

Work Instructions – FL513Y

Subject: Rack and Pinion Steering – Steering Stops

Models Affected: Specific Freightliner Cascadia, Century Class S/T, and Columbia vehicles manufactured November 1, 2004, through September 26, 2007, with rack and pinion steering. (Note: One Freightliner Classic XL vehicle and one Freightliner Coronado vehicle are also involved in this recall.)

This Work Instruction includes the following procedures:

- Replace Rack and Pinion Gear
- Replace Tie Rod Arms
- Replace Right Hand Mounting Bracket

Recall Procedures

1. Check the base label (Form WAR259) for a completion sticker for campaign FL513 (Form WAR260) indicating this work has been done. The base label is usually located on the passenger-side door about 12 inches (30 cm) below the door latch. If a completion sticker is present, no further action is necessary. If a completion sticker is not present, go to the next step.
2. Shut down the engine, apply the parking brake, and chock the rear tires.
3. Raise the hood.
4. Replace the tie rod arms.
 - 4.1 Remove and discard the fasteners that hold the tie rod arms to the steering knuckles. Leave the tie rod arms attached to the steering gear; removing the arms is unnecessary because the gear will be replaced later in the procedure. See **Fig. 1** and **Fig. 2**.

IMPORTANT: Make sure that the new tie rod arms are installed on the correct side. The raised number on each arm will end in an "L" or an "R," which refers to left (driver) side or right (passenger) side of the vehicle.
 - 4.2 Using a solvent, remove all dirt, oil, and other foreign material from the female threads on the steering knuckles. Let the solvent dry completely.
 - 4.3 Apply Loctite 277 to the threads of the new M20 flanged hexbolts and install the new tie rod arms. Tighten the flanged hexbolts 387 to 461 lbf·ft (525 to 625 N·m).
5. Disconnect the hydraulic lines from the rack and pinion gear.
6. Plug the hydraulic lines to keep out dirt.
7. Remove and discard the lower pinch bolt and nut from the steering I-shaft.

WARNING

On vehicles equipped with an SRS air bag, do not rotate the upper steering column while the I-shaft is removed or disconnected. This can cause the clockspring in the steering wheel hub to become off center, which could result in the air bag failing to operate during a crash.

8. Clean and prime the new U-bolts.

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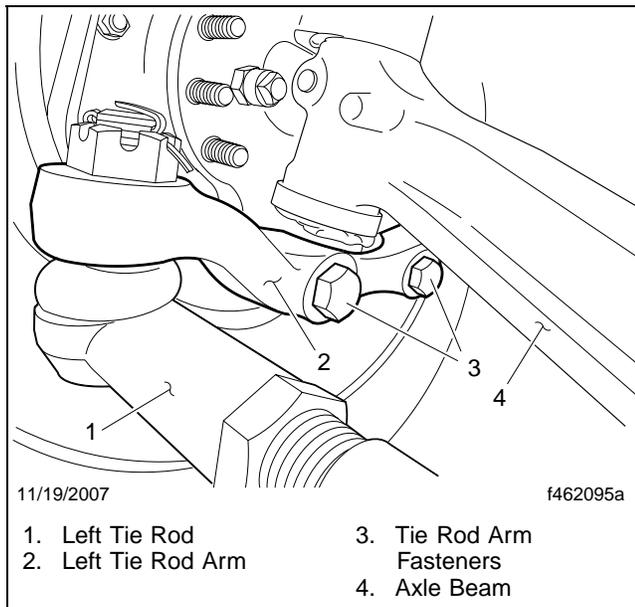


