CAUTION

If the ABS warning light does not illuminate when the ignition is first turned on, there is a problem with the bulb or wiring. Have this inspected as soon as possible. Failure to comply may result in property or equipment damage.

WARNING

No indication will be given via the dashboard warning lights or buzzer if tires of the wrong size are installed on your vehicle. The Anti-Lock Brake System (ABS) is calibrated for the specific tire revolutions per mile. Use of a tire and/or wheel size different from that originally installed on your vehicle may cause the ABS system to not function during a hard braking event. This could cause an accident or serious personal injury. Consult with your dealer before using a different tire and/or wheel size than was originally installed on your vehicle. Failure to comply may result in death, personal injury, equipment damage, or property damage.

Disposition: / Status:
End of New Topic.

Automatic Traction Control

Your truck/tractor ABS is equipped with an Automatic Traction Control (ATC) feature. This feature is controlled by a switch on the dash. Do not allow the traction control lamp to remain on continuously for an extended length of time. Extended continuous use of the ATC can cause overheating of the drive wheel brakes. Engine torque or vehicle speed should be reduced to eliminate wheel spin and prevent excessive application of the ATC system. Except for checking for proper illumination of the ABS and traction control warning lamps when first starting the vehicle, and for monitoring these lamps while driving, no special operating procedures are required. For detailed system description, see literature for your specific ABS that was provided with your vehicle.

Emergency Braking

WARNING

Unless the truck is equipped with an anti-lock braking system (ABS), avoid fully depressing the service brake pedal. Aggressively depressing the brake pedal can cause the wheels to lock, lead to an uncontrolled skid, and/or result in an accident. Failure to comply may result in property damage, personal injury, or death.

For Non-ABS Vehicles:
To stop your vehicle in an emergency, vary the service brake application pressure to provide maximum braking force without locking the wheels. Do not press the clutch pedal until the engine reaches idle speed. This method uses engine compression to assist the service brakes.

Brake Warning Lamp

When the brake warning lamp comes on, it indicates a malfunction in the brake system. Possible malfunctions include loss

of hydraulic pressure from the power steering circuit or a pressure differential between the primary and secondary brake circuits.

WARNING

Do not operate the vehicle if the brake light or buzzer comes on. The light or buzzer indicates a failure in one of the brake components/system. Drive your vehicle to the side of the road immediately. Failure to comply may result in death, personal injury, equipment damage, or property damage.

SERVICE BRAKE WARNING INDICATOR

If the buzzer sounds while driving, or if the BRAKE light comes on, do the following:

1. Slow down carefully. Here are some things you can do to assist in slowing the vehicle:
   - Downshift - Putting the transmission into a lower gear will help slow the vehicle.
   - Pump the brakes - Pumping the brake pedal may generate enough hydraulic pressure to stop the vehicle.
   - Use the parking brake - The parking or emergency brake is separate from the hydraulic system. Therefore it can be used to slow the vehicle.
2. Move a safe distance off the road and stop.
3. Set the parking brake.
4. Turn on the emergency flasher and use other warning devices to alert other motorists.

Disposition: / Status:
End of New Topic.

Wet Brakes

WARNING

DO NOT drive through water deep enough to wet brake components, as it may cause the brakes to work less efficiently than normal. The vehicle's stopping distance may be longer than expected, and the vehicle may pull to the left or right when brakes are applied, which could contribute to an accident involving death or personal injury.

If you have been driving in heavy rain or deep standing water, your brakes will get wet. Water in the brakes can cause them to be weak, to apply unevenly, or to grab. These conditions can cause a lack of braking power, wheel lockups, or pulling of the vehicle to one side or the other.

Disposition: / Status:
Deleted periods at the end of each bullet per SME comment to be consistent with the unordered lists style. Please review.

Avoid driving through deep puddles or flowing water if possible. If not possible, you should to the following:

- Slow down
- Place transmission in lower gear
- Gently press on the brake pedal
- Increase speed while keeping light pressure on the brake pedal for a short distance to dry out the brake linings

Disposition: / Status:
End of New Topic.

Brake Operation

WARNING

DO NOT drive through water deep enough to wet brake components, as it may cause the brakes to work less efficiently than normal. The vehicle's stopping distance may be longer than expected, and the vehicle may pull to the left or right when brakes are applied, which could contribute to an accident involving death or personal injury.

To rectify this condition, check the rear and both sides of the vehicle for clear traffic, then apply the brakes gently, releasing and gently reapplying until the brakes dry out, restoring normal operation. Always check brakes after driving through deep water to help reduce the possibility of personal injury or an accident.

Overheated Brakes

Under normal braking conditions, the energy generated will bring the internal brake drum temperature to about 500˚ F (260˚ C). This is well within the safe zone: the maximum safe temperature of lining for drum type brakes is usually about 800˚ F (427˚ C).

If service brakes are used for emergency braking, used improperly, or for prolonged periods, internal brake drum temperatures may exceed 800˚ F (427˚ C). Such brake overheating may be detected by a burning smell or smoke coming from a drum. If this occurs, you should immediately stop and check for cracked brake drums or lining fires. If neither exists, continue driving and resume a slow speed as soon as possible to cool the brakes. If the vehicle was to remain stopped, the heat transfer could destroy the linings and distort the brake drum.

To prevent drums from distortion while they cool down:

- Park the vehicle on level surface and block the wheels.
- Release the parking brake and allow the brakes to cool down. See *Brake, Parking Brake Valve* on page 92.

Retarders

Disposition: / Status:

Altered topic. **Please review before publication.**

Various retarders are available, which function against the engine, driveline, or transmission. These are devices that use your engine's power to slow down your vehicle. They save wear and tear on your service brakes and can be a safety feature, too, because they can keep your brakes from overheating. Ideally, you should always slow your vehicle with your retarder (where permitted by law) and use your service brakes only for stopping completely. Operating this way will greatly prolong the life of your brakes.

WARNING

Disposition: / Status:
Changed Warning. Please Review.

DO NOT rely only on a retarder (engine brake, exhaust brake, or transmission retarder) to stop your vehicle. If your engine shuts down, the retarder will cease to operate. Always be ready to apply the service brakes. Failure to comply may result in death, personal injury, equipment damage, or property damage

The retarder is NOT intended as the primary brake for the vehicle, nor is it an emergency brake. The retarder only helps the service brakes by using pressure to slow the drivetrain. Use the service brakes for quick stops. Do not use the retarder when operating on road surfaces with poor traction (such as wet, icy, or snow covered roads or gravel). Retarders can cause the wheels to skid on a slippery surface.
We recommend that you do not use your engine retarder to slow down when you are bobtailing or pulling an empty trailer.

WARNING

Disposition: / Status:
Changed Warning. Please Review.

DO NOT use a retarder (engine brake, exhaust brake, or transmission retarder) when operating your vehicle bobtail or with an unloaded trailer. There may not be enough weight on the rear axle to provide traction, causing a loss of vehicle control, resulting in an accident. Make sure the engine brake is switched "OFF" when bobtailing or operating with an unloaded trailer. Failure to comply may result in death, personal injury, equipment damage or property damage.

This vehicle may have a transmission retarder. Take your foot off the throttle and operate the retarder switch. When you do not need full retarder effect, you can apply it intermittently (off and on) to cause gradual or partial slowing. Continuous application of your retarder will cause your hydraulic fluid to get hotter. Intermittent application will help prevent overheating. When transmission retarder is active, the transmission retarder indicator will illuminate.

NOTE

The exhaust brake and engine brake are two types of engine retarders. Refer also to the engine manufacturer's Operator Manual and to the Engine Retarder manual for additional instructions.

Exhaust Brake

With the exhaust brake switch **ON**, the brake automatically creates its braking effect when you remove your foot from the accelerator pedal.
The brake switch is located on the accessory dash panel. It controls whether the brake is **ON** (ready to slow the vehicle down) or **OFF** (no braking action).

- Do not use the engine retarder (such as an exhaust brake) to slow the vehicle down when you are pulling an empty trailer. See Engine Brakes for further details.

WARNING

Disposition: / Status:
Changed Warning. Please Review.

DO NOT use a retarder (engine brake, exhaust brake, or transmission retarder) when operating your vehicle bobtail or with an unloaded trailer. There may not be enough weight on the rear axle to provide traction, causing a loss of vehicle control, resulting in an accident. Make sure the engine brake is switched "OFF" when bobtailing or operating with an unloaded trailer. Failure to comply may result in death, personal injury, equipment damage or property damage.

- Make sure the brake is OFF before starting the engine.
- After the engine is started, warmed up, and you are ready to get under way, turn the exhaust brake switch ON for added braking effect.

WARNING

Disposition: / Status:
Changed Warning. Please Review.

DO NOT use a retarder (engine brake, exhaust brake, or transmission retarder) when operating on road surfaces with poor traction (such as wet, icy, or snow covered roads, or gravel). Retarders can cause the wheels to skid on a slippery surface. You could lose control of the vehicle or jackknife if the wheels begin to skid, resulting in an accident. Failure to comply may result in death, personal injury, equipment damage, or property damage.

WARNING

Disposition: / Status:
Changed Warning. Please Review.

The service brakes must be used in an emergency. Retarders alone (engine brake, exhaust brake, or transmission retarder) might not stop the vehicle fast enough to prevent an accident. Failure to comply may result in death, personal injury, equipment damage or property damage.

If your vehicle is equipped with ABS, the operation of the exhaust brake (if turned ON) will be controlled by the ABS. For further details on how to use the exhaust brake, see the exhaust brake manufacturers Owner's Manual.

Engine Brakes

Disposition: / Status:

Altered iaw CH437.

Engine Brake ON/OFF Switch

Engine Brake Level Switch

Two switches control your vehicle's engine brake. Engine Brake ON/OFF turns on or off engine braking, and Engine Brake Level controls the amount of engine braking that occurs when the engine brake is active. Both switches are located in the right-hand switch panel. With the engine brake switch **ON**, the engine brake automatically creates its braking effect when you remove your foot from the accelerator pedal and becomes active.
When engine braking is **ON**, the three-position Engine Brake Level switch determines the amount of engine braking that will occur when activated: Low, Medium, or High.

Engine Brake Level (3 position)

Switch Position	Amount of Engine Braking
Top	High – 100%
Middle	Medium – 66%
Bottom	Low – 33%

See your Engine Operation and Maintenance Manual or Engine Brake Operation Manual for further details on using engine retarders.

Engine Brake Indicator

This indicator appears when engine braking (compression brake or exhaust brake) is enabled. Vehicles capable of changing the amount of engine braking show available engine braking levels near the indicator, with the selected braking level highlighted:

When actively engine braking, the engine brake indicator turns green. Active engine braking can be overridden when the operator (or a vehicle feature, such as Adaptive Cruise Control (ACC)) provides acceleration. In these cases, the engine brake indicator will turn white (enabled but not active) while acceleration is being applied.

Axle and Suspension

Differential Lock

The vehicle may be equipped with switches to lock the either of the rear axle differentials. Depending on how the vehicle is specified, a combination of individual switches may be available that can lock the interaxle driveline and/or any combination of the forward rear or rear-rear driving

axles. The interaxle differential switch allows each axle to turn independently. In certain situations, engaging the interaxle differential lock relieves stress on the rear axles and reduces tire wear. Engaging this switch will also provide better traction in slippery or loose gravel conditions.
In the LOCK position, continuous operation on paved, dry surfaces, put stress on the axles, and can possibly damage the internal gears. The switch has a guard to prevent accidental operation of the switch. Locking the differentials is typically used during ice or snow conditions and without tire chains, unpaved roads that have loose sand, mud or uneven surfaces. Look ahead and predict when the differential needs to be locked. Stop the vehicle and lock the differentials before approaching. While using the differential in the locked position, do not exceed 25 mph (40 km/h). When disengaging the differential lock, reduce the throttle to prevent drivetrain damage.

WARNING

DO NOT put the differential lock in the LOCK position while the wheels are spinning freely (slipping), you could lose control of the vehicle or cause axle damage. Switch to LOCK only when the wheels are not spinning. Failure to comply may result in death, personal injury, equipment or property damage.

Inter-Axle Differential Lock Operation

WARNING

Disposition: / Status:
Altered Warning. **Please review before publication.**

Do not use the differential lock during downhill operation or at speeds above 25 mph (40 km/h). When it is engaged under these conditions, your vehicle will exhibit understeer handling characteristics. This understeer condition will cause your vehicle to not turn as quickly and more steering effort will be required, which can cause an accident. Failure to comply may result in property damage, personal injury, or death.

Understeer Condition

1. Turning Radius When Unlocked (Disengaged)
2. Turning Radius When Locked (Engaged)

To LOCK the Inter-Axle Differential

1. Anticipate when you might need increased traction, slow down to a steady speed under 25 mph (40 km/h) or stop the vehicle. Do not lock the differential while going down steep grades or traveling faster than 25 mph (40 km/h), or while wheels are spinning or traction is minimal; lock the differential before you encounter these conditions.
2. Put the inter-axle differential lock switch in the **LOCK** position. A light on the switch will turn on, indicating that the differential is locked (engaged).

3. If you **LOCK** or **UNLOCK** the differential while moving, let up momentarily on the accelerator pedal to relieve torque on the gearing and allow full engagement of the clutch (mechanism that locks the wheels).

> **NOTE**
>
> The Meritor main differential lock or Dana Spicer wheel differential lock is controlled by the switch labeled WHEEL DIFFERENTIAL. By moving the switch you can LOCK or UNLOCK the main differential when the vehicle is moving or stopped.

> **NOTE**
>
> If your vehicle has an automatic transmission, it may be necessary to shift the transmission to the Neutral position momentarily to allow the main differential lock splines to fully engage or disengage.

4. Drive the vehicle through the poor traction area, keeping your speed under 25 mph (40 km/h).

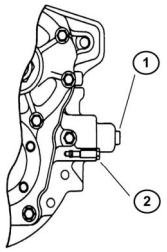
To UNLOCK the Inter-Axle Differential

1. When you reach dry pavement or better road conditions where the differential lock is not needed, switch the differential lock to **UNLOCK**.
2. Let up momentarily on the accelerator pedal to relieve torque and allow the clutch to disengage.
3. When you unlock the differential, normal vehicle handling will resume and the light on the switch will turn off.

Driver Controlled Main Differential Lock

If your vehicle has a Meritor axle with a Driver Controlled Main Differential Lock, install the caging bolt before removing the axles for towing. Installation of the caging bolt prevents damage by locking internal axle components in position. Use the procedure below to lock the Meritor differential.

Driver Controlled Main Differential Lock



1. Air Line - Remove to Install Caging Bolt
2. Caging Bolt Storage Location

Activate the Main Differential Lock

1. Remove the air line.
2. Remove the caging bolt from its storage hole.
3. Screw the caging bolt all the way into the air line hole. This locks the differential by pushing a piston into lock position.

Dual Range (Two-Speed) Rear Axle

Your vehicle may be equipped with a two-speed or dual range axle (option). The low range provides maximum torque for hauling heavy loads or traveling over rough terrain. The high range is a faster ratio for highway speeds and general over-the-road conditions. A switch on the accessory switch panel controls the dual range rear axle. You will notice that the switch has a guard to protect you from activating it accidentally. Always park your vehicle with the range selector in LOW.
Important tips on operating a dual range axle with inter-axle differential:

- Shift the axle with the inter-axle differential in the unlocked position only.
- When you are driving with poor traction, lock the differential. When you have the differential locked, drive with the axle in LOW range only.
- When you are driving on a surface with good traction, keep the inter-axle differential unlocked. You can drive with the axle in the LOW or HIGH range.
- Always UNLOCK the inter-axle differential before shifting the axle speed range.

WARNING

Never shift the axle when moving downhill. Engine driveline disengagement may occur, eliminating engine retardation and allowing the wheels to spin faster than the current speed of the engine. This may require severe braking to slow the vehicle down and can result in an accident. Failure to comply may result in death, personal injury, equipment or property damage.

CAUTION

If you shift the axle range with the inter-axle differential in LOCK, you could seriously damage the axles. Never shift the axle range with the differential locked.

Proper shifting of the axle depends on the synchronization of engine/driveline and wheel speed. When you shift the axle, the connection between the engine and wheels is momentarily disengaged while the gearing is synchronized. Normally when the axle is shifted the speed of the engine, axle, and wheels adjust, allowing for proper gear engagement.
When going downhill the wheels will not slow down, but will tend to speed up, which makes gear synchronization almost impossible. As a result, the axle is neither in HIGH nor LOW range and all engine/driveline retardation is lost. Without engine retardation it is more difficult to slow the vehicle down and greater stress is put on the brake system.

CAUTION

To avoid damaging your vehicle shift the axle at slower travel speeds until you are used to driving with a dual range axle.

How to Operate Two-Speed Axle - Low to High

These steps should be used if operating a two-speed axle in LOW range on rough

terrain and preparing to drive on an improved surface.
When you go from rough terrain to highway driving, shift the axle to the HIGH range following this procedure:

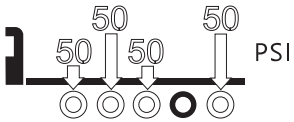
1. Be sure the differential is UNLOCKED.
2. Maintain your vehicle speed (accelerator depressed) and move the Range Selector lever to HIGH.
3. Keep driving with the accelerator depressed until you want the axle to shift.
4. To make the axle shift, release the accelerator until the axle shifts. You are now in the HIGH axle range for highway speeds. Shift the transmission normally to reach your desired cruising speed.

How to Operate Two-Speed Axle - High to Low

These steps should be used if operating a two-speed axle in HIGH range on improved roads and preparing to drive on rough terrain.
When you go from highway driving to rough terrain, shift the axle to the LOW range following this procedure:

1. Maintain vehicle speed (accelerator depressed) and move the Range Selector lever to LOW.
2. Keep driving with the accelerator depressed until you want the axle to downshift.
3. To make the axle downshift, release and depress the accelerator quickly to increase the engine rpm. The axle will shift to LOW range.
4. You are now in the LOW axle range for rough terrain and heavy loads. Shift the transmission normally to maintain the desired speed.

Auxiliary Axle



Adjustable auxiliary axles (commonly known as Pusher or Tag axles) can add to the productivity of the vehicle by increasing the load capabilities of the vehicle when they are in the deployed (down) position. There are different configurations of axles with different functionality (liftable versus steerable). Without the extra axle, the excessive weight can reduce the service life of vehicle components such as, but not limited to, the frame rail, axles, suspension and brakes.
Operation of the auxiliary axles includes the proper maintenance of the system and calibration of its controls. Operating the auxiliary axles will also require a firm understanding of the Gross Axle Weight Rating (GAWR) and the load that is being carried.
The vehicle will have switches on the dash to control the position of the auxiliary axles. In certain situations, however, the system will override the controls to protect the axle system. For Self Steering Lift Axles, the axle will raise when the park brakes are applied or if the vehicle is placed in reverse. For Non-Steer Lift Axles, the axle will only automatically raise if the park brakes are applied and there are no park brakes on the lift axle. Non-Steer Lift Axles do not automatically raise when the vehicle is placed in reverse.
Operating the auxiliary liftable axles must be performed in a manner that does not exceed the axle creep rating. Axle creep ratings are weight and speed limits that are allowed while the vehicle is fully loaded (in excess of the vehicle's standard GAWR) and the axle is in its up position. Axle creep

ratings are assigned by the axle manufacturer and are based on axle model and intended service of the vehicle.
Contact an authorized dealership if you are unable to identify the axle creep rating of this vehicle.

- Liftable/steerable (axle lift calibration required)
- Liftable/non-steerable (axle lift calibration required)
- Non-liftable (some suspensions require dump valve calibration)

WARNING

DO NOT operate or park the vehicle with auxiliary axles without park brakes in the down/loaded position when the vehicle is unladen, or is being unloaded as this could result in loss of vehicle control or roll-away. Raise or dump air into driver controlled auxiliary axle(s) without park brakes prior to unloading the vehicle. Failure to comply may result in death, personal injury, equipment damage, or property damage.

Auxiliary Axle Pressure Regulator

Vehicles with liftable auxiliary axles will have knobs available to adjust the pressure in the auxiliary axle suspension. These knobs are in addition to the tag and pusher axle switches that control the axle position.
Adding more pressure to the auxiliary axle will increase the pressure the auxiliary axle pushes down. Increasing pressure will decrease load on the drive axles and will decrease traction. Decreasing pressure will transfer more weight to the drive axles and will result in more traction from the drive axles.
Deflate the auxiliary axle suspension before coupling or uncoupling a trailer. After the trailer is coupled or uncoupled, then increase pressure to balance traction and axle load requirements. Inflate air springs of the auxiliary axles to the desired pressure after coupling to a loaded trailer while still maintaining proper traction of the drive axles.
Adjust the pressure regulator control knob to a lower pressure until desired traction is obtained. By reducing air pressure at pusher or tag axle, load will be transferred to drive axles. Do not overload drive axles. Always deflate air springs of the auxiliary axles before attempting to unload vehicle. This allows maximum traction of the drive axles to control the vehicle.
Depending on the suspension, various calibrations may be required. Contact your authorized dealer or axle/suspension manufacturer for specific calibration procedures.
Some suspensions require dump valve calibration. For example, some dead axles do not lift, but the air can be dumped out of them to unload them when empty. Air pressure is controlled via an adjustable regulator. These axles need to be calibrated for load.
Contact your authorized dealer or axle/suspension manufacturer for dump valve calibration procedures.

Axle Creep Rating

Vehicles outfitted with auxiliary axles and full truck configuration will have an axle creep rating which defines how much load is allowed when the vehicle has a full load and maneuvering the vehicle, at very slow speeds, with auxiliary axles in the up position. In these situations, the load exceeds the gross axle weight rating of the axles.
Operators using vehicles equipped with liftable auxiliary axles must consider creep ratings when any liftable axle is unloaded

or in the raised position. Liftable auxiliary axles should only be raised (or unloaded) to improve maneuverability in an off-road use or when vehicle is unloaded.

WARNING

NEVER operate the vehicle with more pressure in the lift axles than is necessary to carry the load, as determined by the calibration procedure described. Failure to do so can result in loss of traction and stability at the steer and/or drive axles and can result in increased braking distance, which could cause loss of vehicle control resulting in an accident. Failure to comply may result in death, personal injury, equipment or property damage.

NOTE

Axle Creep ratings MUST NOT be exceeded.

CAUTION

Always lower the axles as soon as possible after receiving a load. Never exceed 5 mph (8 km/h) when driving with a load with the auxiliary axle(s) raised/unloaded. Failure to lower the axle(s) can overload the frame and remaining axles, and could cause equipment damage.

CAUTION

DO NOT modify the air system and/or control functionality on a factory installed auxiliary axle(s). Modifying the factory operation of the pusher and/or tag axle(s) will void your warranty, and can cause equipment damage.

CAUTION

A change in tire size on either the auxiliary axles or the drive/steer axles can change the calibration of the auxiliary axles. If tires are installed with a different loaded radius, the calibration procedure must be repeated. Failure to do so can cause equipment damage.

Contact your dealer or axle manufacturer to determine what the creep rating is for your particular axle(s) and configuration. Creep ratings are generally limited to the following:

- Tandem rear axles only
- Straight trucks only
- Maximum spring mount centers per axle manufacturers specifications
- Maximum tire static loaded radius (SLR) per axle manufacturers specifications

Pusher or Tag Suspension Calibration

Perform this procedure at or near a weight scale. Procedure can be performed while parked on the weight scale if scale is available. To obtain the desired axle load distribution, you must correlate the suspension air gauge pressure to the actual axle load by scaling the axle weight(s) and adjusting the pressure to obtain the desired load. Once the desired load or load range is achieved, document

the pressure-to-load ratio or setting for future use.

> **NOTE**
>
> This procedure must be performed prior to placing the vehicle into service.

Setting the Pressure-to-Load Ratio

To obtain the desired axle load distribution, you must correlate the suspension air gauge pressure to the actual axle load by scaling the axle weight(s) and adjusting the pressure to obtain the desired load. Once the desired load or load range is achieved, document the pressure-to-load ratio or setting for future use.

These instructions are general in nature. For more specific instructions, review the pusher or tag suspension manufacturers maintenance manual or contact the nearest authorized dealer.

1. Park the loaded vehicle on a level surface with the wheels blocked.
2. Release vehicles spring brakes. (Do not release for Liftable/Non-Steerable pusher or tag axles)
3. Lower the pusher/tag axles with the **Axle Lift Control** flip valve. (For some non-liftable axles, inflate air suspension)
4. Adjust the amount of load on each axle by turning the **Pressure Regulator** clockwise to increase the load, or counterclockwise to decrease the load. (The suspension manufacturer may publish pre-established Pressure-to-Load Ratio Pressure Settings to assist you in achieving an estimated ground load).
5. After setting the pressure to obtain the desired axle load, verify proper ground loading with the weight scale.

> **NOTE**
>
> Exceeding local, state, or federal weight limits may result in citations. Contact your local commercial weight enforcement office for limits in your area.

> **NOTE**
>
> Steerable-pusher and/or tag axle(s) will raise when the transmission is shifted into reverse or when the parking brake is applied.

Air Suspension Ride Height

Vehicles equipped with rear or front air suspensions have their ride height and axle (pinion) angle(s) preset at the factory. These are precision settings and should not be altered. Incorrectly adjusted ride height may result in improper interaxle U-joint working angles. This can result in premature driveline wear and driveline vibration.

If it becomes necessary to reset the ride height, you may temporarily set it by following the next procedure. Proper ride height measurement and values are shown in the illustration and table below.

CAUTION

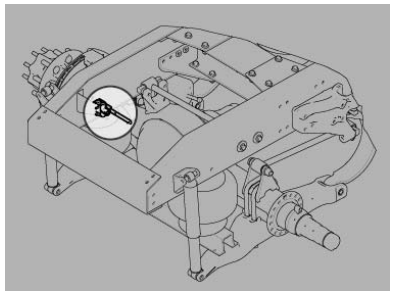
Disposition: / Status:
Changed topic. Please review.

Adjusting the Suspension Ride Height will enable you to reach the nearest authorized dealer or repair facility safely, which should be done as soon as possible. To avoid potential driveline damage, the ride height and pinion angle should be reset using the proper technique and equipment. Failure to comply may result in equipment damage or property damage.

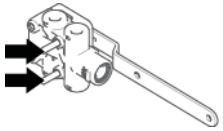
NOTE

Suitable wheel chocks are at a minimum 18 in. (46 cm) long 4x4.

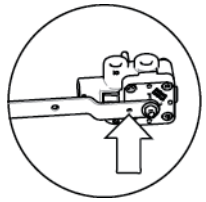
1. Park the vehicle, engage the parking brake and chock the wheels.
2. Locate the air suspension ride height valve.



3. Ensure that the tractor is fully laden during this procedure. Do not use these procedures on a vehicle that is not laden (bobtail).
4. Ensure the air supply and delivery plumbing of the height control valve is consistent with the following illustrations.
5. Loosen the fasteners mounting the height control valve to its bracket.



6. Rotate the valve either clockwise or counterclockwise until air pressure in the air springs provides the ride height specified for that suspension. Measure the ride height from the bottom of the frame rail to the approximate centerline of the rearmost drive axle hub:
   - For tandem axles, make the vertical measurement at the centerline of the suspension.
   - For a single axle, make the measurement in front of the axle, in the area forward of the tires but not past the suspension bracket.
7. When at the correct ride height, ensure that the height control valve lever is in the neutral position, then install either the built-in alignment pin or a 1/8 in. (3 mm) dowel.

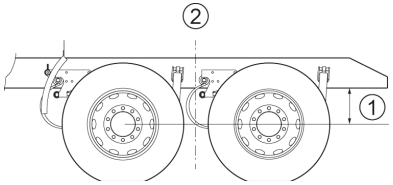


8. Torque the mounting fasteners to 55-75 lb-in. (6.2-8.5 N·m).
9. Remove the alignment pin or dowel.

10. Repeat Steps 2 through 6 above for the right-hand valve on vehicles with a dual-valve system.

Air Ride Height Data

These are factory settings for ride height of the rear air suspension.



1. Ride height
2. Centerline of suspension

Single Axle	Laden Ride Height -in. (mm)
Air Trac	11.00 (279)
Low Air Leaf	6.50 (165)

Single Axle	Unladen Ride Height -in. (mm)
Air Trac	11.39 (289)
Low Air Leaf	6.75 (171)

Tandem Axle	Laden Ride Height - in. (mm)
Air Leaf	11.70 (297)
Air Trac	11.00 (279)
Low Air Leaf	8.50 (216)
Low Low Air Leaf	6.50 (165)
FLEX Air	8.50 (216)

Tandem Axle	Unladen Ride Height -in. (mm)
Air Leaf	12.0 (305)
Air Trac	11.38 (289)
Low Air Leaf	8.75 (222)
Low Low Air Leaf	6.75 (171)
FLEX Air	8.75 (222)

Suspension Air Pressure Gauge & Switch

Your vehicle may have an air suspension and a deflation switch which allows the air in the suspension to be exhausted from a switch on the dash. The normal purpose of this feature is to allow you to lower the vehicle for loading. A guard on the switch prevents you from accidentally deflating the suspension.

The Suspension Air Pressure gauge (optional) indicates the amount of air pressure in the air suspension springs in pounds per square inch (psi). Air pressure in the spring is related to the rear axle load. The greater the rear axle load, the greater the air pressure in the air bags. Therefore, the air pressure displayed will vary, depending upon the rear axle load.

What to do if an Air Spring Ruptures

If an air spring has ruptured, drive the vehicle to a safe stop off the highway to investigate the problem.

WARNING

DO NOT continue to drive with ruptured air springs. The air loss can cause the spring brakes to apply allowing your brakes to drag and burn up the linings, which could lead to an accident causing death or personal injury. DO NOT continue to operate the vehicle in this condition.

WARNING

DO NOT drive the vehicle if the air pressure is less than 100 psi (690 kPa). Driving the vehicle with less than 100 psi (690 kPa) could make the brakes unsafe to use which could cause an accident involving death or personal injury.

CAUTION

Operating a vehicle with air suspension bags either overinflated or underinflated may cause damage to driveline components. If a vehicle must be operated under such conditions, do not exceed 5 mph (8 km/h). Failure to comply may result in equipment damage.

Disposition: / Status:
Change of terminology (truck by vehicle) per SME request. Please review.

You can get to a repair facility by removing the height control link connected to the axle and to the suspension air valve control arm. This will cause the air valve control arm to center in the closed position. Removing the link will allow the air system of the vehicle to operate normally so that the vehicle can be driven to a service center.

Fifth Wheel

The following applies to tractor configurations:

WARNING

Disposition: / Status:
Altered Warning - Changed "mechanic" to "technician." Added standard boilerplate. **Please review before publication.**

Ensure that all fifth wheel maintenance, adjustments, and rebuilding are done only by a qualified technician. An improperly maintained fifth wheel can cause a trailer to separate from a tractor. This could lead to a serious accident. Failure to comply may result in property damage, equipment damage, personal injury, or death.

Your vehicle is equipped with either a Fixed or an Air-Controlled Sliding Fifth Wheel. Either type should self lock when a trailer king pin trips the locking dogs as the tractor is backed under a trailer.

How to Lock the Kingpin

Ensure that the fifth wheel lock is in the unlocked position.

WARNING

Always inspect the fifth wheel for proper locking after coupling the tractor to a trailer. Failure to properly couple the tractor to a trailer (the kingpin is engaged in a closed lock jaw with the lock jaw secured by a closed plunger) may cause trailer separation which could result in an accident involving death or personal injury.

To lock the fifth wheel around the kingpin:

1. Ensure trailer brakes are locked and the landing gear is down.
2. Back the tractor fifth wheel into the trailer kingpin to engage and lock.

JOST Fifth Wheel Indication

If equipped with JOST fifth wheel

3. Pull the tractor forward to ensure the kingpin has been locked in place.
4. Set the tractor parking brake.
5. Connect the tractor brake air and electric lines to the trailer.

Conduct a pre-trip inspection prior to releasing the brakes, raising the landing gear, and driving the vehicle.

Releasing the Kingpin Remotely (option)

CAUTION

Do not deflate the rear suspension before unlocking the fifth wheel. Deflating the rear suspension before unlocking the fifth wheel could cause difficulty during uncoupling and result in damage to the fifth wheel and kingpin.

1. Set both the vehicle and trailer parking brakes.
2. Lower the landing gear.
3. Disconnect the tractor brake air and electric lines from the trailer.
4. Flip up cover, then press and hold the **Kingpin Release** switch for 3 seconds. A countdown timer notification will appear on the display, and the unlock symbol on the **Kingpin Release** switch will illuminate.
   The notification will inform the operator when to release the switch.

JOST Fifth Wheel Indication (option)

If equipped with JOST Fifth Wheel

NOTE

The fifth wheel will not unlock unless the vehicle is stopped and the parking brake is set. In this situation, a red-colored notification appears, informing the operator that kingpin release is not available and to set the parking brake. This will require restarting this procedure.

5. Release the switch.
   The unlock symbol on the **Kingpin Release** switch will turn off.

6. Ease tractor forward enough for the kingpin to clear the fifth wheel (about 12 to 18 inches).

> **NOTE**
>
> Do not drive tractor free of trailer.

7. If the tractor has a rear air suspension, deflate (dump) the rear suspension enough so that the fifth wheel will smoothly separate from the trailer.

Suspension Dump Symbol

8. Ease tractor forward, clearing the trailer.
9. If the rear suspension was deflated, return rear suspension to its normal height.

Releasing the Kingpin Manually

> **CAUTION**
>
> Do not deflate the rear suspension before unlocking the fifth wheel. Deflating the rear suspension before unlocking the fifth wheel could cause difficulty during uncoupling and result in damage to the fifth wheel and kingpin.

> **NOTE**
>
> The specific method required to operate the fifth wheel release handle will depend on the fifth wheel manufacturer and model. The operator should be familiar with this method prior to attempting this procedure.

To release the kingpin and separate tractor from trailer

1. Position the tractor and trailer in a straight line on firm, level ground.
2. Set both the tractor and trailer parking brakes.
3. Exit cab and lower the trailer landing gear.
4. Disconnect brake air and electric lines from trailer, and secure lines.
5. Unlock the fifth wheel release handle if necessary, then unlock the fifth wheel.

> **NOTE**
>
> Operating the release handle and unlocking the fifth wheel will depend on the fifth wheel manufacturer.

6. Return to cab and release tractor parking brake.
7. Ease tractor forward enough for the kingpin to clear the fifth wheel (about 12 to 18 inches).

> **NOTE**
>
> Do not drive tractor free of trailer.

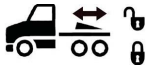
8. If the tractor has a rear air suspension, deflate (dump) the rear suspension enough so that the

fifth wheel will smoothly separate from the trailer.

Suspension Dump Symbol

9. Ease tractor forward, clearing the trailer.
10. If the rear suspension was deflated, return rear suspension to its normal height.

