MAINTENANCE

CLASS PAYS

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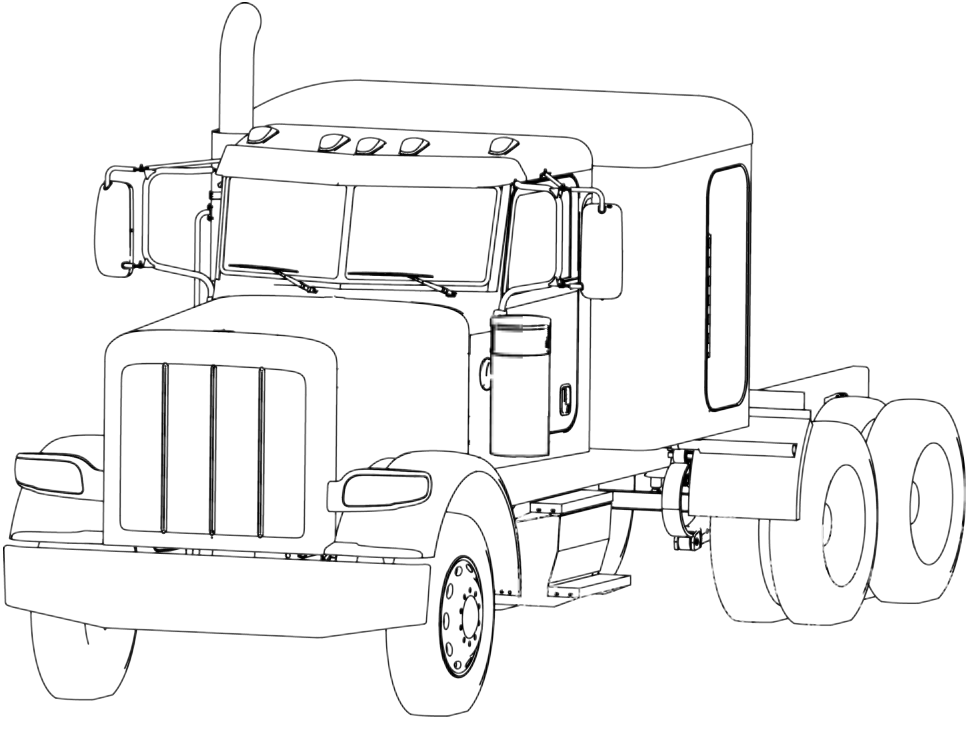

PREVENTIVE MAINTENANCE SCHEDULE

LUBRICANT SPECIFICATIONS

AIR SYSTEM

BRAKE SYSTEM

CAB

COOLING SYSTEM

ELECTRICAL

ENGINE

HEATER AND AIR CONDITIONER

NOISE EMISSION CONTROL

REAR AXLE AND SUSPENSION

STEERING SYSTEM

CLUTCH

PREVENTIVE MAINTENANCE SCHEDULE

Introduction

Preventive maintenance program begins with the daily checks. See Driver's Check List for these routine 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 procedures in the engine compartment, stop the engine and let it cool down. Hot components can burn skin on contact. Failure to comply may result in death, personal injury, equipment or property damage.

WARNING!

If the engine must be operating 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 has to be done with the engine running, always (1) set the parking brake, (2) block the wheels, and (3) ensure that the shift lever or selector is in Neutral. Failure to comply may result in death, personal injury, equipment or property damage.

WARNING!

Exercise extreme caution to prevent neckties, jewelry, long hair, or loose clothing from getting caught in the fan blades or any other moving engine parts. Failure to comply may result in death, personal injury, equipment or property damage.

WARNING!

Disconnect the battery ground strap 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 handy. Failure to comply may result in death, personal injury, equipment 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.

WARNING!

When working underneath the vehicle without appropriate safety stands but with the wheels on the ground (not supported), make sure that (1) the vehicle is on hard level ground, (2) the parking brake is applied, (3) all wheels are blocked (front and rear) and (4) remove the ignition key so that the engine cannot be started. Failure to comply may result in death, personal injury, equipment or property damage.

WARNING!

Never start or let the engine run in an enclosed, unventilated area. Exhaust fumes from the engine contain carbon monoxide, a colorless and odorless gas. Carbon monoxide can be fatal if inhaled. 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. Refer to Oil Changes on page 5-51 before you put a new vehicle into service.
- The initial fill of lubricant in manual transmissions must be changed before the end of the first maintenance interval. See Fuller Transmission Lubrication on page 5-48 for specific information.
- 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.

Maintenance Schedule

New Vehicle Maintenance Schedule

New Vehicle Maintenance Schedule					
Operation\Frequency	First Day	After First Miles (km)			
		50 – 100 (80 – 160)	500 (800)	2,000 (3218)	3,000 –5,000 (4800 –8000)
Steering Shaft U-Bolts. (OFF-HIGHWAY) See Steering System on page 5-136.	X				
Wheel Mounting. See Wheel Mounting and Fastening on page 5-146.		X			
Front Axle U-Bolt Torque. See Front Spring Suspension U-Bolts on page 5-118.			X		
Charge Air Cooler and Air Intake Pipe Clamps, re- torque fasteners.			X		
Rear Suspension Fasteners. See Rear Suspension Fasteners on page 5-132.				X	
Transmission Lubrication. 1. For Fuller transmission, see Fuller Transmission Lubrication on page 5-48. 2. For Allison transmission, see Allison Transmission Lubrication on page 5-50. 3. For Spicer transmission, see Spicer Transmission Lubrication on page 5-50.					X
Axle Lubrication. 1. For Meritor axle, see Meritor Axle Lubrication on page 5-52. 2. For Eaton/Dana axle, see Eaton/Dana Axle Lubrication on page 5-53.					X

PREVENTIVE MAINTENANCE (PM) INTERVALS

I	A	B	C	D	E
At first 15,000 mi/ 24,000 km or at the first PM	15,000 mi/ 24,000 km/ Monthly	30,000 mi/ 48,000 km	60,000 mi/ 96,000 km/ 6 Months	120,000 mi/ 192,000 km/ Annually	240,000 mi/ 384,000 km

SYSTEM	COMPONENT	MAINTENANCE TASK	Recommended PM Interval					
			I	A	B	C	D	E
Frame	Fifth Wheel	Check the kingpin lock and plate for wear and function; lubricate (NLGI #2 grease).		X				
		Inspect fifth wheel operation (shown on page 5-113)				X		
	Frame Fasteners	Check for tightness; tighten to the specified torque value as required (shown on page 5-114).					X	
	Crossmembers and Mounting Brackets	Inspect for cracks and loose fasteners. Replace or tighten to the specified torque value as required (shown on page 5-114).					X	
	Engine Mounting	Inspect engine mounts every 60,000 miles (96,560 km) (shown on page 5-110). Contact an authorized vehicle OEM dealership if engine mounts need servicing.				X		

PREVENTIVE MAINTENANCE (PM) INTERVALS

I	A	B	C	D	E
At first 15,000 mi/ 24,000 km or at the first PM	15,000 mi/ 24,000 km/ Monthly	30,000 mi/ 48,000 km	60,000 mi/ 96,000 km/ 6 Months	120,000 mi/ 192,000 km/ Annually	240,000 mi/ 384,000 km

SYSTEM	COMPONENT	MAINTENANCE TASK	Recommended PM Interval					
			I	A	B	C	D	E
Front Axle (Meritor)	Total Vehicle Alignment	Check and adjust as required.	X				X	
	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 (shown on page 5-136).					X	
	Kingpin bushings, thrust bearings, and tie rod ball ends	Lubricate with approved grease.				X		
	Drawkeys	Tighten nuts	X		X			

PREVENTIVE MAINTENANCE (PM) INTERVALS

I	A	B	C	D	E
At first 15,000 mi/ 24,000 km or at the first PM	15,000 mi/ 24,000 km/ Monthly	30,000 mi/ 48,000 km	60,000 mi/ 96,000 km/ 6 Months	120,000 mi/ 192,000 km/ Annually	240,000 mi/ 384,000 km

SYSTEM	COMPONENT	MAINTENANCE TASK	Recommended PM Interval					
			I	A	B	C	D	E
Front Axle (Dana)	Total Vehicle Alignment	Check and adjust as required.	X				X	
	Kingpin bushings, thrust bearings, and tie rod ball ends (ON HIGHWAY)	Lubricate with approved grease.					X	
	Kingpin bushings, thrust bearings, and tie rod ball ends (OFF-HIGHWAY)	Lubricate with approved grease.				X		
	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.					X	
	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.				X		

PREVENTIVE MAINTENANCE (PM) INTERVALS

I	A	B	C	D	E
At first 15,000 mi/ 24,000 km or at the first PM	15,000 mi/ 24,000 km/ Monthly	30,000 mi/ 48,000 km	60,000 mi/ 96,000 km/ 6 Months	120,000 mi/ 192,000 km/ Annually	240,000 mi/ 384,000 km

SYSTEM	COMPONENT	MAINTENANCE TASK	Recommended PM Interval					
			I	A	B	C	D	E
Front Suspension	Front Spring	Inspect for cracked leaves, worn bushings, and excessive corrosion.				X		
	Spring Pins and Shackles	Inspect for worn parts and excessive joint clearance. Shim or replace as required.				X		
	Shock Absorbers	Inspect for leaking, body damage, and damaged or worn bushings. Replace as required. Check the shock mounting stud torque.				X		
	Spring Pins	Lubricate with approved grease.			X			
		Check for proper function.		X				
	U-bolts (ON HIGHWAY)	Check the general condition and the tightness of the nuts. Tighten the nuts to the specified torque value as required (shown on page 5-118).	X			X		
	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 (shown on page 5-118).		X				

PREVENTIVE MAINTENANCE (PM) INTERVALS

I	A	B	C	D	E
At first 15,000 mi/ 24,000 km or at the first PM	15,000 mi/ 24,000 km/ Monthly	30,000 mi/ 48,000 km	60,000 mi/ 96,000 km/ 6 Months	120,000 mi/ 192,000 km/ Annually	240,000 mi/ 384,000 km

SYSTEM	COMPONENT	MAINTENANCE TASK	Recommended PM Interval					
			I	A	B	C	D	E
Drive Axle (Dana)	Axle Housing	Visually inspect for damage or leaks.				X		
		Check oil level. Check “cold.” Torque the drain plug.				X		
		Drain the lubricant while warm. Flush each unit with clean flushing oil. Change the lubricant.	See information on page 5-53					
	Air Shift Unit	Check the lubricant level.				X		
		Remove the housing cover and drain the lubricant. Wash the parts thoroughly and dry in air.					X	
	Breather	Clean or replace.					X	
	Lube Pump (ON HIGHWAY)	Remove the magnetic strainer and inspect for wear particles. Wash in solvent and dry in air.					X	
	Lube Pump (OFF HIGHWAY)	Remove the magnetic strainer and inspect for wear particles. Wash in solvent and dry in air.				X		
	Lube Filter (ON HIGHWAY)	Change.					X	
	Lube Filter (OFF HIGHWAY)	Change.				X		

PREVENTIVE MAINTENANCE (PM) INTERVALS

I	A	B	C	D	E
At first 15,000 mi/ 24,000 km or at the first PM	15,000 mi/ 24,000 km/ Monthly	30,000 mi/ 48,000 km	60,000 mi/ 96,000 km/ 6 Months	120,000 mi/ 192,000 km/ Annually	240,000 mi/ 384,000 km

SYSTEM	COMPONENT	MAINTENANCE TASK	Recommended PM Interval					
			I	A	B	C	D	E
Drive Axle (Dana)	Magnetic drain plug and breather (ON HIGHWAY)	Clean or replace.					X	
	Magnetic drain plug and breather (OFF HIGHWAY)	Clean or replace.				X		

PREVENTIVE MAINTENANCE (PM) INTERVALS

I	A	B	C	D	E
At first 15,000 mi/ 24,000 km or at the first PM	15,000 mi/ 24,000 km/ Monthly	30,000 mi/ 48,000 km	60,000 mi/ 96,000 km/ 6 Months	120,000 mi/ 192,000 km/ Annually	240,000 mi/ 384,000 km

SYSTEM	COMPONENT	MAINTENANCE TASK	Recommended PM Interval					
			I	A	B	C	D	E
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.)				X		
		Visually inspect for damage or leaks.				X		
		Drain and replace the lubricant.	See information on page 5-51					
	Lubricant filter	Change the filter.					X	
	Breather	Check the operation. If the cap doesn’t rotate freely, replace.				X		
	Input shaft and pinion shaft	Check and adjust the endplay.					X	
	Axle shaft	Tighten the rear axle flange nuts to the specified torque value.					X	
	Interaxle differential	Check the operation.					X	

PREVENTIVE MAINTENANCE (PM) INTERVALS

I	A	B	C	D	E
At first 15,000 mi/ 24,000 km or at the first PM	15,000 mi/ 24,000 km/ Monthly	30,000 mi/ 48,000 km	60,000 mi/ 96,000 km/ 6 Months	120,000 mi/ 192,000 km/ Annually	240,000 mi/ 384,000 km

SYSTEM	COMPONENT	MAINTENANCE TASK	Recommended PM Interval					
			I	A	B	C	D	E
Drive Axle (SISU)	Axle Housing	Change the oil in the differential carrier and the hubs, and clean the magnetic oil drain plugs.	X				X	
		Check the wheel bearing hubs and adjust if necessary.	X			X		
		Visually inspect for damage or leaks.	X			X		
		Check the oil level in the differential carrier and hubs.				X		
	Breather	Check the breather for proper operation.				X		
	Lube Filter	Clean the suction filter for the optional pressure lubrication system.					X	
	S-cam brakes	Overhaul the brakes; degrease all moving parts; check the bushings and seals for wear.				X		

PREVENTIVE MAINTENANCE (PM) INTERVALS

I	A	B	C	D	E
At first 15,000 mi/ 24,000 km or at the first PM	15,000 mi/ 24,000 km/ Monthly	30,000 mi/ 48,000 km	60,000 mi/ 96,000 km/ 6 Months	120,000 mi/ 192,000 km/ Annually	240,000 mi/ 384,000 km

