SECTION 10: FRONT AXLE

CONTENTS

LIST OF ILLUSTRATIONS

1. DESCRIPTION

The front axle is of the tubular-type, and consists of a tempered seamless steel rectangular beam to which steering knuckles are fixed with heat-treated, forged steel pins, Both the steering knuckles upper and lower pin bores are supplied with *"Easy Steer"* bushings. A thrust bearing, installed between the lower end of the axle and each steering knuckle, supports the load of the axle.

A tie rod arm, to which the tie rod is attached is installed on each steering knuckle. The tie rod is supplied with R.H. and L.H. threads to simplify toe-in adjustment. The maximum turning angle is set through the two steering stop screws installed on the axle center.

2. MAINTENANCE

Front axle maintenance consists of periodic inspections and lubrication. Check all parts for damage or distortion, paying particular notice to the tie rod, tie rod ends, tie rod arms, the steering arm and stop screws. Make sure all fasteners are tight (refer to heading *"Specifications"* for recommended tightening torques). Check condition of steering knuckle pins, bushings and thrust bearings, and replace if excessive looseness is found.

Looseness in steering linkage, under normal steering loads, is sufficient cause to immediately check all pivot points for wear, regardless of accumulated mileage. Steering linkage pivot points should be checked each time the front axle assembly is lubricated. Any looseness can be visually detected while rotating the steering wheel in both directions.

Steering knuckles can be overhauled or replaced without removing the axle from the vehicle. However, if extensive overhaul work is necessary, the axle assembly may be removed.

Caution: ***Should removal of a locking device be required when undergoing repairs, disassembly or adjustments, always replace with a new one.***