Air-Controlled Sliding Fifth Wheel (option)



Vehicles that have an air-controlled sliding fifth wheel have a fifth wheel slider lock controlled by a switch on the accessory switch panel. To operate this type of lock, move the switch to the appropriate position. By placing the switch in the **UNLOCK** position, you can slide the fifth wheel to various positions to adjust weight distribution. There is a guard on this switch to protect you against accidentally activating or releasing the lock.

WARNING

DO NOT move the fifth wheel while the tractor-trailer is in motion. Your load could shift suddenly, causing you to lose control of the vehicle. Never operate the vehicle with the switch in the UNLOCK position. Always inspect the fifth wheel after you lock the switch to be sure the fifth wheel slide lock is engaged. Failure to comply may result in death, personal injury, equipment or property damage.

How to Slide the Fifth Wheel

WARNING

DO NOT move the fifth wheel while the tractor-trailer is in motion. Your load could shift suddenly, causing you to lose control of the vehicle. Never operate the vehicle with the switch in the UNLOCK position. Always inspect the fifth wheel after you lock the switch to be sure the fifth wheel slide lock is engaged. Failure to comply may result in death, personal injury, equipment or property damage.

WARNING

Do not attempt to slide the fifth wheel until all persons and obstacles are clear of the vehicle. Failure to comply may result in death, personal injury, equipment damage, or property damage.

NOTE

This procedure assumes a connected trailer. The trailer kingpin must be locked within the fifth wheel when changing slide positions.

1. Position the tractor and trailer in a straight line on firm, level ground.
2. Place the tractor in neutral, and set the tractor and trailer parking brakes.
3. Unlock the slide by repositioning the Fifth Wheel Slide switch.

CAUTION

Ensure the tractor and trailer brakes are engaged prior to sliding the fifth wheel. Failure to engage the brakes could result in uncontrolled sliding of the fifth wheel and possibly damage components on the tractor or trailer.

Fifth Wheel Slide Symbol

4. Inspect and verify that locking plungers have fully withdrawn from the fifth wheel slide tracks.
   a. If locking plungers did not fully withdraw, move tractor slightly to reposition plungers and reinspect.
   b. If plungers are still not fully withdrawn, lower the landing gear and deflate the rear suspension (if available) to lessen pressure on the slide.

Suspension Dump Symbol

5. Release the tractor parking brake, but keep the trailer brake engaged.
6. Slowly ease tractor forward or backward, and stop at the desired position.
7. Lock the slide by returning the Fifth Wheel Slide switch to its previous position.
8. Inspect and verify that the locking plungers are fully inserted into the fifth wheel slide tracks.
   a. If the locking plungers are not fully inserted in the track, move the tractor slightly to reposition plungers and reinspect.

WARNING

Do not operate the vehicle unless the locking plungers are fully inserted into the fifth wheel slide track. Operating the vehicle while the plungers are not fully inserted could lead to the slide moving unexpectedly, resulting in a loss of vehicle control and potentially causing property damage, serious injury, or death.

9. If the landing gear was lowered, raise the landing gear.
10. If the rear suspension was deflated, return rear suspension to its normal height.

Fifth Wheel Lubrication

Frequently operate and lubricate movable or sliding fifth wheels to prevent corrosion.

CAUTION

Both the fifth wheel plate and the slide tracks (if a slider) should be cleaned and lubricated periodically to ensure smooth turning and sliding action. Failure to keep these surfaces lubricated can lead to frame or driveline damage.

For maintenance information see *Fifth Wheel Monthly Maintenance* on page 263, *Fifth Wheel Bi-Annual Maintenance* on

page 263 and *Sliding Fifth Wheels* on page 263.

Driving Tips and Techniques

This section covers additional driving tips and techniques on how to drive your vehicle more efficiently.

Coasting

WARNING

DO NOT coast with the transmission in neutral or with the clutch pedal depressed, it is a dangerous practice. Coasting in neutral may damage your drivetrain when you try to re-engage the transmission and could result in a loss of vehicle control. Failure to comply may result in death, personal injury, equipment damage, or property damage.

Do not coast with the transmission in neutral or with the clutch pedal depressed. Besides being illegal and dangerous, coasting is also expensive. It causes premature failure or damage to the clutch and transmission and overloads the brake system. Coasting with the transmission in neutral also prevents proper transmission component lubrication. During coasting the transmission is driven by the rear wheels, and the countershaft gear (which lubricates the transmission components by oil splash) will only be turning at idle speed.

Descending a Grade

WARNING

DO NOT hold the brake pedal down too long or too often while going down a steep or long grade. This could cause the brakes to overheat and reduce their effectiveness. As a result, the vehicle will not slow down at the usual rate. To reduce the risk of an accident which could cause personal injury or death, before going down a steep or long grade, reduce speed and shift the transmission into a lower gear to help control your vehicle speed. Failure to follow procedures for proper downhill operation could result in loss of vehicle control.

Engine Overspeed

CAUTION

Do not let the engine RPM operate beyond the maximum governed RPM. Operating the engine above the maximum governed RPM may result in Engine damage.

NOTE

Often these recommendations are secondary to maintaining an adequate and safe speed relative to the surrounding traffic and road conditions.

Operate the engine within the optimum engine rpm range and do not allow the rpm to exceed the maximum governed speed. See your Engine Operation and Maintenance manual for information regarding engine rpm. When the engine is used as a brake to control vehicle speed (e.g., while driving down a grade), do not allow the engine rpm to exceed maximum governed speed. Under normal load and road conditions operate the engine in the lower end of the range.

The tachometer is an instrument that aids in obtaining the best performance of the engine and manual transmission, serving as a guide for shifting gears. Refer to the Engine Operation and Maintenance manual for optimum engine rpm.

- If the engine rpm moves beyond the maximum governed speed, indicating an overspeed condition, apply the service brake or shift to a higher gear to bring engine rpm within the optimum speed range.
- When driving downhill: shift to a lower gear, use the engine brake (if so equipped), and use the service brake, keeping the engine speed below 2,100 rpm.

When the engine speed reaches its maximum governed speed, the injection pump governor cuts off fuel to the engine. However, the governor has no control over the engine rpm when it is being driven by the vehicle's transmission, for example, on steep downgrades. Apply service brakes or shift to a higher gear. Fuel economy and engine performance are also directly related to driving habits:

- The best results in trip time and fuel economy are obtained while driving the vehicle at a steady speed.
- Shift into higher or lower gears (or apply the service brake) to keep engine rpm near the lower end of the optimum operating range.
- Avoid rapid acceleration and braking.

Use of Digital Display

WARNING

DO NOT look at the Digital Display for prolonged periods while the vehicle is moving. The Digital Display should be referenced only briefly and should not be used as a substitute for observing actual road and traffic conditions. Failure to pay attention to the vehicle's road position or situation can lead to an accident. Failure to comply may result in death, personal injury, equipment damage, or property damage.

The Digital Display provides information to help the driver optimize vehicle efficiency. See *Trip Summary* on page 63 for more information. A driver will find the section describing Trip Information and the rpm detail useful.

Fuel Consumption

The vehicle's fuel consumption is connected to five important factors: maintenance, driving habits, general condition of the road, traffic conditions, and vehicle load.
Proper maintenance will keep the vehicle running like new even after long periods of use. The driver must perform the daily and weekly checks of the vehicle.
Maintenance factors affecting fuel consumption:

- Air and/or fuel filters partially clogged
- Engine valves out of adjustment
- Injection pump improperly synchronized
- Injection nozzles defective or uncalibrated
- Improperly inflated tires
- Wheel bearings improperly adjusted
- Clutch improperly adjusted or worn (slipping)
- Fuel leaks

Wrong driving habits must be corrected and the recommendations on economic driving should be followed. Driving factors affecting fuel consumption:

- Excessive speed and unnecessary fast acceleration
- Long periods of idling
- Driving with foot resting on the (manual transmission) clutch pedal

General Condition

Other factors affecting fuel consumption are related to loads and the type of roads on which the vehicle operates. It is not always possible to choose the most adequate road, but the ideal road is the one that allows a steady speed in high gear, without requiring frequent braking and acceleration. The following general conditions can affect fuel consumption:

- Overload
- Unbalanced load
- Very high load
- Inadequate roads
- Traffic conditions

Stopping the Vehicle

A hot engine stores a great amount of heat. It doesn't cool down immediately after you shut it off. Always cool your engine down before shutting it off. You will greatly increase its service life.

Idle the engine at 1,000 rpm for five minutes. Then low idle for 30 seconds before shutdown. This will allow circulating coolant and lubricating oil to carry away heat from the cylinder head, valves, pistons, cylinder liners, turbocharger, and bearings. This way you can prevent serious engine damage that may result from uneven cooling.

Turbocharger

This cooling-down practice is especially important on a turbocharged engine. The turbocharger contains bearings and seals that are subjected to hot exhaust gases. While the engine is operating, heat is carried away by circulating oil. If you stop the engine suddenly, the temperature of the turbocharger could rise as much as 100°F (55°C) above the temperature reached during operation. A sudden rise in temperature like this could cause the bearings to seize or the oil seals to loosen.

Refueling

Air space in your fuel tanks allows water to condense there. To prevent this condensation while you are stopped, fill your tanks to 95 percent of capacity. When refueling, add approximately the same amount to each fuel tank on vehicles with more than one tank.

WARNING

DO NOT carry additional fuel containers in your vehicle. Fuel containers, either full or empty, may leak, explode, and cause or feed a fire. Failure to comply may result in death or personal injury.

WARNING

Diesel fuel in the presence of an ignition source could cause an explosion. A mixture of gasoline or alcohol with diesel fuel increases this risk of explosion. DO NOT remove a fuel tank cap near an open flame. Use only the fuel and/or additives recommended for your engine. Failure to comply may result in death, personal injury, equipment or property damage.

CAUTION

Disposition: / Status:
Changed Caution. Please Review. Removed content split into this Caution and two Notes (twa1699548331962.xml) and (xvm1699548525531.xml).

Use only Ultra Low Sulfur Diesel (ULSD) Fuel, as recommended by engine manufacturers. High-sulfur diesel fuel will damage the aftertreatment system and impact the engine emissions which will result in the engine not meeting emission regulations. Failure to comply may result in equipment or property damage.

NOTE

Disposition: / Status:
New Note. Please review. Content extracted from existing Caution. NO NEW CONTENT.

For more information on fuel specifications, consult the engine operator's manual.

If your vehicle is equipped with fuel shut off valves for the take-off and return lines, they are located on the fuel lines entering the top of the fuel tank. Fuel shut off valves for the fuel crossover line are on the bottom of the fuel tank, at the crossover line connection.

Final Stopping Procedures

WARNING

When parking a vehicle, fully raise lift axles that are not equipped with a parking brake. If left in the down position, a lift axle not equipped with a parking brake could cause the parked vehicle to roll, resulting in an accident. Failure to comply may result in death, personal injury, equipment damage, or property damage.

Your vehicle will be easier to start driving when you are ready, and it will be safer for anyone who might be around it. Please remember, too, that in some states it is illegal to leave the engine running and the vehicle unattended.

1. Set the parking brake before leaving the driver’s seat.

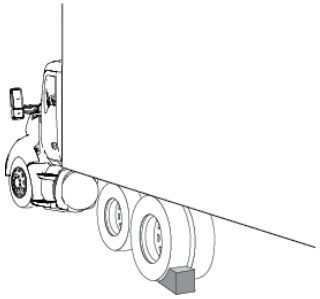
WARNING

DO NOT use the service brake or trailer hand brake to hold a parked vehicle. Because these brakes rely on air pressure, a loss of pressure could loosen the brakes and cause the vehicle to roll, resulting in an accident. Always set the parking brake. Failure to comply may result in property damage, personal injury, or death.

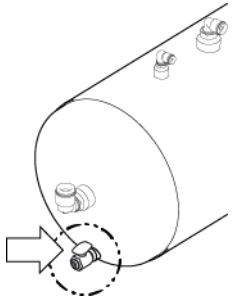
WARNING

DO NOT leave the transmission in gear to hold a parked vehicle. Always set the parking brake. Engine compression may not provide sufficient force to hold the vehicle, or the transmission may move out of gear, causing the vehicle to roll and result in an accident. Failure to comply may result in property damage, personal injury, or death.

2. If you are parked on a steep grade, block the wheels.



3. Drain water from the air reservoirs. Open the reservoir drains just enough to drain the moisture. Don't deplete the entire air supply. Be sure to close the drains before leaving the vehicle.



4. Secure the vehicle. Close all the windows and lock all the doors.

Anti-Lock Brake Systems (ABS)

Disposition: / Status:
Altered Topic. **Please review before publication.**

This vehicle may be equipped with an ABS, which reduces the possibility of wheel lock-up. If a wheel is about to lock during braking, the ABS will automatically adjust air pressure to the brake chambers on the appropriate wheel(s) to prevent wheel lock-up. The ABS is automatically turned on when the ignition switch is turned on.

WARNING

Disposition: / Status:
Altered Warning. **Please review before publication.**

The anti-lock brake system is a critical vehicle safety system. For the safety of you and others around you, have the vehicle submitted for periodic preventive maintenance checks as well as having any suspected problems immediately checked by an authorized dealer. Failure to properly maintain your brake system can lead to serious accidents. Failure to comply may result in death, personal injury, equipment damage, or property damage.

WARNING

Disposition: / Status:
Altered Warning. **Please review before publication.**

DO NOT rely on an anti-lock brake system that is functioning improperly. You could lose control of the vehicle resulting in a severe accident, causing personal injury or death. If your ABS lamp goes on while you are driving or stays on after the self-check, your anti-lock system might not be working. The ABS may not function in an emergency. You will still have conventional brakes, but not anti-lock brakes. If the lamp indicates a problem, have the ABS checked. Failure to comply may result in death, personal injury, equipment damage, or property damage.

Vehicles without ABS are typically equipped with a bobtail brake proportioning system. When a trailer is not connected, the drive axle brake application pressure will automatically be limited by the proportioning system. When driven in a bobtail mode, these tractors will require greater brake pedal application to provide the equivalent braking to a bobtail tractor not equipped with a proportioning system.

Trailer ABS Power Line Communication (PLC)

North American on-highway vehicles are equipped with a separate electrical circuit to power the ABS on towed vehicle(s). In most cases, the ABS power will be supplied through the Auxiliary circuit on the primary 7-way trailer light line connector. If the vehicle was manufactured with a switchable Auxiliary circuit for trailer accessories, an additional 7-way connector would have been provided for trailer ABS power. In either case, the ABS power line on the vehicle will be PLC equipped.

WARNING

Disposition: / Status:
Altered Warning. **Please review before publication.**

DO NOT splice into the non-switchable Auxiliary circuit on the primary 7-way trailer light line. Doing so may cause the trailer ABS to malfunction. This circuit is dedicated for trailer ABS power. To add a switchable auxiliary circuit, contact a dealership. Failure to comply may result in death, personal injury, equipment damage, or property damage.

NOTE

Disposition: / Status:
Indicator color updated from yellow to amber. Please review.

Tractors/Trucks and trailers built after 03/01/2001 must be able to turn on an In-Cab Trailer ABS Warning Light (per U.S. FMVSS121). The industry chose Power Line Communication (PLC) as the standard method to turn it on. On trailers built prior to 03/01/2001, verify trailer ABS system status via the required external warning light mounted on the trailer. The indicator light on the trailer should be amber and identified with the letters ABS.

For doubles or triples, the lamp does not distinguish between trailers. An ABS problem in any of the trailers will activate the Trailer ABS Warning Lamp.
If you change the intended service in any way (e.g., number of axles, multiple trailers, add switchable trailer accessories,

etc.) from the date the vehicle was manufactured, you should contact your trailer manufacturer and/or trailer anti-lock brake manufacturer to determine if the power available at the 7-way trailer light line is adequate. Failure to do so might result in insufficient power to the trailer ABS system, which may affect its operation.

CAUTION

The center pin of the 7-way trailer light line may be constantly powered for ABS. Make sure it will not accidentally turn on trailer equipment.

Special Trailer ABS Without PLC (Option)

If a trailer does not have PLC, but it does have ABS that is powered through an optional second trailer connector (ISO 3731) and that trailer ABS is designed to control the Trailer ABS Warning Lamp in the cab and the vehicle has been ordered with the option to turn on this lamp for these types of trailers, then this lamp will turn on when that trailer ABS has a system problem. This should be checked by a dealer as soon as possible. The Trailer ABS Warning Lamp will not turn on for the power-on test when connected to these types of trailers.

NOTE

Very few trailers built before 03/01/2001 have this option. Trailers built after 03/01/2001 are built with PLC technology.

Chapter 5 | MAINTENANCE

5

New Vehicle Maintenance Schedule — First Day

First Day
Perform a total vehicle alignment once a body is installed on the truck chassis.
Steering U-joint Pinch Bolt • Refer to *Steering Shaft Bolt Torque Specifications* on page 277 for maintenance instructions.
Front Suspension - U-bolts • Check the general condition and the tightness of the nuts. Tighten the U-bolts using a calibrated torque wrench to the specified torque value. (Refer to *Suspension U-Bolts, Grade 8* on page 292 for maintenance instructions.)

First 50-100 mi / 80-160 km

First 50-100 mi / 80-160 km[17]
Wheel Mounting • Refer to *Wheels* on page 281 for maintenance instructions.

First 500 mi / 800 km

[17] **Ensure that all maintenance intervals leading up to this point are repeated during this interval prior to the completion of those listed here.**

First 500 mi / 800 km[18]
Front Axle U-Bolt Torque • Refer to *Suspension U-Bolts, Grade 8* on page 292 for maintenance instructions.
Charge Air Cooler and Air Intake Pipe Clamps • Retorque fasteners. Refer to *Pipe and Hose Clamp Torque Values* on page 254 for maintenance instructions.

First 2,000 mi / 3,218 km

First 2,000 mi / 3,218 km[19]
Rear Suspension Fasteners • Refer to *Rear Axle and Suspension* on page 272 for maintenance instructions.

First 3,000-5,000 mi / 4,800-8,000 km

[18] Ensure that all maintenance intervals leading up to this point are repeated during this interval prior to the completion of those listed here.

[19] Ensure that all maintenance intervals leading up to this point are repeated during this interval prior to the completion of those listed here.

First 3,000-5,000 mi / 4,800-8,000 km [20]
Transmission Lubrication • Refer to Transmission Operator's Manual for maintenance instructions.
Axle Lubrication. • For Meritor axle, refer to *Meritor Axle Lubrication* on page 210 for maintenance instructions. • For Eaton/Dana axle, refer to *Eaton/Dana Axle Lubrication* on page 211 for maintenance instructions.

Preventive Maintenance Intervals

Preventive maintenance program begins with the daily checks. Routine vehicle checks can help avoid many large, expensive, and time consuming repairs. The vehicle will operate better, be safer, and last longer. Neglect of recommended maintenance can void your vehicle's warranty. Some maintenance operations demand skills and equipment you may not have. For such situations, please take your vehicle to an authorized Service Center.

WARNING

Before attempting any procedure in the engine compartment, stop the engine and let it cool down. Hot fluids and components can burn skin on contact. Failure to comply may result in death, personal injury, equipment damage, or property damage.

WARNING

If the engine must be running to inspect, be alert and cautious around the engine at all times. Failure to comply may result in death, personal injury, equipment or property damage.

WARNING

If work must be done with the engine running, always:

- Ensure that the transmission is in neutral (**N**) or park (**P**)
- Set the parking brake
- Block the wheels

Failure to comply may result in death, personal injury, equipment or property damage.

5

[20] **Ensure that all maintenance intervals leading up to this point are repeated during this interval prior to the completion of those listed here.**

WARNING

DO NOT wear neckties, jewelry, and/or loose clothing, and secure long hair to avoid getting caught in the fan blades or other moving engine parts. Failure to comply may result in death, personal injury, equipment damage, or property damage.

WARNING

Always support the vehicle with appropriate safety stands if it is necessary to work underneath the vehicle. A jack is not adequate for this purpose. Failure to comply may result in death, personal injury, equipment or property damage.

Disposition: / Status:
Updated to include boilerplate consequence language and now to include this draft comment.

WARNING

When working underneath the vehicle with the wheels on the ground (not supported), make sure that

- The vehicle is on hard, level ground.
- The parking brake is applied.
- All wheels are blocked (front and rear).
- The ignition key is removed to prevent the engine from starting.

Failure to comply may result in death, personal injury, equipment damage or property damage.

WARNING

NEVER start or let the engine run in an enclosed, unventilated area. Engine exhaust fumes contain carbon monoxide, a colorless and odorless gas. Carbon monoxide can be fatal if inhaled. Failure to comply may result in property damage, personal injury, or death.

WARNING

Disconnect the battery ground cable whenever you work on the fuel system or the electrical system. When you work around fuel, do not smoke or work near heaters or other fire hazards. Keep an approved fire extinguisher near to you. Failure to comply may result in death, personal injury, equipment or property damage.

The following pages contain a table of maintenance tasks with the related intervals for each task on the right side of the table. The top of the table displays a guide to a maintenance interval and its schedule. Some tasks are dependent on the vehicle application. These tasks will be shown as separate tasks and will have the words “ON HIGHWAY”, “CITY DELIVERY” or “OFF-HIGHWAY” after the description. These tasks are differentiated because they are dependent on the vehicle’s operating environment. On highway is defined for applications where the vehicle is NOT used off of a paved road during normal operation. City Delivery is defined for applications where frequent start and stopping is required during normal

operation and the highway is used infrequently and for short periods of time. Off highway is defined for applications where the vehicle may be driven off the pavement on a regular basis, even if it is an infrequent basis and/or for a brief time period. Please contact an authorized service dealership if there are questions regarding which interval to follow. Consult the supplier for specific recommendations where discrepancies develop between these recommendations in this table and component supplier recommendations.

- Engine lubricating oil change intervals aren't listed here. Refer to your engine's operating manual for recommendations. For specific information on maintenance procedures consult your vehicle maintenance manual.
- The initial fill of drive axle lubricant must be changed before the end of the first scheduled maintenance interval. See the axle manufacturer's operator's manual for recommended lubrication specifications and service intervals.
- The initial fill of lubricant in manual transmissions must be changed before the end of the first maintenance interval. See the transmission manufacturer's operator's manual for recommended lubrication specifications and service intervals.
- If your vehicle is equipped with an automatic transmission, consult the owner's manual for it that came with your vehicle to obtain lubricant check and change intervals.

Disposition: / Status:
The items in this table did not fall within a specified interval and will be integrated or a new periodicity will be created before SOP.

5

Drive Axle (Dana) - Axle Housing
• Drain the lubricant while warm. Flush each unit with clean flushing oil. Change the lubricant. (Refer to *Eaton/Dana Axle Lubrication* on page 211 for maintenance instructions.)
Drive Axle (Meritor) - Axle Housing
• Drain and replace the lubricant. (Refer to *Meritor Axle Lubrication* on page 210 for maintenance instructions.)
Main transmission
• Check the oil level; refill as required. Check every 50,000 mi and refill as required. (Refer to *Main transmission* on page 209 for maintenance instructions.)
Air Intake - Air cleaner

• Replace the engine intake air cleaner element. When required by air restriction indicator or required by the engine manufacturers operator manual. (Refer to *Air Intake System* on page 257 for maintenance instructions.)
Tires and Wheels - Tires
• Check inflation pressure. Weekly "cold" using calibrated gauge. (Refer to *Tires* on page 278 for maintenance instructions.)
Driveshafts - Models SPL-90, 1710 and 1810 slip member and U-joints
• Inspect. U-joint inspections should be performed every time a vehicle comes in for scheduled maintenance.**
Driveshafts - Models SPL-100 slip member and U-joints
• Inspect. U-joint inspections should be performed every time a vehicle comes in for scheduled maintenance.**
Driveshafts - Models SPL-140/140HD/170/170HD/250/250HD slip members and U-joints (ON HIGHWAY and LINEHAUL)
• Inspect. U-joint inspections should be performed every time a vehicle comes in for scheduled maintenance.**
Driveshafts - Models SPL-140XL/170XL/ 250XL slip members and U-joints (OFF-HIGHWAY)
• Lubricate*. 350,000 mi (560,000 km) 1st interval and then every 100,000 mi (160,00 km) after that.
Driveshafts - Models SPL-140XL/170XL/ 250XL slip members and U-joints (ON HIGHWAY and LINE HAUL)
• Inspect. U-joint inspections should be performed every time a vehicle comes in for scheduled maintenance.**
Driveshafts - Models SPL-140XL/170XL/ 250XL slip members and U-joints (OFF-HIGHWAY and CITY DELIVERY)
• Inspect. U-joint inspections should be performed every time a vehicle comes in for scheduled maintenance.**
Aftertreatment System - Diesel particulate filter
• Clean filter. Refer to the *Engine Maintenance Manual*.

Aftertreatment System - Diesel exhaust fluid supply module
• Replace filter. Refer to the *Engine Maintenance Manual*.
Air - Air dryer (ON HIGHWAY)
• Overhaul. 360,000 miles/576,000 km (Refer to *Air Dryer Maintenance* on page 216 for maintenance instructions.)
Safety - Three-point Safety Belt System
• Inspect. 20,000 miles/32,000km If the vehicle is exposed to severe environmental or working conditions, more frequent inspections may be necessary. (Refer to *Safety Restraint System - Inspection* on page 232 for maintenance instructions.)

Disposition: / Status:
End of New Topic.

Every 50 Hours

Every 50 Hours [21]
Steer Axles - Kingpin Joint Grease / Tie Rod Ends with Heavy-Duty Multipurpose Lithium Based Lubricant

Every 50 Hours
• Use #1 Grade or #2 Grade: See Kingpins, Thrust Bearings, and Tie Rod Ends.

Every 750 mi / 1,207 km / 1 mo

Disposition: / Status:
Altered topic. **Please review before publication.**

* Use only Spicer Driveshaft approved lubricants when greasing Spicer U-joints.

** Refer to Spicer Driveshaft service manual DSSM-0100 (3264-SPL) for detailed instructions.

21 **Ensure that all maintenance intervals leading up to this point are repeated during this interval prior to the completion of those listed here.**

Every 750 mi / 1,207 km / 1 mo [22]
Front Axle (Meritor) - Drawkeys • Tighten nuts. (Refer to *Steering System* on page 275 for maintenance instructions.)
Disc Brakes (Bendix®) - System operation • Check operation; inspect as per manufacturer's service literature. (Refer to *Air Disc Brakes* on page 221 for maintenance instructions.)

Every 7,500 mi / 12,000 km / 6 mo

Every 7,500 mi / 12,000 km / 6 mo [23]
Frame - Fifth Wheel • Check the kingpin lock and plate for wear and function; lubricate (NLGI #2 grease). (Refer to *Fifth Wheel Monthly Maintenance* on page 263 for maintenance instructions.) • Inspect fifth wheel operation. (Refer to *Frame Fastener Torque Requirements* on page 291 for maintenance instructions.)
Frame - Frame Fasteners • Check for tightness. (Refer to *Frame Fastener Torque Requirements* on page 291 for maintenance instructions.)

[22] **Ensure that all maintenance intervals leading up to this point are repeated during this interval prior to the completion of those listed here.**

[23] **Ensure that all maintenance intervals leading up to this point are repeated during this interval prior to the completion of those listed here.**

Every 7,500 mi / 12,000 km / 6 mo [23]
Frame - Engine Mounting • Refer to *Engine Mounting* on page 260 for maintenance instructions. Contact an authorized vehicle OEM dealership if engine mounts need servicing.
Front Suspension - Spring Pins • Check for proper function. (Refer to *Front Axle and Suspension* on page 263 for maintenance instructions.)
Drum Brakes (All) - Slack adjusters • Check the push rod travel and check the control arm for cracks. Adjust at reline. (Refer to *Operational Checks of Automatic Slack Adjusters* on page 222 for maintenance instructions.) • Lubricate (NLGI #2 grease).
Drum Brakes (All) - Brake air system • Check air lines and fittings for leaks. Adjust routing as required to prevent chafing. Check tank mounting and condition. (Refer to *Air System* on page 213 for maintenance instructions.)
Drum Brakes (All) - Brake lining • Inspect; replace as required. (Refer to *Drum Brake Inspection* on page 223 for maintenance instructions.)
Disc Brakes (Bendix®) - Brake pads • Inspect; replace as required. (Refer to *Air Disc Brakes* on page 221 for maintenance instructions.)
Disc Brakes (Bendix®) - Caliper sliding function • Ensure caliper slides freely with no obstructions or excessive play. (Refer to *Air Disc Brakes* on page 221 for maintenance instructions.)

[23] **Ensure that all maintenance intervals leading up to this point are repeated during this interval prior to the completion of those listed here.**

Every 7,500 mi / 12,000 km / 6 mo [23]
Disc Brakes (Bendix®) - Caliper slide pins • Inspect protective caps of the guide pins for damage or cracking. (Refer to *Air Disc Brakes* on page 221 for maintenance instructions.)
Hydraulic Brakes - Brake pad lining • Inspect; replace as required. (minimum 3/16 in. thickness) (Refer to *Service Brake Component Inspection* on page 225 for maintenance instructions.)
Hydraulic Brakes - Brake Fluid • Check level. (DOT 3 brake fluid) (Refer to *Brake Fluid Check and Refill* on page 224 for maintenance instructions.)
Air Intake - Air intake piping, mounting, and charge air cooler • Check the system for broken pipes, leaks, joint integrity, cleanliness, and proper support. (Refer to *Air Intake System* on page 257 for maintenance instructions.)
Tires and Wheels - Tires • Inspect for cuts, irregular wear, missing lugs, sidewall damage, etc. (Refer to *Tires* on page 278 for maintenance instructions.)
Fuel and Tanks - Fuel tanks *Fuel Tank* on page 262
Driveshafts - Models SPL-90, 1710 and 1810 slip member and U-joints • Lubricate *.
Driveshafts - Models SPL-100 slip member and U-joints • Lubricate *.

[23] **Ensure that all maintenance intervals leading up to this point are repeated during this interval prior to the completion of those listed here.**

Every 7,500 mi / 12,000 km / 6 mo [23]
Driveshafts - Models SPL-140/140HD/170/170HD/250/250HD slip members and U-joints (OFF HIGHWAY) • Lubricate [*].
Battery Boxes, Tool Boxes, and Steps - Battery cables • Check the condition of the cables, cushion clamps, nylon tie straps, and routing. Replace a cushion clamp if the rubber has deteriorated. Repair or tighten terminals, and secure cables to prevent chafing. Replace damaged cables. (cuts, cracks, or excessive wear) (Refer to *Batteries* on page 247 for maintenance instructions.)
Battery Boxes, Tool Boxes, and Steps - Batteries (ON HIGHWAY and LINE HAUL) • Check for cracks and damage, electrolyte level, condition of terminals, and tightness of holddowns. (Refer to *Batteries* on page 247 for maintenance instructions.)
Battery Boxes, Tool Boxes, and Steps - Batteries (OFF HIGHWAY) • Check for cracks and damage, electrolyte level, condition of terminals, and tightness of holddowns. (Refer to *Batteries* on page 247 for maintenance instructions.)
Battery Boxes, Tool Boxes, and Steps - Battery box and tray (ON HIGHWAY and LINE HAUL) • Check the box integrity. Clean the drain tube and check for acid leaks. Check condition of all equipment mounted under the box. (Refer to *Batteries* on page 247 for maintenance instructions.)
Battery Boxes, Tool Boxes, and Steps - Battery box and tray (OFF HIGHWAY) • Check the box integrity. Clean the drain tube and check for acid leaks. Check condition of all equipment mounted under the box. (Refer to *Batteries* on page 247 for maintenance instructions.)

[23] **Ensure that all maintenance intervals leading up to this point are repeated during this interval prior to the completion of those listed here.**

Every 7,500 mi / 12,000 km / 6 mo [23]
Battery Boxes, Tool Boxes, and Steps - Battery Cable Fasteners • Check battery cable fasteners and tighten as necessary to 10-15 lb-ft (13.6-20.3 N·m) as specified on the battery label. (Refer to *Batteries* on page 247 for maintenance instructions.)
Electrical and lights - Headlights • Check the aim and adjust as required.
Electrical and lights - Warning lights in light bar • Check at the ignition start position to verify bulbs and driver information display function. (Shown in *Warning Lights and Indicators* on page 65.)
Electrical and lights - Turn, Stop, Reverse lights and signals • Visual check. (Refer to *Daily Checks* on page 25.)
Electrical and lights - Alternator • Check operation and output. (Refer to *Alternator* on page 251 for maintenance instructions.) • Check tightness of the pulley nut. (Refer to *Install Engine Belt* on page 255 for maintenance instructions.) • Check the tension of the drive belt. (Refer to *Install Engine Belt* on page 255 for maintenance instructions.) • Check tightness of the terminal hex nuts. (Refer to *Install Engine Belt* on page 255 for maintenance instructions.)
Electrical and lights - Starter • Check torque on hex nuts. (Refer to *Electrical System* on page 243 for maintenance instructions.)
Electrical and lights - ECM connector • Check the tightness of the ECM connector. (Refer to *Electrical System* on page 243 for maintenance instructions.)

[23] **Ensure that all maintenance intervals leading up to this point are repeated during this interval prior to the completion of those listed here.**

Every 7,500 mi / 12,000 km / 6 mo [23]
Electrical and lights - Wheel sensors • Check for damaged sensors and connectors, and worn or frayed wires. (Refer to *Electrical System* on page 243 for maintenance instructions.)
Electrical and lights - Fuel and diesel exhaust fluid tank sending unit • Check the mounting screws and electrical connections for worn or damaged wires and connectors. (Refer to *Diesel Exhaust Fluid Tank* on page 272 for maintenance instructions.)
Electrical and lights - Power supply harnesses (engine, transmission, etc.) • Check for worn or damaged insulation, corroded terminals, frayed wires, and oil or fluid leaks on the connectors or wiring. (Refer to *Electrical System* on page 243 for maintenance instructions.) • Wash to remove excess grease. (Refer to *Electrical System* on page 243 for maintenance instructions.)
Heating and Air Conditioning - Heater and air conditioner • Perform the checks listed. (Refer to *Heater and Air Conditioner Maintenance* on page 266 for maintenance instructions.)
Aftertreatment System - System • Check for leaks and proper support. (Refer to *Noise and Emission Control* on page 269 for maintenance instructions.)
Aftertreatment System - Diesel exhaust fluid tank • Inspect the tank, brackets, hoses, and fittings for abrasion damage, leaks, tightness and fully engaged connectors. (Refer to *Diesel Exhaust Fluid Tank* on page 272 for maintenance instructions.)
Air - Air Lines • Check condition and routing to prevent chafing (See *Air Compressor* on page 220 for maintenance instructions).

[23] **Ensure that all maintenance intervals leading up to this point are repeated during this interval prior to the completion of those listed here.**

Every 7,500 mi / 12,000 km / 6 mo [23]
Air - System • Lubricate. (Refer to *Air System* on page 213 for maintenance instructions.)
Air - Inline filters • Replace elements or clean with solvent. (Refer to *Air System* on page 213 for maintenance instructions.)
Air - Air dryer • Perform the checks listed. (Refer to *Air System* on page 213 for maintenance instructions.)