SYSTEM	COMPONENT	MAINTENANCE TASK	Recommended PM Interval					
			I	A	B	C	D	E
Rear Suspension	U-bolts	Check the torque. Tighten to specified torque value as required (shown on page 5-133).	X			X		
	Frame and crossmember bolts	Check the torque. Tighten to specified torque value as required (shown on page 5-114).					X	
	Mounting brackets and fasteners	Check the condition and the fastener torque. Tighten to the specified torque value as required (shown on page 5-114).	X				X	

PREVENTIVE MAINTENANCE (PM) INTERVALS

I	A	B	C	D	E
At first 15,000 mi/ 24,000 km or at the first PM	15,000 mi/ 24,000 km/ Monthly	30,000 mi/ 48,000 km	60,000 mi/ 96,000 km/ 6 Months	120,000 mi/ 192,000 km/ Annually	240,000 mi/ 384,000 km

SYSTEM	COMPONENT	MAINTENANCE TASK	Recommended PM Interval					
			I	A	B	C	D	E
Drum Brakes (All)	Slack adjusters	Check the push rod travel and check the control arm for cracks. Adjust at reline (shown on page 5-69).		X				
		Lubricate (NLGI #2 grease).		X				
	Brake camshaft bearing	Check for excessive camshaft paly in the axial and radial directions. Max allowable play is 0.003 in. Lubricate (NLGI #2 grease).				X		
	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).			X			
	Brake air system	Check air lines and fittings for leaks (shown on page 5-57). Adjust routing as required to prevent chafing. Check tank mounting and condition.		X				
		Clean or replace the inline filters.				X		
	Brake lining	Inspect; replace as required.			X			

PREVENTIVE MAINTENANCE (PM) INTERVALS

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At first 15,000 mi/ 24,000 km or at the first PM	15,000 mi/ 24,000 km/ Monthly	30,000 mi/ 48,000 km	60,000 mi/ 96,000 km/ 6 Months	120,000 mi/ 192,000 km/ Annually	240,000 mi/ 384,000 km

SYSTEM	COMPONENT	MAINTENANCE TASK	Recommended PM Interval					
			I	A	B	C	D	E
Disc Brakes (Bendix®)	Brake pads	Inspect; replace as required.				X		
	Brake disc/rotor	Inspect for visible cracks, heat checking, galling, or scoring of surface. Check for runout (max allowable is 0.002 in.).				X		
	Caliper sliding function	Ensure caliper slides freely with no obstructions or excessive play.				X		
	Caliper slide pins	Inspect protective caps of the guide pins for damage or cracking.				X		
	System operation	Check operation; inspect as per manufacturer's service literature.				X		

PREVENTIVE MAINTENANCE (PM) INTERVALS

I	A	B	C	D	E
At first 15,000 mi/ 24,000 km or at the first PM	15,000 mi/ 24,000 km/ Monthly	30,000 mi/ 48,000 km	60,000 mi/ 96,000 km/ 6 Months	120,000 mi/ 192,000 km/ Annually	240,000 mi/ 384,000 km

SYSTEM	COMPONENT	MAINTENANCE TASK	Recommended PM Interval					
			I	A	B	C	D	E
Hub, Drum, and Hubcap	Hubs (non-LMS)	Check the bearing endplay and adjust as required (shown on page 5-54).			X			
	Hubs (non-LMS) with outrunner seals	Clean the components and check for excessive wear or damage. Change the oil and seal (shown on page 5-54).						X
	Hubs (non-LMS) with standard seals	Clean the components and check for excessive wear or damage. Change the oil and seal (shown on page 5-54).					X	
	Hub seals (all)	Check for leaks; replace as required.			X			
	LMS Hubs (Dana)	Inspect for leaks. Check the bearing endplay and adjust as required (shown on page 5-54).				X		
	LMS Hubs (Dana) with Synthetic Lubricant	Service the bearings, seals and oil. This interval may be different depending on the results of the regular inspection. (shown on page 5-54).	500,000 miles/ 800,000 km					
	LMS Hubs (Dana) with Mineral Lubricant	Service the bearings, seals and oil. This interval may be different depending on the results of the regular inspection. (shown on page 5-54).	350,000 miles/ 560,000 km					

PREVENTIVE MAINTENANCE (PM) INTERVALS

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At first 15,000 mi/ 24,000 km or at the first PM	15,000 mi/ 24,000 km/ Monthly	30,000 mi/ 48,000 km	60,000 mi/ 96,000 km/ 6 Months	120,000 mi/ 192,000 km/ Annually	240,000 mi/ 384,000 km

SYSTEM	COMPONENT	MAINTENANCE TASK	Recommended PM Interval					
			I	A	B	C	D	E
Hub, Drum, and Hubcap	Brake drums	Inspect for visible cracks, heat checking, galling or scoring of the braking surface, and for severe corrosion on the outside surface. Check for out-of-round or oversize condition [0.080 in. (2 mm) more than the original diameter]. Replace as required.			X			
	Hubcaps	Clean the sight window. Check the center plug, mounting flange, and fill plug for leaks and for proper installation. Replace broken or damaged parts. Check the lubricant level and add as required.		X				

PREVENTIVE MAINTENANCE (PM) INTERVALS

I	A	B	C	D	E
At first 15,000 mi/ 24,000 km or at the first PM	15,000 mi/ 24,000 km/ Monthly	30,000 mi/ 48,000 km	60,000 mi/ 96,000 km/ 6 Months	120,000 mi/ 192,000 km/ Annually	240,000 mi/ 384,000 km

SYSTEM	COMPONENT	MAINTENANCE TASK	Recommended PM Interval					
			I	A	B	C	D	E
Main and auxiliary transmis-sion	Main and auxiliary transmission and transfer case	Inspect for visible damage, signs of overheating, and leaks.	X	X				
		Check the drain plugs for tightness.			X			
	Mounting Brackets and Fasteners	Check the condition of the fasteners and their torque. Tighten to the specified torque value as required.				X		
	Oil cooler	Clean the fins (air-to-oil type) and body. Check the hose condition and for leaks; replace as required.				X		
	Main and aux. transmission	Check the oil level; refill as required.			X			
	Main and auxiliary transmission (ON HIGHWAY)	Drain lubricant while warm. Flush each unit with clean flushing oil.	500,000 miles/ 800,000 km					
	Main and auxiliary transmission (OFF HIGHWAY)	Drain lubricant while warm. Flush each unit with clean flushing oil.	X			X		

PREVENTIVE MAINTENANCE (PM) INTERVALS

I	A	B	C	D	E
At first 15,000 mi/ 24,000 km or at the first PM	15,000 mi/ 24,000 km/ Monthly	30,000 mi/ 48,000 km	60,000 mi/ 96,000 km/ 6 Months	120,000 mi/ 192,000 km/ Annually	240,000 mi/ 384,000 km

SYSTEM	COMPONENT	MAINTENANCE TASK	Recommended PM Interval					
			I	A	B	C	D	E
Auxiliary transmis-sion	Cotta Transfer Case TR2205 Fabco Transfer Case TC142/TC143/TC170/ TC270 Marmon-Harrington Transfer Case MVG2000/MVG2000SD	Inspect: Check oil level; inspect for leaks and any visible damage.		X				
		Initial oil change: Drain oil while warm; flush case with gear oil-compatible fluid; clean magnetic drain plug; refill. Do not flush the case with any solvent.	X			X		
		Change oil.				X		
Air Intake	Air intake piping, mounting, and charge air cooler	Check the system for broken pipes, leaks, joint integrity, cleanliness, and proper support (shown on page 5-109).				X		
	Air cleaner	Replace the engine intake air cleaner element (shown on page 5-108).	When required by air restriction indicator or required by the engine manufacturer's operator manual.					
Clutch	Clutch linkage	Lubricate.			X			
	Clutch release bearing	Lubricate.			X			
		Inspect and adjust when necessary (no adjustment required for SOLO type clutches)			X			

PREVENTIVE MAINTENANCE (PM) INTERVALS

I	A	B	C	D	E
At first 15,000 mi/ 24,000 km or at the first PM	15,000 mi/ 24,000 km/ Monthly	30,000 mi/ 48,000 km	60,000 mi/ 96,000 km/ 6 Months	120,000 mi/ 192,000 km/ Annually	240,000 mi/ 384,000 km

SYSTEM	COMPONENT	MAINTENANCE TASK	Recommended PM Interval					
			I	A	B	C	D	E
Cooling	Hoses	Check the radiator and heater hoses for leaks.	X			X		
	Extended Life Coolant (ELC)	Check the freeze point (shown on page 5-83).			X			
		Check for contamination using test strips (shown on page 5-82).			X			
		Replace blank water filter if applicable.					X	
		Perform lab analysis (shown on page 5-82). If lab analysis shows coolant is unsuitable for continued use: Flush, drain, and refill (shown on page 5-82). Add ELC Extender (shown on page 5-82).					X	
		Flush, drain, and refill with new coolant (shown on page 5-82).						X
	Fan clutch	Check for air leaks. (shown on page 5-106). Check the fan drive bearings (turn the sheave in both directions to check for worn hub bearings).	X			X		
	Solenoid valve	Check the fan drive for proper engagement and disengagement.	X			X		

PREVENTIVE MAINTENANCE (PM) INTERVALS

I	A	B	C	D	E
At first 15,000 mi/ 24,000 km or at the first PM	15,000 mi/ 24,000 km/ Monthly	30,000 mi/ 48,000 km	60,000 mi/ 96,000 km/ 6 Months	120,000 mi/ 192,000 km/ Annually	240,000 mi/ 384,000 km

SYSTEM	COMPONENT	MAINTENANCE TASK	Recommended PM Interval					
			I	A	B	C	D	E
Tires and Wheels	Tires	Check inflation pressure (shown on page 5-140).	Weekly “cold” using calibrated gauge					
		Inspect for cuts, irregular wear, missing lugs, sidewall damage, etc.		X				
	Disc wheels	Inspect the wheel disc for any cracks or surface irregularities. Inspect the rim edge and bead seat area for damage. Replace any damaged wheels - DO NOT ATTEMPT TO REPAIR.		X				
	Demountable rims	Inspect the mounting ring, rim gutter, side ring, and lock ring for damage; replace as required.		X				
	Wheel nuts and studs	Check the tightness of the fasteners and tighten the fasteners to the specified torque as required (shown on page 5-146).		X				
		Inspect for damaged hex corners, stripped or damaged threads, and excessive corrosion; clean or replace as required.		X				

PREVENTIVE MAINTENANCE (PM) INTERVALS

I	A	B	C	D	E
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SYSTEM	COMPONENT	MAINTENANCE TASK	Recommended PM Interval					
			I	A	B	C	D	E
Power Steering	Reservoir	Check the fluid level (shown on page 5-55).		X				
	Reservoir (ON HIGHWAY)	Drain, replace the filter, and refill (shown on page 5-55).	X				X	
	Reservoir (OFF HIGHWAY)	Drain, replace the filter, and refill (shown on page 5-55).	X			X		
	Steering gear	Check the lash of the sector shaft; adjust as required.				X		
		Grease the trunnion bearing (EP NLGI #2 lithium-based, moly-filled, HD grease).				X		
		Grease the input shaft seal (EP NLGI #2 lithium-based, moly-filled, HD grease).				X		
	Power assist cylinder	Lubricate the ball joints. Inspect for leaking rod seals, damaged ball joint boots, and damage to cylinder rod or barrel.		X				
	Hoses and tubes	Check for leaks and chafing.				X		
	Steering linkage	Check all joints for excessive lash; replace as required (shown on page 5-136).					X	

PREVENTIVE MAINTENANCE (PM) INTERVALS

I	A	B	C	D	E
At first 15,000 mi/ 24,000 km or at the first PM	15,000 mi/ 24,000 km/ Monthly	30,000 mi/ 48,000 km	60,000 mi/ 96,000 km/ 6 Months	120,000 mi/ 192,000 km/ Annually	240,000 mi/ 384,000 km

SYSTEM	COMPONENT	MAINTENANCE TASK	Recommended PM Interval					
			I	A	B	C	D	E
Power Steering	Draglink tube clamp and ball socket	Check the torque; tighten to specified torque value as required.	X			X		
	Pitman arm clamp bolt and nut	Check the torque; tighten to specified torque value as required.	X			X		
	Steering intermediate shaft	Check the torque on the pinch bolt and nut.	X			X		
	Steering intermediate shaft U-joints (ON HIGHWAY)	Lubricate [EP NLGI #2 HD grease, +325° F to -10° F (+163° C to -23° C) range].	X			X		
	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].	X		X			
	Draglink and tie rod arm ball sockets (ON HIGHWAY)	Lubricate (EP NLGI #2 lithium-based, moly-filled, HD grease).	X		X			
	Draglink and tie rod arm ball sockets (OFF HIGHWAY or CITY DELIVERY)	Lubricate (EP NLGI #2 lithium-based, moly-filled, HD grease).	X	X				

PREVENTIVE MAINTENANCE (PM) INTERVALS

I	A	B	C	D	E
At first 15,000 mi/ 24,000 km or at the first PM	15,000 mi/ 24,000 km/ Monthly	30,000 mi/ 48,000 km	60,000 mi/ 96,000 km/ 6 Months	120,000 mi/ 192,000 km/ Annually	240,000 mi/ 384,000 km

SYSTEM	COMPONENT	MAINTENANCE TASK	Recommended PM Interval					
			I	A	B	C	D	E
Fuel and Tanks	Fuel tanks	Inspect tanks, brackets, hoses, and fittings for correct location, tightness, abrasion damage, and leaks; repair or replace as required.				X		
	Fuel tank breathers	Check for proper function; clean the drain hoses.					X	
	Fuel tank straps	Check the strap tightness; tighten to proper torque value as required: Aluminum tank: 30 Lb. ft. (41 N.m.) Cylindrical Steel tank: 8 Lb. ft. (11 N.m.)	X		X			

PREVENTIVE MAINTENANCE (PM) INTERVALS

I	A	B	C	D	E
At first 15,000 mi/ 24,000 km or at the first PM	15,000 mi/ 24,000 km/ Monthly	30,000 mi/ 48,000 km	60,000 mi/ 96,000 km/ 6 Months	120,000 mi/ 192,000 km/ Annually	240,000 mi/ 384,000 km