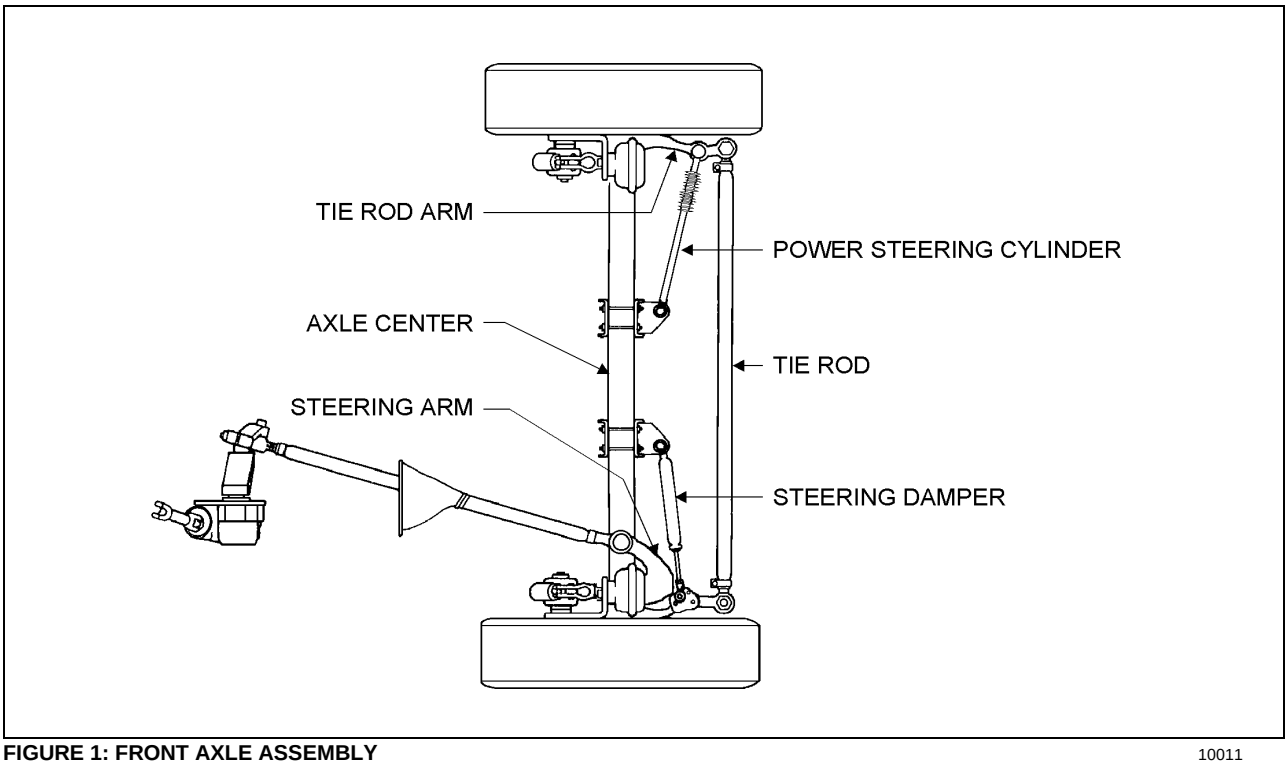


FIGURE 1: FRONT AXLE ASSEMBLY 10011

3. LUBRICATION

Perform lubrication according to *"Rockwell Maintenance Manual No.2: Front Non-Drive Steering Axles"* annexed to this section.

Tie rod ends and drag link ends are supplied with grease fittings, which should be serviced every 6,250 miles (10 000 km) or twice a year, whichever comes first. Steering knuckle pins are also supplied with grease fittings, which should be serviced every 50,000 miles (80 000 km) or once every year, whichever comes first. A good quality lithium-base grease is recommended (refer to section 24 *"LUBRICATION"*).

4. REMOVAL

The following procedure deals with the removal of the front axle assembly. The method used to support the axle assembly and suspension components during removal and disassembly depends upon local conditions and available equipment.

1. Jack-up vehicle until its body is approximately 30" (760 mm) from the floor. Place safety supports underneath body.

Caution: ***Use only the recommended jacking points as outlined in section 18 "BODY".***

2. Support the axle with suitable hydraulic floor jacks at the recommended jacking points.

Warning: ***To help prevent injury caused by the axle rolling off the jacks, these should be equipped with U-adapters, or similar precautions must be taken.***

3. Remove the wheels (if required) (refer to Section 13, *"WHEELS, HUBS AND TIRES"*).

4. Exhaust compressed air from the air supply system by opening the drain valve at each air reservoir.

5. Disconnect the height control valve link from the axle and pull down the overtravel lever to ensure all air is exhausted from air springs.

6. Disconnect air lines from front brake chambers, and cover line ends and fittings to prevent the entry of foreign matter.

7. Remove the ABS sensors from their location in hubs (if applicable), and disconnect the remaining sensor(s) in left wheel hub.

Caution: ***Position the air lines and electric wires so they will not be damaged while removing the front axle assembly.***

8. Disconnect the drag link from steering arm.

9. Proceed with steps a, b and c, while referring to *"SUSPENSION"*, section 16.

   a) Disconnect sway bar links from axle brackets.

   b) Remove shock absorbers.

   c) Disconnect the five radius rods: transversal and lower rods from subframe, and upper rods from axle.

10. Remove the two air spring lower nuts from each suspension support.

11. Slowly lower the axle assembly, and carefully remove from underneath vehicle.

5. REPLACEMENT

Reverse *"Front Axle Removal"* procedure. Ensure cleanliness of air spring mounting plates.

Note: ***Refer to Section 16, "SUSPENSION" and at the end of this section for applicable checks and recommended tightening torques.***

6. OVERHAUL

Refer to *"Rockwell Maintenance Manual No.2 - Front Non-Drive Steering Axles"* annexed to this section.

7. FRONT END ALIGNMENT

Front end alignment is essential for steering comfort and satisfactory tire life. Road shocks and vibrations, as well as normal stresses and strains, under normal operating conditions, can put the front end out of alignment. If a misalignment is suspected, inspect all components which could be involved as outlined under heading *"Front End Inspection"* next.

7.1 Front End Inspection

Before checking front end alignment, first check the following points:

1. Make sure the vehicle is at normal ride height (refer to *"Suspension Height Adjustment"* procedure under heading *"Height Control Valve"*, in section 16 *"Suspension"*).
2. Make sure that front wheels are not generating the problem (refer to section 13 *"Wheels, Hubs and Tires"*).
   a) Check tire air pressure.
   b) Check wheel installation and straightness.
   c) Check wheel and tire balance.
3. Check wheel bearing adjustment.
4. Check steering linkage for bending, and pivot points for looseness.
5. Check knuckle pins for evidence of excessive wear.
6. Check radius rods for bending and rubber bushings for evidence of excessive wear.

7.2 Front Wheel Camber

Wheel camber is the number of degrees the top of the wheel tilts outward (positive) or inward (negative) from a vertical plane.