Fig. 1, Left Side of Vehicle

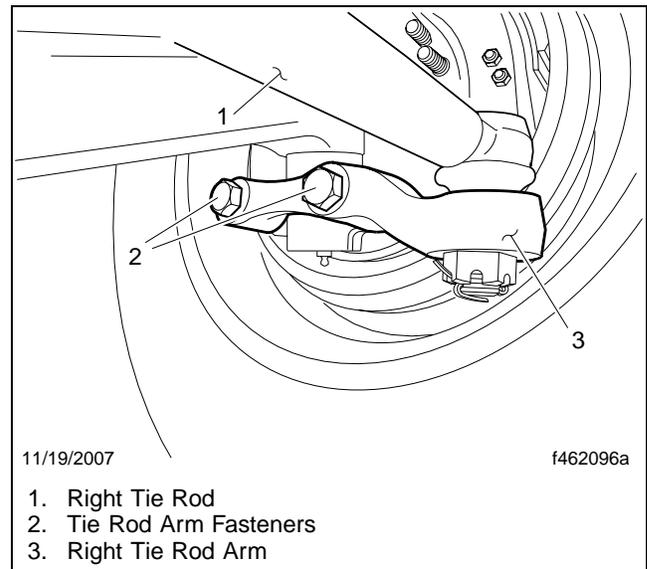


Fig. 2, Right Side of Vehicle

9. Remove and discard the fasteners that connect the rack and pinion gear to the axle-mounted brackets, then remove the gear (along with the tie rod arms) from the vehicle.
10. Paint the new U-bolts.
11. Replace the right-side steering gear mounting bracket.
 - 11.1 Raise the front axle and support the frame with safety stands.
 - 11.2 On the right side of the vehicle, note the configuration of the clamp-group components, then remove the suspension U-bolts, the clamp-group components, and the old mounting bracket for the rack and pinion gear.
 - 11.3 Discard the old mounting bracket fasteners, suspension U-bolts, and nuts.
 - 11.4 Install the new dowel in the axle flange, then place the new rack and pinion mounting bracket over the dowel. Install the new hexbolt that holds the new mounting bracket to the axle flange and fit the bolt into the hexagonal hole in the bracket. Make sure the holes in the new mounting bracket are aligned with the U-bolt holes in the axle flange.
 - 11.5 Install any previously removed clamp-group components and the new U-bolts.
 - 11.6 Lubricate the threads of the new U-bolts to prevent galling, then install the new U-bolt nuts and tighten them 60 lbf-ft (81 N·m) in the sequence shown in **Fig. 3**.
12. Using new fasteners, install the new rack and pinion gear. Tighten the fasteners 202 to 256 lbf-ft (274 to 347 N·m).
13. Install the new flanged hexnut on the recessed hexbolt previously installed in the mounting bracket. Tighten the hexnut 54 to 76 lbf-ft (73 to 103 N·m).
14. Tighten all the new U-bolts 200 lbf-ft (270 N·m), then tighten them all 270 to 330 lbf-ft (370 to 450 N·m).

15. Attach the tie rods to the tie rod arms. Tighten the new castle nuts 240 lbf·ft (325 N·m), then install and lock a new cotter pin in each of the ball studs and nuts. If needed, continue tightening each nut until a slot on the nut aligns with the cotter-pin hole in the ball stud. Do not back off the nut to align it with the cotter pin hole.
16. Raise the vehicle and place the front wheels on turnplates.
17. Install the adaptor fittings in the steering gear, and tighten 30 to 35 lbf·ft (41 to 47 N·m).
18. Attach the lines to the plumbing adaptors on the steering gear, while ensuring that the lines will not touch the axle or each other once installed. Snug the connection with a wrench to ensure the fittings are seated, which is equivalent to approximately 2 lbf·ft (3 N·m). Then, using a backup wrench to keep the adaptors from turning, tighten the return and supply hoses by 1 flat of the tube nut (60 degrees). See **Fig. 4**.
19. Center the rack and pinion gear.
 - 19.1 Measure the length of the bellows from clamp to clamp on each side of the gear. See **Fig. 5**. If measurements are not within 1 inch (25 mm) of each other, move the tires until the bellows lengths are within range.
 - 19.2 Align the pointers on the input shaft seal cover and the input shaft housing. See **Fig. 6**.
20. Install the I-shaft, then install a new lower pinch bolt and nut in the lower U-joint of the I-shaft. Tighten the nut 30 to 35 lbf·ft (41 to 47 N·m).
21. Fill and bleed the power steering system.
 - 21.1 Raise the front wheels off the ground or put the front wheels on turnplates.