SYSTEM	COMPONENT	MAINTENANCE TASK	Recommended PM Interval					
			I	A	B	C	D	E
Driveshafts	Models SPL-90, 1710 and 1810 slip member and U-joints	Lubricate*.	X	X				
		Inspect.	U-joint inspections should be performed every time a vehicle comes in for scheduled maintenance.**					
	Model SPL-100 slip member and U-joints	Lubricate*.		X				
		Inspect.	U-joint inspections should be performed every time a vehicle comes in for scheduled maintenance.**					
	Models SPL-140/140HD/170/ 170HD/250/250HD slip members and U-joints (ON HIGHWAY and LINEHAUL)	Lubricate*.				X		
		Inspect.	U-joint inspections should be performed every time a vehicle comes in for scheduled maintenance.**					

PREVENTIVE MAINTENANCE (PM) INTERVALS

I	A	B	C	D	E
At first 15,000 mi/ 24,000 km or at the first PM	15,000 mi/ 24,000 km/ Monthly	30,000 mi/ 48,000 km	60,000 mi/ 96,000 km/ 6 Months	120,000 mi/ 192,000 km/ Annually	240,000 mi/ 384,000 km

SYSTEM	COMPONENT	MAINTENANCE TASK	Recommended PM Interval					
			I	A	B	C	D	E
Driveshafts	Models SPL-140/140HD/170/ 170HD/250/250HD slip members and U-joints (OFF HIGHWAY)	Lubricate*.	X					
		Inspect.	U-joint inspections should be performed every time a vehicle comes in for scheduled maintenance.**					
	Models SPL-140XL/ 170XL/250XL slip members and U-joints (ON HIGHWAY and LINE HAUL)	Lubricate*.	350,000 mi (560,000 km) 1st interval and then every 100,000 mi (160,00 km) after that.					
		Inspect.	U-joint inspections should be performed every time a vehicle comes in for scheduled maintenance.**					
	Models SPL-140XL/ 170XL/250XL slip members and U-joints (OFF HIGHWAY and CITY)	Lubricate*.					X	
		Inspect.	U-joint inspections should be performed every time a vehicle comes in for scheduled maintenance.**					
	*Use only Spicer Driveshaft approved lubricants when greasing Spicer U-joints. **Refer to Spicer Driveshaft service manual DSSM-0100 (3264-SPL) for detailed instructions.							

PREVENTIVE MAINTENANCE (PM) INTERVALS

I	A	B	C	D	E
At first 15,000 mi/ 24,000 km or at the first PM	15,000 mi/ 24,000 km/ Monthly	30,000 mi/ 48,000 km	60,000 mi/ 96,000 km/ 6 Months	120,000 mi/ 192,000 km/ Annually	240,000 mi/ 384,000 km

SYSTEM	COMPONENT	MAINTENANCE TASK	Recommended PM Interval					
			I	A	B	C	D	E
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) (shown on page 5-87).		X				
	Batteries (ON HIGHWAY and LINE HAUL)	Check for cracks and damage, electrolyte level, condition of terminals, and tightness of holddowns (shown on page 5-87).				X		
	Batteries (OFF-HIGHWAY)	Check for cracks and damage, electrolyte level, condition of terminals, and tightness of holddowns (shown on page 5-87).		X				
	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.				X		
	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.		X				
	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.		X				

PREVENTIVE MAINTENANCE (PM) INTERVALS

I	A	B	C	D	E
At first 15,000 mi/ 24,000 km or at the first PM	15,000 mi/ 24,000 km/ Monthly	30,000 mi/ 48,000 km	60,000 mi/ 96,000 km/ 6 Months	120,000 mi/ 192,000 km/ Annually	240,000 mi/ 384,000 km

SYSTEM	COMPONENT	MAINTENANCE TASK	Recommended PM Interval					
			I	A	B	C	D	E
Electrical and lights	Headlamps	Check the aim and adjust as required.				X		
	Warning lights in light bar	Check at the ignition start position to verify bulbs and driver information display function.		X				
	Turn, Stop, Reverse lights and signals	Visual check.		X				
	Alternator	Check operation and output.				X		
		Check tightness of the pulley nut.				X		
		Check the tension of the drive belt (shown on page 5-105).				X		
		Check tightness of the terminal hex nuts.				X		
	Starter	Check torque on hex nuts.				X		
	ECM connector	Check the tightness of the ECM connector.				X		
	Wheel sensors	Check for damaged sensors and connectors, and worn or frayed wires.				X		
	Fuel and diesel exhaust fluid tank sending unit	Check the mounting screws and electrical connections for worn or damaged wires and connectors.	X		X			

PREVENTIVE MAINTENANCE (PM) INTERVALS

I	A	B	C	D	E
At first 15,000 mi/ 24,000 km or at the first PM	15,000 mi/ 24,000 km/ Monthly	30,000 mi/ 48,000 km	60,000 mi/ 96,000 km/ 6 Months	120,000 mi/ 192,000 km/ Annually	240,000 mi/ 384,000 km

SYSTEM	COMPONENT	MAINTENANCE TASK	Recommended PM Interval					
			I	A	B	C	D	E
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.		X				
		Wash to remove excess grease.				X		
Cab structure, doors and hoods	Hood	Lubricate the lower hood pivot (only if lube fittings are present).				X		
	Hinges and latch	Lubricate with silicone spray.				X		
	Body and cab holddown bolts	Check the condition and tightness.					X	
Heating and Air Conditioning	Air conditioner	Operate the system.		X				
	Heater and air conditioner	Perform the checks listed shown on page 5-120.			X			
		Full operational and diagnostic check.					X	
	Condenser	Clear any debris from the front of the condenser.				X		

5

PREVENTIVE MAINTENANCE (PM) INTERVALS

I	A	B	C	D	E
At first 15,000 mi/ 24,000 km or at the first PM	15,000 mi/ 24,000 km/ Monthly	30,000 mi/ 48,000 km	60,000 mi/ 96,000 km/ 6 Months	120,000 mi/ 192,000 km/ Annually	240,000 mi/ 384,000 km

SYSTEM	COMPONENT	MAINTENANCE TASK	Recommended PM Interval					
			I	A	B	C	D	E
Aftertreatment System	System	Check for leaks and proper support (shown on page 5-123).		X				
	Diesel particulate filter	Clean filter.	Refer to the Engine Maintenance Manual.					
	Diesel exhaust fluid tank	Inspect the tank, straps, brackets, hoses and fittings for abrasion damage, leaks, tightness and fully engaged connectors.				X		
	Diesel exhaust fluid supply module	Replace filter.	Refer to the Engine Maintenance Manual.					

PREVENTIVE MAINTENANCE (PM) INTERVALS

I	A	B	C	D	E
At first 15,000 mi/ 24,000 km or at the first PM	15,000 mi/ 24,000 km/ Monthly	30,000 mi/ 48,000 km	60,000 mi/ 96,000 km/ 6 Months	120,000 mi/ 192,000 km/ Annually	240,000 mi/ 384,000 km

SYSTEM	COMPONENT	MAINTENANCE TASK	Recommended PM Interval					
			I	A	B	C	D	E
Air	Air compressor governor	Replace air strainer.			X			
	Air lines	Check condition and routing to prevent chafing.			X			
	System	Lubricate (shown on page 5-60).				X		
	Inline filters	Replace elements or clean with solvent.				X		
	Air dryer	Perform the checks listed (shown on page 5-57).			X			
	Air dryer (ON HIGHWAY)	Overhaul.	360,000 miles/576,000 km					
	Air dryer (OFF HIGHWAY)	Overhaul.					X	

PREVENTIVE MAINTENANCE SCHEDULE

PREVENTIVE MAINTENANCE (PM) INTERVALS

I	A	B	C	D	E
At first 15,000 mi/ 24,000 km or at the first PM	15,000 mi/ 24,000 km/ Monthly	30,000 mi/ 48,000 km	60,000 mi/ 96,000 km/ 6 Months	120,000 mi/ 192,000 km/ Annually	240,000 mi/ 384,000 km

SYSTEM	COMPONENT	MAINTENANCE TASK	Recommended PM Interval					
			I	A	B	C	D	E
Engine	Basic Engine	Maintenance and service interval recommendations are detailed in the engine manufacturer's Operations and Maintenance Manual included with the vehicle. The engine manufacturer's recommendations vary depending engine model. Information is also available from authorized dealers, the engine manufacturer's authorized service centers, and the engine manufacturer's web site.						
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.					

5

LUBRICANT SPECIFICATIONS

Introduction

WARNING!

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

In this section you will find the basic information you need to do the routine lubrication your vehicle requires. Of course you will want to 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 in prolonging its life is proper lubrication servicing. Neglecting this essential aspect of vehicle care can cost time and money in the long run.

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. A poorly maintained, damaged, or corroded exhaust system can allow carbon monoxide to enter the cab or sleeper. Failure to properly maintain your vehicle could cause carbon monoxide to enter the cab and cause death, personal injury or serious illness.

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 slightly open. Failure to repair the source of the exhaust fumes may lead to death, personal injury or serious illness.

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:

- By a competent technician every 15,000 miles/ 24,000 km,
- Whenever a change is noticed in the sound of the exhaust system,
- Whenever the exhaust system, underbody, cab or sleeper is damaged.

NOTE

Use only an exact replacement parts in Aftertreatment exhaust system. Using a noncompliant replacement part could violate emissions requirements and also void the emission system's warranty.

Pipe and Hose Clamps

Use the following table for torque specifications to check pipe and hose clamps.

Pipe and Hose Clamp Torque Values

APPLICATION	APPROVED CLAMP	TORQUE	
		Nm	Lb-In
Radiator and Heat Exchanger Hoses	Constant-Torque CT-L	10.2-12.5	90-110
Heater Hoses	Constant Tension	not required	not required
Air Intake Pipes	Hi-Torque HTM-L	11.3-14.2	100-125
Plastic Air Intake Pipes	Constant- Torque CT-L	4.5	40 (maximum)
Charge Air Intake Hoses	Flex Seal 667	7.9-11.3	70-100
	B9296	6-7	50-60
Fuel, Oil & Water Heat Exchangers (for hoses less than 9/16 diameter)	Miniature 3600L	1.1-1.7	10-15

Master Lubrication Index

Lubricant Symbol Key	
ATF	MD3 or MERCON®-approved automatic transmission fluid
BB	High temperature ball bearing grease. Chevron SRI Mobile Grease HP, Texaco Multifax 2 or equivalent
CB	Engine oil for mild to moderate requirements
CC/CD	Engine oil for severe requirements (MIL-L-2104B /MIL-L-45199B w/ 1.85% max. sulfated ash content)
CD	Engine oil meeting API “Five engine test sequence”
CD50	SAE50W synthetic transmission fluid
CE	Engine oil meeting severe duty service requirements for direct-injection turbocharged engines
CJ-4	Engine oil for PACCAR MX and Cummins EGR engines
CL	Multipurpose chassis grease
EP	Extreme Pressure Lubricant (Lithium 12-hydroxystearate base NGLI 2)
GL	Straight mineral gear lubricant
HD	Hypoid Gear Oil, A.P.I. - GL-5, SAE 75W-90FE synthetic gear lubricant
HT	High Temperature grease (Timken Spec. 0-616)
MP	Multipurpose gear lubricant (MIL-L-2105B)
DOT3 or DOT4	Brake Fluid

NOTE
The responsibility for meeting these specifications, the quality of the product, and its performance in service rests with the lubricant supplier.

For oil reservoir with side filler plugs (transmission, axles, steering gear boxes, transfer cases, etc.) the oil must be level with the filler opening.

1 Improper Oil Level
2 Proper Oil Level

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.

Component Lubrication Index	
Universal Joints	EP*
Drive Shaft Splines	CL*
Steering Column	CL
Alternator Bearing	BB*
Fan Hub	BB*
Power Steering Reservoir	ATF
Steering Drag Link	CL
Steering Knuckles	CL
Spring Pins	CL
Clutch Release Bearings	BB
Brake Shoe Anchor Pins	HT
Brake Cam Bearings	HT
Slack Adjusters	CL
Starter Bearings	CC
Turbocharger Aneroid	CC
Water Pump	BB*
Suspension Fittings (other than threaded pins and bushings)	EP
Steering Axle: Grease Fittings on Steering Arm; Tie Rod Ends; Drag Link; King Pins	EP
Steering Shaft Grease Fittings	EP

Component Lubrication Index	
Brake Treadle Hinge and Roller	Engine oil
Lock Cylinders	Lock lubricant
Door Hinges	Not required - Teflon bushings
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 or DOT4 (Brake Fluid)
*Consult manufacturer or lubricant supplier for special details.	

Fuller Transmission Lubrication

Fuller transmissions are designed so that the internal parts operate in a bath of oil circulated by the motion of gears and shafts. Grey iron parts have built-in channels where needed to help lubricate bearings and shafts. All parts will be amply lubricated if these procedures are closely followed:

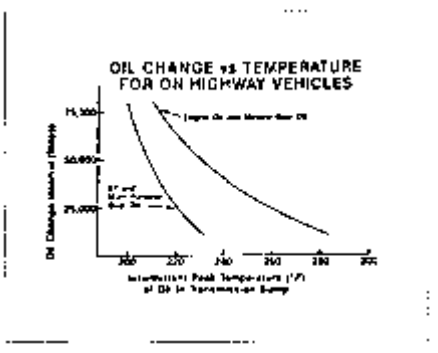
1. Maintain oil level; check it regularly.
2. Change oil regularly.
3. Use the correct grade and type of oil.
4. Buy oil from a reputable dealer.

Lubrication Change and Inspection Off-Highway Use

Refer to the Eaton Fuller transmission manual for servicing information.

Highway Use

- Refer to the Eaton Fuller transmission manual for servicing information.
- Refer to the oil change vs. temperature chart that follows for special oil change information. The “intermittent peak temperature” is the maximum temperature observed for a short time in a fully loaded vehicle performing normally.



CAUTION
Exceeding the recommended oil change intervals may be harmful to the life of the transmission and the transmission oil cooler.

Recommended Lubricants

Type	Grade (SAE)	Ambient Temperature
Heavy Duty Engine Oil MIL-L-2104B, C, or D; API - SF, or API-CD	50	Above 10° F (-12° C)
	40	Above 10° F (-12° C)
	30	Below 10° F (-12° C)
Mineral gear oil with rust and oxidation inhibitor API-GL-1	90	Above 10° F (-12° C)
	80W	Below 10° F (-12° C)
Synthetic Lubricant*	50	All
*See your dealer for approved brands.		

