

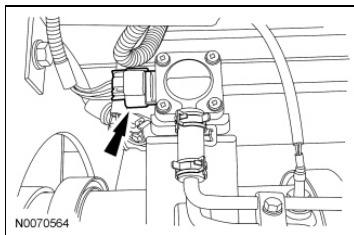
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**Diesel Particulate Filter Pressure Sensor -- Cummins****Removal and Installation**

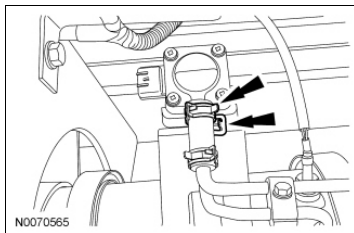
1. **NOTICE:** Make sure the ignition switch is in the OFF position prior to working on the electronic engine controls. Failure to follow this instruction may cause damage to the vehicle electrical system.

Turn the ignition switch to the OFF position.

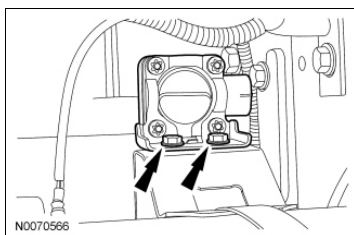
2. Disconnect the Diesel Particulate Filter (DPF) pressure sensor electrical connector.



3. Release the 2 clamps and slide them down the hoses.



4. Remove the 2 bolts and the DPF pressure sensor.
  - To install, tighten to 7 Nm (62 lb-in).



5. To install, reverse the removal procedure.
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<b>Toe-in For All Steer Axles</b>		
<b>Acceptable service range -- unloaded</b>		
0 to 1/8 in	0 to 0.125 in	0 to 0.180 degrees
<b>If out of acceptable service range -- unloaded, reset to:</b>		
1/32 to 3/32 in	0.03 to 0.09 in	0.05 to 0.13 degrees

**Camber and Kingpin Inclination (KPI)**

<b>Degrees</b>	
<b>Left</b>	<b>Right</b>
1/16  (0 to 7/8)	-1/16  (-1/2 to +3/8)
7-3/4 Kingpin Inclination (KPI)	7-3/4 KPI

**Caster**

<b>Degrees</b>
1-1/2 to 2-1/2 <sup>a b</sup>

<sup>a</sup> Caster may vary 1/2 degree side to side.

<sup>b</sup> Caster is controlled by factory installed wedges between the springs and axle. Caster set too high for a specific vehicle may cause shimmy, and in the case of manual steering, a hard steering complaint. Caster set too low for a specific vehicle may result in wander or returnability complaints.

**Toe Readings -- Degrees to Inches Conversion: Toe-in Per Wheel (in)**

<b>Wheel Angle Degrees</b>	<b>Tire Outside Diameter (in)</b>							
	<b>38.0</b>	<b>39.0</b>	<b>40.0</b>	<b>41.0</b>	<b>42.0</b>	<b>43.0</b>	<b>44.0</b>	<b>45.0</b>
0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
0.010	0.007	0.007	0.007	0.007	0.007	0.008	0.008	0.008
0.020	0.013	0.014	0.014	0.014	0.015	0.015	0.015	0.016
0.030	0.020	0.020	0.021	0.021	0.022	0.023	0.023	0.024

2009 F-Super Duty 650-750 Workshop Manual

0.040	0.027	0.027	0.028	0.029	0.029	0.030	0.031	0.031
0.050	0.033	0.034	0.035	0.036	0.037	0.038	0.038	0.039
0.060	0.040	0.041	0.042	0.043	0.044	0.045	0.046	0.047
0.070	0.046	0.048	0.049	0.050	0.051	0.053	0.054	0.055
0.080	0.053	0.054	0.056	0.057	0.059	0.060	0.061	0.063
0.090	0.060	0.061	0.063	0.064	0.066	0.068	0.069	0.071
0.100	0.066	0.068	0.070	0.072	0.073	0.075	0.077	0.079
0.110	0.073	0.075	0.077	0.079	0.081	0.083	0.084	0.086
0.120	0.080	0.082	0.084	0.086	0.088	0.090	0.092	0.094
0.130	0.086	0.088	0.091	0.093	0.095	0.098	0.100	0.102
0.140	0.093	0.095	0.098	0.100	0.103	0.105	0.108	0.110
0.150	0.099	0.102	0.105	0.107	0.110	0.113	0.115	0.118
0.160	0.106	0.109	0.112	0.114	0.117	0.120	0.123	0.126
0.170	0.113	0.116	0.119	0.122	0.125	0.128	0.131	0.134
0.180	0.119	0.123	0.126	0.129	0.132	0.135	0.138	0.141
0.190	0.126	0.129	0.133	0.136	0.139	0.143	0.146	0.149
0.200	0.133	0.136	0.140	0.143	0.147	0.150	0.154	0.157
0.210	0.139	0.143	0.147	0.150	0.154	0.158	0.161	0.165
0.220	0.146	0.150	0.154	0.157	0.161	0.165	0.169	0.173
0.230	0.153	0.157	0.161	0.165	0.169	0.173	0.177	0.181
0.240	0.159	0.163	0.168	0.172	0.176	0.180	0.184	0.188
0.250	0.166	0.170	0.175	0.179	0.183	0.188	0.192	0.196