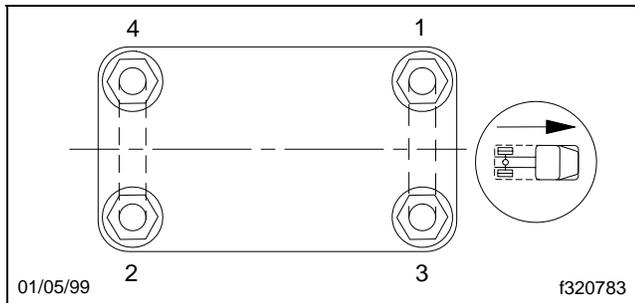


Fig. 3, U-Bolt Nut Tightening Sequence

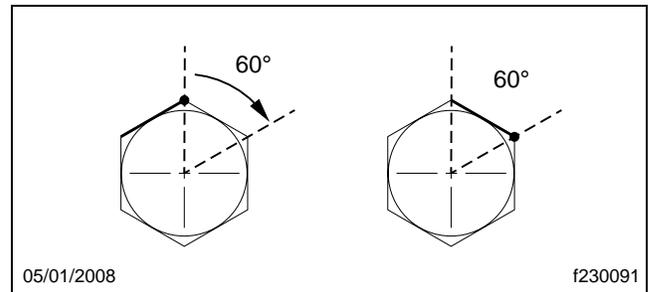
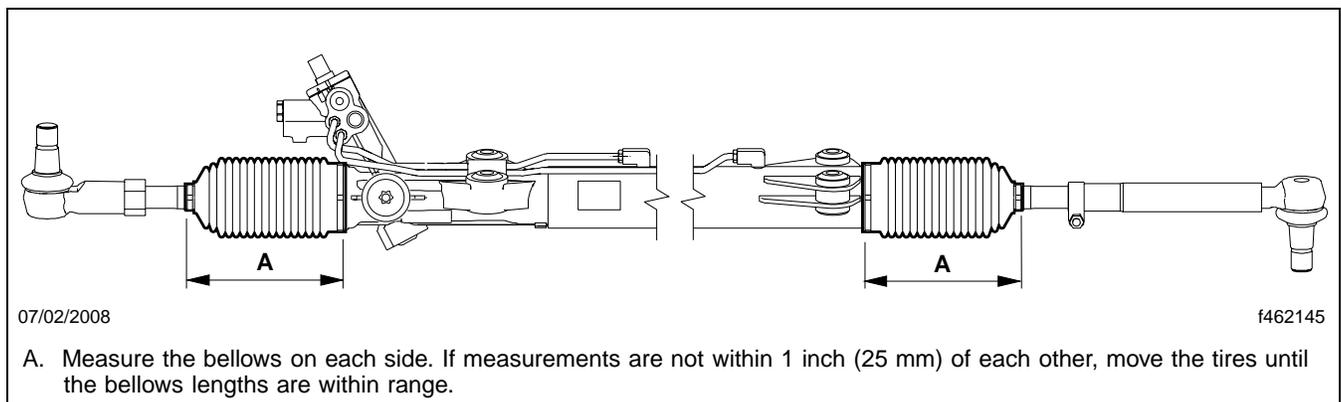


Fig. 4, Turning the Fitting One Flat (60 degrees)



- A. Measure the bellows on each side. If measurements are not within 1 inch (25 mm) of each other, move the tires until the bellows lengths are within range.

Fig. 5, Measuring the Tie Rod Bellows

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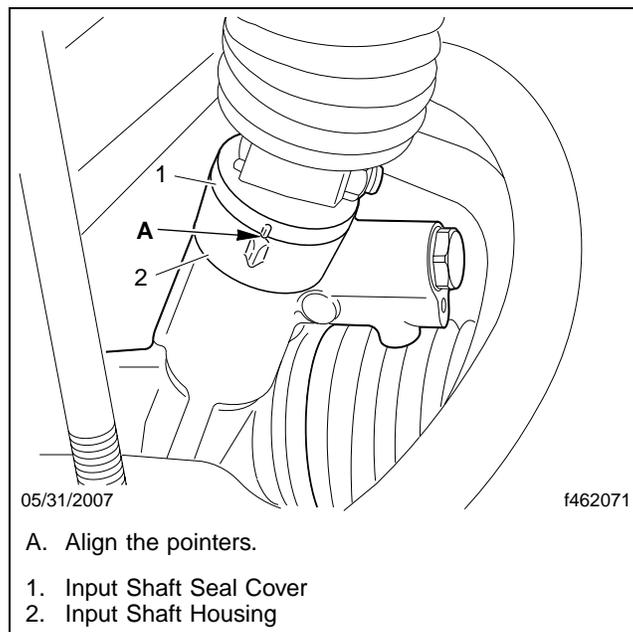


Fig. 6, Pointer Alignment

- 21.2 Fill the power steering reservoir with automatic transmission fluid that meets Dexron III or TES-389 specifications.
 - 21.3 With the engine off, turn the wheel fully left and right five times to bleed the air from the rack.
 - 21.4 Start the engine, turn the wheel fully left and right several times to bleed the remaining air from the rack.
 - 21.5 If the steering system needs additional bleeding, repeat the previous substep after the fluid in the reservoir has had time to release any air.
22. Align the front wheels using a computerized alignment tool.

NOTE: If you do not have access to this type of tool, the alignment procedure must be done by a facility that does.