Allison Transmission Lubrication

Lubrication Change and Inspection

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

Spicer Transmission Lubrication

It is extremely important to use the proper lubricants and maintain the correct oil levels in Spicer units. This will ensure proper lubrication and operating temperatures in these units.

Recommended Lubricants

The lubricants listed below are recommended, in order of preference, for use in all Spicer mechanical transmissions, auxiliaries, and transfer cases. Do not use extreme pressure additives such as those found in multipurpose or rear axle-type lubricants. These additives are not required in Spicer transmissions, and may in some cases create transmission problems. Multipurpose oils, as a group, have relatively poor oxidation stability, a high rate of sludge formation, and a greater tendency to react with or corrode the steel and bronze parts.

Type	Grade (SAE)	Ambient Temperature
Heavy Duty Engine Oil MIL-L-2104D or MIL-L-46152B, API-SF or API-CD (MIL-L-2104B or C or MIL-L-46152 designations are acceptable)	30, 40, or 50	Above 0° F (-18° C)
	30	Below 0° F (-18° C)
Mineral gear oil (R and O type) API-GL-1	90	Above 0° F (-18° C)
	80	Below 0° F (-18° C)

Type	Grade (SAE)	Ambient Temperature
Synthetic Engine Oil meeting MIL-L-2104D or MIL-L-46152B, API-SF or API-CD	CD50 CD30	All
*Synthetic Gear Oil Meeting MIL-2105C or API-GL5	EP75W90 EP75W140	All
*EP Gear Oils are not recommended when lubricant operating temperatures are above 230° F (110° C).		

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 3000 miles (4800 km) but never longer than 5000 miles (8000 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 brakes. When adding oil, **do not** mix different types of oil.

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:

AVAILABLE ADVANCED LUBE AXLES			
RS-17-145	RS-23-180	RT-40-145	RT-44-145P
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

Meritor rear axles that do not appear on the list above will continue to require an initial drain at 3000-5000 miles (4800-8000 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 3000-5000 miles (4800-8000 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 5000 miles (8000 km) if converting to an Eaton-approved synthetic lube.
- Change the lubricant within the first 5000 miles (8000 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.

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 on page 5-45).

Oil-lubricated Nondriven Hubs

Use CD50 synthetic transmission fluid SAE 50W or equivalent. A minimum of 9 oz. (270 ml) of lubricant is required for proper lubrication of an LMS™ hub; 10-13 oz. (295-400 ml) is required for a non-LMS hub, depending on wheel design. Allow time for the fluid to seep through the bearings when initially filling a hub. When properly filled, the

fluid level will lie between the fluid level line and 1/4” above the line.

NOTE
Remember to replace vent plug when done.

Universal Joint Lubrication

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

Steering Gear Lubrication

Fluid Refill

The following recommendations are for general purpose steering systems (both TRW and Sheppard).

- For normal temperatures, use Automatic Transmission Fluid (ATF) Type E or F or Dexron® III.
- For cold temperatures of -22º F (-30º C) and above use ATF Type A.
- For extremely cold temperatures between -22º F (-30º C) and -40º F (-40º C) use ATF Type B.

Inspection

NOTE
Before removing reservoir cover, wipe outside of cover so that no dirt can fall into the reservoir.

1. Check the fluid level; add fluid if required.
2. Check fluid for contamination, discoloration, or burnt smell; correct source of such problems before replacing fluid and filter.

CAUTION
When adding fluid, be sure to use fluid of the same type. While many fluids have the same description and intended purpose, they should not be mixed due to incompatible additives. Mixing incompatible fluids may lead to equipment damage.

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

Introduction

WARNING!

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

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 brakes. Depleting air system pressure may cause the vehicle to roll unexpectedly resulting in an accident causing death or personal injuries. 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 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 death, personal injury, equipment or property damage.

WARNING!

Never attempt to disassemble a component until you have read and understood 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 death, personal injury, equipment or property damage.

WARNING!

Completely bypassing a Bendix® AD-IS 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 an AD-IS-series air dryer. Failure to comply may result in death, personal injury, equipment or property damage.

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

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 brakes 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.

WARNING!

If the supply and service tanks are not drained at the recommended frequency, water could enter the air lines and valves. This could cause corrosion or blockage, which could compromise the brake system safety and potentially cause an accident involving death or personal injury.

Daily

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

Periodically

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

Twice a Year

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

Air Dryer

The function of the air dryer is to collect and remove air system contaminants in solid, liquid and vapor form before they enter the brake system. It provides clean, dry air to the components of the brake system, which increases the life of the system and reduces maintenance costs.

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.

Every 900 operating hours or 25,000 miles (40,200 km) or every three (3) months check for moisture in the air brake system by opening air tanks, drain cocks, or valves and checking for presence of water.

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.

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.

Overhaul

Maintenance intervals typical for on-highway operation would be 2 - 3 years, 350,000 miles or 10,800 hours.

Maintenance intervals typical for high duty cycle usage such as transit bus, refuse hauler, dump truck, cement mixers and off-highway operation would be 1 year, 100,000 miles or 3,600 hours.

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

Bendix® AD-IS Series Air Dryer

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

WARNING!
If a different air dryer brand or model is installed on the vehicle other than what was originally installed, it could cause the air system to not perform correctly unless the full air system design is reviewed and modifications made to comply with Federal Motor Vehicle Safety Standards (FMVSS) 121 - Air Brake Systems. Failure to abide by this warning and maintain compliance to FMVSS 121 could cause loss of vehicle control and may lead to death or serious personal injury.

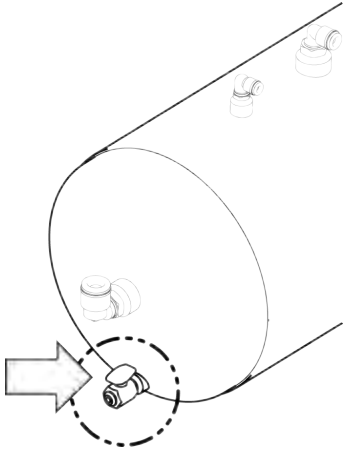
The AD-IS Series air dryer has incorporated into its design various

components that have typically been installed separately on the vehicle (see below for components/areas affected):

- Pressure protection valves
- Safety valve
- Governor 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-IS Series will require changes, modifications and/or additions to your vehicle's air system to maintain compliance with FMVSS 121.

Air Tanks



To eject moisture from the air system tanks, pull the line that is connected to the moisture ejection valve. Continue pulling until the air comes out free of water.

Daily: The supply and service air tanks, must be drained on a daily basis. Operate air devices daily to circulate lubricants within the unit.

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

⚠ WARNING!

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

CAUTION

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

- Maintain the air compressor to prevent excessive oil bypass.
- Replace worn seals in valves and air motors as they are needed. Your authorized dealer carries rebuild kits for most units.

Air Gauges and Air Leaks

Your vehicle comes with air pressure gauges for two separate systems, Primary and Secondary: the Primary gauge indicates pressure in the rear braking system; the Secondary gauge indicates pressure in the front braking system. Each gauge indicates the amount of air pressure in pounds per square inch (psi).

WARNING!

Do not operate the vehicle if leakage in the air system is detected. Conduct the following procedure and 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 and may result in death, personal injury, equipment or property damage.

If the light and alarm do not turn off at start-up, do not try to drive the vehicle until the problem is found and fixed. If the pressure in either or both systems is too low for normal brake operation, i.e., the pointer of one gauge falls below 65 psi (448 kPa), a warning light on the gauge will glow and the audible alarm will sound.

NOTE

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

Primary Air Pressure Gauge

Secondary Air Pressure Gauge

Follow the procedure below to check the compressed air system for leaks:

1. Periodically, or after maintenance or replacement of air system components:
2. Build up air pressure in the system to the governor cutout point or until 120 psi (827 kPa) is reached.
3. Stop the engine and release the service brakes.
4. Without applying the brake pedal, observe the rate of air pressure drop. This rate should not exceed 2.0 psi (14 kPa) per minute.
5. Start the engine and build up the air pressure again.
6. Stop the engine, and apply the brakes fully. Apply the brake pedal and hold it down for five minutes. The pressure drop should not exceed 3.0 psi (21 kPa) per minute.
7. 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

Operation

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 120 psi (827 kPa) and compression is reestablished when system pressure falls to 100 psi (690 kPa).

Preventive Maintenance

The following service checks are provided for your information only and should be performed by a certified mechanic. 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 so 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.

CAUTION
When draining the engine cooling system is required, to prevent damage from freezing, the compressor must also be drained at the cylinder head and block. Engine damage could occur if the cooling system is not periodically drained and maintained. See Cooling System on page 5-82 for further information.

BRAKE SYSTEM

Brake Adjustment

WARNING!

Do not work on the brake system without the parking brake set and wheels chocked securely. If the vehicle is not secured to prevent uncontrolled vehicle movement, it could roll and cause death, serious personal injury or damage to the vehicle.

To operate your vehicle safely and profitably, you need some understanding of its brake systems. For more on brakes, see the Index, under Brakes.

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.

CAUTION

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.

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
  a. Cam Radius
  b. Wedge Angle
  c. Drum Radius
  d. Brake Linings
  e. Brake Chambers
  f. Slack Adjusters
- Disc Brakes
  a. Disc Rotors

WARNING!

Do not use any replacement part in the brake system unless it conforms exactly to original specifications. A nonconforming part in your vehicle's brake system could cause a malfunction resulting in an accident causing death or personal injury. Sizes and types are so related to one another that a seemingly unimportant change in one may result in a change in how well the brakes work for you on the road. If parts do not work together properly, you could lose control of your vehicle, which could cause a serious accident.

All vehicle operators should check their brakes regularly.

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.

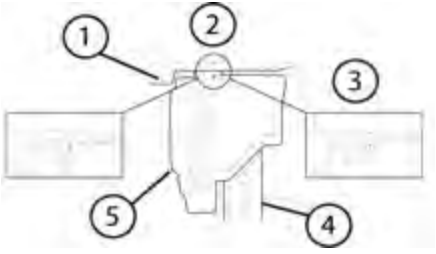
Air Disc Brakes

Have brake pads inspected by a qualified mechanic for wear at regular intervals according to the Preventive Maintenance Schedule on page 5-12. In severe service or off-highway applications inspect the linings more frequently.

Regularly inspect for pad/rotor wear:

- Park on level ground and chock the wheels.
- Temporarily release the parking brakes.
- Compare the relative position of two notches; one located on the caliper and the other on the carrier. See the illustration below to determine if the brakes require a detailed inspection by a qualified mechanic.

- Have a qualified mechanic perform a detailed inspection if the notches are not found. The pads and rotors should be measured and compared against the manufacturer's specifications located in the brake manufacturer’s service manual.



Caliper Detail

1. Brake Caliper Assembly
2. Location of Inspection Grooves
3. Notches Line-Up (Time to schedule inspection of Pads and Rotors)
4. Brake Rotor
5. Brake Carrier Assembly

Regularly inspect caliper for Running Clearance:

- Stop the vehicle on level ground and let the brakes cool down. Hot brake calipers can burn skin on contact.
- Chock the wheels.
- Temporarily release the parking brakes.
- Grab the caliper and move it. This movement is Running Clearance.
- Proper Running Clearance is 0.08 inch (2 mm) of movement of the brake caliper (approximately the thickness of a nickel) in the inboard/outboard direction.
- Have a qualified mechanic provide further inspection if the caliper does not move or appears to move more than the specified clearance.

Drum Brakes

Have brake drum linings and disc brake pads inspected by a qualified mechanic for wear at regular intervals according to the maintenance schedule. In severe service or off-highway applications inspect the linings more frequently.

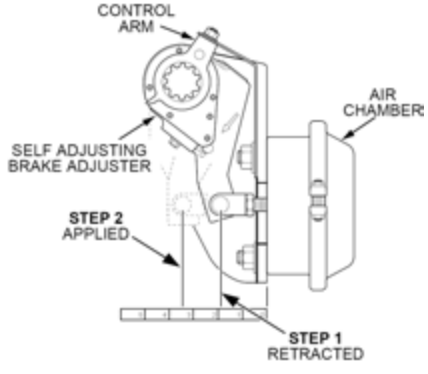
Automatic Slack Adjusters

Periodically check the Brake Chamber Stroke. Replace the slack adjuster if proper stroke cannot be maintained.

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



Brake Chamber Stroke

WARNING!

Manual adjustment of automatic slack adjusters is a dangerous practice that could have serious consequences. It gives the operator a false sense of security about the effectiveness of the brakes. Contact the Service Department at your dealership if the stroke exceeds the above specifications. A stroke exceeding these values may indicate a problem with the slack adjuster or the brake foundation.

CAB

Exterior Maintenance

Painted Surfaces

Wash painted surfaces frequently to remove grime and caustic deposits which may stain the finish. See Cleaning, Protecting, and Weather Stripping on page 5-72.

Chrome and Aluminum Surfaces

To prevent rust, keep chromed parts clean and protected with wax at all times, especially in winter conditions where 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 warm 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 soap solution will help. Rinse thoroughly.

Tail Pipe Surface Cleaning

WARNING!

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

To maintain your quality finish, wash with a soft cloth, mild 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.

Stainless Steel

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, therefore, 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 because minute particles of the steel wool can embed in the surface of the stainless steel and cause rust staining.

Cleaning, Protecting and Weather Stripping

Frequent washings of the vehicle are required to remove 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. But to allow enough time for your truck's finish to cure, wait about 30 days after the date of manufacture before waxing. 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.

Vehicle Cleaning

Precautions

WARNING!

Handle cleaning agents carefully. Cleaning agents may be poisonous. Keep them out of the reach of children. Failure to comply may result in death, personal injury, equipment 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 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 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 or property damage.

- 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 industrial fumes, ice, snow, corrosive road salt, etc., to name just a few causes. A well-cared-for vehicle can look like new many years later. Regular and correct care will contribute to maintaining the beauty and the value of your 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.

CAUTION
Do not aim the water jet directly at door locks or latch. Tape the key holes to prevent water from seeping into the lock cylinders. Water in lock cylinders should be removed with compressed air. To prevent locks from freezing in the winter, squirt glycerin or lock deicer into the lock cylinders.

