

T410 DRIVER'S HANDBOOK



AUSTRALIAN MADE. WORLD'S BEST.

VEHICLE IDENTIFICATION

Owner's Name:Address:
Suburb:State:Postcode:
Phone Number (Business):
Phone Number (Private):
Vehicle Registration Number:
Colour:
Model:
Engine Number:
VIN (Vehicle Identification Number):
Chassis Number:

MAXIMUM VEHICLE WEIGHT

The maximum vehicle weight ratings are stamped on the Vehicle Identification Plate attached to the body. Refer to page 260 for locations.

Registered Tare Weight:
GVM (Gross Vehicle Mass):
GCM (Gross Combination Mass):
Date of Acquisition:
Date:

Stamp & Signature
of Selling Dealer:

The above information fully identifies your vehicle. It will furnish all of the necessary information in the event that warranty repairs are required. Be certain it is completely and properly filled out and signed by your selling dealer or his/her authorised representative. NOTE: Original ratings letter is supplied by the selling dealer for every truck.



WELCOME TO THE KENWORTH FAMILY

We thank you for investing in your new Kenworth. Proudly engineered and built in Australia, this vehicle has been custom designed to meet your exacting standards and the specific requirements of your application. Advanced technology, pride in workmanship and a total commitment to quality have been combined to produce a truck that is unequalled.

Our network of dealers will support your Kenworth with the same quality and attention to detail that went into its manufacture. Anywhere in Australia, New Zealand and Papua New Guinea, support for your investment is only as far away as a phone call to your nearest Kenworth Dealer.

Australian Kenworth or DAF owners in need of emergency roadside assistance can simply call 1800 4 PACCAR (1800 4 722227). Trained operators are available 24-7 to connect you with your nearest PACCAR dealer for support.

Please take the time to read this handbook, as it contains information that will assist you in getting the most from your new Kenworth. We know it will provide many years of productive service, and we welcome you to the family of Kenworth owners.

PACCAR Australia

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This handbook illustrates and describes the operation of features or equipment which may be either standard or optional on this vehicle. This handbook may also include a description of features and equipment which are no longer available or were not ordered on this vehicle. Please disregard any illustrations or descriptions relating to features or equipment which are not on this vehicle.

PACCAR reserves the right to discontinue, change specifications, or change the design of its vehicles at any time without notice and without incurring any obligation.

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ABOUT THIS HANDBOOK

Please take the time to get acquainted with your T410 by reading this Driver's Handbook. We recommend that you read and understand this handbook from beginning to end before you operate your T410.

Your handbook contains important information for the safe, efficient operation and service of your T410. We urge you to become familiar with the handbook's contents and use it as a ready reference.

After you've read this handbook, it should be stored in the cab for convenient reference and remain with this truck when sold.

Your Kenworth may not have all the features or options mentioned in this manual. Therefore, you should pay careful attention to the instructions that relate to your vehicle. In addition, if your vehicle is equipped with special equipment or options not discussed in this handbook, consult your dealer or the manufacturer of the equipment.

All information contained in this handbook is based on the latest production information available at the time of publication. Kenworth Trucks reserves the right to make changes at any time without notice.

Your Kenworth dealer is only too pleased to go over the operation and controls of your new vehicle with you, and to explain any queries you may have.

Safety Alerts

Be sure to read and follow all of the safety alerts contained in this handbook. They are there for your protection and information. These alerts can help you avoid injury to yourself, your passengers, and help prevent costly damage to the vehicle. Safety alerts are recognised by highlighted background and a symbols (see page xvii).

Do not ignore these safety alerts.

The handbook is divided into four sections:

SECTION 1 - OPERATING INSTRUCTIONS include routine checks and operating instructions in a logical sequence, from walk-around inspection to final shut down.

SECTION 2 - PREVENTIVE MAINTENANCE will guide you through the basic operation required to keep your vehicle in good operating condition. More detailed technical information can be found in the Electronic Customised Maintenance Manual.

SECTION 3 - MAINTENANCE & LUBRICATION SCHEDULES include complete lubrication specifications and schedules, recommended service information and intervals, and the Kenworth Preventive Maintenance Program for normal operating conditions.

SECTION 4 - SERVICE RECORDS for each 10,000km service inspection from the First Service Inspection Record through to the 100,000km service. These are duplicated for the dealership to keep a copy in their file. After the 100,000km service there are pages for each 10,000km service to be recorded.

In addition, a Driver's Check List is included for your convenience on pages 12.

We strongly recommend any system covered by State or Federal Regulations be inspected and serviced by an authorised Kenworth dealer or the component manufacturer's service facility. This would apply particularly to safety, emission, lighting and noise control systems.

Kenworth trucks are built to conform to all Australian Federal Standards and Regulations applicable at the time of manufacture. Kenworth Trucks cannot be held liable for any unapproved alterations to systems or components, certified or otherwise.

Some equipment described in this manual is optional and not included in the base price of the vehicle. Kenworth Trucks undertake a continual product improvement program, therefore specifications and data contained in this handbook are subject to change without notice.

If there are any doubts about the safe operation of your Kenworth truck, contact your nearest authorised Kenworth dealer.

To ensure optimum performance and safe operation of your vehicle, Kenworth recommends it is regularly inspected and serviced by an authorised Kenworth dealer.

SAFETY SYMBOLS

A number of alerting messages are used in this manual. Read and follow them. They are for your protection and information. These messages can help you avoid personal injury and costly damage to your vehicle.

WARNINGS

The safety message following this symbol provides a warning against operating procedures which could cause death or personal injury. They could also cause equipment or property damage. The alert will identify the hazard, how to avoid it, and the probable consequence of not avoiding the hazard.

Example:



Do not carry additional fuel containers in your vehicle. Fuel containers, either full or empty, may leak or explode, and cause or feed a fire. Do not carry extra fuel containers. Even empty ones are dangerous. Failure to comply may result in death or personal injury.

CAUTIONS

The safety alert following this symbol and word provides a caution against operating procedures which could cause equipment or property damage. The alert will identify the hazard, how to avoid it, and the probable consequence of not avoiding the hazard.

Example:



Continuing to operate your vehicle with insufficient oil pressure will cause serious engine damage. Failure to comply may result in equipment or property damage.

NOTES

The alert following this symbol and word provides important information that is not safety related but should be followed. The alert will highlight things that may not be obvious and is useful to your efficient operation of the vehicle.

Example:



Pumping the accelerator will not assist in starting the engine.

VEHICLE SAFETY



Do not drink alcohol and drive. Your reflexes, perceptions, and judgment can be affected by even a small amount of alcohol. You could have a serious or even fatal accident, if you drive after drinking. Do not drink and drive or ride with a driver who has been drinking. Failure to comply may result in death, personal injury, equipment or property damage.



Do not text and drive. Your reaction time, perceptions and judgment can be affected while texting or using any other form of mobile messaging while driving. Failure to comply may result in death, personal injury, equipment or property damage.

Make sure your vehicle is in top working condition before heading out on the road, it is the responsible driver's duty to do so. Inspect the vehicle according to the Driver's Check List beginning on page 12.

Every new vehicle is designed to conform to all Federal Motor Vehicle Safety Standards applicable at the time of manufacture. Even with these safety features, continued safe and reliable operation depends greatly upon regular vehicle maintenance. Follow the maintenance recommendations found in Preventive Maintenance on page 214. This will help preserve your investment.

Keep in mind that even a well maintained vehicle must be operated within the range of its mechanical capabilities and the limits of its load ratings. See the Weight Ratings label on the driver's door edge.

Safe driving is only possible with the proper concentration on the driving task. Keep distraction to a minimum to improve your concentration. Examples of distractions may include radio controls, GPS navigation controls, mobile telephone calls, cellular text messages, reading or reaching for something on the floor. Minimising your distractions will improve safe driving and will help avoid an accident involving death or personal injury.

Be aware of regulations that may prohibit the use of cellular telephones while driving. In addition to being an unsafe practice, it may be against local or federal ordinances to use cellular devices while operating the vehicle.

This manual is not a training manual. It cannot tell you everything you need to know about driving your vehicle. For that you need a good training program or truck driving school. If you have not been trained, get the proper training before you drive. Only qualified drivers should drive this vehicle.

A SPECIAL WORD ABOUT REPAIRS



Do not attempt repair work without sufficient training, service manuals, and the correct tools. You could be killed or injured, or you could make your vehicle unsafe. Do only those tasks you are fully qualified to do.

Your dealer's service center is the best place to have your vehicle repaired. You can find dealers all over the country with the equipment and trained personnel to get you back on the road quickly, and keep you there.

Your vehicle is a complex machine. Anyone attempting repairs on it needs good mechanical training and the correct tools. If you are sure you have these requirements, then you can probably perform some repairs yourself. However, all warranty repairs must be performed by an authorised service dealer. If you aren't an experienced technician, or don't have the right equipment, leave all repairs to an authorised service dealer. They are the ones equipped to do the job safely and correctly.

Maintenance Manuals. If you do decide to do any complex repair work, you'll need the Customised Maintenance Manuals supplied in the Driver Information Pack. Please provide your Chassis Serial Number (last 6 digits of the VIN see page 301) when you order, to be sure you get the correct manuals for your vehicle. Allow about four weeks for delivery. There will be a charge for these manuals.

Final Chassis Bill of Material. A complete, non-illustrated computer printout listing of the parts used to custom-build your vehicle is available through the dealer from whom you purchased your vehicle, there will be a charge for this.



Modifying your vehicle can make it unsafe. Some modifications can affect your vehicle's electrical system, stability, or other important functions. Before modifying your vehicle, check with your dealer to make sure it can be done safely. Improper modifications can cause death or personal injury

Additional Sources of Information

Major component suppliers also supply operation manuals specific to their products. Additional manuals and other pieces of literature are included in the Driver Information Pack. Look for information on products such as the engine, driver's seat, transmission, axles, wheels, tyres, ABS/ESP (if applicable), radio, 5th wheel, lane departure and adaptive cruise control. If you are missing these pieces of literature, ask your dealer for copies.

DRIVER INFORMATION PACK (DIP)

In addition to this Driver's Handbook, there are many other publications that are supplied with your new Kenworth truck. Take the time to read them. Also in the Driver Information Pack you will find the operating instructions for the radio/s, etc.

ELECTRONIC CUSTOMISED MAINTENANCE MANUAL (ECMM)

These manuals undergo constant revision and reflect the components installed when your truck was manufactured, your Electronic Customised Maintenance Manual will be in the form of a USB flash drive. It is advisable to make a back-up copy of this to a hard drive on a PC or laptop for safe keeping and easy use. These are specified at the time of purchase of your new vehicle.

ELECTRONIC CUSTOMISED PARTS CATALOGUE (ECPC)

A complete listing of the parts used to custom build your Kenworth truck. This can be ordered through the dealer network. This same information is available electronically to all authorised Kenworth dealers through the PACCAR Parts Electronic Catalogue (ECAT) system. Your Customised Parts catalogue will be in the form of a USB flash drive.

PACCAR CUSTOMER SUPPORT DIRECTORY

This is a pocket sized directory of all authorised Kenworth and DAF dealers covering Parts, Service and Sales. It contains the full address of all current dealers with phone and fax numbers, including after hours numbers. As the directory undergoes continued change, you can in the future purchase updated copies from your authorised Kenworth dealer.

www.kenworth.com.au

AUSTRALIA WIDE ROADSIDE ASSISTANCE

In the event you need roadside assistance, Kenworth and DAF have an Australia Wide Roadside Assistance number, this will direct you to the nearest authorised Kenworth dealership for emergency Service and Parts support. The number is:

1800 4 PACCAR

MASTER SERVICE CHART

Lists all Kenworth recommended lubricants for use in all major and auxiliary components.

Finally, there is a reminder for you to present your new Kenworth truck to any of our authorised Kenworth dealers for its First Service at 10,000km or 30 days. This service includes free labour and inspection, you only pay for the lubricants and filters used.

It is the owner's responsibility to maintain the vehicle and have the recommended services carried out at the intervals specified in the Maintenance Manual.

Should you have any difficulty obtaining service, or require further details, please contact:

Customer Service Department
Kenworth Trucks

A DIVISION OF **PACCAR** AUSTRALIA PTY. LTD.
A.B.N. 43 004 669 667
20-64 Canterbury Road
Bayswater, Vic, 3153. Australia
Telephone: (03) 9721 1500
Fax No: (03) 9720 4144

SECTION ONE OPERATING INSTRUCTIONS

GENERAL INFORMATION

VEHICLE ACCESS

DOOR LOCK AND KEYS

Doors can be locked from the inside via the switch on the armrest. Close the door, then depress the switch to lock. Doors automatically unlock when you open them from inside and can be locked from the outside with the key or the Remote Keyless Entry (RKE) button on the remote control module.

Two keys with black bows are provided for the doors and ignition, and also have the KW 'bug' on both sides. Where your vehicle has a sleeper with tool compartments, two separate toolbox keys have a red bow. **To lock or unlock the doors from outside the cab:**

- insert the key in the door lock
- turn the key toward the truck's rear to lock, and forward to unlock
- press the LOCK or UNLOCK button on remote control module

IGNITION KEY SWITCH

The ignition key switch has four positions: ACC (Accessories), OFF, ON, and START.

OFF: In this position all accessories are OFF (except those listed below) and you can remove the key.

- emergency hazard flasher
- interior and courtesy lamps (on doors)
- electric horn
- tail lights
- marker lamps
- headlights
- radio station memory
- instrument lights
- auxiliary power
- electronic memory power for radios/clock etc

In the **OFF** position, fuel is cut off by a solenoid valve.

ACC (Accessory): With the key in this position, you can play the radio, or use other accessories.

ON: In the ON position, all circuits are energised. A chime will sound initially and panel warning lights will light until the engine is started, and normal oil operating pressure is reached, chime will sound until air brake system pressure is above 414 kPa. In this position the ignition key cannot be removed.

START: Turn the key to this position to start your engine. It energises the starter and retracts the solenoid valve to allow fuel supply to the engine. Release the key after the engine has started. For complete engine starting procedures, see 'Operating the Engine' on page 102.

REMOTE KEYLESS ENTRY (RKE)

Kenworth Remote Keyless Entry system gives you added security and convenience for your Kenworth truck. This system will lock or unlock the driver's and passenger's doors with a remote keypad transmitter. It also activates the dome and door lights.

The Remote Controller provides cab illumination during entry and exit of the vehicle.

Two keypads are supplied, with up to four keypads able to be used for any one vehicle.



REMOTE VERIFICATION

This function is optional and is enabled during the programming stage. When pressed, the LOCK button locks both doors.

To Lock and Unlock the Doors

1. To Unlock the Driver's Door

- a) Press the UNLOCK button once
- b) Driver's door unlocks
- c) Door and dome lamps turn ON for 40 seconds (Door Closed).

2. To Unlock the Passenger's Door

- a) Press the UNLOCK button again within 3 seconds
- b) Passenger's door unlocks
- c) Door and dome lamps turn ON for 40 seconds (Door Closed).

3. To Lock Both Doors

- a) Press the LOCK button once
- b) Both doors lock
- c) Door and dome lights turn ON for 2 seconds.
- d) If Remote Verification is enabled, press the LOCK button again within 5 seconds to sound the horn. Repeated pressing of the LOCK button within a 5 second period causes the horn to sound and the interior lights to stay ON for a further 2 seconds.

4. Doors Open and Close

Door Action	Key Position	Door and Interior Lamps
Open the door	OFF or ACC	Lights turn ON and stay ON as long as door is left open
Close the door	OFF or ACC	Lights stay ON for 40 seconds
Door in closed position	Turn key to ON	If lights are ON, lights go OFF immediately

KEYPAD TRANSMITTER

The range of the Remote Keyless Entry system is approximately 10 metres. This will be reduced if it is operated close to other RF sources such as TV/ Radio transmitters and cell towers.



PROGRAMMING

The system is pre-programmed but may need to be reprogrammed if a key transmitter or receiver has been replaced. The programming procedure is in the Electronic Customised Maintenance Manual.

CAB AND FRAME ACCESS

SAFETY



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

Be careful whenever you get into or out of your vehicle's cab. Always maintain at least three points of contact with your hands on the grab handles and your feet on the steps.



Jumping out of the cab or getting into the cab without proper caution is dangerous. You could slip and fall, which could lead to death or personal injury. Keep steps clean. Clean any fuel, oil, or grease off the steps before entering the cab. Use the steps and grab handles provided, and always keep at least three points of contact between your hands and feet and the truck. Always face toward the vehicle when entering or exiting the cab and look where you are going.

The following cab and frame entry/exit procedure recommendations were prepared with personal safety foremost in mind.



Do not jump out of the cab or get into the cab without proper caution. You could slip or fall, possibly suffering a serious injury.

To help avoid personal injury due to a slip or fall:

- Always face the vehicle when accessing or leaving the cab or frame access area.
- Use three points of contact (two feet one hand; or one foot and two hands) to grip the steps or handholds whenever possible. Look where you are going, refer to page 7.
- **DO NOT** use the steering wheel, door handle or arm rest to pull yourself up into the cabin.
- Keep steps clean. Clean any fuel, oil or grease off the steps before entering the cab or accessing the deck plate. Use even more care when steps and handholds (or footwear) are wet or coated with ice, snow, mud, oil, fuel or grease.
- Mind your head when entering or leaving the cabin.



Do not climb onto or off the deck plate. Use the steps and grab handles provided. If there is no deck plate, or if proper steps and grab handles are not provided, do not climb onto the area behind the cab, you may slip and cause personal injury.



Do not step on vehicle components without anti-slip surfaces or use components not designed for entry-and-exit use. You could slip and fall, resulting in possible injury to yourself if you step onto a slippery surface.

Do not step onto the surface of a fuel tank. A fuel tank is not a step. The tank surface can get very slippery, and you might not be able to prevent a fall. Use only the steps and handholds provided, not chain hooks, quarter fenders, etc.



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

CLIMBING ONTO THE DECK PLATE

When you are climbing onto and off the deck plate, maintain at least three points of contact with your hands on the grab handles and your feet on the steps. Always face toward the vehicle when entering or exiting the cab and look where you are going. Failure to comply may result in death or personal injury.

When stepping onto a surface to enter the cab or access the deck plate, only use the steps and grab handles installed and designed for that purpose. Failure to use the proper steps and grab handles could cause a fall which may result in death or personal injury.

Keep steps clean. Clean any fuel, oil, or grease off the steps before entering the cab or accessing the deck plate. Stepping on a slippery surface can cause a fall which may result in death or personal injury.

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

Any alteration (adding bulkheads, toolboxes, etc.) behind the cab that affects the utilisation of installed grab handles, deck plates, or frame access steps should comply with the original manufacturer's design.



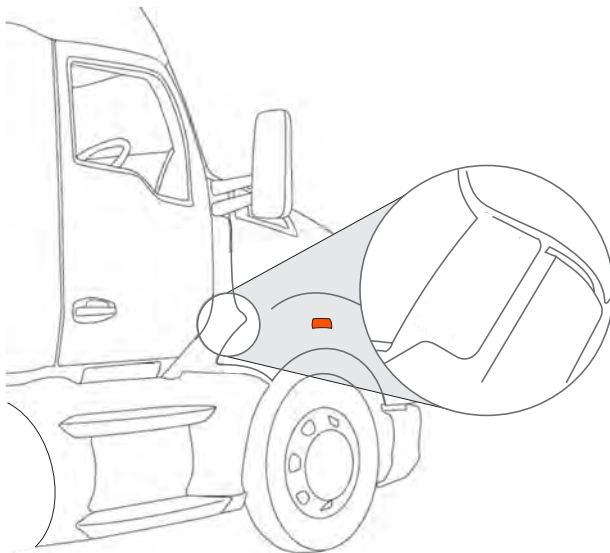
Maintain three points of contact at all times. Using the external cab access grab rails and steps to climb up into a conventional cabin. Use the external grab rail and internal access handle to aid ingress and egress to the cabin. **DO NOT** use the steering wheel, door handle or arm rest to pull yourself up into the cabin.



ENGINE ACCESS

HOOD HOLD-DOWNS

Hood hold-downs keep a hood from opening unexpectedly.



Hood Latch in the Closed Position



A hood not latched securely could open during operation and cause vehicle damage. Be sure to latch the hood securely.



Pull Latch Backwards to Unlock



Pull Back to Separate and Open

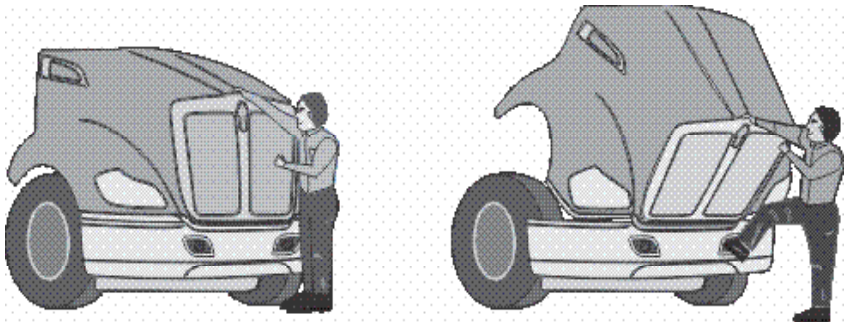
TILTING THE HOOD

To open your hood, unlock the hood hold-downs by unlatching them. Put one or both hands on the top of the hood front. Tilt the hood forward by pulling from the top of the 'KW' emblem, pivoting on the foot placed on the bumper and using the foot on the ground for stability.

Keep pulling on the hood until you are certain that the hood hold-open device is engaged (see opposite). When closing the hood, be sure that you maintain the same points of contact (top of hood and bumper) to control the movement of the hood as it closes.



A pivoting hood could hurt someone or be damaged itself. Before opening or closing the hood, be sure there are no people or objects in the way. Failure to stand in a position of safety can cause death or personal injury.



Before opening or closing the hood, make sure your footing is secure and stable. Failure to do so may cause the hood to close uncontrollably which may result in death or personal injury.



Always ensure the hood hold-open latch is engaged to keep the hood fully open any time anyone gets under the hood for any reason. Failure to do so may cause the hood to close uncontrollably which may result in death or personal injury.



Before closing the hood, be sure the area is clear, no people or objects are in the way. Failure to do so may result in death or personal injury.

Hood Safety Latch

The hood is equipped with a hood safety latch. In order for the hood safety latch to become engaged, the vehicle hood must be fully open. Once the vehicle hood is fully open, the safety latch will automatically engage and will need to be disengaged by the operator.



Hood Safety Latch shown in the safe position

The release lever for the hood safety latch is located near the front hinge of the hood. Press the lever in to disengage the hood hold-open device. If the red clip is engaged to the 'Hood Assist Ram', it is not safety locked in position.



Unlocked

Locked

Hood Safety Latch

SAFE VEHICLE OPERATION

For your safety, as well as that of those around you, be a responsible driver:

- do not drive a vehicle under the influence of alcohol or drugs
- do not drive if you are tired, ill, or under emotional stress

Much has gone into the manufacturing of your Kenworth truck including advanced engineering techniques, rigid quality control and demanding inspections. These manufacturing processes will be enhanced by a safe driver – one who:

- knows and understands how to operate the vehicle and all its controls
- maintains the vehicle properly
- uses driving skills wisely

VEHICLE LOADING

Compare your vehicle's load capacity with the total load you are carrying. If adjustments need to be made, make them. Do not drive an overloaded vehicle. If you are overloaded or your load has shifted, your vehicle may be unsafe to drive.

Gross Vehicle Mass (GVM) is the maximum allowable total mass of a fully loaded motor vehicle, consisting of the *tare mass* (mass of the vehicle) plus the load including occupants and fuel.

Gross Combination Mass (GCM) is when a vehicle is towing one or more trailers, the **GCM** is the total mass of the motor vehicle plus any, and all trailers including load, occupants and fuel.



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 mass rating (GVM) and/or gross combination mass rating (GCM) and/or the maximum front and rear gross axle weight ratings.



An unevenly distributed load or a load too heavy over one axle can affect the braking and handling of your vehicle, which could result in an accident. Even if your load is under the legal limits, be sure it is distributed evenly.

EMERGENCY EQUIPMENT

It is good practice to carry an emergency equipment kit in your vehicle. If you have a roadside emergency you will be glad the following items are with you:

- emergency light
- emergency reflector triangles
- first aid kit
- fire extinguisher

DRIVER'S CHECKLIST

To keep your Kenworth truck in peak condition and maintain a high level of safety for you, your passengers and your load, make a thorough inspection every day before you drive. You will save maintenance time later, and the safety checks could help prevent a serious accident.

You are not expected to become a professional technician. The purpose of your inspections is to find anything that might interfere with the safe and efficient transportation of yourself, any passengers and your load. If you do find something wrong and cannot fix it yourself, have an authorised Kenworth dealership or qualified technician repair your vehicle right away.

The operations on the following pages are to be performed by the driver.

Performing these checks and following the maintenance procedures in this handbook will help keep your Kenworth truck running properly.

IMPORTANT

It is recommended that you have an engine start-up inspection performed within the first 90 days of operation. The inspection may be performed at any service shop authorised by the engine manufacturer.

NEW VEHICLE PRECAUTIONS

Oil changes: Driving Axles

The initial factory lubricants must be drained and the units refilled at the first 10,000km or 30 days service, whichever comes first.

APPROACHING YOUR VEHICLE

- Check the overall appearance and condition. Are windows, mirrors and lights clean and unobstructed?
- Check beneath the vehicle. Are there signs of fuel, oil or water leaks?
- Check for damaged, loose or missing parts. Are there parts showing signs of excessive wear or lack of lubrication? Have a qualified technician examine any questionable items and repair them without delay.
- Check your load. Is it secured correctly?

DAILY CHECKS

ENGINE COMPARTMENT

1. Engine fluid levels:

- engine oil
- coolant (check while engine is cold)
- power steering fluid level

2. Engine Belt

Check Tension and condition of belts:

- if breaks or tears are found, the belt should be replaced before operating the vehicle

3. Fuel Filter/Water Separator Draining - check and drain. Depending on the fuel storage facility, more frequent draining may be required.

4. Windscreen washer reservoir fluid level.

5. Hood closed before entering cab. Is it latched correctly?

CHASSIS AND CAB

Before entering the cab and operating the vehicle, check the following equipment for proper maintenance:

1. Lights - Check headlights, turn signals, emergency flashers and exterior lamps function and are clean and adjusted correctly.
2. Windows and Mirrors - Are they clean and adjusted correctly?
3. Tyres and Wheels - Are tyres inflated properly? Are all wheel nuts in place and torqued correctly? Tighten if necessary. Check front wheel bearing oil levels. Inspect all tyres and wheels for damage. Correct if found.
4. Suspension - Check for loose or missing fasteners. Check damage to springs or other suspension parts.
5. Brake Components - Check lines, linkages, chambers, parking and service brake operation.

6. Air System - Are there leaks?

- Air Tanks - Drain water from all air tanks. Make sure the drain cocks are closed. This procedure is also required for air suspension tanks equipped with automatic drain valves.

See page 146 for further details on Brakes.



Failure to drain air tanks every day may allow water, oil and dirt to be passed through the air system. This can result in malfunctioning valves, which will affect the proper and safe operation of your vehicle.

7. Steps and Handholds - Check for worn surfaces and loose or missing fasteners.
8. Fluid Tanks - Check under the vehicle for signs of leaks. If any are found, correct them before operating the vehicle.
9. Fuel Tank Caps - Are they secure?



Diesel fuel in the presence of an ignition source (such as a cigarette) can cause an explosion. You could be seriously injured.



Do not remove a fuel tank cap near an open flame. Use only the fuel and/or additives recommended for your engine. See Refuelling page 206 for more information.

10. Trailer Connections (Truck) - Are they secure and the lines clear?
If they are not being used, are they stored correctly?
 - Is the trailer spare wheel secure and inflated?
 - Is the landing gear up and the handle secured?
 - Check the fifth wheel. Is the kingpin locked?
11. Is the sliding fifth wheel locked?
12. Is the greasable fifth wheel properly greased?

PRE-START CHECKS

DAILY OPERATIONS

1. Drain moisture from the air tanks. Open the tank drains just enough to drain the moisture. Do not deplete the entire air supply. Doing this at the start of the day, ensures any moisture from the previous day is ejected from the air tanks.
2. Fuel - Check fuel; is there enough?
3. Seat - Adjust the seat to ensure controls are easily reached.
4. Seatbelts - Fasten and adjust your seat belt.
5. Sleeper Restraints - Check and inspect condition.
6. Steering Column - Adjust for easy reach.
7. Mirrors - Check and readjust mirrors if necessary.
8. Lights - Turn ignition key to the ON position and check for warning lights and chimes. Check operation of turn signals and emergency lights.
9. Instruments - Check all instruments.
10. Windscreen - Check operation of windscreen wipers and washers.
11. Horn - Check operation of horn.
12. Sleeper and Luggage Compartment - Loose items should be stowed securely. Is the fire extinguisher fully charged? Is your road emergency kit complete? Are all external compartments closed?

 The above items (Engine Compartment, Chassis and Cab, and Pre-start Checks) should be undertaken daily, as a minimum. This is in addition to, not instead of, your normal maintenance checks.

WEEKLY OPERATIONS

1. Battery - Check battery levels and terminals.
2. Wheel Nuts - Are they all in place and torqued correctly? - Tighten if necessary. See Wheel Nut Torque page 247.
3. Other Controls and Wiring - Check for condition and adjustment.
4. Steering Components - Check pitman arm, draglink and power steering hoses for loose, broken or missing parts.
5. Other Engine Compartment Checks:
 - Check condition and fastening of engine belt, hoses, clamps and radiator.
 - Check the air cleaner, muffler and exhaust pipes. Are they tight and secure?
 - After Engine Warm-up: Looking & listening, check for leaks, all fluids, air system, air intake piping, exhaust for leaks.
 - Automatic Transmission - Check fluid level (if equipped).



Care must be taken not to touch hot or moving parts.