- 22.1 Complete the setup needed for the computerized alignment tool (identical to the setup for integral steering gears).
- 22.2 With the wheels on turnplates, center the rack travel by aligning the timing pointers on the input shaft seal cover and the input shaft housing. See **Fig. 6**.

Whenever the computerized alignment program requires that the steering wheel be pointed straight ahead, the steering rack on-center pointers should be aligned.

NOTE: Do not center the steering wheel; it must be centered at the end of the procedure.

- 22.3 Loosen the driver-side tie rod jam nut. If necessary, hold the inner tie rod in place with a backup wrench on the inner tie rod flat.
- 22.4 With the gear on-center, place a wrench on the driver-side inner tie rod flat and align the left tire by rotating the inner tie rod.

Total left side toe-in should be between 0 and 1/16 inch (1.58 mm).

- 22.5 Tighten the tie rod jam nut 285 to 305 lbf·ft (386 to 413 N·m)
- 22.6 Loosen the passenger-side tie rod clamp nut.
- 22.7 With the gear on-center, place a wrench on the passenger-side inner tie rod flat and align the right tire by rotating the inner tie rod.

Total right side toe-in should be between 0 and 1/16 inch (1.58 mm).

- 22.8 Tighten the tie rod clamp nut 30 to 36 lbf·ft (41 to 48 N·m).

IMPORTANT: Total toe-in for both sides should be between 0 and 1/8 inch (3.18 mm), and the target should be 1/16 inch (1.58 mm).

- 22.9 Check the clearance of the front wheels. With the wheels turned all the way to the right and left, there must be at least 1/2-inch (13-mm) clearance between the wheels and any stationary components, and at least 3/4-inch (19-mm) clearance between the wheels/tires and any moving components.

If the clearance is inadequate, back out the stop bolts and adjust the jam nuts to limit the turning angles and to prevent possible contact with components.

- 22.10 Tighten the stop-bolt jam nuts 80 to 120 lbf·ft (108 to 163 N·m).

- 22.11 Return the wheels to the straight-ahead position.

- 23. Make sure that the steering wheel is within 10 degrees of center as shown in **Fig. 7**. If it is not, remove and center the steering wheel.

IMPORTANT: The spline/pinch bolt connections between the steering gear and the steering wheel fit in only one position. Clocking the splined connections after alignment is not possible.

- 23.1 If the vehicle has an air bag, deactivate and remove the air bag according to the instructions in the applicable vehicle workshop manual. If the vehicle does not have an air bag, remove the horn button by prying it out around the edges.

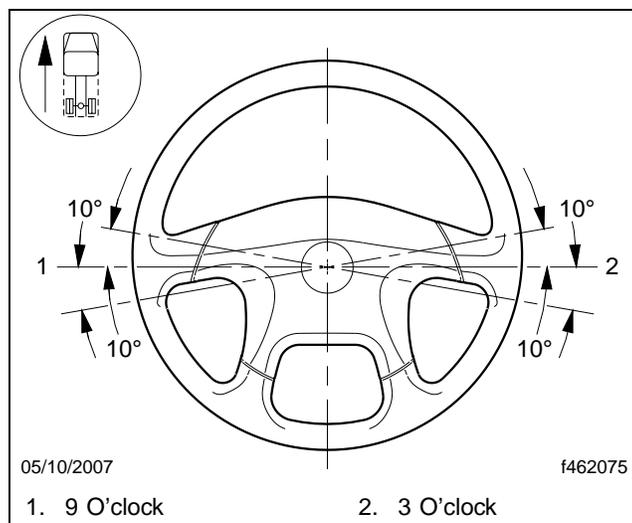


Fig. 7, Steering Wheel Centered

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IMPORTANT: The steering wheel does not have threaded wheel-puller holes. The tapered fit between the steering wheel and the column is designed to be removed by hand.

- 23.2 Loosen the nut that holds the steering wheel on the steering column, but leave it on the shaft until the wheel has been released from the tapered fit.
 - 23.3 Remove the wheel from the tapered fit by striking it from below, at the rim/spoke intersections, with both hands.
 - 23.4 Remove and discard the steering wheel nut, and install and center the steering wheel.
 - 23.5 Install a new steering wheel nut and tighten it 33 to 41 lbf-ft (45 to 55 N·m).
 - 23.6 If the vehicle has an air bag, install and reactivate the air bag according to the instructions in the applicable workshop manual. If the vehicle does not have an air bag, install the horn button.
24. Remove the turnplates and alignment equipment.
 25. Recheck the power steering fluid level.
 26. Clean a spot on the base label (Form WAR259), write the recall number, FL513, on a blank completion sticker (Form WAR260), and attach it to the base label.