The camber angle is not adjustable. Camber variations may be caused by wear at wheel bearings, steering knuckle pins, or by bent knuckles or sagging axle center. Steering effort is affected by improper camber, and uneven tire wear will result. Excessive positive camber results in irregular wear of tire at outer shoulder, and excessive negative camber causes wear at inner shoulder.

Specifications

Camber ..... -1/8° ± 7/16°

Inspection

Position front wheels on turning plates in a straight ahead position. Install alignment gauges, record the camber reading for each wheel (Fig. 2) and compare with specifications.

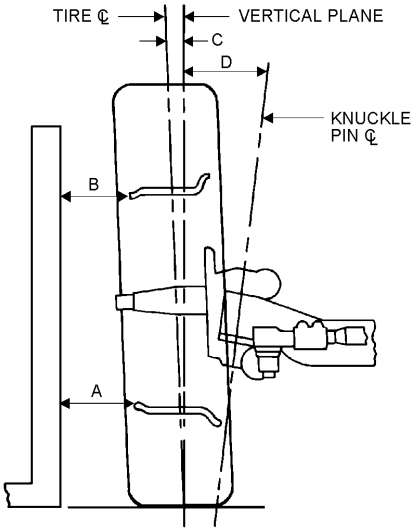
7.3 Front Wheel Toe-In

Wheel toe-in is the distance, measured at spindle height with the wheels in the normal, straight ahead position; both front wheels are closer together at front than at rear of axle.

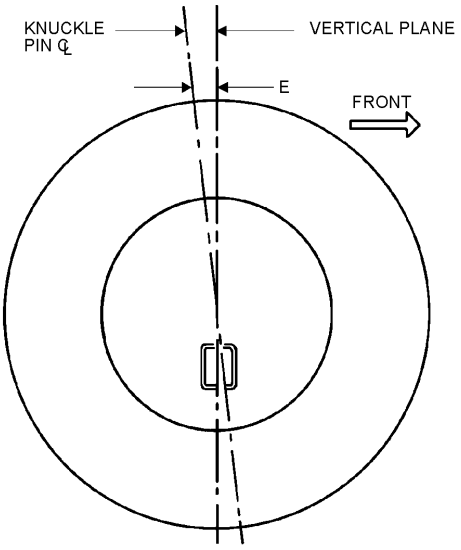
Incorrect toe-in results in excessive tire wear caused by side slippage. Steering instability with a tendency to wander may result.

Specifications

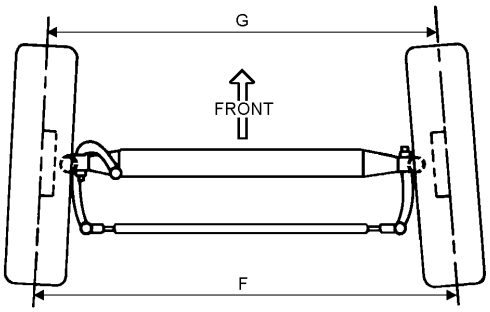
Toe-in.....3/32" ± 1/32" (2,4 ± 0,8 mm)



CAMBER - KNUCKLE PIN INCLINATION

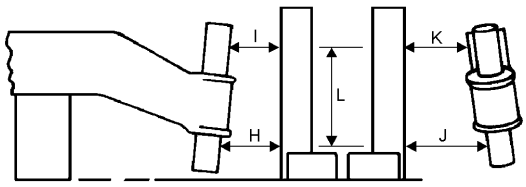


CASTER



TOE-IN

(BENCH CHECK)



KNUCKLE PIN INCLINATION CASTER

A minus B..... Camber (in (mm))
..... 0.025" (0,64 mm) = 1/16°

C.....Camber angle (deg.)

D.....Knuckle pin inclination (deg.)

E.....Caster angle (deg.)

F minus G ..... Toe-in (in(mm))

H minus I.....Knuckle pin inclination (in(mm))
..0.035" (0,89 mm) = 0°15’ (for L = 8" (203,2 mm))

J minus K.....Caster (in(mm))
..0.035" (0,89 mm) = 0°15’ (for L = 8" (203,2 mm))

Note: ***Refer to heading "Specifications" for numerical values.***

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FIGURE 2: FRONT END ALIGNMENT CHART

Inspection and Adjustment

Before checking front wheel toe-in, first check the camber angles and make the necessary corrections.

1. With the vehicle on a flat and level surface, jack up front of vehicle until the tires clear the ground, and place safety supports underneath axle.