AIR LOSS EMERGENCY PROCEDURE

- Slow down carefully.
- Move a safe distance off the road and stop.
- Place the transmission in neutral and set the parking brake.
- Turn OFF the engine.
- Turn ON the emergency flasher and use other warning devices to alert other motorists.

If the light and alarm do not turn off at startup **do not** try to drive the vehicle until the problem is found and fixed (see page 231 for more information about brakes).

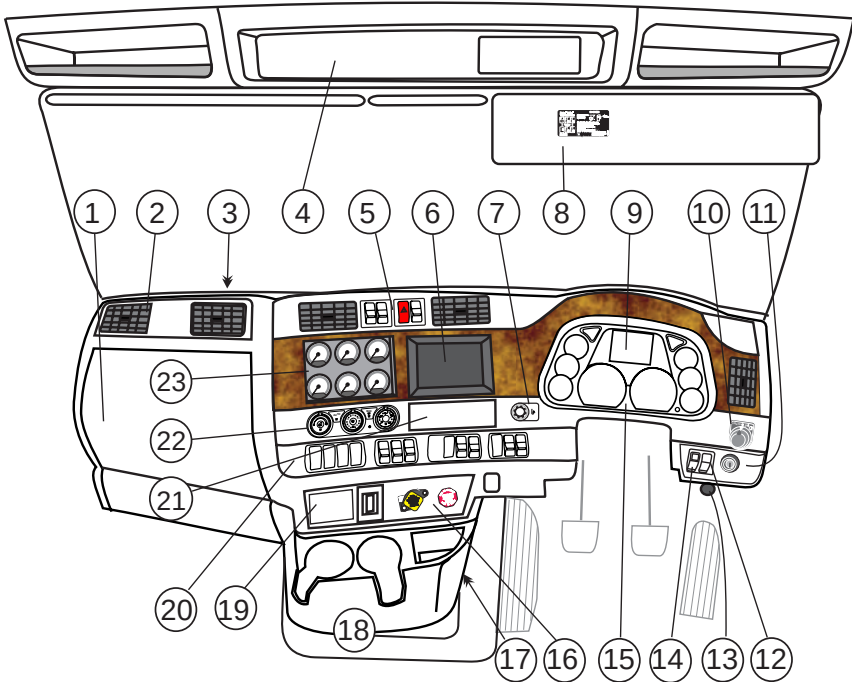
INSTRUMENT PANEL

Getting to Know Your Instrument Panel

This part explains the location of the various features on your vehicle and describes their function. For information on using these features, see the paragraphs that follow. Remember that each vehicle is custom built. Your instrument panel may not look exactly like the one in the pictures that follow.

We have tried to describe the most common features and controls available. You can pick out the parts that apply to you and read them to be fully informed on how your particular vehicle operates.

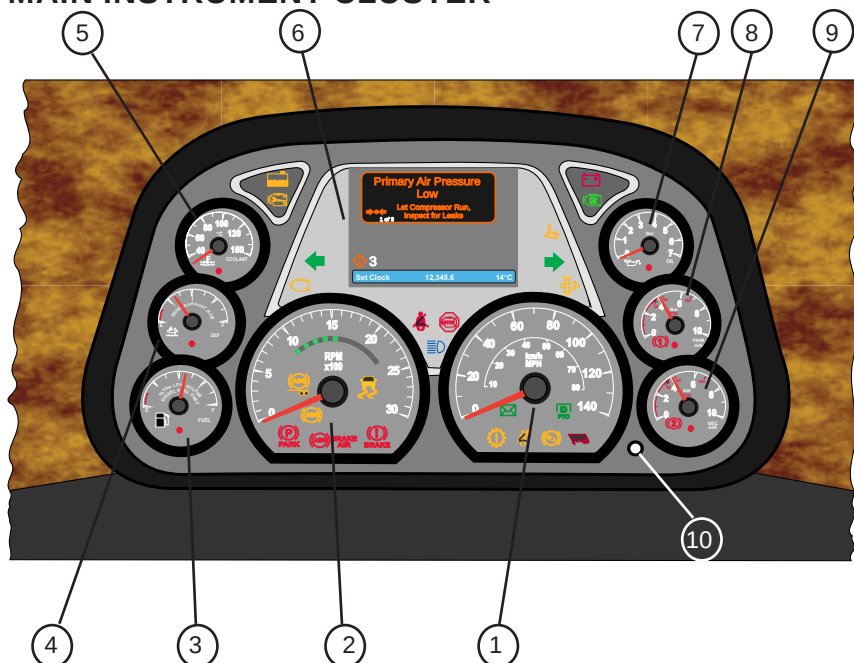
TYPICAL DASH LAYOUT



LEGEND FOR T410 DASH LAYOUT

1. Fuses, Relay & Circuit Breaker Panel Cover
2. Air Conditioning (HVAC) Vents
3. Sun Light Sensor for HVAC (inside windscreen)
4. Overhead Console with Storage
5. Upper Switch Panel, includes Hazard Warning, ABS/ATC and Hill Start Assist
6. Gauges or PACCAR Navigation (Optional)
7. Menu Control Switch (MCS)
8. Sunvisors (Driver's Side Shown Down)
9. Driver Performance Centre Display
10. Headlight Switch
11. Ignition Switch
12. Interior Lights, Dimmer Switch
13. Diagnostic Port (above accelerator pedal)
14. Engine Idle Timer Override Switch
15. Main Instrument Cluster
16. Parking Brake Controls
17. Engine & ABS Diagnostic Switches (below cupholder)
18. Cup Holder
19. Power Socket and USB Port
20. Lower Switch Panel, includes accessory and air switches
21. Radio
22. Air Conditioning (HVAC) Controls
23. Additional Gauges

MAIN INSTRUMENT CLUSTER



1. Speedometer (p21)
2. Tachometer (p22)
3. Fuel Level (p22)
4. Diesel Exhaust Fluid (DEF/AdBlue) (p23)
5. Engine Coolant Temperature (p23)
6. Driver Performance Center (p23)
7. Engine Oil Pressure (p24)
8. Rear/Primary Air Pressure (p25)
9. Front/Secondary Air Pressure (p25)
10. Trip Reset Button (p25)

Instrument System Self Test

When the ignition switch is turned on the Instrument system will undergo a self test. This test will verify the operation of the gauges and warnings.

During the instrument system self test, multiple warning icons will be displayed in a sequence. The total sequence should take no more than 10 seconds to complete.

Refer to Warning Light/Indicator Symbols on page 44 for information on each symbol.

Completing this sequence will indicate a successful self test. Have your Instrument system checked by a qualified service technician if it does not successfully complete.

Audible Alarm

The audible alarm will sound during the instrument system self test. The audible alarm will also sound in conjunction with most warning lights. These events include, but are not limited to, headlights on, fifth wheel, stop engine, primary/secondary air, and driver door open warnings.

Optional Icons

Additional icons may be operational depending on individual vehicle specifications. These will be included in the instrument system self test.



Some optional lights may illuminate even though your vehicle is not equipped with that particular feature.

Check Messages

Check messages are provided to give the operator additional information regarding systems that require attention due to a system malfunction and/or operating conditions that may hinder safe and proper performance for the vehicle. Some messages can be managed by the operator while others may require an authorised dealer repair.

1. Speedometer

The speedometer indicates the vehicle speed in kilometers per hour (km/h). The speedometer cluster also includes several warning and indicator lamps (see Audible Alarm on page 21).

The Speedometer is also available as a viewable screen in the Driver Performance Center. Viewing the Speedometer detail is accomplished by rotating the MCS until the Gauges screen is displayed and then selecting Speedometer.

2. Tachometer

The tachometer measures the engine speed in revolutions per minute (RPM).

The RPM detail is also available as a viewable screen in the Driver Performance Center. Viewing the RPM is accomplished by rotating the MCS until the Gauges screen is displayed and then selecting Tachometer.

The tachometer is a useful gauge when attempting to drive efficiently. It will let you match driving speed and gear selection to the operating range of your engine. If the engine speed gets too high, you can select a higher gear to lower the RPM. If the engine speed drops too low, you can select a lower gear to raise the RPM. (Refer to Driving Tips and Techniques on page 188 for further instruction on driving techniques and using the tachometer.) To avoid engine damage, do not let the pointer exceed maximum governed speed.

The tachometer will illuminate a small green light just below the numbers of the gauge. This is to indicate the engine speed for optimal fuel economy.

3. Fuel Level



The fuel gauge indicates the total (approximate) amount of fuel in the fuel tank. In addition to indicating empty and full, the gauge also indicates the fuel level in graduated increments. When the fuel level for the tank is below $\frac{1}{4}$ full, a red warning light in the gauge will come on.

 This vehicle may be manufactured with a different fuel system and different draw tube locations. Because of this, and the amount of road camber, it is recommended that you do not operate your vehicle with less than one quarter of your truck's fuel capacity. Allowing the fuel level to go below one quarter of capacity could result in the lack of fuel to keep the engine running. In addition, you will want to keep the fuel tanks at least half full to reduce condensation of moisture in the tanks. This moisture can damage the engine.

Refer to Refueling on page 209 for more information.

4. Diesel Exhaust Fluid (DEF/AdBlue)

The diesel exhaust fluid gauge shows the approximate amount of AdBlue fluid in the AdBlue tank. Besides empty and full, the gauge also indicates $\frac{1}{4}$, $\frac{1}{2}$ and $\frac{3}{4}$ of total capacity. AdBlue fluid is required to meet certain emission requirements. Do not allow your AdBlue tank to remain empty.

5. Engine Coolant Temperature

The engine coolant temperature gauge shows the temperature of the engine coolant. Under normal operating conditions the engine coolant temperature gauge should register between 75°C and 90°C. Under certain conditions, somewhat higher temperatures may be acceptable.

6. Driver Performance Centre

The display can show multiple warning lights. Warning information will appear momentarily and then will minimise in the screen. Reviewing the warnings can be done by navigating the menu via the Menu Control Switch.

7. Engine Oil Pressure

It is important to maintain oil pressure within acceptable limits. If oil pressure drops below the minimum pounds per square inch (psi) a red warning light in the gauge will turn on, the stop engine light will come on and an audible alarm will sound.

Operating your vehicle with insufficient oil pressure will cause serious engine damage.

If the oil pressure fails to rise within 10 seconds after the engine starts, stop the engine and determine the cause.

Check the table on page 26 for the correct oil pressure ranges for your vehicle's engine.

If the oil pressure suddenly drops, or the audible alarm and engine oil pressure warning light come on while driving, follow the procedure below.

1. Slow down carefully.
2. Move a safe distance off the road and stop.
3. Place the transmission in neutral and set the parking brake.
4. Turn OFF the engine.

Turn **ON** the emergency flasher and use other warning devices to alert motorists.

Wait a few minutes to allow oil to drain into the engine oil sump, then check the oil level.

Add oil if necessary. If the problem persists, contact an authorised Kenworth service dealer.

8 & 9. Front and Rear Air Pressure

The air gauges indicate the air pressure in the truck air system. There are two indicator dials, the primary dial and icon is for the rear air system while the secondary dial and icon is for the front air system. The gauges indicate the amount of air pressure in each system.

On vehicles equipped with metric air pressure gauges, the gauge face plate includes a bar (major) scale and psi (minor) scale.

Refer to 'Air Loss Emergency Procedure' on page 17 for instructions on what to do if the air system becomes inoperative.



Be sure the air pressure registers more than 100psi (6.9bar) in both service systems before you move the vehicle.



If the pressure in either or both circuits falls below 65psi (4.48bar), a red warning light in the gauge will turn on and an audible alarm will sound when the engine is running.



If the air pressure falls below 60psi (4.14bar), the spring brakes may stop the vehicle abruptly which could cause an accident resulting in death or personal injury. Observe the red warning lamps on the gauges. If one comes on, do not continue to drive the vehicle until it has been properly repaired or serviced. 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.



The air pressure warning light and the audible alarm indicate a dangerous situation; there is not enough air pressure in the air tanks for repeated braking and the brake system has failed. Without the use of your service brakes your spring brakes could suddenly apply causing a wheel lock-up, loss of control, or overtake by following vehicles. This may cause an accident resulting in death or personal injury. Immediately bring the vehicle to a safe stop, while you still have control of the vehicle.

10. Trip Reset Button

The cluster mounted trip reset button is the only way to zero trip data. After toggling the trip odometer (ODO) (short pushes to select trip A, B, C, or D) to the desired trip, HOLD the trip reset button, that resets the displayed trip data.

OPERATING TEMPERATURES*

Engine Oil Normal Operating Range	80°C-90°C
Engine Coolant Thermostat opens at Thermostat opened at least 12mm at	Approx 75°C Approx 87°C
Rear Axle Lubricant Normal Operating Range Maximum difference between axles Climbing steep grades Maximum allowable* (investigate cause)	79°C to 107°C 17°C 107°C 121°C
Transmission Lubricant Normal Operating Range Maximum (investigate cause)	66°C to 93°C 149°C (intermittently) 121°C (continuously)
* For rear axle and transmission, operating at higher temperatures is permissible for short periods. When operation occurs at these higher temperatures, the oil must be changed more frequently. Do not continuously operate with oil temperature exceeding 121°C. At these temperatures, oil oxidation is accelerated.	

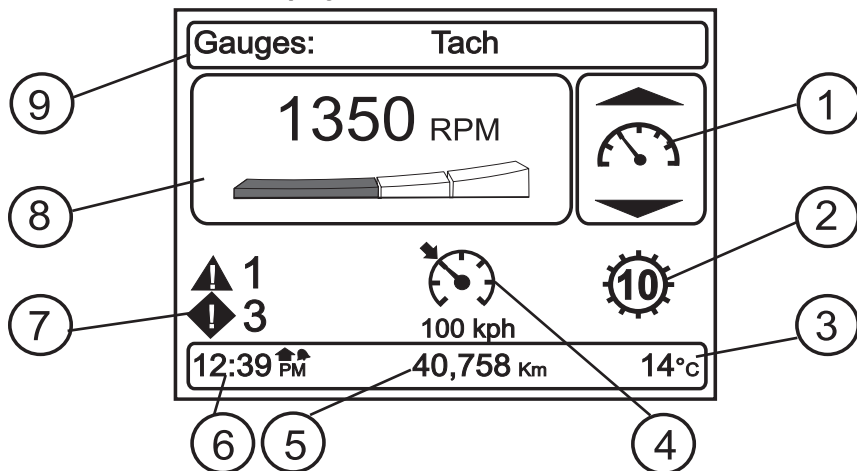
OPERATING PRESSURES*

Engine Oil 10W40 Minimum oil pressure at idle speed Pressure at 1000 rpm Pressure at 1900 rpm	150 kPa Approx 300 kPa Approx 450 kPa
Engine Oil 10W30 Minimum oil pressure at idle speed Pressure at 1000 rpm Pressure at 1900 rpm	135 kPa Approx 285 kPa Approx 435 kPa
Air System Air Governor Range Low Pressure warning light indicator Safety Blow-off Valve Stop Light Switch actuates at	690 to 827kPa 414 to 482kPa 1034kPa 34.5kPa
Spring Brakes Brake Hold off pressure (depending on brake installation)	414 to 482 kPa
Power Steering Pump Relief valve pressure (refer maintenance manual) Pump Pressure is dependent on pump and box combination.	12,065 kPa TAS 85 14,830 kPa TAS 65

DRIVER PERFORMANCE CENTER

The display can show multiple warning lights. Warning information will appear momentarily and then will minimise in the screen. Reviewing the warnings can be done by navigating the menu via the Menu Control Switch.

Driver Information Display



1. Menu Control Switch Cue (p28)
2. Automated Transmission and Shift Indicator Area (p29)
3. Outside Air Temperature (p29)
4. Cruise Control Indicator (p29)
5. Odometer/Trip Odometer (p30)
6. Clock (p30)
7. Active Warnings (p31)
8. Main Content Window (p31)
9. Header (p31)

Description



Do not look at the Driver Performance Center for prolonged periods while the vehicle is moving. Only glance at the monitor briefly while driving. Failure to do so can result in the driver not being attentive to the vehicle's road position or situation which could lead to an accident and possible death, personal injury or equipment damage.

The Driver Performance Center, located at the top of the instrument cluster, displays important vehicle information through a constant monitoring of systems when any of the following conditions are met:

- ignition key in ON or ACC positions
- ignition timer is active
- MCS is pushed or spun (independent of ignition key switch position)
- clock alarm sounds
- driver or passenger door is opened
- hazard warning lamp switch is on
- service brake switch is on
- prime mover marker lamp switch is on
- trailer marker lamp switch is on
- low Voltage Display not active
- and the screen has not been put into 'Display Off Mode'

In addition to a blank screen, the following are menu items and the information available within each of the menu selections.



Some Driver Performance Center functions are only accessible when the vehicle is parked. Other functions are accessible while the vehicle is moving or when parked. Each function is identified in the following descriptions.

1. Menu Control Switch Cue

Used to provide the driver with screen navigation feedback. Cues are provided when a user can push or spin the input control, shows in icon format which function is active, and which function will come up next if the knob is rotated either clockwise or counter clockwise.

2. Automated Transmission and Shift Indicator Area

This area will provide the operator with feedback from the transmission. The display may reflect the transmission gear being operated, may provide Progressive Shift Cues or fault indicators specific for the transmission.

3. Outside Air Temperature

Used to display outside air temperature information and a warning of low temperatures.

The display will also alert the driver when the outside temperature approaches freezing (0°C) by displaying a snowflake symbol. The symbol will turn on when the temperature drops below 1°C and flash for the first 3 seconds, then stay on until the temperature goes above 3°C.

The systems unit of measure (Fahrenheit or Celsius) can be changed by navigating to the settings menu.

The outside air temperature display will come on when the door is open and when the ignition key is in the ACC or ON position and turn off when the ignition switch is turned off.

The outside air temperature display uses a sensor (located at the bottom of the driver's side mirror assembly) to measure outside air temperature only. It is not capable of displaying the temperature of the road surface on either the temperature display or the snowflake icon. Additionally, the outside air temperature reading may be affected by exposure to direct sunlight.

4. Cruise Control Indicator

This area is used to provide the driver with a dedicated location for cruise control set speed and if so equipped, adaptive cruise control with its following distance information. Vehicles with adaptive cruise control will display many different icons in this area to alert the operator to take specific actions.



If there are secondary telltales active while the cruise control is enabled, icons will appear on each side of the cruise control icon.

5. Odometer/Trip Odometer

The Odometer/Trip Odometer comes on when the door is opened and when the ignition key is in the ACC or ON position.

The odometer displays the distance your vehicle has travelled and can be configured to display Metric units or Imperial units.

The current trip odometer displays how far the vehicle has travelled on a particular trip and can display in increments of a tenth of a unit.

To reset the trip odometer, press and hold the button on the main instrument panel. The numbers will reset to zero (0) and begin to count new km travelled.

Press the trip button on the instrument panel any time you wish to view the odometer reading. Press the trip button again to scroll through the other odometers available in the cluster.

6. Clock

The clock presents the home time when the clock is set. If the clock is not set, the words 'SET CLOCK' will appear when the ignition is turned ON. If the clock does not get set, the message will disappear and no time will be displayed. The time can be set while the 'SET CLOCK' prompt is showing or it can be set by navigating to the settings menu via the Menu Control Switch.

- The clock will display the home time of day.
- Set the home time to the current time at the base of operation.
- Refer to settings on page 43 to read more about how to set the clock.

7. Active Warnings

Active warnings will appear in this area in addition to areas around the center of the display. Active warnings are those pop-up messages that appear on the screen and/or have been suppressed with an MCS push. If there are warning icons active while the cruise control is enabled, icons will appear on each side of the cruise control icon. If there are multiple warnings, the display will show how many are active. The numbers may change without user interaction if individual warnings are intermittent, time based, self correcting or the situation is rectified.

8. Main Content Window

There are 5 functions allowed when driving, and 7 when the vehicle is parked. Some functions are available in both modes, but have different content available dependent on the mode.

9. Header

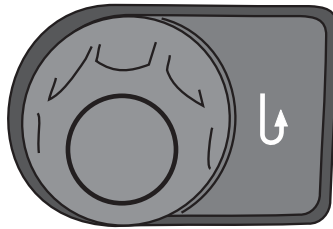
This area displays the function category in which the MCS and display software are currently set. Depending on the display operation, the text colour may change to indicate a user selection.

How to Navigate the Functions in the Driver Performance Center with the Menu Control Switch (MCS)

The MCS is used to navigate the instrument display. It comprises of a back button and a push and spin knob. The MCS is located to the left of the steering column.

The MCS knob can perform two functions. It can select and set values when spun and enter your settings when pushed.

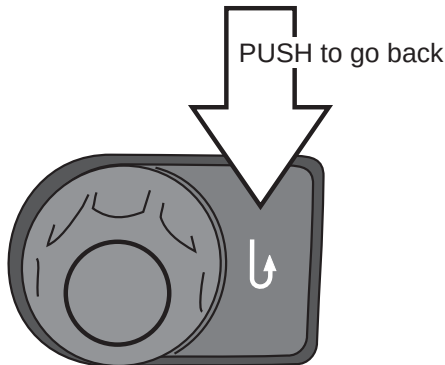
The indicator image on the left lets you know whether spin or push is available. The back button is always available even if there is no indicator image being displayed.

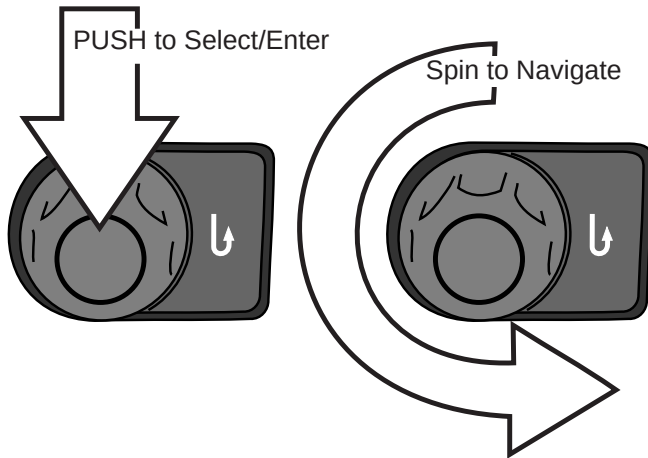


In addition to the prompts for spin and push, this area will show the current menu item as a larger icon and the available menus before and after as smaller icons.

The MCS button has a BACK button located to the right of the knob. Pressing this button will go back to the previous menu.

i If the button is held for 2 seconds, it will turn off the display screen.





Here is a list of the available menu items:

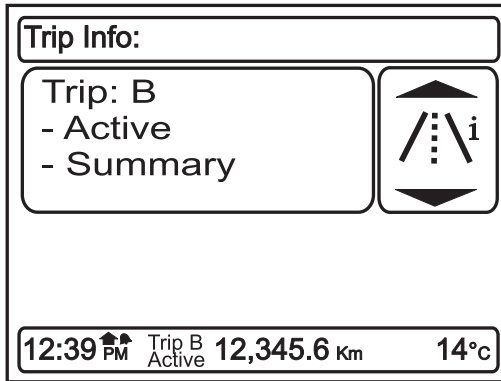
- **Blank Screen** - Use this menu item to minimise information on the screen.
- **Digital Gauges** - This menu item provides dynamic information to the operator.
- **Trip Information** - Use this information to get trip summary details.
- **Truck Information** - Provides information about the vehicle.
- **Active Warnings** - Use this menu to view vehicle fault codes and messages.
- **Settings** - Use these menus to change preferences.
- **Fuel Economy** - Use this display to view the fuel economy performance of the vehicle (available in driving mode).

Navigation of the system is organised into 3 levels of functions. The first level of organisation is identified as 'Trunk' level functions. The second level is identified as 'Branch' level functions. The third level of functions are identified as the 'Leaf' level functions.

Some screens will appear differently depending if the vehicle is moving or parked. The following images provide an example of a screen to get familiarised with the interface.

Trunk Level

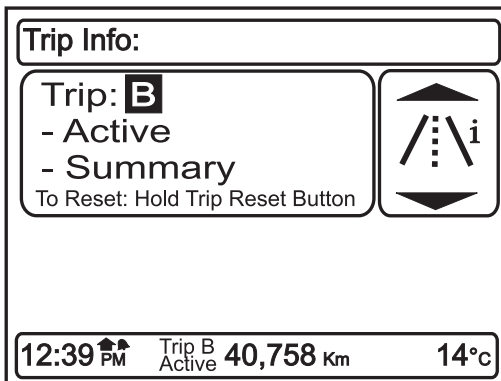
At this level you can navigate between functions by turning the MCS. You can enter a function by pushing the MCS; you would then be going to what is termed the 'Branch' level of the software.



Navigation at Trunk Level

Branch Level

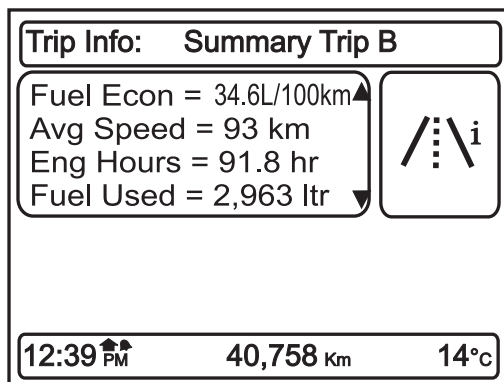
In the branch level of functions, the MCS knob rotation controls a cursor highlight. When something is highlighted, an MCS push will select that item or toggle its contents. Toggle fields typically use a darker coloured text to distinguish them from fields that take the user to the 'Leaf level'.



Display of a Branch Level

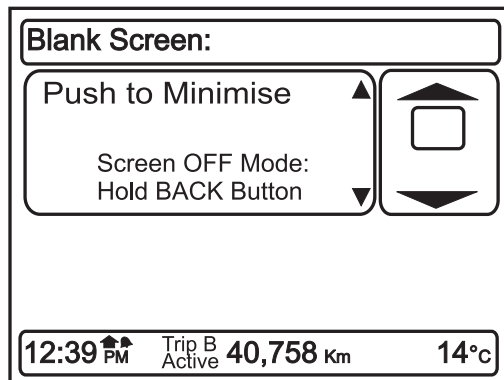
Leaf Level

At this level, there are no more options to choose from. The MCS can be used to scroll through various information and the back button can be used to revert up to the branch (1 push) or the trunk (2 pushes) levels of the system.



Display of a Leaf Level

Description of Menu Screens



Blank Screen

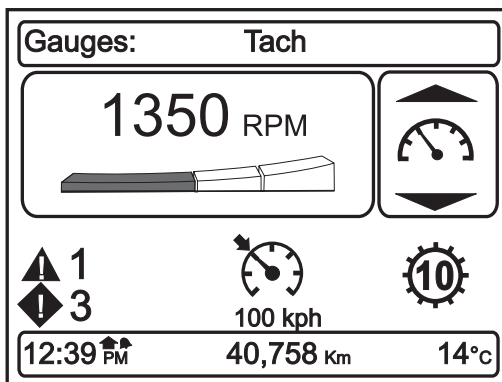
This screen is available in both parked and driving modes.

Blank Screen

The blank screen mode is to allow for minimised screen content, while still maintaining some of the more permanent screen elements such as the odometer, outside air temperature, warning cue, etc. This is different from the Display OFF Mode where the entire display shuts off.

The blank screen mode is selected through the rotary MCS. The Display OFF Mode is selected by pressing the button to the right of the MCS for more than 2 seconds.

Digital Gauges

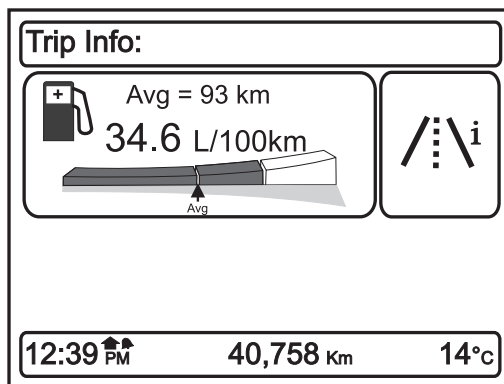


The Digital Gauges function is selected through the rotary MCS and is available in both parked and driving modes.

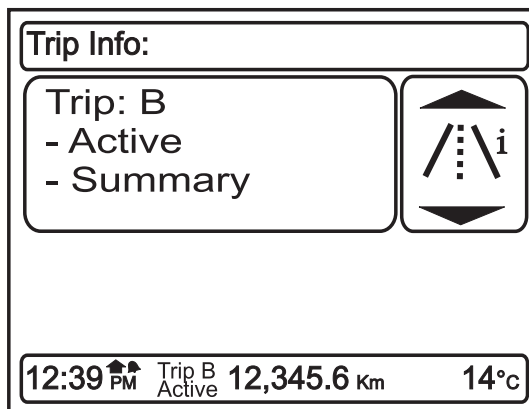
Digital gauges provide dynamic information about the vehicle's performance. Spin the MCS to scroll through the available gauges and push to select the desired gauge to view.

Fuel Economy

This function displays the dynamic fuel economy performance of the vehicle. It shows Average Speed, Average Fuel Economy, and a dynamic instantaneous indication of fuel economy above or below the current average. The screen is available when driving. Average fuel economy is computed by the fuel consumed during the trip (see the next section for Trip information). The fuel economy for a trip will be reset when that trip odometer is reset.



Trip Information



This function allows you to keep trip information data on up to 4 separate trips – labeled A, B, C, and D. Trips are also selectable as 'Active' or 'Inactive' so you can use the data logging function to treat trips separate from each other, or as segments of a combined trip.

When driving, the screen only allows you to toggle which trip is viewed in the trip odometer and set the active/inactive status.

When parked you can select and view a variety of data collected for each trip as seen in the list below:

- fuel economy
- average speed
- engine hours
- idle hours
- % idle hours
- fuel used
- idle fuel used
- % idle fuel used
- sweetspot hours
- cruise control hours
- average engine % load
- drive hours
- PTO hours
- % PTO hours
- PTO fuel used
- % PTO fuel used
- PTO economy

The cluster mounted trip reset button is used to zero and clear accumulated trip data. Short presses toggle between the odometer view, and the 4 trips. Holding the button when on a particular trip will zero the stored data and also automatically set the cleared trip to 'active' status.

