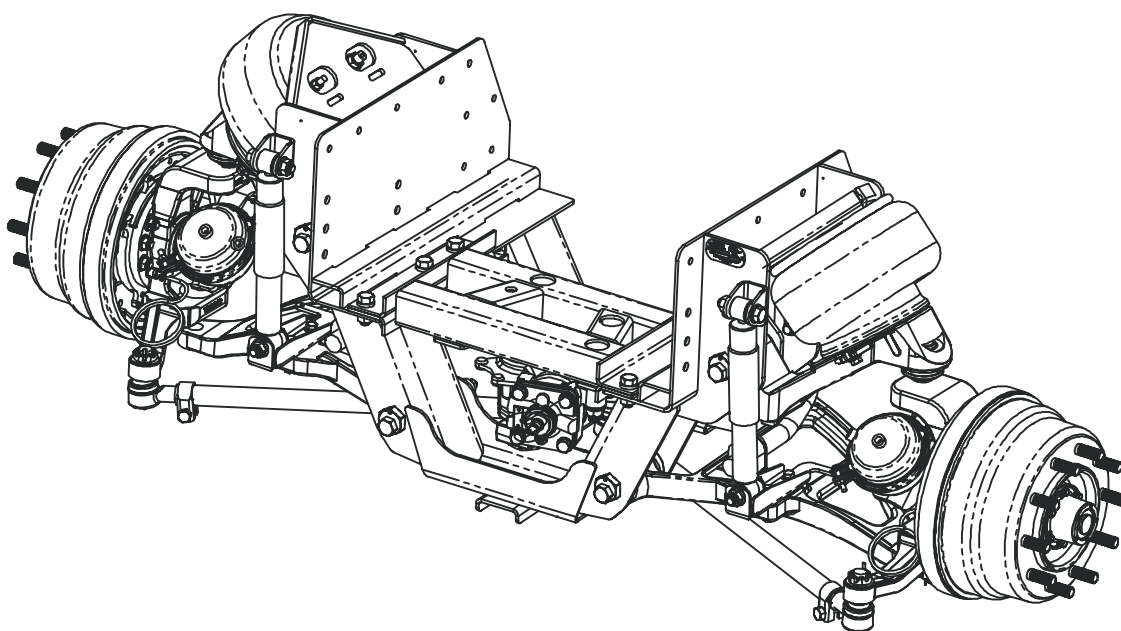




IFS1260/IFS1050S2 INDEPENDENT FRONT SUSPENSION SERVICE MANUAL



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Introduction

Service Notes

This Service Manual describes the correct service and repair procedures for the Reyco Granning® IFS1260 Independent Front Suspension model with 12,600 lbs and the IFS1050S2 Independent Front Suspension model with 10,500 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. Tuthill Transport Technologies reserves the right to modify the suspension and/or procedures and to change specifications at any time without notice and without incurring obligation.

Tuthill Transport Technologies 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.

Identification

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 Tuthill Transport Technologies for control purposes and should be referred to when servicing the suspension or requesting technical support (Figure 2).

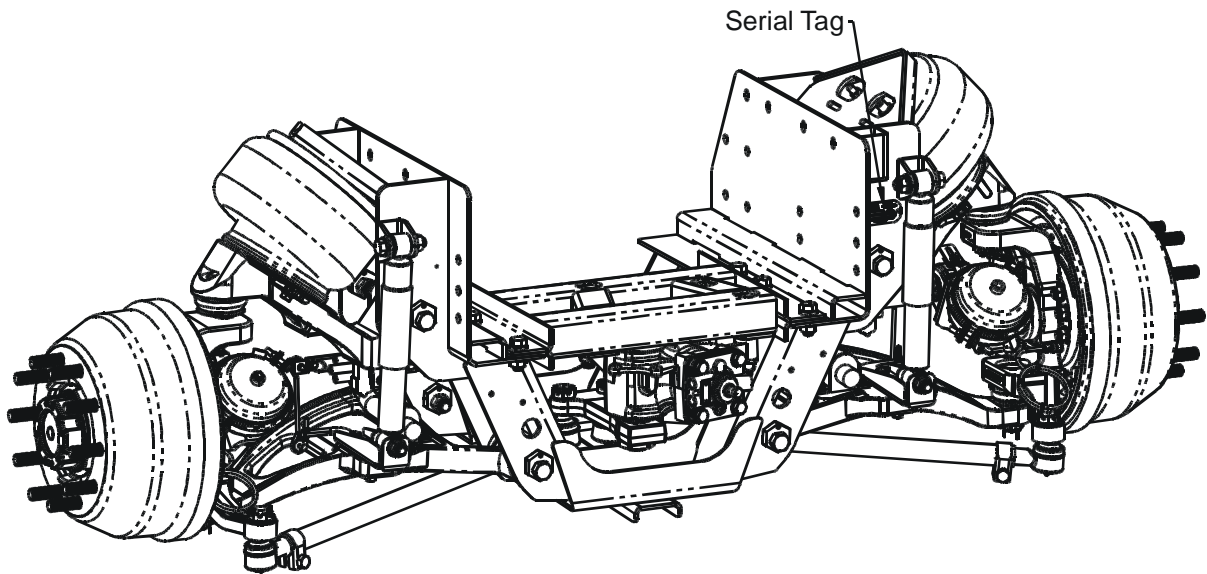


Figure 1- Suspension Identification Location

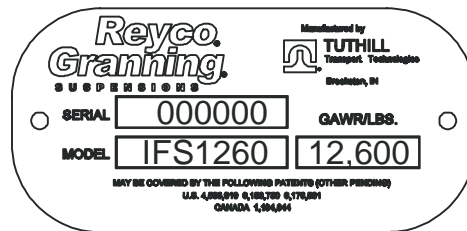


Figure 2 - Suspension Serial Number Tag

Model	GAWR	Wheel Cut	Sway Bar	Drum Brakes
IFS1260S	12,600 lbs.	57° ¹		X
IFS1260S-SB	12,600 lbs.	57° ¹	X	X
IFS1050S2	10,500 lbs.	55° ¹		X
IFS1050S2-SB	10,500 lbs.	55° ¹	X	X

¹Aluminum Rims only. Wheel cut limited to 55° with Steel Rims.

Model Identification Table

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 subframe 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).

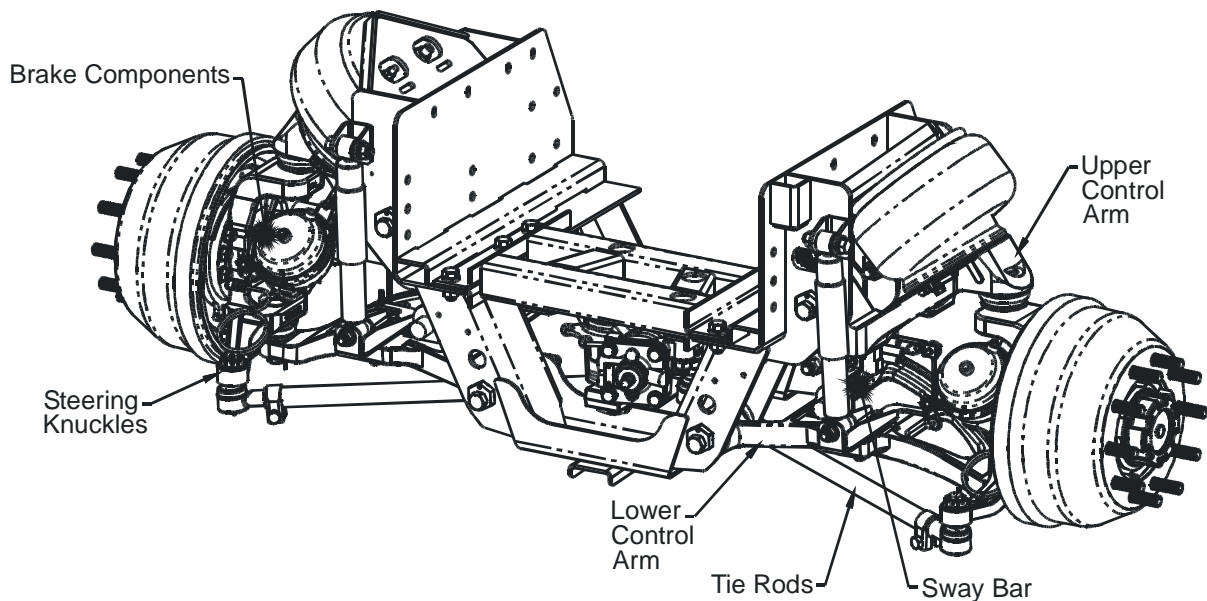


Figure 3 – **Improper** Tow Equipment Attachment Locations

Maintenance Schedule

GENERAL MAINTENANCE	SERVICE TO BE PERFORMED	MILEAGE IN THOUSANDS							
		12	24	36	48	60	72	84	96
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 nut torque	X							
	Check that cotter pin is installed.	X	X	X	X	X	X	X	X ²
Brake System	Inspect slack adjuster for correct stroke.	X	X	X	X	X	X	X	X ²
	Inspect for air leaks using soapy water solution.	X							
Air Springs	Inspect for proper clearance (1" minimum all around).	X							
	Check upper mount nut and lower mount bolt torque.	X							
	Inspect for signs of chafing or wear.	X	X	X	X	X	X	X	X ²
	Inspect for air leaks using soapy water solution.	X							
Height Control Valve and Linkage	Inspect for signs of bending, binding, or slippage.	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
Steering Gearbox / Pitman Arm	Check nut torque.	X							
	Inspect for signs of fluid leak or loose fasteners.	X	X	X	X	X	X	X	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
	Inspect caster and camber 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
Sway Bar Bushings	Check mounting bolt torque.				X				X ²
	Inspect for bushing 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.

Maintenance Record

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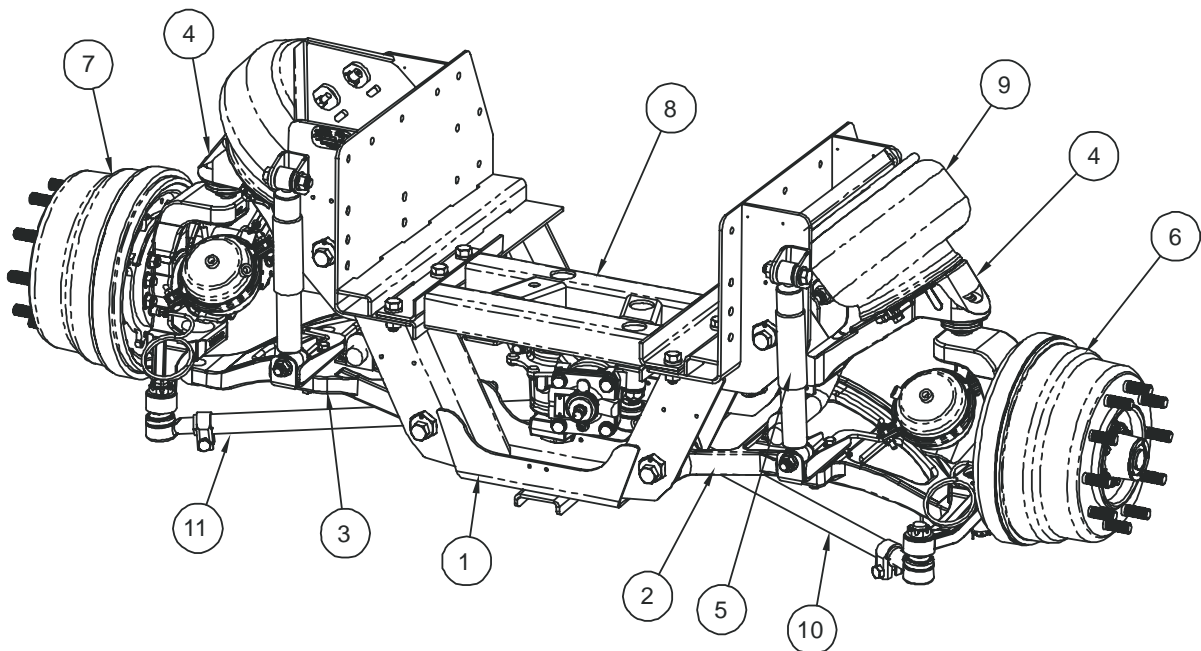
Unit Assembly

Item	Part No.	Description	Item	Part No.	Description
1	704780-01	Cradle Assembly	8	704818-01	Gearbox Assembly *
2	704819-01	Lower Control Arm Assembly, LH		705199-01	Gearbox Assembly **
3	704819-02	Lower Control Arm Assembly, RH		707115-01	Gearbox Assembly ***
4	704823-01	Upper Control Arm Assembly	9	700195-01	Air Spring Assembly
5	8257	Shock Absorber	10	704813-01	Tie Rod Assembly, LH
6	704820-01	Wheel End Assembly, LH*	11	704813-02	Tie Rod Assembly, RH
	704820-03	Wheel End Assembly, LH**			
7	704820-02	Wheel End Assembly, RH*			
	704820-04	Wheel End Assembly, RH**			