Washing the Exterior

1. Begin by spraying water over the dry surface to remove all loose dirt before applying the car wash and wax solution.
   - 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.
   - Use cool or warm water and a mild, household type soap. Strong industrial detergents and cleaning agents are not recommended.
   - 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 surfaces frequently while washing to flush away dirt that might scratch the finishes during the washing operation.
4. 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.
5. Remove road tar with an automotive type tar remover or mineral spirits.
6. After cleaning and drying, apply a quality automotive wax.

NOTE

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

- Do not apply wax in the hot sun.
- Never dust off dry surfaces with a cloth because it will scratch the finishes.

Cleaning the Chassis

- Hose dirt and grime from the entire chassis. Then, if an oil leak develops, you will be able to detect it easier.
- Corrosive materials used for ice and snow removal and dust control can collect on the underbody. If these materials are not removed, accelerated corrosion (rust) can occur on underbody parts such as fuel lines, frames, floor pan, and exhaust system, even though they have been provided with corrosion protection.

At least every spring, flush these materials from the under body with plain water. Be sure to clean any area where mud and other debris can collect. Sediment packed in closed areas of the frame should be loosened before being flushed. If desired, your dealer can do this service for you.

Cleaning Interior Vinyl and Upholstery

- 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. Follow instructions on the container.

Passenger Door Lower View Window

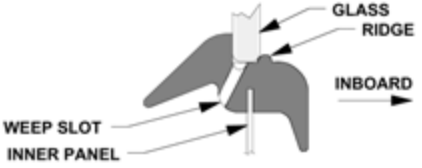
There may be occasions when the inner view window must be removed for maintenance cleaning and/or damage. Follow this procedure when installing and removing an inner view window. The recommended tool for removal of the glass is a glass stick, although other tools may be used provided proper caution is observed.

CAUTION

The use of screwdrivers, gasket tools, knives or other similar instruments may damage the seal or break the glass. Use a glass stick as a tool whenever possible when removing or installing a window. If another tool must be used, exercise extreme care when performing this procedure with such a tool.

NOTE

Always make sure that a gasket is installed properly so the weep slots will be indexed correctly. The notch in the gasket is to face forward on the RH side. This places the weep slots at the bottom of the window opening (see next illustration).There is a ridge on the bottom surface of the gasket (see next illustration). Install the glass outboard of this ridge. The polished satin finish on the glass, which leaves a rounded edge, rests against the edge of the ridge.The installation and removal will be easier by using water or soap as a lubricant on the edge of the glass.



To install a window, slide the glass from the rear of the door toward the removal slot until the forward edge of the glass is against the inside edge of the seal (see next illustration; arrow indicates forward).

When the forward edge of the glass reaches the forward inside edge of the seal, the glass should pivot outboard into the remaining seal (see arrow in next illustration).

Press and slide the glass into the aft portion of the seal to seat it.

To remove an inner view window, insert the glass stick into the removal slot, then use the glass stick to push the glass as far aft as possible.

Use the glass stick to leverage the glass out of the seal.

Continue this process along the entire front edge of the seal until the glass is free.

Safety Restraint System - Inspection

The seat belt system, including webbing, buckles, latches, and mounting hardware, endures heavy use in heavy-duty vehicles, much more than seat belt systems in passenger cars. All users should be aware of the factors contributing to this heavy use and reduced belt life.

WARNING!

Failure to properly inspect and maintain restraint systems can lead to injury or loss of life. Without periodic inspection and maintenance to detect unsafe conditions, seat restraint components can wear out or not protect you in an accident.

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 safety 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.

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.

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 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.

Seat Belt Inspection Points

1 Web cut or frayed or extremely worn at latch area.
2 Web cut or frayed at D-loop web guide.
3 Comfort Clip cracked or damaged.
4 Buckle casting broken.
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 Web for deterioration, due to exposure to the sun

⚠ WARNING!

Failure to adjust tether belts properly can cause excessive movement of the seat in an accident. Tether belts should be adjusted so that they are taut when the seat is in its most upward and forward position. Failure to comply may result in death or personal injury.

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.

Windshield Wiper/Washer

The windshield wiper system is maintenance free. Check wiper blades annually or every 60,000 miles (96,000 km).

Washer Reservoir

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

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

COOLING SYSTEM

Cooling system maintenance

Your engine's cooling system is standard with Extended Life Coolant (ELC). ELC consists of a mixture of ethylene glycol, water, and organic acid technology chemical inhibitors. ELC prevents corrosion and scale formation as well as provides freezing and boiling point protection.

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 manufacturer's owner's manual. It is the owner's responsibility to follow all requirements listed in the engine manufacturer's owner's manual.

What to Check in an ELC-filled Cooling System
ELC Concentration

Check the level of freeze/boilover protection, which is determined by the ELC concentration. Use a glycol refractometer to determine glycol level. Add ELC to obtain the ELC to water ratio required to provide the protection you need. Use the chart below to help determine how much ELC you need to add.

NOTE

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

In an ELC-filled cooling system, the freeze point should be maintained between -30° F and -45° F (-34° C and -43° C).

Desired ELC/Water ratio:																
10%	15%	20%	25%	30%	35%	**40%**	**45%**	**50%**	**55%**	**60%**	65%	70%	75%	80%	85%	90%
Freeze point °F (°C)																
+25 (-4)	+20 (-7)	+15 (-9)	+10 (-12)	+5 (-15)	-5 (-21)	-12 (-24)	-23 (-31)	-34 (-37)	-50 (-46)	-65 (-54)	-75 (-59)	-84 (-64)	-70 (-57)	-55 (-48)	-43 (-42)	-30 (-34)
Items in bold are the recommended levels of concentration.																

ELC Condition (Contamination and Inhibitor Concentration)

Perform a visual inspection of the ELC. 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 ELC manufacturer's representative for recommended ELC test kits, test strips, and laboratory sample procedures.

ELC Extender

Add ELC extender if necessary at the maintenance interval under "Cooling".

Coolant Filter

If your vehicle came with a non-chemical filter ("blank filter"), replace it only with a blank filter at the interval specified in the Preventive Maintenance Schedule on page 5-12. Never use filters that contain SCAs in an ELC-filled system.

Topping Off

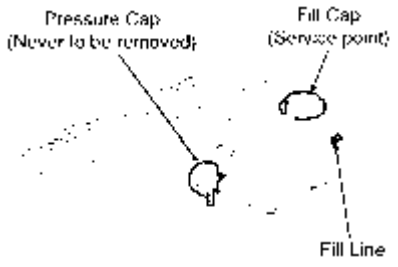
WARNING!

Removing the fill cap on a hot engine can cause scalding coolant to spray out and burn you badly. If the engine has been in operation within the previous 30 minutes, be very careful in removing the fill cap. Protect face, hands, and arms against escaping fluid and steam by covering the cap with a large, thick rag. Do not try to remove it until the surge tank cools down or if you see any steam or coolant escaping. In any situation, remove the cap very slowly and carefully. Be ready to back off if any steam or coolant begins to escape.

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.

Top off the cooling system when coolant does not rise to the level indicated as 'MIN' on the surge tank. The surge tank is translucent which allows the coolant level to be seen. Add coolant through the surge tank fill cap. Do not remove the pressure cap to fill the cooling system.



Surge Tank

NOTE

Do not use the pressure cap to fill the surge tank with fluid.

Proper Coolant Level

NOTE

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

- 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 fluid if the surge tank level does not rise to the “MIN” line regardless if the system is hot or cold.

Refilling Your Radiator

1. If your cooling system is built with drain valves in the upper engine coolant pipe, open them before filling the surge tank.
2. Close any open coolant drains in the system.
3. Remove the surge tank fill cap (do not remove the surge tank pressure cap).
4. Fill the system with premixed coolant through the surge tank fill cap. Pour coolant at a steady flow rate until the surge tank is full (to the base of the fill neck). It may be necessary to pause for 1 minute and then re-fill if the fluid level dropped.
5. Close any drain valves that were opened in Step 1.
6. Start the engine and idle at low RPM.
7. During low rpm idle, air will purge from the cooling system which will lower the coolant level in the surge tank. Continue to fill the surge tank until the coolant level remains approximately ½ in. above the "MIN" line. This may take up to 2 minutes, depending on the outside temperature.
8. Operate the engine throttle until the operating temperature stabilizes (when the thermostat opens).
9. Fill the surge tank as necessary to raise the coolant level to ½ in. above the “MIN” level.
10. Operate the engine at high idle for another 10 minutes and then fill the surge tank again to ½ in. above the “MIN” level.
11. Replace the surge tank fill cap.

Check the coolant level after each trip. Add coolant as necessary. You may find your coolant level is not up to the correct level soon after you have filled the radiator. This may be because all the trapped air in the system has not yet been purged. It takes a little time for all of the air to leave the system after you fill your radiator.

Engine (Block) Heater

WARNING!

Do not use the heater if there are any signs of problems. Engine block heaters can cause fires resulting in death, personal injury, equipment or property damage if not properly maintained and operated. Regularly inspect the engine block heater wiring and connector for damaged or frayed wires. Contact your authorized dealer or the manufacturer of the heater if you are in need of repairs or information. Failure to comply may result in death, personal injury, equipment or property damage.

CAUTION

Always unplug the block heater before starting your engine. Damage to the cooling system could occur if not turned OFF (unplugged).

Use a solution of half ethylene glycol antifreeze and half water for best heater performance. Do not use more than 65 percent concentration of antifreeze, as a shortened heater life will result.

After servicing the cooling system, operate the vehicle for a day or two before using the heater. Trapped air inside the engine needs time to escape.

ELECTRICAL

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 vehicles 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.

Low Voltage Disconnect (LVD)

Purpose

The LVD may increase battery life and prevent unnecessary jump start conditions by ensuring that an unattended load does not deplete the battery charge to a level that will prevent you from starting your vehicle.

Operation

The LVD will disconnect non-vital battery loads when battery voltage drops below 12.3V for 3 minutes and the key switch is in the ACC or OFF position. During the last 2 minutes the LVD will emit a slow audible beep. 30 seconds before disconnecting loads the alarm will change to a fast beep. The battery voltage must come back up above a certain voltage before the LVD will reset.

See an authorized dealer if the LVD fails to reconnect loads during normal operation.

Circuits Disconnected By LVD

- Cab Dome Lamps
- Cab Accessories
- Spare Battery A and B

NOTE

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

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 RP-136. 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.

Light Bulbs

WARNING!

Optional HID headlights have high voltage circuits and should only be serviced by a trained technician. Attempting to service the HID ballast without proper training may result in severe electrical shock which could lead to death or personal injury.

Headlight Replacement

Turn the bulb lock ring counterclockwise and remove the bulb. Do not allow the glass of the new headlamp bulb to come into contact with anything. The glass could become contaminated and cause bulb failure. Reassemble in reverse order.

Headlight Aiming

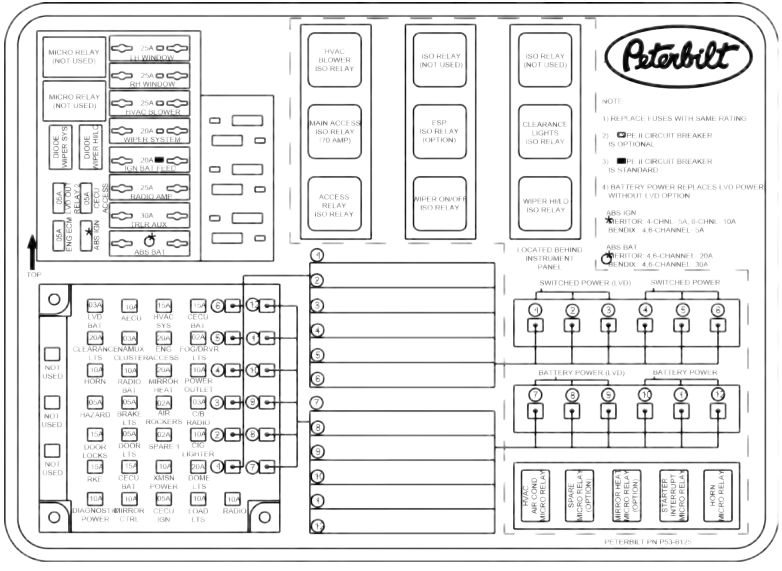
The headlights were properly aimed at the factory to meet safety specifications. If the headlights need to be adjusted, please have an authorized dealership aim the headlights.

Bulb Specifications

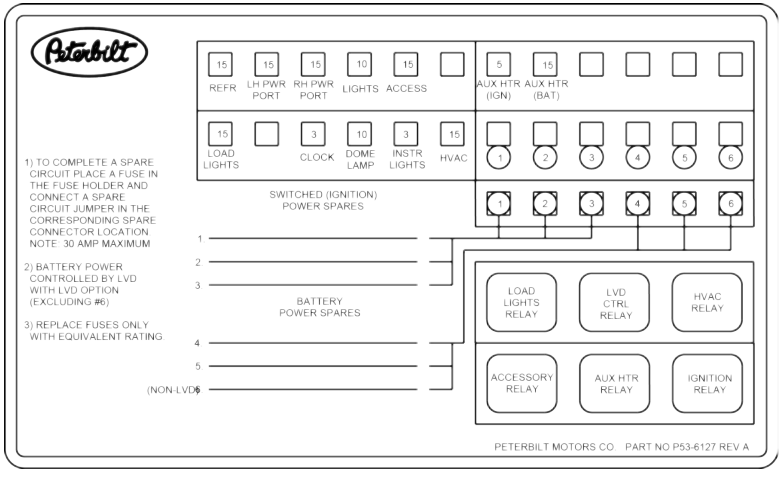
Bulb Location	Type of Bulb
Low Beam Halogen	H11-LL (SAE), H7 (ECE) (long life version not required)
Low Beam HID	D1-S
High Beam Halogen	HB3A – LL (long life version not required)
Daytime Running Lamp/ Position Lamp/Turn Signal/ Side Marker	4157K (SAE), 3157K (ECE)
Rear tail light/ Turn Signal	Not applicable – LED lighting
Interior map/dome/ indirect light	Not applicable – LED lighting

Fuses, Circuit Breakers and Relays

Fuses, circuit breakers, and relays are located in the Power Distribution Box to the left of the steering column behind the clutch pedal. Additional fuses are located in the engine compartment (driver's side bulkhead) and also in the sleeper under bunk storage compartment.