**Tire Group Chart**

Group	Tire Size
A	7.50 x 20, 8.25 x 20, 9.00 x 20, 8-19.5, 8-22.5, 9-22.5, 10-22.5, 245/70R19.5, 245/75R22.5, 265/75R22.5, 295/75R22.5, 255/70-22.5, 235/80-22.5, 255/80-22.5, 275/80-22.5, 225/70R19.5
B	10.00 x 20, 11-22.5, 285/75R24.5, 275/80-24.5, 10.00/90R20
C	11.00 x 20, 12-22.5, 315/80R22.5, 315/75R22.5
D	10.00 x 22, 11-24.5
E	12.00 x 20
F	11.00 x 22, 12-24.5
G	13/80 x 20
H	14/80 x 20
J	15-22.5, 365/80R20, 385/65R22.5
K	16.5-22.5, 425/65R22.5
L	18-22.5, 425/65R22.5
M	14.00 x 20
N	295/80R22.5
P	1200 x 24
R	1100 x 24

S	16.00 x 20
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**Turning Angle (Wheel Cut) Charts -- Maximum Turn Angle (Wheel Cut) as Related to Wheel Base (W/B)**

Axle Code	Tire Group	Up to 185-inch W/B (Degrees)	More Than 185-inch W/B (Degrees)
02ADC	A	43 to 45	43 to 45
	B	43 to 45	38 to 40
	C	38 to 40	33 to 35
02ADD	A, B	38 to 40	38 to 40
	C	38 to 40	33 to 35

**Torque Specifications**

Description	Size		Torque				
	Diameter (In)	No. Threads	Nm		lb-ft		lb-in
			Min	Max	Min	Max	--
Tie-rod end nut and drag link end nut <sup>a</sup>	3/4	16	116	143	85	105	--
	7/8	14	163	218	120	160	--
Tie-rod clamp bolt	1/2	13	54	68	40	50	--
	5/8	11	61	88	45	65	--
Steering arm nut and tie-rod arm nut <sup>a</sup>	1-1/8	12	407	544	300	400	--
	1-1/4	12	1054	1428	775	1050	--
U-bolt nuts (8,500 lb axles)	--	--	244	271	180	200	--
U-bolt nuts (10,000 lb axles and greater)	--	--	353	407	260	300	--
Hubcap bolt	--	--	20	20	--	--	177

<sup>a</sup> If cotter pin cannot be installed after minimum torque is attained, the nut must be advanced until cotter pin can be installed. Torque specified is for taper and threads which are clean and oil free. **DO NOT LOOSEN THE NUT TO INSTALL THE COTTER PIN.**



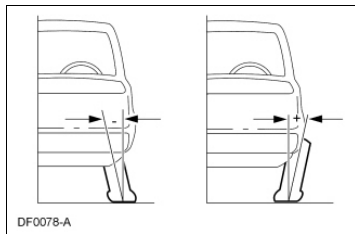
## Wheel Alignment Angles

Front wheel alignment is part of total vehicle alignment which involves both steering and drive axles. Correct front wheel alignment is important. It promotes longer tire wear by reducing lateral forces on tires, also known as side scrub. Reduced side scrub promotes slow tire wear and a greater tread mileage potential. It also promotes ease of handling and reduces strain on the steering and axle components.

It is important to recognize the symptoms of correct alignment as well as those of incorrect alignment. It is also important to be able to recognize treadwear tendencies not related to alignment.