* IFS1260

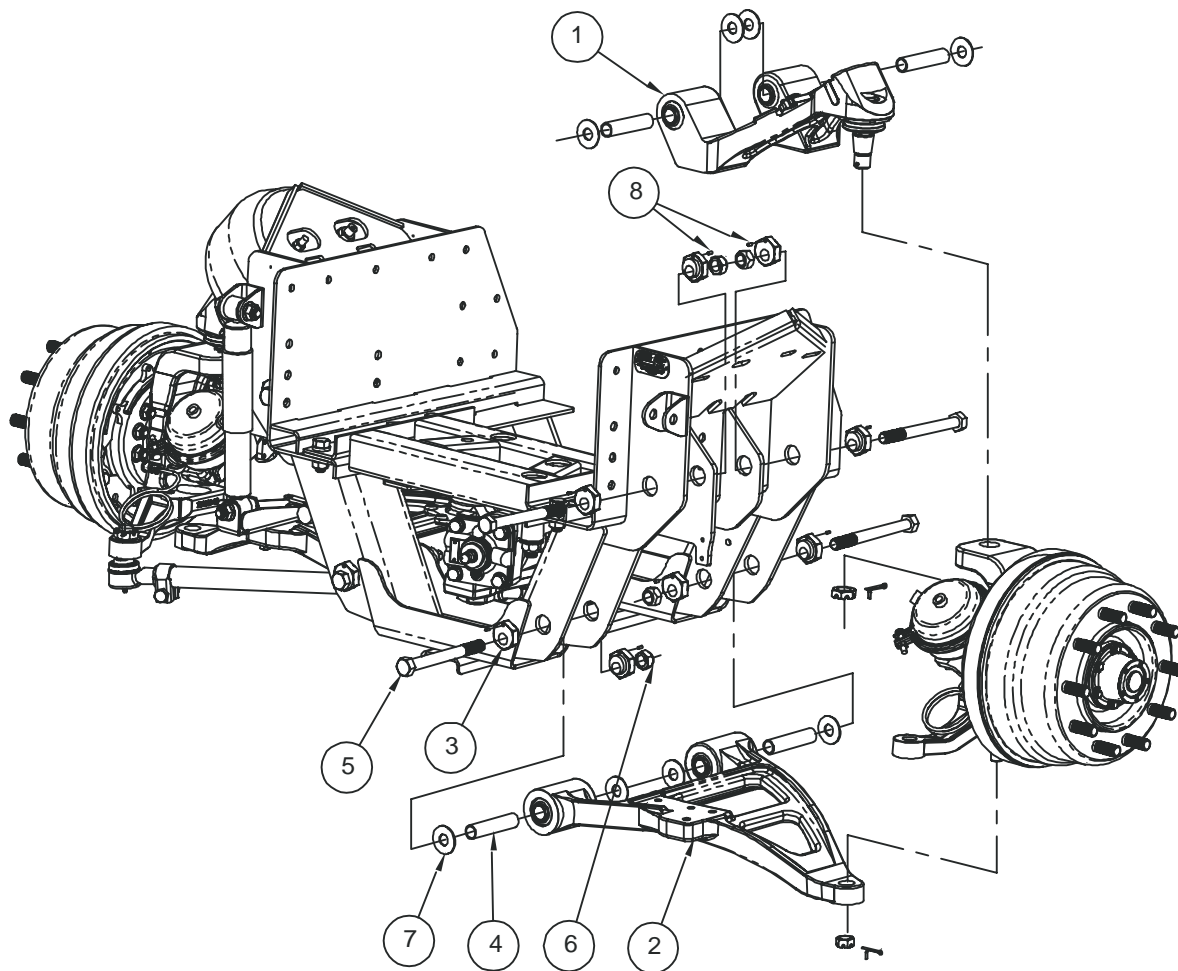
** IFS1050S2

*** IFS1260-TRW



Control Arm Assemblies

Item	Part No.	Description	Item	Part No.	Description
1	704823-01	Upper Control Arm Assembly	5	292	Hex Head Bolt, 7/8"-9 x 8.50", Grade 8, ZN
2	704819-01	Lower Control Arm Assembly, LH	6	100122-P1	Lock Nut, 7/8"-9 Grade C, ZN
	704819-02	Lower Control Arm Assembly, RH	7	701683-04	Hardened Flat Washer, 7/8"
3	700245-01	Eccentric Boss	8	293	Socket Set Screw, #10-24 x .38"
4	8490	Spacer			

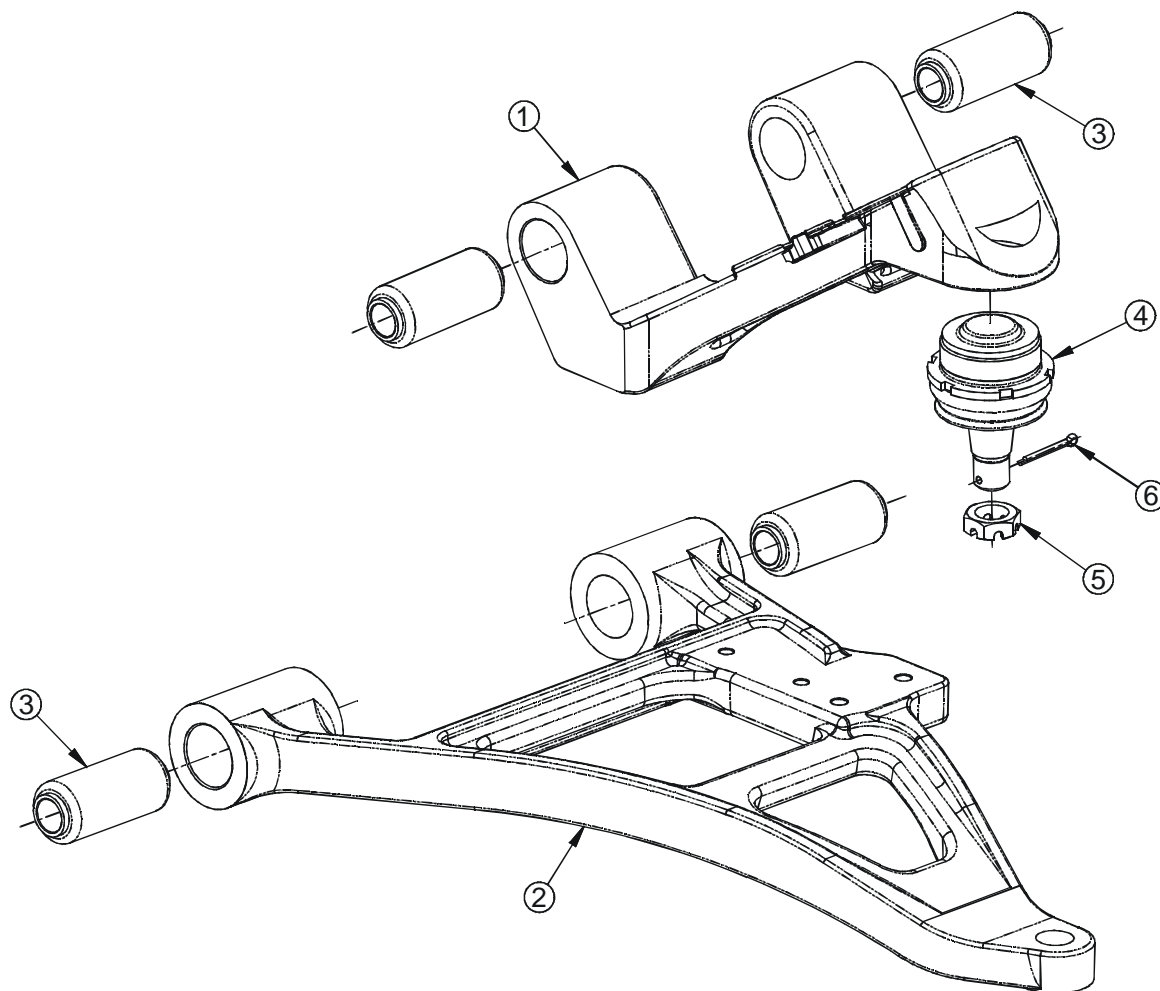


Control Arm Components

Item	Part No.	Description	Item	Part No.	Description
1	704822-01	Upper Control Arm	-	*K705383	Ball Joint Kit (65mm)
2	704814-01	Lower Control Arm, LH	4	**705383-01	-Ball Joint (65mm)
	704814-02	Lower Control Arm, RH	5	**705383-02	-Slotted Nut, M30 x 1.5
3	8382	Bushing	6	**705383-03	-Cotter Pin, 1/4 x 1.94 ZN

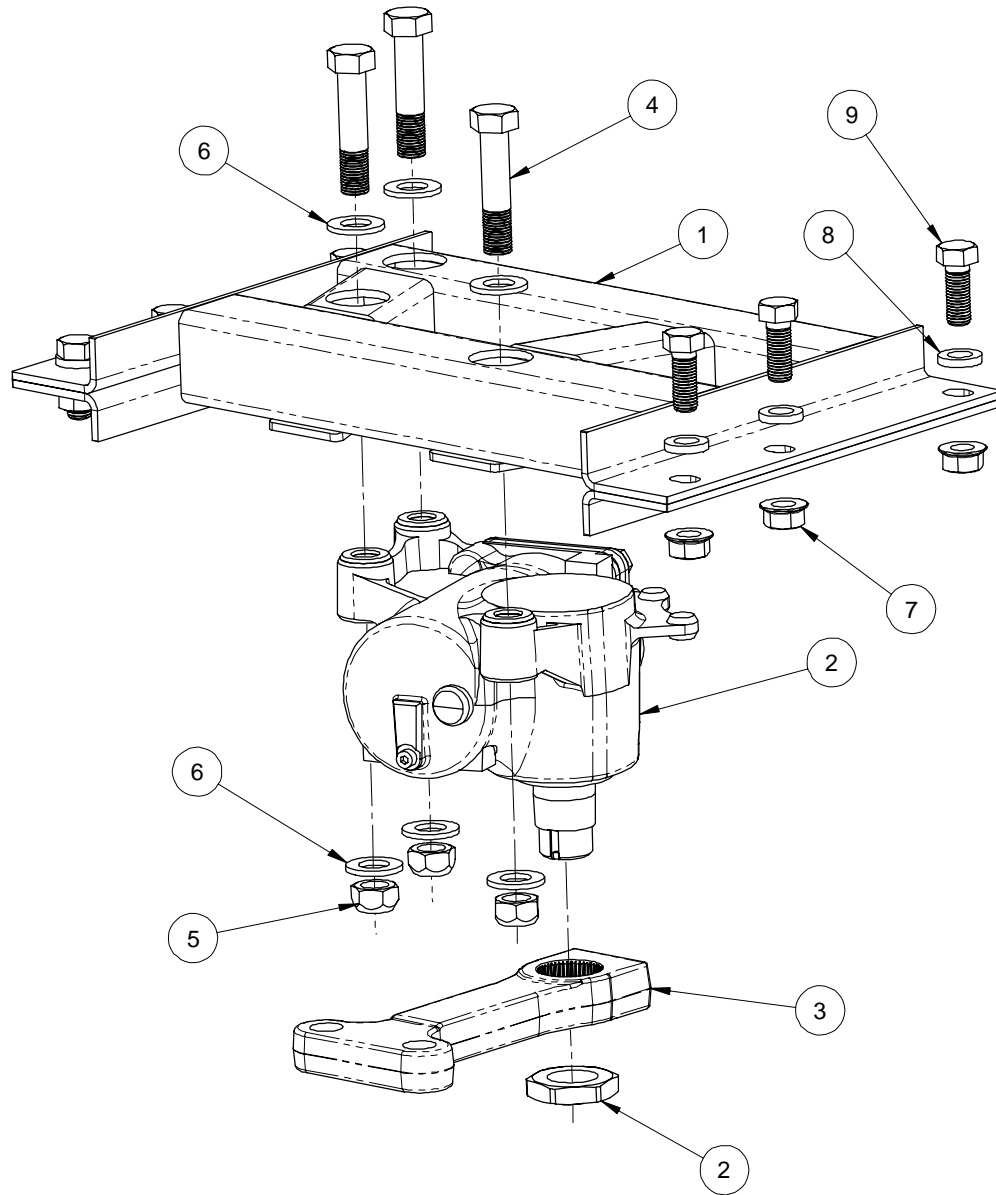
*Ball Joint Asy. is a component of Upper Control Arm Assembly

**Components of Ball Joint Kit K705383



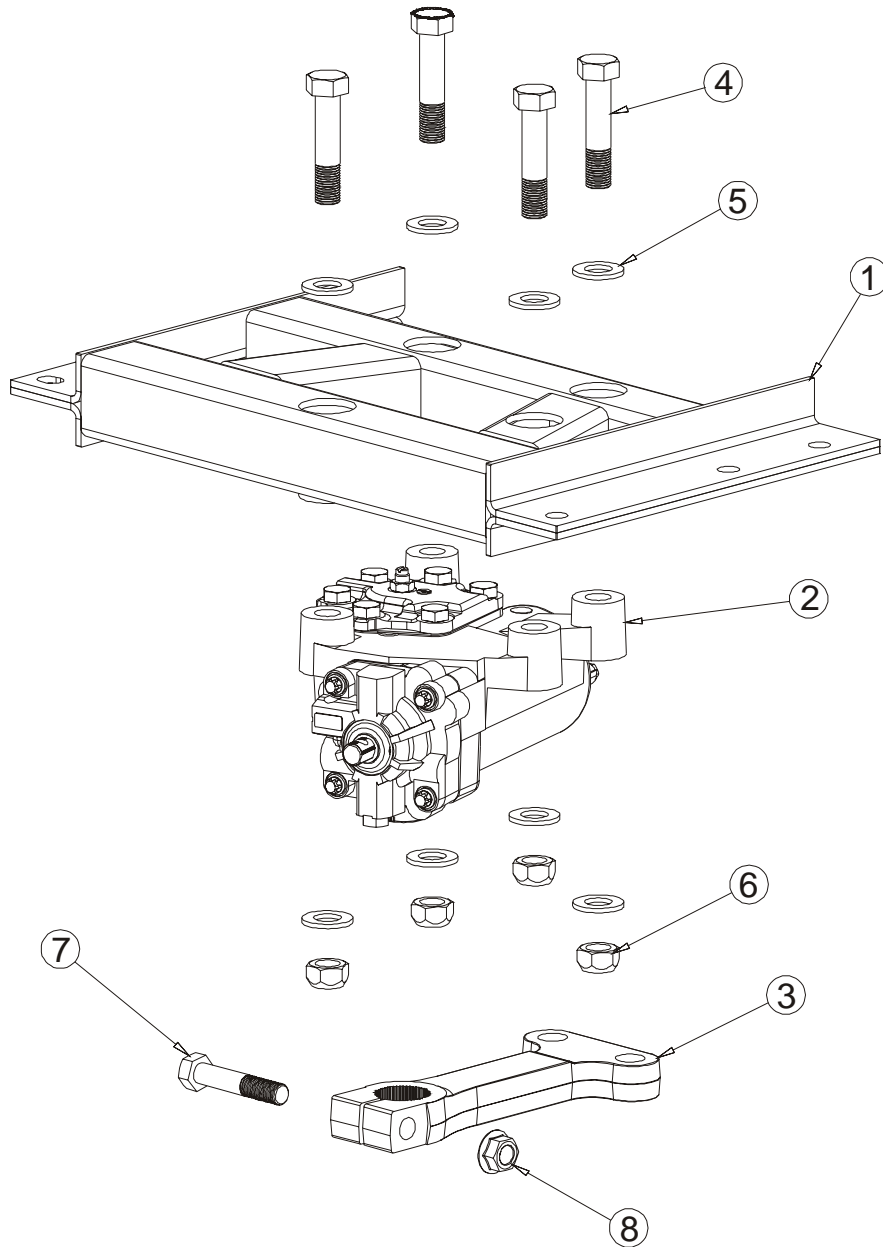
Steering Gearbox Assembly (IFS1260)