Every 15,000 mi / 24,000 km / 12 mo

Every 15,000 mi / 24,000 km / 12 mo [24]
Air Intake - Pre-cleaner Filter Assembly • Clean Pre-cleaner filter media. (Refer to *How to Clean the Pre-cleaner Filter* on page 259.)
Frame - Crossmembers and Mounting Brackets • Inspect for cracks and loose fasteners. Replace or tighten to the specified torque value as required. (Refer to *Frame Fastener Torque Requirements* on page 291 for maintenance instructions.)

[23] **Ensure that all maintenance intervals leading up to this point are repeated during this interval prior to the completion of those listed here.**

* Use only Spicer Driveshaft approved lubricants when greasing Spicer U-joints.

[24] **Ensure that all maintenance intervals leading up to this point are repeated during this interval prior to the completion of those listed here.**

Every 15,000 mi / 24,000 km / 12 mo [24]
Front Axle (Meritor) - Steering knuckle spindles, thrust bearings, kingpins, drawkeys, tie rod ends, steering stops, and bushings • Inspect for wear and damage and endplay. Shim or replace as required. (Refer to *Steering System* on page 275 for maintenance instructions.)
Front Axle (Meritor) - Kingpin bushings, thrust bearings, and tie rod ball ends • Lubricate with approved grease. (Refer to *Meritor Axle Lubrication* on page 210 for maintenance instructions.)
Front Axle (Meritor) - Drawkeys • Tighten nuts. (Refer to *Steering System* on page 275 for maintenance instructions.)
Front Axle (Dana) - Kingpin bushings, thrust bearings, and tie rod ball ends (ON HIGHWAY) • Lubricate with approved grease. (Refer to *Eaton/Dana Axle Lubrication* on page 211 for maintenance instructions.)
Front Axle (Dana) - Kingpin bushings, thrust bearings, and tie rod ball ends (OFF HIGHWAY) • Lubricate with approved grease. (Refer to *Eaton/Dana Axle Lubrication* on page 211 for maintenance instructions.)
Front Axle (Dana) - Steering knuckle spindles, thrust bearings, kingpins, drawkeys, tie rod ends, steering stops, and bushings (ON HIGHWAY) • Inspect for wear and damage and for endplay. Shim or replace as required. (Refer to *Front Axle and Suspension* on page 263 for maintenance instructions.)
Front Axle (Dana) - Steering knuckle spindles, thrust bearings, kingpins, drawkeys, tie rod ends, steering stops, and bushings (OFF HIGHWAY) • Inspect for wear and damage and for endplay. Shim or replace as required. (Refer to *Front Axle and Suspension* on page 263 for maintenance instructions.)

[24] **Ensure that all maintenance intervals leading up to this point are repeated during this interval prior to the completion of those listed here.**

Every 15,000 mi / 24,000 km / 12 mo [24]
Front Suspension - Front Spring • *Front Axle and Suspension* on page 263 for maintenance instructions.)
Front Suspension - Spring Pins and Shackles • Inspect for worn parts and excessive joint clearance. Shim or replace as required. (Refer to *Front Axle and Suspension* on page 263 for maintenance instructions.)
Front Suspension - Shock Absorbers • Inspect for leaking, body damage, and damaged or worn bushings. Replace as required. Check the shock mounting stud torque. (Refer to *Front Axle and Suspension* on page 263 for maintenance instructions.)
Front Suspension - Spring Pins • Lubricate with approved grease. (Refer to *Front Axle and Suspension* on page 263 for maintenance instructions.)
Front Suspension - U-bolts (ON HIGHWAY) • Check the general condition and the tightness of the nuts. Tighten the nuts to the specified torque value as required. (Refer to *Suspension U-Bolts, Grade 8* on page 292 for maintenance instructions.)
Front Suspension - U-bolts (OFF HIGHWAY) • Check the general condition and the tightness of the nuts. Tighten the U-bolts after the first day or two of operation. Then tighten the nuts to the specified torque value as required. (Refer to *Suspension U-Bolts, Grade 8* on page 292 for maintenance instructions.)
Drive Axle (Dana) - Axle Housing • Visually inspect for damage or leaks. (Refer to *Drive Axle - Dana* on page 275.) • Check oil level. Check "cold." Torque the drain plug. (Refer to *Drive Axle - Dana* on page 275.)

[24] **Ensure that all maintenance intervals leading up to this point are repeated during this interval prior to the completion of those listed here.**

Every 15,000 mi / 24,000 km / 12 mo [24]
Drive Axle (Dana) - Air Shift Unit • Check the lubricant level. (Refer to *Drive Axle - Dana* on page 275.) • Remove the housing cover and drain the lubricant. Wash the parts thoroughly and dry in air. (Refer to *Drive Axle - Dana* on page 275.)
Drive Axle (Dana) - Breather • Clean or replace. (Refer to *Drive Axle - Dana* on page 275.)
Drive Axle (Dana) - Lube Pump (ON HIGHWAY) • Remove the magnetic strainer and inspect for wear particles. Wash in solvent and dry in air. (Refer to *Drive Axle - Dana* on page 275.)
Drive Axle (Dana) - Lube Pump (OFF HIGHWAY) • Remove the magnetic strainer and inspect for wear particles. Wash in solvent and dry in air. (Refer to *Drive Axle - Dana* on page 275.)
Drive Axle (Dana) - Lube Filter (ON HIGHWAY) • Change. (Refer to *Drive Axle - Dana* on page 275.)
Drive Axle (Dana) - Lube Filter (OFF HIGHWAY) • Change. (Refer to *Drive Axle - Dana* on page 275.)
Drive Axle (Dana) - Magnetic drain plug and breather (ON HIGHWAY) • Clean or replace. (Refer to *Drive Axle - Dana* on page 275.)

[24] **Ensure that all maintenance intervals leading up to this point are repeated during this interval prior to the completion of those listed here.**

Every 15,000 mi / 24,000 km / 12 mo [24]
Drive Axle (Dana) - Magnetic drain plug and breather (OFF HIGHWAY) • Clean or replace. (Refer to *Drive Axle - Dana* on page 275.)
Drive Axle (Meritor) - Axle Housing • Check the "cold" fill level at the differential carrier plug for a pinion angle of less than 7 degrees, or at the axle bowl plug for a pinion angle of greater than 7 degrees. Tighten the plug to 35-50 lb-ft (47-68 N·m). (Refer to *Drive Axle - Meritor* on page 275.) • Visually inspect for damage or leaks. (Refer to *Drive Axle - Meritor* on page 275.)
Drive Axle (Meritor) - Lubricant filter • Change the filter. (Refer to *Drive Axle - Meritor* on page 275.)
Drive Axle (Meritor) - Breather • Check the operation. If the cap doesn't rotate freely, replace. (Refer to *Drive Axle - Meritor* on page 275.)
Drive Axle (Meritor) - Input shaft and pinion shaft • Check and adjust the endplay. (Refer to *Drive Axle - Meritor* on page 275.)
Drive Axle (Meritor) - Axle shaft • Tighten the rear axle flange nuts to the specified torque value. (Refer to *Drive Axle - Meritor* on page 275.)
Drive Axle (Meritor) - Interaxle differential • Check the operation. (Refer to *Inter-Axle Differential Lock Operation* on page 157 for maintenance instructions.)
Rear Suspension - U-bolts • Check the torque. Tighten to specified torque value as required. (Refer to *Suspension U-Bolts, Grade 8* on page 292.)

[24] **Ensure that all maintenance intervals leading up to this point are repeated during this interval prior to the completion of those listed here.**

Every 15,000 mi / 24,000 km / 12 mo [24]
Rear Suspension - Frame and crossmember bolts • Check the torque. Tighten to specified torque value as required. (Refer to *Frame Fastener Torque Requirements* on page 291.)
Rear Suspension - Mounting brackets and fasteners • Check the condition and the fastener torque. Tighten to the specified torque value as required. (Refer to *Frame Fastener Torque Requirements* on page 291.)
Drum Brakes (All) - Brake camshaft bearing • Check for excessive camshaft play in the axial and radial directions. Max allowable play is 0.003 in. Lubricate (NLGI #2 grease). (Refer to *Drum Brake Inspection* on page 223.)
Drum Brakes (All) - Brake treadle valve • Clean the area around the treadle, boot, and mounting plate. Check the pivot and mounting plate for integrity. Check the plunger boot for cracks. Lubricate roller pin, pivot pin, and plunger (NLGI #2 grease). (Refer to *Drum Brake Inspection* on page 223.)
Drum Brakes (All) - Brake air system • Clean or replace the inline filters. (Refer to *Air System* on page 213.)
Disc Brakes (Bendix®) - Brake disc/rotor • Inspect for visible cracks, heat checking, galling, or scoring of surface. Check for runout (max allowable is 0.002 in.). (Refer to *Air Disc Brakes* on page 221 for maintenance instructions.)
Hydraulic Brakes - Rotor • Inspect for visible cracks, heat checking, galling, or scoring of surface. (Refer to *Hydraulic Brake System* on page 223 for maintenance instructions.)

[24] **Ensure that all maintenance intervals leading up to this point are repeated during this interval prior to the completion of those listed here.**

Every 15,000 mi / 24,000 km / 12 mo [24]
Hydraulic Brakes - Park Brake • Inspect for wear, cracks, or breakage. (minimum 2.5 mm (0.10 in)) (Refer to *Hydraulic Brake System* on page 223 for maintenance instructions.)
Clutch - Clutch linkage • Lubricate. (Refer to *Hydraulic Clutch* on page 286 for maintenance instructions.)
Clutch - Clutch release bearing • Lubricate. (Refer to *Hydraulic Clutch* on page 286 for maintenance instructions.) • Inspect and adjust when necessary (no adjustment required for SOLO type clutches). (Refer to *Hydraulic Clutch* on page 286 for maintenance instructions.)
Cooling - Hoses • Check the radiator and heater hoses for leaks. (Refer to *Radiator Hoses Inspection* on page 238 for maintenance instructions.)
Cooling - Extended Life Coolant (ELC) • Check the freeze point. (Refer to *Cooling System Maintenance* on page 235) • Check for contamination using test strips. (Refer to *Cooling System Maintenance* on page 235 for maintenance instructions.) • Replace blank water filter if applicable. • Perform lab analysis. (Refer to *Cooling System Maintenance* on page 235 for maintenance instructions.) If lab analysis shows coolant is unsuitable for continued use: Flush, drain, and refill. (Refer to *Cooling System Maintenance* on page 235 for maintenance instructions.) Add ELC Extender (Refer to *Cooling System Maintenance* on page 235 for maintenance instructions.). • Flush, drain, and refill with new coolant. (Refer to *Cooling System Maintenance* on page 235 for maintenance instructions.)

[24] **Ensure that all maintenance intervals leading up to this point are repeated during this interval prior to the completion of those listed here.**

Every 15,000 mi / 24,000 km / 12 mo [24]
Cooling - Fan clutch • Check for air leaks. (Refer to *Engine Fan* on page 256 for maintenance instructions.) • Check the fan drive bearings (turn the sheave in both directions to check for worn hub bearings). (Refer to *Engine Fan* on page 256 for maintenance instructions.)
Cooling - Solenoid valve • Check the fan drive for proper engagement and disengagement. (Refer to *Engine Fan* on page 256 for maintenance instructions.)
Power Steering - Reservoir • Check the fluid level. (Refer to *Power Steering Fluid* on page 277 for maintenance instructions.)
Power Steering - Steering gear • Check the lash of the sector shaft; adjust as required. (Refer to *Steering System* on page 275 for maintenance instructions.) • Grease the trunnion bearing (Chevron Delo EP NLGI-2 grease or equivalent). (Refer to *Steering System* on page 275 for maintenance instructions.) • Grease the input shaft seal (Chevron Delo EP NLGI-2 grease or equivalent). (Refer to *Steering System* on page 275 for maintenance instructions.)
Power Steering - Power assist cylinder • Lubricate the ball joints. Inspect for leaking rod seals, damaged ball joint boots, and damage to cylinder rod or barrel. (Refer to *Steering System* on page 275 for maintenance instructions.)
Power Steering - Hoses and tubes • Check for leaks and chafing. (Refer to *Steering System* on page 275 for maintenance instructions.)

[24] **Ensure that all maintenance intervals leading up to this point are repeated during this interval prior to the completion of those listed here.**

Every 15,000 mi / 24,000 km / 12 mo [24]
Power Steering - Steering linkage • Check all joints for excessive lash; replace as required. (Refer to *Steering System* on page 275 for maintenance instructions.)
Disposition: / Status: Changed language from "tube clamp and ball socket," please review. Not authorized for publication. Power Steering - Drag link castle nut and ball stud • Check the torque; tighten to specified torque value as required. (Refer to *Steering System* on page 275 for maintenance instructions.)
Power Steering - Pitman arm clamp bolt and nut • Check the torque; tighten to specified torque value as required. (Refer to *Steering System* on page 275 for maintenance instructions.)
Power Steering - Steering intermediate shaft • Check the torque on the pinch bolt and nut. (Refer to *Steering System* on page 275 for maintenance instructions.)
Power Steering - Steering intermediate shaft U-joints (ON HIGHWAY) • Lubricate [EP NLGI #2 HD grease, +325° F to -10° F (+163° C to -23° C) range]. (Refer to *Steering System* on page 275 for maintenance instructions.)
Power Steering - Steering intermediate shaft U-joints (OFF HIGHWAY or CITY DELIVERY) • Lubricate [EP NLGI #2 HD grease, +325° F to -10° F (+163° C to -23° C) range]. (Refer to *Steering System* on page 275 for maintenance instructions.)

[24] **Ensure that all maintenance intervals leading up to this point are repeated during this interval prior to the completion of those listed here.**

Every 15,000 mi / 24,000 km / 12 mo [24]
Power Steering - Drag link and tie rod arm ball sockets (ON HIGHWAY) • Lubricate (Chevron Delo EP NLGI-2 grease or equivalent). (Refer to *Steering System* on page 275 for maintenance instructions.)
Power Steering - Drag link and tie rod arm ball sockets (OFF HIGHWAY or CITY DELIVERY) • Lubricate (Chevron Delo EP NLGI-2 grease or equivalent). (Refer to *Steering System* on page 275 for maintenance instructions.)
Fuel and Tanks - Fuel tank breathers • Check for proper function; clean the drain hoses. (Refer to *Fuel Tank* on page 262 for maintenance instructions.)
Driveshafts - Models SPL-140XL/170XL/250XL slip members and U-joints (OFF HIGHWAY and CITY) • Lubricate *.
Cab structure, doors and hoods - Hinges and latch • Lubricate with silicone spray.
Cab structure, doors and hoods - Body and cab holddown bolts • Check the condition and tightness.
Heating and Air Conditioning - Heater and air conditioner • Full operational and diagnostic check. (Refer to *Heater and Air Conditioner Maintenance* on page 266 for maintenance instructions.)

[24] **Ensure that all maintenance intervals leading up to this point are repeated during this interval prior to the completion of those listed here.**

Every 15,000 mi / 24,000 km / 12 mo [24]
Heating and Air Conditioning - Condenser • Clear any debris from the front of the condenser. (Refer to *Heater and Air Conditioner Maintenance* on page 266 for maintenance instructions.)

Altered Topic. **Please review before publication.**

Every 60,000 mi / 96,000 km / 6 mo

Disposition: / Status:

Every 60,000 mi / 96,000 km / 6 mo [25]
Main and Auxiliary Transmission - Mounting Brackets and Fasteners • Check the condition of the fasteners and their torque. Tighten to the specified torque value as required. Refer to *Frame Fastener Torque Requirements* on page 291 for maintenance instructions.
Steer Axle Wheel Ends - Steer Axle Oil Bath (Adjusted) with Synthetic Lubricant • Use SAE 75W-140, SAE 50L: See Oil Bath for maintenance instructions.
Steer Axle Wheel Ends - Steer Axle Oil Bath (Adjusted) with Mineral Base Lubricant • Use SAE 75W, 75W-90, 75W140, 80W-90, 85W-140: See Oil Bath for maintenance instructions.

[24] **Ensure that all maintenance intervals leading up to this point are repeated during this interval prior to the completion of those listed here.**

* Use only Spicer Driveshaft approved lubricants when greasing Spicer U-joints.

[25] **Ensure that all maintenance intervals leading up to this point are repeated during this interval prior to the completion of those listed here.**

Every 60,000 mi / 96,000 km / 6 mo [25]
Steer Axle Wheel Ends - Steer Axle Semi-Fluid (Adjusted) with Semi-Fluid Synthetic Grease • Use Delo SF, Mobil SHC 007: Refer to *PACCAR FX-20 Front Axle Lubrication* on page 265 for maintenance instructions.
Steer Axle Wheel Ends - Steer Axle Grease Pack (Adjusted) with Heavy-Duty Multipurpose Lithium Base • #2 Grade: Refer to *PACCAR FX-20 Front Axle Lubrication* on page 265 for maintenance instructions.

Every 60,000 mi / 96,000 km

Every 60,000 mi / 96,000 km [26]
Power Steering System - Fluid and Filter Change • It is extremely difficult for an owner-operator to change the fluid or filter of the Power Steering Reservoir in an environmentally responsible manner without specialized tools and training. Have your power steering system serviced at an authorized service center or dealership.
Driveshafts - Models SPL- 140/140HD/170/170HD/250/250HD slip members and U-joints (ON HIGHWAY and LINEHAUL) • Lubricate.
Air - Air dryer (OFF HIGHWAY) • Overhaul. (Refer to *Air Dryer Maintenance* on page 216 for maintenance instructions.)

[25] **Ensure that all maintenance intervals leading up to this point are repeated during this interval prior to the completion of those listed here.**

[26] **Ensure that all maintenance intervals leading up to this point are repeated during this interval prior to the completion of those listed here.**

[27] Use only Spicer Driveshaft approved lubricants when greasing Spicer U-joints.

Every 75,000 mi / 120,000 km

New topic. **Please review before publication.**

Disposition: / Status:

Every 75,000 mi / 120,000 km [28]
Front Axle (Meritor) - Total Vehicle Alignment • Check and adjust as required. (Refer to *Front Axle and Suspension* on page 263 for maintenance instructions.)
Front Axle (Dana) - Total Vehicle Alignment • Check and adjust as required. (Refer to *Front Axle and Suspension* on page 263 for maintenance instructions.)

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Every 120,000 miles /193,000 km / 2 yr

Altered Topic. **Please review before publication.**

Disposition: / Status:

Every 120,000 miles /193,000 km / 2 yr [29]
Hydraulic Brakes - Brake Fluid • Change every 2 years. (DOT 3 brake fluid) (Refer to *Brake Fluid Check and Refill* on page 224 for maintenance instructions.)
Steer Axle Oil Bath LMS with Synthetic Lubricant • Use SAE 75W-90: See*Oil Bath* on page 266 Oil Bath for maintenance instructions.

[28] **Ensure that all maintenance intervals leading up to this point are repeated during this interval prior to the completion of those listed here.**

[29] **Ensure that all maintenance intervals leading up to this point are repeated during this interval prior to the completion of those listed here.**

Every 120,000 miles /193,000 km / 2 yr [29]
Air Intake - Pre-cleaner Filter Assembly • Install new Pre-cleaner Filter Assembly. (Refer to *How to Remove the Pre-cleaner Filter* on page 259.))
Main and Auxiliary Transmission - (PACCAR 8 Speed Transmission) (ON HIGHWAY) • Drain lubricant while warm. Flush each unit with clean flushing oil.

Fender Liners

The fender liners are located on both sides of the hood underside and protect the headlight assembly and other engine bay content from water and debris. Some maintenance processes require one or both liners to be removed.

How to Remove a Fender Liner

Performed with hood open (*Opening the Hood*) standing on either side of hood.

1. Unlock all four liner fasteners by twisting each ¼ turn counter-clockwise.
2. Gently pull liner up and away from hood to remove.
3. Place fender liner aside.

How to Reinstall a Fender Liner

Performed with hood open (*Opening the Hood*) standing on appropriate side of hood.

1. Hook bottom of liner to inside hood, below the headlight assembly.
2. Replace fender liner in hood, lining up locking fasteners.
   Align hood guide with groove on liner: "LOCATE TO HOOD REINFORCEMENT."
3. Gently insert then twist all four locking fasteners ¼ turn clockwise to secure liner.

Lubricants

Schedule service more frequently if you are operating under severe conditions such as extreme heat or cold, with very heavy loads, off-road, etc. For any special service requirements, consult your service manuals and your lubricant supplier. Please remember: one key to keeping your truck running at top economy and prolonging its life is proper lubrication servicing. Neglecting this essential aspect of vehicle care can cost time and money in the long run.

[29] **Ensure that all maintenance intervals leading up to this point are repeated during this interval prior to the completion of those listed here.**

WARNING

Handle lubricants carefully. Vehicle lubricants (oil and grease) can be poisonous and cause sickness, personal injury, or death. They can also damage the paint on the vehicle.

CAUTION

DO NOT mix different types of lubricants. Mixing lubricants (oil and grease) of different brands or types could damage vehicle components; therefore, drain (or remove) old lubricants from the unit before refilling it.

Engine

Proper engine lubrication depends on the outside temperatures where you will be driving. Use the oil recommended for the conditions you are most likely to be operating in. You will find a complete engine lubrication service guide in the Engine Operation Manual that came with your vehicle. The engine operator manual contains specific maintenance tasks that you or a qualified service technician need to perform to maintain the engine.

WARNING

Exhaust fumes from the engine contain carbon monoxide, a colorless and odorless gas. DO NOT breathe the engine exhaust gas. A poorly maintained, damaged, or corroded exhaust system can allow carbon monoxide to enter the cab. Entry of carbon monoxide into the cab is also possible from other vehicles nearby. Failure to properly maintain your vehicle could cause carbon monoxide to enter the cab, resulting in personal injury or death.

WARNING

Never idle your vehicle for prolonged periods of time if you sense that exhaust fumes are entering the cab. Investigate the cause of the fumes and correct it as soon as possible. If the vehicle must be driven under these conditions, drive only with the windows open. Failure to repair the source of the exhaust fumes may result in death, personal injury, equipment or property damage.

NOTE

Keep the engine exhaust system and the vehicle's cab ventilation system properly maintained. It is recommended that the vehicle's exhaust system and cab be inspected (1) By a competent technician every 15,000 miles (24,140 km); (2) Whenever a change is noticed in the sound of the exhaust system; or (3) Whenever the exhaust system, underbody, or cab is damaged.

NOTE

Use only an exact replacement DPF in exhaust systems. Using a noncompliant DPF as a replacement could violate these standards and also void the emission system's warranty.

Driveline Universal Joints

Refer to the Spicer Universal Joints and Driveshafts service manual and lubrication specifications.

Transmissions, Axles, and Hubs

See the manufacturer's operator's manual for recommended lubrication specifications and maintenance intervals.

Checking Oil Level

For oil reservoir with side filler plugs (transmission, axles, steering gear boxes, transfer cases, etc.) the oil must be level with the filler opening. Use care when checking the oil level with a finger. Just because you can reach the oil level with a finger does not mean the oil level is correct.

Improper Oil Level

Correct Oil Level

Main transmission

Oil Changes

CAUTION

When adding oil, types and brands of oil should not be intermixed because of possible incompatibility, which could decrease the effectiveness of the lubrication or cause component failure.

An initial oil change and flush should be performed after the transmission has been placed in actual service. This change should be made any time after 3,000 miles (4,800 km) but never longer than 5,000 miles (8,000 km) of over-the-road service. In off-highway use, the change should be made after 24 hours but before 100 hours of service have elapsed.

Refilling

Remove all dirt around filler plug. Refill with new oil of the grade recommended for the existing season and prevailing service. Fill to the bottom of the level testing plug positioned on the side of the transmission. Do not overfill the transmission. Overfilling usually results in oil breakdown due to excessive heat and aeration from the churning action of the gears. Early breakdown of the oil will result in heavy varnish and sludge deposits that plug up oil ports and build up on the splines and bearings. Overflow of oil can also escape onto clutch or parking brake. When adding oil, do not mix different types of oil.

Allison Transmission Lubrication

- Refer to your transmission manual (furnished separately) for lubrication information.
- Refer to the Allison Transmission manual for servicing information.

PACCAR TX-8 Lubrication

Disposition: / Status:
Created topic as starting point: awaiting data.

Recommended Lubricants

Type	Grade (SAE)	Ambient Temperature
ZF-ECONFLUID LIFE PLUS		@ 100°C oil sump temp./mixed route

Meritor Axle Lubrication

> **NOTE**
>
> Axles utilized in 100% off-highway use are not eligible for Meritor's Advanced Lube Rear Drive Axle program.

Under Meritor's Advanced Lube Rear Drive Axle program, the axles listed below are exempt from an initial lubricant change:

5

Available Advanced Lube Axles

RS-19-145	RS-26-180	RT-40-145P	RT-46-160
RS-21-145	RS-30-180	SQ-100A	RT-46-160P
RS-23-160	RT-34-145	SQ-100AP	RT-52-160
RS-23-161	RT-34-145P	RT-44-145	RT-52-160P
RS-17-145	RS-23-180	RT-40-145	RT-44-145P

Meritor rear axles that do not appear on the list above will continue to require an initial drain at 3,000-5,000 miles (4,800-8,000 km).

- Refer to the *Meritor Field Maintenance Manual* for a particular axle for lubricant specifications.
- See your dealer for Meritor-approved lubricant brands.
- Refer to the following chart for lubricant change intervals:

Application	Type Of Lubricant	Mileage Interval
On Highway	Synthetic	240,000 mi. (384,000 km)
	Synthetic with Pump and Filter	500,000 mi. (800,000 km)
	Mineral Base	120,000 mi. (192,000 km)
City Delivery	Synthetic	120,000 mi. (192,000 km)
	Synthetic with Pump and Filter	240,000 mi. (384,000 km)
	Mineral Base	120,000 mi. (192,000 km)
Off Highway	Synthetic	120,000 mi. (192,000 km)
	Synthetic with Pump and Filter	120,000 mi. (192,000 km)
	Mineral Base	120,000 mi. (192,000 km)

- Change the lubricant filter every 120,000 miles (192,000 km). Top off the lubricant level with a similar lubricant

Eaton/Dana Axle Lubrication

- The original mineral-based lubricant must be drained within 3,000-5,000 miles (4,800-8,000 km) on all Eaton axles. This initial change is very important because it flushes out break-in contaminants that might otherwise cause premature wear.
- No initial drain is required on Eaton axles that are factory filled with an Eaton-approved synthetic lubricant.
- Mineral-based lubes must be drained within the first 5,000 miles (8,000 km) if converting to an Eaton-approved synthetic lube.
- Change the lubricant within the first 5,000 miles (8,000 km) of operation after a carrier head replacement, regardless of the lubricant type.
- Refer to the *Eaton Field Maintenance Manual* for a particular axle for lubricant specifications.
- See your dealer for Eaton-approved lubricant brands.
- Refer to the chart below for lubricant change interval.

Eaton/Dana Axle Lubrication

Type of Lubricant	On-Highway Mi. (km)	Maximum Change Interval	On/Off Highway Severe Service Mi. (km)	Maximum Change Interval
Mineral-Based	120,000 (192,000)	Yearly	60,000 (96,000)	Yearly
Eaton-Approved Synthetic	240,000 (384,000)	2 Years	120,000 (192,000)	Yearly
Eaton-Approved Synthetic in axle with extended drain interval option	350,000 (560,000)			

Wheel Bearing Lubrication

Oil-lubricated Driven Hubs

Use hypoid oil, A.P.I.-GL-5 SAE 75W-90FE synthetic gear lubricant or equivalent. A minimum of 1 quart (921 ml) of oil is required for proper lubrication of each drive hub. Add oil through the filler hole in the hub; if none, add oil through the differential filler hole.

> **NOTE**
>
> Remember to replace vent plug or threaded filler plug when done.

Allow time for the oil to seep through the bearings when initially filling a hub. Maintain the differential oil level by adding oil until its surface is even with the bottom of the filler hole (see illustration in *Checking Oil Level* on page 209).

Disposition: / Status:
End of New Topic.

Oil-lubricated Nondriven Hubs

Use hypoid oil, A.P.I.-GL-5 SAE 75W-90FE synthetic gear lubricant or equivalent. A minimum of 1 quart (921 ml) of oil is required for proper lubrication of each drive hub. Add oil through the filler hole in the hub; if none, add oil through the differential filler hole.

> **NOTE**
>
> Remember to replace vent plug or threaded filler plug when done.

Allow time for the oil to seep through the bearings when initially filling a hub. Maintain the differential oil level by adding oil until its surface is even with the bottom of the filler hole (see illustration in *Checking Oil Level* on page 209).

Disposition: / Status:
End of New Topic.

Inspect Power Steering Fluid

Access the power steering reservoir in the engine compartment. Take all safety precautions when opening the hood.

CAUTION

Disposition: / Status:
Altered Caution. Please review.

When adding fluid, only use fluid of the same type. While many fluids have the same description and intended purpose, they may contain incompatible additives. Incompatible fluids may result in cavitation which reduces the lubrication between moving parts, wearing them down. Failure to comply may result in equipment or property damage.

1. Turn engine off and open hood.
2. Wipe outside of power steering reservoir cover so that no dirt can fall into the reservoir.
3. Verify that the fluid level is at the correct level. Add more fluid if required.
4. Check fluid for air bubbles which may indicate contamination, discoloration, or burnt smell; correct source of such problems before replacing fluid and filter.

If incompatible (insoluble) fluids are mixed in a power steering system, air bubbles can be produced at the interface of the two fluids. This can cause cavitation, which reduces the lubrication between moving parts in the gear. This could result in worn components. The mixture of two different fluids, although harmless to individual internal components, may initiate a chemical reaction that produces a new compound that will attack seals and other internal components. DO NOT mix different fluids.

Air System

The operation of the vehicle's braking system and many vehicle accessories depends on the storage and application of a high-pressure air supply.

WARNING

DO NOT modify, alter, repair, or disconnect any air system component. Repairs or modifications to the air system, other than what is described in this section, should be performed by an authorized dealer, only. Failure to comply may result in property damage, personal injury, or death.

WARNING

Prior to the removal of any air system component, always block and hold the vehicle by a secure means other than the vehicle's own brake. Depleting air system pressure may cause the vehicle to roll unexpectedly resulting in an accident causing personal injury or death. Keep hands away from chamber push rods and slack adjusters, they may apply as system pressure drops.

WARNING

After completing any repairs to the air system, always test for air leaks, and check the brakes for safe operation before putting the vehicle in service. Failure to comply may result in death, personal injury, equipment or property damage.

WARNING

Never connect or disconnect a hose or line containing air pressure. It may whip as air escapes. Never remove a component or pipe plug unless you are certain all system pressure has been depleted. Failure to comply may result in death, personal injury, equipment damage, or property damage.

WARNING

Never exceed recommended air pressure and always wear safety glasses when working with air pressure. Never look into air jets or direct them at anyone. Failure to comply may result in property damage, personal injury, or death.

WARNING

Never attempt to disassemble a component until you have read and understood the recommended procedures. Some components contain powerful springs, and injury can result if not properly disassembled. Use only proper tools, and observe all precautions pertaining to use of those tools. Failure to comply may result in property damage, personal injury, or death.

WARNING

Completely bypassing a Bendix® air dryer will bypass the system’s pressure protection valves. This could lead to loss of air pressure or damage to the vehicle’s air system, which could cause an accident involving death or personal injury. Always adhere to the manufacturer’s procedure if it is necessary in an emergency to temporarily bypass a Bendix® air dryer. Failure to comply may result in death, personal injury, equipment or property damage.

WARNING

Use of an air dryer brand or model that differs from what was originally installed could cause the air system to not perform correctly unless the full air system design is reviewed and modifications are made to comply with Federal Motor Vehicle Safety Standard (FMVSS) 121 Air Brake Systems. Failure to abide by this warning and maintain compliance with FMVSS 121 could cause loss of vehicle control and may lead to serious personal injury or death.

WARNING

If the air tanks are not drained at the recommended frequency, water could enter the air lines and valves. This could cause corrosion or blockage, compromising brake system safety, which could lead to an accident. Failure to comply may result in death, personal injury, equipment damage, or property damage.

Your vehicle's compressor takes outside air and compresses it, usually to 100-120 psi (689-827 kPa). The compressed air then goes to the reservoirs to be stored until needed. When you operate your air brakes, the stored compressed air flows into the chambers where it is used to apply your truck and trailer brakes. That is why, when you push down on your brake pedal, you don't feel the same amount of pressure on the pedal that you do when you apply the brake on your car. All you are doing on your truck is opening an air valve to allow air to flow into the brake chambers. Contamination of the air supply system is the major cause of problems in air-operated components such as brake valves, and suspension height control valves. To keep contaminants to the lowest possible level, follow these maintenance procedures.

Daily Checks

- Drain moisture from the supply and service air tanks.
- Operate air devices to circulate lubricant within the unit.

Periodically

- Clean filter screens ahead of the valves by removing the screens and soaking them in solvent. Blow dry with pressurized air before reinstalling them.

Twice a Year

- Maintain the air compressor to prevent excessive oil bypass. See your maintenance manual for details.
- Replace worn seals in valves and air motors as needed.

Dual Air System Function Test

Conduct this test at least every 3 months or if there is any indication of a potential problem.
Park the vehicle on level ground and block the wheels. Have an assistant open drain valves and, where required, observe brake action at the wheels. If a malfunction occurs during this test, do not move the vehicle until the problem has been corrected. Engine should be Off with the key switch to the ON or RUN position.

> **NOTE**
>
> Tractor air system must be connected to trailer.

Air Dryer Maintenance

> **NOTE**
>
> Because no two vehicles operate under identical conditions, maintenance and maintenance intervals will vary. Experience is a valuable guide in determining the best maintenance interval for any one particular operation.

> **NOTE**
>
> A small amount of oil in the system may be normal and should not, in itself, be considered a reason to replace the desiccant cartridge. Oil stained desiccant can function adequately.

Every 900 operating hours or 25,000 miles (40,000 km) or every 3 months check for moisture in the air brake system by opening air tanks, drain cocks, or valves and checking for presence of water.
A tablespoon of water found in the air tank would point to the need for a desiccant cartridge change. However, the following conditions can also cause water accumulation and should be considered before replacing the desiccant cartridge.

- Air usage is exceptionally high and not normal for a highway vehicle. This may be due to accessory air demands or some unusual air requirement that does not allow the compressor to load and unload (compressing and non-compressing cycle) in a normal fashion or it may be due to excessive leaks in the air system.
- In areas where more than a 30°F (17°C) range of temperature occurs in one day, small amounts of water can accumulate in the air brake system due to condensation. Under these conditions, the presence of small amounts of moisture is normal and should not be considered as an indication that the dryer is not performing properly.
- An outside air source has been used to charge the air system. This air did not pass through the drying bed.

> **NOTE**
>
> Review the warranty policy before performing any maintenance procedures. An extended warranty may be voided if unauthorized maintenance is performed during this period.

> **NOTE**
>
> Each time the oil-coalescing desiccant cartridge is changed, the air dryer purge valve should be changed.