 Using the MCS while in this screen will only activate or deactivate a trip function.

PTO options in the display will only be shown if the vehicle is equipped with a PTO.

Truck Information



Only available truck information will be shown (e.g., manual transmissions do not have a software version).

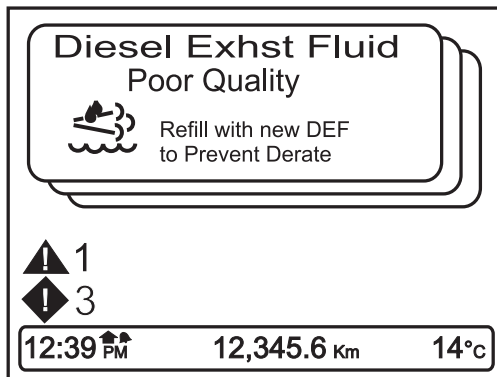
This information is available when the vehicle is parked.

Truck Info:	
Chassis Engine Trans ABS	
12:39  PM Trip B Active 12,345.6 Km 14°C	

1. Chassis Information:
 - a. Chassis Number
 - b. Fleet ID Number
 - c. CECU Software Version Number
2. Engine Information:
 - a. Engine Make
 - b. Engine Model
 - c. Engine Software Version
 - d. Governed Speed Limit
 - e. Engine Power + Hours
3. Transmission Information:
 - a. Transmission Make
 - b. Transmission Model
 - c. Transmission Software Version Number

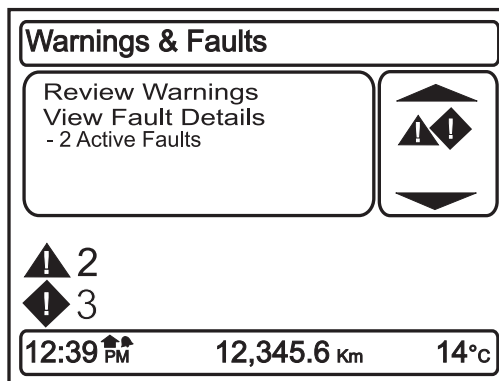
4. ABS Information:
 - a. ABS Make
 - b. ABS Model
 - c. ABS Software Version Number

Warning and Faults



The display has a message alerting function that overrides the normal viewing and navigation of functions when an issue occurs on the truck. These alert messages are called 'pop-ups' because they take over the screen. Some messages are low enough priority that they can be 'suppressed', which is done by pushing the MCS. There will be a screen indicator showing which messages are suppressible. If multiple pop-ups are present at the same time, they are viewed in a stack format, and a spin of the MCS will allow you to see the different warnings. The highest priority warning defaults to the top of the stack.

When the vehicle is parked, the Warnings and Faults function will access suppressed pop-ups that are counted and presented in the upper left corner of the screen.

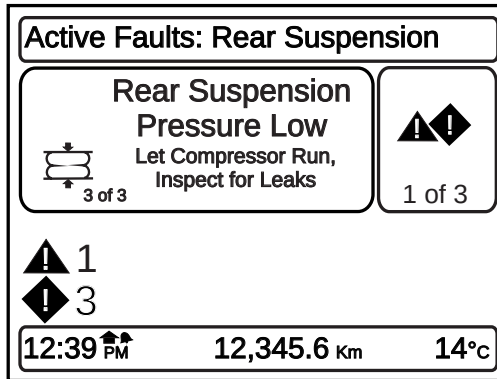


By selecting Review Warnings the pop-up messages are recalled, and if multiple are active, the stack can be navigated by spinning the MCS. The warning description can be viewed when driving or when parked, but the fault details are visible only when parked. The menu selection shown in the image on page 40 will not be displayed when the truck is driving, though the warnings and telltale indicators on the cluster will still be available as indicators if the problem is serious. Fault detail screens include:

1. How many faults, shown in a scrollable stack format.
2. Which ECU the fault is being generated from.
3. A text description of the issue.
4. Its actual fault code.
5. Action instructions telling you what to do (e.g., red warning stop and call for service or orange warning correct at next scheduled service).

An example of a Fault Details screen is shown below.

Fault Details Example



Settings

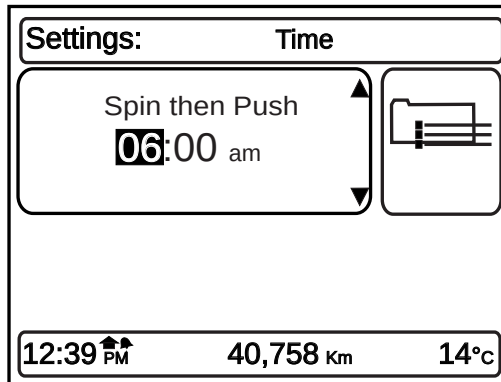
This function is available only when the vehicle is parked.

Various settings may be changed using this function. The operator can change the time format (12hr/24hr), the time of day, units of measure for the display (mile/kilometer), and the language being displayed.

Changing settings functions are typically done one of two ways. Items can be toggled straight from the highlighted selection (at the branch level); these cases use dark blue text that changes to the set value. Others are menu selections that bring up new 'leaf level' screens. The following example shows the clock screen that is navigated to in order to set the clock time.

To Set Clock Display Format:

1. When in the Settings Menu, scroll through the list of menu items to 'Format'.
2. Press the MCS to display either 12 hour (AM/PM) or 24 hour time.

To Set Time:

1. When in the Settings Menu, scroll through the list of menu items to Set Home Time.
2. Press the MCS to select the item to change.
3. Rotate the MCS to change the hour. Press the MCS.
4. Rotate the MCS to change the minutes. Press the MCS.
5. Rotate the MCS to toggle AM/PM (if 12 hour clock selected). Press the MCS.
6. Press the button beside the MCS to exit.

Display Mode - Press 'Back' and hold MCS 2 seconds

The Display Off mode is available at any time in menu navigation, but the screen minimise mode can only be done when on this screen.



There are times when the Display Off mode is not allowed or over-ridden by the system, for example if a pop-up message appears, the screen will turn back on, or if the truck is equipped with an adaptive cruise control system, the screen cannot be turned off when it is active.

WARNING SYMBOLS

Guide to the Warning Symbols

The warning lights and audible alarm may indicate a system malfunction. Check the lights frequently, and respond properly as soon as you see one go on. These lights could save you from a serious accident.

When multiple warning icons are shown on the instrument cluster, they will appear at first and then minimise. When minimised they will be represented in the active warnings area of the display (see Driver Performance Center on page 27 for details). A triangle represents that a warning is registered and a diamond represents a check message.



Do not ignore a warning light or audible alarm. These signals tell you something is wrong with your vehicle. It could be a failure in an important system, such as the brakes, which could lead to an accident causing death or injury. Have the appropriate system checked immediately.

Check messages are provided to give the operator additional information regarding systems that require attention due to a system malfunction and/or operating conditions that may hinder safe and proper performance for the vehicle. The system will emit a chime to alert the operator that a message is appearing on the cluster. Some messages can be managed by the operator while others may require an authorised dealer repair.

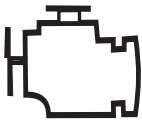
The following is a list of Warning Light/Indicator Symbols that appear in the instrument cluster and Driver Performance Center:

- the symbol name
- the appearance of the symbol
- the symbol colour when it is illuminated
- whether the symbol is standard (STD) or optional (OPT)
- whether the symbol has an associated check message
- the page number reference for additional information

Symbols are listed by major component sections.

Example: Engine - and then in alphabetical order.

Symbol Name	Symbol	Colour	STD/ OPT	Page
1. Axle - Traction Control (ATC)		Yellow	OPT	49
2. Brakes - Anti-Lock Brake System (ABS)		Yellow	STD	49
3. Brakes - Low Air		Red	STD	50
4. Brake - Parking brake		Red	STD	50
5. Brake - Service Brakes & Trailer Low Air		Red	OPT	50
6. Brake Wear. Disc Brakes ONLY		Red	OPT	50
7. Brakes - Trailer Anti Lock Brake System (ABS)		Yellow	STD	50
8. Differential - Inter Axle Diff Lock		Yellow	OPT	50
9. Tipper Truck - Body Up		Red	OPT	51

Symbol Name	Symbol	Colour	STD/ OPT	Page
10. Tipper Truck - Gate Open		Yellow	OPT	51
11. Tipper Truck - Trailer Body Up		Red	AFTER MARKET	51
12. Emissions - Malfunction Indicator Lamp (MIL)		Yellow	STD	51
13. Engine - Check Engine		Yellow	STD	51
14. Engine - Engine Fan		Green	STD	51
15. Engine - Low Coolant Level		Yellow	STD	51
16. Engine - Retarder (Brake)		Green	STD	51
17. Engine - Stop Engine		Red	OPT	52
18. Engine - Wait To Start		Yellow	OPT	52

Symbol Name	Symbol	Colour	STD/ OPT	Page
19. Fuel - Water In Fuel (WIF)		Yellow	OPT	52
20. Lane Departure Warning (LDW)		Yellow	OPT	52
21. Lights - High Beam		Blue	STD	52
22. Power Take-off (PTO)		Yellow	OPT	52
23. Power Take-off (PTO) - Pump Mode	PUMP MODE	Green	AFTER MARKET	53
24. Refrigerator		Green	OPT	53
25. Seat Belt - Fasten		Red	STD	53
26. Suspension Dump		Yellow	STD	53
27. Tyre Inflation		Yellow	OPT	53

Symbol Name	Symbol	Colour	STD/ OPT	Page
28. Transmission - Auxiliary		Yellow	OPT	53
29. Transmission - Check		Red	OPT	53
30. Transmission - Retarder (includes Brakesaver when applicable)		Yellow	OPT	53
31. Transmission - Service Transmission (Allison)		Yellow	OPT	53
32. Turn Signal - Left		Green	OPT	54
33. Turn Signal - Right		Green	OPT	54

DESCRIPTION OF WARNING SYMBOLS



1. Axle - Traction Control (ATC or Automatic Traction Control)

- A. Illuminates during the power-on self test when the ignition is turned ON. It turns off after a few seconds if no system problems are detected. If an ATC problem is detected, the ATC warning lamp will turn on and stay on.
- B. Flashes when the ATC is regulating wheel spin. (Refer to Automatic Traction Control for more information.)
- C. It blinks continuously when the ABS OFF ROAD switch is turned on, indicating this feature is active. (Refer to Anti-Lock Braking System on page 154 and ABS OFF ROAD function switch on page 156 for more information.)



For vehicles equipped with Electronic Stability Program (ESP), refer to additional material supplied with the Customised Maintenance Manual in the Driver Information Pack.



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

2. Brakes - Anti-Lock Brake System (ABS)



Illuminates during the instrument system self test. Have the ABS system checked by an authorised dealer if the ABS warning lamp stays on for more than 3 seconds.

Illuminates during normal operating conditions to indicate a problem with the ABS System. See ABS Warning Lamps on page 154 for more information.

Illuminates when a problem exists with the optional Wheel Spin Control feature. See ABS with Stability Control on page 156 for more information.



3. Brakes - Low Air

Illuminates when the air pressure in the air reservoirs are low.



4. Brake - Parking brake

Illuminates in the status indicator when parking brakes are applied.



5. Brake - Service Brake & Trailer Low Air

Indicates that a fault exists in the brake system. This should be checked by an authorised dealer as soon as possible.



6. Brake Wear - Disc Brake Pads Low Warning

Indicates that the disc brake pads need replacement.



7. Brakes - Trailer Anti-Lock Brake System (ABS)

Illuminates during the instrument system self test and the prime mover is connected with an ABS equipped trailer.

Illuminates during normal operating conditions to indicate a problem with the trailer ABS System.

This should be checked by an authorised dealer as soon as possible. See ABS Warning Lamps on page 154 for more information.

8. Differential - Inter Axle Diff Lock



Illuminates when the inter-axle differential switch is ON thus locking the inter-axle differential. This powers the forward rear and the rear rear differentials equally. When the switch is turned off (inter-axle differential unlocked) the engine power is allowed to flow to any of the 4 drive tyres based on the differential effect (mostly to the forward rear differential). (This feature is standard on all tandem axles.)



9. Tipper Truck - Body Up

Illuminates when Truck Tipper Body is up.



10. Tipper Truck - Gate Open

Illuminates when Truck Tipper Gate is open.



11. Tipper Truck - Trailer Body Up

Illuminates when Trailer Tipper Body is up.



12. Emissions - Malfunction Indicator Lamp (MIL)

Illuminates when an engine emissions failure has occurred. The vehicle can be safely driven but should be serviced to correct the problem. The situation should not be considered an emergency.



13. Engine - Check Engine

Illuminates when a non emissions related problem exists, but the vehicle can still be safely driven. Vehicle should be serviced to correct the problem but the situation should not be considered an emergency.



14. Engine - Engine Fan

Illuminates when fan is active.



15. Engine - Low Coolant Level

Illuminates with an audible alarm indicating critically low coolant level. The vehicle must be serviced to correct the problem but the situation should not be considered an emergency.



16. Engine - Retarder (Brake)

Illuminates when the engine retarder (compression brake or exhaust brake) switch is turned on. (Engine retarders are an option.)



17. Engine - Stop Engine

Illuminates and an audible alarm will sound when a major engine system problem exists.



The illumination of the Stop Engine Light should be considered an emergency. You should stop the vehicle as safely as possible and turn OFF the ignition. The vehicle must be serviced and the problem corrected before driving again. Failure to do so may cause severe engine damage or cause an accident involving death or personal injury.



18. Engine - Wait To Start

Illuminates when Engine Grid Heater is on.



19. Fuel - Water In Fuel (WIF)

Illuminates when water has been detected in the fuel.



20. Lane Departure Warning (LDW)

Illuminates when optional LDW system is not able to track the vehicle's position within the lane.



For vehicles equipped with Lane Departure Warning, refer to Lane Departure Warning Driver's Instructions on page 168.



21. Lights - High Beam

Illuminates when the high beams are on. This icon will flash with audible alarm if the headlights are left on when the door is open. In addition, this icon will flash, but without an audible alarm, if there is a problem with the low beam headlights or the low beam headlight wiring. In such an event, the high beam headlights will turn on at 50% normal brightness.



PTO

22. Power Take-off (PTO)

Illuminates when the PTO is engaged.



Do not drive vehicle with PTO engaged.



PUMP MODE

23. Power Take-off (PTO) - Pump Mode

Illuminates with remote throttle application. Indicates pump mode is active.



24. Refrigerator

Illuminates to indicate the refrigerator is on and ignition is off.



25. Seat Belt - Fasten

Illuminates when the ignition key is turned on as a reminder to fasten your seat belt.



26. Suspension Dump

Illuminates when the Suspension Dump switch is activated and the suspension air bags are deflated. Wait for suspension to fully deflate before moving vehicle.



27. Tyre Inflation

Illuminates when tyre pressures need to be checked. (Tyre Pressure Monitoring System is an option.)



28. Transmission - Auxiliary

Illuminates to indicate auxiliary transmission is in neutral.



29. Transmission - Check

Illuminates when transmission has recorded a fault code. This icon may also appear in the Transmission Display menu of the Driver Performance Center. If the user is in this display menu, the icon does not indicate a fault code.



30. Transmission - Retarder (may include Brakesaver when applicable)

Illuminates when BrakeSaver (export only) or Transmission Retarder is active.



31. Transmission - Service Transmission (Allison)

Illuminates when Allison 3000/4000 transmission requires service.



32 & 33. Turn Signals - Left or Right

Blinks when the left or right turn signal or the hazard light function is operating.

OPTIONAL GAUGES

Introduction

Listed here are gauges that may or may not be on your dashboard or the center instrument cluster. For vehicles with a telematic navigation screen, optional gauges will be part of the screen functions. refer to the navigation system supplement for further details about its functions and how it works.



Fuel Filter Restriction Pressure

This gauge tells you the condition of the fuel filter by indicating the restriction from the fuel filter to the fuel pump. Check the engine manual for proper restriction. Replace the filter with an approved filter only. Do not substitute the wrong micron element.



The maximum allowable restriction could vary according to the type or make of engine. Consult the engine manufacturer's manual or engine dealer for fuel restriction specifications.

Air Filter Restriction Indicator or Gauge



This gauge indicates the condition of the engine air cleaner and is measured by inches of water (H_2O). A clean filter should register 7in. H_2O (may vary with system design) and a filter whose life is over will register approximately 25in. H_2O .



Continued operation with the Air Filter Restriction Gauge reading 25in. H_2O may cause damage to the engine. Inspect the filter and replace if necessary. Holes in the paper element render an air cleaner useless and may cause the Air Filter Restriction Gauge to give a false reading, even if the element is clogged. Replace the element if it is damaged.

Engine, Oil Pressure



It is important to maintain oil pressure within acceptable limits. If oil pressure drops below the minimum psi a red warning light in the gauge will turn on, the Stop Engine light will come on and an audible alarm will sound.



Engine, Oil Temperature

The Engine Oil Temperature gauge indicates the engine oil temperature. If the oil temperature exceeds the maximum limits, a red warning light in the gauge will turn on. Do not exceed maximum engine oil temperature recommended by the engine manufacturer.



Manifold Pressure Gauge

Your Manifold Pressure Gauge indicates the power your engine is putting out by showing the amount of turbo boost. If the pressure indicated by your manifold pressure gauge goes down, there may be something wrong with your engine. Have it checked by an authorised service technician.



Fuel Pressure Gauge

Your vehicle may also have a fuel pressure gauge.



Transmission Temperature Gauge

Your Transmission Temperature Gauge indicates the temperature of the oil in your transmission. Watch this gauge to know when your transmission is overheating. If it is, have it checked by an authorised service technician.

Maximum transmission temperature may vary, depending upon the transmission and type of lubricant. Check the transmission service manual in the Customised Maintenance Manual in the Driver Information Pack.



Drive Axle Temperature Gauge (Forward and Rear)



These gauges indicate the temperature of the lubricant in your vehicle's axle(s). These temperatures will vary with the kind of load you are carrying and the driving conditions you encounter. Maximum axle temperature may vary, depending upon the axle and type of lubricant. Very high temperatures signal a need to have your axle(s) lubrication checked.

Depending on the vehicle configuration, there may be a drive axle temperature gauge for more than just the forward and rear driver. The icon will have an 'X' over the representative axle to indicate which axle the temperature is being displayed in the gauge.



Driving with very hot temperatures in your rear drive axles can cause serious damage to axle bearings and seals. Have your axle lubrication checked if you notice a sign of overheating.



Suspension Load Air Pressure, No's 1 & 2

The Suspension Load Air Pressure gauge indicates the amount of air pressure in the air suspension air bags.



When the vehicle is equipped with dual leveling valves, the No 1 gauge indicates the air pressure in the left hand side (passenger's side) air bags. The No 2 gauge indicates the air pressure in the right hand side (driver's side) air bags.



Prime Mover Brake Application Air Pressure

The Prime Mover Brake Application Air Pressure gauge indicates the amount of air pressure applied to the prime mover brakes.



Transfer Case Oil Temperature

The Transfer Case Oil Temperature gauge indicates the temperature of the oil in the transfer case. If the oil temperature exceeds maximum limits, a red warning light in the gauge will turn on. Do not exceed maximum oil temperature recommended by the manufacturer. (See the Transfer Case Operation in the Customised Maintenance Manual in the Driver Information Pack.)



Transmission Oil Temperature, Auxiliary

The Auxiliary Transmission Oil Temperature gauge indicates the temperature of the oil in the auxiliary transmission.



Watch this gauge to know when the transmission is overheating.

Do not exceed maximum oil temperature recommended by the manufacturer. (See the Transmission Operation and Maintenance Manual for details.)



Transmission Retarder Oil Temperature

The Transmission Retarder Oil Temperature gauge indicates the temperature of the oil in the transmission retarder.



Watch this gauge to know when the transmission is overheating.

Do not exceed maximum oil temperature recommended by the manufacturer. (See the Transmission Operation and Maintenance Manual in the Customised Maintenance Manual in the Driver Information Pack.)

DASH SWITCHES

This custom vehicle will have a wide variety of switch controlled equipment. However, this particular vehicle may not have every switch identified in this section of the operator manual.

Some air device switches on the dash may require that the vehicle either be at a specific speed, parking brakes set or another device to be on or off for the air device to operate.

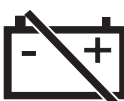
The instrument display will display information regarding what needs to change in order for the air device to operate as expected.

Some of these switches control air system functions and may require the vehicle's ignition to be in the ACC or ON position for switch to maintain control via air pressure. If the switch requires ignition power, it will allow that air circuit to lose pressure (deactivate) once the ignition is turned OFF. To activate that function again, the ignition needs to be turned to the ACC or ON position and the switch needs to be re-engaged. Some of the switches that control air functions will not disengage when the vehicle ignition is turned off.

If the ignition is turned off, air pressure will be maintained in the circuit for that control switch. The few switches that do not require ignition power are described accordingly after the Dash Switch table.

The Dash Switch table provides a complete list of icons that may be found on the switch.

Symbol Name	Symbol	Colour	STD/ OPT	Page
1. Axle - Diff-Lock - Dual		Amber	OPT	63
2. Axle - Diff-Lock - Forward Rear		Amber	OPT	63
3. Axle - Diff-Lock - Steer		Amber	OPT	63

Symbol Name	Symbol	Colour	STD/ OPT	Page
4. Axle - Diff-Lock - Rear Rear		Amber	OPT	63
5. Axle - Diff-Lock - Single Rear		Amber	OPT	63
6. Axle - Inter-Axle Differential Locked (Tandem)		Amber	OPT	63
7. Axle - Two Speed		Green	OPT	63
8. Reversing Alarm Mute		Amber	OPT	63
9. Batteries - Low Voltage Disconnect (LVD)		None	STD	64
10. Brakes - ABS Off Road		Amber	OPT	64
11. Brakes - Parking Brake Valve (Yellow Button)		Red	STD	64
12. Brakes - Trailer Air Supply Valve (Red Button)		Red	STD	64 & 149
13. Brakes - Trailer Hand		None	STD	64

Symbol Name	Symbol	Colour	STD/ OPT	Page
14. Cab Dimmer Switch		None	STD	65
15. Tipper Truck Gate Open		Red	OPT	65
16. Engine Idle Timer		Green	OPT	65
17. Engine - Cruise Control On/Off		Green	STD	65
18. Engine - Cruise Control Set/Resume		None	STD	65
19. Engine - Fan Override		Green	OPT	66
20. Engine - Remote Throttle	PUMP MODE	Amber	OPT	66
21. Alternator Isolation Switch		Green	OPT	66
22. Generic - Air Accessory		Green	OPT	66
23. Generic - Spare	SPARE	Green	OPT	67
24. Lights - Auxiliary		Green	OPT	67

Symbol Name	Symbol	Colour	STD/ OPT	Page
25. Lights - Beacon		Green	OPT	67
26. Lights - Interior		None	STD	67
27. Lights - Exterior Lights Self Test		None	STD	67
28. Lights - Flood		Amber	OPT	67
29. Lights - Flood ISO 3732 Spare		Amber	OPT	67
30. Lights - Fog		Green	OPT	67
31. Lights - Hazard		Red	STD	68
32. Lights - Headlight & Parking Lights		None	STD	68
33. Lights - Marker (ID)/ Clearance		None	STD	68
34. Lights - Marker / Clearance/Cab		None	OPT	68
35. Lights - Marker / Clearance/Trailer		None	OPT	69

Symbol Name	Symbol	Colour	STD/ OPT	Page
36. Lights - Spot		Green	OPT	69
37. Power Take-off (PTO)		Amber	OPT	69
38. Suspension Dump		Amber	OPT	69
39. Transmission - Transfer Case		Amber	OPT	70
40. Transmission - Transfer Case 2 Speed		Amber	OPT	70



1. Axle - Diff-Lock - Dual

Turn switch on to engage Front and Rear Axle Diff Lock.



2. Axle - Diff-Lock - Forward Rear

Turn switch on to engage Forward Rear Axle Diff Lock.



3. Axle - Diff-Lock - Steer

Turn switch on to engage Front Axle Diff Lock.



4. Axle - Diff-Lock - Rear Rear

Turn switch on to engage Rear Rear Axle Diff Lock.



5. Axle - Diff-Lock - Single Rear

Turn switch on to engage Single Rear Axle Diff Lock.



6. Axle - Inter-Axle Differential Locked (Tandem)

Turn switch on to engage Inter-Axle on to Differential Lock.



7. Axle - Two Speed

If equipped, the two speed axle switch allows you to select axle high and low ranges. The low range (Off) provides maximum torque for operating off-highway. The high range (On) is a faster ratio for highway speeds. This switch does not require ignition power to maintain the desired switch setting.



8. Reversing Alarm Mute

Turn switch on to mute Back Up Alarm.

The mute function use is discouraged. Only use mute when legally required.



9. Batteries - Low Voltage Disconnect (LVD)

If your vehicle is equipped with a Low Voltage Disconnect (LVD) feature, the LVD module is located inside the driver's side kick panel.



10. Brakes - ABS Off Road

Turn switch on to engage ABS Off-Road mode. See Anti-Lock Braking System on page 235. Momentarily push switch in to engage Traction Control (TC)



11. Brakes, Parking Brake Valve

Pull yellow knob to activate parking brakes. See Parking Brake Valve on page 148.



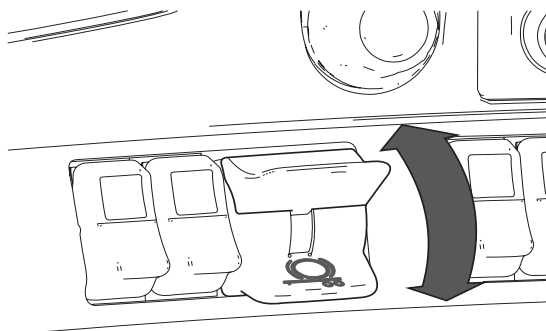
12. Brakes, Trailer Air Supply Valve.

The red octagonal knob controls the air supply to the trailer. With both knobs pushed IN, air is now being supplied to both the trailer and the truck spring brakes; all brakes are released.



13. Brakes, Trailer Hand.

This dash mounted switch provides air pressure to apply the trailer brakes only. It operates independently of the foot treadle valve. See Using the Brake System on page 146-179, for more instructions on proper use of the Trailer Brake Hand Valve.





14. Cab Dimmer Switch

This switch is used to alter the brightness of the instrument panel lights.

The Headlamp Switch is an ON or OFF switch. The panel lights are on full intensity during the day and go to dimmer mode when headlights are on.



15. Tipper Truck Gate Open

Turn switch on to open Tipper Gate.



16. Engine Idle Timer

Turns ON when park brake applied and engine turned OFF. An override switch located on the dash is available if the vehicle needs to be turned off before the timer reaches 3 minutes.



17. Engine - Cruise Control On/Off

Turn switch on to activate Cruise Control System.



18. Engine - Cruise Control Set/Resume

The Cruise Control Set/Resume switch allows you to SET the desired speed or RESUME the desired speed after the cruise control function has been interrupted.



Do not operate the cruise control when operating on road surfaces with poor traction (wet, icy, or snow covered roads) or in heavy traffic. Accelerations caused by the normal operation of the cruise control could cause you to lose control of the vehicle resulting in an injury or accident.



19 Engine - Fan Override

The engine fan switch allows you to control the engine fan manually or automatically.

 ***Do not work on or near the fan with the engine running. Anyone near the engine fan when it turns on could be seriously injured. If it is set at MANUAL, the fan will turn on any time the ignition key switch is turned to the ON position. In AUTO, it could engage suddenly without warning. Before turning on the ignition or switching from AUTO to MANUAL, be sure no workers are near the fan.***

 The fan or equipment near it could be damaged if the fan turns on suddenly when you do not expect it. Keep all tools and equipment away from the fan.

 Do not operate the engine fan in the MANUAL position for extended periods of time. The fan hub was designed for intermittent operation. Sustained operation will shorten the fan hub's service life as well as reduce fuel economy.

PUMP MODE

20. Engine - Remote Throttle

Turn switch on to activate Remote Throttle Control.



21. Alternator - Isolation Switch

Used in fuel haul applications. When activated the switch cuts the field isolation in the alternator so that alternator does not charge.



22. Generic - Air Accessory

Provides accessory air to the end of frame connection when end of frame connection switch is turned on.

The generic air accessory switch is designed by the original equipment manufacturer to reset when the ignition power is turned off. When ignition is turned off, this circuit will exhaust air pressure.

SPARE 23. Generic - Spare

Turn switch on to power customer installed accessory.



24. Lights - Auxiliary

Turn switch on for Auxiliary Lights.



25. Lights - Beacon

Turn switch on for Beacon Light(s).



26. Lights - Dome Lights (Interior)

A two-position switch, located on the dome light, controls each dome light. In addition, the dome lights can be switched on or off with the dash-mounted control labelled DOMELIGHT.



27. Lights - Exterior Lights Self Test

This switch will engage a program which will illuminate exterior lights for the operator to verify functionality. Refer to Exterior Lights Self Test on page 82 for more detail on how to use the program.



28. Lights - Flood

Turn switch on for cab mounted Flood Lights.



29. Lights - Flood ISO 3732 Spare

Turn switch on for trailer mounted Flood Lights.



30. Lights - Fog

Turn switch on for Fog Lights.



31. Lights - Hazard Warning

With the switch in the ON position, the emergency flasher makes all four turn signals (front and rear) flash simultaneously. The flasher works independently of the ignition switch. You should always use the flasher if the vehicle is disabled or parked under emergency conditions.



Use your Hazard Warning Light System any time you have to stop off the road or on the side of the road, day or night. A hard to see vehicle can result in an injury or accident. Another vehicle could run into you if you do not set your flashers and follow the placement of emergency signals.



32. Lights - Headlight and Parking Lights

Turn switch on for headlights. When the headlights are ON, side, and tail lights are also on. When the headlights are on, the instrument lights including Smart Wheel, side and tail lamps are also on. This switch also controls the park lights.