Caution: ***Use only the recommended jacking points as outlined in section 18 "BODY".***

2. Use paint or chalk and whiten the center area of both front tires around the complete outer surface of the tire.

3. Position front wheels in a straight ahead position as follows:

   a) Install two pins, of the same size and known to be straight, with conical nuts in the existing holes at axle center (Figs. 3 & 4).

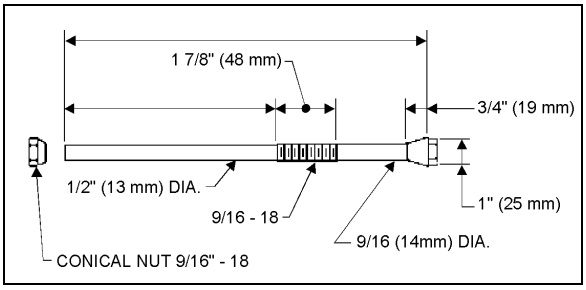

FIGURE 3: POSITION PIN 10013

FIGURE 4: POSITION PIN INSTALLATION 10014

   b) Measure the distance between the pin and wheel for each wheel, and position them in order to obtain the same reading e.g.: If L.H. side = 7 1/2" (191 mm) and R.H. side = 7 3/4" (197 mm) in the straight ahead position, the final reading should be 7 5/8" (194 mm) on each side.

4. With the wheels in a straight ahead position, mark the center line of each tire tread using a scriber or similar instrument. Apply sufficient pressure on scriber to obtain a single, straight line all around the tire.

5. Lower the vehicle to the floor, and move it forwards and backwards approximately 10' (3 m) in order to neutralize front suspension.

6. Put a trammel bar at the back of tires, adjust pointers to spindle height and align them with the marks on the tires. Measure and record the distance between the pointers.

7. Measure and record the distance between the marks at front of tires as per step 6.

8. To get the toe-in measurement, subtract the reading taken at front of tires (G) from the one taken at back (F) (Fig. 5). Compare with specifications.

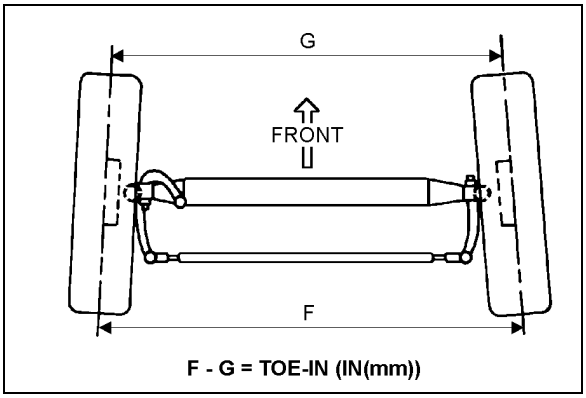

FIGURE 5: TOE-IN MEASUREMENT 10015

Note: ***A steel measuring tape can also be used to check toe-in.***

9. If toe-in needs adjustment, proceed as follows:

   a) Loosen the clamp nut on each end of the tie rod.

   b) Turn the tie rod until the specified toe-in distance is obtained.

Note: ***The tie rod is supplied with R.H. and L.H. threads to simplify toe-in adjustment.***

   c) Tighten tie-rod clamp nuts to 40/60 lbf•ft (55/80 N•m).

10. Recheck toe-in as outlined in steps 1-8.

7.4 Front Axle Caster

Positive caster is the rearward tilt from the vertical of the knuckle pin. Negative caster is the forward tilt from the vertical of the knuckle pin (Fig. 2). This vehicle is designed with a positive caster. The purpose of the caster angle is to give a trailing effect. This results in a stabilized steering and a tendency for the wheels to return to the straight-ahead position after taking a turn.

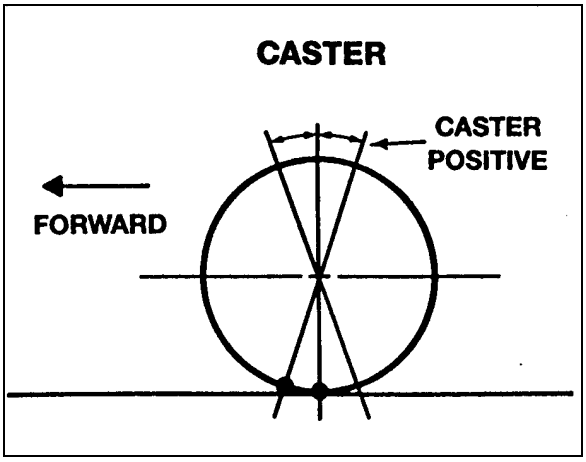

FIGURE 6: CASTER 10007

Excessive caster results in hard steering around corners. A shimmy may also develop when returning to the straight ahead position (pulling out of curves).