In-Cab Fuse Label



Sleeper Fuse Label

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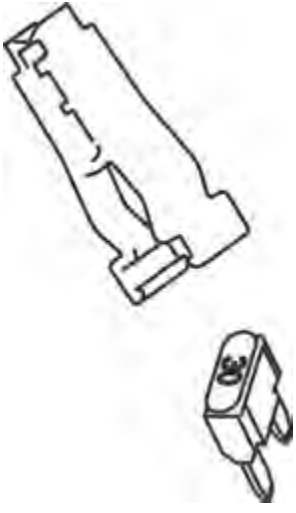


Fuse Puller

Fuse Inspection and Replacement

If a fuse is blown, see What to do if fuse or relay blows in the Driving and Operating Instructions manual.

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.

CAUTION

Follow all manufacturers' circuit protection recommendations for the components and wires being added. Failure to comply may result in equipment damage.

NOTE

If you are unfamiliar with proper electrical repair practices and procedures, see your authorized dealer for assistance.

NOTE

Easy addition of circuits is provided by plug-in connectors that have a ground and a power wire.

For proper electrical system performance, refer to a wiring diagram for your chassis before adding electrical options.

WARNING!

Never install a circuit breaker in a circuit that is designated as “fuse-only” circuit(s). Fuse-only circuits are marked with an * on the reverse side of the Power Distribution Box cover. Using a circuit breaker in those fuse-only circuits may cause the circuit to overheat when a short exists which could lead to equipment damage and/or personal injury.

Batteries

Battery Access

The vehicle is originally equipped with three or four batteries. Replacement batteries must meet the following specifications: maintenance-free, group 31 size, threaded stud, 12V/ 650 cold cranking ampere (CCA), and 160 minutes of reserve capacity.

The battery compartment is located on the left side of the vehicle, under the cab access steps.

1. Remove the 6 bolts that are located in the 2 cab access step plates.
2. Remove battery cover for access.

In-Cab Battery Box

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. Remove 6 fasteners securing the passenger side seat base to the battery box assembly.
2. Remove the seat and seat base as one unit to gain access to the batteries.

WARNING!

Replace only with AGM (Group 31) batteries. Use of other batteries could result in acid leaks causing personal injury in the event of a vehicle accident. Failure to comply may result in death, personal injury, equipment or property damage.

WARNING!

Battery cables and air/electrical harnesses are mounted to the bottom of the floor. Do not drill or screw into floor pan without first checking the location of the cables, harnesses or any other component that might be damaged. Damaging any component could result in electrical shock which could cause personal injury and/or loss of a critical truck system. Failure to comply may result in death, personal injury, equipment or property damage.

WARNING!

Electrical damage or battery explosion can occur when improperly charging batteries. Refer to the Battery Charging on page 5-97 for appropriate charging instructions. Failure to comply may result in death, personal injury, equipment or property damage.

WARNING!

Batteries release gases that are flammable. Batteries are equipped with vent tubes and flash arrestors which vent battery gases out of the cab. Ensure all vent tubes, flash arrestors and grommets are properly installed and ensure they are clear and functioning properly. Failure to reinstall or keep the vent tubes and grommets clear or ensure the flash arrestor(s) are functioning properly could result in personal injury or equipment damage. Failure to comply may result in death, personal injury, equipment or property damage.

CAUTION

Do not store other items in this battery box. Failure to comply could result in damage to the truck 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 purges to prevent damage from freezing. If your vehicle is equipped with battery disconnect switches, do NOT disconnect battery power within two minutes of switching the ignition key off. Failure to comply may result in vehicle or property damage.

Removing and Installing Batteries:

1. Be sure all switches on the vehicle are turned OFF.
2. Wait 2 minutes after turning ignition off then disconnect negative ground cable first.
3. Disconnect positive cable.
4. Unscrew bolt of holding plate with 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.

NOTE

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

Follow the procedure below to reinstall batteries on the vehicle:

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

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.

Replacing Parts Removed for Access

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

WARNING!

Always reinstall the steps before entering the cab. Without the steps you could slip and fall, resulting in possible injury to yourself.

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.

WARNING!

Before attempting any work on the batteries or electrical system, remove all jewelry. If metal jewelry or other metal comes in contact with electrical circuits, a short circuit may occur causing you to be injured, as well as electrical system failure and damage.

Battery Care

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

Except for using small trickle charges to maintain battery condition, you should have your vehicle's batteries charged by a qualified service facility.

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 death, personal injury, equipment or property damage.

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 petroleum jelly or commercially available, noncorrosive, nonconductive terminal coatings.
- 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 competent mechanic with the proper equipment.

Slow Battery Charging

NOTE
Follow the instructions that come with your battery charger.

- It is not necessary to remove the battery from the compartment.

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 death, personal injury, equipment or property damage.

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.

1. Disconnect the battery cables.
2. Connect charger cables.
3. 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.
4. After charging, turn OFF charger and disconnect charger cables.

Electrical and Alternator Precautions

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 remote keyless entry system may become inoperative due to a key fob battery. If you have issues with a key fob, replace the battery and re-synchronize the key fob. In some situations, the key fob may need to be replaced and in others, a fuse may have failed and may render both key fobs inoperative.

Contact your dealer for more help if a key fob does not work and it is not because of a bad battery.

ENGINE

Engine Maintenance

WARNING!

Exhaust fumes from the engine contain carbon monoxide, a colorless and odor less 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 and cause death or personal injury.

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 vehicles cab ventilation system properly maintained. It is recommended that the vehicles exhaust system and cab be inspected:

- By a competent technician every 15,000 miles,
- Whenever a change is noticed in the sound of the exhaust system,
- Whenever the exhaust system, underbody or cab is damaged.

5

Engine Lubrication

Refer to the engine manufacturer's Engine Operation and Maintenance Manual supplied with your vehicle for information about draining and refilling engine oil, engine crank case capacity, engine oil type, and changing oil filters, etc.

WARNING!

Hot engine oil can be dangerous. You could be burned. Let the engine oil cool down before changing it. Failure to comply may result in death, personal injury, equipment or property damage.

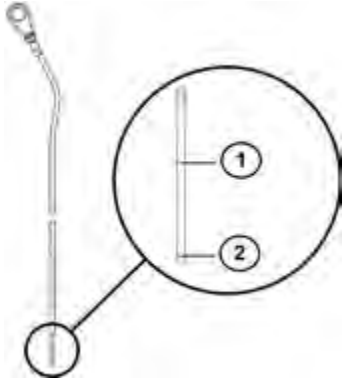
Inspection of the Engine Oil Level

NOTE

It takes approximately 15 minutes for all the oil to run into the sump when the engine is 'warm.' If the level is checked immediately after switching off the engine, the dipstick will show a low oil level.

1. Make sure that the vehicle frame rail is standing on a flat and level surface.
2. Make sure that the vehicle is horizontal, both lengthwise and crosswise. Check this carefully on a vehicle with air suspension. Note that the engine may be inclined up to 4° depending on the vehicle model and wheelbase.
3. Twist the dipstick handle to unlock it, then pull the dipstick out of the holder.
4. Wipe the dipstick clean with a lint-free cloth.
5. Place the dipstick back into the holder.
6. Pull the dipstick out again and check the oil level. The oil level should always be between the 2 marks on the dipstick.

7. Reinstall the dipstick and twist to lock it in place.



1. Engine Oil High Level
2. Engine Oil Low Level

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 Clamps

Use the following table for torque specifications to check pipe and hose clamps.

Pipe and Hose Clamp Torque Values

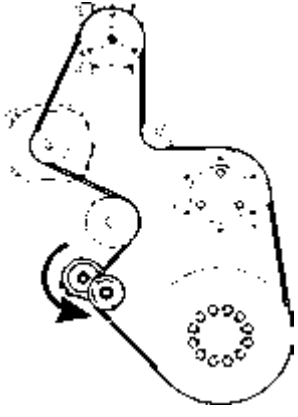
APPLICATION	APPROVED CLAMP	TORQUE	
		Nm	Lb-In
Radiator and Heat Exchanger Hoses	Constant-Torque CT-L	10.2-12.5	90-110
Heater Hoses	Constant Tension	not required	not required
Air Intake Pipes	Hi-Torque HTM-L	11.3-14.2	100-125
Charge Air Intake Hoses	Flex Seal 667	7.9-11.3	70-100
	B9296	6-7	50-60
Fuel, Oil and Water Heat Exchangers (for hoses less than 9/16 diameter)	Miniature 3600L	1.1-1.7	10-15
Exhaust Clamps	Breeze V-Band	54	480

Accessory Drive Belts

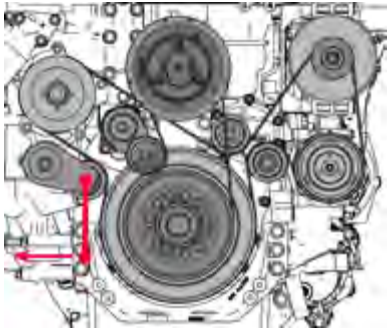
You can extend the reliability and service life of your vehicle's drive belts with proper attention to installation, and maintenance. Neglect could cause belt failure. The result could be the loss of the electrical or air system as well as possible engine damage from overheating. So it's a very good idea to check your belts frequently and replace them as soon as you detect trouble.

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.



Cummins Belt Routing



PACCAR MX Belt Routing

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

5

Engine Fan

WARNING!

Do not work on the fan with the engine running. The engine fan can engage at any time without warning. Before turning on the ignition, be sure that no one is near the fan. Failure to comply may result in death or personal injury.

Your truck may be equipped with an On/Off or Viscous Fan Drive. Follow these guidelines to check your engine fan:

- Check the fan bearings for fan hub bearing looseness, loss of lubricant and any abnormal conditions. (For example, fan belt misaligned or excessive wear/damage.) Before starting the engine and with the engine off, look and feel for looseness in the fan hub.
- 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.

Fan Drive and Blade

WARNING!

Do not work on the fan with the engine running. The engine fan can engage at any time without warning. Before turning on the ignition be sure that no one is near the fan. Failure to comply may result in death or personal injury.

Fan Blade Clearance: Around the fan shroud, the recommended distance 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 not correct.
- 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

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

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.

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.

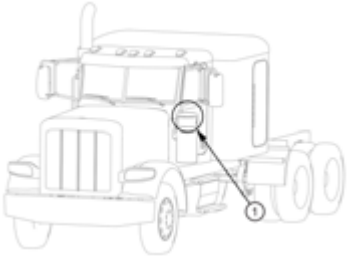
High Frequency Vibration: Vibration may indicate turbo rotor imbalance. Have your dealer investigate this immediately. If you detect any deficiencies, take the vehicle to an authorized dealer for servicing. Delay could lead to severe and expensive damage to your vehicle.

Air Cleaners

The following service information is basic to all air cleaner makes and models.

CAUTION
Failure to replace air filter at proper intervals may result in passage of dirt/debris into the engine or the "dusting" of an engine resulting in significant engine damage.

Service the air cleaner filter elements as specified in the Preventive Maintenance Schedule on page 5-12. This vehicle is equipped with an air inlet restriction indicator. Service the filter elements when the air inlet restriction indicator locks in the extreme Up position. Paper elements require care and proper handling because they are critical to engine service life. If your vehicle has an external air cleaner and cab-mounted mirrors, the mirror must be pivoted to provide access for servicing the filter element.

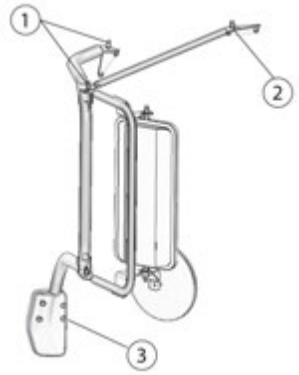


Replacing the Engine Air Intake Filter

1. Loosen (do not remove) upper 5/16 in. mounting hardware.
2. Remove acorn nut and flat washer, then pivot upper stabilizer rod away from cab.
3. Loosen the two rearmost M6 hex socket head screws on the lower clamp.

NOTE

The two forward screws secure the cover to the base. The two rearmost screws provide the clamping force on the main support tube.



1. Steps 1 and 6
2. Steps 2, 5, and 6
3. Steps 3 – 7

4. Rotate the main support tube rearward to provide clearance to remove and replace the air cleaner filter element.

CAUTION

To prevent possible engine damage, torque the four hex nuts attaching the air cleaner cover assembly to the body assembly to 8 Lb. ft. (10 N.m) after installing the new air cleaner filter element.

5. After installation of the new filter element, rotate the main support tube forward and reinstall the upper stabilizer rod to its mounting bracket.
6. In any sequence, tighten the upper fasteners to a torque of 13 - 17 Lb. ft. (17 - 23 N.m).
7. Tighten the two rearmost screws in the lower clamp to a torque of 4 - 4.5 Lb. ft. (5 - 6 N.m).

ServiSignal™ Mini Indicator

The ServiSignal™ Mini Indicator is installed on the air cleaner or air induction piping so it has access to clean filtered air. As the filter plugs and restriction increases, a red flag appears in the window. When it reaches the red zone, the air filter should be replaced. The indicator can be reset by pressing the button at the end of the indicator.

Exhaust System

The exhaust system is part of the noise and emission control system. Periodically check the exhaust for wear, exhaust leaks, and loose or missing parts. For details see Noise Emission Control on page 5-123.

Please refer to the Engine Operator's Manual for more details on how to maintain the emission's components in the exhaust system.

Please refer to the aftertreatment manual for emissions related components such as the DEF system and DPF.

Engine Mounting

Periodic Inspection: Inspect engine mounts every 60,000 miles (96,560 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 Nm).

CAUTION
Do not re-torque 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 the new bolts. Failure to comply may result in equipment or property damage.

FUEL SYSTEM

Location of Fuel Shut-off Valves

Fuel shut-off valves for the fuel crossover line are on the bottom of the secondary fuel tank, at the crossover line connection. They are optional on the primary fuel tank.

Specification

Use only diesel fuel as recommended by engine manufacturers.

WARNING!