If you have confirmed there is a problem in the low beam wiring circuit, proceed with caution to the next available exit/turnoff and safely pull your vehicle completely off the road and call for assistance. Driving your vehicle with the headlights on high beam (at reduced intensity) for a prolonged period could lead to an injury or accident. Contact your nearest dealer to have the problem corrected as soon as possible.



33. Lights - Marker (ID)/Clearance

Turn switch on to control Cab and Vehicle Marker (ID)/Clearance lights. Marker (ID) and clearance lights are the five amber lights on top of the cab and the front of the trailer, and the five red lights on the rear of the truck or trailer. They are switched on when the headlight switch is in the park light position.



An interrupt switch for the trailer marker lights is mounted on the end of the turn signal lever.



34. Lights - Marker/Clearance/Cab

Turn switch on to control Cab Marker/Clearance lights separately from the trailer.



35. Lights - Marker/Clearance/Trailer

Turn switch on to control Trailer Marker/Clearance lights separately from the vehicle marker/clearance lights.



36. Lights - Spot

Turn switch on for Spot Light.



37. Power Take-off (PTO)

Turn switch on to engage PTO. Your vehicle may be equipped with a dash mounted switch that controls PTO engagement/disengagement.

When the operator activates the switch for the PTO, the status indicator lamp (located on the switch) will immediately illuminate even though PTO engagement may not have occurred.

If the PTO is engaged and the operator turns the switch OFF, the PTO status indicator lamp (located on the switch) will go out immediately even though PTO disengagement may not have occurred.



Actual PTO engagement/disengagement may be delayed momentarily since it is controlled by the air system and mechanical movement.



Increasing engine RPM before the PTO is actually engaged could prevent the PTO from engaging and/or cause PTO damage.



38. Suspension - Dump

Turn switch on to deflate Suspension Air Bags. This switch does not require ignition power to maintain the desired switch setting.



Do not operate the Air Suspension Deflate Switch (Dump Valve) while driving. Sudden deflation while your vehicle is moving can affect handling and control and could lead to an accident. Use this switch only when your vehicle is not moving.



Operating a vehicle with air suspension bags either over-inflated or under inflated may cause damage to driveline components. If a vehicle must be operated under such conditions, do not exceed 8km/h.



39. Transmission - Transfer Case

Turn switch on to shift the Transfer Case.

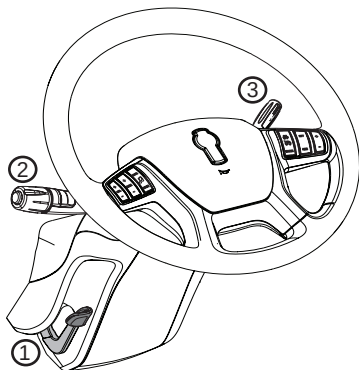


40. Transmission - Transfer Case 2 Speed

Turn switch on to shift the 2 Speed Transfer Case.

STEERING COLUMN AND CONTROLS

The steering column has controls for tilt/telescope, turn signal, wipers, engine brake and optional transmission controls.



1. Tilt/Telescoping Lever
2. Turn Signal/Wiper/Lights
3. Engine Brake (optional Transmission Shifter)

The turn signal lever is mounted on the left side of the steering column. The lever controls several functions; turn signal, high beam and windscreen wiper control.



The ignition key must be turned to ON for the signal/switch to operate.

TILT/TELESCOPING STEERING COLUMN

Your truck is fitted with an adjustable Tilt/Telescoping steering column.

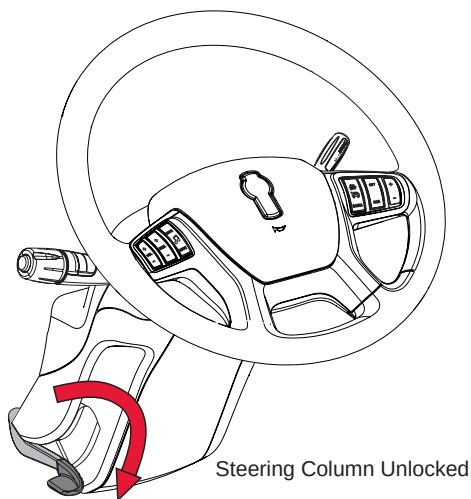
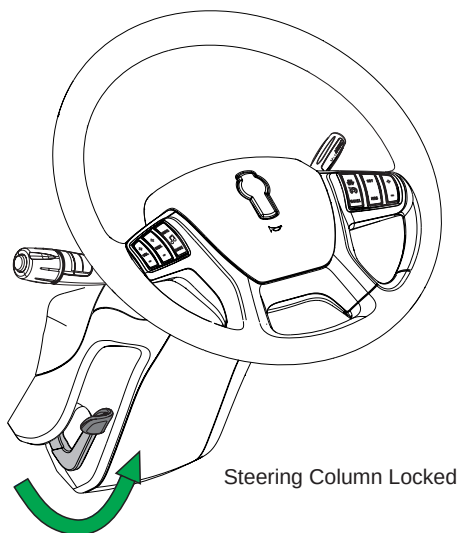
- the tilt feature allows forward and rearward movement of the wheel
- the telescoping feature allows you to adjust the height by moving the wheel up and down

To activate these features, locate the Tilt/Telescoping lever.



Make all adjustments to the steering mechanism while the vehicle is stopped. Adjusting the Tilt/Telescoping Steering Wheel while the vehicle is in motion could cause loss of control. You wouldn't be able to steer properly and could have an accident resulting in death or personal injury.

To adjust the steering wheel, PUSH and HOLD the lever down fully. Adjust the steering wheel by pulling or pushing the wheel to the desired height and angle, then return the lever back into the locked position.



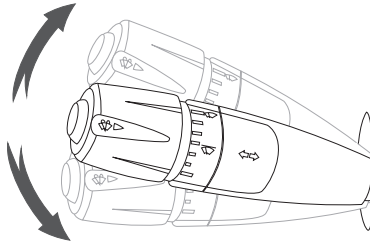
TURN SIGNAL/HIGH BEAM SWITCH



The ignition key must be turned to ON for the signal/switch to operate.

The lever-action turn signal/high beam switch is located on the left side of the steering column. Each time a turn signal indicator is activated the buzzer will emit a short click sound.

Turn Signals



Turn Signal/High Beam Switch on Steering Column

- To signal a right turn, push the lever forward (clockwise).
- To signal a left turn, pull the lever back (counterclockwise).
- Each time the turn indicator is activated the audible warning emits a short click.



If the vehicle turn signals and turn signal indicators in the dash gauge cluster ever begin flashing at an accelerated rate (115 cycles per minute) when the turn signal lever is in the OFF (center) position, or when a Right/ Left turn has been selected, the problem may be related to a failed turn signal switch or turn signal module. In either case, the problem is not a failed bulb. Contact your nearest authorised dealer to have the problem corrected as soon as possible.



After you complete a turn, shut the system off by returning the lever to the 'OFF' (center) position. Failure to shut off a turn signal could confuse other drivers and could result in an injury or accident. An indicator light in the instrument panel will flash until the turn signal is turned off.

HIGH BEAM

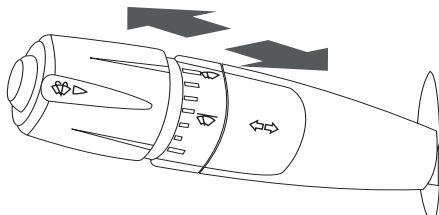


The headlights must be ON for the high beam switch to operate.

- To switch your headlights to low or high beam, gently pull the turn signal lever toward the steering wheel until you hear the switch click and the beam changes. The blue indicator light in the instrument panel will illuminate when the high beam is being used.
- To return to previous beam; pull the lever towards the steering wheel again.
- The high beams can be momentarily flashed with or without the headlights being on. To flash the high beams, gently push the headlight lever away from the steering wheel to momentarily turn on the lights.

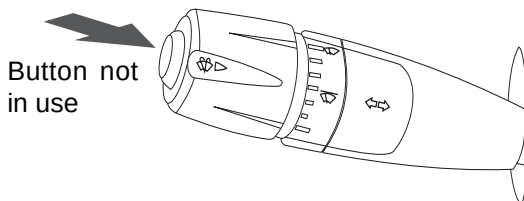


Continued pressing of the high beam flash will not keep the high beams on.



Flash to Pass on Steering Column

The 'flash to pass' functionality of the headlight switch is not available for vehicles manufactured with High Intensity Discharge (HID) headlights. Check with local regulations regarding restrictions on using high beam flashing.



ID and Clearance Lights Flash on Steering Column



WINDSCREEN WIPERS/WASHER

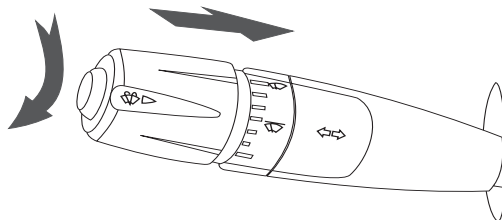
Your vehicle is equipped with a two-speed intermittent windscreen wiper system. The windscreen wiper system is integrated with the exterior lights so the low beam headlights will turn on when the windscreen wipers turn on.

To override this function, turn the headlights on and then off again and the low beams will turn off.

A seven position rotary wiper switch (located on the turn signal lever) operates the windscreen wipers and washer. Rotate the end of the turn signal lever to change the wiper mode.



The ignition key must be turned to ON or ACC for the wiper/washer switches to operate.



Wiper/Washer on Steering Column

The first position after OFF is the intermittent No 1 cycle. The next positions are intermittent No's 2, 3, and 4. The last two positions are wiper low speed and wiper high speed.

To Wash the Windscreen

Push the rotary wash/wipe knob in (towards steering column), hold for more than 0.8 seconds and then release. Hold the knob in to extend the washing cycle. After the lever is released, the wipers will shut off automatically or resume the wiper's setting speed.

To activate the wipers for one swipe without activating the washer ('mist' function), push the turn signal lever in (towards the steering column) and release in less than 0.5 seconds. The wipers will perform a single swipe and then resume the wipers setting speed.

 ***Clean blades regularly with a damp cloth to remove road film and wax build-up. Do not drive with worn or dirty wiper blades. They can reduce visibility, making driving hazardous which may lead to an injury or accident resulting in death or personal injury.***

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

 ***If the electric pump is operated for a long period (more than 15 seconds) with a dry reservoir, the pump motor may be damaged.***

The washer bottle filler is located on the passenger's side cowl panel. The washer bottle contains approximately 13 litres of water. Check the windscreen washing fluid level daily. If necessary, fill to top. See image below for location.

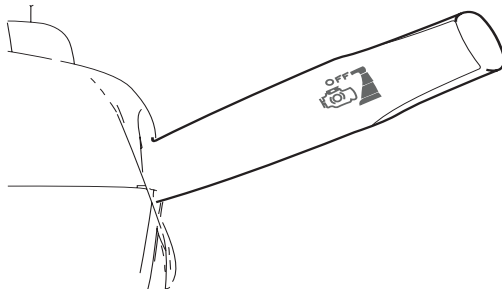


Windscreen Washer Reservoir Location on Left Hand Cowl Panel

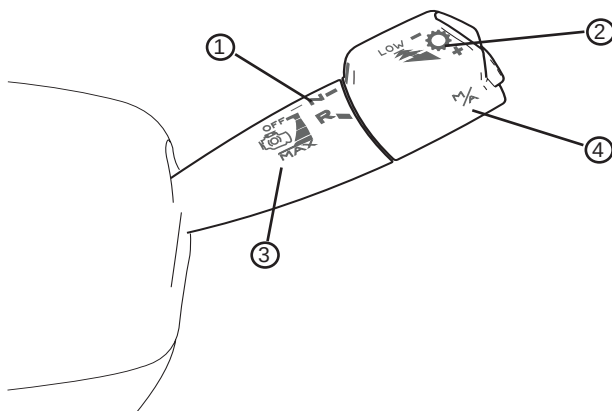
Clean all inside and outside windows regularly. Use an alcohol-based cleaning solution and wipe dry with either a lint-free or a chamois cloth. Avoid running the wiper blades over a dry windscreen to prevent scratching the glass. Spray on washer fluid first. A scratched windscreen will reduce visibility.

CONTROLS ON RIGHT HAND SIDE OF THE STEERING COLUMN

The lever on the right hand side of the steering column will operate the engine brake for vehicles with manual transmissions.



This vehicle may be equipped with a PACCAR Transmission or Eaton UltraShift Plus Transmission. The lever on the right hand side of the steering column will operate the transmission functions in addition to operating the engine brake. For detailed instruction see Engine Brake Operations on pages 111-112 and Transmission Controls on pages 121-122.



1. Transmission **D - N - R** Function
2. Up (+) and Down (-) Shift and **Low** Mode
3. Engine Brake and **Max** Mode
4. Manual (**M**)/Automatic (**A**) Mode Button

STEERING WHEEL CONTROLS (OPTIONAL)



Under no circumstances should you attempt to service the steering wheel, clockspring or any of the electrical wiring in the multiplex system or any steering components (steering column, steering driveline or steering gear). Tampering with these components may result in an inoperable multiplex system.

This vehicle may be equipped with an optional steering wheel with audio and cruise control button mounted on the spokes of the steering wheel.



1. Left Switch Pad 2. Horn Pad 3. Right Switch Pad

System Description

The steering wheel contains controls for commonly used functions so the operator does not have to take their hands off the steering wheel to operate these functions.

CRUISE CONTROL

Vehicles with steering wheel controls will have cruise control options on the right hand of the wheel instead of the switches on the dashboard. These optional switches for cruise control include a third switch to allow the operator to accelerate or coast while maintaining cruise control operation.



Left Switch Pad	Right Switch Pad
1. Audio Volume +/-	1. Cruise Control On/Off/Cancel
2. Audio Seek +/-	2. Cruise Control Set/Resume
3. Audio Mute/Mode	3. Cruise Control Accelerate /Coast



Do not operate the cruise control when operating on road surfaces with poor traction (wet, icy or snow covered roads) or in heavy traffic. Acceleration caused by the normal operation of the cruise control could cause you to lose control of the vehicle resulting in an injury or accident.

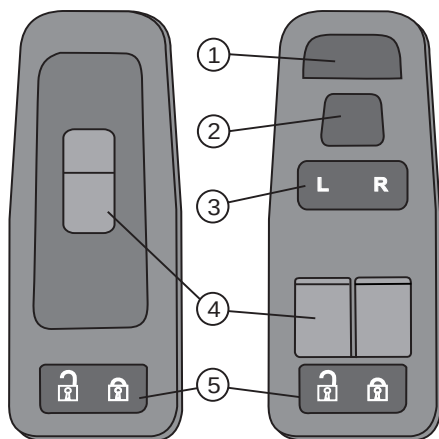
HORN

To use the electric horn, press the pad in the center of the steering wheel, which is the standard location for electric horns. Your vehicle may be equipped with air horns. To operate, pull on the lanyard extending from the overhead console panel adjacent to the 'A' pillar.

DOOR MOUNTED CONTROLS

Introduction

Your vehicle is fitted with power mirrors, the mirror controls will be located on the driver side door pad. Mirrors can be adjusted in 4 directions.



- 1 Mirror Heat Switch
- 2 Power Mirror Switch
- 3 Mirror Selector Switch
- 4 Power Window Switch
- 5 Power Door Lock Switch

Adjust all mirrors before driving. Adjusting the mirrors while driving could cause you to take your eyes off the road which can result in an accident. Failure to do so could lead to serious injury or equipment damage.

To provide good visibility, adjust the mirror so the side of your vehicle appears in the inboard part of the mirror.

Convex mirrors can distort images and make objects appear smaller and further away than they really are. You could have an accident if you are too close to another vehicle or other object. Keep plenty of space between your vehicle and others when you turn or change lanes. Remember that other objects are closer than they may appear.

1. Mirror Heat Switch

Your vehicle may be equipped with standard heated mirrors. Mirror heat is controlled by the mirror heat switch button, which is part of the mirror switch module located on the driver side door pad.

2. Power Mirror Switch

If your vehicle is equipped with standard power mirrors, the directional controls for both mirrors are located near the top of the driver side door trim pad.

1. Move the mirror selector switch (3) to the right or left from the neutral center position to select the desired mirror for adjustment.
2. Depress the mirror directional control pad (2) in one of its four arrow directions to adjust the mirror in/out or up/down.



After mirror adjustments have been completed, return the mirror selector switch back (3) to the center (neutral) position to prevent unintentional adjustments to the mirrors.

3. Mirror Selector Switch

If the mirrors require adjustment, use this switch to select either right or left hand mirror.

4. Power Window Switch

Power window rocker switches are located on the door pads. Depress the switch to open the window or pull up on the switch to close the window. Release the switch to stop window movement. The drivers side window has an express down feature. Pushing on the switch all the way down until the switch bumps will activate the express down feature. Release the button and the window will continue to open until it is completely open.

5. Power Door Lock Switch

Power door lock rocker switches are located on the door pads. To lock or unlock both cab doors, depress any door lock switch that displays a closed or open padlock symbol, respectively, on the switch face.

Exterior Lights Self Test

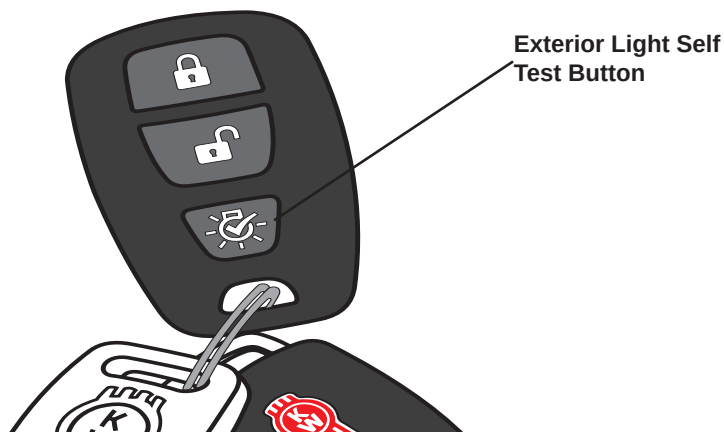
This feature allows the operator to verify and inspect exterior lighting operation typically performed during a pre-trip inspection. When the feature is engaged, via a switch on the key fob, it will illuminate the:

- park lights
- side marker lights
- hazard/turn signals
- low & high beam headlights
- first set of fog lights
- stop/brake lights

After turning these lights off, the system will resume testing the first set of lights. The light test will eventually stop on its own. The operator may interrupt the test by turning the vehicle off or pressing the switch a second time while the test is running. The operator can verify the functionality of the lights by visibly watching the lights from outside the vehicle during the test or can read the instrument cluster for any faults displayed that are lighting related.

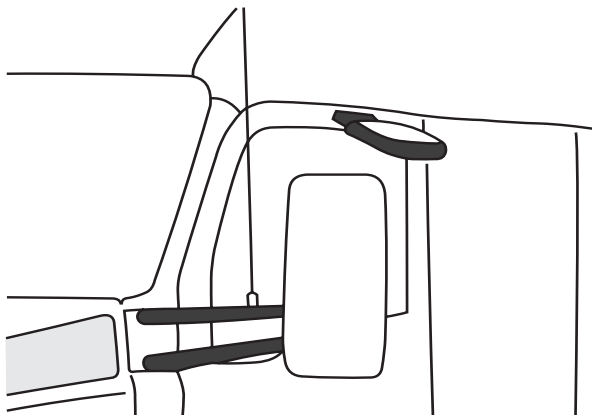
To start the Exterior Light Self Test feature:

1. Park the vehicle and set the parking brakes.
2. Insert the key into the ignition, start the engine and allow the vehicle to run through its Power On Self Test.
3. Press the momentary switch on the key fob to start the cycle.

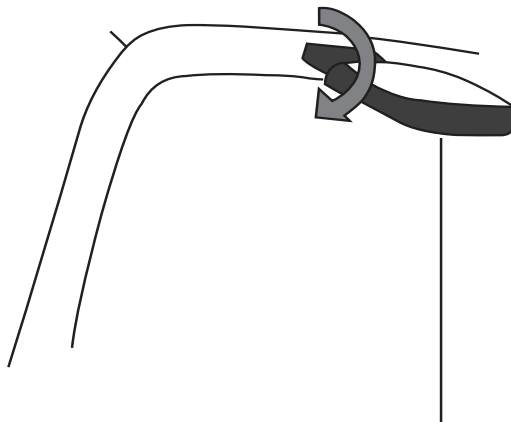


CURB SIDE MIRROR

General information on using the curb side mirror.

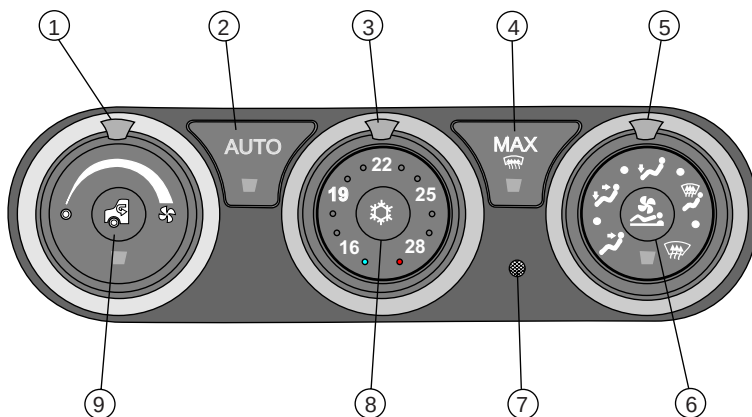


A mirror is located above the passenger door that provides a quick view of the blind spot created by the passenger door.



Rotate the mirror up or down to get the desired view.

CAB HVAC CONTROLS



- | | | |
|-----------------------------|--|---|
| 1. Fan Control Dial | 4. MAX Defrost Button | 7. Temperature Sensor |
| 2. AUTO Mode Button | 5. Air Distribution Dial | 8. Air Conditioner Button |
| 3. Temperature Control Dial | 6. Sleeper Override Button
(for vehicles with a sleeper and optional auxiliary A/C) | 9. Outside Air/Recirculation Air Button |

Introduction

Your vehicle's heating and air conditioning system operates in three distinct modes; manual, automatic and maximum defrost. Each mode provides the driver with the greatest level of comfort and convenience while maintaining the flexibility of traditional systems.

The recommended mode for all conditions that do not require windscreen defrosting is the automatic mode as detailed on page 87. This mode is capable of maintaining cab comfort under various driving conditions without driver interaction.

The cab heater and A/C controls are located together towards the left hand side of the dash.



Do not drive with visibility reduced by fog condensation or frost on the windscreen. Your view may be obscured which may result in death, personal injury, equipment or property damage. For clear visibility and safe driving it is extremely important for you to follow the instructions pertaining to the function and use of the ventilation/heating and defogging/defrosting system. If in doubt, consult your dealer. Maximum heating output and fast defrosting can be obtained only after the engine has reached operating temperature.



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



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.



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 10,000 kilometers
- 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, keep the inlet grille at the base of the windscreen clear of snow, ice, leaves and other obstructions at all times.



Do not stay in the vehicle with the engine running or idling for more than 10 minutes with the vehicle's heater and A/C ventilation system in RECIRC or at LOW FAN SPEED. Even with the ventilation system on, running the engine while parked or stopped for prolonged periods of time is not recommended.



When idling for short periods of time:

- set the heating or cooling system to heat or A/C
- set the fan to medium or high speed
- set the controls to FRESH AIR



If you are required to idle your vehicle for long periods of time, install an auxiliary heater or automatic idle control. These auxiliary devices can reduce fuel consumption and save you money. If you are parked next to idling vehicles, move your vehicle or do not stay in your vehicle for prolonged periods of time.

Manual Control Mode

The manual mode is the default mode when the heating and air conditioning system is turned on. The fan speed, air temperature and air outlets are selected using the dials on the controller.

Adjusting the settings:

- Step 1** To adjust the fan speed, turn the fan control dial clockwise to increase speed or counter-clockwise to decrease speed. Setting the fan dial to '0' turns the HVAC system off.
- Step 2** To adjust the temperature setting, turn the temperature control dial to the desired temperature. The system automatically adjusts the outlet air temperature to achieve the desired cab temperature.
- Step 3** To adjust the air distribution, turn the air distribution dial to the desired position as indicated by the graphics.

The temperature of the air from the vents will fluctuate as the vehicle works to achieve the chosen cab temperature. Note that in manual mode the system does not engage the A/C compressor automatically. To engage the air conditioning, press the button inside the temperature dial. To engage recirculation of cab air, press the button inside the fan speed dial.



Automatic Control Mode

Your vehicle's air conditioning system is equipped with an automatic button that provides complete cab climate control without driver intervention. When selected, the system will manipulate the air distribution, air temperature, fan speed, A/C compressor, and cab air recirculation to achieve the comfort level selected on the temperature dial. The button that enables automatic mode is labeled AUTO. The system will remain in automatic mode until the driver adjusts the dials on the control.

AUTO

Adjust the temperature knob and the system will respond to obtain the selected comfort level as quickly as possible.

Using the automatic mode:

Step 1 Turn on HVAC by rotating fan speed control clockwise.

Step 2 To engage automatic mode, press the AUTO button.

Step 3 To adjust cab temperature, rotate the temperature dial to the desired temperature. The system automatically adjusts to achieve the desired cab temperature.

The system will achieve the comfort level associated with the selected temperature on the temperature dial. Therefore, depending on the specific environmental conditions, the air temperature can be slightly higher or lower than the set point. This is a normal function of the AUTO mode and is not to be mistaken for a malfunctioning system.

The AUTO function uses a sunlight sensor to measure the amount of sunlight entering the cab. This sensor is located at the base of the windscreen on the passenger's side of the dashboard. Do not block this sensor.



Partial Automatic

During AUTO mode the operator may override any setting and operate in a partial automatic mode. This can be done via the dials and/or buttons on the HVAC control. In the partial automatic mode, the AUTO button indicator will cease to be illuminated. Instead, the indicator of the adjusted setting will illuminate.

For example, if the driver adjusts the fan dial while in AUTO mode, the fan dial indicator will illuminate and fan speed will adjust to the setting of the dial. However, the temperature and air outlet settings will continue to function automatically. Similarly, if the driver adjusts the air distribution setting while in AUTO mode, the air distribution dial indicator will illuminate and the distribution will adjust to the setting of the dial. The fan and temperature settings will continue to function automatically.

Economy Function

An economy function is also available in partial automatic mode. In this mode the system will operate in AUTO mode without the use of the A/C compressor.

The operator may select economy by initiating AUTO mode and then pressing the A/C button to disengage the compressor. The indicators for A/C compressor and AUTO mode do not illuminate while operating in economy mode.

MAX Defrost Mode

The heating and air conditioning system provides for one touch windscreen defrosting. Certain driving conditions will cause fog or ice to form on the windscreen. By pressing the MAX defrost button, the HVAC system will automatically adjust the blower speed, air temperature and air outlet distribution to maximise clearing of the windscreen. The system will remain in this mode until the driver presses the button again or adjusts the dials.



Maximum Defrost Button

Note that the air temperature in MAX defrost mode will be set to the warmest temperature setting. This setting helps to clear the windscreen of ice and fog more quickly. Outside air mode and A/C compressor are also active to maximise performance.

BUTTONS AND DIALS

Fan Speed Control Dial

The fan speed is adjusted by rotating the dial clockwise to increase speed or counter clockwise to decrease speed. Setting the fan dial to 'O' turns the HVAC system off.



Fan Speed Adjustment

The source of air entering the cab can be set to either outside air or recirculation air using the button inside the fan speed control dial. Outside air mode is automatically selected when any of the defrost modes are selected.



Outside Air/Recirculation Air Button

Air Distribution Dial

The mode of air distribution inside the cab is set using the air distribution dial. Five icons on the dial indicate the primary mode options. The driver may also select a secondary mode in between the primary modes indicated by points on the dial. Airflow is provided to the side windows in all modes.



Panel Vents



Panel and Floor Vents



Floor Vents



Floor and *Defrost Vents



*Defrost and demister vents

*Automatically engages outside air and A/C compressor.

Power to the sleeper HVAC unit can be toggled using the button inside the air distribution dial. When activated, the indicator on the button illuminates. The sleeper HVAC unit will function to the settings of the sleeper control.



Sleeper Override Button (for vehicles with a sleeper)

Temperature Control Dial

The cab temperature is set using the temperature control dial. The operating range is 16°C to 28°C. Adjustments of 1° increments.



o 22 o Temperature Control Set Point

The button inside the temperature control dial engages the A/C compressor. When activated the indicator on the button will illuminate. During AUTO mode, the A/C button indicator will remain illuminated at all times even though the compressor may be cycling.



Air Conditioner Button



The fan speed control dial must also be in the ON position to engage the A/C compressor. The A/C engages automatically when AUTO, Defrost or Floor/Defrost modes are selected.

OPERATING TIPS

Defrosting and Defogging the Windscreen

The cab windscreen and side windows can be cleared of ice and fog in two ways. The first is to use the MAX defrost mode (See MAX Defrost Section on page 88). The second is to manually adjust the air distribution dial to the defrost position.



During extreme cold weather, do not blow hot defroster air onto cold windscreens. This could crack the glass. Turn the air flow control dial to defrost and adjust the fan speed accordingly while the engine warms. If the engine is already warm, move the temperature control dial to cool, then gradually increase the temperature when you see the windscreen is starting to warm up. Failure to comply may result in equipment damage.

Manual Windscreen Defrosting/Defogging

The manual defrost/defogging mode differs from the MAX defrost mode by allowing the driver to select an air temperature other than full heat. This allows the driver to maintain a constant cab temperature while defrosting the windscreen. Note however that performance may be reduced.

- Step 1** Adjust the fan speed to high by rotating the fan control dial clockwise.
- Step 2** Set the air distribution dial to the defrost mode setting. This automatically engages the outside air and A/C compressor.
- Step 3** Adjust the temperature dial to add heat as needed. For maximum performance, adjust the temperature to maximum heat by rotating the temperature dial clockwise.