### Camber

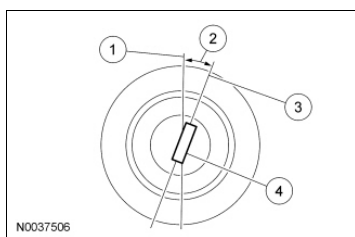
#### Negative and Positive Camber



Camber is the vertical tilt of the wheel when viewed from the front. Camber can be positive or negative and has a direct effect on tire wear.

### Caster

#### Caster and Steering Axis

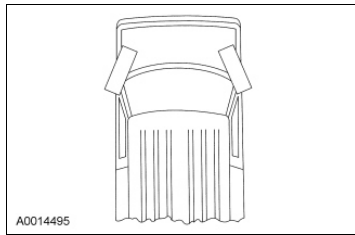


Item	Description
1	True vertical
2	Positive caster angle
3	Kingpin centerline
4	Pivot centerline

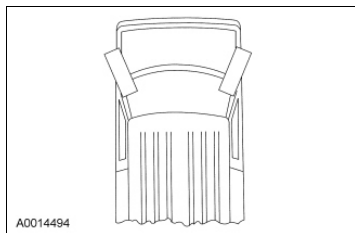
Caster is the deviation from vertical of an imaginary line drawn through the ball joints when viewed from the side. The caster specifications in this section will give the vehicle the best directional stability characteristics when loaded and driven. The caster setting is not related to tire wear.

## Toe

### Positive Toe (Toe-In)



### Negative Toe (Toe-Out)



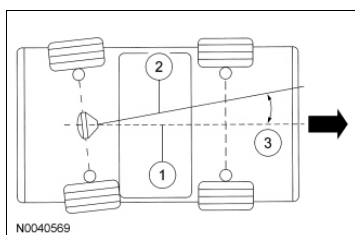
The vehicle toe setting:

- affects tire wear and directional stability.
- must be checked after adding aftermarket equipment, such as a snowplow or body.

When the wheels are turned in toward the front of the vehicle, the toe is positive (+) (toe-in). When the wheels are turned out toward the front of the vehicle, the toe is negative (-) (toe-out). This is measured in degrees, from side-to-side, and totaled.

## Thrust Angle

### Incorrect Thrust Angle (Dogtracking)



Item	Description
1	Vertical centerline
2	Axle centerline
3	Thrust angle

Incorrect thrust angle (dogtracking) is the condition in which the rear axle is not square to the chassis. Heavily crowned roads can give the illusion of incorrect thrust angle.



### **Wander**

Wander is the tendency of the vehicle to require frequent, random left and right steering wheel corrections to maintain a straight path down a level road.

### **Shimmy**

Shimmy, as observed by the driver, is large, consistent, rotational oscillations of the steering wheel resulting from large, side-to-side (lateral) tire/wheel movements.

Shimmy is usually experienced near 64 km/h (40 mph) and can begin or be amplified when the tire contacts pot holes or irregularities in the road surface.

### **Nibble**

Sometimes confused with shimmy, nibble is a condition resulting from tire interaction with various road surfaces and observed by the driver as small rotational oscillations of the steering wheel.

### **Poor Return/Sticky Steering**

Poor return and sticky steering are terms used to describe the poor return of the steering wheel to center after a turn or a steering correction.

### **Drift/Pull**

Pull is a tugging sensation, felt by the hands on the steering wheel, that must be overcome to keep the vehicle going straight.

Drift describes what a vehicle with this condition does with hands off the steering wheel.

- A vehicle-related drift/pull, on a flat road, will cause a consistent deviation from the straight-ahead path and require constant steering input in the opposite direction to counteract the effect.
- Drift/pull may be induced by conditions external to the vehicle (for example, wind or road camber).

### **Poor Groove Feel**

Poor groove feel is characterized by little or no buildup of turning effort felt in the steering wheel as the wheel is rocked slowly left and right within very small turns around center or straight-ahead (under 20 degrees of steering wheel turn). Efforts may be said to be "flat on center".

- In the diagnosis of a driveability problem, it is important to understand the difference between wander and poor groove feel.

### **Kingpin Inclination (KPI)**

Kingpin Inclination (KPI) is the amount in degrees that the top of the kingpin tilts away from the vertical toward the center of the truck as viewed from the front of the truck.