Insufficient caster will cause wandering and steering instability. Caster variations may be caused by a bent axle, tilting or distortion of the side suspension supports, damaged radius rod bushings, or unequal tightening of the front and rear suspension support bolts.

Specifications

Caster (both sides) .....+2 3/4º ± 3/4

Inspection and Adjustment

Position front wheels on turning plates in a straight ahead position. Install alignment gauges, record caster reading for each wheel (Fig. 2) and compare with specifications.

Shorter and longer radius rods (P/N 121101 (short) & P/N 121313 (long)) are available to correct caster angle by 1.3º. Replace radius rods as necessary to adjust caster angle.

Note: ***Caster correction radius rods may already have been factory installed to provide correct caster.***

7.5 Steering Geometry

The front end is designed to keep the front wheels in the proper relative alignment while turning to the right or left.

Turning Angle Adjustment

The maximum turning angle is set through the two steering stop screws installed on the axle center. Steering stop screws are factory adjusted to accommodate the chassis design, and therefore do not require adjustment on new vehicles**.** However, these should be checked and adjusted if necessary, when any component of the steering system is repaired, disassembled or adjusted.

Caution: ***To prevent the steering damper from interfering with the adjustment of turning angles. make sure its fixing bracket is at the correct location on the axle center (refer to section 14 "STEERING").***

Mechanical Stop

R.H. Turn Adjustment

1. Turn steering wheel to the right until the boss on the axle center touches the right stop screw.

2. Measure the closest distance between the drag link and tire.

3. Adjust stop screw to obtain a distance of 3/4" (19 mm). Unscrew the jam nut, turn the stop screw accordingly, then tighten jam nut to 50/65 lbf•ft (70/85 N•m).

L.H. Turn Adjustment

1. Turn steering wheel to the left until the boss on the axle center touches the left stop screw.

2. Measure the rod length protruding from steering damper cylinder; between housing and ball joint jam nut.

3. Adjust stop screw to obtain a length of 12" (305 mm). Unscrew the jam nut, turn the stop screw accordingly, then tighten the jam nut to 50/65 lbf•ft (70/85 N•m).

Caution: ***Reduce or shut off the power steering hydraulic pressure before the boss on the axle center touches the stop screw. If not, the components of the front axle will be damaged (refer to "TAS Service Manual" annexed to section 14 "STEERING" under heading "Poppet Readjustment").***

Caution: ***Never maintain the relief pressure for more than 5 seconds, since damage to the power steering pump may occur.***

8. WHEEL BEARING MAINTENANCE

Refer to *"Rockwell Maintenance Manual No. 2 - Front Non-Drive Steering Axle"* annexed to this section.

9. TROUBLESHOOTING

Refer to *"Rockwell Maintenance Manual No. 2 - Front Non-Drive Steering Axle"* annexed to this section.

10. SPECIFICATIONS

Make	Rockwell International
Model	FG952
Rated load capacity	14,600 lb (6 600 kg)
Gross axle weight rating (G.A.W.R.)	14,400 lb (6 480 kg) or 14,600 (6570 kg) depending on wheel size
Track	85.66" (2 175,8 mm)

11. FRONT WHEEL ALIGNMENT

Camber (under load)	-1/8º ± 7/16º
Knuckle pin inclination, R.H. side	6º15'
Knuckle pin inclination, L.H. side	5º45'
Toe-in	3/32 ± 1/32" (2,4 ± 0,8 mm)
Caster (both sides)	+2 3/4º ± 3/4
Caster correction radius rod (1.3º), 22 7/8" C/C (short)	Prévost P/N = 121101
Caster correction radius rod (1,3º), 23 7/8" C/C (long)	Prévost P/N = 121313

12. TORQUE SPECIFICATIONS

Drag link end nut (steering arm)	160/300 lbf•ft (220/405 N•m)
Steering arm nut	775/1,450 lbf•ft (1 050/1 965 N•m)
Tie rod arm nut	550/1,025 lbf•ft (750/1 390 N•m)
Tie rod end nut	160/300 lbf•ft (220/405 N•m)
Tie rod clamp nut	40/60 lbf•ft (55/80 N•m)
Stop screw jam nut	50/65 lbf•ft (70/85 N•m)