The driver may also use the floor/defrost setting on the air control dial to maintain a clear windscreen while providing heat to the floor. This setting may be helpful in conditions where the windscreen re-fogs. To increase the effectiveness of the defroster, engage the A/C compressor.

For Maximum Cooling

- Step 1** Adjust the fan speed to high by rotating the fan control dial clockwise.
- Step 2** Set the air distribution dial to the panel setting.
- Step 3** Adjust the air temperature to maximum cool by rotating the temperature dial counter clockwise.
- Step 4** Engage the A/C compressor by pressing the air conditioner button.
- Step 5** Set the air source to recirculation mode by pressing the outside air/recirculation air button. The button indicator light should be illuminated.

For Maximum Heating

- Step 1** Adjust the fan speed to high by rotating the fan control dial clockwise.
- Step 2** Set the air distribution dial to the floor setting.
- Step 3** Adjust the air temperature to maximum heat by rotating the temperature dial clockwise.

 The engine must be at operating temperature for maximum heating. If operating in AUTO mode, heating airflow is not allowed until the engine warms sufficiently to provide required coolant temperatures.

Air Dehumidification

The HVAC system can be used to reduce the humidity level of the cab and clear fog from the windscreen.

- Step 1** Adjust fan speed to the desired airflow setting.
- Step 2** Engage the A/C compressor by pressing the air conditioner button.
- Step 3** Set the air source to outside air mode by pressing the outside air/recirculation air button. The button indicator light should NOT be illuminated.

 The A/C compressor may not engage when the outside temperature is below 1°C.

CAB AIR DISTRIBUTION

Equal distribution of air is important in maintaining a constant cab interior temperature. For best performance, all vents should remain open to allow the AUTO mode to function properly.

To maintain the selected cab temperature the AUTO mode may provide an air temperature from the vents that differs from the temperature set point. To ensure proper operation, it is recommended the driver redirects the air instead of adjusting the temperature set point or closing the vent. The system may have difficulties in obtaining the desired cabin temperature if the temperature setting is repeatedly changed.

Outside Air/Recirculation Air

Selecting air recirculation mode completely isolates the cab interior from the outside air. This mode is helpful in preventing dust, pollen, and odours from entering the cab. Additionally, recirculation mode can reduce the amount of time needed to cool down the vehicle while in maximum cool down. Note this mode may increase fogging on the windscreen. A coarse air filter is provided for recirculation air and is located behind the fuse panel on the passenger side.

The outside air mode provides for 100% outside air into the cab. This mode is helpful with windscreen defogging. A pleated air filter located under the hood provides filtration for dust, pollen and debris.

RADIO (OPTION)

As an option, your vehicle has either an AM/FM stereo receiver, which may or may not have a CD, or may have the stereo system integrated with your navigation and telematics unit.

Other radio options include a bluetooth or satellite receiver.

For instructions on how to operate your particular radio, see the supplemental operating manual for your unit, there is also a PDF version user manual which is loaded onto the Customised Maintenance Manual in the Driver Information Pack.

INTERIOR STORAGE COMPARTMENTS

There are a variety of interior storage compartments to store your personal supplies or small tools:

- overhead storage compartments
- sleeper storage compartments
- centre console
- map pocket/records holder, on front of rider's seat base
- door in passenger seat base
- rear wall storage pocket

Appliances

If your vehicle is equipped with a television, or other appliance, be sure they are compatible with your vehicle's electrical system. Secure them in the cab so they cannot come loose in a sudden stop.

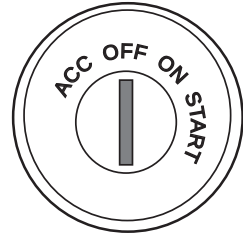
 ***Do not carry loose objects in your cab. It can be dangerous. In a sudden stop, or even going over a bump in the road, they could fly through the air and strike you or your passenger. Carry any heavy objects such as luggage in the exterior storage compartment and close it securely.***

TOOLBOXES

Cabs with sleeper have additional storage or toolboxes, overloading these with heavy objects such as dogs and chains etc... will overload the cab suspension.

IGNITION KEY SWITCH

The ignition key switch (located to the right of the steering column) has four positions; ACC (Accessories), OFF, ON, and START.



ACC With the key in this position you can play the radio, defrost mirrors or use other accessories.

OFF In this position all accessories are OFF (except those listed below) and you can remove the key.

The following lights and accessories have power when the key is in the OFF position:

- brake lights
- emergency hazard flasher
- dome and courtesy lamps (on doors)
- electric horn
- cigarette lighter
- tail lights
- marker lamps
- headlights
- radio station memory
- instrument lights
- auxiliary power
- instrument panel memory settings

ON In the ON position all circuits are energised. Panel warning lights will light and the buzzer will sound until (1) the engine is started, (2) normal oil operating pressure is reached, and (3) air brake system pressure is above 65psi (441kPa). In this position, the ignition key cannot be removed.

START Turn the key to this position to start your engine. Release the key after the engine has started. For complete engine starting procedures, see Operating The Engine on page 102.

VEHICLE TELEMATIC SYSTEM

Your vehicle may be equipped with an onboard telematics system. This system is a Global Positioning Satellite (GPS) linked computer. It receives input from multiple sources to locate your vehicle. Read and understand the Supplemental Telematics and Navigation System Owner's Manual and observe the Warnings, Cautions, and Notes that follow before using the system.

 ***Verify legal weight and height restrictions for the route suggested by the telematic system. Failure to verify height restrictions could lead to an accident causing death, personal injury or property damage. Failure to verify weight restrictions could result in a traffic infraction.***

 ***Only glance at the system monitor while driving. Prolonged periods of viewing while driving could result in an accident involving death or personal injury.***

 ***Do not program the telematic system while driving. Always stop your vehicle when programming or changing the settings on the telematic system. Programming the system while driving can cause you to take your eyes off the road, which could result in an accident involving death, personal injury or equipment damage.***

 ***Regardless of how and where the navigation system directs you, it is your responsibility to operate the vehicle in a safe and legal manner. Failure to comply may result in death, personal injury, equipment or property damage.***

 ***Ensure the volume level of all audio devices is set to a level that still allows you to hear outside traffic and emergency vehicles. Failure to comply may result in death, personal injury, equipment or property damage.***

 ***Do not rely on the telematic system to route you to the closest emergency services. Not all emergency services are in the database.***

 **The map database is the most current available at the time of production. The database is designed to provide you with route suggestions and does not take into account the relative safety of a suggested route or of factors that may affect the time required to reach your destination. See the Supplemental Navigation System Owner's Manual for more information.**

Care of the Display Screen

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

Screen Display On/Off

1. Press and hold the radio POWER/LIGHT button for approximately 1 second.
2. After the display has been turned on, the following Warning/Information screen will appear:

WARNING

Do not let this device distract you while driving. Always concentrate on your driving. Distractions could cause an accident resulting in injuries to you or others.

Disclaimer: Map data may be inaccurate and navigation routes may not be available for larger size vehicles. Regardless of how and where the navigation system directs you, it is your responsibility to operate the vehicle in a safe and legal manner.

Note: Before using this system, read the Owner's Manual and learn how it operates. Some functions of this system will not operate when the truck is moving.

3. After reading the information, touch the 'T' in the upper right corner of the screen with your finger indicating you acknowledge and understand the information. The MENU screen will automatically appear next.
4. To turn the system off, press and hold the radio POWER/LIGHT button for 3 seconds.

Disclaimer

The vehicle manufacturer is not responsible for erroneous map data, misrouting or any downtime or other damages associated with or arising out of the use of the Navigation System.

SEATS

This section covers the operation and safe use of your Kenworth seats. For further information on features and adjustment of the seat, see the seat manufacturer's Service and Operation information supplied with the vehicle.

SEAT ADJUSTMENT



Do not adjust the driver's seat while the vehicle is moving. The seat could move unexpectedly and can cause the driver to lose control of the vehicle. After adjusting the seat, and before driving off, always check to ensure the seat is firmly latched in position.

Standard Driver's Seat

The standard driver's seat can be adjusted forward and backward as well as up and down. The seat back angle can also be adjusted. These three movements are each controlled by levers located either beneath, or at the sides of the seat.

Driver's Seat with Air Suspension



Before driving or riding in the vehicle, ensure there is adequate head clearance at maximum upward seat travel. You could seriously injure your head or neck by bumping into the cab roof if clearance is not adequate.

Reclining Seats

Reclining seats are easy to use if you follow these steps:

1. Make sure the sleeper curtain is tied back.
2. Raise the seat all the way up so the seat will tilt back and completely clear objects behind you.
3. Do not drive or ride with your seat back in the reclined position. You could be injured by sliding under the seatbelts in a collision.

SAFETY RESTRAINT BELTS

Seatbelts have proven to be the single most effective means available for reducing the potential for either serious injury or death in motor vehicle accidents. Therefore, read the following instructions and always observe user warnings pertaining to seatbelts.



Seatbelts are designed to bear upon the bony structure of the body, and should be worn low across the front of the pelvis or the pelvis, chest and shoulders, as applicable. Wearing the lap section of the belt across the abdominal area must be avoided.

Seatbelts should be adjusted as firmly as possible, consistent with comfort, to provide the protection for which they have been designed. A slack belt will greatly reduce the protection afforded to the wearer. Care should be taken to avoid contamination of the webbing with polishes, oils and chemicals, and particularly battery acid.

Cleaning may safely be carried out using mild soap and water. The belt should be replaced if webbing becomes frayed, contaminated or damaged. It is essential to replace the entire assembly after it has been worn in a severe impact even if damage to the assembly is not obvious. Belts should not be worn with straps twisted.

Each belt assembly must only be used by one occupant; it is dangerous to put a belt around a child being carried on the occupant's lap.

No modifications or additions should be made by the user which will either prevent the seatbelt adjusting devices from operating to remove slack, or prevent the seatbelt assembly from being adjusted to remove slack.

LAP & SHOULDER BELT

The combination lap-shoulder belt is equipped with a locking mechanism. The system adjusts automatically to a person's size and movements as long as the pull on the belt is slow. Hard braking or a collision locks the belt. The belt will also lock when vehicle is going up or down a steep hill or in a sharp curve.

Make sure all seatbelts are correctly adjusted before moving the vehicle. Adjustment is made by sliding the adjusting buckle either up or down the seatbelt until the belt is comfortable. Take care not to over tighten the belt by removing all of the slack.

Safety Belt Tips

- Anyone riding in your vehicle should wear a correctly adjusted seatbelt. A responsible operator sees to it that everyone in the vehicle rides safely and that means with a seatbelt.
- Do not wear a belt over rigid or breakable objects in or on your clothing, (for example eye glasses, pens, keys) as these may cause injury in an accident.
- Several layers of heavy clothing may interfere with proper positioning of belts and reduce the overall effectiveness of the system.
- Keep belt buckles free of any obstruction that may prevent secure locking.
- Cab or sleeper belts which have been damaged or worn because of cuts, tears, normal wear or excessive stretch forces from crashes must be replaced. They may not protect you if you have an accident.
- If belts show damage to any part of their assembly, such as webbing, bindings, buckles or retractors, they must be replaced.
- Do not allow seatbelts to become damaged by getting caught in the door or seat hardware, or by rubbing against sharp objects.
- The belts must be kept clean or the retractors may not work properly.
- Never bleach or dye seatbelts; chemicals can weaken them. Do, however, keep them clean by following the directions on the care label on the belts. Let them dry completely before allowing them to retract.

- Make sure the belt of the unoccupied passenger seat is fully wound up on its retractor, so the belt tongue is in its stowed position. This reduces the possibility of the tongue becoming a striking object in a sudden stop.
- Do not modify or disassemble the seatbelts in your vehicle.
- If any seatbelt is not working properly, see your authorised Kenworth service dealer for repair or replacement.

SLEEPER - BUNKS AND RESTRAINTS

For Kenworth cabs equipped with a sleeper, be sure to use the fitted restraint devices. Your vehicle may have belts and/or a net restraint system which are over the bunk or cover the opening.

Be sure to stow away all loose belongings before you move your vehicle. Do not store objects on the bunks. They could cause serious damage or injury in an accident.

OPERATING THE ENGINE

NORMAL STARTING PROCEDURE

1. Ensure the parking brake is set ON and the transmission shift selector is in neutral. For automatic transmissions that have park position, place the shift selector in park.
2. With the accelerator pedal in the idle position, turn the ignition key to the START position.
3. Release the key after 10 seconds if the engine does not start. Then wait for 10 seconds and try again.



Engaging the starter motor for more than 30 seconds in any 5 minute period may cause it to overheat and can damage the starter motor. If starter is engaged continuously for 30 seconds, you MUST wait 5 minutes before trying to start the engine to allow the starter motor to cool down.



If the engine is running, do not increase engine speed (rpm) or operate the vehicle until the low oil pressure warning light turns off.

The engine must have adequate oil pressure within 15 seconds after starting. If the warning light indicating low oil pressure has not gone out or there is no oil pressure indicated on the gauge within 15 seconds, shut OFF the engine immediately to reduce the possibility of engine damage.

As soon as the engine starts, watch the oil pressure gauge. Refer to your engine manufacturer's handbook for engine idle speed oil pressure. If oil pressure does not rise within a few seconds, stop the engine. Locate and correct the trouble before starting the engine again.

Watch the primary and secondary air pressure gauges. They should both register 689kPa (100psi) before you release the parking brake and move the vehicle. Also check the alarm system for any type of faults and correct them before moving the vehicle.

Unnecessary stress and possible brake malfunction could occur if the vehicle is forced to move before the air system reaches 689kPa (100psi).

Turbocharged Engines

Do not idle or accelerate the engine over 1000rpm until normal engine oil pressure registers on gauge.



ENGINE WARM-UP

The purpose of engine warm-up is to allow an oil film to be established between pistons and liners, shafts and bearings while your engine gradually reaches operating temperature.

After the engine starts, the electronics will check the coolant temperature and other engine temperature indicators. If needed, the ECM will take necessary action(s) to warm the engine up. This is called cold mode. Depending on the engine type, this may include changing the idle speed of the engine. It may also reduce the amount of power available.

The engine must have adequate oil pressure within 15 seconds after starting. If the warning light indicating low oil pressure has not gone out, the ECM low oil pressure warning activates; or if there is no oil pressure indicated on a gauge within 15 seconds, shut off the engine immediately to avoid engine damage. Confirm the correct oil level in the engine sump.

Once the engine has warmed sufficiently to exit cold mode, the engine should be operated at low rpm and low load until normal operating temperature is reached. Operating the engine in this way will warm it faster than if the engine is operated at high rpm and low load.

Slow oil flow to the turbocharger reduces oil available for bearings. Watch engine oil temperature or pressure gauges for a warming trend before increasing engine idle rpm.

Check alternator output. The voltmeter must read between 13.8 and 14.2 volts.

Warm-Up Procedure

After you start the engine, idle the engine at approximately 600 rpm while you check the following vital engine systems:

- oil pressure
- air pressure
- alternator output

Before placing engine under load, continue warm-up with the engine at 900 to 1,000rpm for 3 to 5 minutes.

When a cold engine is started, increase the engine speed (rpm) slowly to be sure adequate lubrication is available to the bearings and to allow the oil pressure to stabilise. In extremely cold temperatures, you may have to increase idle speed.

In colder climates where the temperatures are often below freezing, sufficient warm-up for turbocharged engines is especially important. Chilled external oil lines leading to the turbocharger will slow the oil flow until the oil warms, reducing oil available for the bearings. Watch the engine oil temperature or pressure gauge for a warming trend before increasing engine idle speed (rpm).

Continue the engine warm-up until the coolant temperature reaches at least 54°C. At this temperature, you can use partial throttle. Wait until the coolant temperature is at least 71°C before operating at full throttle. See Transmission Warm-Up, page 113.



Exhaust fumes from the engine contain carbon monoxide, a colourless and odourless gas. Do not breathe the engine exhaust gas. A poorly maintained, damaged or corroded exhaust system can allow carbon monoxide to enter the cab or sleeper.

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/sleeper and cause serious illness.

Never idle your vehicle for prolonged periods of time if you sense that exhaust fumes are entering the cab or sleeper. Investigate the cause of the fumes and correct the problem 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 lead to personal harm.

Keep the engine exhaust system and the vehicle's cab/sleeper ventilation system properly maintained. It is recommended that the vehicle's exhaust system and cab/sleeper be inspected:

- By a competent technician every 10,000km.
- Whenever a change is noticed in the sound of the exhaust system.
- Whenever the exhaust system, underbody, cab or sleeper is damaged.

Before Driving Away

1. Check ALL operating temperatures and pressures are within correct range.
2. Check operation of windscreen washers and wipers.
3. Check horn (electric and air) operation.
4. Check position of the inter-axle differential control.
5. Turn emergency flashers OFF.
6. Check air suspension is inflated.
7. Load-test trailer hitch for security.
8. Check service brake operation and air pressure gauge.

Engine Oil Temperature Gauge

The Engine Oil Temperature gauge indicates engine oil temperature. Do not exceed the maximum engine oil temperature recommended by the engine manufacturer.

IDLING THE ENGINE

 *Do not idle for extended periods of time. Excessive idle time can cause poor engine performance and waste fuel.*

Internal combustion engines **must not** operate at low idle speed for extended periods of time. This operating condition may lead to poor engine performance.

Stationary Power Take Off Operation

The cruise control buttons for this vehicle may be used to control the engine rpm when the vehicle is stationary and the operator wants to use the Power Take Off (PTO) on the engine. Use the cruise control options in the same manner as with the vehicle in motion, but instead of setting vehicle speed, the engine speed (rpm) is set instead.

1. Ensure parking brakes are applied.
2. Ensure transmission is in Neutral.
3. Engage PTO per the manufacturer's operating instructions.
4. Move the ON/OFF switch to the ON position.
5. Toggle the SET/RESUME switch to obtain the desired engine rpm.

Cancel the PTO operation by canceling the engine rpm set speed. This can be done by tapping the brake or clutch pedal or by using the cruise control switches.

After starting the engine, idle the engine for 3 to 5 minutes before operating with a load.

After starting a cold engine, increase the engine speed (rpm) slowly to provide adequate lubrication to the bearings and to allow the oil pressure to stabilise.

 *Do not operate engine at low idle for long periods with engine coolant temperature below the minimum specification in Coolant Recommendations and Specifications.*

Low coolant temperature can result in:

- fuel dilution of the lubricating oil
- carbon build-up in the cylinder
- cylinder head valve sticking
- reduced performance

ENGINE AFTERTREATMENT SYSTEMS (EAS)

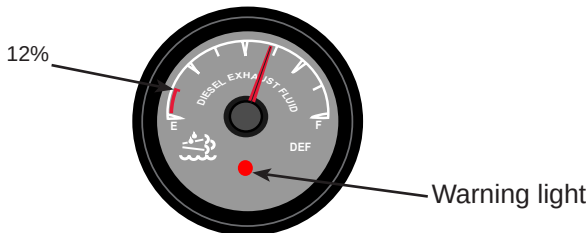
In order to meet ADR 80/03 engine emission requirements, vehicles must have an Exhaust Aftertreatment System (EAS) which will include either Selective Catalytic Reduction (SCR) or a Diesel Particulate Filter (DPF). These are two very different systems and the T410 uses SCR for the PACCAR MX-13 Euro V engines.



The T410 is equipped with a 24V EAS system.

PACCAR MX-13 ENGINE WITH SELECTIVE CATALYTIC REDUCTION (SCR)

If your truck is equipped with Selective Catalytic Reduction (SCR) it uses Diesel Exhaust Fluid (DEF/AdBlue) to reduce emissions from diesel engines. AdBlue is injected into the exhaust gas upstream of the catalyst. AdBlue is consumable and needs to be replenished.



Close to Empty (approx 12% remaining) - AdBlue warning light will illuminate on the AdBlue Gauge

ADBLUE LOW LEVEL WARNING AND INDUCEMENT

The low AdBlue warning light will illuminate when the AdBlue level is at 12% to warn the operator to refill the SCR system, at 6% the light will start to blink and the engine will derate. The derate would take effect when the vehicle speed goes to 0 km/h or when the engine goes to idle.



Trucks with SCR and equipped with a battery isolation switch require the driver to wait for at least 120 seconds after turning OFF the ignition before switching OFF the battery isolation switch. This is to allow the EAS system to purge any remaining AdBlue from the AdBlue lines. Shutting off the battery isolation switch whilst the engine is running or without waiting the required 120 seconds may cause AdBlue to be trapped in the AdBlue lines. This could lead to a blockage of the lines and cause serious damage to the EAS system.



If the AdBlue indicator light turns on, check the AdBlue level and refill if necessary. Failure to refill may cause the engine to derate and limit vehicle speed.

EAS SYSTEM TAMPERING

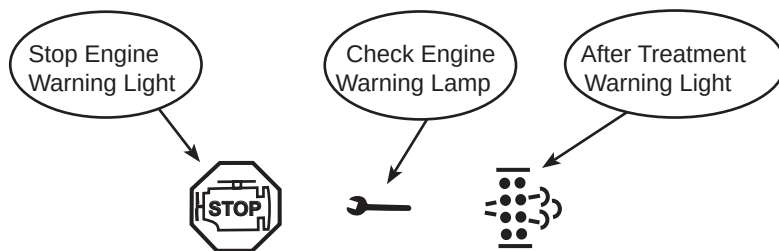
If the engine system detects failures that may be the result of tampering with the EAS system, the Check Engine light will come on, the engine will derate, and if fitted the warning lamp will be on.

DIESEL EXHAUST FLUID - AdBlue LEVEL

If the engine detects that AdBlue level is below acceptable levels the AdBlue warning light will flash, the Check Engine light will come on and the engine will be derated.



Levels given are for example only. Actual levels depend on specific vehicle configuration. SCR System Tampering: If the engine system detects failures that may be the result of tampering with the SCR system, the Check Engine light will come on, the engine will derate, and if equipped the Malfunction Indicator Lamp (MIL) will be on. AdBlue Level: If the engine detects that AdBlue level is below acceptable levels (12%) the AdBlue warning light will flash, when the level is below 6% the Check Engine light will come on, and the engine will be derated.



AdBlue Warning Lights in Main Instruments Panel

‘ENGINE DERATE’ MEANS; ENGINE POWER LIMITING

Derate will only be activated at vehicle standstill or at engine idle if the vehicle speed sensor has failed.

When the above conditions to activate derate are no longer applicable, the derate is de-activated immediately.

Derate will be de-activated as soon as the On Board Diagnostics (OBD) monitoring of the specific fault has completed and passed.

DIESEL EXHAUST FLUID - AdBlue

Diesel Exhaust Fluid, AdBlue is also known as: AUS32 (Aqueous Urea Solution 32), NoNOx, NOx Reduction Agent or Catalyst Solution. Diesel Exhaust Fluid must meet *ISO22241-1*.

To avoid malfunction and damage of the system, it is important to strictly observe the following precautions.

- It is recommended to fill the AdBlue tank directly with AdBlue supplied by PACCAR Parts or any other supplier (always from the original packaging), using official AdBlue filling equipment.
- Always top up the system with 100% clean AdBlue according to DIN 70070. Never use contaminated AdBlue or contaminated canisters or funnels to top up the AdBlue tank.
- Avoid diesel mixing with AdBlue in the AdBlue tank: always use 100% clean canisters and funnels that have not been used for any other liquids, such as coolant, oil, diesel or petrol.

SAFETY

Avoid physical contact with AdBlue.

Eye Contact

If this product comes in contact with the eyes:

- Wash out immediately with fresh running water.
- Ensure complete irrigation of the eye by keeping eyelids apart and away from eye and moving the eyelids by occasionally lifting the upper and lower lids.
- Seek medical attention without delay; if pain persists or recurs seek medical attention.
- Removal of contact lenses after an eye injury should only be undertaken by skilled personnel.

Skin Contact

If skin contact occurs:

- Immediately remove all contaminated clothing, including footwear.
- Flush skin and hair with running water (and soap if available). Seek medical attention in event of irritation.

Inhalation

- If fumes, aerosols or combustion products are inhaled remove from contaminated area.
- Other measures are usually unnecessary.

Ingestion

- Immediately give a glass of water.
- First aid is not generally required. If in doubt, contact a Poisons Information Centre or seek medical attention.

General Warning

- Keep system and vehicle clean to avoid crystallisation of AdBlue, potential corrosion, staining and discolouration by washing the immediate area with clean fresh water. Ensure AdBlue is not allowed to crystallise around electrical wiring harness, particularly around connector blocks.
- It is not allowable to open the EAS dosing module. Therefore internal components cannot be changed.
- Replace the AdBlue filler cap as soon as filling of the AdBlue tank is completed, do not allow foreign matter to enter the AdBlue tank.

ADBLUE FILLING

When filling the AdBlue tank, the filler neck is welded at a specific location to enable part of it to be inserted within the tank, this physically prevents the tank being filled over 90% due to the AdBlue reaching the bottom of the neck and causing a 'head' of air which becomes trapped in the top 10% of the tank. This design allows the automatic fuel shut off at the pump to work.

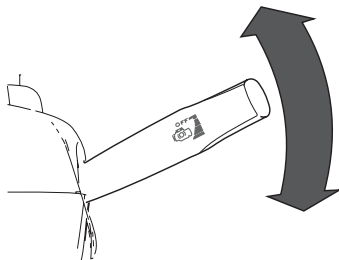
Do not attempt to overfill the tank above 90% of its capacity. Ninety percent is to the edge of the filler neck so that air gap is not visible, as this provides room for expansion resulting from temperature extremes.

Ensure that the 'AdBlue' lettering and symbol are in the horizontal position when the filler cap is fully screwed on. The lettering can be either the right way up or upside down (180°), to ensure correct sealing of the AdBlue tank.



ENGINE BRAKE OPERATION

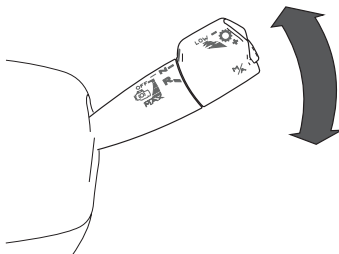
Engine Brake Operation for T410 with Manual Transmission



Moving the lever clockwise will engage the engine brake. Increase the amount of engine brake by moving the lever further clockwise. Each position has a corresponding level of engine brake.

Position	Engine Brake Level
Off	OFF
1	LOW
2	HIGH

Engine Brake Operation for T410 with Automated Transmission



Moving the lever clockwise will engage the engine brake. Increase the amount of engine brake by moving the lever further clockwise. Each position has a corresponding level of engine brake.

The corresponding engine brake level (or MAX mode) will be illuminated in the instrument cluster.

Position	Engine Brake Level
Off	OFF
1	LOW
2	HIGH
3*	MAX (HIGH and will engage transmission low gear)
* Position 3 is a momentary position and will revert back to position 2 when the lever is released.	

 MAX level should only be used for steep or long downhill situation not every day driving.

Deactivating Max Mode

Vehicles with automated transmissions will have the engine brake function integrated with the transmission controls. Follow these steps to deactivate **MAX** engine brake mode.

1. Accelerate with the throttle pedal.
2. Upshift, see Up or Down Shifting on page 122.
3. Wait for the transmission coast down gear to engage.
4. Reduce engine brake level, see Engine Brake Operation on page 111.
5. Re-initiate **MAX** mode, see Engine Brake Operation on page 111.
6. Select Neutral **N**, see Drive Neutral Reverse Selector on page 121.
7. Select **LOW** mode, see Engine Brake Operation on page 111.

OPERATING THE TRANSMISSION

Because each Kenworth is custom-equipped, the specific operating procedures for your particular transmission are not included in this handbook. Therefore, you should read the general guidelines and instructions that follow, and read the specific instructions contained in the transmission manufacturer's Driver/Operator's Instruction Manual.

Transmission Warm-Up

To warm up the transmission lubricating oil during engine warm-up, check that the transmission is in NEUTRAL and release the clutch pedal. This will allow the transmission counter-shaft to turn and agitate the oil, thereby warming it. This practice is particularly desirable in cold weather operation when sluggish shifting may be experienced.

Operating Manual Transmissions

You will find a shift pattern diagram in the cab. Check to be sure that you know the correct sequence for your particular transmission. A decal with the shift pattern and operating instructions is normally located on the sunvisor.

PUTTING THE VEHICLE IN MOTION

After making sure the vehicle's oil and air pressure are correct and all other parts and systems are in proper working condition:

1. Fully depress the clutch pedal (for manual transmission) until the clutch brake makes contact. The contact will occur at about 25mm to 40mm or less from the floorboard:
 - The total stroke of the clutch pedal is approximately 254 mm. The first 13mm is free travel. After the free travel comes the release stroke, which is the part that fully releases the clutch. The last 25mm to 40 mm engages the clutch brake (see page 275).



Always use first gear or a low speed range to start the vehicle in motion. The use of a higher gear or speed range forces undue strain on the engine, clutch and other transmission components, and may cause damage.

2. Evaluate the road surface conditions and terrain your vehicle is on. Select a gear low enough to let your vehicle start forward with the throttle at idle.

3. Push the parking brake valve handle (Yellow) against the dash panel to release the brakes.
4. Release the clutch pedal (manual only), then gradually accelerate to permit smooth starting.
5. Do not allow your vehicle to roll (even a little) in the opposite direction during clutch engagement. If you need to start up on an incline, apply your service brakes before you release the parking brake. Then release your service brakes as you engage the clutch and apply throttle.

If you have a misaligned gear condition in your vehicle's transmission and cannot start, gradually release the clutch, allowing the drive gear teeth to line up properly. Then the drive gear can roll enough to allowing the teeth to line up and complete the shift.

The best engine performance and maximum economy are obtained if gears are properly selected. This efficiency is achieved by always selecting gears within optimum engine rpm, which is where maximum torque and power are obtained. For further information, see ULTRASHIFT PLUS FEATURES, page 140.

For further instructions on operating your transmission, see the transmission manufacturer's Driver/Operator's Instruction Manual.