KPI, working together with the camber angle, puts the approximate center of the tire tread in contact with the road. KPI has the effect of reducing steering efforts and improves directional stability in the vehicle.

KPI is not adjustable, corrections or changes to this angle are accomplished by replacement of damaged or worn parts.

### Turning Angle

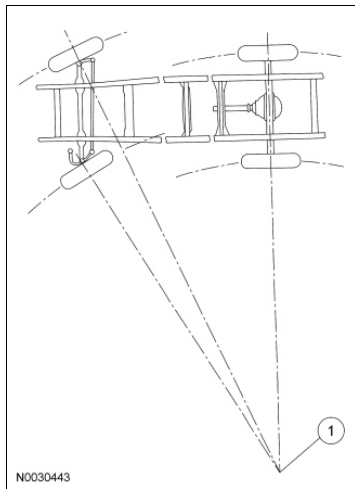
Turning angle is the degree of movement from a straight-ahead position of the front wheels to either an extreme right or left position. Two factors of major importance when adjusting the turning angle are tire interference with chassis and steering gear travel.

Turning Angle (Wheel Cut) Charts are located in Specifications for special applications. Use turning radius plates and the adjustable stop bolts, located on the wheel knuckles, to adjust turning angle. Refer to Toe Adjustment -- Front in this section.

### Ackerman Angle (Toe-Out On Turn)

Ackerman angle is measured in degrees and is the amount one front wheel turns sharper than the other on a turn.

#### Inner Wheel Turns in a Smaller Circle Than Outside Wheel

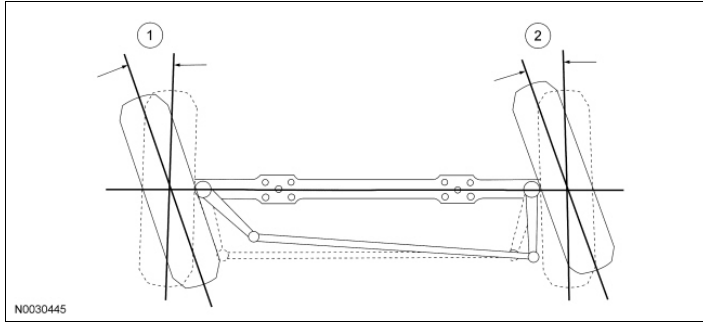


Item	Description
1	Common center point (all wheels)

When a vehicle is turned either to the right or left, the inner wheel is required to turn in a smaller circle than the outside wheel.

If the inner wheel is not permitted to turn in a smaller circle or at a greater angle, tire scuffing will result. Therefore, it is necessary for the front wheels to assume a toe-out position during a turn.

**Inside Wheel Turns at a Greater Angle**



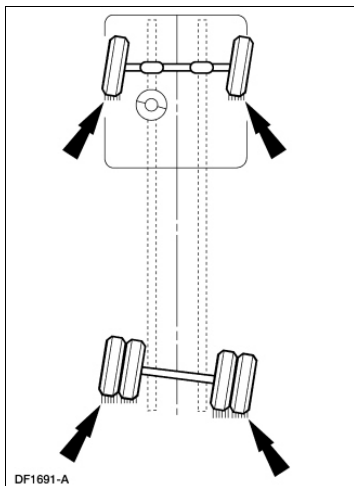
Item	Description
1	Greater angle
2	Smaller angle

Toe-out on turns is accomplished by having the ends of the lower steering arms (tie-rod arms) closer together than the king pins. The amount of toe-out depends on the length and angle of the steering arms. Toe-out on turns varies with the wheelbase. Typically, there is more toe-out on turns with shorter wheelbase vehicles and less with longer wheelbase vehicles.

Even though the toe-in with the wheels in the straight-ahead position may be adjusted correctly, a bent steering arm may cause the toe-out on a turn to be incorrect, causing scuffing of tires.

**Drive Axle Alignment**

Vehicle alignment (axle alignment) is the process of setting the axle of the vehicle into a position to establish true rolling action of the tires on the ground. Misalignment of the axle will cause tire scrub. The amount of tire scrub is proportional to the amount of misalignment.



Drive axle alignment affects the overall wear rate and wear patterns of steering axle tires, as well as tires on the drive axle. Correct drive axle alignment must be confirmed before making final front end alignment settings.

The primary objective in setting drive axle alignment is that the drive axle be positioned perpendicular to the chassis centerline. Refer to Drive Axle Alignment in this section.