A mixture of gasoline or alcohol with diesel fuel in the presence of an ignition source (such as a cigarette) could cause an explosion resulting in death or personal injury. Use only the recommended diesel fuel.

CAUTION

If anyone ever pours gasoline into your fuel tank, drain the entire system. Otherwise, the pump and engine will be damaged. Don't try to dilute the gasoline by adding diesel fuel (See Warning above).

Fuel Filters

See Engine Manufacturer's Operator Manual provided with this chassis or the instructions provided with a Fleetguard filter.

FRAME

Introduction

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 death, personal injury, equipment or property damage.

Emergency Welding

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.

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.

Welding Precautions

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 Maintenance

Proper preventive maintenance is essential to trouble-free service and safe operation of the fifth wheel.

Every 15,000 miles or monthly:

- 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).

Every 60,000 miles or 6 months:

- 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.”

Frame Fastener Torque Requirements

Tighten all frame fasteners with a torque wrench. Torque specifications apply to the following fasteners with lightly lubricated threads.

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

Standard Grade 8 UNF or UNC and Metric

FASTENER SIZE	TORQUE *	
	Nm	Lb-Ft
5/16	22-30	16-22
3/8	41-54	30-40
7/16	75-88	55-65
1/2	109-122	80-90
9/16	156-190	115-140
5/8	224-265	165-195
3/4	394-462	290-340
7/8	517-626	380-460
1	952-1,129	700-830
1-1/8	1,346-1,591	990-1,170
1-1/4	1,877-2,217	1,380-1,630
METRIC WITH NYLON INSERT NUTS		
M5	8-12	6-9
M6	9-15	7-11
M8	23-31	17-23
M10	33-43	24-32

FAS-TENER SIZE	TORQUE *	
	Nm	Lb-Ft
M12	75-101	55-75
M16	163-217	120-160
M20	352-460	260-340

* ESNA Style Lock Nut, with nylon insert. Lubricate nylon insert nut lightly with SAE 20/30 oil.

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

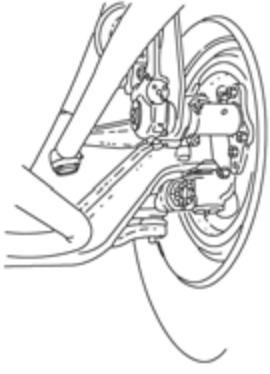
Axle Lubrication

Change bearing lubrication when seals are replaced, or brakes are relined. See Preventive Maintenance Schedule on page 5-12.

Thoroughly clean hubs and bearings with solvent and a stiff bristle brush, then dry and inspect components for wear or damage. Re-lubricate with approved axle lubricant.

Kingpin Lubrication

Lubricate with approved lubricant. Lubricate knuckle thrust bearings, knuckle pins, and tie rod ends. See Preventive Maintenance Schedule on page 5-12. Lack of lubrication causes premature wear and hard steering. Lubrication schedule may be shortened if necessary.



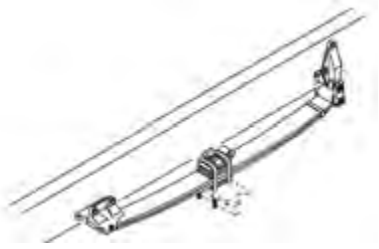
Suspension Lubrication

Each standard spring anchor pin has a grease fitting. Pressure lubricate spring pins as specified. See Preventive Maintenance Schedule on page 5-12.

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 fasteners, abnormal wear, or damage. However, even with proper maintenance, the service life of leaf springs is affected by many factors, such as: 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.

Visually inspect shock absorbers and rubber bushings.

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.

U-Bolt Torque

It is important that U-bolts remain tight. Severe use of your vehicle will cause them to loosen faster. But 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!

Do not operate the vehicle if the U-bolts are not properly tightened. Loose U-bolts will cause the axle to not be properly secured to the suspension, which could cause loss of vehicle control and an accident. Loose U-bolts can also cause uneven tire wear and poor alignment. 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 mechanic.

Tighten U-bolt nuts to the specified torque value with the vehicle loaded to its normal gross weight. The following torque values apply to U-bolts and nuts with clean threads lubricated with Chevron zinc lubricant (SAE 20 or 30 oils acceptable but not preferred).

⚠ 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 U-bolts and nuts of SAE Grade 8 specification or better. Failure to comply may result in death, personal injury, equipment or property damage.

Front Spring Suspension U-Bolts, Grade 8

U-BOLT SIZE DIAMETER (Inch Dimensions)	TORQUE	
	Nm	Lb-Ft
3/4	333-408	245-300
7/8	598-734	440-540

U-BOLT SIZE DIAME-TER (Inch Di-mensions)	TORQUE	
	Nm	Lb-Ft
1	925-1,060	680-780
1-1/8	1,470-1,660	1,080-1,220
1-1/4	1,890-2,120	1,390-1,560
1-1/2	3,130-3,860	2,300-2,840

HEATER AND AIR CONDITIONER

Introduction

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 as follows:

- Inspected by a competent technician every 15,000 miles
- Whenever a change is noticed in the sound of the exhaust system
- Whenever the exhaust system, 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!

Excessive heat may cause the pressurized components of the air conditioning system to explode. Never weld, solder, steam clean, or use a blow torch near any part of the air conditioning system. 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

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

CAUTION

During extreme cold weather, do not blow hot defroster air onto cold windshields. This could crack the glass. Turn the air direction lever to Defrost and adjust the fan speed accordingly while the engine warms. If the engine is already warm, move the temperature selector to Cool, then gradually increase the temperature when you see that the windshield is starting to warm-up.

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 with the right facilities to do the job. Failure to comply may result in death, personal injury, equipment or property damage.

- 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

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necessary. Small particles may be removed with compressed air blown through the core in the opposite direction of normal air flow.

WARNING!

Wear eye protection any time you blow compressed air. Small particles blown by compressed air could injure your eyes.

- 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.

NOISE EMISSION CONTROL

Noise Emission Warranty

This section describes responsibilities for the vehicle noise emissions. For information about exhaust emissions, please refer to the aftertreatement system operators manual.

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.

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 cleaner/silencers or intake piping.

Engine Cooling System

- Removing or rendering inoperative the fan clutch.
- 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.

Inspection and Maintenance Instructions

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 5-129.

If, during periodic inspection and maintenance of other systems and components, it is found that parts of the noise control system require attention, we recommend that those parts be inspected at more frequent intervals to assure adequate maintenance and performance.

Air Intake System

- Do all checks and maintenance procedures listed in this manual under Engine Air Intake System and Air Cleaner. See Air Dryer on page 5-60.
- 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 cleaner 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 Catalyst Reduction (SCR)

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

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 Filters (DPF)

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

Engine Fan and Shroud

WARNING!

Do not work on the fan with the engine running. The engine fan can engage at any time without warning. Anyone near the fan when it turns on could be injured. Before turning on the ignition, be sure that no one is near the fan.

- 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.

Hood Insulation Blanket

- Check all fasteners for condition and security. Repair or replace any broken or defective fasteners.
- 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 Fender Shields and Cab Skirts

- Check all fasteners that hold the fender shields in place.
- Check fender shields for tire marks, worn spots, or damage from objects thrown from tire treads.
- 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.

Noise Control System - Maintenance Log

To ensure your vehicles 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.

Noise Control System - Maintenance Log

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						

Component	Recommended Interval (Miles)	Date & R.O. No.	Repair Facility & Location	Work Performed	Date & R.O. No.	Repair Facility & Location	Work Performed
Clutch Type Fan Drive	10,000						

REAR AXLE AND SUSPENSION

General Maintenance

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.

Your 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!

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. See Front Spring Suspension U-bolts on page 5-118 for proper torque specifications. Failure to comply may result in death, personal injury, equipment or property damage.

WARNING!

Do not operate the vehicle if the U-bolts are not properly tightened. Loose U-bolts will cause the axle to not be properly secured to the suspension, which could cause loss of vehicle control and an accident. Loose U-bolts can also cause uneven tire wear and poor alignment. 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. However, even with proper maintenance, many factors affect the service life of springs and suspension components, such as: fatigue, vehicle gross weight, type of load, road conditions, and vehicle speed.

It is important that U-bolts remain tight. Severe use of your vehicle can cause them to loosen faster. But 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.

- After the first 500 miles (800 km) of operation, inspect the suspension periodically, as noted below:
- Visually check for loose or missing fasteners, cracks in hanger, or axle connection brackets.
- Check that springs are centered in hangers and in good condition.
- Check for cracks, wear marks, splits, or other defects on the surface of the spring.
- Replace defective parts. Because repaired springs cannot be fully restored 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 (3,218 km) of service and every 60,000 miles (96,000 km) thereafter.

Torque recommendations apply to fasteners supplied and installed by vehicle manufacture. The values listed in the tables below, are for cadmium plated or phosphate and oil fasteners only.

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 mechanic.

U-Bolt Torque

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!

Do not operate the vehicle if the U-bolts are not properly tightened. Loose U-bolts will cause the axle to not be properly secured to the suspension, which could cause loss of vehicle control and an accident. Loose U-bolts can also cause uneven tire wear and poor alignment. Failure to comply may result in death, personal injury, equipment or property damage.

NOTE

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

Rear Suspension Fasteners (Metric and Standard)

SIZE/ TYPE	TORQUE *	
	Nm	Lb-Ft
M16 nylon-insert nuts	163-217	120-160
M20 nylon-insert nuts	352-460	260-340
M20 all-metal lock nuts	427-475	315-350
1/2 in. nut	109-122	80-90
3/4 in. nut	394-462	290-340
1-1/4 in. nut	1,877-2,217	1,380-1,630

* Torque requirements apply to manufacturer proprietary suspensions. All other suspensions must refer and adhere to original manufacturer's shop manual.

Rear Suspension U-Bolts, Grade 8 (lubricated*)

U-BOLT SIZE DIAMETER THREAD	TORQUE**	
	Nm	Lb-Ft
3/4	333-408	245-300
7/8	598-734	440-540
1	925-1,060	680-780
1-1/8	1,470-1,660	1,080-1,220
1-1/4	1,890-2,120	1,390-1,560
1-1/2	3,130-3,860	2,300-2,840

*Chevron Zinc Lubricant or SAE 20/30 oil should be used on U-Bolt threads
**Torque requirements apply to manufacturer proprietary suspensions. All other suspensions must refer and adhere to original manufacturer's shop manual.

- Load the vehicle to its normal gross weight before tightening U-bolts. Loading the vehicle

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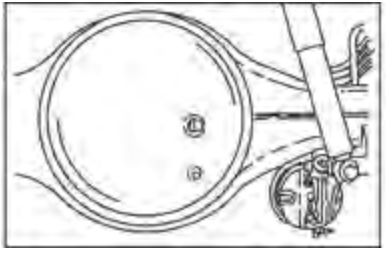
ensures proper adjustment of the U-bolt and spring assembly.

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 U-bolts and nuts of SAE Grade 8 specification or better. 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 L2105C), 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.

Dana Spicer and Fabco

No initial drain is required on Dana Spicer axles that are factory filled with an 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 Schedule on page 5-12 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 Schedule on page 5-12. 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).

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.

In addition to pre-delivery inspections, suspension alignment should be checked when any one of the following conditions exist:

- 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.

STEERING SYSTEM

Power Steering

Oil (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.

⚠ 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 death, personal injury, equipment or property damage.

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, yet it will require much greater effort.

Visually check the following parts:

- Crosstube: Is it straight?

- Draglink tube clamp: Check for looseness or interference.
- 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
  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 truck to an authorized dealer for evaluation.

Fluid Level and Refill

Have the power steering fluid and filters changed at an authorized dealer.

CAUTION
When adding fluid, be sure to use fluid of the same type. While many fluids have the same description and intended purpose, they should not be mixed due to incompatible additives. Mixing incompatible fluids may lead to equipment damage.

- Check and completely change the fluid level according to Preventive Maintenance Schedule on page 5-12. Use the following procedure:

NOTE
Before removing reservoir cover, wipe outside of cover so that no dirt can fall into the reservoir.

- Maximum/Minimum level is indicated on the reservoir. These same levels are also indicated by two lines on the dipstick in the reservoir.
- There are two ways to check whether the power steering fluid is at its proper level. Both checks are with the engine NOT running.

1. 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.
2. 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.

Fluid Filter Replacement

CAUTION

Servicing the power steering system without bleeding it of trapped air may cause damage to the power steering pump.

1. Replace both fluid and filter.
2. Bleed the system if necessary.

Steering Shaft

The following are common torque specifications for most steering shafts.

- Torque on U-joint pinch bolt and nut (7/16 in) 74–81 Nm (55 to 60 lb-ft), lubricated.
- Torque on Pitman arm clamp bolt and nut (3/4 in): 406–433 Nm (300 to 320 lb-ft), lubricated.
- For off-highway vehicles, tighten the U-bolts after the first day or two of operation. Then check weekly.

WARNING!

If this chassis is equipped with an electronic stability system (ESP) and any part of the steering system (e.g., linkage, steering driveline, column, front-end alignment, etc) is repaired, removed, or disassembled in any way, or if the steering angle sensor is replaced, the steering angle sensor must be recalibrated. Any repairs or adjustments to any part of the steering system must be performed by an authorized dealer. Failure to comply may result in death, personal injury, equipment or property damage.

DRIVELINE

Driveshaft Maintenance

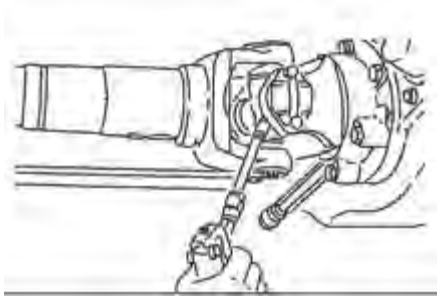
The slip joints and universal joints of the driveshaft should be lubricated periodically.

Use a good quality lithium-soap-base or equivalent extreme pressure (E.P.) grease: NLGI Grade 2.

Dana SPL U-joints and driveshafts should be inspected every time a vehicle comes in for scheduled maintenance (Refer to Spicer Driveshaft service manual DSSM-0100 (3264-SPL) for detailed instructions.)

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

U-Joints



The slip joints and universal joints of the drive shaft should be lubricated according to Preventive Maintenance Schedule on page 5-12.