SHIFTING GEARS IN A NEW VEHICLE

Shift gears carefully in a new vehicle. The transmission may be a little stiff at first. Avoid gear clashing by closely following these procedures:

- When you are operating a new vehicle or one that has been exposed to cold weather, you want the transmission lubricant (fluid) to circulate and coat the contacting surfaces of the gears.
- Metal contacting metal in moving parts may seriously damage your transmission. Do not drive in one gear for long periods of time until the transmission lubricant has had a chance to coat all contacting surfaces.
- Carefully observe the free travel in the clutch for the first few hundred kilometres. As the clutch lining wears and high spots get worn smooth, you will get less free travel.

CLUTCH BRAKE AND TRAVEL

The clutch brake is used for stopping transmission gears, allowing you to easily shift into first gear or reverse without grinding gears. Approximately the last 25mm of clutch pedal travel activates the clutch brake (see page 275).

To apply the clutch brake (while the vehicle is stopped) fully depress the clutch pedal to the floorboard to stop the gears. With the throttle at idle, select first gear, then release the clutch pedal to let the vehicle start forward, until the clutch is fully engaged. See the manufacturer's Driver/Operator's Instruction Manual for further details.

If the transmission has a butt-tooth condition and you cannot engage a gear, gradually release the clutch. Then the drive gear can roll enough to allow the teeth to line up properly and complete the shift.

During Normal Driving

If you want to shift directly into any gear other than first or reverse, depress the clutch pedal only far enough to release the clutch. Pushing the clutch to the floor applies the clutch brake and will cause gear hang-up.



Be careful not to apply the clutch brake while the vehicle is moving. The purpose of the clutch brake is to stop the transmission so you can shift into a starting gear without grinding gears. Applying the clutch brake when the vehicle is moving causes a braking effect on the drivetrain and shortens the service life of the clutch brake.



DO NOT push the clutch pedal completely to the floor when shifting while the vehicle is in motion. using the clutch brake while shifting a vehicle in motion will damage the clutch brake. A non functioning clutch brake will make shifting very difficult when the vehicle is stationary.

DOUBLE CLUTCHING

Whether you are up-shifting or down-shifting, it is best to double clutch. Double clutching is easier on the transmission and engine, helping your vehicle match engine speed with driveline speed and achieving clash-free shifts.

To double clutch:

1. Push the clutch pedal down to disengage the clutch.
2. Move the gear shift lever to neutral.
3. Release the pedal to engage the clutch. This lets you control the rpm of the main shaft gears, allowing you to match the rpm of the main shaft gears to those of the output shaft.
 - **Upshifts** - let the engine and gears slow down to the rpm required for the next gear.
 - **Downshifts** - press accelerator and increase engine and gear speed to the rpm required in the lower gear.
4. Now quickly press the pedal to disengage the clutch and move the gear shift lever to the next gear speed position.
5. Release the pedal to engage the clutch.

CLUTCH OPERATION

STARTING

To properly put a vehicle into motion, depress the clutch pedal until the clutch brake is contacted. This contact should occur 25mm or less from the floorboard - excluding carpet. Select a gear low enough to allow the vehicle to start forward with throttle at idle until the clutch is fully engaged.

This procedure is especially important with ceramic or metallic-faced clutches. Do not 'feather' or attempt to slip the clutch to start in a higher gear, even if load conditions are light. Any slippage of a ceramic or metal-faced clutch will result in very aggressive engagement and a very jumpy start. Also, do not allow the vehicle to roll at all in the opposite direction during clutch engagement. The service brakes may be used to accomplish a start from a full stop.

Once the vehicle is moving, do not attempt to use the clutch brake. The clutch brake provides a means of stopping the transmission so that the shift into a starting gear may be accomplished with 'raking'.

Once the vehicle is in motion, use of the clutch brake will try to stop the vehicle, resulting in very short service life of the clutch brake.

Release Bearing Wear

Whenever the engine is idling for any period of time, shift transmission to neutral and disengage the clutch to prevent unnecessary wear of the clutch release bearing.

Riding the Clutch

DO NOT use the clutch pedal as a foot rest, or drive with your foot resting on the clutch pedal. This allows the clutch to slip, which in turn causes excessive heat, wear and possible damage.

Clutch Adjustment

Manual and self-adjusting clutches must be inspected periodically to maintain correct adjustment (see Maintenance Schedule for recommended interval).

Drivers of new vehicles should carefully note free travel clearance during the first few hundred kilometres. As clutch lining wears, free travel decreases. Any high spots on the new clutch will quickly wear smooth, causing free travel to diminish more rapidly than usual.

Inspect manual clutches according to the manufacturer's recommendations. Regular maintenance should be followed to maintain correct clutch adjustment. Have your dealer's service department perform any adjustment necessary.

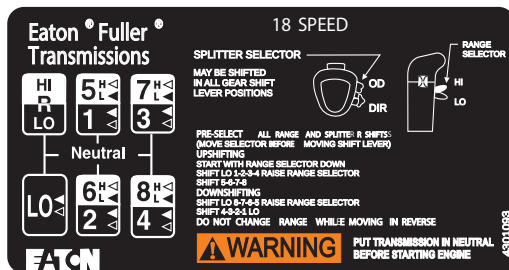
Clutch Tips

- Always use the clutch when making upshifts or downshifts.
- Always select a starting gear that will provide sufficient gear reduction for the load and terrain.
- Never downshift when the vehicle is moving too fast.
- Never slam or jerk the shift lever to complete gear engagement.
- Never coast with the transmission in neutral and the clutch disengaged.
- To provide smooth gear engagements while shifting, use proper coordination between shift lever and clutch.

TRANSMISSION OIL TEMPERATURE GAUGE

The Transmission Oil Temperature Gauge (optional) indicates the temperature of the oil in the transmission. Watch this gauge to know when the transmission is overheating: (max 120°). If it is, have it checked by an authorised service representative.

TRANSMISSION SHIFT PATTERNS



Eaton 18 Speed Transmission RTLO Shift Lever Patterns and Shifting Controls

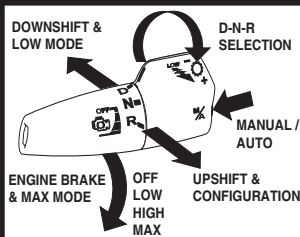
PACCAR RIGHT HAND STALK CONTROLS



CAUTION: READ OWNERS MANUAL PRIOR TO OPERATION

- MINIMUM RECOMMENDED OPERATING PRESSURE TO BE 90 PSI (621KPa)
- DO NOT OPERATE VEHICLE IF ALTERNATOR LIGHT OR LOW VOLTAGE INDICATOR IS ILLUMINATED
- NEUTRAL MUST BE SELECTED TO START ENGINE
- AVOID CLUTCH DAMAGE, DEPRESS BRAKE PEDAL WHEN STOPPED ON INCLINE
- AVOID VEHICLE MISHAP, SELECT NEUTRAL AND SET PARKING BRAKES PRIOR TO EXITING

- DEPRESS BRAKE PEDAL PRIOR TO SELECTION FROM NEUTRAL
- AUTO/MANUAL: - DEPRESS BUTTON TO CHANGE MODE
- LOW MODE
 - ACTIVATION: - PRESS STALK FORWARD FOR APPROX. 1 SECOND
 - DEACTIVATORS: - UPSHIFT
 - SHIFT TO NEUTRAL
- ENGINE BRAKE*
 - ACTIVATION: - MOVE STALK CLOCKWISE ABOUT COLUMN AXIS
 - MAX MODE ACTIVATION: - MOMENTARY MOVEMENT BEYOND MAXIMUM ENGINE BRAKE (FOOT OFF ACCELERATOR)
 - MAX MODE DEACTIVATORS: - ACCELERATE
 - UPSHIFT
 - TRANSMISSION COAST DOWN GEAR REACHED
 - REDUCE ENGINE BRAKE LEVEL
- CONFIGURATION SWAP*: - HOLD UPSHIFT FOR 4 SECONDS



*(IF AVAILABLE)

PACCAR and UltraShift PLUS Transmission Shift Controls

AUTOMATED TRANSMISSIONS

OPERATING AUTOMATED TRANSMISSIONS

An automated transmission makes shifting much easier, but because your truck pulls a heavy load, it is important to use it efficiently. For correct automated transmission operation, see the manufacturer's Driver/Operator's Instruction Manual.

On most automated transmissions there is no **Park** position, so you will need to apply the parking brake before leaving the cab. See Using the Parking Brake, page 148.

Parking Brake

On a vehicle with no Park position on the transmission shift selector, always put the selector in Neutral and apply the parking brake to hold the vehicle when it is unattended.



If your vehicle has an automated transmission, be aware that it can roll backwards when stopped on a hill or grade, or when starting from a stop on a hill or grade. Failure to comply may result in death, personal injury, equipment or property damage.

Observe the following guidelines:

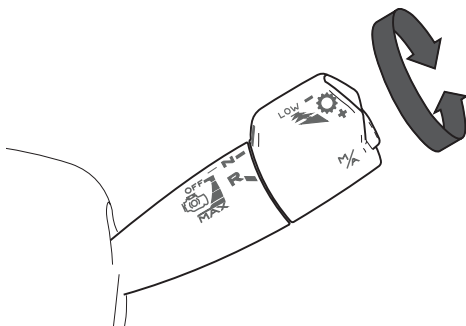
- 1. When stopped on a hill or grade, press the brake pedal.*
- 2. When starting from a stop on a hill or grade, quickly remove your foot from the brake pedal and firmly press on the accelerator pedal.*

DO NOT leave the cab of your vehicle without applying the parking brake, turning OFF the ignition and removing the key. The truck could roll and cause an accident resulting in death or personal injury. Always apply the parking brake before you leave the cab.

CONTROLS FOR VEHICLES WITH A PACCAR OR EATON AUTOMATED TRANSMISSION

This vehicle may be equipped with either an Eaton Automated or a PACCAR Transmission. The PACCAR or Eaton Automated Transmission controls are located on the right hand side of the steering column, refer page 77 for functions.

Drive Neutral Reverse Selector



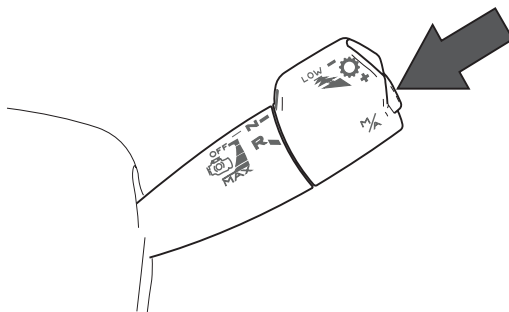
Transmission mode is selected by rotating the lever's outer knob. There is a detent for **Drive**, **Neutral** and **Reverse**.

The instrument cluster will display the corresponding mode.



The transmission selector must be in **N** (Neutral) to start the truck.

Manual - Automatic Button

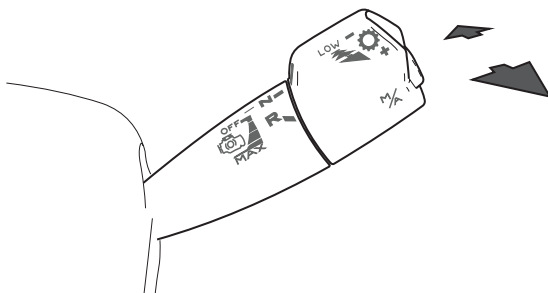


This button will put the transmission into manual mode. Manual mode will allow the operator to select the gear. See Up or Down Shifting on page 122.



To activate Manual mode, put the gear selector in the **D** (Drive) mode and then depress the **M/A** button. The instrument cluster will display the corresponding selection.

Up or Down Shifting



When in the Manual mode, the transmission gears can be manually selected by pushing or pulling on the lever.

- Pushing the lever forward, away from the steering wheel will downshift the transmission.
- Pushing and holding the lever forward will engage the LOW mode.
- Pulling the lever towards the steering wheel or driver will upshift the transmission.

The instrument cluster will illuminate with the corresponding gear.



PACCAR TRANSMISSIONS

Gear Display

The Gear Display indicates the current gear position of the transmission. During an upshift or downshift the gear display may momentarily flash the target gear position.

Current Gear



SOLID

Gear Shift Transition



FLASHING

Successful Gear Shift



SOLID

The 'DASH' indicates the transmission may be torque locked in gear and unable to confirm neutral.



'CA' will appear in the gear display if a clutch abuse event is occurring.



'AN' will appear in the gear display if the transmission goes into Auto Neutral.



START-UP AND POWER DOWN

Start-up

1. Ensure **Neutral** is selected on the Transmission Mode Selector on the right-hand steering column stalk.

 The transmission will not allow the engine to crank if a mode other than **Neutral** is selected, on Transmission Mode Selector, when attempting to start the engine.

2. Turn the ignition key to ON and allow the PACCAR Automated Transmission to power-up.

 Engine cranking is delayed until the transmission power-up is complete and the gear display shows a solid **N** (neutral). If **Neutral** is not shown in the gear display, ensure that the vehicle air system is at normal operating range before attempting to start the vehicle.

3. Start the engine.
4. Allow vehicle air system pressure to build to normal operating range.

 The transmission requires a minimum system pressure of 90psi or **Trans Air Low** error message will display and the transmission will not be able to select gears.

5. Apply service brake.

 If the service brake is not applied while selecting a starting gear, the initial start gear will not be engaged and the driver will have to reselect **Neutral** and press the brake while re-selecting the desired mode.

6. Select the desired mode and starting gear on the Transmission Mode Selector.

 The transmission will override inappropriate start gear selections to avoid driveline damage.

7. Release the vehicle parking brakes.
8. Release service brake and Urge to Move will allow the vehicle to automatically launch and creep at constant engine idle.
 - Upshifts and downshifts can be made while at constant engine idle by utilising the up/downshift request procedure. The transmission may deny a shift and sound a tone if the load of the vehicle or grade of the terrain falls outside the acceptable range to perform a shift.

Power Down

1. Select **Neutral** on the Transmission Mode Selector.
 - If gear display does not show solid **N**, neutral has not yet been obtained.



Neutral should always be reached before initiating power down, except in cases of emergency.

2. Set the vehicle parking brakes.



Apply parking brake, refer to page 148 for instructions. Failure to follow these instructions could cause unintended vehicle movement resulting in death, serious injury or damage to property.

3. Turn off the ignition key and allow the engine to shut down.

PACCAR TRANSMISSION MODES

Neutral Mode

- Selects **Neutral**.
- Initial Gear position after Start-Up.



Apply parking brake, refer to page 148 for instructions. Failure to follow these instructions could cause unintended vehicle movement resulting in death, serious injury or damage to property.



When attempting to start the engine and the engine does not crank, confirm **Neutral** is selected, vehicle parking brake is applied and service brake is depressed.

Drive Mode

- Intelligent Start Gear Selection will automatically select the start gear depending on inputs such as, load, grade, and axle/transmission ratio. (see Note* page 126) This start gear can be changed by using the up/downshift request procedure, as long as the selection still falls into a gear that would allow the vehicle to launch without causing damage to the transmission.
- If the start gear is changed by up or down shifting, it will remain as the default until the vehicle is powered down or the selection is change. However, conditions such as, grade, may still override the default start gear selection.
- A shift can be advanced by up or down shifting when the transmission is near the shift point.

 Multiple gear upshifts and downshifts may be allowed when the up/downshift request procedure is performed multiple times (Each request equals one gear change request).

- The transmission may also deny a shift while ascending or descending grades if the load of the vehicle, and grade of the terrain in combination with the drivetrain ratio and engine torque will fall outside of the acceptable range to perform a shift. If the shift is denied it will sound a tone.

 *If you attempt to select a non-neutral mode without depressing the service brakes the transmission will not shift into gear and you will have to return to Neutral and depress the brakes before selecting the desired mode again.

Reverse Mode

- Reverse mode selects the default **Reverse** gear. (see Note* page 126).
- Each time **Reverse** is selected from **Neutral**, the default **Reverse** gear is engaged.

LOW Mode

LOW mode should be used any time you want to maximize engine braking and minimize the use of the brake pedal. For example, when driving down low grades or when coming to a stop.

- Selects lowest available gear for start gear (see Note* page 126). The starting gear cannot be changed in LOW mode.
- If LOW is selected while moving, the transmission will not upshift (except for the Transmission Override conditions noted below). The transmission system will downshift at the earliest opportunity to enable higher than normal engine RPM to provide maximum engine braking.

Transmission LOW Override

- If the vehicle is being back driven and the engine is approaching a higher than normal level, the transmission system will override the MANUAL position and perform and upshift.

 The PACCAR Transmission initiates upshifts from Low and Manual for engine overspeed protection above governed speed.

 ***On slippery surfaces minimize engine braking in LOW mode. Excessive engine braking at higher engine RPM could cause a loss of traction and vehicle control.***

MANUAL Mode

MANUAL mode should be used whenever the driver wants to select the shifts instead of letting the transmission select them automatically. For example, when the driver is moving around the yard, over railroad tracks, or on steep grades.

- Driver manually selects the start gear and uses the up/downshift request procedure to shift (see Note* page 126).
- System holds current gear unless otherwise prompted by using up/downshift request, except for the "Transmission Override" conditions noted below.



Multiple gear upshifts and downshifts may be allowed when the up/downshift request procedure is performed multiple times (Each request equals one gear change request).

For optimal vehicle performance, it is recommended the vehicle be operated in **Drive** mode.

Transmission MANUAL Override

- If the vehicle is being back driven and the engine is approaching a higher than normal level, the transmission system will override the MANUAL position and perform an upshift.
- If the start gear is changed and it causes the engine to lug at takeoff, the transmission system will override the MANUAL position and select the best available gear.



The PACCAR Transmission initiates upshifts from MANUAL and LOW for engine overspeed protection.

Urge to Move

Urge to Move allows the vehicle to automatically start moving when the transmission is in gear and the driver releases the service brake. After the vehicle has launched the vehicle will creep at a constant speed at engine idle without the need to apply the accelerator pedal. The configuration is useful for stop and go applications allowing the vehicle to launch and creep without applying the accelerator.

Use Urge to Move to launch the truck, then ease onto the throttle once the truck is moving, this would only require $\pm 75\%$ throttle as opposed to $\pm 100\%$ throttle with otherwise high or aggressive shift pattern

Creep Mode

Creep allows the vehicle to be driven at a constant speed at engine idle without the need to apply the accelerator pedal. The configuration is useful for slow speed applications where steady vehicle speed is required. Upshifts and downshifts can be requested to increase or decrease vehicle speed.

PACCAR TRANSMISSION FEATURES

Intelligent Start Gear Selection

- Intelligent Start Gear Selection will automatically select the start gear depending on inputs such as load, grade and axle/transmission ratio.
- The start gear selection can be changed using the up/downshift request, however, if the selection requested could cause damage or engine lugging the request will be denied and an audible tone will sound.

Skip Shifting

- The PACCAR Automated Transmission will shift multiple gears at one time (skip shift) with moderate to high accelerator pedal input while in Drive mode, up to 8th gear.

Clutch Protection



The PACCAR Automated Transmission clutch can still overheat and slip with improper use.

- DO select the lowest possible start gear for the application. If moving slowly is require, select **1st** or **R1**.
- DO use the Service Brakes and let Hill Start Aid assist when launching on an incline.
- Do NOT use the throttle to hold the vehicle on an incline. (Use Service Brakes).
- Do NOT use the throttle to stop roll back on an incline after Hill Start Aid disengages. (Use Service Brakes and then relaunch).

- If the PACCAR Automated Transmission clutch does start to overheat, the display will show **CA** along with a warning tone. If **CA** is active in the gear display, immediately discontinue the operation that is being performed which is causing the clutch to overheat.
- If the driver continues abusive operation, the system will either open the clutch if the accelerator pedal is not applied or close the clutch if the accelerator pedal is applied.
- If the abuse continues, the system will open the clutch and take away accelerator pedal control for a short period of time to allow the clutch to cool down. Urge to Move may be inoperable when the clutch is overheated.

Below are some examples of situations which may initiate clutch abuse along with some helpful hints on how to avoid them.

Example	How to Avoid
Starting on hills using the throttle rather than the brake	Use the service brakes to hold on a hill. To start moving, apply the throttle and release the brakes as you feel the truck start to pull.
Moving trailer tandems	Be sure to always start off in 1st gear when moving forward, and Low Reverse when moving backwards (R or R1 on gear display).
Hooking up to a trailer	Always be sure the trailer is high enough to back under. Use Low reverse (R or R1 on gear display). Use light brake pedal pressure to reduce the 'jerking' of the vehicle.

Engine Over-Speed Protection

- The transmission system will upshift if necessary to prevent engine over-speed in Drive, MANUAL and LOW modes.

Cruise Control

The PACCAR Automated Transmission system is compatible with cruise control.

Load-Based Shifting

The transmission will adapt to the changing conditions of the vehicle to change the shift points based on the following inputs:

- Vehicle grade
- Engine RPM
- Throttle position
- Vehicle load

After changing loads or powering up, the transmission system needs to relearn these inputs for the first few shifts to make the proper adjustments.

Coast Mode

When coasting to a stop, in Drive mode, on level terrain the transmission system may not downshift into the lower gears. This allows the transmission to coast to a stop.

Auto Neutral

- The transmission system will automatically shift to neutral if the vehicle is left in Drive and the parking brakes are set.
- **AN** will appear in the gear display. The driver must then select the desired forward or reverse mode with the service brake applied.

EATON TRANSMISSIONS

ULTRASHIFT PLUS TRANSMISSIONS

Shift Lever Patterns and Shifting Controls

UltraShift PLUS is an automated manual Eaton Fuller transmission that automatically selects and engages the transmission's gears with an ECA (Electronic Clutch Actuator) that operates the clutch.



Refer to UltraShift PLUS Automated Transmission Driver Instruction booklet included in you Driver's Information Pack for further information relating to operation, service and maintenance of your UltraShift PLUS transmission.

Gear Display

The Gear Display indicates the current gear position of the transmission. During an upshift or downshift the gear display may momentarily flash the target gear position.

Current Gear



SOLID

Gear Shift Transition



FLASHING

Successful Gear Shift



SOLID

The 'DASH' indicates the transmission may be torque locked in gear and unable to confirm neutral. (See 'Service and Maintenance Manual Locked in Gear' section in UltraShift PLUS Automated Transmission Driver Instruction booklet included in you Driver's Information Pack for more details.)



'CA' will appear in the gear display if a clutch abuse event is occurring. If abuse continues the clutch will open and throttle control is removed till clutch cools.



The transmission system will automatically shift to neutral if the vehicle is left in **Drive** and the parking brakes are set. 'AN' will appear in the gear display. The driver must select **Neutral** and then select the desired forward or reverse mode with the service brake applied.



In heavy duty UltraShift PLUS models, 'GI' may briefly appear in the gear display after the engine is started. This indicates the clutch release bearing will need to be greased soon (see 'Optional Automated Lube Schedule' section in UltraShift PLUS Automated Transmission Driver Instruction booklet included in you Driver's Information Pack for more information).



 'GI' stands for grease interval and may be misread as 'G1' on the gear display.

START-UP AND POWER DOWN

Start-up

1. Turn the ignition key to ON and allow the UltraShift® PLUS to power-up:
 - Engine cranking is delayed until the transmission power-up is complete and the gear display shows a solid **N** (neutral).
2. Start the engine.
3. Apply service brake:
 - If the service brake is not applied while selecting a starting gear, the initial start gear will not be found and the driver will have to re-select **Neutral** and press the brake while re-selecting the desired mode.
4. Select the desired mode and starting gear on the shift console.



The transmission will override inappropriate start gear selections to avoid damaging the transmission.

5. Release the vehicle parking brakes.
6. Release service brake and apply accelerator.

Power Down

1. Select **Neutral** on the shift control:
 - If gear display does not show solid **N**, neutral has not yet been obtained.



Neutral should always be reached before the UltraShift PLUS power down is performed except in cases of emergency.

2. Set the vehicle parking brakes.
3. Turn off the ignition key and allow the engine to shut down.

EATON TRANSMISSION MODES

Reverse Mode

- Selects default **Reverse** gear (see Note* below).
- Each time **Reverse** is selected from **Neutral**, the default **Reverse** gear is engaged.
- The vehicle will not engage **Reverse** above 2 mph.
- On multi-speed auxiliary models, **R1** to **R2** and **R3** to **R4** shifts will only be made by manually up or down shifting while driving.
- Single-speed auxiliary (10-speed) and medium-duty models have only one reverse speed.

 The transmission cannot range shift while moving, but the driver can split shift while moving if the vehicle is equipped with a multi-speed auxiliary section.

 **R4** is only available on the UltraShift PLUS Multipurpose Extreme Performance (MXP) and UltraShift PLUS Vocational Extreme Performance (VXP) models.

 *If you attempt to select a non-neutral mode without depressing the service brakes the transmission will not shift into gear and you will have to return to Neutral and depress the brakes before selecting the desired mode again.

 *Launching the vehicle in high range increases the likelihood of clutch abuse, and depending on the level of usage, could have a detrimental impact on clutch life.*

DRIVE Mode

- Automatically selects the start gear (see Note* page 134). The selected start gear will vary depending on several vehicle inputs like load, grade, and axle/transmission ratio. This start gear can be changed by up or down shifting using the righthand steering column stalk, as long as the selection still falls into a gear that would allow the vehicle to launch without causing damage to the transmission.
- If the start gear is changed by up or down shifting, it will remain as the default until the vehicle is powered down or the selection is changed by up or down shifting again.
- Automatically performs all upshifts and downshifts in all gears except 1st (Only on the UltraShift PLUS Vocational Multipurpose Series (VMS) models) and Reverse on all models.
- A shift can be advanced by up or down shifting when the transmission is near the shift point.
- The transmission may also deny a shift while ascending or descending grades if the load of the vehicle, and grade of the terrain in combination with the drivetrain ratio and engine torque will fall outside of the acceptable range to perform a shift. If the shift is denied it will sound a tone.



Multiple gear upshifts and downshifts may be allowed when the up/downshift request procedure is performed multiple times (Each request equals one gear change request).



Prior to ascending a steep grade the driver should reduce default start gear by one or ensure full throttle is applied for the duration of the grade so the vehicle maintains the proper engine and vehicle speed during the entire grade. The driver can shift down by using the downshift procedure.



If the driver depresses and holds both pedals (even if done accidentally) the launch will be abrupt and the engine and brake forces may rock and bounce the vehicle. Releasing either pedal will stop this immediately.

MANUAL Mode

MANUAL mode should be used whenever the driver wants to select the shifts instead of letting the transmission select them automatically. For example, when the driver is moving around the yard, over railroad tracks, or on steep grades.

- Driver manually selects the start gear and uses the up/downshift request procedure to shift (see Note* page 134).
- System holds current gear unless otherwise prompted by using up/downshift request, except for the “Transmission Override” conditions noted below.

 Multiple gear upshifts and downshifts may be allowed when the up/downshift request procedure is performed multiple times (Each request equals one gear change request).

 For optimal vehicle performance, it is recommended the vehicle be operated in Drive mode.

 UltraShift PLUS initiates upshifts from MANUAL and LOW for engine overspeed protection.

Transmission MANUAL Override

- If the vehicle is being back driven and the engine is approaching a higher than normal level, the transmission system will override the MANUAL position and perform an upshift.
- If the start gear is changed and it causes the engine to lug at takeoff, the transmission system will override the MANUAL position and select the best available gear.

LOW Mode

LOW mode should be used to maximize engine braking and minimize the use of the brake pedal. For example, when driving down long grades or when coming to a stop.

- Selects lowest available gear for start gear (see Note* page 134). The starting gear cannot be changed in LOW mode.
- If LOW is selected while moving, the transmission will not upshift (except for the Transmission Override conditions noted below). The transmission system will downshift at the earliest opportunity to provide maximum engine braking.

Transmission LOW Override

- If the vehicle is being back driven and the engine is approaching a higher than normal level, the transmission system will override the MANUAL position and perform and upshift.



UltraShift PLUS initiates upshifts from Low and Manual for engine overspeed protection above governed speed.

At higher engine speeds additional engine braking in LOW Mode could cause a loss of traction when on slippery surfaces.

Urge to Move

- Urge to Move allows the vehicle to automatically start moving when the transmission is in gear and the driver releases the service brake. After the vehicle has launched the vehicle will creep at a constant speed at engine idle without the need to hold the throttle pedal position. The configuration is useful for stop and go applications allowing the vehicle to launch and creep without applying the accelerator.
- The vehicle speed is determined by the selected gear ratio operating at governed low engine idle speed. Any available start gear may be selected. However, the transmission will downshift or exit Creep if the engine lugs 150 rpm below the governed low engine idle speed due to load conditions.
 - When a gear is engaged and the driver releases the service brake; the clutch will close automatically providing vehicle movement.
 - The clutch will remain closed; allowing the vehicle to creep at constant engine idle after the service brake is released.
 - The clutch will also open if the engine lugs 150 rpm below the governed low engine idle speed.

Launching:

1. Engage the desired gear.
2. Release service brake (vehicle will automatically launch and creep at constant engine idle).
 - Upshifts and Downshifts can be made while at constant engine idle by pushing the Upshift / Downshift buttons. The transmission may deny a shift and sound a tone if the load of the vehicle or grade of the terrain falls outside the acceptable range to perform a shift.
3. Apply accelerator to accelerate the vehicle above idle.

Stopping:

1. Release the accelerator (vehicle will creep at constant engine idle).
 - Upshifts and Downshifts can be made while at constant engine idle by pushing the Upshift / Downshift buttons.
2. Apply service brake.

Creep

- Creep allows the vehicle to be driven at a constant speed at engine idle without the need to hold the throttle pedal position. The configuration is useful for slow speed applications where steady vehicle speed is required (e.g. dump / spreader applications).
- The vehicle speed is determined by the selected gear ratio operating at governed low engine idle speed. Any available gear may be selected. However, the transmission will downshift or exit Creep if the engine lugs 150 rpm below the governed low engine idle speed due to load conditions.
 - When a gear is engaged; the clutch remains open until the driver releases the service brake and applies the accelerator.
 - The clutch will close and remain closed after the accelerator is released, allowing the vehicle to creep at constant engine idle.
 - The clutch will also open if the engine lugs 150 rpm below the governed low engine idle speed due to load conditions.