Bendix® AD-HF Series Air Dryer

Your vehicle may be equipped with a Bendix® AD-HF series air dryer. Any air dryer replacement should be made with an identical component.

WARNING

Use of an air dryer brand or model that differs from what was originally installed could cause the air system to not perform correctly unless the full air system design is reviewed and modifications are made to comply with Federal Motor Vehicle Safety Standard (FMVSS) 121 Air Brake Systems. Failure to abide by this warning and maintain compliance with FMVSS 121 could cause loss of vehicle control and may lead to serious personal injury or death.

The AD-HF Series air dryer has incorporated into its design various components that have typically been installed separately on the vehicle (see below for components/areas affected):

- Pressure protection valves
- Safety valve
- Solenoid valves and plumbing
- Plumbing of the front and rear service air tanks
- Plumbing to accessory systems

These components are required to meet the Federal Motor Vehicle Safety Standards (FMVSS 121 - Air Brake Systems). As the Warning above states, any other type of air dryer installed in the place of an AD-HF Series will require changes, modifications and/or additions to your vehicle's air system to maintain compliance with FMVSS 121.

Air Dryer Oil-coalescing Cartridge

Vehicles outfitted with an air system will be equipped with an oil-coalescing air dryer. The air dryer's oil-coalescing cartridge must be replaced yearly, regardless of mileage.

CAUTION

Replace the oil-coalescing desiccant air dryer cartridge annually, regardless of mileage. Use only an oil-coalescing desiccant cartridge as a replacement. Failure to comply will void the transmission warranty and may cause transmission damage.

Air Tanks

WARNING

If the air tanks are not drained at the recommended frequency, water could enter the air lines and valves. This could cause corrosion or blockage, compromising brake system safety, which could lead to an accident. Failure to comply may result in death, personal injury, equipment damage, or property damage.

CAUTION

This vehicle may be equipped with an air actuated transmission. If so equipped, one tank will have two separate air supply's: vehicle air and transmission air. The transmission side of the air tank must be drained daily or transmission damage could occur. Failure to comply could result equipment or property damage.

CAUTION

DO NOT use penetrating oil, alcohol, brake fluid, or wax-based oils in the air system. These fluids may cause severe damage to air system components.

The air tanks must be drained daily. Operate air devices daily to circulate lubricants within the unit.

5

Air Gauges and Air Leaks

WARNING

DO NOT operate the vehicle if leakage in the air system is detected. Contact an authorized dealer (or any other properly equipped service center) if a leak is detected. Failure to check the brakes or follow these procedures could cause a system failure, increasing the risk of an accident. Failure to comply may result in death, personal injury, equipment damage, or property damage

If your vehicle is equipped with air brakes, it has two separate, additional air systems: Primary and Secondary. Each air system is monitored by a gauge indicating system pressure in either pounds per square inch (psi), and/or kilopascals (kPa).
The Primary gauge indicates pressure in the rear braking system:

Primary Air Pressure Gauge

The Secondary gauge indicates pressure in the front braking system:

Secondary Air Pressure Gauge

The Primary and Secondary Air Pressure gauges are shown in the Primary Gauges View on the Digital Display.[30]
At start-up, the Primary and Secondary Air Pressure gauges may indicate red, and the Low Air System Pressure alarm may sound until the minimum operational pressure setpoint of 65 psi (448 kPa) is reached.[31][32]
If the tanks are empty, this can take up to two minutes. If these gauges

- Remain red
- Turn red
- Indicate below 65 psi (448 kPa)

Or the Low Air System Pressure Alarm

- Turns on
- Does not turn off

Do not attempt to drive the vehicle until the problem is found and fixed: system pressure is too low for normal brake operation.

30 Low cab forward right-hand stand-up model uses additional physical gauges for Primary and Secondary Air Pressure.
31 Low cab forward right-hand stand-up model also indicates low air pressure using a warning light in the physical gauges.
32 The Low Air System Pressure alarm is not active when the engine is off.

NOTE

Park brakes lock up at 60 psi (414 kPa), the audible alarm will sound at 65 psi (448 kPa).

How to Check the Compressed Air System for Leaks

WARNING

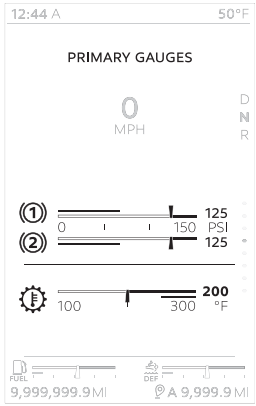
DO NOT operate the vehicle if leakage in the air system is detected. Contact an authorized dealer (or any other properly equipped service center) if a leak is detected. Failure to check the brakes or follow these procedures could cause a system failure, increasing the risk of an accident. Failure to comply may result in death, personal injury, equipment damage, or property damage

Check the compressed air system for leaks:

- After maintenance
- When an air system component is replaced
- When a leak is suspected
- Periodically, to ensure system integrity

To check for Air System leaks

1. Start the engine if not already running.
2. **Scroll** to the Primary Gauges View to monitor Primary and Secondary Air Pressures.



3. Build up air pressure in the system until the system cutout setpoint or until 120 psi (827 kPa) is reached.
4. Turn the Ignition Switch to OFF (stopping the engine) and then back to the ON position, but don't start the engine.
   The Primary Gauges View will appear.
5. Release the service brakes, and observe the rate of air pressure drop. This rate should not exceed 2.0 psi (14 kPa) per minute.
6. Start the engine and build up air pressure again.
7. Turn the Ignition Switch to OFF (stopping the engine) and then back to the ON position, but don't start the engine.
8. Apply the brake fully, holding the pedal down for five minutes. The pressure drop should not exceed 3.0 psi (21 kPa) per minute.
9. If you detect excessive leakage (air pressure loss greater than 3.0 psi (21 kPa) after five minutes of brake application), a leakage test should be made at the air line connections and at all air brake control units. These tests should determine where air is escaping.

Air Compressor

All compressors, regardless of make or model, run continuously while the engine is running. System pressure is controlled by the governor. The governor acts in conjunction with the unloading mechanism in the compressor cylinder block to start and stop compression of air. The compressor is unloaded when the system pressure reaches 130 psi (896 kPa), and compression is reestablished when system pressure falls to 110 psi (758 kPa).

Preventive Maintenance

The following service checks are provided for informational purposes, and should only be performed by a certified technician. Contact your dealer or the engine manufacturer's maintenance manual for further information on servicing air compressors. After completing any repairs to the air system, always test for air leaks, and check the brakes for safe operation before putting the vehicle in service. Below is a list of areas to maintain for the air compressor:

- Inspect compressor air filter element, if equipped, and replace element if clogged. Check compressor mounting and drive for alignment and belt tension. Adjust if necessary.
- Remove compressor discharge valve cap nuts and check for presence of excessive carbon. If excessive carbon is found, clean or replace the compressor cylinder head. Also, check compressor discharge line for carbon, and clean or replace the discharge line if necessary.
- Disassemble compressor and thoroughly clean and inspect all parts. Repair or replace all worn or damaged parts, or replace compressor with a factory exchange unit.

Brake System

To learn more about brakes, see the Index, under Brakes.

WARNING

Do not work on the brake system without the parking brake set, keys removed from the ignition, and wheels chocked securely. If the vehicle is not properly secured to prevent movement, it could roll unintentionally. Failure to comply may result in death, personal injury, equipment, or property damage.

WARNING

DO NOT use brake linings with a thickness below the specified minimum. Such linings will have lining rivets exposed that can damage the brake drum and reduce brake efficiency, which could cause death, personal injury or system failure.

WARNING

DO NOT use any replacement part in the brake system unless it conforms exactly to original specifications. A nonconforming part in the vehicle's brake system could cause a malfunction resulting in a loss of vehicle control, leading to an accident. Failure to comply may result in death, personal injury, equipment damage, or property damage.

WARNING

Disposition: / Status:
Altered Warning. **Please review before publication.**

The air brake system of this vehicle was configured for ONE of the following operations: tractor or truck, and complies with the respective portions of FMVSS 121. A tractor shall not be operated or configured as a truck, nor shall a truck be operated or configured as a tractor, without significant modifications to the air brake system in order to retain compliance with FMVSS 121. Contact your dealer for instructions. Failure to comply may result in death, personal injury, equipment damage, or property damage.

Brake adjustment and brake balance must be set carefully to (1) make the most efficient use of the forces available for braking and (2) allow equal stopping forces at all wheels. Once a brake system is set to specifications, changing any one of its components or any combination of components may cause the system to not work as well. All parts have to work together to perform as they should. Any replacement components in your brake system should be exactly equal to the original components. Any changes from the original specifications can affect the whole system. All of the following areas are interrelated and must conform to original specifications:

- Tire size
- Drum brakes
- Cam radius
- Wedge angle
- Drum radius
- Brake linings
- Brake chambers
- Slack adjusters
- Disc brakes
- Disc rotors

All vehicle operators should check their brakes regularly.

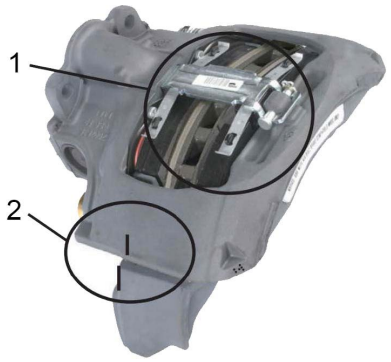
Air Disc Brakes

Have brake pads inspected by a qualified technician for wear at regular intervals according to the *Preventive Maintenance Intervals* on page 183. In severe service or off-highway applications inspect the linings more frequently.
Regularly inspect for pad/rotor wear:

1. Park on level ground, apply the parking brake, and chock the wheels.
2. Look through the wheel at the brake pad, and ensure there is a minimum of 0.08 in. (2 mm) remaining. This is the maximum allowable pad wear. A U.S. nickel and Canadian dime are approximately 0.08 in. (2 mm) thick. Contact a PACCAR Service Center if the pad wear is approaching the maximum pad wear.

3. See the illustration below to determine whether the brakes require a detailed inspection by a qualified technician.

Caliper Detail



1. Quick Visual Inspection of Pad Thickness and Rotor
2. Location of Wear Indicator Notches (both sides of brake)

Disposition: / Status:
End of New Topic.

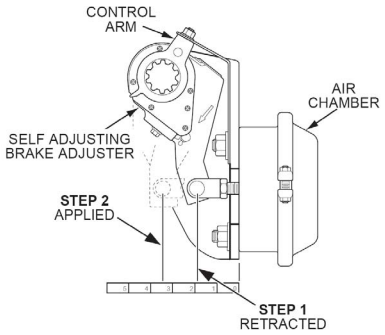
Operational Checks of Automatic Slack Adjusters

- Measure brake chamber stroke with the spring brake released and the air pressure no less than 100 psi (690 kPa).
- Brake Chamber Stroke is the difference between the applied and the retracted position of the air chamber pushrod.
- A correctly installed and functioning auto slack adjuster will produce the following strokes:

Chamber Type	Stroke
36 (rear brakes)	1-1/2" - 2-1/4" (38 - 57 mm)

Chamber Type	Stroke
30 (rear brakes)	1-1/2" - 2" (38 - 51 mm)
16, 20 & 24 (front brakes)	1" - 1-3/4" (25.4 - 44.4 mm)

Brake Chamber Stroke



WARNING

Do not manually adjust automatic slack adjusters. Contact the Service Department at your dealership if the stroke exceeds specifications. A stroke exceeding specifications may indicate a problem with the slack adjuster or the brake foundation. Failure to comply may result in death, personal injury, equipment damage, or property damage.

Disposition: / Status:
End of New Topic.

Drum Brake Inspection

Have brake drum linings inspected by a qualified technician for wear at regular intervals according to the maintenance schedule. In severe service or off-highway applications inspect the linings more frequently. In addition, periodically check the brake chamber stroke. Replace the slack adjuster if proper stroke cannot be maintained.

Operational checks of automatic slack adjusters

1. Start the vehicle and get the air system up to normal operating pressure. Do not apply the parking brake.
2. Apply pressure to the brake pedal and measure the distance the air chamber pushrod traveled.
3. Compare the results to the specification to determine if the automatic slack adjusters need replacing.

Automatic Slack Adjuster Stroke Specification

Chamber Type	Stroke
36 (rear brakes)	1.5-2.5 in. (38-57 mm)
30 (rear brakes)	1.5-2 in. (38-51 mm)
16, 20 and 24 (front brakes)	1-1.75 in. (25.4-44.4 mm)

Hydraulic Brake System

To operate your vehicle safely, you need some understanding of its brake systems. Brake adjustment and brake balance must be set carefully to allow equal stopping forces at all wheels. Tires are also a very important part of the whole system. How fast you can stop depends on how much

friction there is between the road and your tires.
All of the following areas are interrelated and must conform to original specifications:

- wheel size
- tire size
- brake pads
- brake rotors
- front wheel bearings
- front end alignment
- parking brake drum radius

Once a brake system is set to specifications, changing any one of its components or any combination of components may degrade the system. All parts have to work together to perform as they should.
Your brake system is hydraulically operated. Refer to *Service Brake Component Inspection* on page 225 for more information on inspecting the brakes. Any replacement components in the brake system must meet the specifications of the original components. Any changes from the original specifications can affect the performance of the entire system.

WARNING

DO NOT use any replacement part in the brake system unless it conforms exactly to original specifications. A nonconforming part in the vehicle's brake system could cause a malfunction resulting in a loss of vehicle control, leading to an accident. Failure to comply may result in death, personal injury, equipment damage, or property damage.

WARNING

Do not work on the brake system without the parking brake set, keys removed from the ignition, and wheels chocked securely. If the vehicle is not properly secured to prevent movement, it could roll unintentionally. Failure to comply may result in death, personal injury, equipment, or property damage.

Disposition: / Status:
End of New Topic.

Brake Fluid Check and Refill

WARNING

Wear protective clothing when handling hydraulic fluid. It is mildly toxic and can cause skin and eye irritation.

WARNING

Use only the type of hydraulic fluid specified. Do not use or mix different types of hydraulic fluid. The wrong hydraulic fluid will damage the rubber parts of the brake system. Failure to comply may result in death, personal injury, equipment damage, or property damage.

CAUTION

Hydraulic brake systems use two distinct and incompatible fluids. Power steering fluid is used in the hydraulic brake booster system. Brake fluid is used in the master cylinder and brake pipes. Do not mix these fluids when replenishing the system or seal damage can result.

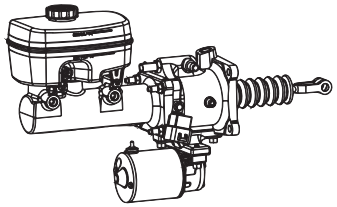
CAUTION

Hydraulic brake fluid may damage painted surfaces of the vehicle.

Make sure that the fluid level registers on or above the fluid level mark molded on the reservoir - add more if necessary, as follows:

1. Remove reservoir cap and extract the rubber diaphragm from the reservoir.

Booster and Master Cylinder Assembly



2. Fill reservoir with clean hydraulic fluid of the approved specification (DOT 3 brake fluid).
3. Insert the rubber diaphragm into reservoir.
4. To prevent leakage, ensure that the seal in the reservoir cap is in good condition before refitting the cap.

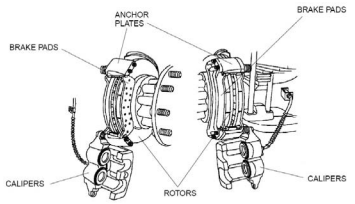
WARNING

If the brake fluid reservoir requires an excessive amount of hydraulic fluid, the complete system must be inspected for leaks and repaired if necessary (consult your nearest dealer). Failure to keep the brake system in good repair may lead to loss of braking. Failure to comply may result in death, personal injury, equipment damage, or property damage.

Service Brake Component Inspection

Remove each wheel to inspect the brake components.

System Components



5

WARNING

Disposition: / Status:
Altered Warning. **Please review before publication.**

When replacing disc brake pads, be sure to use the same lining material on both axles. Mixing lining types can result in unbalanced braking, increased pad wear, or degraded stopping performance. Consult your nearest dealer. Failure to comply may result in death, personal injury, equipment damage, or property damage.

Disc brake pads	Visually inspect all brake pad linings. Brake pads should be replaced when the remaining lining reaches 3.16 inch thickness or less. It is recommended that all disc brake pads be replaced at the same time since this will maintain balanced braking. At a minimum, replace all disc brake pads on one axle, both ends, at the same time.
Calipers	Visually inspect calipers for brake fluid leakage, damaged or defective pistons or piston boots. If there is evidence of leakage, damage, or other defects the caliper should be replaced or repaired.
Disc brake rotors	Visually inspect rotors for scoring, warping, cracks, bluing or heat spots or other damage or defects. If signs of damage or defects are found, the rotor(s) should be resurfaced or replaced in accordance with the vehicle manufacturer's recommended service procedure.
Anchor plates	Visually inspect anchor plates for worn or damaged slippers, damaged or dislodged guide pin boots or other defects. If signs of wear, damage or defects are found, the anchor plate(s) should be repaired or replaced.

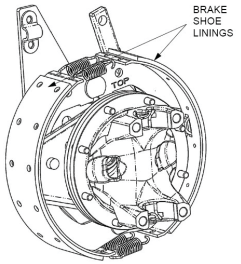
Disposition: / Status:
End of New Topic.

Parking Brake Component Inspection

NOTE

If you are not properly trained to perform brake inspections or service, take your vehicle to your nearest dealer.

Visually inspect brake shoe lining for wear, cracks, or breakage. If linings are worn down to 2.5 mm (0.10 in), they must be replaced. Inspect brake drum for deep scores, heat spots, cracks, or damage. Replace if needed.



Disposition: / Status:
End of New Topic.

Cab Maintenance

Cab exterior, interior, frame, and engine compartment components need maintenance to ensure longevity and safe operations. A clean vehicle also allows leaks to be detected easier.

WARNING

Always allow hot surfaces to cool down before attempting to work near them. Failure to comply may result in personal injury or death.

WARNING

Handle cleaning agents carefully. Cleaning agents may be poisonous. Failure to comply may result in death, personal injury, equipment damage, or property damage.

WARNING

DO NOT use gasoline, kerosene, naphtha, nail polish remover, or other volatile cleaning fluids. They may be toxic, flammable, or hazardous in other ways. Failure to comply may result in death, personal injury, equipment damage, or property damage.

WARNING

DO NOT clean the underside of chassis, fenders, wheel covers, etc. without protecting your hands and arms. You may cut yourself on sharp edged metal parts. Failure to comply may result in death, personal injury, equipment damage, or property damage.

WARNING

Moisture, ice, and road salt on brakes may affect braking efficiency. Test the brakes carefully after each vehicle wash. Failure to comply may result in death, personal injury, equipment damage, or property damage.

Vehicle Cleaning

- Observe all caution labels
- Always read directions on the container before using any product
- Do not use any solution that can damage the body paint
- Most chemical cleaners are concentrates that require dilution
- Only use spot removing fluids in well ventilated areas
- Any vehicle is subjected to deterioration from multiple causes (i.e. industrial fumes, ice, snow, corrosive road salt, etc.)

Exterior and Engine Compartment

Corrosive materials used to remove ice, snow, and dust from the road can collect on the entire vehicle with concentrated accumulations throughout the underbody and engine compartment. If these materials are not removed, accelerated corrosion (rust) can occur on underbody parts such as fuel lines, frame rails, floor pan, electrical and exhaust system, even though they have been provided with corrosion protection.

At least every spring, flush these materials from the entire vehicle, including the underbody and engine compartment, with plain water using light water pressure. On vehicles used in applications and/or areas that experience high usage of, or exposure to, corrosive materials, cleaning of the entire vehicle should be done more frequently. If desired, your dealer can do this service for you.

WARNING

Do not direct high pressure water onto electrical components, plug connectors, seals or flexible hoses on the engine. Failure to comply can accelerate corrosion and degrade electrical component which may cause a fire or equipment damage. Failure to comply may result in death, personal injury, equipment damage, or property damage.

CAUTION

Do not direct high pressure water onto seals or flexible hoses. Water may enter the part which will contaminate the system lubricants and fluids. To prevent damage to these components, keep a gentle flow of water moving at all times. Failure to comply may result in equipment damage.

To prevent rust, keep chromed parts clean and protected with wax at all times, especially in winter conditions when the roads are salted.

- If necessary, use a commercial chrome cleaner to remove light rust.
- Chrome surfaces are best cleaned with fresh water. Wipe dry to preserve their luster. A commercial chrome cleaner will remove light rust. After cleaning, wax flat surfaces and apply a thin coat of rust preventive lubricant around bolts or other fasteners.
- Clean aluminum wheels and bumpers with cool water. Tar-remover will get rid of heavy deposits of road grime. To prevent spotting, wipe aluminum surfaces dry after washing.
- Under corrosive conditions, such as driving on salted roads, clean aluminum parts with steam or high-pressure water from a hose. A mild automotive soap solution will help. Rinse thoroughly.

To maintain the tailpipe's quality finish, wash the tailpipe with a soft cloth, mild automotive soap, and water or glass cleaner. A non-abrasive chrome polish can be used sparingly on hard-to-clean areas. DO NOT clean your high-heat chrome using scouring pads, abrasive chrome polish, highly acidic chemical cleaners or any other abrasive cleaners.

Even high quality stainless steel parts can rust under prolonged exposure to salt water, especially when the salt-laden moisture is held against the metal surface by road grime. It is important to frequently clean salty moisture and grime from stainless steel surfaces.

- If surface rust is encountered, wash the surface and use a commercial polishing compound to clean off the rust, followed by a coating of wax.
- Never use steel wool when cleaning stainless steel. Minute particles of the steel wool can become embedded in the surface of the stainless steel part and cause rust staining.

Weather Stripping

Frequent washing of the vehicle is required to remove road grime and contaminants that can stain and oxidize paint and accelerate corrosion of plated and polished metal surfaces. Waxing offers added protection against staining and oxidation. Do not apply wax in the hot sun and do not friction burn the paint with a buffing machine. Occasionally spray weather-

stripping on doors and windows with silicone compound to help preserve resiliency. This is especially useful in freezing weather to prevent doors and windows from sticking shut with ice.

NOTE

Disposition: / Status:
Change of terminology (truck by vehicle) per SME request. Please review.

To allow enough time for your vehicle's finish to cure, wait at least thirty days after the date of manufacture before waxing.

Cleaning Interior Vinyl and Upholstery

NOTE

Strong cleaning agents such as hand sanitizer, solvents, paint thinners, window cleaner and gasoline/ diesel fuel must never be used on your vehicle's interior. Repeated exposure to chemicals such as sunscreen, insect repellents containing DEET, or brake fluid may cause accelerated wear, tackiness, or discoloration of interior surfaces.

Wipe vinyl upholstery and lining with a good commercial upholstery cleaner. Do not use acetone or lacquer thinner. Clean fabric upholstery with upholstery shampoo specially formulated for this purpose.

- First remove loose dirt, dust, or debris with a vacuum cleaner.
- Use a soft brush to loosen caked-on dirt before vacuuming it away.
- Wipe the fabric surface with a slightly damp cloth and dry the seat fabric thoroughly. If the fabric is still dirty, wipe using a mixture of mild soap and lukewarm water, then dry thoroughly.
- If the stain does not come out use an upholstery shampoo specially formulated for this purpose. Test the cleaner on a hidden place to make sure it does not harm the fabric. Follow the instructions on the container.

Other interior surfaces may be cleaned using a mixture of mild soap and lukewarm water, or an automotive interior cleaner, used on its intended surface (i.e. use leather conditioner on leather surfaces, etc.).
Avoid frequent or repeated use of the following products on interior surfaces:

- Alcohol-based cleaners (including hand sanitizer)
- Methanol-based cleaners
- Bleach
- Acetone
- Any other strong solvent
- Abrasive cleaners
- Sunscreen

How to Wash the Exterior of the Vehicle

Your dealer has a number of vehicle care products and can advise you on which ones to use for cleaning the exterior and interior of your vehicle.

WARNING

Handle cleaning agents carefully. Cleaning agents may be poisonous. Failure to comply may result in death, personal injury, equipment damage, or property damage.

WARNING

DO NOT use gasoline, kerosene, naphtha, nail polish remover, or other volatile cleaning fluids. They may be toxic, flammable, or hazardous in other ways. Failure to comply may result in death, personal injury, equipment damage, or property damage.

WARNING

DO NOT clean the underside of chassis, fenders, wheel covers, etc. without protecting your hands and arms. You may cut yourself on sharp edged metal parts. Failure to comply may result in death, personal injury, equipment damage, or property damage.

WARNING

Moisture, ice, and road salt on brakes may affect braking efficiency. Test the brakes carefully after each vehicle wash. Failure to comply may result in death, personal injury, equipment damage, or property damage.

WARNING

DO NOT aim the water jet directly at a door lock or latch and tape over the key holes to prevent water from entering. An occupant could become trapped in the vehicle if water seeps into the lock cylinder and freezes. Prevent locks from freezing in the winter by squirting glycerin or lock deicer into the lock cylinders. If water should seep in, remove it with compressed air. Failure to comply may result in death, personal injury, equipment damage, or property damage.

NOTE

Disposition: / Status:
Change of terminology (truck by vehicle) per SME request. Please review.

To allow enough time for your vehicle's finish to cure, wait at least thirty days after the date of manufacture before waxing.

1. Begin by spraying water over the dry surface to remove all loose dirt before applying the car wash solution.

CAUTION

Do not direct high pressure water onto seals or flexible hoses. Water may enter the part which will contaminate the system lubricants and fluids. To prevent damage to these components, keep a gentle flow of water moving at all times. Failure to comply may result in equipment damage.

WARNING

Do not direct high pressure water onto electrical components, plug connectors, seals or flexible hoses on the engine. Failure to comply can accelerate corrosion and degrade electrical component which may cause a fire or equipment damage. Failure to comply may result in death, personal injury, equipment damage, or property damage.

- **Disposition: / Status:**
  Is this really an either/or situation, or are both of these things true?
- Do not wash the vehicle in direct sunshine.
- Do not spray water directly into the cab vents.

2. Using soapy water, wash the vehicle with a clean soft cloth or a soft brush made for automotive cleaning.
   - **Disposition: / Status:**
     Is it an either/or situation?
   - Use cool water and a mild, automotive-type soap. Strong industrial detergents, cleaning agents and household-type soaps are not recommended and may damage the vehicle's paint.
   - Do not use stiff brushes, paper towels, steel wool, or abrasive cleaning compounds because they will scratch painted, plated, and polished metal surfaces.
3. Rinse painted surfaces with gentle water pressure frequently while washing to flush away dirt that might scratch the finishes during the washing operation.
4. Hose dirt and grime from the entire chassis.

WARNING

Do not direct high pressure water onto electrical components, plug connectors, seals or flexible hoses on the engine. Failure to comply can accelerate corrosion and degrade electrical component which may cause a fire or equipment damage. Failure to comply may result in death, personal injury, equipment damage, or property damage.

CAUTION

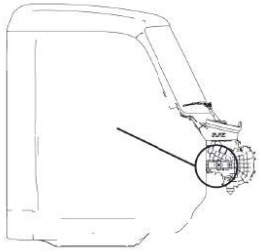
Do not direct high pressure water onto seals or flexible hoses. Water may enter the part which will contaminate the system lubricants and fluids. To prevent damage to these components, keep a gentle flow of water moving at all times. Failure to comply may result in equipment damage.

5. Wipe everything dry with a chamois to avoid water spots. To prevent water spotting, dry off the cosmetic surfaces with a clean cloth or chamois.
6. Remove road tar with an automotive-type tar remover or mineral spirits.
7. After cleaning and drying the entire vehicle, apply a quality automotive wax to protect the vehicle's finish.

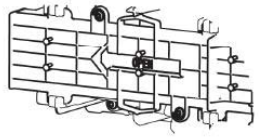
Cab HVAC Fresh Air Filter Replacement

The fresh air filter for the cab HVAC is located in the air intake housing that is mounted to the firewall in the passenger side rear corner of the engine compartment. The filter can be replaced without using any tools.

1. Tilt the hood open.
2. Locate the air intake housing at the passenger side rear corner of the engine bay, below the rain tray.



3. Locate the filter cover labeled “OPEN” with an arrow pointing towards the rear of the vehicle. Slide the filter cover towards the rear of the vehicle, until you are able to remove the cover.



4. Remove and inspect the filter, referring to the maintenance interval schedule.
5. Install the new air filter into its housing, taking care to align the airflow direction indicated on the filter element with the airflow direction that's marked on the air intake housing.
6. Replace the filter cover on the air intake housing and slide the cover toward the front of the vehicle. An audible "snap" sound can be heard when the cover is correctly installed. If the snap feature is damaged there are two screw features that may be used to secure the cover.
7. Close and secure the vehicle's hood.

Display Screen Care

To clean the screen, dampen a clean, soft, and lint-free cloth with water only. A mild glass cleaner that does not contain alcohol or ammonia may also be used. Cleaners that contain alcohol and/or ammonia will eventually dry out, crack, and "yellow" the screen. Wipe the screen back and forth gently. You can also use a commercial cleaner specially designed for LCD screens.

Safety Restraint System - Inspection

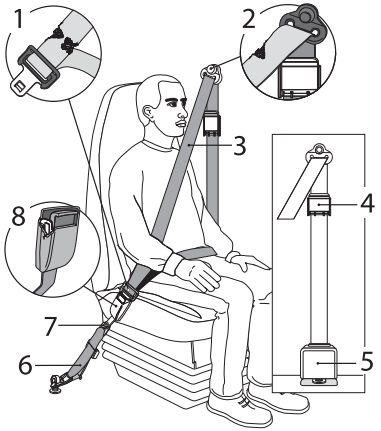
Disposition: / Status:
Revised topic IAW safety restraint terminology updates

WARNING

Periodically inspect and maintain the safety restraint system. Safety restraint components can wear out and no longer protect the occupant in the event of an accident. Failure to comply may result in death or personal injury.

WARNING

It is important to remember that any time a vehicle is involved in an accident, the entire seat belt system must be replaced. Unexposed damage caused by the stress of an accident could prevent the system from functioning properly the next time it is needed. Failure to comply may result in death or personal injury.



1. Web cut or frayed or extremely worn at latch area
2. Web cut or frayed at D-loop web guide
3. Web for deterioration, due to exposure to the sun
4. Comfort Clip cracked or damaged
5. Retractor Web Storage for damage (located behind trim panel)
6. Tethers for web wear and proper tightness of mounting hardware
7. Mounting hardware for corrosion, proper tightness of bolts and nuts
8. Buckle casting broken

Factors contributing to reduced seat belt life:

- Heavy trucks typically accumulate twice as many miles as the average passenger car in a given time period.
- Seat and cab movement in trucks causes almost constant movement of the belt due to ride characteristics and seat design. The constant movement of the belt inside the restraint hardware and the potential for the belt to come in contact with the cab and other vehicle parts, contributes to the wear of the entire system.

- Environmental conditions, such as dirt and ultraviolet rays from the sun, will reduce the life of the seat belt system.

Due to these factors, the three-point seat belt system installed in your vehicle requires thorough inspection every 20,000 miles (32,000 km). If the vehicle is exposed to severe environmental or working conditions, more frequent inspections may be necessary. Any seat belt system that shows cuts, fraying, extreme or unusual wear, significant discoloration due to UV (ultraviolet) exposure, abrasion to the seat belt webbing, or damage to the buckle, latch plate, retractor hardware, or any other obvious problem should be replaced immediately, regardless of mileage.

Inspection Guidelines

Follow these guidelines when inspecting for cuts, fraying, extreme or unusual wear of the webbing, and damage to the buckle, retractor, hardware, or other factors. Damage to these areas indicates that seat belt system replacement is necessary.

WARNING

Replace the entire belt system (retractor and buckle side) if replacement of any one part is necessary. Unexposed damage to one or more components could prevent the system from functioning properly the next time it is needed. Failure to comply may result in death or personal injury.

1. Check the web wear in the system. The webbing must be closely examined to determine if it is coming into contact with any sharp or rough surfaces on the seat or other parts of the cab interior. These areas are typical places where the web will experience cutting or abrasion. Cuts, fraying, or excessive wear would indicate the need for replacement of the seat belt system.
2. The pillar web guide (D-loop) is the area where almost constant movement of the seat belt webbing occurs because of relative movement between the seat and cab.
3. Check the Komfort Latch for cracks or possible damage and check for proper operation.
4. Check buckle and latch for proper operation and to determine if latch plate is worn, deformed, or damaged.
5. Inspect the retractor web storage device, which is mounted on the floor of the vehicle, for damage. The retractor is the heart of the occupant restraint system and can often be damaged if abused, even unintentionally. Check operation to ensure that it is not locked up and that it spools out and retracts webbing properly.
6. If tethers are used, be sure they are properly attached to the seat and, if adjustable, that they are adjusted in accordance with installation instructions. Tethers must also be inspected for web wear and proper tightness of mounting hardware.
7. Mounting hardware should be evaluated for corrosion, and for tightness of bolts and nuts.
8. Check web in areas exposed to ultraviolet rays from the sun. If the

color of the web in these areas is gray to light brown, the physical strength of the web may have deteriorated due to exposure to the sun's ultraviolet rays. Replace the system.

Once the need for replacement of the seat belt has been determined, be certain it is only replaced with an authorized PACCAR Parts replacement seat belt. If the inspection indicates that any part of the seat belt system requires replacement, the entire system must be replaced. An installation guide is attached to every replacement belt. Utilize the proper guide for your type of seat, and follow the instructions very closely. It is vitally important that all components be reinstalled in the same position as the original components that were removed and that the fasteners be torqued to specification. This will maintain the design integrity of the mounting points for the seat belt assembly. Contact your dealer if you have any questions concerning seat belt replacement.

Cooling System Maintenance

The cooling system in your vehicle was factory filled with extended life coolant that meets or exceeds ASTM D6210, Cummins Engineering Standard 14603 for ISX and PX series engines, and MAT74002 Standard when equipped with an MX series engine. PACCAR recommends only using a 50/50 mixture of distilled water and ELC when cooling system service is required. A 50/50 mixture of ELC and distilled water will provide freeze protection down to -34°F (-36.7°C), which is adequate for most locations in North America. For extremely cold operating conditions, a 60/40 mixture (coolant/water ratio) can be used to provide freeze protection down to -62°F (-52.2°C).

Unless otherwise optioned, factory fill coolant is an ethylene glycol, nitrited organic acid technology (NOAT) extended life coolant (ELC) formulation at a 50:50 coolant-to-distilled water mixture. The factory fill meets or exceeds ASTM D6210 and Cummins Engineering Standard 14603 for ISX and PX engines, and MAT74002 for PACCAR MX-11 and MX-13 engine requirements. Maintaining coolant chemistry and freeze protection is critical to engine and cooling system component health and longevity.