Item	Part No.	Description	Item	Part No.	Description
1	704803-01	Gearbox Mounting Bracket Assembly	6	104098	Hardened Flat Washer, 7/8"
2	704730-01	Gearbox (includes pitman arm retaining nut)	7	208	Locking Flange Nut, 3/4"-10, Grade G, ZN
3	704169-02	Pitman Arm	8	152	Hardened Flat Washer, 3/4"
4	702637-02	Hex Head Bolt, 7/8"-9 x 4.0", Grade 8, ZN	9	10689-P1	Hex Head Bolt, 3/4"-10 x 2", Grade 8, ZN
5	100122-P1	Lock Nut, 7/8"-9, Grade C, ZN			



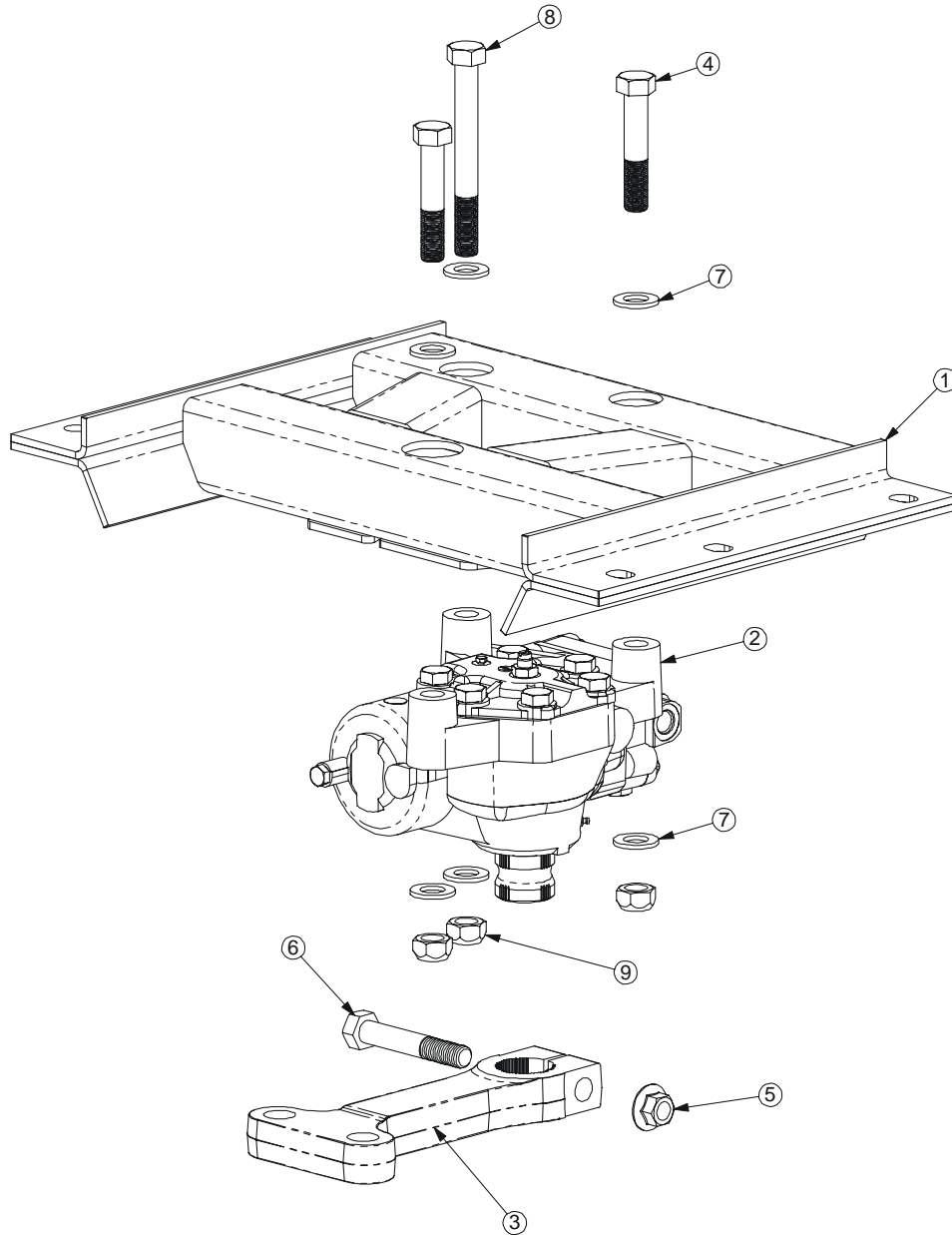
Steering Gearbox Assembly (IFS1260-TRW)

Item	Part No.	Description	Item	Part No.	Description
1	707111-01	Gearbox Mounting Bracket Assembly	5	104098	Lock Nut, 7/8"-9, Grade C, ZN
2	707098-01	Asy, Gearbox, TRW TAS66	6	100122-P1	Hardened Flat Washer, 7/8"
3	704169-03	Pitman Arm	7	8223833	Hex Head Bolt, 3/4"-16 x 4", Grade 8, ZN
4	702637-02	Hex Head Bolt, 7/8"-9 x 4.0", Grade 8, ZN	8	178	Locking Flange Nut, 3/4"-16, Grade C, ZN



Steering Gearbox Assembly (IFS1050S2)

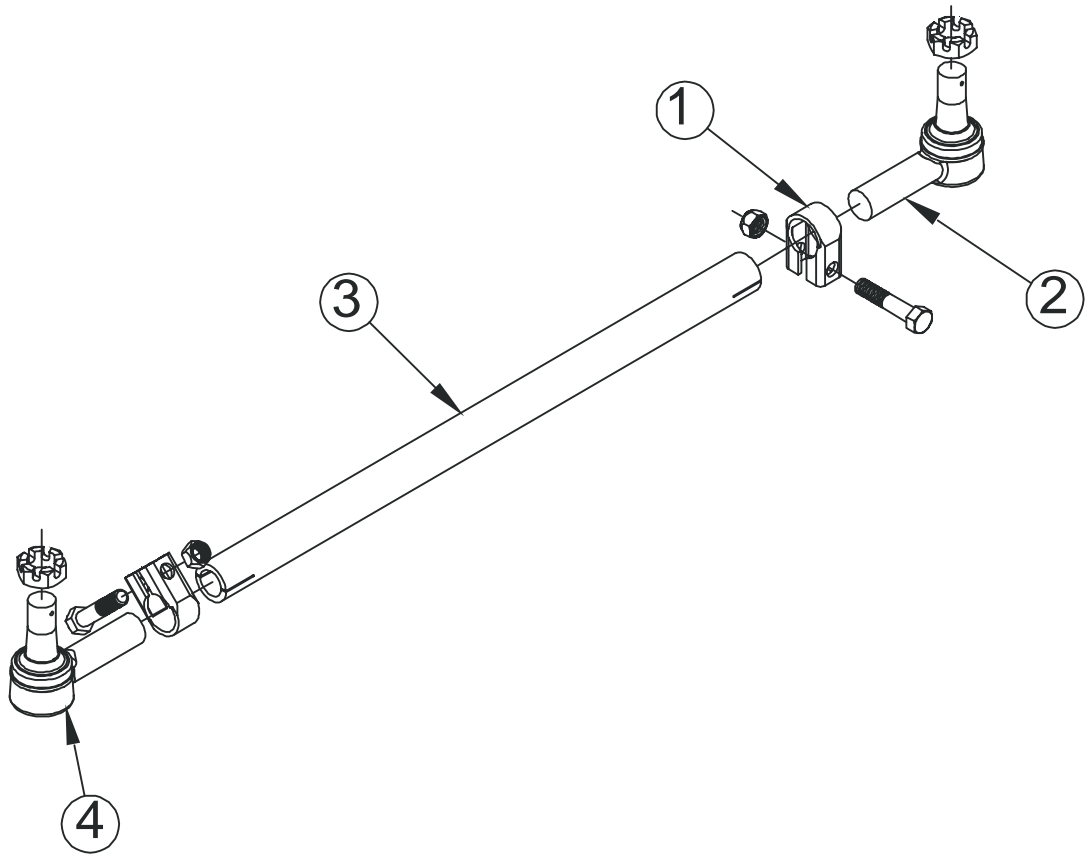
Item	Part No.	Description	Item	Part No.	Description
1	705200-01	Gearbox Mounting Bracket Assembly	6	150	Hex Head Bolt, 3/4"-16 x 4.5", Grade 8, ZN
2	700030-01	Gearbox (includes pitman arm retaining nut)	7	8131017	Hardened Flat Washer, 3/4"
3	704169-01	Pitman Arm	8	8224262	Hex Head Bolt, 3/4"-16 x 6.5", Grade 8, ZN
4	8223833	Hex Head Bolt, 3/4"-16 x 4.0", Grade 8, ZN	9	89422308	Lock Nut, 3/4-16, Grade C, ZN
5	178	Locking Flange Nut, 3/4-16, Grade C, ZN			



Tie Rod Assemblies

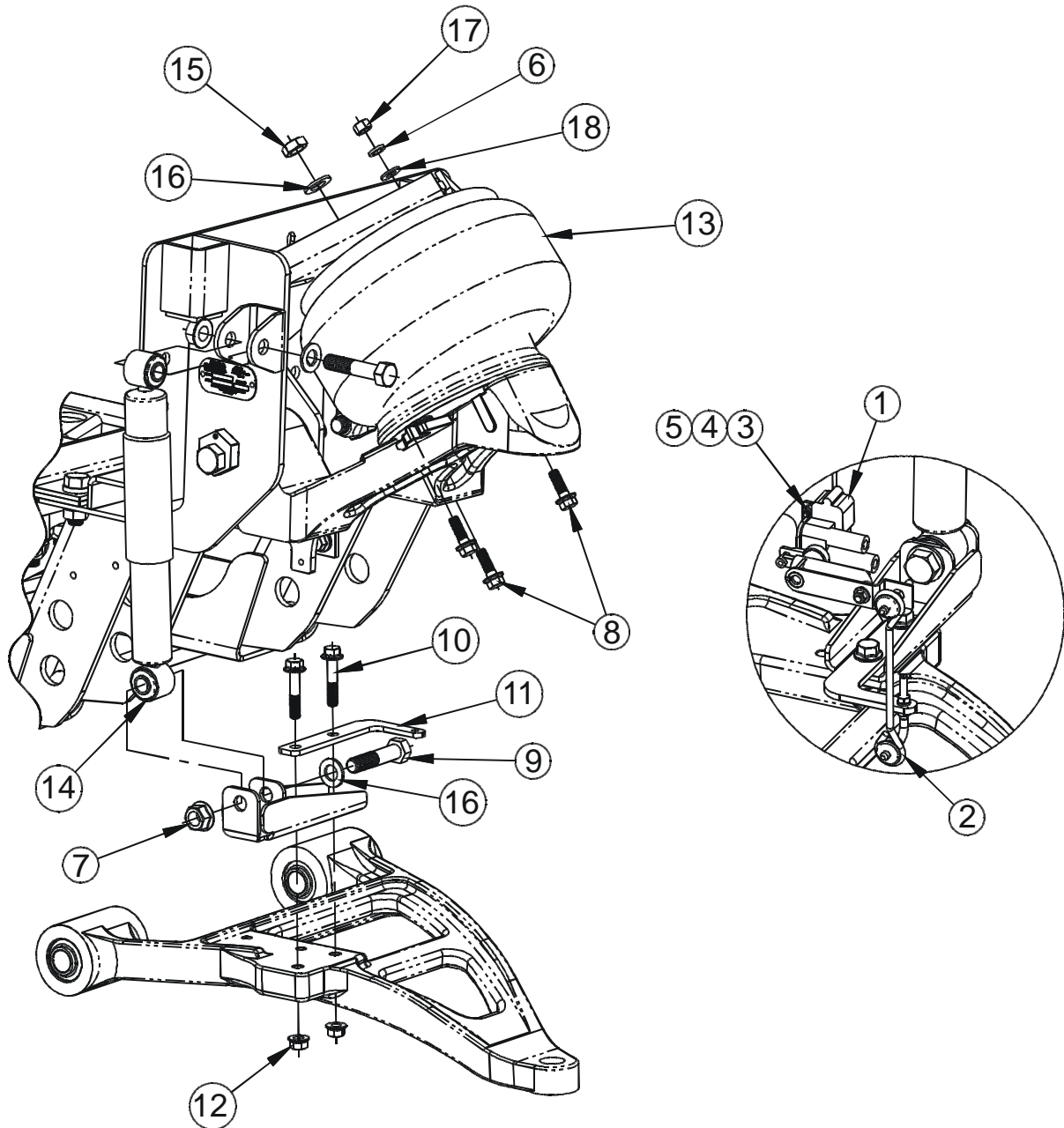
Item	Part No.	Description	Item	Part No.	Description
1	6632	Tie Rod Clamp Assembly (includes bolt and nut)	3	704240-01	Tie Rod Tube
2	105564	Tie Rod End, LH (includes castle nut)	4	8455	Tie Rod End, RH (includes castle nut)

101445-P1 Cotter Pins not shown.