Launching:

1. Engage the desired gear.
2. Release service brake.
3. Apply the throttle pedal to accelerate the vehicle until the clutch is closed (engaged).
4. Release the throttle pedal (vehicle will creep at constant engine idle).
 - Upshifts and Downshifts can be made while at constant engine idle by pushing the Upshift / Downshift buttons. The transmission may deny a shift and sound a tone if the load of the vehicle or grade of the terrain falls outside the acceptable range to perform a shift.
5. Apply accelerator to accelerate the vehicle above idle.

Stopping:

1. Release the accelerator (vehicle will creep at constant engine idle).
 - Upshifts and Downshifts can be made while at constant engine idle by pushing the Upshift / Downshift buttons.
2. Apply service brake.

ULTRASHIFT PLUS FEATURES

Proper Starting Gear

Choose a starting gear appropriate for the load and grade conditions while at a stop in DRIVE and MANUAL modes by using the up/downshift request procedure. Refer to DRIVE Mode (page 135) for detailed information.

Skip Shifting

- When appropriate, the transmission system may skip shift in DRIVE Mode.
- Skip shifts can be performed in MANUAL Mode by pressing the up/down buttons providing the current conditions like load and grade allow this condition.

 Multiple gear up/downshifts may be performed by using the up/downshift procedure more than once.

Clutch Protection

- This vehicle uses an automated clutch for launching the vehicle; however the clutch can still overheat and slip with improper use.
- DO select the lowest possible start gear for the application. If moving slowly is require, select **1st** or **R1**.
- DO use Creep mode when appropriate.
- DO use the Service Brakes and let Hill Start Aid assist when launching on an incline.
- DO minimize the time it takes to engage the clutch from rest.
- Do NOT use the throttle to hold the vehicle on an incline. (Use Service Brakes).
- Do NOT use the throttle to stop roll back on an incline after Hill Start Aid disengages. (Use Service Brakes and then relaunch).
- Do NOT continually start and stop, especially when loaded (use a lower gear or Creep mode).
- If the automated clutch does start to overheat, the display will show **CA** along with a warning tone. Full clutch actuation must be completed quickly. If the abuse continues, the system will open the clutch and take away throttle control for a short period of time to allow the clutch to cool down.

Repeated incidents of clutch abuse may cause the clutch to fail and render the truck immobile, resulting in extended down time.

Below are some examples of situations which may initiate clutch abuse along with some helpful hints on how to avoid them.

Example	How to Avoid
Starting on hills using the throttle rather than the brake	Use the service brakes to hold on a hill. To start moving, apply the throttle and release the brakes as you feel the truck start to pull.
Moving trailer tandems	Be sure to always start off in 1st gear when moving forward, and Low Reverse when moving backwards (R or R1 on gear display).
Hooking up to a trailer	Always be sure the trailer is high enough to back under. Use Low reverse (R or R1 on gear display). Use light brake pedal pressure to reduce the 'jerking' of the vehicle.

Engine Over-Speed Protection

- The transmission system will upshift if necessary to prevent engine over-speed in Drive, MANUAL and LOW modes.



UltraShift PLUS initiates upshifts from Low and Manual for engine overspeed protection above governed speed.

Optimal Engine Braking

The LOW Mode can be selected while moving. This initiates downshifts as soon as possible.

Skid Conditions

If a skid condition occurs, the UltraShift PLUS senses the vehicle speed dropping rapidly. In this case, the transmission delays downshifting.

Cruise Control

The UltraShift PLUS is totally compatible with cruise control. If a shift is required while cruise control is active, cruise is temporarily interrupted while the shift is performed and then automatically resumed after the shift.

Load-Based Shifting

In DRIVE Mode, the transmission will adapt to the changing conditions of the vehicle to change the shift points based on the following inputs:

- Vehicle grade
- Engine RPM
- Throttle position
- Vehicle load

After changing loads or powering up, the UltraShift PLUS transmission needs to relearn the new conditions. While learning, it may hold a gear instead of upshifting. Simply upshift using the Upshift request procedure to start the upshift. It may take three or four shifts for the transmission system to learn the new conditions. After that it will handle upshifts and downshift automatically.

Depending on conditions, UltraShift can activate the engine brake in order to bring the engine down faster for an upshift. This can happen even if the engine brake dash switch is OFF.

Coast Mode

When coasting to a stop on level terrain the transmission system may not downshift into the lower gears. It will select a gear after the throttle is reapplied.

DRIVER DIAGNOSIS - ULTRASHIFT PLUS

During power-up, the service light will come on for 1 second and go off. This is normal operation. But if the service light comes on and stays on, or comes on while driving, it means UltraShift has detected a fault. Book in to an authorised service dealer as soon as possible.

In the event of a problem with the UltraShift PLUS, there are three primary tasks the driver should perform:

- Note the **driving condition** under which the problem occurred.
- Note the **condition of the UltraShift** under which the problem occurred.
- **Retrieve fault codes** as described below.

RETRIEVING FAULT CODES

Retrieve UltraShift fault codes by enabling the UltraShift system's self-diagnostic mode.

1. Place the touch pad/shift lever in neutral.
2. Set the parking brake.
3. Turn the ignition key on but do not start the engine. If the engine is already running, you may still retrieve codes. However, do not engage the starter if engine stalls.
4. To Retrieve **Active** Codes - Start with the key in the ON position. Turn the key off and on two times within five seconds, ending with the key in the ON position. After five seconds, the service lamp begins flashing two-digit fault codes. If no codes are active, the service light will flash code 25 (no codes).
5. To Retrieve **Inactive** Codes - Start with the key in the ON position. Turn the key off and on four times within five seconds, ending with the key in the ON position. After five seconds, the service lamp begins flashing two-digit fault codes. If no codes are active, the service light will flash code 25 (no codes).
6. Observe the sequence of flashes on the indicator lamp and record the codes. A one to two-second pause separates each stored code and the sequence automatically repeats after all codes have been flashed.

FAULT CODES

Fault Codes	Description UltraShift
11	No ECU Operation Test
12	Improper ECU Configuration
13	J1939 Control Device
14	Invalid Shift Lever Voltage
15	HIL Shift Device Communication
16	High Integrity Link
17	Start Enable Relay
19	CAN ECA message
21	Auto-Neutral Parking brake Switch
22	ABS CAN message
23	Urge to Move Brake Switch Signal
25	No Faults Found
26	Clutch Slip
27	Clutch Disengagement
29	Remote Throttle Enable
33	Low Voltage Supply
34	Weak Battery Voltage Supply
35	J1939 Communication Link
36	J1939 Engine Message
37	Power Supply
41	Range Failed to Engage
43	Range Solenoid Valve
45	Inertia Brake Performance
51	Rail Position Sensor
52	Gear Position Sensor
56	Input Shaft Sensor
57	Main Shaft Sensor
58	Output Shaft Sensor
61	Rail Motor Circuit
63	Gear Motor Circuit
64	Electronic Clutch Actuator (ECA)
65	ECA Speed Sensor

FAULT CODES

Fault Codes	Description UltraShift Cont....
66	ECA Battery Voltage
67	ECA Ignition Voltage
68	Grade Sensor
71	Unable to Disengage Gear
72	Failed to Select Rail
73	Failed to Engage Gear
74	Engine Speed Response Fault Engine Torque Response Fault Shift Quality
75	Power Down in Gear
81	Gear Engagement Detected
83	Shift Lever Missing
84	Shift Controller Device not Configured
85	Shift Control Device Incompatible
99	Direction Mismatch

An 88 code may appear in gear display which indicates self testing.

USING THE BRAKE SYSTEM

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

The air brake system contains dual circuits; a circuit for the rear brakes (primary) and a circuit for the front brakes (secondary). The trailer air is supplied from these two circuits. The system is supplied by an engine-driven compressor. The vehicle's compressor takes outside air and compresses it, usually to 690 to 896kPa. The compressed air then goes to the reservoirs to be stored until needed.

Upon operation of the service brake, stored air flows from the air tanks to the brake chambers. The pressure of this delivered air is regulated through the foot valve. There is no direct force applied to the air by foot pressure.

In hydraulic braking systems, such as cars, force applied to the brake pedal is transferred directly to the hydraulic fluid. As fluid is virtually incompressible, this gives the feeling of a firm brake pedal. You will not feel this in a pneumatic brake system as used in trucks, because the operator is simply operating a valve.



The brake system is a critical vehicle safety system. For the safety of yourself and others around you, have the vehicle submitted for scheduled preventive maintenance checks as well as having any suspected problems immediately checked by an authorised service dealer. Failure to properly maintain your brake system can lead to serious accident and/or injury.

Never drive your vehicle with the parking brake applied. Always release the parking brakes prior to moving the vehicle. Failure to disengage the parking brakes prior to moving your vehicle could result in excessive heat build-up in the brake system, resulting in a fire.

Today's diesel electronic engines have significant torque and startability power at low rpm. Combinations of engine speed and available torque may over-power the vehicle's parking brakes.

AIR SUPPLY SYSTEM

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 all maintenance procedures.

BRAKE OPERATION



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

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

Front Brake System

When the brake pedal is depressed, the front circuit portion of the treadle valve delivers air from the front service reservoir to the front axle brake chambers via the front relay/ATR-6 valve and ABS pressure modulation valves.

Simultaneously (on-full truck configurations) air is also supplied to the modulating valve control port. In the event of a rear service circuit failure, the modulating valve will exhaust air from the spring brake chambers, applying the spring brakes in proportion to the front circuit application.

Rear Brake System

When the brake pedal is depressed, the rear circuit portion of the treadle valve delivers air from the rear service reservoir to the rear ATR-6 valve control port. The ATR-6 valve then delivers air directly from the rear service reservoir to the rear brake chambers via the ABS pressure modulation valves in proportion to the treadle pressure.

Brake Application Air Gauge

The Brake Application Air gauge will show how much air pressure is being applied from the foot brake valve or trailer brake hand valve to the air brakes. It is a virtual gauge which is connected to the brake valve.

USING THE PARKING BRAKE

The yellow diamond-shaped knob on the dash controls the truck parking brakes. These are spring brakes that you activate by releasing air pressure from their chambers. When they are not in use, air pressure compresses the springs and releases the brakes. Pulling the valve OUT applies the parking brake, which exhausts air from the chambers and allows the springs to extend and apply the brakes.

 ***Do not leave the cab without applying the truck parking brake. The truck could roll and cause an injury or accident.***

BEFORE YOU LEAVE THE CAB

1. Apply parking brake. Pull out the Yellow Parking Brake Control knob located on the dash. The red Trailer Air Supply Control valve will automatically apply.
2. Shift the transmission into PARK position:
 - Manual transmission, select Neutral.
 - Automated and Automatic transmission, select Neutral.
3. Turn the key to the OFF position and remove the key.

The parking brakes act on the rear wheels only. They are spring-applied, with air pressure used to release them.

Release air is supplied by both the front and rear circuit reservoirs through a double check valve.

 ***Trailer parking brake is not intended to be used as parking brake for truck and trailer combination. The truck could roll and cause an injury or accident.***

TO RELEASE THE TRUCK PARKING BRAKES ONLY

- Push IN the yellow knob on the dash. Your trailer will remain parked.
- Below the threshold pressure of 207kPa (30psi) the Yellow valve remains OUT (in the ON position) when you attempt to push it in.

See Air System Pressure Gauges on page 25 for more information.

TO RELEASE THE FULL COMBINATION OF BRAKES

- Push IN BOTH knobs on the dash.
- If the air pressure is reduced below a safe level, the low-air warning light will come on first. If air pressure continues to drop the parking brake valve will pop OUT, automatically applying the spring brakes.

Do not try to put the vehicle in motion before pressure in the system reaches 689kPa, because the wheels are locked by the spring brake action.

Unnecessary stress and possible brake malfunction could occur if the vehicle is forced to move before the air system reaches 689kPa.



If air pressure drops below the spring brake (Yellow) threshold pressure, the spring brakes may stop the vehicle abruptly, which could result in an accident and/or injuries. Observe the red warning lamps on the gauges. If one comes on, do not continue to drive the vehicle until it has been properly repaired or serviced.

TRUCK/TRAILER AIR SUPPLY VALVE

Initial Charge

The red octagonal knob controls the air supply to the trailer. With the system completely discharged, both the red (trailer air supply) and the yellow (parking brake) knobs are OUT; thus, truck and trailer parking (spring) brakes are applied.

Allow the truck air system pressure to build up to operating level.

Normal Run Position

- The Yellow knob (system park) may now be pushed IN, which will supply air to the truck spring brakes, releasing them.
- The Red knob may now be pushed in to charge the trailer system.
- With both knobs pushed IN, air is now being supplied to both the trailer and the truck spring brakes; all brakes are released.

Trailer Park or Emergency Brake Application Only

If you ever have a failure or disconnect the air supply hose to the trailer, the trailer parking brakes will set. The red knob will automatically pop OUT and seal off the truck air reservoirs to protect the truck air system pressure.

To apply the trailer brakes only: Pull OUT the red knob. This will exhaust air from the trailer supply line, causing the truck protection valve to close and the trailer spring brakes to apply. The trailer is now in 'emergency' or 'park' mode. This mode would be used to uncouple from the trailer and during bobtail operation (running without a trailer connected).

 ***Do not use the trailer hand brake or service brakes to park and hold an unattended vehicle. Use the parking brakes. Because service brakes work with air pressure, these brakes could slowly release. Your vehicle could roll and cause a serious accident. Someone could be hurt or killed. Never rely on the service brakes to hold a parked vehicle.***

TRAILER PARKING BRAKE RELEASE VALVE

The trailer park release valve is an optional fitment for use with semi/full rear tipping trailers.

The trailer park release valve is interlocked with the main parking brake system, per ADR 35/03 requirements. The trailer brakes can only be released after all the parking brakes have activated and stabilised.

 The engine must be running for the system to operate (engine oil pressure switch controlled) and not moving.

The basic operation of the trailer is that the tipping motion 'drags' the trailer forwards toward the truck due to the effective shortening of the drawbar as the tip angle increases. If the trailer brakes are applied, this would then cause the tyres of truck/trailer to be dragged backwards.

The basic sequence of operations is:

- Reverse trailer into position and then apply the parking brakes for the complete truck/trailer combination.
- Release trailer parking brakes by activating the 'black valve', then activate the tilt mechanism.
- Once tilt cycle is completed, release system parking brake to move off, this deactivates the trailer release valve.

The trailer park release valve operates, once complete combination parking brakes applied, by supplying air only to the trailer parking brakes to release them. At the same time, because the combination parking brakes have been activated, the foot pedal controlled service air brake system is inoperative.

WARNING

The trailer parking brake release valve is only designed to be used by the driver during tipping. **DO NOT** leave the driving position while activated.

Only operate on relatively flat ground, if the truck brakes are insufficient to hold the combination, release the parking brakes and operate the service brakes

SYSTEM TRUCK PARK

With both knobs pushed in for normal operating modes, the parking brakes of both the truck and the trailer may be applied by pulling the yellow knob OUT. This will exhaust the air from the truck spring brakes, and simultaneously cause the red knob to pop OUT, which will apply the trailer brakes. This complies with the ADR 35/03 requirement that one control should apply all the parking brakes on the vehicle.

BRAKE SAFETY AND EMERGENCY



Do not operate the vehicle in the event of a malfunction in any air circuit. The vehicle should not be operated until the system is repaired and both braking circuits, including all pneumatic and mechanical components, are working correctly.

Loss of system air can cause the service brakes to not function, resulting in the sudden application of the spring brakes, causing wheel lock-up, loss of control or collision by following vehicles. Loss of air system could result in an accident and/or personal injury.

If pressure is lost in the truck front or rear circuit, the 'check' valves isolate the unaffected circuit, allowing this circuit to continue normal operation. The trailer brakes are still functional:

- If air pressure is lost in the trailer supply/park circuit, and the pressure drops below the threshold pressure, the trailer spring brakes are automatically applied, and the truck air pressure circuits are unaffected.
- If air pressure is lost in the trailer brake service circuit, and the pressure in the truck front and rear circuits drops below threshold pressure, the truck and trailer spring brakes are automatically applied.

EMERGENCY BRAKING



Unless you have an anti-lock braking system (ABS), always avoid completely depressing the service brake pedal, if possible, even during emergency braking. Depressing the brake pedal too aggressively can cause the wheels to lock, which can lead to an uncontrolled skid and can result in an accident.

Overheated Brakes

Under normal braking conditions, the energy generated will bring the internal brake drum temperature to about 260°C. This is well within the safe zone. The maximum safe temperature of linings for drum type brakes is usually about 427°C.

If service brakes are used improperly for prolonged periods or for emergency braking, internal brake drum temperatures may exceed 427°C. Such brake overheating may be detected by a burning smell or smoke coming from a drum. If this occurs, you should immediately stop and check for cracked brake drums or lining fires. If neither exists, get back behind the wheel and resume at slow speed as soon as possible to cool the brakes.

If the vehicle were to remain stopped, the heat transfer could destroy the linings and distort the brake drum.

To prevent drums from distorting while they cool down:

- Park the vehicle on a level surface and block the wheels.
- Release the parking brake and allow the brakes to cool down. See Using the Parking Brake on page 148.

DISC BRAKES

The air disc brakes are high performance, low weight, high efficiency brakes designed for trucks and other commercial vehicles requiring between 10,000 and 23,000Nm of braking torque at each wheel.

Clamping force is produced by a globular cast iron caliper located above the rotor and housing two lining pads. The pads are pushed against the rotor by a dual piston actuating block connected to an eccentric shaft, which is in turn driven by a lever operated by a standard air actuator (rotation chamber).

The caliper is carried on a saddle which is a fixed support bolted to the axle flange.

An equalised clamping action both on the inner and outer pads is generated by allowing the caliper to float on the two slide pins fixed to the saddle. The clamping force generated by the primary actuation is applied to the inner pad which forces it into contact with the rotor. A reactive force through the caliper body applies equal clamping force to the outer pad applying a balanced clamping force to the rotor.

The slide pins also allow the caliper to freely position itself on the saddle to compensate for the reduction in lining pad thickness due to wear. An automatic self-adjuster mechanism is incorporated in order to maintain constant clearance between pads and rotor.

The automatic adjuster operates on each clamping action to sense excessive pad-rotor clearance, and reduces excessive clearance by a fixed proportion with each actuation.

For brake adjustment and new lining installation, the brake incorporates provision for manual adjustment, easily performed by using a standard hexagonal wrench.

Brake actuation can be either clockwise or counterclockwise, depending on how the rotation chamber has been installed on the brake unit.

ELECTRONIC BRAKE SAFETY SYSTEM (EBSS)

ANTI-LOCK BRAKING SYSTEM (ABS)

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

ABS WARNING LAMP



Do not rely on an anti-lock brake system that is functioning incorrectly. You could lose control of the vehicle, resulting in a severe accident and/or personal injury. If your ABS lamp comes on while you are driving, or stays on after the self-check, your anti-lock system might not be working. The ABS may not function in an emergency. You will still have conventional brakes, but not anti-lock brakes. If the lamp indicates a problem, have the ABS checked.

If the ABS warning light does not illuminate when the ignition is first turned on, there is a problem with the bulb or wiring. You should have this checked as soon as possible.



The ABS warning lamp will come on momentarily when the key switch is first turned. The lamp will go out and stay off unless the system detects a failure or malfunction.

Except for checking the proper illumination of the ABS and wheel spin control warning lamps when first starting the truck, and for monitoring these lamps while driving, no special operating procedures are required. For a detailed system description, see operation and service literature for your specific ABS.

AUTOMATIC TRACTION CONTROL (ATC)

ATC is a standard feature of the EBSS system. This feature is monitored by a wheel spin control warning lamp. As such, the system consists of Wheel Speed Sensors (WSS), Electronic Control Unit (ECU) and Pressure Modulation Valves (PMV) and in addition, an Automatic Traction Control Valve (ATC Valve).

The traction control warning lamp will briefly illuminate and then go out when the ignition switch is first turned on. The traction control warning lamp will illuminate whenever the ATC system detects drive wheel spin. The lamp will remain illuminated as long as wheel spin is detected and the ATC system is applying the drive wheel brakes or reducing engine torque.

Do not allow the traction control lamp to remain on continuously for an extended length of time. Extended, continuous use of the ATC can cause overheating of the drive wheel brakes. Engine torque or vehicle speed should be reduced to eliminate wheel spin and prevent excessive application of the ATC system.

ATC is used for slip control of the driving wheels. Under acceleration, one or more of the driving wheels may start to spin as the drive torque exceeds the drive tyre to road surface adhesion. ABS responds to braking by inhibiting wheel lock, ATC reacts to acceleration by holding acceleration slip within acceptable levels to prevent wheel spin.

The ATC system communicates with the engine ECU via the J1939 data bus. In the event of a wheel slip incident both engine and ATC systems operate simultaneously to reduce engine torque/RPM and apply or release pressure in the service brake system to prevent wheel slip or spin.

The ATC system sensitivity can be reduced by enabling the ATC Off Road switch.

If the ATC Off Road switch is enabled, the ATC sensitivity threshold will be decreased up to a speed of approximately 50km/h, at which normal ATC operation will automatically resume.

Optional features of the Electronic Brake Safety System are outlined below, and a more comprehensive section is located on the USB memory stick in the Driver's Information Pack.

DRAG TORQUE CONTROL (DTC)

Premium EC-80 controllers have a feature referred to as drag torque control which reduces wheel slip on a driven axle due to driveline inertia. This condition is addressed by increasing the engine torque to overcome the inertia. Drag torque control increases vehicle stability on low traction road surfaces during down-shifting or retarder braking.

ELECTRONIC STABILITY PROGRAM (ESP)

ESP helps to restore vehicle stability through the use of ABS, ATC, steering direction and vehicle directional stability information. Steering angle, yaw, suspension pressure and brake application pressure sensors monitor the intended vehicle directional control versus actual vehicle movement. ESP intervenes by applying individual wheel brakes, or reduced engine torque when required to enhance vehicle stability. The system is compatible with multi trailer combinations.

TRAILER RESPONSE MANAGEMENT (TRM)

Electronic trailer brake actuation (for EBSS compatible trailers only) for improved trailer braking response to assist with reduced stopping distances.

ABS OFF-ROAD FUNCTION SWITCH

Your Kenworth vehicle may be equipped with a separate electrical switch to activate an ABS off-road function. This function is NOT to be used for on-highway driving, but is intended to be used to improve stopping performance in off-highway conditions (e.g. loose gravel and mud). The ABS off-road function is accomplished by **not** allowing a 'wedge' of material to build-up in front of momentarily locked wheels.



OFF ROAD

Features and Benefits

- Changes the ABS control limits to allow for a more aggressive ABS function while off-road.
- Improves vehicle control and helps reduce stopping distances in off-road conditions or on poor traction surfaces such as loose gravel, sand and dirt.
- Allows retarders to function independently of the ABS function.
- If your vehicle does not have an engine retarder, the ABS off-road switch will function the same.



While the off-road mode can improve vehicle control and shorten stopping distances, some steering ability may be reduced on certain surfaces resulting from the momentarily sliding tyres. Always operate your vehicle at safe operating speeds. Failure to do so might cause your vehicle to lose control and could result in an accident and/or injury.



Never drive your vehicle on improved roads/highways with the ABS off-road function turned on. When you drive your vehicle onto an improved road surface/highway, immediately turn off the ABS off-road switch. Failure to do so will cause the ABS system to not function properly if required and could result in an accident and/or injury.

- The ABS lamp flashes slowly during off-road mode engagement. This is done to alert the driver of a modification to the ABS control software.
- At speeds above 40km, the ABS controller automatically switches back to normal on-highway control mode.
- At speeds between 16 and 40km, the ABS control software is modified to allow short periods (0.25 seconds) of locked-wheel cycles.
- At speeds below 16km, the ABS control software is turned off to allow locked wheels.
- When the ABS off-road function is enabled, the retarder disable output is turned off. That is, the engine retarders are left to function without ABS intervention.

For more information explaining individual EBSS elements, see your Electronic Customised Maintenance Manual (USB), Section 5 - Air System. For vehicles with EBSS read either BW2428 or BW2429 as specified.

HILL START ASSIST (HSA)

Vehicles fitted with Eaton UltraShift Plus transmissions or PACCAR Automated transmission also have the Hill Start Assist feature. HSA defaults to the ON position. It can be turned OFF by pressing and releasing the HSA switch, however, it will turn back on after the first successful launch. If the switch is turned off, the lamp in the HSA switch will flash. For HSA to function the following conditions must be met:



- Vehicle must be on incline greater than 3% and in a forward mode.
- Bring vehicle to a stop and depress the service brakes then release the service brakes.



The vehicle will begin to move after 3 seconds, and the clutch will perform partial engagements to slow the vehicle motion. You must either step on the brake or apply the throttle.

FUSION - ACTIVE SAFETY SYSTEM

All vehicles equipped with the Fusion system are also equipped with the ESP stability system. The ESP stability system is an always ready, full-stability system which monitors vehicle performance. When necessary, ESP automatically intervenes to reduce the throttle and/ or apply the foundation brakes to help you maintain stability during potential loss-of-control or rollover events.

The Fusion system uses the ESP system to help maintain vehicle stability during automatic brake applications on slick surfaces.

The ESP stability system and the Fusion system do not replace the need for you to remain alert, react appropriately and in a timely manner, and use safe driving practices.

 ***You are always responsible for the control and safe operation of the vehicle at all times. The Fusion system does not replace the need for a skilled, alert professional driver, reacting appropriately and in a timely manner, and using safe driving practices.***

System Components

The main components used in the Fusion system are the ESP EC-80 Controller; the FLR-20 radar; the FLC-20 Camera (powered by the Mobileye System-on-Chip EyeQ processor with state-of-the-art-vision algorithms); the Driver Interface Unit (DIU), or dash display; the SafetyDirect CVS Processor; and the vehicle's telematics system.



The Fusion radar locates and tracks moving vehicles. The radar is located at the front of your vehicle— either on the bumper or just behind it on a cross-member. When located behind the bumper, in some cases the unit may also be behind a protective covering that allows the radar signal to pass through. The camera is located on the windshield inside the wiper pattern.

The Fusion radar is pre-aligned at the factory and no adjustment should be needed. If the radar becomes misaligned— or any other system problem is detected— a message (or light) on the dash lets you know that service is needed.

The Fusion camera works with the radar to better identify forward vehicles (moving and stationary).

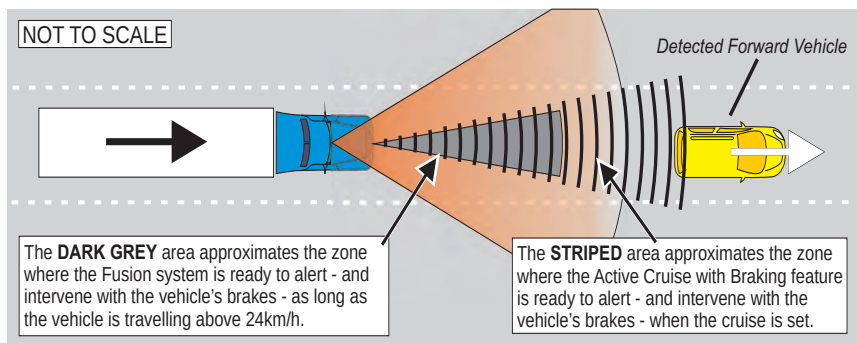


Due to the inherent limitations of image recognition technology, camera-based safety technology – on rare occasions – may not be able to detect or may misinterpret lane markings. At these times, alerts may not occur, or erroneous alerts may occur.

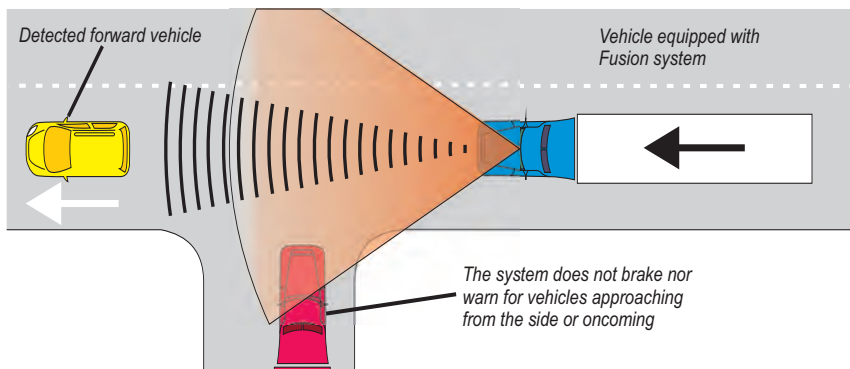
System Overview

Integrating camera, radar, and brakes, the Fusion Active Safety System provides the following alerts and actions:

1. Active Cruise with Braking (ACB);
2. Enhanced Collision Mitigation Braking (CMB);
3. Stationary Vehicle Braking (SVB);
4. Lane Departure Warnings (LDW);
5. Stationary Object Alerts (SOA); and
6. Alert prioritisation.



! The Fusion system reacts *ONLY* to vehicles that are stationary or moving in the same direction as your vehicle. The Fusion system *DOES NOT* respond to side-to-side moving traffic, or oncoming traffic. The system will not slow your vehicle or provide an alert as you approach vehicles in these circumstances.



! When the Fusion system needs to intervene, it works in conjunction with the ESP stability system to engage the brakes. The system should never be relied upon to stop your vehicle or to avoid a collision. You can, and should, still apply full braking force, if needed.

Active Cruise with Braking

Think of the Active Cruise with Braking (ACB) feature as an additional upgrade to ordinary cruise control. When using cruise control, your vehicle not only will maintain the set speed, but the system will also intervene – as needed – to help maintain a set following distance behind the vehicle in front of you.

i Whenever the cruise control is set, the Active Cruise with Braking feature is also set. You can not engage cruise control without also using all the features of the Fusion system.