WARNING

Coolant is toxic. Avoid contact with eyes. If contact occurs, rinse eyes with large amounts of water for 15 minutes. Avoid prolonged or repeated contact with skin. In case of contact, immediately wash skin with soap and water. DO NOT consume coolant. If swallowed, seek immediate medical attention. DO NOT induce vomiting. Failure to comply may result in death or personal injury.

CAUTION

The engine cooling system has very specific maintenance and inspection requirements. Failure to follow requirements can damage the engine. Engine damage can include but is not limited to freezing, boiling, corrosion, pitted cylinder liners. This information is found in the engine manufacturers owner's manual. It is the owner's responsibility to follow all requirements listed in the engine manufacturer's owner's manual. Failure to comply may result in engine damage.

CAUTION

Use of non-genuine PACCAR coolant filters can cause severe engine damage.

NOTE

Coolant is harmful to the environment. Unused coolant must be stored as a toxic hazardous material in leak-proof containers. Used coolant must be processed as industrial chemical waste. Please follow HAZMAT guidelines with both used and unused coolants.

Concentration

Check the level of freeze/boil-over protection, which is determined by the glycol concentration. Use a glycol refractometer to determine glycol level. Add coolant to obtain the coolant/water ratio required to provide the protection you need. A 50:50 mix of coolant and water is adequate for most applications. For extremely cold operating conditions, the ratio can be adjusted to a higher concentration of coolant.

NOTE

Maximum recommended ELC concentration is 60% ELC and 40% water by volume (a 60/40 coolant mixture). The minimum recommended concentration is 40% ELC and 60% water by volume (a 40/60 coolant mixture).

Glycol Concentration Level

Level	Desired Coolant / Water Ratio	Freeze Point °F (°C)
Recommended Levels	40%	-12 (-24)
	45%	-23 (-31)
	50%	-34 (-37)
	55%	-50 (-46)
	60%	-62 (-52)

Condition

Perform a visual inspection of the coolant. It should have no cloudiness or floating debris. Determine the chemical inhibitor concentration level by using an ELC specific test kit or test strips. Inhibitor concentration level determines corrosion protection. If you are concerned about possible coolant quality, contamination, or mechanical problems, submit a coolant sample for analysis. Improper maintenance may cause coolant degradation and could

result in damage to the cooling system and engine components. Consult your dealer or the coolant manufacturer’s representative for recommended ELC test kits, test strips, and laboratory sample procedures.

Coolant Extender

Add ELC extender, if necessary, according to the corrosion inhibitor concentration required. DO NOT add coolant extender to nitrite-free coolant.

Checking Coolant Level

Check the coolant level daily. When adding coolant, avoid mixing different brands and formulations. If the coolant is mixed with more than 25% of a different formulation, engine corrosion damage can occur. If mixing exceeds 25% of total system volume, it is recommended to flush and refill the system completely with one type of coolant.

Coolant Filter

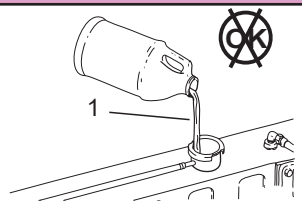
Your engine may be equipped with a coolant filter. It is a "blank filter" and does not contain chemicals or time-release additives. Replace it only with a blank filter at the interval specified in your engine's operator's manual. Never use filters that contain supplemental coolant additives (SCAs) in an ELC-filled system. Consult your engine operator's manual for information on the coolant filter and service procedures.

CAUTION

The use of non-genuine PACCAR coolant filters may cause severe engine damage.

Cooling System Sealing Additives and Soluble Oils

Disposition: / Status:
 below changed to <ul> per SME feedback.



- Do not use soluble oils or sealing additives.

CAUTION

The use of sealing additives or soluble oils in the cooling system can cause damage to the engine. These additives can plug various areas of the radiator, EGR system and oil cooler. The plugging of the cooling system can hamper heat transfer, causing internal engine damage. DO NOT use sealing additives or soluble oils in the cooling system. The use of sealing additives can

- Build up in coolant low-flow areas
- Plug the radiator and oil cooler
- Damage the water pump seal
- Damage heat transfer surfaces
- Damage seals and hoses
- Corrode brass and copper

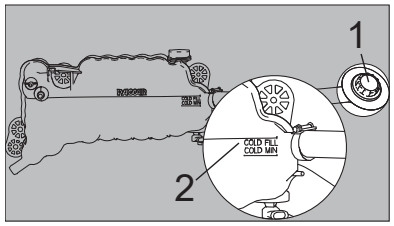
Failure to comply may result in equipment or property damage.

Inspect Coolant Level

Inspect the vehicle's coolant surge tank for proper coolant level. Add coolant if the level in the tank is below the line marked **MIN**.

The minimum fluid level is determined by the line on the surge tank indicated by the letters "MIN." This indicator is located below the fill cap. The cooling system will need to be filled if the level is not above the "MIN" line, regardless of engine temperature.

Bulkhead Mounted Coolant Surge Tank



1. Fill location
2. Fill line

Radiator Hoses Inspection

Perform this procedure for radiator hoses inspection.

1. Check the following radiator hose conditions:
   - Deterioration/signs of leaking
   - Hose clamp torque

How to Add Coolant to the Cooling System

WARNING

DO NOT remove the coolant fill cap while the engine is hot. Wait until coolant temperature is below 120°F (50°C). Scalding steam and fluid under pressure may escape and cause serious burns. Failure to comply may result in death or personal injury.

WARNING

Only use the fill port to fill the surge tank. DO NOT attempt to fill the tank using the pressure port. Scalding steam and fluid under pressure may escape and cause serious personal injuries. Failure to comply may result in death, personal injury, equipment damage, or property damage.

WARNING

DO NOT touch, inhale, or swallow antifreeze or coolant. Many antifreeze/coolant solutions contain ethylene glycol, which is poisonous. Failure to comply may result in death or personal injury.

NOTE

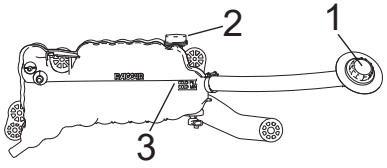
If frequent topping off is necessary and there are no visible signs of coolant leaks when the engine is cold, check for leaks with the engine operating at normal temperature.

NOTE

Do not overfill a cooling system. Excess coolant may result in overflow, loss of antifreeze, and reduced corrosion protection.

> **NOTE**
>
> Store coolant and antifreeze carefully. Keep only in a dedicated, sealable container (ideally, the original packaging). Dispose of coolant/antifreeze responsibly.

Bulkhead Mounted Coolant Surge Tank



1. Fill cap and port (service point)
2. Pressure cap (never to be removed)
3. Fill level indicator

1. Turn off the engine and let it cool for a minimum of 10 minutes.
2. If your cooling system is built with an air bleed valve in the upper engine coolant pipe, open the air bleed valve before filling the surge tank.
3. Close any open coolant drain valves in the lower engine coolant pipe.
4. Remove the surge tank fill cap (1), but DO NOT remove the surge tank pressure cap (2).
5. Fill the system with premixed coolant through the surge tank fill port. Pour coolant at a steady rate until it reaches the lower of the two lines indicated by either "COLD MIN" or "MIN" on the surge tank. Wait for one minute after adding coolant. If the coolant level drops, add coolant until it returns to the lower line.
6. Start the engine and maintain an idle at a low rpm.
7. While the engine is idling air will purge from the cooling system via the surge tank's coolant fill port, which will lower the coolant level in the surge tank. Continue to fill the surge tank until the coolant level remains approximately 1/2 in. (13 mm) above the "MIN" line. This may take up to 2 minutes, depending on the outside temperature.
8. Maintain a low idle until the thermostat opens and the operating temperature stabilizes. A sign that the thermostat has opened is when the upper coolant pipe gets hot on the bottom side indicating hot coolant is now running through it.
9. Add coolant to the surge tank until the coolant remains 1/2 in. (13 mm) above the "COLD MIN" or "MIN" level.
10. Operate the engine at high idle for 10 minutes. Afterward, add coolant to the surge tank until the coolant remains 1/2 in. (13 mm) above the "COLD FULL" line.
11. Reinstall the surge tank fill cap (1).

Windshield Wiper/Washer

The windshield wiper system is designed to be maintenance-free. Check wiper blades annually, every 60,000 miles (96,000 km), or when they begin to show signs of wear.

Check the washer reservoir water level daily, located in the engine compartment. If necessary, refill to the proper level.

Refilling the Washer Fluid Reservoir

CAUTION

DO NOT use antifreeze or engine coolant in the windshield washer reservoir, damage to seals and other components will result.

1. Park the vehicle and apply the parking brake.
2. Open the hood and secure it in the open position.
3. Locate the washer fluid reservoir located on the driver's side of the engine compartment, on top of the radiator, and open the filler cap.
4. Fill the 2.1 Gallon (7.9 Liter) reservoir with windshield washer fluid and replace the cap.
5. Close and secure the hood.

Exterior Lighting

How to Replace a Headlight Bulb

Each headlight assembly contains three bulbs:

- Low beam/high beam
- Daytime running light (DRL)/ parking light
- Turn signal/side marker/side turn.

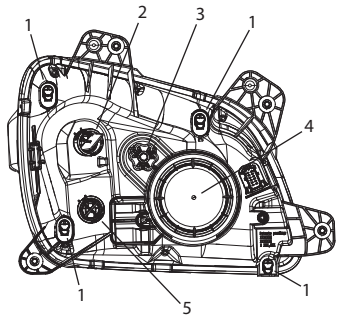
Replacing a headlight bulb is accomplished by opening the hood and accessing the rear of the headlight (located behind a removable fender panel). See *Vehicle Light Bulb Specifications* on page 293 for bulb replacement data.

Disposition: / Status:
Copied note from the 589 topic of the same name IAW LED Headlamp updates.

NOTE

LED headlights (option) are not user serviceable. If you experience a LED headlight failure, contact your nearest dealer to correct the problem as soon as possible.

Headlight Assembly



1. Vents - NON SERVICEABLE - (removal will destroy).
2. Turn signal/side marker bulb socket.
3. Headlight beam-angle adjustment knob.
4. High/Low beam main headlight bulb socket.
5. Daytime Running Light bulb socket.

1. Park the vehicle and apply the parking brake.
2. Open the hood and secure it in the open position (*Opening the Hood*).
3. Remove fender liner to access headlight assembly (*How to Remove a Fender Liner* on page 207.
4. Replace a headlight assembly bulb:
   When replacing the low beam/high beam bulb, the low beam/high beam socket cap must first be unscrewed and removed.
   a. Twist bulb socket counter-clockwise to loosen and remove socket and bulb from the headlight assembly.
   b. Change the bulb in the socket.
   c. Replace socket and bulb into headlight assembly by lining up the tab on the socket with the slot in the headlight housing and then insert.
   d. Twist socket clockwise to lock. Replace low beam/high beam socket cap if removed earlier in this step.
5. Reinstall fender liner (*How to Reinstall a Fender Liner* on page 207).
6. Close and secure hood (See *Close the Hood* on page 17).

Maintaining Headlight Performance

Disposition: / Status:
Topic revised. Please review.

Bulb Replacement

NOTE

Halogen, incandescent, and HID bulbs are brightest when they are new, and they dim over time. For optimal performance, replace your bulbs frequently. Keep a spare or lightly used bulb in the glove compartment and **never operate the vehicle with only one headlamp**.

WARNING

Disposition: / Status:
Warning revised. Please review.

LED replacement light sources are not approved for use in PACCAR headlamps. Using an incorrect bulb type may result in a thermal event due to the headlamp's internal optics. Damage caused by the use of unauthorized LED light sources is not covered by warranty. Failure to comply may result in death, personal injury, equipment damage, or property damage.

NOTE

LED headlights (option) are not user serviceable. If you experience a LED headlight failure, contact your nearest dealer to correct the problem as soon as possible.

Know your vehicle headlamp type – Standard Incandescent, Halogen, or LED. See *Vehicle Light Bulb Specifications* on page 293 for headlight bulb replacement information.

- An unclear bulb indicates that it has overheated. It may perform poorly and/or be close to failure, and should be replaced as soon as possible.

- Bulbs should be replaced with a premium brand. Bulbs with the long life designation "LL" are recommended, but not required.
- When replacing a bulb, do not touch the globe with your fingers. Oil from human skin can focus the light locally, resulting in early bulb failure.
- If the access caps or fender liner are removed during the bulb replacement, they must be re-installed to protect the headlight from high pressure water spray and gravel bombardment.

Lens and Body

CAUTION

Do not clean the headlamp lens with solvents, abrasive brushes or substances, or petroleum products. Improper cleaning methods can break down the lens coating, which could cloud or scratch the lens. This may result in a glare that reduces headlight performance. Failure to comply may result in equipment or property damage.

- Use a soft cloth with mild, particulate free dish soap and water to clean your headlamp lenses.
- Replace your headlamp if the lens is so worn that it is not completely clear.
- A headlamp lens should only be buffed by a professional polishing service. To avoid stripping the lens of its protective coating, do not have the lens buffed more than twice in its lifetime.
- Do not hit or push on your headlamp lens, as it is only designed to withstand the force of wind.
- The headlamp assembly is equipped with filtered vents to keep out insects, allow for bulb cooling, and evacuate water vapor. Keep obstructions, or obstructing agents like mud, away from the vents. The filters are non-serviceable since the filter cap is destroyed when removed.

Alignment

WARNING

Disposition: / Status:
New warning. Please review.

DO NOT operate the vehicle with misaimed headlamps. Misaimed headlamps may impact the driver's ability to see the road and other drivers. Failure to comply may result in death, personal injury, equipment damage, or property damage.

NOTE

Headlamp misalignment must be corrected by a trained technician. Please contact your nearest authorized dealership for next steps.

Headlamps are aimed according to safety standards before your truck leaves the factory. However, certain truck loads or trailer types may impact your vehicle’s rake by offsetting the truck’s weight distribution. This will misaim your headlamps. Some maintenance procedures can also affect headlamp alignment, such as:

- Headlamp assembly replacement
- Hood replacement

To check if your headlamps are properly aimed, park your truck on a level surface and direct the headlamps at a wall. If you notice that the focus of one light appears higher than the other, your headlamps are misaligned.

Final Checks

1. After everything is reconnected, turn on your headlights and check for operation.
2. Have your headlights periodically checked for proper alignment by dealer.
3. Keep your headlights clean, using only clean soap and water. A dirty headlight reduces performance and creates glare.

Electrical System

WARNING

Battery posts, terminals and related accessories contain lead and lead compounds, chemicals known to the State of California to cause cancer and reproductive harm. Wash hands after handling.

CAUTION

DO NOT modify or improperly repair the vehicle's electrical system or power distribution box. All electrical repairs should be performed by an authorized dealer. Improper repair or modifications will void your warranty and/or cause serious damage to your vehicle.

Disposition: / Status:
End of New Topic.

Engine Aftertreatment System Power Requirements

CAUTION

Before disconnecting battery power, wait at least 20 minutes after the ignition switch is turned OFF. The engine aftertreatment system (EAS) uses battery power to circulate DEF and prevent overheating of the DEF system. Failure to comply may result in property damage.

For situations where the battery will be disconnected (for example, service or maintenance of the vehicle), please wait 20 minutes before disconnecting battery power.

Low Voltage Disconnect (LVD) (option)

The Low Voltage Disconnect (LVD) may extend battery life and prevent the battery from being drained below the charge required to start the engine. It does this by shutting off non-vital battery loads.
When battery voltage drops below the LVD setting, LVD starts a two-minute countdown. If battery voltage remains below the LVD setting and the engine is not started, when the countdown ends, all non-vital battery loads (hotel loads) will be shut off. The LVD setting is adjusted in the Settings sub-menu of the Digital Display.
When battery voltage drops below the LVD setting

1. An amber LVD notification occurs, accompanied by an audible

warning. This starts the two-minute countdown.

2. Thirty seconds before the countdown ends, the Battery Voltage indicator is replaced by the amber (or red) LVD telltale[33]. The LVD notification will turn red and will be accompanied by a continuous audible warning.

3. When the two-minute countdown has ended, the LVD “Hotel Loads Disconnected” notification appears, and LVD shuts off all loads connected through the LVD system.

The LVD condition will not clear until battery voltage increases above the LVD setting or the engine is started.

Electrical loads shut off by LVD

- Cab dome lamps
- Cab accessories
- Spare LVD wiring for customer added accessories

WARNING

DO NOT use the Spare Battery A and B circuits or other circuits that are controlled by the LVD to power electronic engine controls, ABS circuits, or safety/work related lighting. Before adding any device to the vehicle's electrical system, consult your nearest authorized dealer or read the contents of TMC RP136. Failure to do so may cause equipment damage or lead to personal injury.

NOTE

The determination of what circuits/loads that were connected to the LVD was based upon the recommendation from Technology and Maintenance Council (TMC) of the American Trucking Association. To review the recommended practice, see TMC RP-136.

NOTE

All LVD circuits are color-coded blue on the central electrical panel cover label.

LVD Setup

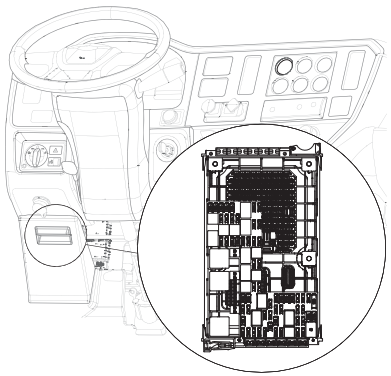
Change the LVD battery voltage set point for LVD to turn on *Low Voltage Disconnect (LVD) (option)* on page 243.

Fuses, Circuit Breakers, and Relays

Disposition: / Status:
Changed topic.Please review wording for location of fuses, circuit breaker and relays.

Fuses, circuit breakers, and relays are located in the Power Distribution Box to the left of the steering column behind the kick panel.

[33] On the 15 inch display, LVD telltale color depends on the severity of battery depletion.



Additional fuses for the alternator, engine electronics and trailer battery charge circuit may be located in the Power Distribution Center (PDC) inside the battery box and/or on the engine side of the cab firewall.

Adding Electrical Options

WARNING

Do not add a fuse with a rating higher than 30 amps. Follow the circuit protection size/type recommended by the component manufacturer. Installing a fuse or circuit breaker greater than designated may damage the electrical system which could lead to equipment damage and/or personal injury.

WARNING

Never install a circuit breaker/polyswitch in a location indicated for “fuse only.” Using a polyswitch (circuit breaker) in a fuse-only circuit may cause the circuit to overheat when a short exists, which could lead to equipment damage and/or personal injury.

NOTE

Polyswitches/circuit breakers are allowed in certain locations as indicated by the label on the fuse box. In these applications, a fuse may be used instead of a circuit breaker.

NOTE

Do not install a circuit breaker in place of a fuse for the following circuits:

- ACC FEED
- BODY IGN
- CAB ABS - BATT
- CAB ABS - IGN
- CAB ACC
- CB PWR
- CECU - BATT (2 PLCS)
- CECU IGN
- DOOR IGN
- ENG AUX
- ENG SD
- FOG LMPS
- GAUGE CL

- HIGH BEAM SUP
- LH DR / DOOR LOCK
- LOW BEAM SUP
- PARK LMP SNSE
- RADIO MEM
- RADIO PWR
- RH DOOR
- SLPR ACC
- RKE
- TRLR ABS
- TURN MOD PWR

Typical - See reverse side of Power Distribution Box cover for fuse and relay locations

Maximum Number of Lamps Allowed per Circuit

- Vehicle Stop/Turn Signal Circuit

The lighting control unit is limited to 5 amps total, or two (2) 25 watt incandescent bulbs per side. Do not wire more than two incandescent bulbs per side to the vehicle tail lamp fixtures. If more than two bulbs are required for each tail lamp fixture, install LED type lamps, or contact your nearest authorized dealer for other options.

- Trailer Turn and Vehicle Forward Side Facing Turn Lamp Circuit

The lighting control unit is limited to 20 amps or nine (9) 25 watt incandescent bulbs total (per side) for the combination of trailer turn lamps and vehicle forward side facing turn lamps. Do not wire more than nine incandescent bulbs per side for the combination of trailer turn lamps and vehicle forward side facing turn lamps.
If more than nine bulbs per side are required, install LED type lamps, or contact your nearest authorized dealer for other options.

CAUTION

Before installing additional vehicle stop/turn lamps, trailer turn lamps or additional forward side facing turn lamps on the vehicle, make sure the lighting circuit limits described above are not exceeded. Exceeding the number of lamps designated above can/will cause the electronic control unit to default to a protection mode, causing the lamps to not function properly.

Similar to the headlamp system, if a problem is detected with the electronic control unit, the control unit will cycle the turn signals off once every 9 seconds. You can detect that this is occurring if the turn signal indicators in the dash operate intermittently.
If you experience intermittent turn signal operation, the problem is either a short in the turn signal circuit or the maximum number of bulbs has been exceeded for the circuit.
If you experience any vehicle stop/turn signal issues, contact your nearest authorized dealer.

Vehicle CAN Bus

Your vehicle is equipped with a CAN bus electrical system. Because of how the electrical system is designed it is important that any accessories added after the vehicle is built are installed only on the K-CAN or the S-CAN. These dedicated CANs are provided on the driver's side of the cab, near to the interior fuse panel. Access to the K-CAN and S-CANs is provided by two RP1226 connectors. DO NOT tap into, connect to, tamper with, or splice into any CAN network other than the K-CAN or the S-CAN. Connecting to an unapproved CAN network may trigger CAN fault codes.

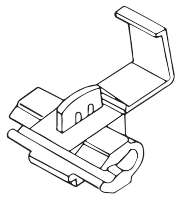
CAUTION

Connecting to an unapproved CAN network may trigger CAN fault codes. The manufacturer will not warrant failures or damage caused to CAN network components when the failure or damage is a result of improper connections to the CAN network.

CAUTION

The use of scotch locks, scraped off insulation, and electrical tape are not approved CAN connection techniques. These are the source of numerous CAN faults.

Scotch locks



Batteries

Regular attention to the charging system will help prolong the service life of the batteries.

WARNING

Batteries contain acid that can burn and gases that can explode. Ignoring safety procedures may result in death, personal injury, equipment or property damage.

WARNING

Never remove or tamper with battery caps. Ignoring this could allow battery acid to contact eyes, skin, fabrics, or painted surfaces. Failure to comply may result in property damage, personal injury, or death.

CAUTION

Disposition: / Status:
Change of terminology (truck by vehicle) per SME request. Please review.

DO NOT store other items in the battery box. Failure to comply could result in damage to the vehicle and/or batteries.

CAUTION

Properly secure battery tie downs and battery box cover when reinstalling batteries after service. DO NOT over tighten. Over tightening can crack the battery case which can lead to equipment damage.

CAUTION

The Diesel Exhaust Fluid (DEF) system recirculates fluid to the doser to prevent damage from heat after key off. If your vehicle is equipped with battery disconnect switches do NOT disconnect battery power within TEN minutes of switching the ignition key off. Failure to comply may result in vehicle or property damage.

Here are some common causes of battery failure:

- Overcharge: this condition results from improper voltage regulator adjustment. It results in overheating of the battery, warped plates, and evaporation of electrolyte.
- Undercharge: the voltage regulator is malfunctioning, the drive belt is slipping, or your vehicle has undergone long periods of idling or short distance driving. These conditions result in battery plates becoming covered with a hard coating.
- Vibration: loose battery hold-downs may cause battery plate failure.
- Short Circuits: these discharge the battery by draining electricity.
- Dirty or Loose Connections: improper connections may stop the flow of electrical power to and from the battery.

Battery Charging

WARNING

Batteries can injure you severely. They contain acid, produce poisonous and explosive gases, and supply levels of electric current high enough to cause burns. A spark or flame near a battery on charge may cause it to explode with great force. Never remove or tamper with the battery caps. Failure to comply may result in property damage, personal injury, or death.

Except for using small trickle charges to maintain battery condition, you should have your vehicle's batteries charged by a qualified service facility. To help reduce the risk of personal injuries, follow these guidelines carefully when recharging a battery:

- Before attempting any service in the electrical installation, disconnect the battery negative cable.
- Allow no sparks or open flame anywhere near the charging area.
- Charge a battery only in a well-ventilated area, such as outdoors or in a fully open garage which contains no pilot lights or other flames. Gases generated during the charging process must be allowed to escape.
- Always make sure the battery charger is OFF before connecting or disconnecting the cable clamps.
- To avoid short circuits, damage to the vehicle, or personal injury, never place metal tools or jumper cables on the battery or nearby. Metal that accidentally comes in contact with the positive battery terminal or any other metal on the vehicle (that is in contact with the positive terminal), could cause a short circuit or an explosion.

Charging Reminders

- Use protective eyewear
- Keep all batteries away from children
- Never reverse battery poles
- Never attempt to place the vehicle in motion, or run the engine with batteries disconnected
- Keep the battery clean and dry
- Look for any signs of damage
- Battery terminals should not be coated with improper grease. Use a commercially available, noncorrosive, non-conductive terminal coating, or petroleum jelly.

- Never use a fast charger as a booster to start the engine. This can seriously damage sensitive electronic components such as relays, radio, etc., as well as the battery charger. Fast charging a battery is dangerous and should only be attempted by a qualified technician with the proper equipment.

Under Cab Battery Access

Disposition: / Status:
New Topic. Please Review.

The standard battery location is on the left side of the vehicle, under the cab access steps.

1. Locate rubber straps on either side of the cab access steps.
2. Lift rubber straps away from step to unfasten the top access step. This is the battery box cover.
3. Pull battery box cover away from vehicle to reveal batteries, and set aside.

Replace battery box cover as soon as battery box access is no longer required and refasten both rubber straps.

Disposition: / Status:
Consider altering Warning to state "battery box" vs "battery compartment."

WARNING

Always reinstall the battery compartment cover (step) before entering the cab. Without the battery cover in place, you could slip and fall, resulting in possible injury to yourself.

In Cab Battery Access

Your vehicle may be equipped with Absorbed Glass Mat (AGM) batteries located in the cab under the passenger's seat. The glass mat in AGM batteries are designed to absorb the battery acid inside the battery that can leak or spill out in conventional batteries. This design feature allows batteries to be positioned in any orientation without risk of leaking.

To access the batteries:

1. Enter the cab.
2. Remove six fasteners securing the passenger side seat base to the battery box assembly.
3. Remove the seat and seat base as one unit to gain access to the batteries.
4. Installation is the reverse of removal.

Cranking Battery Specification

Category	Specification
Group	31
Stud Type	Threaded
Cold Crank Amps	650
Voltage	12 V
Reserve Capacity	160 minutes
General	Maintenance free

Removing Batteries

After accessing the batteries, follow these steps to remove them from the vehicle.

CAUTION

Before disconnecting battery power, wait at least 20 minutes after the ignition switch is turned OFF. The engine aftertreatment system (EAS) uses battery power to circulate DEF and prevent overheating of the DEF system. Failure to comply may result in property damage.

1. Be sure all switches on the vehicle are turned OFF
2. Wait 10 minutes after turning ignition off before disconnecting the batteries
3. Disconnect negative (-) ground cable first
4. Disconnect positive (+) cable
5. Unscrew the holding plate bolts with an open end wrench

NOTE

Always dispose of automotive batteries in a safe and responsible manner. Contact your authorized dealer for disposal standards. Call your local authorized recycling center for information on recycling automotive batteries.

Follow the procedures below to reinstall batteries on the vehicle and replace parts removed for access.

Installing Batteries

Follow the procedure below to reinstall main batteries on the vehicle:

WARNING

Battery replacement may alter or disturb battery cable routing. Check to insure battery cables are free from any point of chaffing. Failure to comply may result in death, personal injury, equipment or property damage.

NOTE

Always dispose of automotive batteries in a safe and responsible manner. Contact your authorized dealer for disposal standards. Call your local authorized recycling center for information on recycling automotive batteries.

NOTE

Make sure to reconnect the ground (negative) cable last.

1. Place batteries in vehicle and tighten bolt of holding plate
2. Reconnect positive cable
3. Reconnect ground (negative) ground cable

Replace Battery Box Cover

WARNING

Always reinstall steps before entering the cab or accessing the deckplate. Without steps you could slip and fall. Failure to comply may result in personal injury or death.

WARNING

Fairings not installed properly could come loose and cause other motorists to have an injury accident. It is important that fairings be installed properly. Failure to comply may result in death, personal injury, equipment or property damage.

1. Replace battery cover.
2. Install two bolts in step strut. Torque to 24-32 lb-ft (33-43 N·m).
3. Install fairing and install four bolts. Torque to 6-7 lb-ft (8-9 N·m).
4. Install steps by installing two bolts in each step. Torque to 24-32 lb-ft (33-43 N·m).

Slow Battery Charging

WARNING

Charger cables must be connected positive to positive (+ to +) and negative to negative (- to -). If connected improperly, batteries could explode. Failure to comply may result in property damage, personal injury, or death.

WARNING

Always make sure the battery charger is OFF before connecting or disconnecting the cable clamps to reduce the danger of explosions and resulting death or personal injury. Do not connect or disconnect charger cables while the charger is operating. Damage to the charging system may occur. Failure to comply may result in death, personal injury, or equipment/property damage.

NOTE

Some vehicles may have an ultra capacitor mounted in the battery box. These devices have a similar shape to a battery but have two positive posts and one negative posts. Do not attach battery chargers to these devices to recharge the vehicles batteries. Connect directly to the conventional two post charging batteries to charge them.

NOTE

Follow the instructions that come with your battery charger.

1. Access the battery terminals, the batteries do not have to be removed from the vehicle.
2. Make sure the battery charger is turned off.
3. Disconnect the battery cables.
4. Connect charger cables.
5. Start charging the battery at a rate not over 6 amperes. Normally, a battery should be charged at no more than 10 percent of its rated capacity.
6. After charging, turn OFF charger and disconnect charger cables.

Alternator

Take the following precautions to avoid burning out alternator diodes:

- DO NOT start the engine with alternator disconnected

(connections removed) from the circuit.

- Before welding, disconnect all electronic connections to the vehicle batteries.
- Remove battery power cable and insulate it from the vehicle.
- DO NOT run the engine with the batteries disconnected.
- DO NOT disconnect the battery cables or alternator connection cables with the engine running
- Never turn the ignition switch from the ON position to the START position with the engine running.
- When charging the battery (installed in the vehicle) disconnect the battery cables.
- DO NOT reverse the cables of the alternator, starter motor, or battery.
- DO NOT polarize the alternator. The alternator should not be polarized like a generator. To ensure correct polarity, use a test lamp or a voltmeter.

Remote Keyless Entry

The system will lock or unlock cab doors with the key fob. The system will alert you with parking lights when the selected doors are locked or unlocked. There are two key fobs provided with the system which provide secure rolling code technology that prevents someone from recording the entry signal.

If you have issues with a key fob, replace the battery and reprogram the key fob. In some situations, the key fob may need to be replaced and in others, a fuse may have failed that could render both key fobs inoperative. Contact your dealer for help if a key fob does not work and it is not because of a bad battery.

The key fob uses one CR2032, 3V battery. Batteries should last approximately three years, depending on use. Consistently reduced range is an indicator that the battery needs replacement. Batteries are available at most discount, hardware, and drug stores. The battery can be accessed by removing the cover of the key fob. After a new battery is installed, the key fob may need to be reprogrammed to pair with the vehicle.

Quantity	Type
1	CR2032

How to Replace Key Fob Battery

If the key fob will not unlock the doors, replace the battery.

1. Remove the cover of the key fob.
2. Replace the battery and dispose of the old battery.
3. Check to see if the key fob is still paired to the vehicle. If not, reprogram the key fob.

Programming Key Fobs

The key fob may need to be paired with the truck when the battery is replaced or when the key fob has not been used for an extended period of time.

1. Turn the ignition switch to the ON position.
2. Open the driver and passenger doors.
3. Press and hold the passenger door’s unlock button for 5 seconds, then release the button.

4. Within 3 seconds press and hold the passenger door's lock button for 5 seconds, then release the button. At this time you should hear the vehicle cycle the locking system by unlocking, then relocking the doors. (This indicates that the door module has entered "learning mode.")
5. Within the next 10 seconds, press and hold the key fob's lock button for 5 seconds, (you should hear the vehicle lock the doors) then press and release the unlock button.
6. Once programming is complete (or the 10 seconds from Step 5 has passed), the vehicle will cycle the locking system twice (unlock, lock, unlock, lock). This process should be repeated for each fob to be paired with the module. A maximum of five key fobs may be paired to a single module.

Engine Maintenance

These topics relate to the operator maintenance tasks for the engine. Information provided here is in addition to information contained in the Engine Operator Manual supplied with the vehicle.

WARNING

Exhaust fumes from the engine contain carbon monoxide, a colorless and odorless gas. DO NOT breathe the engine exhaust gas. A poorly maintained, damaged, or corroded exhaust system can allow carbon monoxide to enter the cab. Entry of carbon monoxide into the cab is also possible from other vehicles nearby. Failure to properly maintain your vehicle could cause carbon monoxide to enter the cab, resulting in personal injury or death.

WARNING

NEVER start or let the engine run in an enclosed, unventilated area. Engine exhaust fumes contain carbon monoxide, a colorless and odorless gas. Carbon monoxide can be fatal if inhaled. Failure to comply may result in property damage, personal injury, or death.

WARNING

Never idle your vehicle for prolonged periods of time if you sense that exhaust fumes are entering the cab. Investigate the cause of the fumes and correct it as soon as possible. If the vehicle must be driven under these conditions, drive only with the windows open. Failure to repair the source of the exhaust fumes may result in death, personal injury, equipment or property damage.

NOTE

Keep the engine exhaust system and the vehicle's cab ventilation system properly maintained. It is recommended that the vehicle's exhaust system and cab be inspected (1) By a competent technician every 15,000 miles (24,140 km); (2) Whenever a change is noticed in the sound of the exhaust system; or (3) Whenever the exhaust system, underbody, or cab is damaged.

Check Engine Oil Level

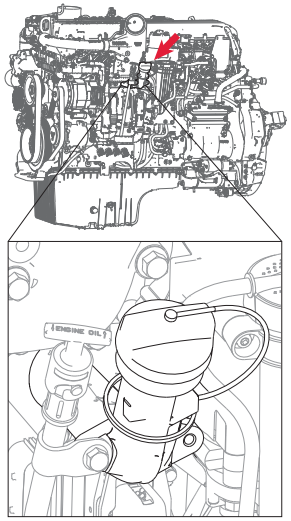
WARNING

DO NOT change hot engine oil as you could be burned. Let the engine cool down before changing the engine oil. Failure to comply may result in death, personal injury, equipment damage, or property damage.

To check the engine oil level:

1. Park the vehicle on level ground and wait 15 minutes after shutting the engine OFF. This allows time for the oil to drain to the oil pan.
2. Remove the dipstick and wipe it off with a clean, lint-free rag.
3. Reinsert the dipstick all the way in and pull it out again to check oil level. Correct oil level is between the low (L) and high (H) marks on the dipstick.

Topping Up the Engine Oil



1. Top up with oil, if necessary, via the filler opening. Use the correct grade in the correct quantity. For oil replacement, please see engine Operator's Manual included with this chassis.
2. After topping up, wait 1 minute and check the oil level again.
3. Reinstall the oil fill cap and twist to lock it in place.