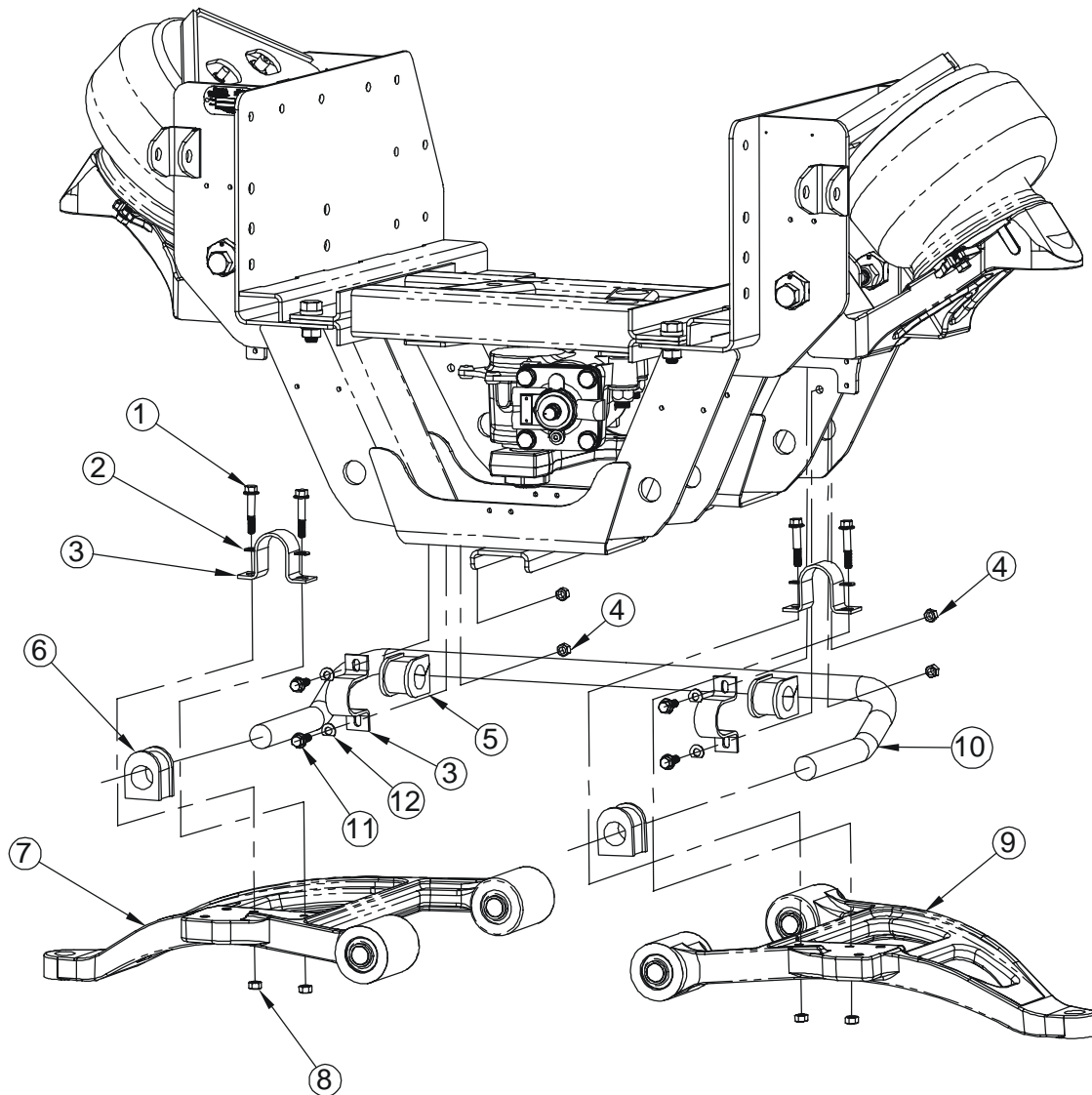
Air Spring, Shock & HCV Components

Item	Part No.	Description	Item	Part No.	Description
1	8718	Height Control Valve Assembly	10	180	Flange Head Bolt, 1/2"-13 x 2.50", Grade 8, ZN
2	703915-03	Height Control Linkage	11	704799-01	Height Control Support Arm
3	100703-P1	Lock Nut, 1/4"-20, Grade C, ZN	12	308	Locking Flange Nut, 1/2"-13, Grade G, ZN
4	100702-P1	Hex Head Bolt, 1/4"-20 x 1.0" Grade 8, ZN	13	700195-01	Air Spring Assembly
5	8120392	Flat Washer, 1/4"	14	8257	Shock Absorber
6	8103323	Spring Lock Washer, 1/2"	15	8219758	Jam Nut, 3/4"-16, Grade 5, ZN
7	208	Locking Flange Nut, 3/4"-10, Grade G, ZN	16	8131017	Flat Washer, 3/4"
8	307	Flange Head Bolt, 1/2"-13 x 1.50", Grade 8, ZN	17	8120378	Hex Nut, 1/2"-13, Grade 5, ZN
9	100678-P1	Hex Head Bolt, 3/4"-10 x 3.50", Grade 8, ZN	18	118	FW 1/2 .531x1.062x.095 ZP



Sway Bar Components

Item	Part No.	Description	Item	Part No.	Description
1	702797-03	Flange Head Bolt, 7/16"-14 x 2.5", Grade 8, ZN	7	704819-02	Lower Control Arm Assembly, RH
2	702898-01	HFW 7/16", Cut, Sway Bar	8	89422299	Lock Nut, 7/16"-14, Grade 8, ZN
3	702894-01	D-Ring Mount	9	704819-01	Lower Control Arm Assembly, LH
4	308	Lock Nut, 1/2"-13, Grade 8, ZN	10	704816-01	Sway Bar
5	702895-02	Split Sway Bar Bushing	11	307	Flange Head Bolt, 1/2"-13 x 1.5", Grade 8, ZN
6	702895-01	Solid Sway Bar Bushing	12	702898-02	HFW 1/2", Cut, Sway Bar



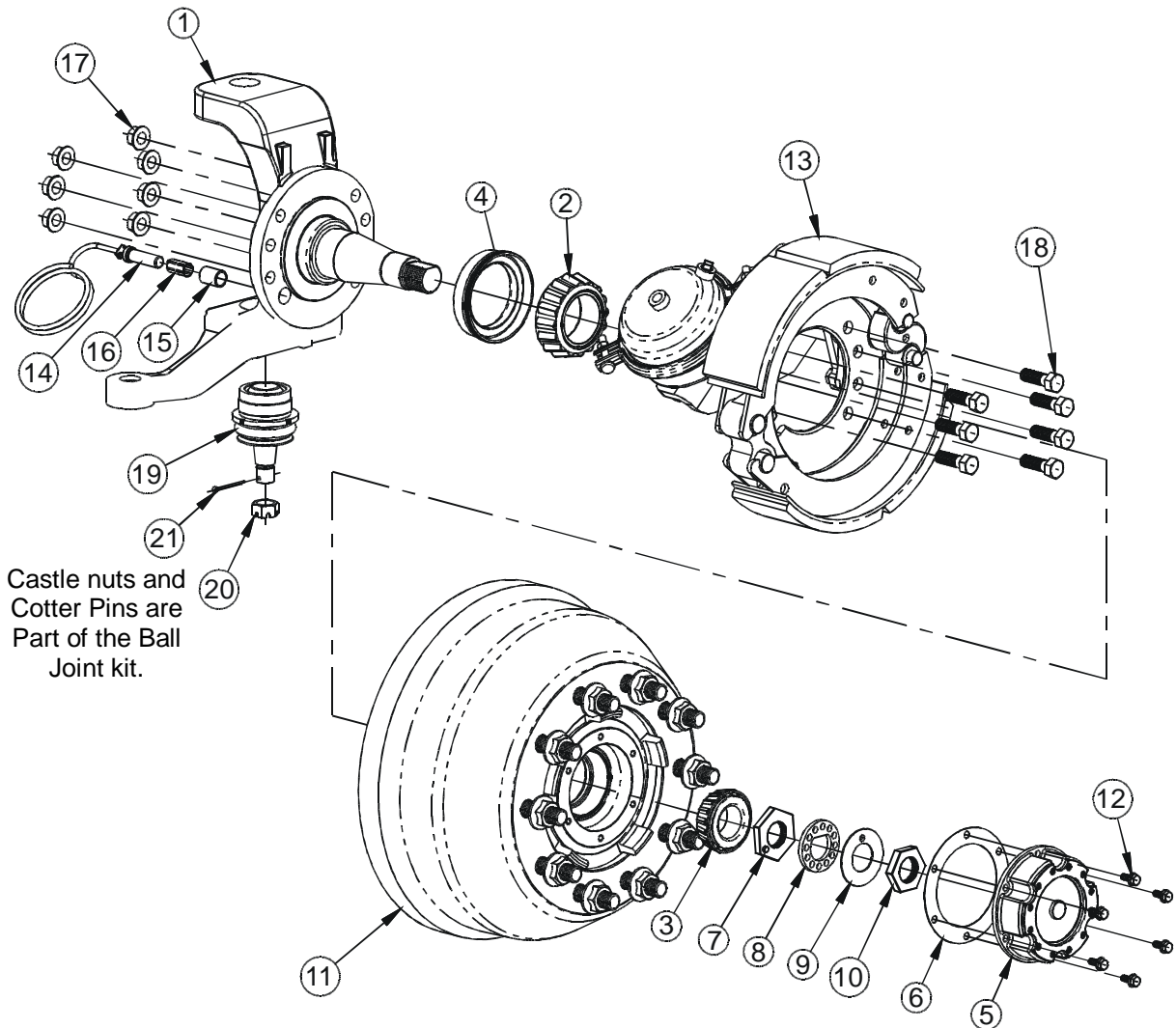
Wheel End Components

Item	Part No.	Description	Item	Part No.	Description
1	704821-01	Knuckle Assembly, LH	13	704824-01	Brake Assembly, 15x4, LH*
	704821-02	Knuckle Assembly, RH		704824-02	Brake Assembly, 15x4, RH*
2	1784	Taper Roller Bearing		700248-01	Brake Assembly, 15x4, LH**
3	6972	Taper Roller Bearing		700248-02	Brake Assembly, 15x4, RH**
4	7977	Oil Seal Assembly	14	7328	ABS Sensor
5	6973	Hub Cap	15	7329	ABS Sensor Bushing
6	1786	Hub Cap Gasket	16	6946	ABS Sensor Retainer Spring
7	6967	Inner Nut	17	4599	Locking Flange Nut, 5/8"-18, Grade G
8	6968	Spindle Lockwasher	18	126	Hex Head Bolt, 5/8"-18 x 2", Grade 8, ZN
9	6969	Spindle Washer	***	K705381	Ball Joint Kit
10	6970	Outer Nut	19	705381-01	- Ball Joint (50mm)
11	705015-01	Hub and Drum Assembly	20	705381-02	- Castle Nut, M24 x 1.5
12	266	Flange Head Bolt, 5/16"-18 x .75", Grade 5	21	705381-03	- Cotter Pin 1.58 x .18 Dia.

*IFS1260

**IFS1050S2

***Ball Joint Kit for service use.

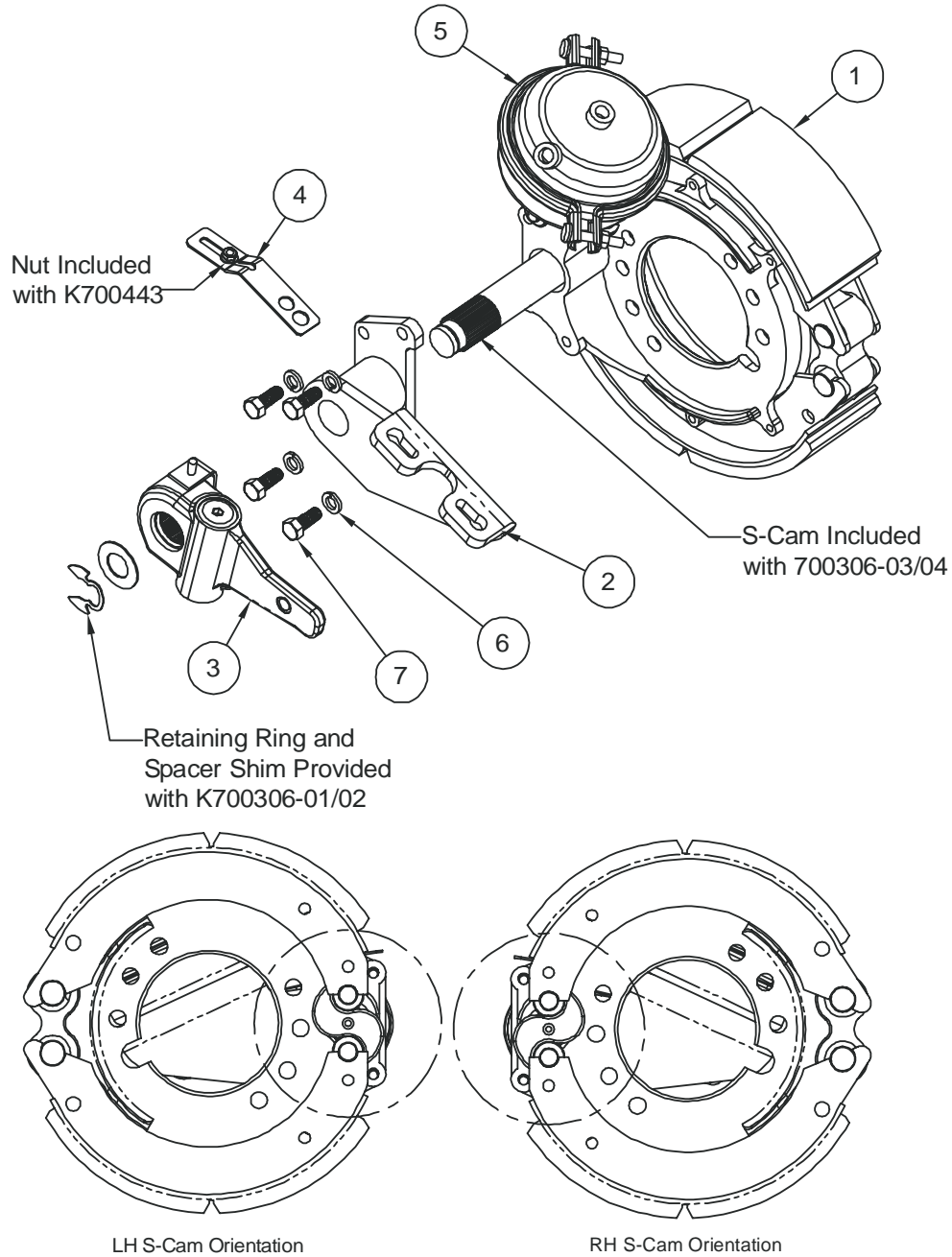


Drum Brake Components

Item	Part No.	Description	Item	Part No.	Description
1	705300-01	Brake Spider Assembly, LH	4	K700443	Slack Adjuster Bracket Kit
	705300-02	Brake Spider Assembly, RH	5	700305-02	Air Chamber Assembly, Type 20 (includes mounting hardware)*
2	700306-03	S-Cam Tube Assembly, LH		700305-01	Air Chamber Assembly, Type 16 (includes mounting hardware)**
	700306-04	S-Cam Tube Assembly, RH	6	8103323	Spring Lock Washer, 1/2"
3	700420-01	Automatic Slack Adjuster (Haldex)	7	102782	Hex Head Bolt, 1/2"-13 x 1.25", Grade 8, ZN

*IFS1260

**IFS1050S2



Lubrication

Lubricant Specifications and Intervals

COMPONENT	SERVICE INTERVAL	CHANGE INTERVAL	LUBRICANT SPECIFICATION
Ball Studs on Ends of Tie Rods	Which ever comes first: Every oil change or every 6 months.	N/A	Multi-Purpose Chassis Grease Premium Multi-Purpose Chassis Grease NLGI Grade 2
Brake S-Cam Tube and Automatic Slack Adjuster ¹	Which ever comes first: Brakes relined. 50,000 miles (80,000 kilometers) or once a year.	N/A	Premium Multi-Purpose Chassis Grease NLGI Grade 2
Wheel End	1000 miles (1600 kilometers) Check fluid level.	Which ever comes first: Seals replaced, brakes relined, 100,000 miles (160,000 km), or once a year.	Gear Oil SAE 80W/90 or equivalent

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

General Lubrication

Proper lubrication practices are important in maximizing the service life of your ReycoGranning® 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.