Use a good quality lithium-soap-base or equivalent extreme pressure (E.P.) grease: NLGI Grade 2.

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

For SPL170XL and SPL250XL, the U-joint lube interval changes after the initial lube at 350,000 miles. After the first lube interval, the U-joint needs lubrication every 150,000 miles. Inspection of the U-joints is the same regardless of when the U-joint grease interval occurs.

⚠ 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 AND WHEEL

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.

Your tires are a very important part of your vehicle's whole braking system. How fast you can stop depends in large measure 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.

Checking Inflation Pressure

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.

Underinflated Tires

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 you'll want to check tire pressure regularly. Lower tire pressure does not provide better traction on ice or snow.

WARNING!

Do not operate a vehicle with underinflated tires. The extra heat caused by underinflation can cause sudden tire failure such as a tire fire or blow out, which can cause an accident resulting in death or personal injury. Low pressure may affect control at the front wheels, which could result in an accident involving death or personal injury. Keep your tires inflated to the manufacturer's recommended air pressure.

WARNING!

Do not attempt to raise the vehicle to remove or install a damaged tire and wheel assembly if you are not fully qualified and not equipped with the proper tools and equipment. Do not attempt to re-inflate a tire that has been run flat. Obtain expert help. A person can be seriously injured or killed if using the wrong service methods. Truck tires and wheels should be serviced only by trained personnel using proper equipment. Follow OSHA regulations per section 1910.177.

NOTE

Follow all warnings and cautions contained within the tire and wheel manufacturer's literature.

1

TREAD CONTACT WITH ROAD

Proper-Inflation: the correct profile for full contact with the road.

2

TREAD CONTACT WITH ROAD

Under-Inflation: causes abnormal tire deflection, which builds up excessive heat, running the risk of failure. It also causes irregular wear.

3

TREAD CONTACT WITH ROAD

Over-Inflation: 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.

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.

5

EFFECT OF LOAD PRESSURE ON TIRE LIFE						
Vehicle Load	Normal	20% Over	40% Over	60% Over	80% Over	100% Over
Tire Pressure	Normal	20% Low	30% Low	35% Low	45% Low	55% Low
Expected Total Tire Mileage	Normal	70%	50%	40%	30%	25%

Overinflated Tires

Too much air pressure reduces the tire tread contact area and results in rapid wear in the center of the tread.

WARNING!

Overinflated tires can cause accidents. They wear more quickly than properly inflated tires and are more subject to punctures, cracks, and other damage. They could fail and cause you to lose control of your vehicle resulting in an accident causing death or personal injury. Be sure all tires are inflated correctly according to the manufacturer's recommendations.

Matching Tires

Be sure to buy matched 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 tires, it can be dangerous. Never 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 and causing death or personal injury.

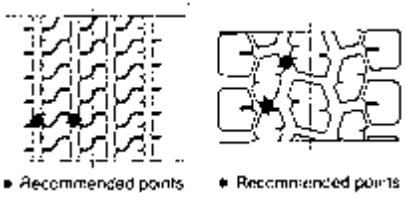
WARNING!

Do not install regrooved or reinforcement-repaired tires on steering axles. They could fail unexpectedly and cause you to lose control of your vehicle resulting in an accident causing death or personal injury.

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. See the next illustration for recommended measuring points for tread depth.



Steer Tire Points (left), Drive Tire Points (right)

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. And of course, you should have your tires balanced anytime you change a tire.

Greenhouse Gas Certified Tires

Replacing a tire that is greenhouse gas certified.

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 equal or lower rolling resistance level (TRRL or C_{rr}). Consult with your tire supplier(s) for appropriate replacement tires.

Maintaining a greenhouse gas certified tire.

In order to limit the rolling resistance of the tires and optimize fuel economy, the maintenance procedures specified by the tire manufacture must be followed.

For warranty information, See Original Equipment Tires on page 6-10.

Tire Chains

If you need tire chains, install them on both sides of each driving axle.

CAUTION
Chains on the tires of only one tandem axle can damage the driveline U-joints and the interaxle differential. Your repairs could be costly and time-consuming.

Speed Restricted Tires

WARNING!
This vehicle may be equipped with speed restricted tires. Check each tire's sidewall for maximum rated speed. The vehicle should not be operated at sustained speed in excess of maximum rated speed. Failure to comply with these speed restrictions could cause sudden tire failure which can result in death, personal injury or property damage.

Wheel Mounting and Fastening

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.

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 Cap Nut Torque

At the first scheduled lube interval, have all wheel cap nuts torqued to their specified value listed in Wheel Cap Nut Torque chart below. 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 Cap Nut Torque

WHEEL and NUT CONFIGURATION	STUD SIZE	TORQUE FOR INNER and OUTER CAP NUTS and RIM CLAMP NUTS	
		Nm	Lb-Ft
Steel or Aluminum Disc-Type Wheel; Double Cap Nut Mounting; Standard 7/8 Radius Ball Seat	3/4-16	610-680	450-500
	1-1/8-16	610-680	450-500
Heavy-Duty Steel Disc-Type Wheel; Double Cap Nut Mounting; 1-3/16 Radius Ball Seat:	15/16-12	1,020-1,220	750-900
	1-1/8-16	1,020-1,220	750-900
	1-15/16-12	1,020-1,220	750-900

WHEEL and NUT CONFIGURATION	STUD SIZE	TORQUE FOR INNER and OUTER CAP NUTS and RIM CLAMP NUTS	
		Nm	Lb-Ft
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	610-680	450-500
Stud Backnuts (when used)	3/4-16	240-270	175-200
	1-14	240-410	175-300
Cast Spoke Wheel Assembly		Rim Clamp Nut Torque	
	1/2” Dia.	110-120	80-90
	5/8” Dia.	220-250	160-185
	3/4” Dia.	305-335	225-245

Threads should be clean and dry. Do not lubricate wheel nuts or studs.

Proper Torque and Sequence

Proper wheel torque can best be obtained on level ground. Install lug nuts and finger-tighten in the numerical sequence as shown below. See Nut Tightening Sequence for Hub Piloted Disc Wheels on page 5-148 or Nut Tightening Sequence for Stud Piloted Disc Wheels on page 5-148. This procedure will ensure that the wheel is drawn evenly against the hub. Torque each nut to the torque value listed in Wheel Cap Nut Torque on page 5-146.

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.

Nut Tightening Sequence for Hub Piloted Disc Wheels

Nut Tightening Sequence for Stud Piloted Disc Wheels

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!

If the hood falls, anyone under it could be injured. Always make sure that the hood hold open device engages when the hood is in its open position any time anyone gets under the hood for any reason.

- The hood could hurt someone that is in the way of its descent. Before lowering the hood, be sure no objects or people are in the way.

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.

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.

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 death, personal injury, equipment or property damage.

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 BEARING

Wheel Bearing Adjustment

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.

TRANSMISSION MAINTENANCE

Introduction

Proper maintenance of the transmission will ensure that the vehicle will operate efficiently.

To check the transmission fluid level, park the vehicle on level ground. For an automatic transmission the oil level should be checked with the engine idling and the transmission fluid at operating temperature. Checking the fluid of a manual transmission may be done with the engine off.

The recommended fluid replacement intervals contain an initial change and a separate interval for the changes after the initial drain. When the oil needs to be replaced, be sure to refer to the manufacturer's literature on the correct grade and type of oil to purchase.

For more details, please refer to the maintenance section in the transmission manufacturer's manual or service literature.

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.

Initial Change: drain and replace according to Preventive Maintenance Schedule on page 5-12; for some transmissions this may not be required.

Oil Change

Change fluid according to change procedures specified in the Transmission Service Manual.
Use the recommended types of oil as specified in the Operation and Service Manual (included with vehicle). Select from the appropriate lubricant for varying ambient (outside air) temperatures.

Transmission Lubricants

Manual Transmission

Manual transmissions are designed so that the internal parts operate in a bath of oil circulated by the motion of gears and shafts.

Service Intervals

For recommended types and brands of all lubricants, see the transmission manufacturer's Service Manual and Preventive Maintenance Schedule on page 5-12.

Check all hoses for kinks, deterioration, chafing, and leaks. Adjust kinked or chafing hoses to eliminate restrictions and prevent further wear. To ensure proper inspection, it may be necessary to inspect under and inside frame rails and unclip harnesses, hoses and cable bundles.

Standard Transmission Oil Level

NOTE
The vehicle must be parked on level ground.

See the Transmission Operator's Manual for information on checking the transmission oil level.

Automatic Transmissions

Service Intervals

Check daily with engine idling. See Preventive Maintenance Schedule on page 5-12 for service intervals.

Automatic Transmission Oil Level

NOTE
The vehicle must be parked on level ground.

See the Transmission Operator's Manual for information on checking the transmission oil level.

CLUTCH

Introduction

Free pedal is the distance the clutch pedal moves by applying only slight pressure. During free pedal the release yoke in the transmission moves until its bearing pads contact the release bearing. This movement of the release yoke is called free travel. Thus, free pedal and free travel are directly related to each other.

As the clutch pedal is depressed further, with harder pressure, the release yoke moves the release bearing away from the engine. This causes the clutch plate to release from the driven disks in the clutch. This is called release travel. And finally, on 9-, 10-, and 11-speed transmissions, as the pedal is pushed to the last 1/2 to 1 inch of travel, the release bearing contacts and engages the clutch brake. This is called clutch brake squeeze.

When the clutch wears, the release bearing gradually moves toward the engine, decreasing free pedal and free travel. When all free pedal and free travel are gone, the clutch requires adjustment.

The clutch is adjusted by turning an adjustment ring that is built into the clutch. When the ring is turned, the release bearing moves back toward the transmission, restoring free pedal and clutch free travel. Under normal clutch wear this is the only adjustment needed. Do not attempt to change any other component.

Clutch Adjustment - Normal Wear

Clutch pedal free travel is usually 1 3/4 in. to 2 in. (34 to 51 mm). This should be your guide for determining whether your truck needs clutch adjustment. Also, if it becomes increasingly difficult to shift into gears, or the truck creeps with the clutch pedal depressed, your clutch needs adjustment. See the Maintenance Manual for the proper adjustment procedures.

Some vehicles have automatic clutch adjustment. If yours doesn't have this feature, adjustment will have to be done by a trained certified mechanic. Have the adjustment done before clutch pedal free travel is reduced to the minimum allowable 1/2 in. (13 mm).

Clutch Linkage

This vehicle is equipped with a rod and lever mechanical clutch linkage. Lubricate each pivot point on the clutch linkage.

CONSUMER INFORMATION AND VEHICLE IDENTIFICATION

CONSUMER INFORMATION

VEHICLE EMISSIONS LIMITED EXPRESS WARRANTY

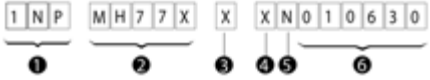
CONSUMER INFORMATION AND VEHICLE IDENTIFICATION

Vehicle Identification

Each vehicle completed by Peterbilt Motors Company uses a Vehicle Identification Number (VIN) that contains the model year designation of your Peterbilt. The practice is in compliance with 49 CFR 565, Code of Federal Regulations.

The Vehicle Identification Number is on the Peterbilt labels on the left hand door post. The VIN contains 17 digits. The 10th digit is the code for the model year of your vehicle. The example VIN below shows how this code works:

Example VIN:



1 Manufacturer Identifier

2 Vehicle Attributes

3 Reserved Space

4 Model Year

5 Assembly Plant

6 Serial Number (Chassis Number)

Model Year

J = 2018

K = 2019

L = 2020

M = 2021

Glider Kit Identification

0 (zero) = Glider Kit

Plant Code

D = Denton Factory

General VIN Information

VIN Locations

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
- Cab back, 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 Weights 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

WARNING!

Do not exceed the specified load rating. Overloading can result in loss of vehicle control and personal injury, either by causing component failures or by affecting vehicle handling. Exceeding load ratings can also shorten the service life of the vehicle.

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).

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.

Greenhouse Gas Certification

This vehicle may be equipped with components that are identified as Greenhouse Gas Certified components (GHG). A label on the door is printed with codes that identify the components manufactured on the vehicle that are part of the GHG certification. The codes are translated in the following table:

Emission Control Identifier	Emissions Related Components
VSL, VSLS, VSLE, or VSLD	Engine Software parameters that affect the Vehicle Speed Limiter
IRT5, IRTE	Engine software parameters that affect the automatic engine shutdown timer
ATS	Aerodynamic side skirts and/or fuel tank fairings
ARF	Aerodynamic roof fairing
ARFR	Adjustable height aerodynamic roof fairing
TGR	Gap reducing fairing (tractor to trailer)
LRRA, LRRD, or LRRS	Greenhouse Gas (GHG) Tires

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.

Drive Axles: The drive axle numbering system includes three labels or stamps:

1. Axle Specification Number, usually stamped on the right rear side of the axle housing. This number identifies the complete axle.
2. Axle Housing Number Tag, usually located on the left forward side of the housing arm. This tag identifies the axle housing.
3. 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.

CONSUMER INFORMATION

Federal Safety Standard Certification Label

The National Highway Traffic Safety Administration 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 left hand cab door post.

How to Order Parts

Replacement parts may be obtained from an authorized dealership.

When you order, it is IMPORTANT that you have the following information ready:

- Your name and address.
- Serial number of the truck.
- 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.

NHTSA Consumer Information

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:

	Toll Free 888-327-4236 (800-4249153 TTY) 8:00 am to 10:00 pm ET Monday-Friday
	Office of Defects Investigations/CRD NVS-216 1200 New Jersey Ave SE. Washington, D.C. 20590
www	www.safercar.gov
@	nhtsa.webmaster@dot.gov

Canadian Consumer Information

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 Street
Ottawa ON K1A 0N5

For additional road safety information, please visit the Road Safety website at:

www.tc.gc.ca

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, 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 greenhouse gas (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 first occurs, 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 for Class 8 vehicles, 185,000 miles for Class 6-7, and 110,000 for Class 5.

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 will be performed by any authorized PACCAR dealer using new or genuine approved rebuilt parts and assemblies PACCAR 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 the GHG regulation of the EPA Clean Air Act. 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 the GHG regulation of the EPA Clean Air Act. 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.

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