Pipe and Hose Clamp Torque Values

Torque specifications for engine parts.

Application	Type of Clamp	lb-in.	N•m
Radiator and Heat Exchanger Hoses	Constant Torque CT-L	90-110	10.2-12.5
Heater Hoses	Constant Tension	not required	not required
Air Intake Pipes	Hi Torque HTM-L	100-125	11.3-14.2
Plastic Air Intake Pipes	Constant Torque CT-L	88	10.0
Charge Air Intake Hoses	Flex Seal	70-100	7.9-11.3
	B9296	50-60	6-7
Fuel, Oil and Water Heat Exchangers (for hoses less than 9/16 in. diameter).	Miniature 3600L	10-15	1.1-1.7

Install Engine Belt

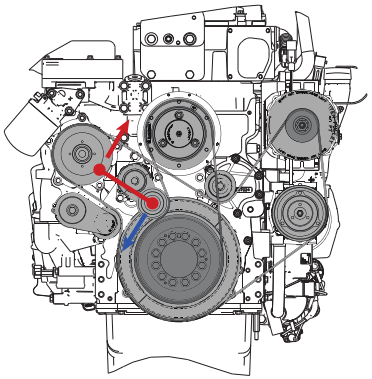
You can extend the reliability and service life of your vehicle's drive belts with proper attention to installation and maintenance. Neglect could cause belt failure. The result could be the loss of the electrical or air system as well as possible engine damage from overheating.

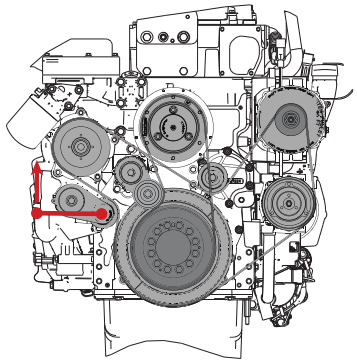
NOTE

See the engine manufacturer's operator's manual for further information on replacing engine drive belts.

The images below may not appear like the configuration of the vehicle. The procedure is still the same. Follow this procedure to install an accessory drive belt:

1. Route the new belt around the pulleys, and then rotate the automatic tensioner so that the idler pulley swings toward the belt routing. The following figure shows an example of the rotation direction to release the tensioner.





2. Slip the belt around the idler pulley attached to the automatic tensioner.
3. Release the automatic tensioner.
4. Check the belt alignment on each pulley. The belt must fall between the flanges of each pulley.

Engine Fan

WARNING

DO NOT work on or near the fan with the engine running. Anyone near the engine fan when it turns on could be injured. If it is set at MANUAL, the fan will turn on any time the ignition key switch is turned to the ON position. In AUTO, it could engage suddenly without warning. Before turning on the ignition or switching from AUTO to MANUAL, be sure no workers are near the fan. Failure to comply may result in death or personal injury.

Follow these guidelines to check your engine fan:

- With the engine shut off, check the fan hub bearings for looseness, loss of lubricant, and any abnormal conditions (e.g. fan belt misaligned or excessive wear/damage, etc.).
- With the engine idling and the hood open, stand at the front of the vehicle. Listen for any noises coming from the fan hub. Bearings that have lost lubricant and are dry will typically emit a squeal or a growl when the engine is at operating temperature and the fan clutch is engaged. If noise is detected, have the fan bearings inspected by an authorized dealership.

Engine Fan Blade

Verify that there is enough fan blade clearance with the fan shroud. The recommended distance around the fan shroud is 1 in. (25 mm) from front edge of any fan blade-to-radiator side member. Minimum clearance is 3/4 in. (19 mm).

- Rear edge of any blade must be no closer than 3/8 in. (9 mm) to the nearest engine component. If this cannot be obtained, the fan spacer or fan is incorrectly placed.
- The leading edge of any fan blade must be 1 in. (25 mm) from the inside edge of the shroud.

Air Intake System

Engine heat, vibration, and age combine to loosen air intake connections and cause cracks in the tubing and elbows. Leaks in the intake system allow abrasive dust to enter the engine and quickly cause expensive damage. During your daily walk-around inspection, carefully check all tubing, elbows, clamps, supports, and fasteners for condition and tightness. Check the charge-air-cooler for air leaks annually. The air leaks can be caused by cracked tubes or header. For service see your authorized dealer.

CAUTION

DO NOT use air intake pipes and connections as a step or to pull yourself up. This could loosen the connections and open the system to unfiltered air which could damage the engine.

Turbocharger

WARNING

DO NOT operate engine with turbocharger intake piping disconnected. A suction is created when the engine is running. This suction could draw your hand or anything else near it into the impeller fan. You could be injured. Always keep the intake piping connected when you will be running the engine.

When servicing the air intake and exhaust systems on a turbocharged engine, check the items listed below:

Lubricating System

Check the oil lines, housing, and connections. Look for leaks, damage, or deterioration. Leaks could mean you have damaged oil lines or oil seals.

Manifold

With the engine operating, check for leaking manifold or flange gaskets.

High Frequency Vibration

Vibration may indicate turbo rotor imbalance. Have your dealer investigate this immediately. If you detect any deficiencies, take the vehicle to an authorized dealer for servicing. Delay could lead to severe and expensive damage to your vehicle.

Engine Air Filters

The following service information is basic to all air cleaner makes and models. Service the filter elements when the (option) locks in the extreme High position. Have the element serviced at an authorized dealer. Paper elements require care and proper handling, because they are critical to engine service life.
Service the air cleaner periodically. If the vehicle operates in areas with heavy dust, maintenance should be more frequent.

Replace Engine Air Filter

Disposition: / Status:
Caution moved prior to Note per SME feedback. Also <postreq> section added. Please review.

CAUTION

Disposition: / Status:
New caution per change log CH-0741 request. Please review.

Use only PACCAR-branded (Donaldson) engine air filters when replacement is needed. Using a non-genuine PACCAR air filter decreases sealing strength and impacts correct alignment. Failure to comply may result in equipment or property damage.

NOTE

If the vehicle is equipped with cab-mounted air cleaner and under hood air intake option, remove the air solenoid first.

1. Park the vehicle. Set the parking brake and turn the ignition OFF.
2. If the air cleaner is under the hood, open the hood to access the air filter housing.
3. Loosen the hardware that holds the housing cap to the main filter enclosure.
4. Pull the air filter housing cap away from the main enclosure to access the filter.
5. Visually inspect the filter housing, enclosure, and hardware for damage.
6. The filter can be removed by gently pulling it directly out of the main enclosure. Be careful not to drop or tap the filter on the housing during removal, as this could loosen dirt and dust trapped in the filter. DO NOT clean or reuse the original filter.
7. Inspect the sealing surfaces and clean out any debris from the inside of the filter enclosure before installing the new filter. Be careful to not push any contaminant into the engine inlet.
8. Visually inspect the new filter prior to installation. There should not be any damage to the filter media or gaskets, such as dents, dings, cracks, or holes.
9. After installing the filter, inspect for a good seal, if possible.
10. Install the filter housing cap and tighten the hardware. DO NOT use the housing cap to drive the filter into position.
11. Start the engine and allow the air system to reach operating pressure. Activate the under hood air switch and verify that there are no air leaks.

Disposition: / Status:
Is this a correct suggestion to make? Please review.

If an Air Filter Restriction Indicator is installed on the air filter housing, the indicator must be reset.

Engine Air Filter Pre-Cleaner (Option)

Certain truck models may have an engine air filter pre-cleaner. This pre-cleaner keeps the main engine air filter from quickly filling with dust in vocational applications. The pre-cleaner should be inspected and cleaned periodically as defined in the Maintenance chapter or sooner based on your vehicle's application. Vehicles operating in extremely dusty environments may need to inspect and clean the pre-cleaner more frequently than suggested in the Maintenance chapter. The air filter restriction gauge may not be an accurate indicator of pre-cleaner condition.

How to Remove the Pre-cleaner Filter

Tools and Components:

- 8mm torque wrench

Perform with hood open (see *How to Open the Hood*), standing on either side of hood.

1. Locate Pre-cleaner at underside of hood, top center.
2. Remove fender liner for better access to Pre-cleaner (see *How to Remove a Fender Liner* on page 207).
3. Remove upper left and lower right Pre-cleaner fasteners using wrench, and set aside.
4. Loosen, but do not remove, lower left and upper right Pre-cleaner fasteners.
5. Twist Pre-cleaner counter-clockwise to unlock, then remove.

NOTE

Verify hood plenum is free of debris.

If cleaning the Pre-cleaner, see *How to Clean the Pre-cleaner Filter*. If installing a replacement, see *How to Install a Pre-cleaner Filter*.

How to Clean the Pre-cleaner Filter

Tools and Components:

- Gentle soap
- Warm, low-pressure water source

CAUTION

Do not use high-pressure water or air to clean or dry the Pre-cleaner Filter Assembly. High-pressure water or air could damage the filter media, reducing its effectiveness, and decrease the service life of both the Pre-cleaner Filter Assembly and the Primary Engine Air Cleaner. Failure to comply may result in equipment or property damage.

The Pre-cleaner must be removed from the vehicle prior to cleaning (see *How to Remove the Pre-cleaner Filter* on page 259.).

1. Shake Pre-cleaner until majority of dust and debris is removed.
2. Examine Pre-cleaner for damage to the filter media:
   a. If the filter media is damaged, stop this procedure and install a new Pre-cleaner assembly.
3. Apply (or spray) soap on both sides of the Pre-cleaner media and allow a few minutes for the soap to sink in.
4. Flush dirt from filter using warm, low-pressure water applied to cleaner (engine side) side of filter until water runs clear.
5. Rinse Pre-cleaner using warm, low-pressure water until no soap remains.
6. Gently shake filter of excess water and allow Pre-cleaner to dry before installing.

See *How to Install the Pre-cleaner Filter* on page 259 for installation.

How to Install the Pre-cleaner Filter

Tools and Components:

- 8mm torque wrench
- New (or cleaned and dry) Pre-cleaner Filter Assembly

Steps in this procedure assume that the How to Remove the Pre-cleaner Filter procedure was performed.

1. Insert new (or cleaned and dry) Pre-cleaner into cavity, aligning both installed fasteners with larger holes on Pre-cleaner.

2. Twist Pre-cleaner clockwise to lock in filter.
3. Tighten then torque both fasteners to 7–11 lb-ft (9–15 N·m).
4. Install and tighten remaining fasteners, then torque to 7–11 lb-ft (9–15 N·m).
5. Reinstall Fender Liner (*How to Reinstall a Fender Liner* on page 207).
6. Close and secure hood (*Close the Hood* on page 17).

Exhaust System

The exhaust system is part of the noise and emission control system. Periodically check the exhaust system for wear, exhaust leaks, and loose or missing parts. For details on how to maintain the emissions components in the exhaust system, see "Noise and Emission Control" in your vehicle operator's manual. Please refer to the engine operator's manual for more details on how to maintain the emissions components in the exhaust system.

Engine Mounting

CAUTION

DO NOT retorque or reuse existing flange head bolts. These bolts are factory set to the specified torque. If bolts are loose or damaged, they must be replaced with new bolts. Failure to comply may result in property damage.

Periodic Inspection: Inspect engine mounts every 60,000 miles (96,000 km).
Check for the following:

- Inspect both mount and leg fasteners. Check for loose or broken bolts. Replace as necessary.
- Check mount and leg for fractures, breaks or deformation. Replace as necessary.
- Check for complete insertion of motor mount. Replace as necessary.
- New leg to mount flange head bolts should be torqued to 210-230 lb-ft (284-311 N·m).

Fuel System

Please follow these recommendations when you are changing your fuel filters or strainer elements. Your vehicle's engine will run better and last longer if you do. See the engine manufacturer's recommendations for proper water and micron requirements.

Disposition: / Status:
End of New Topic.

Draining the Primary Fuel Filter

The following tools are suggested for this procedure:

- Container (1 liter capacity) (optional)
- 3/8" diameter rubber hose (optional)

Perform with engine OFF. Cover any electrical equipment and wiring that might get soaked with fuel – diesel fuel may permanently damage electrical insulation. If draining to replace filter, drain into container with a minimum 1 liter (1 qt) capacity, and use hose to route fluid.

1. Open the hood (see *How to Open the Hood*), and locate the primary fuel filter.
2. Open drain valve (by hand only) until draining occurs.
   If draining to replace the filter, before opening valve, push one end of hose onto drain valve and route other end to the container.
3. Drain fluid from filter assembly:
   - If draining water from fuel, drain filter bowl of water until clear fuel is visible, then close drain valve, or
   - If replacing filter, drain until flow stops, then close valve.

CAUTION

Do not overtighten the valve. Over tightening can damage the threads.

   If a hose was used to drain fluid, remove hose.

If entire filter assembly was drained, proceed to Replacing the Primary Fuel Filter.

Replacing the Primary Fuel Filter

The following tools are suggested for this procedure:

- Bowl wrench RK61680
- 1" wrench
- New PACCAR primary fuel filter element designed for this application
- 2 new O-rings

Start procedure with engine off. Cover any electrical equipment and wiring that might get soaked with fuel; diesel fuel may permanently damage electrical insulation. To expel air from density-type strainer elements, soak them in clean fuel before installing them. Lubricate new O-rings with clean fuel to ensure a positive seal.

1. Disconnect clip-type electrical connections from bowl bottom:
   a. Disconnect water in fuel (WIF) sensor from wire bundle.
   b. Disconnect electrical heater sensor from wire bundle.
2. Using bowl wrench, loosen filter bowl and lower at least 2 inches. Take care not to damage bowl sensors on surrounding components.
3. Slowly remove bowl and filter from upper filter assembly.
4. Remove the filter element and both upper and lower O-rings.
5. Install new filter element:
   a. Install new upper and lower O-rings.
   b. Install new fuel filter element.
6. Reconnect clip-type electrical connections to bowl bottom:
   a. Reconnect water in fuel (WIF) sensor to wire bundle.
   b. Reconnect electrical heater sensor to wire bundle.
7. If your vehicle has a fuel blending valve, turn valve to “Prime.”
8. Prime fuel filter assembly:
   - If your assembly contains a manual priming pump (PX-7 engines) press priming pump repeatedly until pumping action becomes firm, or
   - Allow the electric priming pump to prime assembly (non PX-7 engines).
9. Start the vehicle.
   For PX-7 and PX-9 engines, idle for 5 minutes.

10. If your vehicle has a fuel blending valve, turn valve to “Run.”

Observe fuel filter assembly for leaks. Dispose of old filter element and O-rings properly.

Fuel Tank

Disposition: / Status:
Altered Topic. **Please review before publication.**

Check the strap tightness. Tighten to proper torque value as required:

- Aluminum tank - 30 lb-ft (41 N·m)

Frame

WARNING

DO NOT cut, splice or weld frame rails or drill through the top or bottom flanges of the rails. These operations could affect frame rail strength leading to a failure resulting in an accident. Rail failures resulting from such modifications are not warrantable. Failure to comply may result in property damage, personal injury, or death.

WARNING

Frame welding is NOT recommended. The high heat of welding nullifies the special heat treatment of the rails, greatly reducing the tensile strength of the frame rail. If a frame member becomes cracked from overloading, fatigue, surface damage, or a collision, the only permanent repair is to replace the damaged frame member with a new part.

Emergency Welding

In an emergency, a temporary repair may be performed. Observe the following precautions to protect electronic systems during welding operations. Emergency welding procedures are further explained in the maintenance manuals. Please refer to the ordering information on the back cover to obtain a maintenance manual.
In the event of emergency welding of a frame rail and when welding any other part of your truck or any component attached to your truck, observe the following precautions before welding:

- Disconnect all electronic devices. It is not possible to list all of the electronics that could be affected, but a few examples include the following: alternator, engine Electronic Control Unit (ECU), transmission ECU, ABS ECU, navigation devices, diagnostic devices, and monitoring devices.
- Disconnect battery cables and insulate them from the vehicle.
- Do not use the ECU or engine ground stud for the ground of the welding probe.
- Ensure that the ground connection for the welder is as close to the weld point as possible. This ensures maximum weld current and minimum risk to damage of electrical components on the vehicle.

Painting

Do not electrostatically paint your truck or any component on your truck without first removing all of the electronic components from the truck. It is not possible to list all of the electronics that could be affected, but a

few examples include the alternator, engine Electronic Control Unit (ECU), transmission ECU, ABS ECU, navigation devices, diagnostic devices, and monitoring devices.

Fifth Wheel Monthly Maintenance

- Refer to specific manufacturer's literature for any special instructions.
- Steam clean the fifth wheel.
- Check lock guard operation using a commercial lock tester.
- Clean and oil all moving parts.
- Lubricate the lock mechanism with a lithium-base grease.
- All grease fittings (especially those which grease the top surface of the fifth wheel).

Fifth Wheel Bi-Annual Maintenance

NOTE

Whenever possible, torque all frame fasteners on the nut end, not the bolt head.

- Refer to specific manufacturer's literature for any special instructions.
- Remove fifth wheel from vehicle. Refer to the Shop Manual, "Fifth Wheel Removal."
- Steam clean the fifth wheel and mounting brackets.
- Check all moving parts for excessive wear or damage. Replace all worn or broken parts.
- Complete two-month service procedure.
- Install fifth wheel. Refer to the Shop Manual, "Fifth Wheel Installation."

Tighten all frame fasteners with a torque wrench. See *Frame Fastener Torque Requirements* on page 291.

Sliding Fifth Wheels

Lubricate bearing surface of support bracket through the grease fittings on the side of the fifth wheel plate. Use a water resistant lithium-base grease.

NOTE

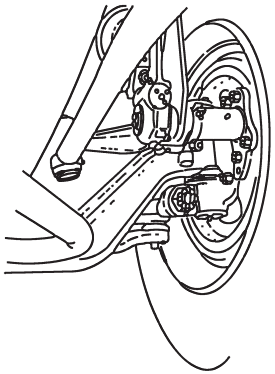
The plate must be lifted up slightly to relieve the weight of the bracket while applying grease.

Front Axle and Suspension

Axle Lubrication

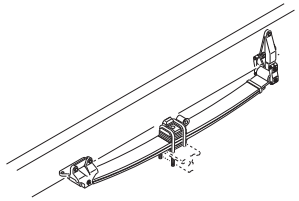
Refer to the axle manufacturer's operator's manual for lubrication specifications and service intervals.

Kingpin Lubrication



Lubricate with approved lubricant. Lubricate knuckle thrust bearings, knuckle pins, and tie rod ends. Lack of lubrication causes premature wear and hard steering. Lubrication schedule may be shortened if necessary.

Suspension Lubrication



Each standard spring anchor pin has a grease fitting. Pressure lubricate spring pins as specified. At regular intervals, the spring leaves may be lubricated with a rust-inhibiting oil applied with a spray gun or brush. Depending on your suspension, lubricate all spring pins until grease flows out of both ends of the bushing. Look for signs of rust or water in the flushed grease. If a pin will not accept grease, it should be removed, cleaned, and inspected.

CAUTION

DO NOT spray the suspension with chemical products or mineral oil; it can cause damage to the bushings.

Inspection

For all vehicles, mandatory maintenance procedures include retightening all U-bolts and inspecting the suspension for loose, damaged, or abnormally worn fasteners. Visually inspect the shock absorbers, the rubber bushings, the leaf springs, and that the suspension is aligned and functioning properly. Mono leaf spring suspensions should also have their rear shackle brackets checked for proper alignment. Even with proper maintenance, however, the service life of leaf springs are affected by many factors: fatigue, vehicle gross weight, type of load, road conditions, and vehicle speed. Check for cracks, wear marks, splits, or other defects on the surface of the spring. Defective parts must be replaced. Because repaired springs cannot be fully restored to their original service life, replace the complete assembly if cracks or other defects are detected.

Wheel Alignment

For driving safety and comfort, and to prolong the life of your vehicle, it is important to have wheels correctly aligned. Check tire wear frequently. Uneven tire wear is a sign that the wheels may be misaligned. If you see uneven wear, take

your vehicle to an authorized dealer familiar with aligning wheels on your vehicle.

Suspension U-Bolts

It is important that U-bolts remain tight. Severe use of your vehicle will cause them to loosen faster, and all vehicles need to have their U-bolts checked and tightened regularly. Be sure someone with the proper training and the right tools checks and tightens the U-bolts on your vehicle. New springs can settle in after service, relieving the tension on the U-bolts. Loose U-bolts can cause leaf spring breakage, axle misalignment, hard steering, and abnormal tire wear. All vehicles should have suspension U-bolts tightened after the first 500 miles (800 km) of operation. Re-torque the front spring pinch bolts and shackle pinch bolts.

WARNING

Disposition: / Status:
Altered Warning. Please Review.

DO NOT operate the vehicle if the suspension U-bolts are not properly tightened. Improperly tightened (loose) suspension U-bolts can lead to an unsafe vehicle condition, including: hard steering, axle misalignment, spring breakage, or abnormal tire wear. Failure to comply may result in death, personal injury, equipment or property damage.

U-bolts are difficult to tighten unless you have the right equipment. If you cannot tighten them correctly yourself, be sure to have them checked and tightened regularly by an authorized technician. Tighten U-bolt nuts to the specified torque value with the vehicle loaded to its normal gross weight. See *Suspension U-Bolts, Grade 8* on page 292 specifications for torque values applying to U-bolts and nuts.

WARNING

DO NOT replace U-bolts and nuts with common U-bolts or standard nuts. These parts are critical to vehicle safety. If the wrong U-bolts or nuts are used, the axle could loosen or separate from the vehicle and cause a serious accident. Use only PACCAR replacement parts. Failure to comply may result in death, personal injury, equipment or property damage.

PACCAR FX-20 Front Axle Lubrication

Proper lubrication practices are important in maximizing the service life of the steer axle assembly.

Kingpins, Thrust Bearings, and Tie Rod Ends

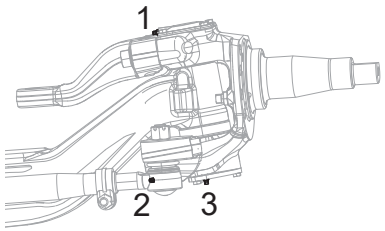
On-Highway Applications - Standard

- Pressure lubricate every 6 months or 25,000 miles (40,000 km).
- A more frequent lubrication cycle is required for axles used in on/off-highway, refuse, or other severe service applications. Use heavy-duty, multipurpose lithium base (#2 grade) grease.

NOTE

DO NOT mix with sodium-based grease.

PACCAR FX-20 Front Axle Lube Points



1. Upper kingpin bearing
2. Tie rod end
3. Lower kingpin bearing

NOTE

If it is difficult to grease either the upper or lower bearing, try greasing the bearings with the vehicle jacked up and supported on axle stands to improve grease flow and flush contamination.

Oil Bath

Lubricate wheel end assembly with a drive axle lubricant that meets MIL-L-2105D specifications. Either SAE 80W-90 mineral based or 75W-90 synthetic gear oil is acceptable. Check the lubricant level at each greasing interval. Maintain the lubrication fluid level at centerline of axle or fill line on hub cap. Always check fluid level on flat ground.

CAUTION

Never mix oil bath and grease-packed wheel ends. Mixing oil and grease will reduce the effectiveness of both lubricants and may cause damage to the wheel ends.

Heater and Air Conditioner Maintenance

The combination heater-air conditioner provides comfort for those in the cab through accurate control of the cab environment in all weather conditions. Regular attention to the items below will help you keep the heater-air conditioner unit running well. Keep the vehicle's ventilation system, engine exhaust system, and cab joints properly maintained. It is recommended that the vehicle's exhaust system and cab be serviced by a competent technician as follows:

- Inspected every 15,000 miles
- Whenever a change is noticed in the sound of the exhaust system
- Whenever the exhaust system, vehicle underbody, or cab is damaged

To allow for proper operation of the vehicle ventilation system, proceed as follows:

- Keep the inlet grille at the base of the windshield clear of snow, ice, leaves, and other obstructions at all times.

- Keep the exhaust pipe area clear to help reduce the buildup of exhaust gas under the vehicle.
- Check the drain tube of the fresh air inlet for trapped water before assuming that there is a leak in the heating system.

Special Precautions

WARNING

Never weld, solder, steam clean, or use a blow torch near any part of the air conditioning system. Excessive heat may cause the pressurized components of the air conditioning system to explode. Failure to comply may result in death, personal injury, equipment or property damage.

WARNING

Air conditioning refrigerant can be hazardous to your health. DO NOT expose yourself to leaking refrigerant for prolonged periods near excessive heat, open flames, or without proper ventilation. Failure to do so may result in death or personal injury.

If a refrigerant leak develops in the presence of excessive heat or an open flame, hazardous gases may be generated. If you become aware of a refrigerant leak on your vehicle have your system serviced immediately and observe the following precautions: Stay away from the hot engine until the exhaust manifold has cooled. Do not permit any open flame in the area. Even a match or a cigarette lighter may generate a hazardous quantity of poisonous gas. Do not smoke in the area. Inhaling gaseous refrigerant through a cigarette may cause violent illness.

Heater

CAUTION

During extreme cold weather, DO NOT blow hot defroster air onto cold windshields. This could crack the glass. Turn the Air Flow Control Dial to Defrost and adjust the fan speed accordingly while the engine warms. If the engine is already warm, move the Temperature Control Dial to "cool," then gradually increase the temperature when you see that the windshield is starting to warm up. Failure to comply may result in equipment damage.

- Check all heater controls for full-range operation.
- Check hoses, connections, and heater core for condition and leaks.

Air Conditioner

WARNING

The air conditioning system is under pressure. If not handled properly during servicing, it could explode. Any servicing that requires depressurizing and recharging the air conditioning system must be conducted by a qualified technician in an approved facility. Failure to comply may result in death, personal injury, equipment damage, or property damage.

WARNING

Wear eye protection any time you use compressed air. Failure to comply may result in personal injury

- Listen to the compressor and drive clutch for noise and vibration. If you find problems, have the system checked thoroughly. A malfunctioning clutch usually indicates trouble elsewhere in the system.
- Check the evaporator core, filter, and condenser core for debris restricting air flow. Clean if necessary. Small particles may be removed with compressed air blown through the core in the opposite direction of normal air flow.
- Check the engine belt for condition and proper tension.
- Check all hoses for kinks, deterioration, chafing, and leaks. Adjust kinked or chafing hoses to eliminate restrictions and prevent further wear.
- Check all components and connections for refrigerant leaks. If you discover a leak, do not try to tighten a connection. Tightening a connection may cause a leak to worsen. Have a qualified technician correct the problem.

NOTE

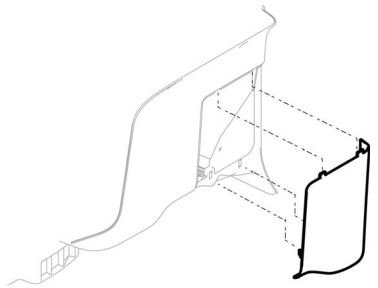
A leaking evaporator or condenser core cannot be repaired; it must be replaced.

Have the air conditioning system fully serviced annually by your authorized dealer. Qualified service technicians will have to evacuate and recharge the system.

Cabin Fresh Air Filter

The cab air conditioning filter is located inside the cab behind the passenger side kick panel (located below the glovebox). After removing the required panels, the filter can be pulled from the blower unit without using any tools.
To remove the HVAC access panel: pull panel out from the bottom to release the clips, then pivot the panel outward so the tabs at the top allow the panel to drop down.

HVAC Access Panel



Inspect and clean cab air filter element every 3 - 6 months of service. Depending on the operating environment, if air flow from the air conditioner and heater is less efficient or windows fog easier, you may need to replace the cab air filter.

Disposition: / Status:
End of New Topic.

Replace the Recirculation Air Filter

Please contact an authorized dealer when the service interval is required to inspect the cabin recirculation air filter.

Noise and Emission Control

There are specific components on the vehicle that are designed to meet certain Environmental Protection Agency (EPA) emissions and noise regulations. To maintain conformance with the regulations, these components need to be functional and properly maintained.

Noise Emission Warranty

Peterbilt warrants to the first person who purchases this vehicle for purposes other than resale and to each subsequent purchaser that this vehicle as manufactured by Peterbilt, was designed, built, and equipped to conform at the time it left Peterbilt's control with all applicable U.S. EPA Noise Control Regulations. This warranty covers this vehicle as designed, built, and equipped by Peterbilt, and is not limited to any particular part, component, or system of the vehicle manufactured by Peterbilt. Defects in design, assembly, or in any part, component, or system of the vehicle as manufactured by Peterbilt, which, at the time it left Peterbilt's control, caused noise emissions to exceed Federal standards, are covered by this warranty for the life of the vehicle.

Tampering with Noise Control System

Federal law prohibits the following acts or the causing thereof:

1. The removal or rendering inoperative by any person other than for purposes of maintenance, repair, or replacement, of any device or element of design incorporated into any new vehicle for the purpose of noise control prior to its sale or delivery to the ultimate purchaser or while it is in use, or
2. The use of the vehicle after such device or element of design has been removed or rendered inoperative by any person. Among those acts presumed to constitute tampering are the acts listed below:

Air Intake System	Removing or rendering inoperative the air filter housing/silencers or intake piping
Engine Cooling System	Removing or rendering the fan clutch inoperative
	Removing the fan shroud
Engine	Removing or rendering engine speed governor inoperative so as to allow engine speed to exceed manufacturer's specifications
	Modifying ECU parameters
Exhaust System	Removing or rendering inoperative exhaust system components
Fuel System	Removing or rendering engine speed governor inoperative, allowing engine speed to exceed manufacturer's specifications
	Removing of air signal attenuator on engines equipped with this device
	Removing of diesel exhaust fluid tank and system
Inner Fender Shields and Cab Skirts	Removing shield or skirts
	Cutting away parts of shields, skirts or damaged or loose portions of shields or skirts
Noise Insulating Blankets	Removing noise insulators from engine block or from around the oil pan
	Cutting holes in, or cutting away part of noise insulators
	Removing hood-mounted noise insulation

Inspecting Noise and Emission Components

The following instructions are based on inspection of the noise control system at regular intervals as indicated in the *Noise Control System - Maintenance Log* on page 291.

Air Intake System

- Do all checks and maintenance procedures listed in this manual under engine air intake system and air filter housing.
- Check the induction tubing, elbow connections, clamps, brackets, and fasteners for deterioration, cracks, and security.
- If you find an air leak anywhere between the air filter housing and the engine, repair that leak immediately.

CAUTION

Air leaks cause excessive noise and may result in serious damage to the engine. If you do not repair them the engine damage will not be covered by your warranty. Repair all air leaks as soon as you find them.

Engine Mounted Noise Insulators

- Check condition. Is the insulator secure? How you do this will depend on the method of attaching the noise insulators on the engine and around the oil pan (bolts, snap fasteners, or straps). Tighten loose fasteners and repair or replace any worn or damaged fasteners.
- Check insulators around fasteners and stress points, especially where they may be affected by engine vibration. Repair any cracked or damaged mounting points. Use suitable reinforcing plates to ensure that the insulators will remain in position.

Exhaust System

- Check for exhaust leaks, which would indicate a leaking manifold gasket; replace gasket if necessary.
- Check cap screws for tightness, including those at the flanges. Refer to the engine manufacturer's service manual for proper tightening sequence and torque values.

Joints and Clamps

- Check for leaks, and tighten as necessary. Check for deterioration or dents in pipes and clamps which could allow exhaust to escape.
- Replace any serviceable joints, flexible pipes and gaskets at the service intervals.

Selective Catalysts Reduction (SCR)

- Check SCR canister filter, clamps, and mounting brackets. Tighten if necessary. Inspect SCR canister for signs of rust or corrosion.

Exhaust Piping

- Check exhaust piping for rust, corrosion, or damage. Replace deteriorated piping before holes appear. If piping is perforated at any point, temporary patching or lagging is acceptable until you can have permanent repairs made. On turbocharged engines, check joints at flanges and mounting brackets for tightness.

Diesel Particulate Filter (DPF)

- Check DPF, clamps, and mounting brackets. Tighten if necessary.

Inspect DPF for signs of rust or corrosion.

- Check internal baffling. You can do this by listening for rattling sounds while tapping on the (DPF with a rubber mallet or revving the engine up and down through its normal operating range.

Mufflers

- Check muffler, clamps, and mounting brackets. Tighten if necessary. Inspect muffler for signs of rust or corrosion.
- Check internal baffling. You can do this by listening for rattling sounds while tapping the muffler with a rubber mallet or revving the engine up and down through its normal operating range.

DEF Tank (See Engine Aftertreatment System manual)

Exhaust Tail Pipe

- Check the mounting. Tighten as necessary. The miter cut at the tip of the pipe must be facing the rear of the vehicle. Do not modify the end of the pipe in any way.

Engine Fan and Shroud

WARNING

Do not work on the engine fan with the engine running. The fan can engage at any time without warning, and anyone near the fan when it turns on could be injured. Ensure no one is near the fan before turning on the ignition. Failure to comply may result in death, personal injury, equipment damage, or property damage.

- Check all fasteners for tightness. Check for stress cracks in the shroud. Make sure the shroud is adjusted so that it does not touch the fan blades.
- Check to verify that the fan is disengaged (not turning) with the engine running at normal operating temperatures (from cold to the point that the fan engages).
- Check fan blade mounting bolts. Inspect fan blades to be sure they are not cracked or bent.

Transmission and Driveline

- Substituting a different main transmission or driveline components, other than design-specified units, may result in increased vehicle noise emission.

Hood Insulation Blanket

- Check all fasteners for condition and security. Repair or replace any broken or defective fasteners.

Blanket

- Check for chafing or tears. Patch it if necessary. Find the cause of the damage. If any component or accessory is causing wear or damage and cannot be relocated, put reinforcing pads on the blanket at the site of wear.

Inner Fenders Shields and Cab Skirts

- Check all fasteners, especially the self-tapping hex head screws. Are they secure? Remove and replace any loose rivets.

Shields and Skirts

- Check shields and skirts for cracks at mounting and stress points. Check fender shields for tire marks, worn spots, or damage from objects thrown from tire treads. You can repair cracked or damaged fiberglass fender shields with fiberglass and resin.
- If you find damage at a fastening point, you can gain additional

strength by installing a suitable reinforcing plate. This plate should be drilled to accept a rivet and laminated to the shield with fiberglass and resin.

- Check cab skirts, sills, and brackets for overall condition and repair them as necessary. Damaged rubber fender shields or cab skirting cannot be repaired. You will need to replace it.

NOTE

Your authorized dealer can perform all of these checks and repairs or replacements.

Diesel Exhaust Fluid Tank

Vehicles that comply with 2010 EPA emission requirements will have a Diesel Exhaust Fluid (DEF) tank mounted to the vehicle frame.

Rear Axle and Suspension

The vehicle's suspension, by design, requires a minimal amount of maintenance. However, suspensions in over-the-road operations require periodic inspection to ensure trouble-free performance.