Ball Studs on Tie Rods

1. Review lubricant specification and interval requirements before servicing.
2. Apply lubricant to grease fitting until new lubricant discharges from the dust boot (Figure 4).

Brake S-Cam Tube and Automatic Slack Adjuster

1. Review lubricant specification and interval requirements before servicing.
2. Apply lubricant to the S-cam tube until new lubricant discharges from the S-camshaft bushing seal next to the automatic slack adjuster. (Figure 4).
3. Apply lubricant to the automatic slack adjuster until new lubricant discharges from the cone clutch adjacent the adjusting hex nut. (Figure 4).

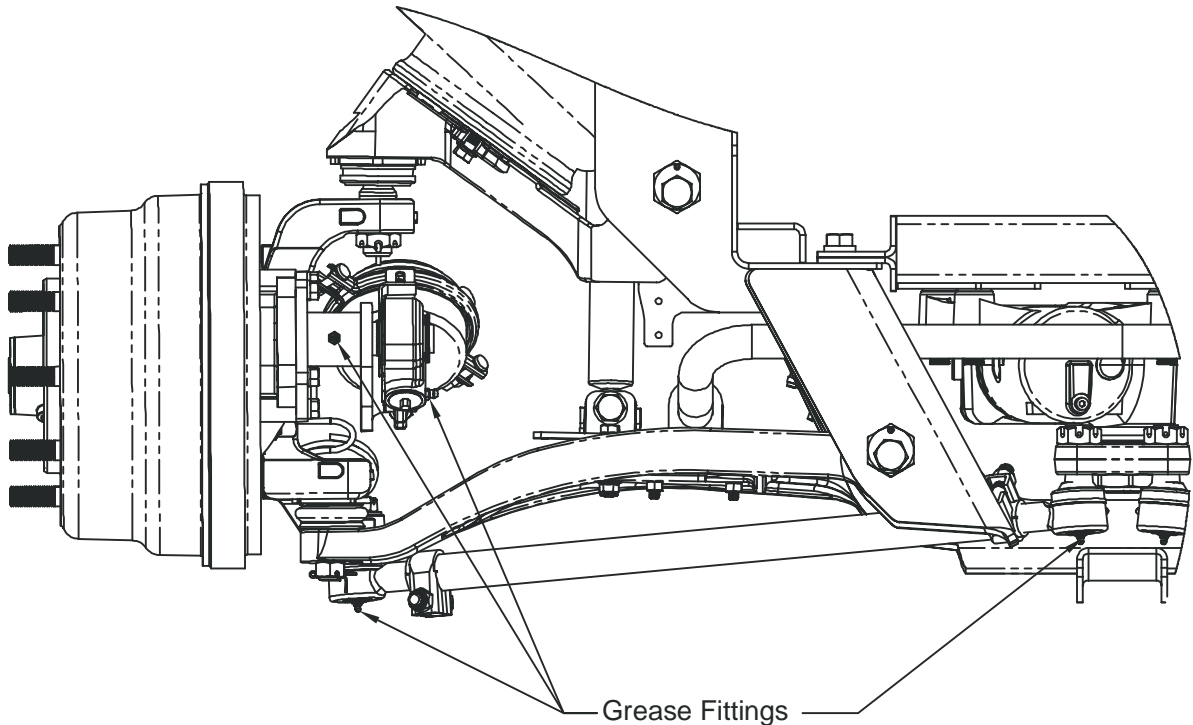


Figure 4 – Location of lubrication fittings. Note: Left side only shown.

Wheel Bearings

1. Review lubricant specification and interval requirements before servicing.
2. 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.)
3. 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.

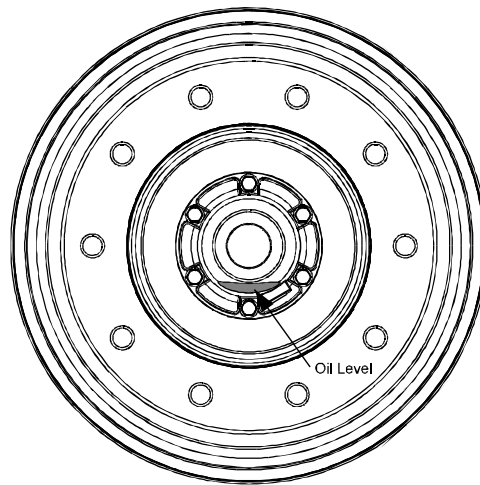


Figure 5 - Wheel Bearing Oil Level

Troubleshooting

SYMPTOMS	POSSIBLE CAUSES	REMEDIES
Tires wear out quickly or have uneven tire tread wear. Note: <i>Wear pattern will indicate possible cause(s). Consult tire manufacturer for guidance.</i>	Tires have incorrect pressure.	Put specified air pressure in tires.
	Tires out of balance.	Balance or replace tires.
	Incorrect toe-in setting.	Adjust toe-in to specified setting.
	Incorrect ride height.	Adjust ride height to specified setting.
	Incorrect rear axle alignment.	Align rear axle to specified thrust angle.
	Incorrect steering arm geometry.	Adjust tie rod lengths as required.
	Improper (mismatched) tires and wheels.	Install correct tire and wheel combination.
Vehicle is difficult to steer. Note: <i>Engine must be running for power steering to be active and able to provide steering assist.</i>	Improper oversized tires.	Install correct tire and wheel combination.
	Tires not uniform.	Install correct tire and wheel combination.
	Tires have incorrect pressure.	Put specified air pressure in tires.
	Incorrect steering arm geometry.	Adjust tie rod lengths as required.
	Ball joints binding.	Inspect ball joints for wear and replace as required.
	Tie rod ends binding.	Inspect tie rod ends for wear and lubricate as needed.
	Steering column linkage binding.	Align or adjust as required.
	Steering miter box binding.	Check steering miter box and repair or replace as required.
	Steering gear valve binding.	Inspect, repair or replace as required.
	Steering 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.
	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.

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.
	Ball joints binding or worn.	Inspect ball joints for wear or contamination 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 to specification.
	Steering column mis-aligned.	Realign steering column as required.
	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 slack adjusters 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.

SYMPTOMS	POSSIBLE CAUSES	REMEDIES
Vehicle pulls to one side with the brakes applied.	Grease, oil or dirt on brake linings.	Replace brake linings as required.
	Brake linings are glazed.	Deglaze brake linings by burnishing or replace as required.
	Brake linings are not a balanced set, different friction codes or lining brand.	Replace brake linings as required.
	Loose or broken brake linings.	Replace brake linings as required.
	Brake drum out of round.	Re-machine or replace brake drum as required.
	Defective brake drum.	Inspect for defects and replace as required.
	Brake air chamber clevis pin or camshaft binding.	Check and lubricate as needed.
	Defective slack adjuster.	Inspect for defects and replace as required.
	Uneven brake adjustment side to side.	Adjust slack adjuster as required.
	Different brake air chamber size or slack adjuster length side to side.	Replace with same size brake air chambers and length slack adjusters.
	Brake chambers air pressure uneven side to side.	Check side-to-side air pressure and correct as needed.
	Unequal brake air chamber stroke side to side.	Check side-to-side stroke and adjust as required.
	Rear axle brakes mis-adjusted 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.
	Sway bar bushings worn.	Check sway bar bushings and replace as needed.
	Sway bar mounting brackets loose.	Check sway bar mounting brackets and tighten as needed.
	Control arm pivot bushings worn.	Inspect and replace as required.
	Internal leak in height control valve.	Check height control valve and replace as required.
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.

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.
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 gear poppet valves set incorrectly.	Check wheel turn angles and adjust as required.
	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.
Brakes are noisy.	Grease, oil or dirt on brake linings.	Replace brake linings as required.
	Brake linings are glazed.	Deglaze brake linings by burnishing or replace as required.
	Brake linings are not a balanced set, different friction codes or lining brand.	Replace brake linings as required.
	Loose or broken brake linings.	Replace brake linings as required.
	Brake drum out of round.	Re-machine brake drum as required.
	Defective brake drum.	Inspect for defects and replace as required.
	Excessive dirt built up in brake drum cavity.	Remove excessive dirt from brake drum cavity.

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

Tuthill Transport Technologies 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 for Wear

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 subframe-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 subframe mount or presence of small rubber particles near subframe bushing mount.

-
3. Check that the control arm mounting bolts are tight. Recommended torque is **460-490 lbf·ft.** for the control arms. See Torque Table. A loose joint will result in wear between the bushing inner sleeve and sub frame mount.

Checking the Ball Joint Seal and Axial Play



WARNING

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

1. Deflate the air springs. The air spring may be deflated by disconnecting the vertical link from the height control valve (HCV) horizontal link or the upper control arm mount and positioning the HCV horizontal link downward. Secure the HCV link to ensure it does not move and re-inflate the air spring.
2. Remove the tires as needed for access to inspect seals and make measurements.

Lower and Upper Ball Joint 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.

Lower Ball Joint Axial Play Inspection

1. Place a support under the tire or brake drum to position the suspension near its ride height. The shock length at ride height is 16.36”.
2. Install a dial indicator with a magnetic base so that the base is fixed to the lower control arm. Place the indicator tip on the bottom of the lower ball joint base.
3. Using a C-clamp, squeeze the knuckle and the lower control arm together to seat the ball joint. Do not apply excessive clamp load.
4. Set the dial indicator on “zero”.
5. Release the clamp. Place the pry bar between the lower control arm and steering knuckle. Firmly pry the steering knuckle downward and record the dial indicator reading. A reading greater than .040 inch will require ball joint replacement

Upper Ball Joint Axial Play Inspection

1. Place a support under the tire or brake drum to position the suspension near its ride height. The shock length at ride height is 16.36”.
 2. Install a dial indicator with a magnetic base so that the base is fixed to the upper control arm. Place the indicator tip on the bottom of the upper ball joint base.
 3. Using a C-clamp, squeeze the knuckle and the upper control arm together to seat the ball joint. Do not apply excessive clamp load.
 4. Set the dial indicator on “zero”.
 5. Release the clamp. Place the pry bar between the upper control arm and steering knuckle. Do not allow the pry bar to contact the ball joint seal. Firmly pry downward using the steering knuckle as a fulcrum to lower the upper control arm. The pry load must not cause the tire or brake drum to be lifted off its support thus causing the suspension to change position.
 6. Record the dial indicator reading. A reading greater than .060” will require ball joint replacement.
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. 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 lbf·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. 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)

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.

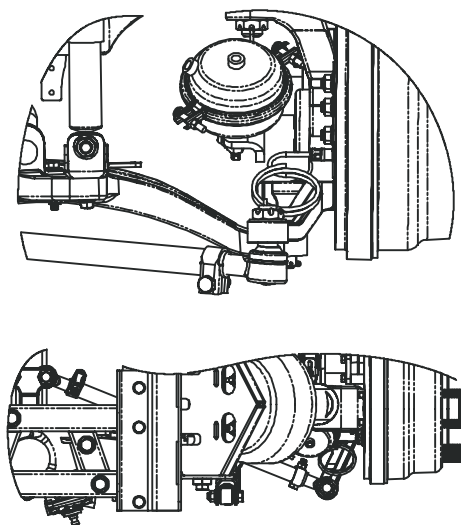


Figure 6 - Tie Rod Orientation
(Driver Side Shown)

Inspecting the Automatic Slack Adjusters and Brake System

Automatic Slack Adjusters

The suspension system is equipped with automatic slack adjusters for steer axles. For inspection and adjustment refer the Haldex technical service guidelines.

Brake System

The suspension system is equipped with Dana 15x4 S-cam air brakes. Refer to Dana maintenance inspection and service procedures.

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 millivolt 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 is normal.
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 then replace the ABS sensor (Note: Check voltage output of new sensor).

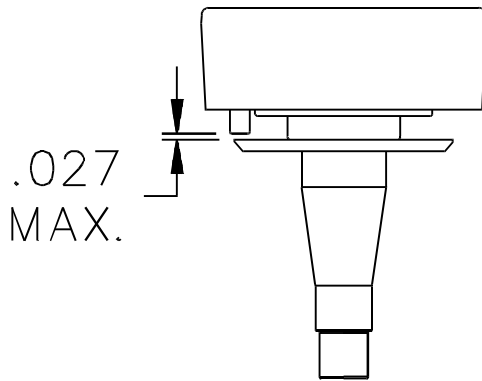


Figure 7 - ABS Sensor and Tone Ring Gap

Inspecting the Shock Absorber

1. Check shock absorbers for oil leakage, bent components, missing or broken components, excessive corrosion, or worn bushings. Replace shock absorbers if any of the above items is present.

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 airlines to make sure contact does not exist between the airlines and the outside diameter of the air spring. Re-secure airlines to prevent contact as needed. Check for airline and fitting leaks with soapy water solution.
4. Check to see that there is minimum of 1-inch clearance around the circumference of the air spring while it is energized with air.

5. Check the air spring piston for build up 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 that the ride height is within +/- .125" of the following:

A: From the center of the wheel to the bottom of the frame is 6.75"

B: Shock eye to eye center = 16.36"
4. The actuation arm of the height control valve should be horizontal at ride height (Figures 8). See section for adjusting to correct ride height.

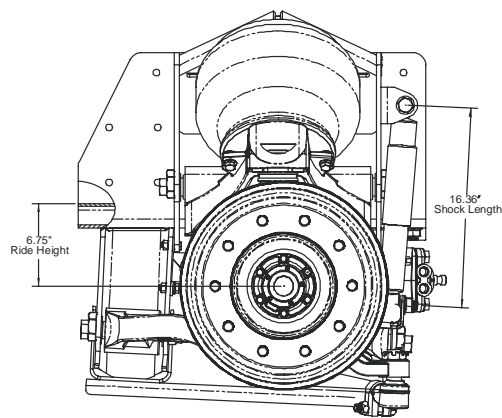


Figure 8 - Ride Height Measurement

Inspecting the Steering Gearbox and Pitman Arm (IFS1260)

Refer to ZF Steering Gearbox Service Manual for inspection and adjustment procedure.

Inspecting the Steering Gearbox and Pitman Arm (IFS1260-TRW)

Refer to TRW Steering Gearbox Service Manual for inspection and adjustment procedure.

Inspecting the Steering Gearbox and Pitman Arm (IFS1050S2)

Refer to TRW Steering Gearbox Service Manual for inspection and adjustment procedure.

Inspecting Wheel Bearing Endplay

1. If the tire and wheel are not removed make sure all the wheel nuts are tightened to the specified torque of **450-500 lbf·ft.** See Torque Table.
2. If the tire and wheel are removed (recommended for aluminum wheels) secure the brake drum to the hub with the wheel nuts or remove the brake drum.
3. Remove the vent plug from the hubcap.
4. 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.
5. Place the tip of the dial indicator on the center of the steering knuckle spindle. Set the dial indicator on zero. (Figure 10).

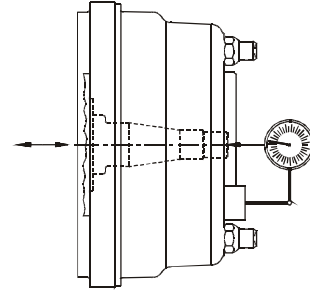


Figure 10 - Wheel End Play Measurement

NOTE

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

6. 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-.004", see the section on adjusting the wheel bearing endplay.

Inspecting the Rebound Bumper Stop

Note: The rebound stop is built into the shock absorber and can not be replaced independently.

1. Jack the front end of the vehicle until the front wheels are completely off the ground.
2. Place jack stands securely under the frame.
3. Measure the shock absorber length (center of mount to center of mount). If the length is greater than 18.30", then the rebound stop is incorrect and the shock absorber needs to be replaced.

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. The correct distance is 6-3/4". An alternate measurement may be taken as the distance between the centers of the shock mounts, which should be 16.36". (See Figure 11).

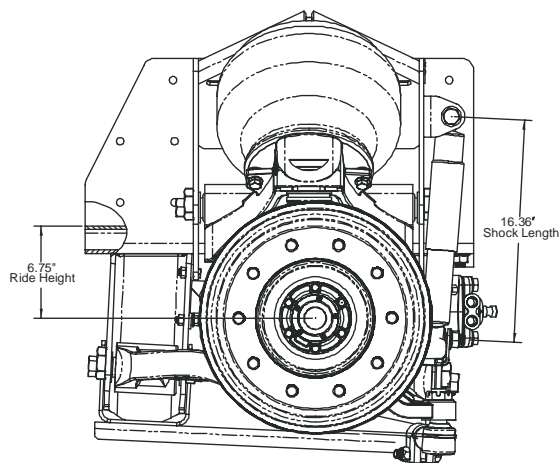


Figure 11 – Measurement at Ride Height

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 the ride height of the rear suspension on vehicles with front suspension equipped with (2) height control valves.
4. Measure either the wheel center to bottom of frame or shock length. If the dimensions are not within $\pm 1/8$ " of the dimensions specified in figure 11, adjust as follows.
 - A: Loosen the height control valve linkage stud-retaining nut.
 - B: Raise or lower the L-shaped linkage stud as necessary.
 - C: Tighten the retaining nuts. Note: It is recommended that the upper and lower studs be positioned parallel to each other. Torque to **8-12 lbf-ft**.
5. After adjusting the length, it is recommended to dump and re-inflate the air suspension to obtain the ride height. Allow the suspension to settle.

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6. If not completed already check and adjust the ride height of the rear suspension.
 7. Verify at each axle that the side-to-side ride heights are within .25" of each other.

Adjusting Wheel Bearing Endplay

1. Secure the vehicle by setting the parking brake and block the drive wheels to prevent vehicle movement.



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.

2. Raise the vehicle until the front wheels are off the ground. Support the raised vehicle with safety stands.
3. If the tire and wheel are not removed make sure all the wheel nuts are tightened to the specified torque of **450-500 lbf·ft.** See Torque Table.
4. If the tire and wheel are removed (recommended for aluminum wheels) secure the brake drum to the hub with the wheel nuts or remove the brake drum.

5. 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.
6. 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.
7. 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 inner and outer spindle nuts, use the correct wrench sockets to avoid damaging the nuts. Do not use impact driver to tighten inner and outer nuts. Only use a torque wrench to tighten the nuts.

8. Unbend the retainer washer and remove the spindle outer nut, retainer washer, and locking washer. Loosen the inner spindle nut.
9. Seat the bearings by tightening the inner spindle nut to **180 lbf·ft.** while rotating the wheel in both directions.
10. Loosen the inner spindle nut completely and then tighten the nut to **20 lbf·ft.**
11. Back off the inner spindle nut 1/4 turn.
12. Install spindle-locking washer.

NOTE

If the dowel pin of the inner spindle nut and a hole in the locking washer are not aligned, turn the locking washer over and re-install. If required, loosen the inner spindle nut just enough for alignment.



CAUTION

Never tighten the inner spindle nut to align the dowel pin with hole in locking washer. This can pre-load the bearings and cause premature bearing failure.

13. Install the retainer washer and outer spindle nut. Tighten outer spindle nut to **200-300 lbf·ft.** See Torque Table.
14. Verify that wheel endplay is between .001-.004 inches. (See inspecting wheel endplay section). If not, loosen outer nut, re-index the inner nut accordingly, and repeat Steps 10 thru 12 until proper endplay is achieved.
15. Bend retainer washer over one wrench flat of the outer nut.
16. Install hubcap gasket and hubcap. Tighten the capscrews to **20-30 lbf·ft.** See Torque Table. Replace the hubcap vent plug if removed.
17. Fill the hub cavity with the appropriate amount and type of lubricant and secure drain plug.
18. Check oil level through the hubcap window. (Figure 12). 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.)
19. 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.

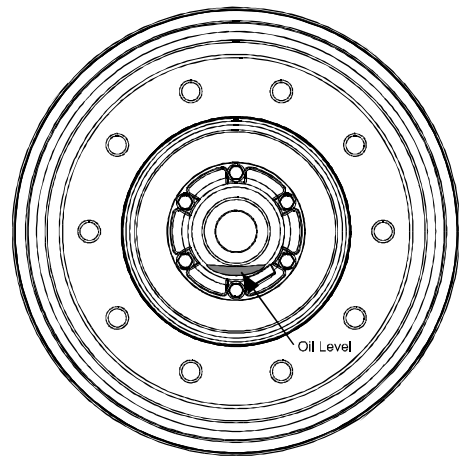


Figure 12 - Wheel Bearing Oil Level

Adjusting the Maximum Wheel Turn Angle

CAUTION

Do not adjust maximum wheel turn angle greater than 57° (Aluminum Rims, 55° Steel Rims). 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, 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 ZF’s Steering Gear Service Manual for readjusting the poppets.

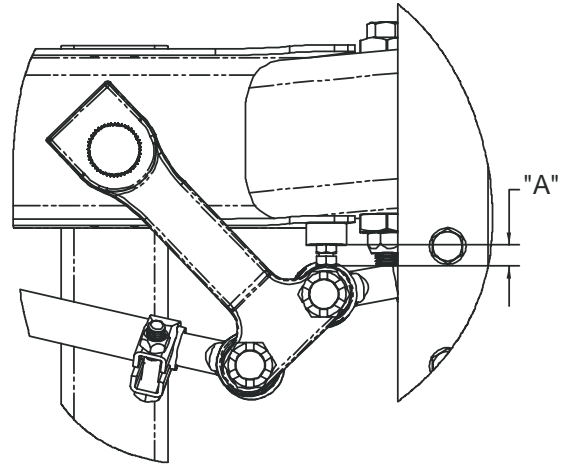


Figure 13 - Steering Stop Bolt

Rim Style	Length “A”	Maximum Wheel Cut
Aluminum (8.25” and 7.5” Widths)	.71”	57°
Steel (7.5” Width only)	.84”	55°
IFS1050S2 (All wheels)	.84”	55°

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. The drag link length may be adjusted to attain steering gear on center condition while maintaining equal toe-in side to side. Do not adjust the length of the drag link or tie rods to center the steering wheel. This can cause the steering gear to become off center.

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 and refer to Spartan chassis service guidelines for centering the steering gear.
4. Check that the lengths of the outer tie rods are equal to each other within 1/16 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 pitman arm 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 Spartan chassis 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 pitman arm.

9. Tighten the jam nut to **50-75 lbf·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 the opposite direction.

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 lbf·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, control arm bushings, and damaged suspension components. Replace worn components as needed.
4. Check for loose ball joint and tie rod end tapered connections, tie rod end jam nuts, 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

Tuthill 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.

NOTE

The Tuthill IFS1260/IFS1050S2 features adjustment eccentrics in both upper and lower control arms. It is recommended to use the Upper Control Arm eccentrics to adjust caster and the Lower Control Arm eccentrics to adjust camber. A combination of upper and lower eccentrics can be used for additional adjustment.

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 all 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.

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. Do not adjust the length of the drag link or tie rods to center the steering wheel. This can cause the steering gear to become off center.

3. 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 Spartan's guidelines.
4. 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.
5. 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 drop causing serious personal injury.

6. Raise the vehicle until the front wheels are off the ground. Support the raised vehicle with safety stands.

Adjusting the 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. 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°)

Eccentric Camber Adjustment

The setscrew in the eccentric adapter denotes the orientation of the eccentricity of the adapter. When the setscrew is in the 6 o'clock or 12 o'clock position, then the adapter is in the "neutral" position. There are two adapters at each lower control arm mount and they must be oriented the same.

When the setscrews in both lower control arm mounts are oriented closer to the frame rail, the tire camber becomes more negative. When the setscrews in both lower control arm mounts are oriented farther from the frame rail, the tire camber becomes more positive. The eccentric adapters at both lower control arm mounts must be oriented the same to affect only camber. The eccentrics as installed in the upper control arm work opposite. Close to the frame results in more positive camber, while furthest from the frame results in more negative 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. Loosen the setscrews.
3. Rotate each eccentric adapter to the same orientation as needed based on measured wheel camber. The eccentric adapters at each control arm mount must have the same orientation.
4. Tighten the adapter locknuts to **460-490 lbf·ft.** See Torque Table.

5. Tighten the setscrews to **30-40 lbf·ft.** See Torque Table.
6. Remove the jack stands and lower vehicle completely. Check that the suspension is at the proper ride height.
7. Re-measure the camber and readjust as needed.

Adjusting the Caster Angle



CAUTION

Do not adjust the suspension ride height or alter components to adjust the caster.

The caster angle is the angle between a vertical axis and the axis defined by the king pin when viewed from the side of the vehicle. When the king pin axis appears rotated clockwise relative to the vertical axis, then the caster is positive. Positive caster creates a self-aligning moment to stabilize the vehicle when driving straight ahead.

The caster angle is indirectly measured from the change in wheel camber as the wheel is turned through a prescribed turn angle. Therefore, the calculated caster is affected by the ride height of the suspension. See the inspecting and adjusting suspension ride height sections before measuring caster. The table below lists the recommended caster angles.

Nominal Caster Values-Degrees		
	Unloaded	Loaded
Left	+3° (±1/2°)	+3° (±1/2°)
Right	+3° (±1/2°)	+3° (±1/2°)

Eccentric Caster Adjustment

The setscrew in the eccentric adapter denotes the orientation of the eccentricity of the adapter. When the setscrew is in the 6 o'clock or 12 o'clock position, then the adapter is in the "neutral" position. There are two adapters at each control arm mount and they must be oriented the same.

When the setscrews in the forward upper control arm mount are oriented closer to the frame rail and the setscrews in the rearward upper control arm mount are oriented farther from the frame rail, the caster becomes more positive.

When the setscrews in the forward upper control arm mount are oriented farther from the frame rail and the setscrews in the rearward upper control arm mount are oriented closer to the frame rail, the caster becomes more negative.

The eccentrics in the lower control arm work opposite.

The eccentric adapters at both control arm mounts must be oriented opposite each other to affect caster.

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. Loosen the setscrews.
3. Rotate the eccentric adapters at the forward and rearward control arm mounts opposite one another as needed based on measured wheel caster. The eccentric adapters at each control arm mount must have the same orientation.

4. Tighten the adapter locknuts to **460-490 lbf-ft.** See Torque Table.
5. Tighten the setscrews to **30-40 lbf-ft.** See Torque Table.
6. Remove the jack stands and lower vehicle completely. Check that the suspension is at the proper ride height.
7. Re-measure caster and readjust as needed.

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. Center the steering gearbox.
2. Loosen all four tie rod clamps.
3. Adjust the length of each tie rod until the toe-in on each side is $1/16'' \pm 1/32''$ and the overall toe-in is $1/8'' \pm 1/16''$

4. Measure the length of each tie rod. If the length of the tie rods are not within 1/16" of each other, readjust each tie rod length.
5. Repeat steps #3 and #4 until proper toe and equal tie rod lengths are achieved.

WARNING

Orientation of the tie rod clamps is critical to attain full steering angle and avoid interference with adjacent parts.

6. Orient the tie rod clamps as shown in Figure 14, 15 and 16.
7. Retighten the tie rod clamps by torquing to **50 lbf·ft**

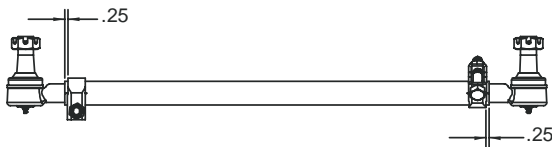


Figure 14 – Tie Rod Clamp Spacing

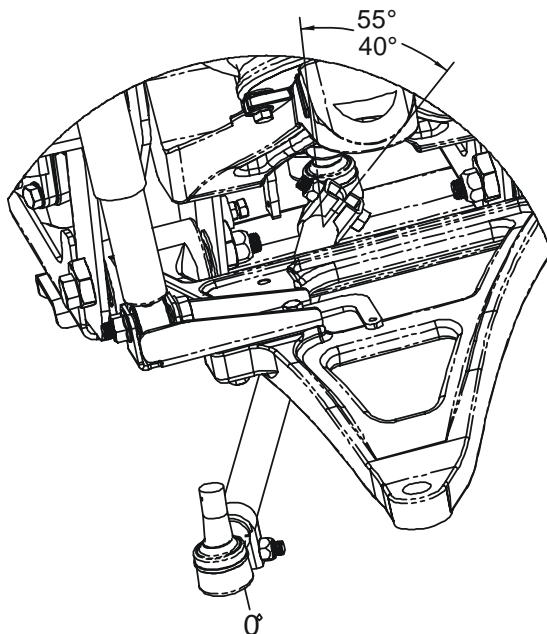


Figure 15 – Left Tie Rod Clamp Orientation

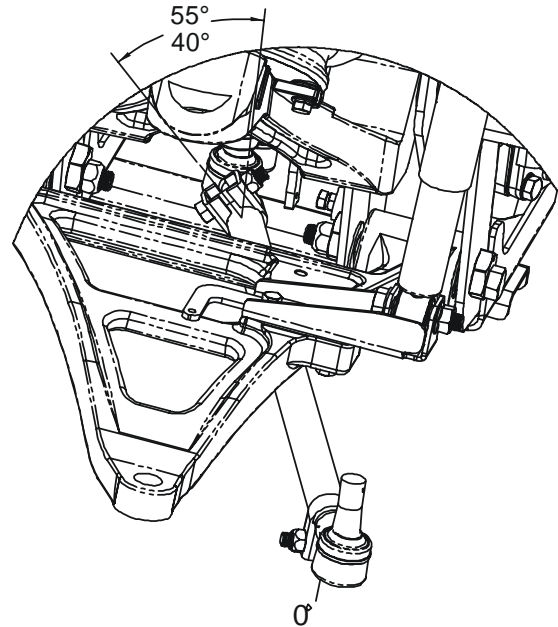


Figure 16 – Right Tie Rod Clamp

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 subframe 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 ball studs 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 drop causing serious personal injury.