WARNING

DO NOT work on the vehicle without the parking brake set and wheels blocked securely. If the vehicle is not secured to prevent uncontrolled vehicle movement, it could roll and may result in death, personal injury, equipment or property damage.

WARNING

Disposition: / Status:
Altered Warning. Please Review.

DO NOT operate the vehicle if the suspension U-bolts are not properly tightened. Improperly tightened (loose) suspension U-bolts can lead to an unsafe vehicle condition, including: hard steering, axle misalignment, spring breakage, or abnormal tire wear. Failure to comply may result in death, personal injury, equipment or property damage.

WARNING

Failure to maintain the specified torque values or to replace worn parts can cause component system failure, possibly resulting in an accident. Improperly tightened (loose) suspension U-bolts can lead to unsafe vehicle conditions, including: hard steering, axle misalignment, spring breakage or abnormal tire wear. Failure to comply may result in death, personal injury, equipment or property damage.

CAUTION

DO NOT spray the suspension with chemical products or mineral oil; it can cause damage to the bushings.

> **NOTE**
>
> Failure to follow these recommendations could void warranty.

Visual Inspection

For all vehicles, mandatory maintenance procedures include retightening of U-bolts and complete inspection. Even with proper maintenance, however, many factors affect the service life of springs and suspension components: fatigue, vehicle gross weight, type of load, road conditions, and vehicle speed. All vehicles must have their U-bolts checked and tightened regularly. Severe use of the vehicle can cause them to loosen faster. It is important that U-bolts remain tight. Make sure that a technician with proper training and the right tools checks and tightens the U-bolts on the vehicle. After the first 500 miles (mi) (800 km) of operation, periodically inspect the suspension as noted below:

- Visually check for loose or missing fasteners, cracks in hanger, or axle connection brackets
- Check for centered springs in hangers that are in good condition
- Check for cracks, wear marks, splits, or other defects on the surface of the spring
- Replace defective parts. It is impossible to restore springs to their original service life. Replace the complete assembly if cracks or other defects are detected
- After replacement of any part or discovery of loose components, check the torque of all fasteners
- New springs settle-in after the vehicle's initial service, causing the U-bolts to become loose

Rear Suspension Fasteners

To maintain the performance of the air suspension, check fastener torque values after the first 2,000 miles (mi) (3,200 km) of service and every 60,000 miles (mi) (96,000 km) after. Torque recommendations apply to fasteners supplied and installed by vehicle manufacture. The values listed at the back of this chapter (See *Suspension U-Bolts, Grade 8* on page 292 and *Frame Fastener Torque Requirements* on page 291), are for cadmium plated or phosphate and oil fasteners only.

Rear Suspension U-bolts

U-bolts are difficult to tighten unless you have the right equipment. If you cannot tighten them correctly yourself, make sure to have them checked and tightened regularly by an authorized technician.

> **NOTE**
>
> To ensure an accurate torque reading, use properly maintained and calibrated torque wrenches. Clean the nut and bolt. No dirt, grit, or rust should be present.

WARNING

Disposition: / Status:
Altered Warning. Please Review.

DO NOT operate the vehicle if the suspension U-bolts are not properly tightened. Improperly tightened (loose) suspension U-bolts can lead to an unsafe vehicle condition, including: hard steering, axle misalignment, spring breakage, or abnormal tire wear. Failure to comply may result in death, personal injury, equipment or property damage.

NOTE

Whenever possible, torque all frame fasteners on the nut end, not the bolt head.

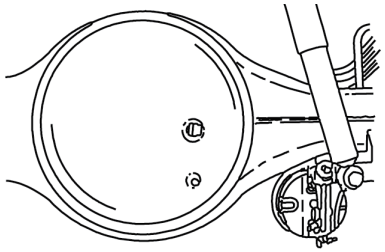
Load the vehicle to its normal gross weight before tightening the U-bolts. Loading the vehicle ensures proper adjustment of the U-bolt and spring assembly.

WARNING

DO NOT replace U-bolts and nuts with common U-bolts or standard nuts. These parts are critical to vehicle safety. If the wrong U-bolts or nuts are used, the axle could loosen or separate from the vehicle and cause a serious accident. Use only PACCAR replacement parts. Failure to comply may result in death, personal injury, equipment or property damage.

Rear Axle Lubrication

Check oil level with the vehicle parked on level ground and the fluid warm. The level should be even with the bottom of the filler hole.



CAUTION

DO NOT mix lubricants of different grades; although, mixing different brands of the same grade lubricant (meeting MIL-L-2105C), is acceptable. Lubricants of different grades are not compatible and could damage the axle.

NOTE

In all cases, lubricant supplier assumes full responsibility for the performance of their product, and for product and patent liability.

For recommended types and brands of lubricants, contact your dealer.

Disposition: / Status:
End of New Topic.

Dana Spicer and Fabco

No initial drain is required on Dana Spicer axles that are factory filled with a Dana Spicer-approved synthetic lubricant.

- Petroleum-based lubricants must be drained within the first 5,000

miles (8,000 km) if converting to an approved synthetic lubricant.

Initial Change: See *Preventive Maintenance Intervals* on page 183 for standard rear axle service intervals. Change mineral-based lubricant in other Dana Spicer and Fabco axle assemblies (new or rebuilt) within the first 3,000 to 5,000 miles (4,800 to 8,000 km).

- For petroleum-based axles, use lubricants meeting MIL L2105C/D grade specifications or approved synthetic lubrication. Do not use oil additives.

All Vehicles with Dana Spicer and Fabco Axles: See *Preventive Maintenance Intervals* on page 183. Contact your dealer for approved synthetic lubricant brands.

- Dana Spicer Axles with synthetic lubrication and Out Runner Seals: drain, flush, and refill at 500,000 miles (804,000 km).

Axle Housing Breather Vent:

- Check and clean the axle housing breather vent at each oil level check.

Meritor:

- See *Meritor Lubrication Maintenance Manual (MM1)*.

Disposition: / Status:

End of Topic.

Drive Axle - Dana
Drain the lubricant while warm. Flush each unit with clean flushing oil. Change the lubricant.

Drive Axle - Meritor
Drain and replace the lubricant.

Rear Axle Alignment

Continual road shock and load stresses may force the rear axles out of alignment. If you detect rapid tire wear on the rear axles, you may have misaligned axles. If you suspect rapid tire wear, have your rear axle alignment checked and adjusted by an authorized dealer.

Suspension alignment should be checked when any one of the following conditions exist:

- Total vehicle alignment required after a body has been installed on truck chassis.
- Discovery of loose suspension fasteners (Loose, defined as any torque below the recommended torque value)
- Discovery of elongated holes in a suspension component
- Bushing replacement
- Excessive or abnormal tire wear
- Immediately after post body installation (See First Day in the Maintenance Chapter)

Steering System

WARNING

DO NOT operate the vehicle if the steering system is not working properly. You could lose control of your vehicle if the steering system is not in good working condition, which could result in a serious accident. For driving safety, visually check the steering gear and components. Frequent checks are important for driving safety, especially after traveling over rough roads. Failure to comply may result in personal injury, property damage, or death.

WARNING

Adjustments or repairs made to any part of the steering system must be performed by an authorized dealer. Failure to comply may result in property damage, personal injury, or death.

WARNING

If this chassis is equipped with electronic stability control (ESC) and the steering angle sensor is replaced or any part of the steering system (e.g., linkage, steering driveline, column, front end alignment, etc.) is repaired, removed, or disassembled, the steering angle sensor must be recalibrated. Failure to comply may result in death, personal injury, or property damage.

Hydraulic fluid (under low pressure) provides the power to operate the steering gear. It also serves to lubricate moving parts and remove heat. A loss of steering efficiency will occur if too much heat builds up in the system.

If the steering feels unbalanced from side-to-side while turning, check for the following possible causes:

- Unequal tire pressures
- Vehicle overloaded or unevenly distributed load
- Wheels out of alignment
- Wheel bearings improperly adjusted

If you cannot correct the problem, check with an authorized dealer.

Your vehicle is equipped with integral power steering. The system includes an engine-driven fluid pump, a fluid reservoir, the steering gear, and connecting hoses. Because of the hydraulic power assist, little effort is required to turn the steering wheel. When no input is applied through the steering wheel, the steering gear will return to the neutral position. If, for any reason, the power assist system goes out, steering the vehicle is still possible but it will require much greater effort.

Visually check the following parts:

- Crosstube: Is it straight?
- Drag link castle nut: Check for looseness or interference. (Refer to *Drag Link Castle Nut Torque* on page 287 for specified torque).
- Ball joints and steering U-joints: Check for looseness
- Steering wheel for excessive free-play. Check the simplest probable causes first: (A) unequal tire pressures; (B) loose cap nuts; (C) bent crosstube; or (D) lack of lubrication

If these checks do not reveal the problem, or if you correct them and still have a steering problem, take your vehicle to an authorized dealer for evaluation.

Power Steering Fluid

CAUTION

Disposition: / Status:
Altered Caution. Please review.

When adding fluid, only use fluid of the same type. While many fluids have the same description and intended purpose, they may contain incompatible additives. Incompatible fluids may result in cavitation which reduces the lubrication between moving parts, wearing them down. Failure to comply may result in equipment or property damage.

NOTE

Before removing reservoir cap, wipe the outside of the cap so that no dirt or debris falls into the reservoir.

Check the power steering fluid level using the following procedure:

1. Park the vehicle on level ground and turn the engine off.
2. Open hood
3. Open the fill cap to the power steering reservoir.
   - If you check the fluid with the engine and steering system COLD, the fluid level should be at or above the Minimum indicator level and should generally not exceed the middle point between Maximum and Minimum level indicators.
   - If you check the fluid with the engine and steering system WARM, the fluid should NOT exceed the Maximum level indicator and should generally not drop below the middle point between the Maximum and Minimum level indicators.

Steering Shaft Bolt Torque Specifications

The steering (intermediate shaft) U-joint pinch bolt should be tightened on the first day or two of operation, then checked weekly (see Weekly Checks). The following are common torque specifications for most steering shafts.

Steering U-joint Pinch Bolt

Fastener Size	Torque Spec. lb-ft (N•m)
7/16 -in.	37-43 (50-58)

Pitman Arm Clamp Bolt

Fastener Size	Torque Spec. lb-ft (N•m)
3/4 -in.	300-320 (406-433)

WARNING

If this chassis is equipped with an Electronic Stability Control (ESC) and is modified (e.g. adding or removing an axle, converting from a truck to a tractor, converting from a tractor to a truck, changing the body, lengthening of the wheelbase and/or frame, relocating frame components, or modifying pneumatic or electrical ABS/ESC harnesses) the ESC must be evaluated by a qualified technician. If you have any questions, contact your authorized dealer. Failure to comply may result in death, personal injury, equipment damage, or property damage.

Driveline

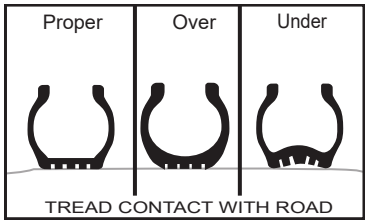
See the driveshaft manufacturer's operator manual for lubrication specifications and service intervals.

WARNING

Improper lubrication of U-joints can cause them to fail prematurely. The driveshaft could separate from the vehicle and result in an accident. Make sure lubricant is purged at all four ends of each U-joint and loosen caps if necessary. Also, regularly inspect U-joints for excessive wear or movement, and repair or replace as necessary. Failure to comply may result in death, personal injury, equipment or property damage.

Tires

Your tires are a very important part of your vehicle’s whole braking system. How fast you can stop depends mostly on how much friction you get between the road and your tires. In addition, keeping your tires in good condition is essential to the safe, efficient operation of your vehicle. Regular, frequent inspection and the right care will give you the assurance of safe and reliable tire operation. Here are some tips on maintaining your tires.



WARNING

DO NOT repair damaged tires unless you are fully qualified and equipped to do so. Wheel and tire assemblies cannot be worked on without proper tools and equipment, such as: safety cages or restraining devices. Have all tire repairs performed by an expert. Stand away from the tire assembly while the expert is working. Failure to do this may result in death or injury.

Checking Inflation Pressure

Low pressure is a tire’s worst enemy. Underinflation allows tires to flex improperly, causing high temperatures to build up. Heat causes early tire damage such as flex break, radial cracks, and ply separation. Low pressure may affect

control of your vehicle, especially at the front wheels. Most tire wear problems are caused by underinflation as the result of slow leaks, so check tire pressure regularly. Lower tire pressure does not provide better traction on ice or snow. Give your tires a visual test every day, and check inflation with a gauge every week:

- When checking tire pressure, inspect each tire for damage to sidewalls, cuts, cracks, uneven wear, rocks between duals, etc. If a tire appears underinflated, check for damage to the wheel assembly. Don't forget to check between dual wheels. If you find wheel damage, have an expert tire service repair it.
- Maximum tire pressure will be indicated on the sidewall of a tire.
- Check pressure only when the tires are cool. Warm or hot tires cause pressure buildup and will give you an inaccurate reading. So never deflate a warm tire to the specified pressure.

WARNING

DO NOT operate a vehicle with underinflated tires. Underinflation (or low tire pressure) can create extra heat leading to sudden tire failure (such as a tire fire or blow out) or may affect control of the front wheels, both conditions possibly resulting in an accident. Keep your tires inflated to the manufacturer's recommended air pressure. Failure to comply may result in death, personal injury, equipment damage, or property damage.

WARNING

DO NOT install a damaged wheel assembly, and DO NOT install or inflate a tire that has been damaged or has been run flat. Always follow section 1910.177 of OSHA regulations. Truck wheels and tires should be serviced only by fully qualified and properly equipped technicians authorized to do so. Failure to comply may result in death, personal injury, equipment damage, or property damage.

NOTE

Follow all warnings and cautions contained within the tire and wheel manufacturers literature.

Overloaded Tires

Overloading your truck is as damaging to your tires as underinflation. The following chart shows how neglect or deliberate abuse can affect the life of your tires.

Effects of Load and Pressure on Tire Life

Vehicle Load	Tire Pressure	Expected Total Tire Mileage
Normal	Normal	Normal
20% over	20% low	70%
40% over	30% low	50%
60% over	35% low	40%
80% over	45% low	30%

Vehicle Load	Tire Pressure	Expected Total Tire Mileage
100% over	55% low	25%

Overinflated Tires

Overinflating the tires reduces the tread contact area with the road surface, concentrating all of the vehicle weight on the center of the tread. This causes premature wear of the tire.

WARNING

Ensure all tires are inflated correctly according to the manufacturer's recommendations. Overinflated tires wear more quickly and are more subject to punctures, cracks, and other damage that can cause loss of vehicle control. Failure to comply may result in death, personal injury, equipment damage, or property damage.

Matching Tires

Be sure to buy matching tires for your vehicle, especially on the rear axles. Mismatched tires can cause stress between axles and cause the temperature of your axle lubricant to get too hot. Matched tires will help your driveline last longer and will give you better tire mileage.

WARNING

DO NOT mismatch or mix tires of different design such as steel belted radials and bias ply tires, etc. Mixing tire types and sizes will adversely affect the road-holding ability of both types of tires and can lead to loss of vehicle control. Failure to comply may result in death, personal injury, equipment damage, or property damage.

WARNING

DO NOT install regrooved or reinforcement repaired tires on steering axles. They could fail unexpectedly and cause loss of vehicle control. Failure to comply may result in death, personal injury, equipment damage, or property damage.

Replacing Tires

Front: Replace front tires when less than 4/32 -in. of tread remains. Check at three places equally spaced around the tire.
Drive Axles or Trailers: Replace tires on drive axles or trailers when less than 2/32 -in. of tread depth remains in any major groove. Check at three places equally spaced around the tire.

WARNING

DO NOT replace original equipment tires with load ratings less than the original tires. Doing so could lead to unintentional overloading of the tire, which could cause a failure resulting in loss of vehicle control and an accident. Failure to comply may result in death, personal injury, equipment or property damage.

NOTE

To prolong your tires' life and make them safer, have their radial and lateral run-out checked at your dealer. Anytime a tire is replaced, it should be rebalanced.

Tire Chains

If you need tire chains, install them on both sides of each driving axle.

NOTE

To prolong your tires' life and make them safer, have their radial and lateral run-out checked at your dealer. Anytime a tire is replaced, it should be rebalanced.

Speed Restricted Tires

CAUTION

Check each tire's sidewall and/or tire manufacture's data book for maximum rated speed. This vehicle is equipped with speed restricted tires and should not be operated at speeds in excess of maximum rated speed. Failure to comply may cause sudden tire failure, resulting in equipment or property damage.

Greenhouse Gas Certified Tires

NOTE

The tires installed on this vehicle at the factory as original equipment are certified for Greenhouse Gas and Fuel Efficiency regulations. Replacement tires must be of an equal or larger loaded drive tire size and an equal or lower rolling resistance level (TRRL or Crr). Consult with your tire supplier(s) for appropriate replacement tires.

In order to limit the rolling resistance of the tires and optimize fuel economy, the maintenance procedures specified by the tire manufacturer must be followed. Please see Vehicle Emissions Limited Express Warranty for warranty on greenhouse gas certified tires.

Wheels

After the vehicle travels about 50 to 100 miles (80 to 160 km), wheel mountings seat in and will lose some initial torque. Check hub/wheel mountings after this initial period and retighten. Threads should be clean and dry. Do not lubricate wheel nuts or studs.

WARNING

Never use oil or grease on studs or nuts; improper torque readings will result, which could cause improper wheel clamping and could lead to a wheel failure resulting in an accident. Failure to comply may result in death, personal injury, equipment or property damage.

Wheel Replacement with Disc Brake Option

WARNING

Use only the wheel brand, size and part number originally installed. Use of a different wheel brand or size could cause valve stem to interfere with a brake component which could lead to loss of vehicle control. Failure to comply may result in death, personal injury, equipment or property damage.

Vehicles equipped with front disc brakes are fitted with wheels designed specifically for disc brake applications. If it ever becomes necessary to replace an original equipment wheel, the replacement wheel must be the same brand and size as the take-off wheel. On vehicles equipped with 22.5 in. disc wheels, installing the wrong replacement wheel could result in the wheel valve stem making contact with the disc brake assembly. When installing any replacement wheel, always inspect the tires/wheels to ensure there is adequate clearance between other vehicle components. With the hood open, check for clearance between the wheel and disc brake assembly. Use a hydraulic jack to raise the front of the vehicle off the ground to allow the wheel to spin freely. While rotating the wheel, check to ensure there is adequate clearance between the wheel and disc brake assembly.

WARNING

Improperly mounting and demounting tire and rim assemblies is dangerous. Failure to observe proper precautions could cause the tire rim assembly to burst explosively, causing death or personal injury. See the wheel manufacturer's literature for the proper way to mount and demount your tires and rims. Follow their precautions exactly.

WARNING

Always ensure the hood lock has engaged whenever the hood is opened. Failure to lock the hood open may result in the hood closing uncontrollably, which may result in death, personal injury, equipment damage, or property damage.

WARNING

Always support the vehicle with appropriate safety stands if it is necessary to work underneath the vehicle. A jack is not adequate for this purpose. Failure to comply may result in death, personal injury, equipment or property damage.

Disposition: / Status:
Updated to include boilerplate consequence language and now to include this draft comment.

Disc Wheels

WARNING

Use the correct components and tools when working on wheels. Grooves in the wheel disc or other damage to the disc can weaken the wheel and cause it to eventually come off. This could cause you to lose control of your vehicle, and may result in an accident. Failure to comply may result in property damage, personal injury, or death.

The end of the wheel wrench must be smooth. Burrs on the end of the wrench can tear grooves in the disc. These grooves may lead to cracks in the disc, and can cause it to fail.

Wheel Bearings

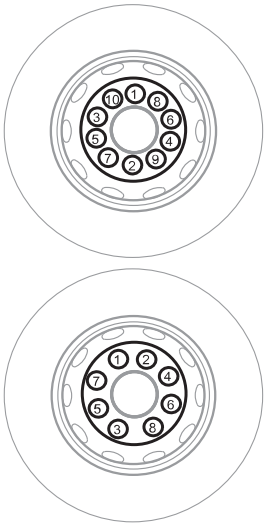
Service the bearings, seals and oil. This interval may be different depending on the results of the regular inspection. 350,000 mi (560,000 km). For safe, reliable operation and adequate service life, your wheel bearings must be adjusted properly at the recommended intervals. Contact your authorized dealer to make sure the wheel bearings are properly adjusted.

Tightening Wheel Cap Nuts

WARNING

Tighten wheel cap nuts properly. If they are not tightened properly, wheel nuts could eventually cause the wheel to become loose, to fail, and/or to come off while the vehicle is moving, possibly causing loss of control and may result in death, personal injury, equipment or property damage.

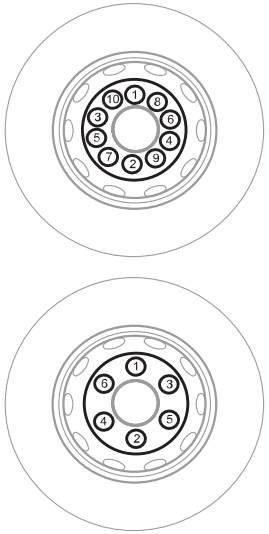
Hub Piloted Disc Wheels



Proper wheel torque can best be obtained on level ground. Install lug nuts and finger-tighten in the numerical sequence as shown below. This procedure will ensure that the wheel is drawn evenly against the hub. Contact an authorized dealer for information on the proper installation procedure for the wheels on your truck.

This is a job you may not be able to do yourself. You need the right torquing equipment to do it.

Stud Piloted Disc Wheels



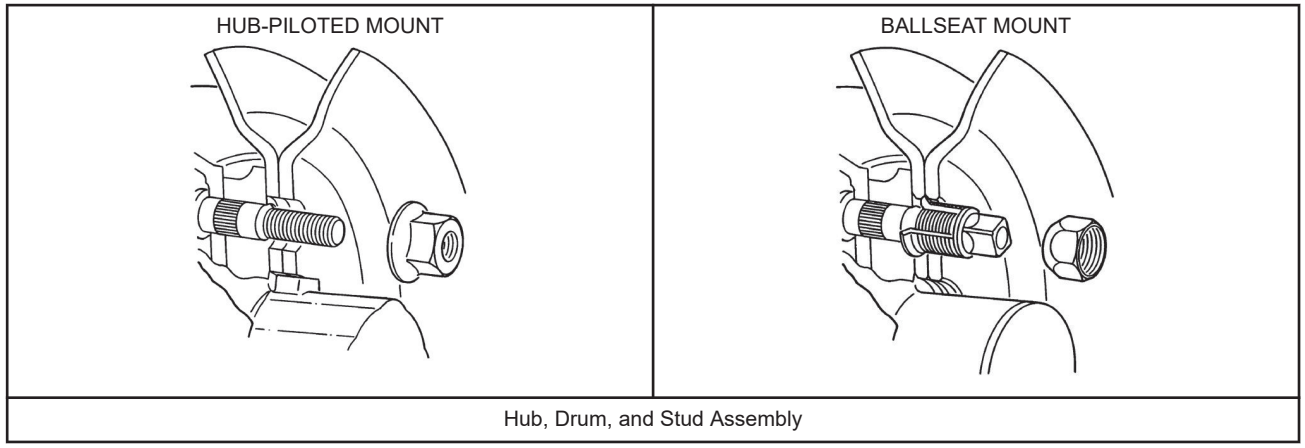
Comparing Hub Piloted and Ball Seat Parts

WARNING

Do not mismatch wheel components. Equipment that does not exactly match original specifications or that is mismatched could cause the wheels to break and separate from the vehicle. The resulting accident could be very serious. Each mounting system is engineered for use only with its correct mating part. Be sure properly matched components are used for each type of mounting. Failure to comply may result in property damage, personal injury, or death.

The following comparison (*Comparing Hub-piloted and Ball-seat Wheels* on page 284), shows the difference between parts used in hub pilot mount and ball seat mount applications.

Comparing Hub-piloted and Ball-seat Wheels



Hub-piloted mountings use M22 x 1.5 metric threads (about 7/8 in. diameter). The stud stands out at least 1.94 in. beyond the brake drum. All studs are right-hand threads. Pilot bosses (machined surfaces) on the hub, fit tightly to the wheel center bore.	Ball-seat (stud-piloted) mountings use 3/4x16 or 1-1/8x16 threads. The dual mounting studs provide 1.30 in. 1.44 in. standout. Right-hand and left-hand threads are required. Inner and outer wheel nuts center the wheels by seating against wheel ball seats.
Wheels	
Hub-piloted wheels have stud holes reamed straight through (no ball seats). Center bore diameter is 8-21/32 in.	Ball-seat wheels have spherical chamfers machined on each stud hole. Center bore diameter is 8-23/32 in.
Wheel Nuts	
Hub-piloted wheel nuts have a hex body and a flange for clamping against wheel face. Hex size is 1-5/16 in. (33 mm).	Ball-seat inner and outer wheel nuts mate with spherical chamfers on wheels. The inner nut has 13/16 in. square end. The outer nut has a 1-1/2 in. hex.

Transmission Maintenance

See the transmission manufacturer's operator's manual for lubrication specifications and service intervals.

CAUTION

When adding oil, types and brands of oil should not be intermixed because of possible incompatibility, which could decrease the effectiveness of the lubrication or cause component failure.

Vehicles equipped with the PACCAR TX-12 transmission must maintain the oil coalescing desiccant cartridge of the air dryer as part of transmission maintenance. Refer to the PACCAR TX-12 Operator's Manual for details.

CAUTION

Replace the oil-coalescing desiccant air dryer cartridge annually, regardless of mileage. Use only an oil-coalescing desiccant cartridge as a replacement. Failure to comply will void the transmission warranty and may cause transmission damage.

Hydraulic Clutch

The clutch pedal position is factory set and does not require adjustment.

Clutch Hydraulic Fluid

Visually inspect the clutch fluid from the reservoir. There are molded lines with the letters MIN to indicate minimum fluid level and MAX to indicate the maximum fluid level recommended for proper operation. Be sure to maintain the fluid between the MIN and MAX levels indicated on the plastic reservoir. If the fluid level repeatedly goes below the MIN line, then it is time to have your clutch adjusted or the hydraulic system inspected for service. To replace the fluid, locate the drain fitting on the air solenoid mounted to the transmission housing. Open this fitting and allow fluid to drain out of the system. Once all the fluid is drained out, close the fitting and fill the system through the master cylinder reservoir in the engine compartment. Once the system is full, then purge the system of air by simultaneously pressing on the pedal and opening the fitting to allow air to escape. Close the fitting when fluid starts coming out. Then refill the reservoir. Repeat this until all air has been purged from the system. Replace with the recommended fluid per *Lubrication Specification Chart* on page 289.

Clutch Adjustment

Some clutches are self-adjusting, however; there are manually adjusted clutches that will require the operator to know when to adjust the clutch. The clutch will need adjustment when your clutch pedal stroke seems to get longer and its effectiveness at a seamless shift becomes less. Another sign of the clutch needing adjustment is the level of the fluid in the reservoir. If the hydraulic fluid is not leaking, but the fluid level is getting lower, then the clutch may need to be adjusted. Please take the vehicle to an authorized dealership to have the clutch adjusted. See the clutch manufacturer's Service Manual for the proper adjustment procedures.

Specification Reference Charts

Pipe and Hose Clamp Torque Values

Torque specifications for engine parts.

Application	Type of Clamp	lb-in.	N•m
Radiator and Heat Exchanger Hoses	Constant Torque CT-L	90-110	10.2-12.5
Heater Hoses	Constant Tension	not required	not required
Air Intake Pipes	Hi Torque HTM-L	100-125	11.3-14.2
Plastic Air Intake Pipes	Constant Torque CT-L	88	10.0
Charge Air Intake Hoses	Flex Seal	70-100	7.9-11.3
	B9296	50-60	6-7
Fuel, Oil and Water Heat Exchangers (for hoses less than 9/16 in. diameter).	Miniature 3600L	10-15	1.1-1.7

Drag Link Castle Nut Torque

Ball Stud Fastener	Castle Nut Torque lb·ft (N·m)
3/4-16	85 to 100 (115 to 136)
7/8-14	120 to 170 (163 to 231)

Wheel Cap Nut Torque Specifications

At the first scheduled lube interval, have all wheel cap nuts torqued to their specified value. After that, check wheel cap nuts at least once a week.
Contact an authorized dealer for information on the proper installation procedure for the wheels on your truck. This is a job you may not be able to do yourself. You need the right torquing equipment to do it.

Wheel and Nut Configuration	Stud Size	Torque for Inner and Outer Cap Nuts and Rim Clamp Nuts	
		lb-ft	N•m
Steel or Aluminum Disc-Type Wheel; Double Cap Nut Mounting; Standard 7/8 Radius Ball Seat	3/4-16	450-500	610-680
	1-1/8-16	450-500	610-680
Heavy-Duty Steel Disc-Type Wheel; Double Cap Nut Mounting; 1-3/16 Radius Ball Seat:	15/16-12	750-900	1,020-1,220
	1-1/8-16	750-900	1,020-1,220
	1-15/16-12	750-900	1,020-1,220
Hub-Piloted Disc-Type Wheel w/Two Piece Flanged Cap Nuts: Steel or Aluminum Wheel PHP-10; Budd Uni-Mount-10; WDH-8	M22-1.5	450-500	610-680
Stud Backnuts (when used)	3/4-16	175-200	240-270
	1-14	175-300	240-410
Cast Spoke Wheel Assembly Rim Clamp Nut Torque	1/2 in. Dia.	80-90	110-120
	5/8 in. Dia.	160-185	220-250
	3/4 in. Dia.	225-245	305-335

Lubrication Specification Chart

> **NOTE**
>
> The responsibility for meeting these specifications, the quality of the product, and its performance in service rests with the lubricant supplier.

*Consult manufacturer or lubricant supplier for special details.

Component Lubrication Index

Application	Type
Steering Column	Multipurpose chassis grease
Alternator Bearing	High temperature ball bearing grease. Chevron SRI Mobile Grease HP, Texaco Multifax 2 (1)
Fan Hub	High temperature ball bearing grease. Chevron SRI Mobile Grease HP, Texaco Multifax 2 (1)
Power Steering Reservoir	MD3 or MERCON®-approved automatic transmission fluid
Steering Drag Link	Multipurpose chassis grease
Steering Knuckles	Multipurpose chassis grease
Spring Pins	Multipurpose chassis grease

Application	Type
Clutch Release Bearings	High temperature ball bearing grease. Chevron SRI Mobile Grease HP, Texaco Multifax 2
Brake Shoe Anchor Pins	High Temperature grease (Timken Spec. 0-616)
Brake Cam Bearings	High Temperature grease (Timken Spec. 0-616)
Slack Adjusters	Multipurpose chassis grease
Starter Bearings	Engine oil for severe requirements (MIL-L-2104B /MIL-L-45199B) w/ 1.85 % max. sulfated ash
Turbocharger Aneroid	Engine oil for severe requirements (MIL-L-2104B /MIL-L-45199B) w/ 1.85 % max. sulfated ash
Water Pump	High temperature ball bearing grease. Chevron SRI Mobile Grease HP, Texaco Multifax 2 (1)
Suspension Fittings (other than threaded pins and bushings)	Extreme Pressure Lubricant (Lithium 12-hydroxystearate base NLGI 2)
Steering Axle: Grease Fittings on Steering Arm; Tie Rod Ends; Drag Link; King Pins	Extreme Pressure Lubricant (Lithium 12-hydroxystearate base NLGI 2)
Steering Shaft Grease Fittings	Extreme Pressure Lubricant (Lithium 12-hydroxystearate base NLGI 2)
Brake Treadle Hinge and Roller	Engine oil
Lock Cylinders	Lock lubricant
Door Hinges	Do not lubricate

Application	Type
Door Latches and Striker Plates	Polyethylene grease stick
Door Weatherstrip	Silicone lubricant
Hub-piloted Aluminum Wheels	Coat the wheel pilot or hub pads with Freylube #3 lubricant (light colored) or Chevron Zinc lube. Do not get lubricant on the face of the wheel or the hub.
Manual Transmission Hydraulic Clutch	DOT3 (Brake Fluid)
(1) Consult manufacturer or lubricant supplier for special details.	

Frame Fastener Torque Requirements

CAUTION

When torquing fasteners, always consider the following:

- Use a torque wrench for final tightening of these fasteners. Do not use an impact gun. These bolts may over-torque and break.
- When torquing, the nut must rotate slightly before achieving the torque value. If the nut does not rotate, the fastener is over-torqued and should be replaced.
- To achieve correct clamp loads, the frame fasteners must be torqued with the nut. The intended clamp load may not be achieved if the nut is held and torque is applied to the bolt.

Incorrectly tightening the fasteners may result in clamp load or frame failures. Failure to comply may result in equipment or property damage.

Noise Control System - Maintenance Log

To ensure your vehicle's noise control requirements are maintained, record maintenance checks. Use the following log sheet and retain copies of documents regarding maintenance services performed and parts replaced on the vehicle.

Component	Recommended Interval (Miles)	Date & R.O. No.	Repair Facility & Location	Work Performed	Date & R.O. No.	Repair Facility & Location	Work Performed
Exhaust System Routing Integrity	25,000						
Shutters Shrouds	25,000						
Hood Insulation Blanket	10,000						
Engine Mounted Hose Insulators Fasteners	10,000						
Inner Fender Shields	50,000						
Cab Skirts Fasteners	50,000						
Air Intake System Integrity Element	5,000						
Clutch type Fan Drive	10,000						

Suspension U-Bolts, Grade 8

Tighten all U-bolts with a torque wrench. Torque requirements in the table below apply to PACCAR proprietary suspensions using Protec Torque/TEXO coated U-bolts, only. For all other suspensions, follow the manufacturer's recommended torque values. PACCAR proprietary suspension u-bolts must be tightened in a specific sequence. Take your vehicle to an authorized dealer to tighten the U-bolts on your vehicle.

Torque for Grade 8 U-Bolts

Front Suspension U-bolts		
U-Bolt Size Diameter (-in.)	**Torque (lb-ft)**	**Torque (N•m)**
3/4	260-290	353-393
7/8	370-415	502-563
For all non-PACCAR suspension systems, see the manufacturer's operator's manual for torque specifications.		

Rear Suspension U-bolts		
Rear Suspension Type	**U-Bolt Diameter**	**Torque lb-ft (N•m)[34]**
Low Air Leaf (U-bolt, spring)	M22 x 1.5	375–475 (508–644)
Flex Air	M22 x 1.5	325–375 (440–508)

Rear Suspension U-bolts		
Rear Suspension Type	**U-Bolt Diameter**	**Torque lb-ft (N•m)**
Tandem Low Air Leaf	M22 x 1.5	375–475 (508–644)
Air Leaf (U-bolt, spring)	1.0 -in. NF	450–550 (610–746)
Air-Trac	1.0 -in. NF	450–550 (610–746)
13.5K Taper Leaf (Axle U-bolt)	¾ -in. 16 UNF	275–320 (373–434)
18K Taper Leaf (Axle U-bolt)	¾ -in. 16 UNF	275–320 (373–434)
18K Air Leaf (Axle U-bolt)	¾ -in. 16 UNF	275–320 (373–434)
For all non-PACCAR suspension systems, see the manufacturer's		

Rear Suspension U-bolts		
Rear Suspension Type	**U-Bolt Diameter**	**Torque lb-ft (N•m)**
operator's manual for torque specifications.		