The vehicle may be supported on safety stands by the suspension subframe 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 parts with clean paper or 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.

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 lbf·ft.** See Torque Table. See *Adjusting Toe-In Section* for proper tie rod clamp orientation.
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.

Removing and Installing the Upper Control Arm

Removal

1. Detach the air spring from the upper control arm.
2. Detach the shock absorber from the upper control arm.

3. Remove the retaining clip and spacer shims from the S-cam on the air brake.
4. Remove the slack adjuster, air brake chamber and air brake chamber bracket from the air brake spider (See Figure 17).

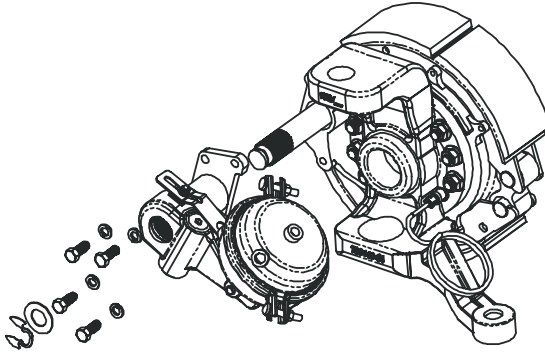


Figure 17 – Brake Components

5. Remove the cotter pin and castle nut from the ball stud.

WARNING

The steering knuckle is heavy and unevenly balanced. Use a portable crane or suitable jack to support it prior to disconnecting it from the control arm.

6. Disconnect the upper control arm from the knuckle. The ball stud may be forced from the tapered hole by the use of a suitable tool.

CAUTION

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

7. Loosen and remove the control arm mounting bolts. Remove any existing eccentric components. Note the orientation of the set screws for reinstallation. Remove the control arm bushing bolts.

WARNING

The steering knuckle and control arm are heavy and unevenly balanced. Use a portable crane or suitable jack to support it.

Installation

1. Place the control arm in its mount location.
2. Place the spacer into the bushing.
3. Insert an eccentric adapter on each end of the upper control arm mounting plate.
4. Place bolt and washer through the spacer and bushing as shown.
5. Install washer and locking nut.
6. Repeat the process for the rear upper control arm mounting bolt.
7. Rotate the eccentric adapters on the front mounting bolt, such that the set screw are located as previously oriented
8. Connect the ball joint to the knuckle.
9. Tighten the castle nut lock nut to **330-370 lbf·ft.** See Torque Table.
10. Install the cotter pin. If necessary, tighten the castle nut to align the hole in the ball stud and slots in the castle nuts. Do not loosen the castle nut to install the cotter pins.
11. Reinstall the slack adjuster, air brake chamber and air brake chamber bracket to the air brake spider. Torque the bolts to **70-80 lbf·ft.** See Torque Table.
12. Reinstall the shims and retaining clip to the S-cam. Note: The S-cam may have to be pushed out fully.

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13. Reattach the shock absorber to the upper control arm. Torque the fasteners to **170-190 lbf·ft.** See the Torque Table.
 14. Reinstall the air spring to the upper control arm and torque the bolts to **20-30 lbf·ft.** See the Torque Table.
 15. Vehicle alignment should be checked. Please refer to section 5. When the eccentric adapters are properly orientated, tighten the bolts.
 16. Support the control arm such that it is at ride height and torque the fasteners to **460-490 lbf·ft.** See the Torque Table.
 17. Install and tighten the set screw on any eccentrics installed to **30-40 lbf·ft.** See Torque Table
 18. Regrease the S-cam tube as needed. See lubrication section.

Replacing the Ball Joints

Ball joints may be replaced individually, however, it is recommended to replace upper and lower ball joints at the same time. The ball joints cannot be rebuilt or repaired.

The thread-in mount type upper and lower 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 steering knuckle 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 the ball stud 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 control arms and to remove the ball joints from the steering knuckle. A suspension alignment should be performed after ball joint replacement.

NOTE

Be careful to not displace or damage ball joint seals during removal from the control arm taper hole.

Upper Ball Joint Removal -

1. Remove the upper control arm
2. Secure Upper control arm in a vise or similar device. Loosen the ball joint and remove it from the control arm.

Upper Ball Joint Installation

1. Inspect the threads in the upper control arm and remove any burrs or debris.
2. Apply thread adhesive Loctite #242 or equivalent to the ball joint thread and thread the ball joint into the control arm.
3. Tighten the base of the ball joint to **525-575 lbf·ft**
4. Reinstall the upper control arm, if necessary.
5. Connect the ball joint to the knuckle.
6. Tighten the castle nut to **330-370 lbf·ft.**
7. Install the cotter pin. If necessary, tighten the castle nut to align the hole in the ball stud and the slots in the castle nut. Do not loosen the castle nuts to install the cotter pins.

Lower Ball Joint Removal

1. Remove the cotter pin from the ball stud.
2. Remove the castle nut from the ball stud.

WARNING

The steering knuckle is heavy and unevenly balanced. Use a portable crane or suitable jack to support it prior to disconnecting it from the control arm or removing the control arm with the steering knuckle attached.

3. Disconnect the lower control arm. The ball stud may be forced from the tapered hole by use of a suitable tool.

CAUTION

Do not strike the lower control arm directly with a steel hammer. Parts can break and cause serious personal injury. Wear eye protection.

4. Inspect the ball joint taper and upper control arm tapered hole. If abnormal wear exists on the ball stud taper or in the tapered hole, replace the lower control arm.
5. Secure steering knuckle in a vise or similar device. Loosen the ball joint and remove it from the steering knuckle.

Lower Ball Joint Installation

1. Inspect the threads in the steering knuckle and remove any burrs or debris.
2. Apply thread adhesive Loctite #242 or equivalent to the ball joint threads and thread the ball joint into the steering knuckle.
3. Tighten the base of the ball joint to **325-375 lbf·ft.** See Torque Table.

4. Connect the ball joint to the lower control arm.
5. Tighten the castle nut to **225-245 lbf·ft.**

Replacing the Upper and Lower Control Arm Bushings

The subframe control arm mounts may require widening to accommodate replacement bushings. The width may be increased by inserting a suitable jack between the bushing mounts and cold bending the mounts. Care must be taken to not exceed 5.25" width after widening. The control arm mounts should be inspected for damage.

Both control arm bushings and mounting fasteners must be replaced in a control arm when bushings are serviced. It is recommended replacing 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.

If the control arm is to be separated from the steering knuckle, follow the removal and installation procedures in the "Replacing the Ball Joint" Section.

Upper Control Arm

1. If desired, disconnect the upper control arm from the steering knuckle. Follow the removal procedure in "Replacing the Upper Control Arm" Section.

WARNING

The steering knuckle is heavy and unevenly balanced. Use a portable crane or suitable jack to support it prior to disconnecting it from the control arm or removing the control arm with the steering knuckle attached.

2. Loosen and remove the control mount arm bolts. Remove any existing eccentric components. Note the orientation of the set screws for reinstallation.
3. Press the bushing out of the control arm housing. Be sure too properly support the housing.
4. Inspect the housing bores and remove any burrs in the housing by honing.
5. Press the bushing into the control arm housing. Be sure too properly support the housing.
6. Place the spacer into the bushing.
7. Insert an eccentric adapter on each end of the upper control arm mounting plate.
8. Place bolt and washer through the spacer and bushing as shown.
9. Install washer and locking nut.
10. Repeat the process for the rear upper control arm mounting bolt.
11. Rotate the eccentric adapters on the front mounting bolt, such that the set screws are located as previously orientated.
12. Vehicle alignment should be checked. Please refer to Section 5. When the eccentric adapters are properly oriented, tighten the bolts.

13. Support the control arm such that it is at ride height and tighten the bolts to **460-490 lbf·ft.** (with eccentrics). See Torque Table.
14. Install and tighten the set screw on any eccentrics installed to **30-40 lbf·ft.** Refer to Torque Table.
15. Reconnect the steering knuckle to the control arm if disconnected. Follow the installation procedure in “Replacing the Upper Ball Joint” Section.

Lower Control Arm

1. Disconnect the height control valve from the lower control arm. Follow the removal procedure in “Replacing the Height Control Valve” Section.

WARNING

The steering knuckle is heavy and unevenly balanced. Use a portable crane or suitable jack to support it prior to disconnecting it from the control arm or removing the control arm with the steering knuckle attached.

2. If desired, disconnect the lower control arm from the steering knuckle. Follow the removal procedure in “Replacing the Lower Ball Joint” Section.
3. Loosen and remove the control mount bolts. Remove any eccentric components. Note the orientation of the set screw for reinstallation.
4. Press the bushing out of the control arm housing. Be sure too properly support the housing.
5. Inspect the housing bores and remove any burrs in the housing by honing.

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6. Press the bushing into the control arm housing. Be sure too properly support the housing.
 7. Place the control arm in its mount location.
 8. Place the spacer into the bushing.
 9. Insert an eccentric adapter on each end of the upper control arm mounting plate.
 10. Place bolt and washer through the spacer and bushing as shown.
 11. Install washer and locking nut.
 12. Repeat the process for the rear upper control arm mounting bolt.
 13. Rotate the eccentric adapters on the front mounting bolt, such that the set screws are located as previously orientated.
 14. Vehicle alignment should be checked. When the eccentric adapters are properly oriented, tighten the bolts.
 15. Support the control arm such that it is at ride height and tighten the bolts to **460-490 lbf·ft**. See Torque Table.
 16. Install and tighten the set screw on any eccentrics installed to **30-40 lbf·ft**. Refer to Torque Table.
 17. Reconnect the steering knuckle to the control arm if disconnected. Follow the installation procedure in “Replacing the Lower Ball Joint” Section.
 18. Reconnect the height control valve linkage. Follow the installation procedure in “Replacing the Height Control Valve” Section.

Replacing Wheel Bearings, Oil Seals, and Hub Caps

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 hubcap nuts if present and the wheel hubcap before loosening the wheel nuts. Place the wheel hubcap in 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 drum and place it aside. Mark the brake drum to ensure it can be identified for installation on same side as removed.

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 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 the hub cap window may be damaged by solvents.

NOTE

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

4. Unbend the spindle washer and remove the spindle outer nut, spindle washer, locking “D” washer, and the inner spindle nut. Retain all components for re-assembly except discard the spindle washer.
5. Place a shop towel on top of the lower brake shoe to prevent oil from dripping onto the brake lining.
6. 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.
7. 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.
8. Remove the hub seal and discard it. Remove the wear ring from the spindle and discard it.
9. 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.

10. 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 555-5098) 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 ¼”. 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-lubed outer bearing and place it onto the spindle until it seats on the outer cup in the hub. The inner spindle nut may be used to guide the bearing onto the spindle. The hub should be supported to prevent misalignment and binding.
7. Install the inner spindle nut and tighten hand tight.
8. Seat the bearings by tightening the inner spindle nut to **180 lbf·ft** while rotating the wheel in both directions.
9. Loosen the inner spindle nut completely and then re-tighten the inner nut to **20 lbf·ft**.
10. Back off the inner spindle nut ¼ turn.
11. Install the spindle locking “D” washer.

NOTE

If the dowel pin of the inner spindle nut and a hole in the locking washer are not aligned, turn the locking washer over and re-install. If required, loosen the inner spindle nut just enough for alignment.



CAUTION

Never tighten the inner spindle nut to align the dowel pin with hole in locking washer. This can pre-load the bearings and cause premature bearing failure.

12. Install the spindle washer and the outer spindle nut. Tighten the outer spindle nut to **200-300 lbf·ft**. See Torque Table for sequence.

13. Refer to the Wheel Bearing Endplay Adjustment section to measure and adjust the endplay to .001-.004 inch. Adjust by loosening outer nut, re-indexing the inner nut accordingly, and repeat Steps 11 thru 13 until proper endplay is achieved.
14. Bend retainer washer over one wrench flat of the outer nut.
15. Install hubcap gasket and hubcap. Tighten the capscrews to **20-30 lbf·ft**. See Torque Table. Replace the hubcap vent plug if removed.
16. Fill the hub cavity with the appropriate amount and type of lubricant and secure drain plug.
17. Check oil level through the hubcap window. (Figure 18). 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.)

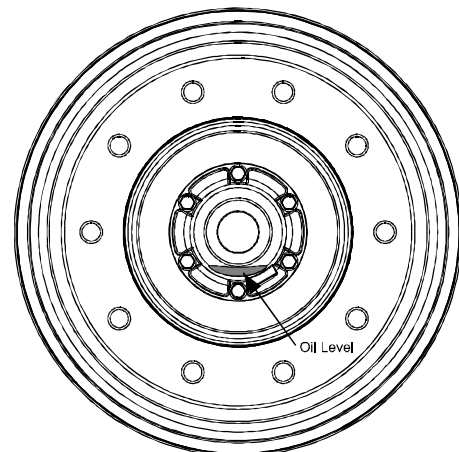


Figure 18 - Wheel Bearing Oil Level

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18. 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.
 19. Install the brake drum.
 20. Install the wheel and tire assembly and the wheel nuts.
 21. On aluminum wheels, use a plastic anti-scuff guard over the wheel nuts. Tighten the wheel nuts to **450-500 lbf·ft**. See Torque Table for sequence.
 22. Replace the wheel hubcap nuts and hubcaps if removed to service the wheel bearings.

Replacing Brake Components

Brake Drums

The brake drums should be replaced if they are damaged or exceed the drum manufacturers recommended maximum diameter or runout specification. Refer to manufacturer brake drum guidelines for inspection and specifications.

Automatic Slack Adjuster

The automatic slack adjusters are not serviceable and should be replaced if damaged or malfunctioning. Refer to manufacturer guidelines for correct function of the automatic slack adjuster.

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 limits. When the brake linings are serviced, other components such as the S-cam rollers and return springs should also be serviced. Refer to the brake manufacturer guidelines for servicing the brakes.

Replacing Brake Components

Note: The air brakes of the IFS1260 have been integrated into the design of the knuckle. Failure to replace with proper components can result in a loss of brake performance.

Removal

1. Remove the retaining clip and shims.
2. Remove the slack adjuster, air brake chamber and air brake chamber bracket.
3. Remove the spider and shoe assemblies.

Installation

1. Attach the spider and shoe assembly to the steering knuckle. Torque to **170-190 lbf·ft**.
2. Insert the S-cam into the spider and shoe assemblies as shown. Note the correct orientation of the S-cam. See Figures in Section 1 at bottom of Page 17.
3. Lightly grease the S-cam.
4. Attach the air brake chamber assembly to the air brake chamber bracket with the Haldex bracket kit. Torque the fasteners to **113-118 lbf·ft**. See the Torque Table.

5. Attach the air brake chamber bracket assembly to the spider and shoe assembly. Torque the fasteners to **70-80 lbf·ft.** See the Torque Table.
6. Install the slack adjuster.
7. Install the spacer shims and retaining clip.
8. Adjust the slack adjuster as per the Haldex Slack Adjuster Installation Procedure.
9. Attach the lock nut to the slack adjuster and torque to **8-12 lbf·ft.** See the Torque Table.

Haldex Slack Adjuster Installation Procedures

1. Check that the push rod is fully retracted; apply air to release spring brake.
2. Install anchor bracket loosely as illustrated (See Figure 19) using the shorter hole location.

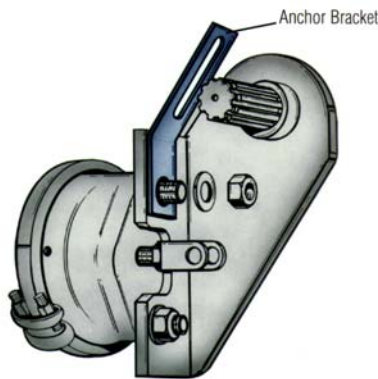


Figure 19 – Anchor Bracket

3. Do not tighten anchor bracket fasteners at this time.
4. Apply “Anti-Seize” type lubricant to camshaft splines.
5. Install the brake adjuster on the camshaft with the adjusting hex pointing **away** from the brake chamber (See Figure 20).

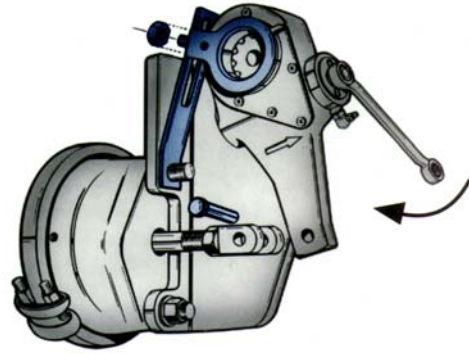


Figure 20 – Adjusting Hex

6. Secure the brake adjuster on the camshaft. Use at least one inner washer and enough outer washers to allow no more than .060 movement of adjuster on camshaft.

NOTE

Do NOT pull the push rod out to meet the brake adjuster.

7. Rotate the 7/16” adjusting hex nut clockwise until the clevis hole lines up with the brake adjuster armhole.
8. Apply anti-seize to clevis pin, install and secure with cotter pin.
9. Rotate the control arm away from the adjusting hex toward the air chamber, until it comes to a definite internal stop (See Figure 21).

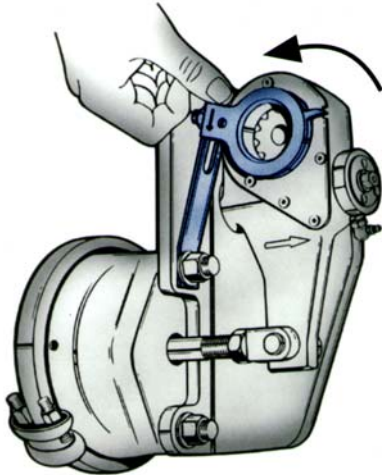


Figure 21 – Internal Stop

10. The “Installation Indicator” must fall within the slot for proper installation with brakes full released (See Figure 22).



Figure 22 – Installation Indicator

NOTE

NOTE: If the control arm position is wrong, tight brake will occur (Figure 23).



Figure 23 – Control Arm Position

11. Tighten all anchor bracket fasteners (make sure the control arm does not move from its position while tightening fasteners).

12. The adjuster must be manually adjusted at this time.
13. Rotating the adjusting hex clockwise until the lining contacts the drum.
14. Then back off the adjuster by turning the adjusting hex counter-clockwise 1/2 of a turn (See Figure 24).

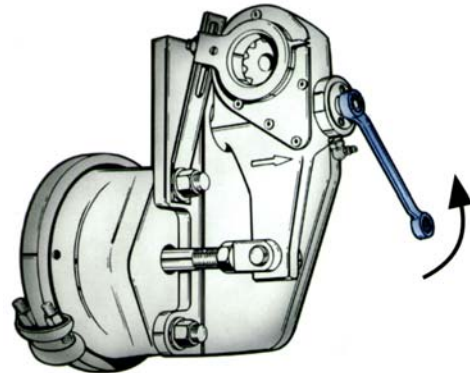


Figure 24 – Adjusting Hex

15. A minimum of **13 ft-lbs.** is necessary to overcome the internal clutch. A ratcheting sound will be present.

⚠ WARNING

Do NOT use an impact wrench or internal damage will occur.

⚠ FINAL INSPECTION

Make sure brakes are still fully released, and check that the “Installation Indicator” is within the slotted area. If out of position, repeat Step #3. A mis-set control arm can cause a tight brake.

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 ring are replaced.

Replacement parts must be equivalent to the vehicle manufacturers 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. Remove the brake drum to provide access to sensor.
2. Press sensor out of steering knuckle. Do not pull sensor out by its lead wire.
3. 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 scale of 1-10V.
4. Spin the hub by hand and read the voltage output of the sensor. A minimum reading of .8V AC is normal. 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 runout 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 manufacturers guidelines for removal and installation of the tone ring.

Replacing the Shock Absorber

CAUTION

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

Removal

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

-
2. Remove upper shock bushing mounting hardware and retain for installation.

Installation

1. Attach upper shock bushing to suspension subframe with mounting hardware. Do not tighten.
2. Attach lower shock to lower mounting bracket with mounting hardware. Tighten nuts to **170-190 lbf·ft.** See Torque Table.
3. Tighten upper mounting nut to **170-190 lbf·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. Disconnect the airline at the air spring and remove the connection fitting.
2. Remove the bolts that secure the air spring to the upper control arm. (See Figure 25).
3. Remove the nuts and washers from the upper air spring mount studs. (See Figure 25).
4. Remove the air spring.

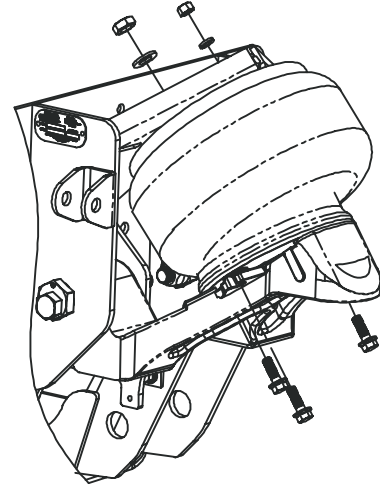


Figure 25 - Air Spring Upper Mount

Installation

1. Assemble the nuts and washers that connect the air spring to the upper air spring mount on the subframe. Tighten the nuts to **20-30 lbf·ft.** See Torque Table.
2. Assemble the air spring to the upper control arm. Tighten the bolts to **20-30 lbf·ft.** See Torque Table.
3. Install the connection fitting into the air spring. Use Permatex or equivalent thread sealant.
4. Connect the airline to the air spring.
5. Lower the vehicle frame and inflate the air springs.
6. Check the air fittings for 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.

Removal

1. Mark airline connections for re-assembly. Disconnect the airlines from the HCV. If any other plumbing fixtures are connected to the HCV, mark them for re-assembly.
2. Disconnect the vertical link from the lower control arm.
3. Remove the mounting bolts, nuts, washers, and HCV from the subframe.
4. Remove any other plumbing fixtures from the HCV.

Installation

1. Assemble the actuation arm and the vertical link of the replacement HCV the same as the removed HCV.
2. Assemble any other plumbing fixtures to the HCV as marked for re-connection.
3. Mount the replacement HCV to the subframe with bolts, nuts, and washers. Tighten the nuts to **10-15 lbf·ft.** See Torque Table.
4. Reconnect airlines and check for proper operation and leaks.
5. Check and adjust ride height per Adjusting Suspension Ride Height Section.

Replacing the Steering Gearbox and Pitman Arm

Removal

1. Disconnect the tie rod ends from the pitman arm.
2. Disconnect the slip shaft to the gearbox.
3. Disconnect all the hydraulic lines to the steering gearbox.

4. Loosen and remove the 3/4" hex head fasteners attaching the gearbox mounting plate to the cradle.
5. Slide the assembly out of the cradle.



WARNING

The steering gearbox assembly is heavy and unevenly balanced. Use a suitable jack to support.

Installation

1. Slide the steering gearbox assembly into the cradle.
2. Install the 3/4" hex head bolts and torque to **280 lbf·ft.**
3. Reconnect all the hydraulic lines to the steering gearbox.
4. Reconnect the slip shaft to the steering gearbox.
5. Connect the tie rod ends to the pitman arm and torque to **90-100 lbf·ft.**

Replacing the Sway Bar and Components

Removal



WARNING

It is recommended to secure the height control valve arm such that the valve will not "dump" air while the sway bar is being replaced.

1. Remove the bushing brackets.
2. Remove the sway bar.
3. Remove the sway bar bushings from the bar.
4. Inspect bushings for any damage.

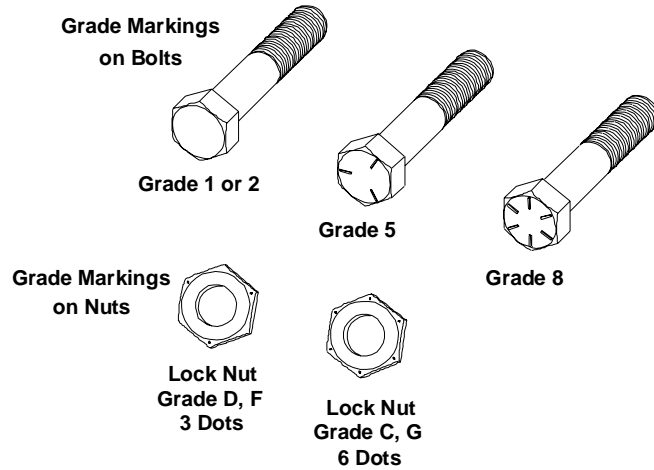
Installation

1. Lubricate the bushings' inner diameter with Aqua Shield Grease (TC1920).
2. Install the two split bushings over the sway bar.
3. Install the bar to the suspension.
4. Install the two bushings brackets over the split bushings. Torque the fasteners to **52 lbf·ft**. See torque table.
5. Lubricate the two non-split bushings.
6. Install these two bushings over the ends of the bar.
7. Install the two bushing brackets over the remaining two bushings. Torque to **52 lbf·ft**. See torque table

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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.



Torque Table 1

APPLICATIONS	FASTENER SIZE	TORQUE SPECIFICATION (lbf.-ft.) (CLEAN AND DRY)
Upper and Lower Control Arm Bushing Pivot Bolt (with Eccentric Adapters)	7/8-9 Grade 8	460-490 ⁽¹⁾
Eccentric Set Screw	#10-24x3/8	30-40 lbf.-in.
Upper Ball Joint Base	M85x1.5	525-575 ⁽²⁾
Upper Ball Joint Ball Stud Castle Nut	M30x1.5	330-370 ⁽³⁾
Lower Ball Joint Base	M70x1.5	400-450 ⁽²⁾
Lower Ball Joint Ball Stud Castle Nut	M24x1.5	225-245 ⁽³⁾
Air Spring Upper Mount Nut	3/4-16 Grade 5	20-30
	1/2-13 Grade 5	20-30
Air Spring Lower Mount Bolts	1/2-13 Grade 5	20-30 ⁽¹⁾
Upper and Lower Shock Mount Nut	3/4-10 Grade G	170-190
Steering Stop Jam Nut	1/2-20 Grade 5	60-65
Tie Rod Clamp Nuts	5/8-11 Grade 5	50
Tie Rod Ball Stud Castle Nut	7/8-14	90-100 ⁽³⁾
Height Control Valve Body Mount Lock Nut	1/4-20 Grade C	10-15
Height Control Valve Linkage Stud Mount Nut	5/16-18 Grade 2	8-12
Gearbox Mount to Subframe	3/4-10 Grade C	280
Shock Absorber Mount to LCA	1/2-13 Grade C	80-90
Gearbox to Mounting Plate	7/8-14 Grade 8	475
Pitman Arm Retaining Nut		346-422
Height Control Valve Control Arm Pivot Set Bolt	5/16-18 Grade 2	8-12
Height Control Valve Linkage Clamp Screw		Tighten clamp until rod is tight.
Spindle Inner Nut	1-1/2-12	See Section 5 Adjusting the Wheel Bearings
Spindle Outer Nut	1-1/2-12	200-300
Sway bar bushing mount	7/16-14 Grade 8	48-56
S-Cam tube mounting bolts	1/2-13 Grade 8	70-80 ⁽²⁾
Air Brake Chamber to Mount Bracket	5/8-11 Grade 8	113-118

1) Torque applied to bolt head.

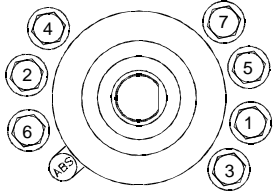
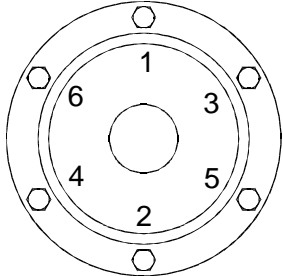
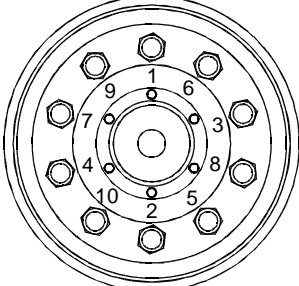
2) Apply thread adhesive Loctite #242 or equivalent to threads.

3) Install cotter pin after tightening.

4) Apply thread adhesive Loctite #271 or equivalent to threads.

Torque Tables

Torque Table 2

APPLICATIONS	FASTENER SIZE	TORQUE SPEC. (lbf.-ft.) (CLEAN AND DRY)	TORQUE SEQUENCE
Brake Spider Mount Nuts	5/8-18 Grade 8	170-190	 <p>Driver Side</p>
Hub Cap Bolt	5/16-18 Grade 5	20-30 ⁽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.