NOTE

The values shown here are for suspension U-bolts and should not be applied to bolts and fasteners for the frame.

Vehicle Light Bulb Specifications

Bulb Location	Type of Bulb	Notes
Low beam/ High beam headlight	9007LL (SAE)	Dual Filament Bulb

[34] **Torques listed are for primed (or non-oiled) U-bolts.**

Bulb Location	Type of Bulb	Notes
Daytime running light/ Parking light	4157K (SAE)	Dual Filament Bulb
Turn Signal/ Side Marker Light/ Side Turn Indicator	4157K (SAE)	Dual Filament Bulb
Stop/ Tail turn	1157 BULB or LED	N/A
Backup	1156 BULB or LED	N/A
Rear Tail Light/ Turn Signal	N/A	LED
Roof Markers	N/A	LED
Hood Markers	N/A	LED
License Light	N/A	LED

Bulb Location	Type of Bulb	Notes
Interior Map Light	N/A	LED
Interior Dome Light	N/A	LED
Interior Ambient Light	N/A	LED
Warning lamp module	#37 or 73 (T1 3/4 wedge base)	N/A

Rear Suspension Fasteners

Torque requirements apply to manufacturer proprietary suspensions. All other suspensions must refer and adhere to original manufacturer's shop manual.

SIZE/TYPE	TORQUE	
	lb-ft	N•m
M16	125-165	169.5-223.7

SIZE/TYPE	TORQUE	
	lb-ft	N•m
M20 all-metal lock nuts	315-350	427-475
1/2 -in. nut	80-90	109-122
3/4 -in. nut	290-340	394-462
1-1/4 -in. nut	1,380-1,630	1,877-2,217

Air Leaf Fastener Torque Values

Fastener	Fastener Name	Torque lb-ft (N•m)
1 NF x 8.5"	Spring eye bolt	225–550 (305–746)
0.75 NC x 2.25"	Alignment cap screw	208–296 (282–401)

Fastener	Fastener Name	Torque lb-ft (N•m)
0.75 NF	Spring eye U-bolt (rolled threads)	50–100 (68–136)
0.75 NC x 5.0"	Spring eye clamp bolt	165–210 (68–136)
0.75 NF	Spring center bolt	165–210 (224–285)[35]
1 NF	U-bolt, spring[36]	Refer to section on Suspension U-Bolts, Grade 8.
0.5 UNC	Air bag stud nut	40–50 (54–68)
M16	Tracking rod bolts	155–195 (210–264)

Air-Trac Fastener Torque Values

Fastener	Fastener Name	lb•ft (N•m)
M16	Tracking rod bolts	155–195 (210–264)
0.75 NF	Spring center bolt	165–210 (224–285)[37]
M16 0.75 NF	Radius rod bolts (forward)	155–195 (210–264)
	Radius rod bolts (at axle)	250–350 (339–475)
M16	Frame bracket bushing bolts	50–65 (68–88)

Fastener	Fastener Name	lb•ft (N•m)
1.0 NF	U-bolt[38]	Refer to section on Suspension U-Bolts, Grade 8.
0.5 UNC	Air bag stud nut	40–50 (54–68)
M16	Tracking rod bolts	155–195 (210–264)

35 Torque requirement applies at subassembly of air spring support and leaf spring only.

36 PACCAR proprietary suspension U-bolts must be tightened in a specific sequence. Take your vehicle to an authorized dealer to tighten the U-bolts on your vehicle.

37 Torque requirement applies at subassembly of airspring support and leaf spring only.

38 See owners manual for torque tightening sequence.

Flex Air Fastener Torque Values

Fastener	Fastener Name	Torque lb-ft (N•m)
M16	Drive bracket - frame bolts	125–165 (170–224)
	Drive bracket - link spring bolt	
	Drive bracket - radius rod bolt	
	Drive beam - shock bolt (lower)	
	Shock bracket - shock bolt (upper)	

Fastener	Fastener Name	Torque lb-ft (N•m)
	Tracking rod bolts (all)	
M10	Air spring support beam bolts	36–51 (49–69)
0.88 - 14 UNF	Drive beam - link spring bolt	380–460 (515–624)
0.88 - 14 UNF	Radius rod bracket bolt	380–460 (515–624)
M22 x 1.5	U-bolt[39]	Refer to section on Suspension U-Bolts, Class 10.9.
0.5 UNC	Air bag stud nut	40–50 (54–68)

Low Air Leaf Torque Values

Low Air Leaf Torque values apply to both single and tandem axles.

Fastener	Fastener Name	Torque lb•ft (N•m)
M20 x 2.5	Bar pin bolts	325–425 (441–576)
M22 x 1.5	U-bolt, spring[40]	Refer to section on Suspension U-Bolts, Class 10.9.
0.5 UNC	Air bag stud nut	40–50 (54–68)
M16	Tracking rod bolts	155–195 (210–264)

39 Contact your dealer for torque tightening procedure.

40 Contact your dealer for torque tightening procedure.

18K Taper Leaf Torque Values

Fastener	Fastener Name	Torque lb•ft (N•m)
M20	Spring Pivot Eye Bolt	260–340 (353–461)
0.75 UNF	Axle U-bolt[41]	Refer to section on Suspension U-Bolts, Class 10.9.
M16	Shock Bolts	120–160 (163–217)

13.5K Taper Leaf Torque Values

Fastener	Fastener Name	Torque lb•ft (N•m)
M20	Spring Pivot Eye Bolt	260–340 (353–461)
0.75 UNF	Axle U-bolt[42]	Refer to section on Suspension U-Bolts, Class 10.9.
M16	Shock Bolts	120–160 (163–217)

18K Air Leaf Torque Values

Fastener	Fastener Name	Torque lb•ft (N•m)
M20	Spring Pivot Eye Bolt	260–340 (353–461)
0.75 UNF	Axle U-bolt[43]	Refer to section on Suspension U-Bolts, Class 10.9.
M16	Track Rod, Shock Bolts	120–160 (163–217)
0.5 UNC	Air Spring Stud Nut	40–50 (54–68)

41 Contact your dealer for torque tightening procedure.
42 Contact your dealer for torque tightening procedure.
43 Contact your dealer for torque tightening procedure.

Over-the-Air (OTA) Software Updates

When OTA system updates are available for selected Electronic Control Units (ECU), a message appears on the digital display. To install the updates, use the Steering Wheel Control pad.

WARNING

Performing an over-the-air (OTA) update has the potential to render the vehicle inoperable. Perform the OTA only in a safe location. Failure to comply can result in death, personal injury, equipment or property damage.

Before you begin:

- Find a safe location preferably in a town or city
- Stop the truck
- Set the parking brake
- Switch off the engine
- Place the key in the ON position
- The 12 V battery must show as "OK"

CAUTION

Follow all instructions to prevent the vehicle from becoming inoperable. Avoid high electrical power draw by other vehicle systems while performing the update.

Using the Steering Wheel Control pad:

1. Select "Menu."
2. Select "Settings."
3. Select "Start Installation."
   - The message "System Update In Progress" appears.
   - If successful, "System Update Complete" appears.
4. Turn the key to the OFF position to exit updates.

NOTE

If the restore *fails*, "System Restore Failed" appears. **At this point, it is possible that the vehicle is inoperable.** The instructions now direct the driver to seek service immediately.

(See *Roadside Assistance* on page 31).

- If *unsuccessful*, "System Update Failed" appears AND the system automatically starts restoring the previous software version. A message appears to inform the operator of the start of the restoration process.
- If the system restore succeeds, "System Restored" appears.

Chapter 6 | INFORMATION

Consumer Information

How to Order Replacement Parts

Replacement parts may be obtained from an authorized dealership. When you order, it is IMPORTANT that you have the following information ready:

Disposition: / Status:
Change of terminology (truck by vehicle) per SME request. Please review.

- Your name and address
- Serial number of the vehicle
- The name of the part you need
- The name and number of the component for which the part is required
- The quantity of parts you need
- How you want your order shipped

National Highway Traffic and Safety Administration (NHTSA)

If you believe that your vehicle has a defect, which could cause a crash or could cause death or personal injury, you should immediately inform the National Highway Traffic Safety Administration (NHTSA) in addition to notifying the vehicle manufacturer. If NHTSA receives similar complaints, it may open an investigation, and if it finds that a safety defect exists in a group of vehicles, it may order a recall and remedy campaign. However, NHTSA cannot get involved in individual problems between you, your dealer, and vehicle manufacturer. Contacting NHTSA is possible through telephone, written mail, and email. NHTSA also has a website where you can input your comments directly to them on the web. Please use any of the four ways to contact NHTSA:

Ex: Toll Free 1-888-327-4236 (800-424-9153 TTY) 8:00 a.m. to 10:00 p.m. EST Monday-Friday

Mail: Office of Defects Investigations/CRD NVS-216 1200 New Jersey Ave. SE Washington, D.C. 20590

Website: www.safercar.gov

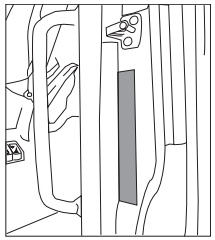
Email: nhtsa.webmaster@dot.gov

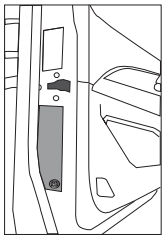
Transport Canada

Canadian customers who wish to report a safety-related defect to Transport Canada, Defect Investigations and Recalls, may telephone the toll free hotline 1-800-333-0510, or contact Transport Canada by mail at:
Transport Canada, ASFAD Place de Ville Tower C 330 Sparks St. Ottawa, ON K1A 0N5
For additional road safety information, please visit the Road Safety website at:
http://www.tc.gc.ca

Vehicle Identification Labels

Each vehicle completed by Peterbilt Motors Company uses a vehicle identification number (VIN) that contains the model year designation of your vehicle. The practice is in compliance with 49 CFR 565, Code of Federal Regulations.
The full, 17-digit VIN is located on the Weight Rating Data Label. The label is located on the driver's side door edge or on the driver's side door frame.





Chassis Number

The Chassis Number refers to the last six characters of the VIN. This number will allow your dealer to identify your vehicle. You will be asked for this number when you bring it in for service. Chassis Number Locations:

- Right frame rail, top flange, about 3 ft. from the front end
- Back of cab, left-hand rear panel, lower edge
- Tire, Rim, and Weight Rating Data label (truck)
- Components and Weights label
- Noise Emission label
- Paint Identification label

Certification Labels

Your vehicle information and specifications are documented on labels. As noted below, each label contains specific information pertaining to vehicle capacities and specifications that you should be aware of.

Components and Chassis Weight Label

The Components and Chassis Weight Label is located on either the driver's side door edge or on the driver's side door frame. It includes chassis number, chassis weight and gross weight, plus model information for the vehicle, engine, transmission, and axles.

Tire, Rim and Weight Rating Data Label

The Tire, Rim, and Weight Rating Data Label is located on the driver's side door edge or on the driver's side door frame. It contains the following information:

- GVWR - Gross Vehicle Weight Rating
- GAWR FRONT, INTERMEDIATE and REAR - Gross Axle Weight Ratings for Front, Intermediate and Rear Axle
- TIRE/RIM SIZES AND INFLATION PRESSURES - Tire/Rim Sizes and Cold Pressure Minimums
- VIN including CHASSIS NUMBER

The components of your vehicle are designed to provide satisfactory service, if the vehicle is not loaded in excess of either the gross vehicle weight rating (GVWR), or the maximum front and rear gross axle weight ratings (GAWRs).

WARNING

DO NOT exceed the specified load rating. Overloading can result in loss of vehicle control, either by causing component failures or by affecting vehicle handling. Exceeding load ratings can also shorten the service life of the vehicle. Failure to comply may result in death, personal injury, equipment damage, or property damage.

NOTE

GVW is the TOTAL SCALE WEIGHT the vehicle is designed to carry. This includes the weight of the empty vehicle, loading platform, occupants, fuel, and any load.

Noise Emission Label

The Noise Emission Label is located in the driver's side door frame. It contains information regarding U.S. noise emission regulations, chassis number, and date of manufacture.

Paint Identification Label

The Paint Identification Label contains the paint colors used by the factory to paint your vehicle. It lists frame, wheels, cab interior and exterior colors. This label is located inside the glove box.

Federal Safety Standard Certification Label

The NHTSA regulations require a label certifying compliance with Federal Safety Standards, for United States and U.S. Territories, be affixed to each motor vehicle and prescribe where such label may be located. This certification label, which indicates the date of manufacture and other pertinent information, is located on the driver’s side door edge or on the driver’s side door frame.

Component Identification

Each of the major components on your vehicle has an identification label or tag. For easy reference, record component numbers such as, model, serial, and assembly number.

Engine	For further information, please refer to the Engine Operation and Maintenance Manual.
Transmission	For both manual and automatic transmissions, the identification number is stamped on a tag affixed to the right rear side of the transmission case.
Clutch	Enclosed in clutch housing. Location depends on manufacturer.
Steer Axle	The front axle serial number is stamped on a plate located on the center of the axle beam.
Axle Specification Number	Usually stamped on the right rear side of the axle housing. This number identifies the complete axle.

Axle Housing Number	Usually located on the left forward side of the housing arm. This tag identifies the axle housing.
Axle Differential Carrier Identification	Usually located on the top side of the differential carrier. The following information is either stamped, or marked with a metal tag: Model No., Production Assembly No., Serial No., Gear Ratio, and Part Number.

Clean Idle

To comply with CARB or EPA emissions requirements, your vehicle must have the Certified Clean Idle label. Some vehicles, however, are exempt from these requirements because of their configurations (for example: fire truck service).
Your vehicle may have any of these labels affixed to the vehicle to identify that its engine meets the strict low exhaust emission regulations instituted by CARB or EPA. It is important that you do not remove or deface this label. Do not block it from view. Please contact your authorized dealership if you need to replace this label. The dealership will be able to help you to determine whether or not your vehicle's engine may be a candidate for a Certified Clean Idle label if it did not already have the label.

If you have a PACCAR engine, your label will look like one of the images below.

Disposition: / Status:
Information below updated. Please review before publication.

If you have a Cummins engine, your label will look like one or both of the images below.

Engine Shutdown System

If the vehicle’s engine is not CARB certified, it does not meet the low exhaust emission standard. It must have an Engine Shutdown System (ESS) to meet limited

idle regulations implemented by CARB and some additional states. These regulations require that the engine have an automatic system to restrict the idle time on certain vehicles. An Engine Shutdown System will shut down the engine after 5 minutes if the vehicle idles with the park brake set and the transmission in ‘Neutral’ or ‘Park’. The ESS will also allow the vehicle 15 minutes of idle time if the driver does not set the park brake and shifts the transmission to ‘Neutral’ or ‘Park’. The ESS, however, will not shut down the engine if the engine is operating in Power Take Off (PTO) mode, if the engine coolant is below 60 degrees Fahrenheit, or if the engine is performing a parked regeneration. The check engine light will alert you when the ESS shutdown timer reaches the last 30 seconds before the engine shuts down. The last 30 seconds prior to engine shutdown is the only time the driver may reset the idle time by pressing on the accelerator. More detailed information may be available in the Engine Operator’s Manual provided with your vehicle.

Greenhouse Gas Certified Configuration

This vehicle includes Greenhouse Gas (GHG) regulated parameters and technologies. A Vehicle Emission Control Information label is located on the driver’s door with codes that partially identify the vehicle’s GHG certified configuration. In addition to the Vehicle Emission Control Information label, other technologies that reduce GHG emissions and regulated parameters included in the vehicle’s GHG certified configuration are described in this section.

NOTE

Modifying a vehicle’s certified configuration without good engineering judgment or PACCAR’s approval may be a violation of the Clean Air Act and subject to fines and penalties. Please contact the vehicle manufacturer for further information about this vehicle’s certified configuration.

Vehicle Emission Control Information Label Descriptions

Label Identifiers	Label Identifier Descriptions
Family Name	Describes the vehicle’s certified manufacturer, regulatory category, and regulatory subcategory
Emission Controls	Describes regulated emission control devices installed on the vehicle
Compliance Statement	Describes the vehicle’s compliance standards
Regulatory Subcategory	Describes the vehicle’s certified regulatory subcategory

Emission Controls	Emission Control Descriptions
ARF	Aerodynamic roof fairing
ARFR	Adjustable height aerodynamic roof fairing
ATS	Aerodynamic side skirt and/or fuel tank fairing
AFF	Aerodynamic front fairing
AREF	Aerodynamic rear fairing
TGR	Gap reducing fairing
LRRA	Low rolling resistance tires (all)
LRRD	Low rolling resistance tires (drive)
LRRS	Low rolling resistance tires (steer)
VSL	Vehicle speed limiter
VSLS	Soft-top vehicle speed limiter
VSLE	Expiring vehicle speed limiter
VSLD	Vehicle speed limiter with both soft-top and expiration
IRT	Engine shutoff system
IRT5	Engine shutoff after 5 minutes or less of idling
IRTE	Expiring engine shutoff
ADVH	Vehicle includes advanced hybrid technology components
ADVO	Vehicle includes other advanced-technology components
INV	Vehicle includes innovative (off-cycle) technology
ATI	Automatic tire inflation system
TPMS	Tire pressure monitoring system

GHG Regulated Technology Not On the Emission Control Information Label

Technology	Compliance Requirements

Wheel-Related Weight Reduction	Wheel-related weight reduction benefits may be included in this vehicles certified configuration. Changing aluminum wheels to a steel wheels may be a violation of the Clean Air Act and subject to fines and penalties.
Nonwheel-Related Weight Reduction	Nonwheel-related weight reduction benefits may be included in this vehicles certified configuration. Changing aluminum material to steel material may be a violation of the Clean Air Act and subject to fines and penalties.
Other Technologies	This vehicle may be equipped with factory installed automatic engine shutdown (AES), neutral idle, start-stop systems, intelligent controls (Predictive Cruise Control and Neutral Coast), or extended idle reduction systems (Engine Idle Shutdown Timer, Engine Auto Start, Sleeper APUs, Fuel-Fired Sleeper Heater System). Disabling or modifying any GHG regulated technology may be a violation of the Clean Air Act and subject to fines and penalties.

GHG Regulated Powertrain Parameters Not On the Emission Control Information Label

Powertrain Components	Regulated Parameters
Engine	Engine idle speed, torque, horsepower, and governed RPM
Transmission	Lock up gear, number of gears, and torque converter
Axle	Configuration and drive axle ratio

GHG Regulated Aerodynamic Performance

The vehicle needs to stay in as-built aerodynamic performance unless good engineering judgment shows that the modification will improve safety or will not increase greenhouse gases.

GHG Regulated Certified Tires

> **NOTE**
>
> The tires installed on this vehicle at the factory as original equipment are certified for Greenhouse Gas and Fuel Efficiency regulations. Replacement tires must be of an equal or larger loaded drive tire size and an equal or lower rolling resistance level (TRRL or Crr). Consult with your tire supplier(s) for appropriate replacement tires.

In order to limit the rolling resistance of the tires and optimize fuel economy, the maintenance procedures specified by the tire manufacturer must be followed. Please see Vehicle Emissions Limited Express Warranty for warranty on greenhouse gas certified tires.

GHG Regulated Air Conditioning Leakage Standards

Loss of refrigerant from the air conditioning systems may not exceed a total leakage rate of 11.0 grams per year or a percent leakage rate of 1.50 percent per year, whichever is greater. This vehicle was built to meet these air conditioning leakage standards. Any modification of the air conditioning system must comply with leakage rates defined in SAE J2727.

> **NOTE**
>
> Modifying a vehicle's certified configuration without good engineering judgment or PACCAR's approval may be a violation of the Clean Air Act and subject to fines and penalties. Please contact the vehicle manufacturer for further information about this vehicle's certified configuration.

Vehicle Emissions Limited Express Warranty

Original Equipment Tires

PACCAR Inc. warrants the tires installed as original equipment on this vehicle only against defects in materials and workmanship which cause the vehicle to fail to comply with applicable U.S. and Canadian greenhouse gas emission limits ("Warrantable Emissions Failures"). This vehicle emissions limited express warranty relating to original equipment tires is valid for two (2) years or 24,000 miles (38,000 km), whichever occurs first. YOUR SOLE AND EXCLUSIVE REMEDY AGAINST PACCAR Inc. IS LIMITED TO THE REPAIR OR REPLACEMENT OF ORIGINAL EQUIPMENT TIRES, SUBJECT TO PACCAR'S TIME AND MILEAGE LIMITATIONS LISTED ABOVE. This Vehicle Emissions Limited Express Warranty relating to original equipment tires begins on the date of delivery of the vehicle to the first purchaser or lessee and accrued time and mileage is calculated when the vehicle is brought in for correction of the Warrantable Emissions Failures relating to the original equipment tires. PACCAR MAKES NO OTHER VEHICLE EMISSIONS WARRANTIES RELATING TO THE ORIGINAL EQUIPMENT TIRES, EXPRESS OR IMPLIED. WHERE PERMITTED BY LAW, PACCAR EXPRESSLY DISCLAIMS ANY WARRANTY OF MERCHANTABILITY OR FITNESS FOR A PARTICULAR PURPOSE RELATING TO VEHICLE EMISSIONS. PACCAR AND THE SELLING DEALER SHALL NOT BE LIABLE FOR INCIDENTAL OR CONSEQUENTIAL DAMAGES INCLUDING, BUT NOT LIMITED TO: LOSS OF INCOME OR LOST PROFITS;

VEHICLE DOWNTIME; COMMUNICATION EXPENSES; LODGING AND/OR MEAL EXPENSES; FINES; APPLICABLE TAXES OR BUSINESS COSTS OR LOSSES; ATTORNEY'S FEES; AND ANY LIABILITY YOU MAY HAVE IN RESPECT TO ANY OTHER PERSON OR ENTITY RELATING TO WARRANTABLE EMISSIONS FAILURES. This Vehicle Emissions Limited Express Warranty relating to original equipment tires is limited to emissions compliance only. The tires are separately warranted by their manufacturer for defects in materials and workmanship other than those which cause non-compliance with U.S. and Canadian GHG regulations, subject to limitations and conditions contained within the tire manufacturer's warranty agreement. You are responsible for the safe operation and maintenance of the vehicle and its tires. PACCAR does not warrant wear and tear of the tires.

Greenhouse Gas (GHG) Components Other Than Tires

This GHG vehicle Warranty applies to the vehicle (hereafter, vehicle) certified with the US Environmental Protection Agency.

Your Warranty Rights and Obligations

This vehicle is warranted for components that directly impact the manufacturers GHG certification with the US Environmental Protection Agency. PACCAR must warrant these components for the periods of time listed below provided there has been no abuse, neglect or improper maintenance of the vehicle. If a GHG-related part on your vehicle is found to have a defect in material or assembly, the part will be repaired or replaced by PACCAR.

Manufacturer's Warranty Coverage

This warranty coverage is provided for five years or 100,000 miles (160,000 km), whichever occurs first, from the date of delivery of the vehicle to the first purchaser or first lessee. Where a Warrantable Condition exists, PACCAR will diagnose and repair the vehicle, parts and labor included, at no cost to the first purchaser or first lessee and each subsequent purchaser or lessee. This warranty does not override any extended warranty purchased to cover specific vehicle components.

Owner's Warranty Responsibilities

The vehicle owner is responsible for performing required maintenance that is listed in your engine and vehicle Operator's Manuals. The owner is responsible for presenting the vehicle to a service location as soon as a problem exists. Any warranty repairs should be completed in a reasonable amount of time. Retain all receipts covering maintenance on this equipment. PACCAR cannot deny warranty solely for the lack of receipts or for the failure to ensure the performance of all scheduled maintenance. PACCAR may deny warranty coverage if a vehicle component has failed due to abuse, neglect, improper maintenance, unapproved modifications (both physical components and computer programming) or using non-Original Equipment replacement parts. If there are any questions regarding these warranty rights and responsibilities, please contact the vehicle OEM manufacturer at the customer center telephone number provided with the vehicle operating instructions. Prior to the expiration of the applicable warranty, Owner must give notice of any warranted failure to an authorized PACCAR dealer and deliver the vehicle to such facility for repair. Owner is responsible for incidental

costs such as: communication expenses, meals, lodging incurred by Owner or employees of Owner as a result of a Warrantable Condition. Owner is responsible for downtime expenses, cargo damage, fines, all applicable taxes, all business costs, and other losses resulting from a Warrantable Condition. Owner is responsible for maintaining all emissions related engine and vehicle computer program settings in accordance with manufacturer specifications. This responsibility includes GHG specific settings that may not be altered before the GHG-related expiration mileage has been reached for each system. Owner is responsible for maintaining all physical parts related to GHG-regulations in the as-built configuration and in proper working order for the full regulatory useful life of 435,000 miles (700,000 km) or 10 years for Class 8 vehicles, 185,000 miles (300,000 km) or 10 years for Class 5-7.

Replacement Parts

PACCAR recommends that any service parts used for maintenance, repair or replacement of GHG components be new or genuine approved rebuilt parts and assemblies. The use of non-genuine engine or vehicle replacement parts that are not equivalent to the PACCAR engine or OEM vehicle manufacturer's original part specification as built from the factory may impair the engine and vehicle emissions control system from working or functioning effectively, and may jeopardize your GHG warranty coverage. In addition, genuine vehicle or engine parts must be replaced with the same material and function as the part assembled on the vehicle from the factory. The owner may elect to have maintenance, replacement or repair of the emission control parts performed by a facility other than an authorized PACCAR dealer and may elect to use parts other than new or genuine approved rebuilt parts and assemblies for such maintenance, replacement or repair; however, the cost of such service or parts and subsequent failures resulting from such service or parts may not be fully warranted if the manufacturer determines that the replacement part is not of similar material and function as the OEM part assembled to the vehicle at the factory.

PACCAR Responsibilities

The warranty coverage begins when the vehicle is delivered to the first purchaser or first lessee. Repairs and service performed by any authorized PACCAR dealer using new or genuine approved rebuilt parts and assemblies will utilize replacement parts that are selected and installed to support the GHG compliance certification. PACCAR will repair parts found by PACCAR to be defective without charge for parts or labor (including diagnosis which results in determination that there has been a failure of a warranted part).

Warranty Limitations

Sole and exclusive remedy against PACCAR and the Selling Dealer arising from the purchase and use of this vehicle is limited to the repair or replacement of "warrantable failures", for replacement parts that are similar in material and function to OEM specifications and subject to PACCAR's time, mileage, and hour limitations of the greenhouse gas warranty. The maximum time, mileage and hour limitations of the warranty begin with the Date of Delivery to the first purchaser or first lessee. The accrued time, mileage, or hours is calculated when the vehicle is brought in for correction of warrantable failures. PACCAR is not responsible for failures or damage resulting from what PACCAR determines to be abuse, neglect or uncontrollable acts of nature, including, but not limited to: damage due to accident;

operation without adequate coolants or lubricants; overfueling; overspeeding; lack of maintenance of cooling, lubricating or intake systems; improper storage, starting, warm-up, run-in or shutdown practices; unauthorized modifications to the vehicle and its components. PACCAR is also not responsible for failures caused by incorrect oil, fuel or diesel exhaust fluid or by water, dirt or other contaminants in the fuel, oil or diesel exhaust fluid. Failure of replacement parts used in repairs due to the above non-warrantable conditions is not warrantable. This warranty is void if the vehicle is altered with parts that do not meet the material and functional specifications as manufactured from the factory. Any alterations to vehicle or engine computer settings will void GHG warranty and potentially cause the vehicle to become non-compliant with EPA Clean Air Act GHG regulations. Any alterations to GHG specific settings prior to the GHG related expiration mileage for each system will void GHG warranty and potentially cause the vehicle to become non-compliant with EPA Clean Air Act GHG regulations. This warranty is void if certain GHG components are not properly maintained and thus cannot perform to their designed capability. PACCAR is not responsible for failures resulting from improper repair or the use of parts which are not genuine approved parts. PACCAR is not responsible for the material and labor costs of emission control parts and assemblies replaced during Scheduled Maintenance of the engine as specified in PACCAR Operator's Manuals. THIS WARRANTY, TOGETHER WITH THE EXPRESS COMMERCIAL WARRANTIES ARE THE SOLE WARRANTIES MADE BY PACCAR IN REGARD TO THIS VEHICLE. THIS LIMITED GHG WARRANTY IS THE SOLE WARRANTY MADE BY PACCAR AND THE SELLING DEALER. EXCEPT FOR THE ABOVE LIMITED WARRANTY, PACCAR AND THE SELLING DEALER MAKE NO OTHER WARRANTIES, EXPRESS OR IMPLIED. PACCAR AND THE SELLING DEALER EXPRESSLY DISCLAIM ANY WARRANTY OF MERCHANTABILITY OR WARRANTY OF FITNESS FOR A PARTICULAR PURPOSE. PACCAR AND THE SELLING DEALER SHALL NOT BE LIABLE FOR INCIDENTAL OR CONSEQUENTIAL DAMAGES INCLUDING, BUT NOT LIMITED TO: LOSS OF INCOME OR LOST PROFITS; ENGINE OR VEHICLE DOWNTIME; THIRD PARTY DAMAGE, INCLUDING DAMAGE OR LOSS TO OTHER ENGINES, VEHICLES OR PROPERTY, ATTACHMENTS, TRAILERS AND CARGO; LOSS OR DAMAGE TO PERSONAL CONTENTS; COMMUNICATION EXPENSES; LODGING AND/OR MEAL EXPENSES; FINES; APPLICABLE TAXES OR BUSINESS COSTS OR LOSSES; ATTORNEYS' FEES; AND ANY LIABILITY YOU MAY HAVE IN RESPECT TO ANY OTHER PERSON OR ENTITY.

Remote Keyless Entry (Option)

Remote Keyless Entry (RKE) is a system that adds security and convenience to your vehicle. The system will lock or unlock cab doors with the key fob. The system will alert you with parking lights when the selected doors are locked or unlocked. The system includes two key fobs that provide secure rolling code technology that prevents someone from recording the entry signal.

NOTE

FCC ID: L2C0031T IC: 3432A-0031T
FCC ID: L2C0032R IC: 3432A-0032R
This device complies with Part 15 of the FCC Rules and with RSS-210 of Industry Canada. Operation is subject to the following two conditions (1) This device may not cause harmful interference, and (2) This device must accept any interference received, including interference that may cause undesired operation. Changes or modifications not expressively approved by the party responsible for compliance could void the user's authority to operate the equipment. The term IC: before the radio certification number only signifies that Industry Canada technical specifications were met.

Telematics Control Unit FCC Information

Disposition: / Status:
This topic taken from EMUX_TCU2_TruckManualUpdates.docx received from O. Frisvold 12/5/2023

General Information

Model	IC
TCU2 NA IP30	2AUXS-TCU2NAIP30
TCU2 NA IP67	2AUXS-TCU2NAIP67

Contains FCC ID: NKRUMC-STD31BPN

NOTE

This device complies with Part 15 of the FCC Rules.
Operation is subject to the following two conditions:

1. This device may not cause harmful interference, and
2. This device must accept any interference received, including interference that may cause undesired operation.

NOTE

Changes or modifications not expressly approved by the party responsible for compliance could void the user's authority to operate the equipment.

NOTE

This equipment has been tested and found to comply with the limits for a Class B digital device, pursuant to Part 15 of the FCC Rules. These limits are designed to provide reasonable protection against harmful interference in a residential installation. This equipment generates, uses and can radiate radio frequency energy and, if not installed and used in accordance with the instructions, may cause harmful interference to radio communications. However, there is no guarantee that interference will not occur in a particular installation. If this equipment does cause harmful interference to radio or television reception, which can be determined by turning the equipment off and on, the user is encouraged to try to correct the interference by one or more of the following measures:

- Reorient or relocate the receiving antenna
- Increase the separation between the equipment and receiver
- Connect the equipment into an outlet on a circuit different from that to which the receiver is connected
- Consult the dealer or an experienced radio/TV technician for help

Radiofrequency radiation exposure Information:
This equipment complies with FCC radiation exposure limits set forth for an uncontrolled environment. This equipment should be installed and operated with minimum distance of 8 in. (20 cm) between the radiator and your body. This transmitter must not be co-located or operating in conjunction with any other antenna or transmitter.

- Distance needs to be checked

Used Frequency Bands (+antenna)

4G

Band	MHz
2 (incl. 25)	1900
66 (incl. 4)	1700
12 (incl. 17)	700
26 (incl. 5)	800
7	2600
71	600

2G

MHz
850
1900

Canada-specific Information

Model	IC
TCU2 NA IP30	25847-TCU2NAIP30

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Model	IC
TCU2 NA IP67	25847-TCU2NAIP67

Contains IC ID: 4441A-UMCSTD31BPN

NOTE

This device contains license-exempt transmitter(s)/receiver(s) that comply with Innovation, Science and Economic Development Canada's licence-exempt RSS(s). Operation is subject to the following two conditions:

- This device may not cause interference
- This device must accept any interference, including interference that may cause undesired operation of the device

RF Exposure Information:
This equipment complies with Canada radiation exposure limits set forth for an uncontrolled environment. This equipment should be installed and operated with minimum distance of 8 inches (20 cm) between the radiator and your body.

Disposition: / Status:
Use this text for French localization:

Model	IC
TCU2 NA IP30	25847-TCU2NAIP30
TCU2 NA IP67	25847-TCU2NAIP67

Contains IC ID: 4441A-UMCSTD31BPN

NOTE

L'émetteur/récepteur exempt de licence contenu dans le présent appareil est conforme aux CNR d'Innovation, Sciences et Développement économique Canada applicables aux appareils radio exempts de licence. L'exploitation est autorisée aux deux conditions suivantes:

- L'appareil ne doit pas produire de brouillage;
- L'appareil doit accepter tout brouillage radioélectrique subi, même si le brouillage est susceptible d'en compromettre le fonctionnement.

Déclaration d'exposition aux radiations:
Cet équipement est conforme aux limites d'exposition aux rayonnements IC établies pour un environnement non contrôlé. Cet équipement doit être installé et utilisé avec un minimum de 20 cm de distance entre la source de rayonnement et votre corps.

Mexico-specific Information

Disposition: / Status:
This information can be added but is not required:
IFT or IFETEL No.: (if not on the device sticker)
Marca: e.g. BOSCH
Modelo (s): ____

The operation of this equipment is subject to the following two conditions:

- This equipment or device may not cause harmful interference and
- This equipment or device must accept any interference, including interference that may cause undesired operation

Disposition: / Status:

Use this text for Spanish localization:
La operación de este equipo está sujeta a las siguientes dos condiciones:

- es posible que este equipo o dispositivo no cause interferencia perjudicial y
- este equipo o dispositivo debe aceptar cualquier interferencia, incluyendo la que pueda causar su operación no deseada.

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