Using a radar (with a range of approximately 150m) mounted to the front of your vehicle, the System reacts *ONLY* to vehicles moving in the same direction as you. (The system *DOES NOT* respond to side-to-side moving traffic or oncoming traffic.)

See the STRIPED area in the diagram on page 159. The Active Cruise with Braking feature is designed to help maintain a set following distance between your vehicle and the vehicle ahead when cruise control is set.

Once cruise control is set and the system is maintaining a set following distance between you and the forward vehicle:

- **If the vehicle in front of you slows down** below your cruise control's set speed, the system will intervene, as necessary, in this order:
 - reduce the engine throttle; then
 - apply the engine retarder; then
 - apply the foundation brakes,in an attempt to maintain the set following distance behind the vehicle ahead.

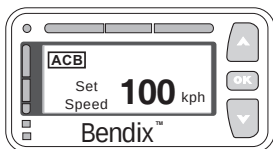


If during the intervention, it is necessary to apply the foundation brakes, the vehicle will not automatically resume the cruise control set speed.

- **If the vehicle ahead slows, below your cruise control's set speed, but then accelerates away** and the Fusion system did not need to use the foundation brakes, the system will automatically accelerate back to the original cruise control set speed, and again maintain a set following distance behind any vehicles ahead of you.

Because the Fusion system operates along with normal cruise control, all the typical features built into cruise control work as usual. For example, limits imposed by factory-set road speed governors, etc. are fully supported by the Fusion system.

Where the Driver Interface Unit (DIU) display is used, a text message will provide the set speed information.



You can switch the Active Cruise with Braking feature off manually by either stepping on the brake, or switching OFF the cruise control.

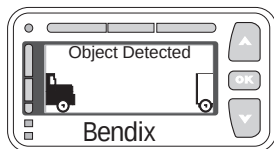


Cruise control will automatically cancel whenever the Fusion system applies the foundation brakes. You can verify the system is disengaged by observing that the cruise-enabled icon is no longer illuminated. You must resume, or set, cruise control in order to regain normal cruise control functionality and to re-engage the Active Cruise with Braking feature of the Fusion system.

Forward Detected Vehicle Icon

When cruise control is switched on and set, and a vehicle ahead of you is detected by the radar, the forward detected vehicle icon (or similar) on the vehicle dashboard or Driver Interface Unit (DIU) display will illuminate.

No LEDs Illuminated



Driver Interface Unit (DIU) – Showing Object Detected warning – no audio tones will sound.

This is an indication to you that the Fusion system is actively managing the distance between your vehicle and the vehicle ahead, and that the system may automatically intervene.

Automatic Foundation Brake Applications

The vehicle automatically manages foundation braking priorities among the various vehicle systems that use the foundation brakes, such as Fusion, ESP (Electronic Stability Program), ATC (Automatic Traction Control), and the ABS (Antilock Braking System).

Applying the Brakes Before the System Does

If you determine that a hazard or unsafe condition exists, you should take all necessary actions immediately. **Never wait for the Fusion system to intervene.**

 ***Safe operation and control of the vehicle is the responsibility of the driver at all times. If you, the driver, apply the brakes, cruise control will disengage automatically, and no Fusion intervention will occur.***

Approaching Slower-Moving Vehicles

When approaching a slower-moving vehicle ahead, the driver should anticipate this and begin applying the vehicle's brakes early. **Do not wait for the Fusion system to intervene.**

Alerts and Warnings

The Fusion system functions differently than other cruise control/forward collision alert and mitigation systems. The system also assists by giving audible and visual alerts, whether or not cruise control is on. It is important for you to fully understand the system's features, especially the driver indications and alerts.

Six main alerts provided by the Fusion system are:

- Impact Alert (IA),
- Following Distance Alert (FDA),
- Stationary Object Alert (SOA),
- Stationary Vehicle Braking (SVB), and
- Lane Departure Warning (LDW)

All of the alerts are always ready to alert you, whether or not you are using cruise control.



Any audible and/or visual alert by the system means that your vehicle is too close to the vehicle ahead or your vehicle is outside the intended lane of travel. You must immediately act to potentially avoid, or lessen the severity of, a collision and to maintain control of the vehicle to the intended lane.



Pedestrians, Animals, Non-metallic, or Limited-metallic Objects

The Fusion system will not warn or react to pedestrians, animals, and non-metallic objects. The system may not warn or react to limited-metallic objects (such as recreational vehicles, horse-drawn buggies, motorcycles, logging trailers, etc.).



Metallic Objects May Impair the Radar

Objects that are radar-reflective – such as crash barriers, guard rails, construction zone barricades, and tunnel entrances – may impair the function of the radar.

Impact Alert (IA) / Collision Mitigation Braking (CMB)

• Always available above 24km/h

 **The Impact Alert (IA)/Collision Mitigation Braking (CMB) is the most severe warning issued by the Fusion system.** This alert indicates that a collision with the detected forward vehicle is likely. As the driver, you must immediately act to potentially avoid, or lessen the severity of, a collision.

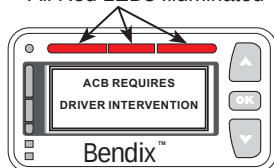
Collision Mitigation Braking applies vehicle braking to help avoid or lessen the severity of a collision, and the system will also provide visual and audible alerts when it is braking.

The IA/CMB is ready to alert you, the driver, whenever the vehicle is moving above 24km/h.

When activated, the IA/CMB will sound and a visual message/icon typically appears on the dash screen or Driver Interface Unit (DIU) display.

 The IA/CMB is typically accompanied by automatic brake interventions, if a collision with the forward detected vehicle is likely to occur. The Fusion system is ready to intervene with braking as needed. It does not require cruise control to be set. You must apply additional braking, when necessary, to maintain a safe distance from the vehicle ahead.

All Red LEDs Illuminated



Driver Interface Unit (DIU) – Showing Impact Alert warning – a loud continuous tone will also sound.

Following Distance Alert (FDA)

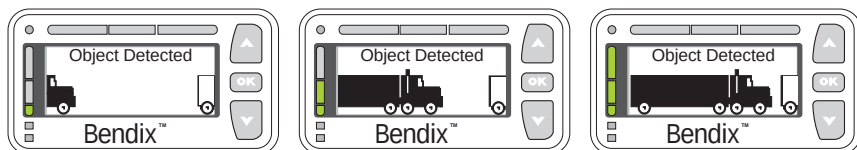
- **Always available above 8km/h**

Following distance refers to the time gap – measured in seconds – between the vehicle with Fusion and the vehicle ahead of it. The actual physical distance between the two will vary based on the speeds of both vehicles; however, the set gap will remain the same for all set cruise speeds.



The Following Distance Alert (FDA) provides both audible and visual alerts whenever the time between your vehicle and the vehicle ahead is at least one and a half (1.5) seconds* and getting closer. Once the audible alert is given, you should increase the distance between your vehicle and the vehicle ahead until the audible alert stops.

The FDA is ready to alert you whenever the vehicle is moving above 8km/h. If the following distance continues to decrease, you will hear more rapid audible alerts. When the FDA reaches its highest level, a visual indication/alert will activate.



Driver Interface Unit (DIU) – Showing Examples of Following Distance Alerts – with progressively faster audible alerts.

* 1.5 seconds is the system default and may vary by fleet.

Stationary Object Alert (SOA)

- Typically available above 16km/h

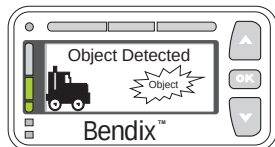
 **The Fusion system will give up to three (3) seconds alert to you when approaching a detected, sizable, stationary object with metallic (radar-reflective) surfaces in your lane of travel.** This alert indicates that a collision with a stationary object is likely and you must immediately act to potentially avoid, or lessen the severity of, a collision.

Typically, the SOA is ready to alert you whenever the vehicle is moving above 16km/h, but some fleets may select higher minimum speeds.

 **Due to the inherent limitations of radar technology, the Stationary Object Alert System may alert in response to stationary objects not in the vehicle lane of travel.**

These objects may include bridges, signs, parked vehicles, and traffic lights. Braking or throttle intervention will not occur in response to stationary objects. As the driver, you remain responsible for safely controlling the vehicle at all times by appropriately applying the brakes, steering, or throttle as needed.

You should be especially careful when approaching certain types of vehicles and objects. The Wingman Fusion radar may not be able to detect objects with limited metal surfaces (such as recreational vehicles, horse-drawn buggies, motorcycles, logging trailers, etc.).



DIU – Showing Stationary Object Alert – a continuous tone will also sound.

 Entering a curve may reduce the alert time to less than three (3) seconds.

Stationary Vehicle Braking (SVB)

• Typically available above 24km/h

Fusion's Stationary Vehicle Braking (SVB) is designed to be ready to react to the presence of stationary vehicles in front of your vehicle (whether or not cruise control is set, as long as your vehicle is traveling above 24km/h.) See the DARK GREY area in the diagram on page 159.

The system provides you with an alert before an intervention occurs. You must immediately act to potentially avoid, or lessen the severity of, a collision.

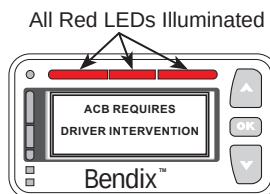


As part of the collision mitigation system, when a large, stationary, metallic object in your vehicle's lane of travel is definitively identified as a vehicle, the driver is notified up to three and a half (3.5) seconds before impact. If the driver does not take action to address the potential impact that caused the alert, the Fusion system can automatically engage the brakes to assist the driver in reducing the severity of or potentially avoiding a collision with that stationary vehicle.



If the system cannot definitively identify the stationary object as a vehicle — for example, if the vehicle is not a licensed motorized vehicle, or certain types of trailers — the driver will get up to three (3) seconds of alert to address the situation ahead; no automatic braking will be applied.

Stationary Vehicle Braking is most useful when approaching a line of stopped traffic or a stalled vehicle that is not immediately recognized by the driver. Without the automatic alert and braking, it may be too late to avoid impact.



DIU– Showing Stationary Vehicle Braking Alert – a continuous tone will typically also sound.



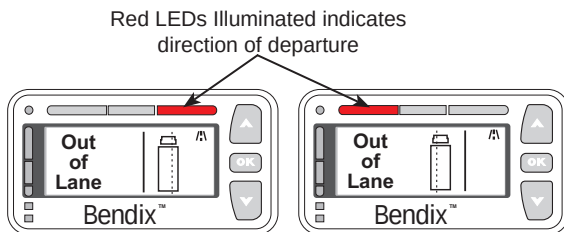
Entering a curve may reduce the alert time to less than three (3) seconds.

Lane Departure Warning (LDW)

- **Enabled above 60km/h**

 **The Fusion system has the ability to warn you if the vehicle is not tracking in the intended roadway path. In most vehicle applications the LDW system is enabled above 60km/h. The Lane Departure Warnings will be issued through the dedicated speakers and, in some cases, may mute the radio. You should immediately correct the vehicle tracking and maintain the correct position in the lane.**

In some driving scenarios – such as constructions zones, overlapping or changing lanes – lines may cause LDW alerts. For these cases the LDW system can be temporarily disabled through a LDW Enable / Disable switch on the dash.



DIU– Showing Lane Departure Warning – a 'rumble strip' tone will typically also sound on the side where the vehicle has departed from the lane of travel.

Temporarily Disable the Lane Departure Warning (LDW)

To avoid erroneous LDW warnings in areas such as construction zones, where the non-standard or overlapping road markings present might cause false alerts, the Fusion system has an enable/disable switch.

Brake Overuse Alert

 **The Fusion system provides a warning when the system is intervening and using the foundation brakes excessively.** Overuse of the foundation brakes can lead to the brakes overheating and a potential loss of braking performance caused by brake fade.

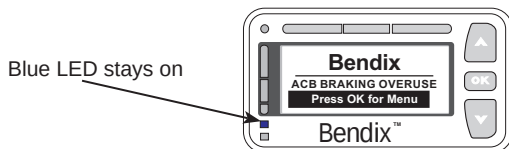
Using cruise control on downhill runs will cause this alert to be activated.

 **Approach grades as you would normally, with the appropriate gear selected and at a safe speed.**

Cruise control should NOT be used on downhill grades.

You should use appropriate gearing and brake techniques on downhill grades.

When the system detects brake overuse a text message will be displayed on the dashboard and an audible alert will be activated. You should intervene immediately.



DIU– Showing Brake Overuse Warning.

- Once the brake overuse alert is activated, certain driver interventions that cancel cruise control – such as stepping on the brake pedal or switching off cruise – will discontinue the alert. Following an overuse alert, you should not reset cruise control for at least 20 minutes. This gives the brakes time to cool down.

If you choose to reset cruise control during that 20 minute period, Fusion system interventions will be limited to de-throttling and engine retarder only. The system will automatically disable all Fusion system foundation brake applications for at least 20 minutes.

- If the system does not detect a driver intervention within 15 seconds after the brake overuse alert sounds, it will shut itself off and set a Diagnostic Trouble Code (DTC). You will continue to receive alerts, but ALL Fusion interventions (de-throttling, engine retarder or brake applications) will be disabled until the next ignition cycle.



In all cases, you still have the ability to apply the foundation brakes if necessary. You should take care since overheated brakes may reduce the vehicle's braking capability.

Potential False Alerts

Radar and camera technology is not perfect, and false alerts sometimes occur. Radar misalignment will likely lead to increases in stationary object false alerts.

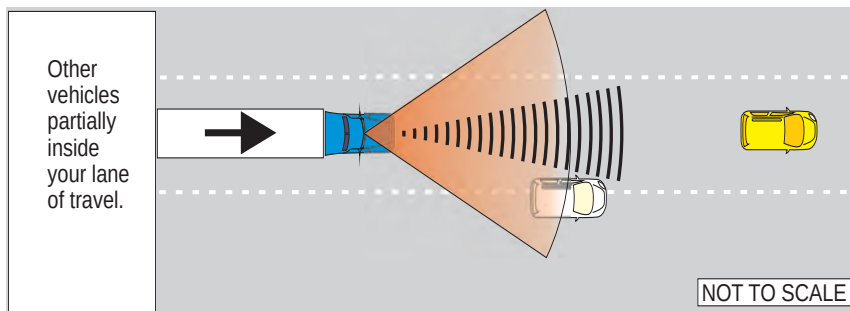
Drivers should take into account the road conditions, and any other factors they are encountering, as they choose how to react to any alerts they receive from the Fusion system.

 ***Due to the inherent limitations of radar and camera technology, the enhanced Collision Mitigation Technology – on rare occasions – may not detect moving vehicles or stationary vehicles in your vehicle's lane of travel. Alerts, warnings or brake interventions may not occur.***

 ***Due to the inherent limitations of radar and camera technology, the enhanced Collision Mitigation Technology – on rare occasions – may react to moving vehicles not in your vehicle's lane of travel. Alerts, warnings, or brake interventions may occur.***

Potentially Challenging Situations for the Fusion System

The Fusion system may unexpectedly issue warnings, apply braking, or not respond. The following examples illustrate situations that may issue an alert or braking in a manner not consistent with your expectations.



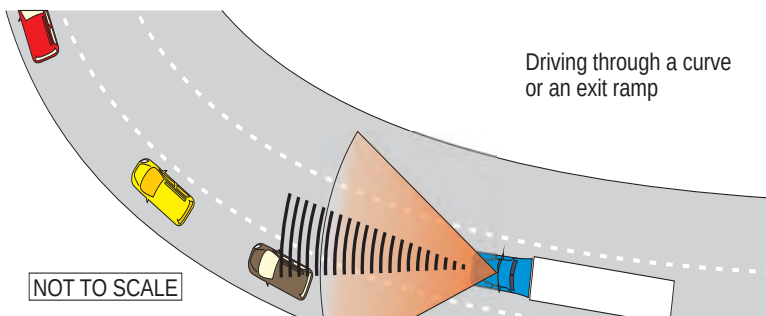
Example 1 - Other vehicles ahead in the lane of travel

Tracking Vehicles in a Curve: With cruise control set, when following a detected forward vehicle around a curve, the forward vehicle may be lost by the Fusion system. The Active Cruise with Braking feature will delay acceleration back to the set speed until it regains contact with the vehicle ahead, or detects that there is no longer a vehicle ahead, or after a time gap (based on the last following distance recorded).

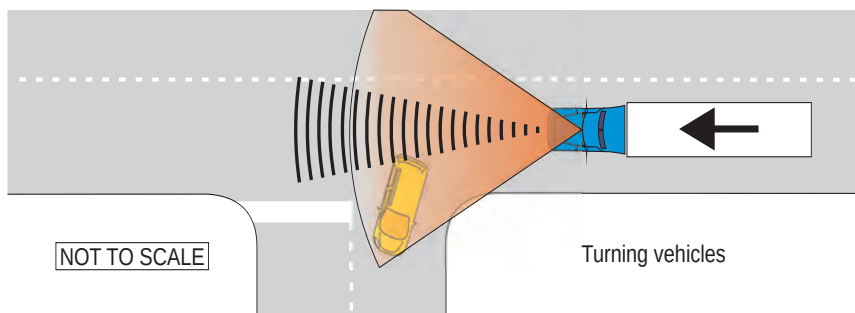


You should be especially attentive to the Fusion system behavior through curves. In some cases, when traveling around a curve, the Fusion system may lose the vehicle ahead and attempt to accelerate when resuming the set speed.

It is also possible for the Fusion system to begin tracking vehicles in other lanes when traveling around curves. In cases where the Fusion system perceives that an adjacent-lane vehicle is in your lane, the system may intervene and begin making brake applications.

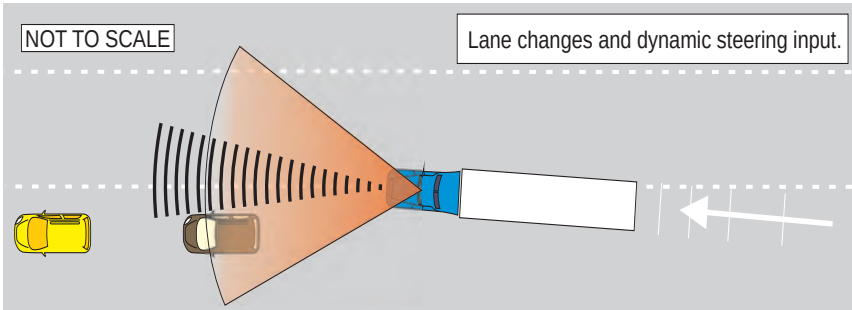


Example 2 - Driving through a curve

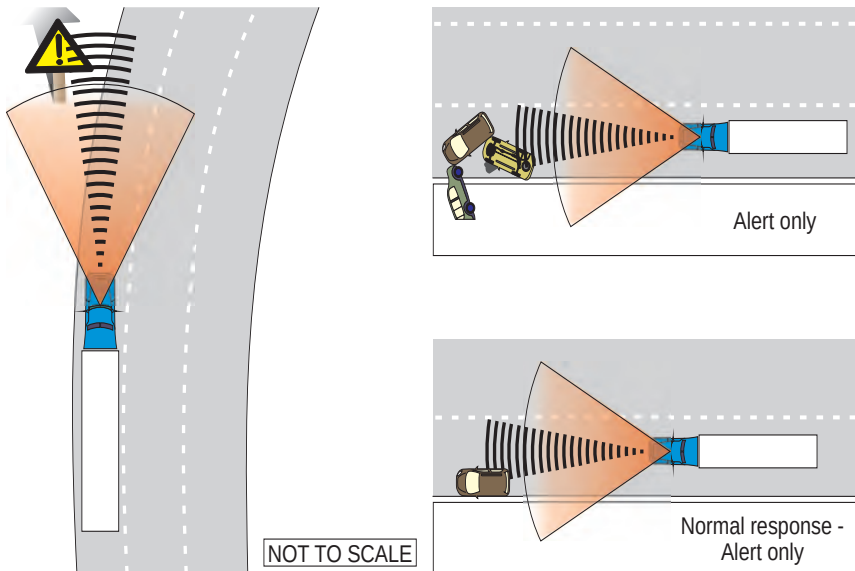


Example 3 - Turning vehicles

Passing a Vehicle/Changing Lanes: With cruise control set, if you decide to change lanes or pass a vehicle by applying the throttle, the vehicle being passed will no longer be detected by the radar and camera.



Example 4 - Lane changes



Example 5 - Stationary objects

How Your Actions Impact the Fusion System

This chart illustrates how the Fusion system will react to various actions you may initiate.

Your Action	Reaction of the Fusion System
If you, the driver, do this:	Expect the Fusion system to do this:
Step on the brake. (During a collision mitigation event.)	As the driver, you are always in control and are able to apply full braking power.
Step aggressively on the accelerator. (During a collision mitigation event.)	As the driver, you are always in control. Your actions override any Fusion system actions. NOTE: If cruise control is engaged, it will be overridden until the accelerator is released; then cruise control will resume the original set speed automatically.
Step on the brake. (When in cruise.)	Cruise control will be cancelled.
Step on the accelerator. (When in cruise.)	Cruise control will be overridden until the accelerator is released; then cruise control will resume the original set speed automatically.
Switch on the cruise control.	Nothing. The Active Cruise with Braking feature will not engage until the driver sets the cruise control speed.
Switch off the cruise control.	The Active Cruise with Braking feature will turn off; the collision mitigation feature remains active and ready to intervene. You, the driver, will continue to hear all alerts as needed.
Set the cruise control speed.	The Active Cruise with Braking feature is automatically activated, and your vehicle maintains set speed and following distance behind the vehicle ahead.
Cover or block the radar or camera.	The Fusion system performance will be diminished, or disabled, when either the radar or the camera become blocked. An alert will be issued to alert the driver to indicate this condition. Radar: Radar blocked will be indicated through an alert and will disable all Radar functions. Camera based functions such as LDW will remain. Camera: Camera blocked will be indicated through an alert and will disable all camera based functions. The radar will maintain its function as a Advanced system.
Use normal cruise control "+/-" switch.	Vehicle speed increased (+) or reduced (-) to achieve the new set speed while actively maintaining the following distance with the vehicle ahead, if one is present within 150m.



The system responses above are typical, but may vary from the descriptions shown here. These represent examples of driver actions and typical Fusion system responses, however this chart does not attempt to cover all possible situations.

Stability System Performance

System Maintenance and Troubleshooting

Importance of Antilock Braking System (ABS) Maintenance – Optimal Fusion system braking requires a properly maintained ABS system, without any active ABS Diagnostic Trouble Codes (DTCs). Have active DTCs repaired by a qualified technician. Any ABS DTCs will cause Fusion to deactivate.

Importance of Brake Maintenance – Optimal Fusion braking requires properly maintained truck foundation brakes (drum, wide-drum, or air disc) which meet appropriate safety standards and regulations. Brake performance also requires that the vehicle be equipped with properly sized and inflated tires, with a safe tread depth.

System Problems – If a problem with the Fusion system is detected – depending on the vehicle manufacturer – typically there will be a message on the dashboard display. Depending on the type of problem detected, the system will determine if the vehicle may continue normal cruise control functions (without the benefits of Fusion), or whether all cruise control functions should be disabled until service is performed. The system should be serviced as soon as possible to restore full Fusion functionality.

Radar Inspection – You should visually inspect the radar and mounting bracket regularly and remove any mud, snow, ice build-up, or other obstructions. The installation of aftermarket deer guards, bumper guards, snow plows, or similar potential obstructions is not recommended, and could impair the operation of the radar.

Radar Damage / Misalignment / Tampering – In cases where the bumper and/or radar have sustained any damage, are misaligned – or if you suspect that the radar has been tampered with – do not use the cruise control until the vehicle has been repaired and the radar re-aligned. In addition, an indicator on the dash typically will illuminate if the system detects any of these conditions. Consult your vehicle Operator's Manual and contact an authorised PACCAR dealer for more information.

Camera Inspection – The Fusion camera is mounted to the windshield of the vehicle. The camera will be mounted inside the wiper pattern and should be clear of any obstructions.



If the windscreen requires replacement, the camera will need to be refitted, aligned and recalibrated by an authorised PACCAR dealer.

Preventive Maintenance

The Fusion system is not maintenance free. The key items to keep the system functioning properly include:

1. Keep the radar and camera lens clean and free of obstructions.
2. Visually inspect for any damage to the bumper or the Fusion cover, bracket, or radar to ensure that the alignment has not been compromised. Never use the radar unit as a step.
3. Periodically have the radar alignment checked by an authorised PACCAR dealer.
4. Perform appropriate inspections of the braking system as required by the manufacturer to ensure brakes are in proper working order.
5. Ensure that the tires are properly inflated and that adequate tread is present.

What to Expect When Using the Fusion System

Part One: All driving scenarios (Cruise is either “ON” or “OFF”)		
What to Expect		
Situation	Typical System Indication / Alerts	Typical System Actions / Cautions
Stationary objects/vehicles ahead in your lane of travel		
A stationary – non-vehicle – object is detected ahead in your lane.	A Stationary Object Alert (SOA) may be issued up to three (3) seconds prior to impact.	None.  Warning <i>You must immediately act to potentially avoid, or lessen the severity of, a collision.</i>
A stationary motor vehicle is detected ahead in your lane.  Note Significant feature enhancement. Factors that can potentially affect the system's ability to identify a vehicle include: if the vehicle is not a licensed motorized vehicle; or certain types of trailers.	If the vehicle is traveling above 16km/h, a Stationary Vehicle Alert (SVA) may be issued up to three-and-a-half (3.5) seconds prior to impact.	 Warning <i>You must immediately act to potentially avoid, or lessen the severity of, a collision.</i> If a collision is likely to occur, the Fusion system can provide a warning and/ or apply the vehicle brakes.
Moving objects/vehicles ahead in your lane of travel		
Your vehicle comes up fast behind a slower-moving detected forward vehicle.	Your vehicle comes up fast behind a slower-moving detected forward vehicle.	None. <i>You must respond as needed.</i>
The detected forward vehicle slows rapidly.	The Following Distance Alert (FDA), or Impact Alert (IA) warning (continuous tone) will sound and a visual message/icon typically appears on the dash screen or DIU display.	None. <i>You must respond as needed.</i> If a collision is likely to occur, the collision mitigation feature will apply your vehicle's brakes.
A pedestrian, deer or dog runs in front of your vehicle or any organic or nonmetallic object is in front of your vehicle.	None.	None. <i>You must respond as needed.</i>

Part One: All driving scenarios (Cruise is either “ON” or “OFF”)		
What to Expect		
Situation	Typical System Indication / Alerts	Typical System Actions / Cautions
Another vehicle crosses the road perpendicular to your path of travel – such as at an intersection.	None.	None. <i>You must respond as needed.</i>
Your vehicle signals a lanechange and crosses a lanemarking.	None.	None.
Traveling below 60km/h, your vehicle crosses a lane-marker (without the corresponding turn signal activated).	None.	None. <i>You must respond as needed.</i>
Traveling above 60km/h, your vehicle departs your lane of travel without the corresponding turn signal activated.	A “rumble strip” audible / vibration/visual alert is initiated.	None. <i>You must respond as needed.</i> (Use the turn signal when changing lanes and/or keep your vehicle within the lane markings.)

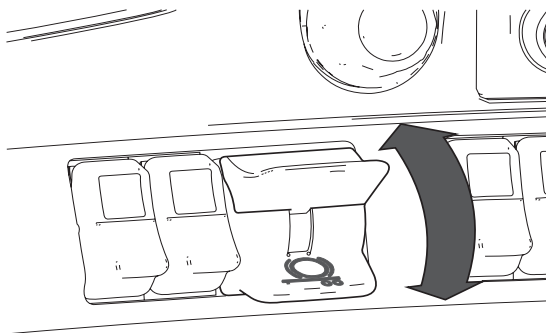
Part Two: Cruise is “ON” and speed is “SET”		
What to Expect		
Situation	Typical System Indication / Alerts	Typical System Actions / Cautions
Interactions with vehicles ahead in your lane of travel		
With no detected forward vehicle.	None.	Your vehicle maintains the set speed.
With a detected forward vehicle.	The cruise control ON indicator is illuminated and the detected forward vehicle icon is illuminated.	The Active Cruise with Braking feature will maintain the set speed and following distance.

Part Two: Cruise is “ON” and speed is “SET”		
What to Expect		
Situation	Typical System Indication / Alerts	Typical System Actions / Cautions
The detected forward vehicle slows moderately.	The Following Distance Alert (FDA) will sound and a visual message / icon typically appears on the dash screen or Driver Interface Unit (DIU) display.	You must respond as needed. If the system intervenes, the vehicle throttle will be reduced; the engine retarder engaged; and the foundation brakes applied, in that order. Note When the foundation brakes are applied, cruise control is cancelled.
The detected forward vehicle slows rapidly.	The Impact Alert (IA) warning (continuous tone), will sound and a visual message/icon typically appears on the dash screen or DIU display. The Following Distance Alert may also be heard.	You must respond as needed. If the system intervenes, the vehicle throttle will be reduced; the engine retarder engaged; and the foundation brakes applied, in that order. Note When the foundation brakes are applied, cruise control is cancelled.
A detected forward vehicle cuts in front of your vehicle and speeds away.	Following Distance Alerts (FDAs) may be given to you, depending on the exact system configuration that has been set for the vehicle, and how close the vehicle cuts in front.	Vehicle maintains set speed.
Downhill Grades		
Going down a grade with a detected forward vehicle.	DO NOT USE cruise control on downhill grades.	DO NOT USE cruise control on downhill grades. Brake overuse may occur. (See page 168 for more information.)
Cruise control should NOT be used on downhill grades.		

TRAILER BRAKE HAND VALVE

This dash mounted hand valve provides air pressure to apply the trailer brakes only. It operates independently of the foot treadle valve.

To operate the trailer brake hand valve, press the lever down to engage the Trailer Hand Brakes. Push the lever back up to release the Trailer Hand Brakes, independent of the truck brakes.



For trucks delivered in Australia, this valve is **NOT** self-returning. When pressure is removed from the valve lever, it will remain in the ON position until manually pushed up to the OFF position.

For trucks delivered to New Zealand, this valve is self-returning. When pressure is removed from the valve lever, it will return to the OFF position.



The trailer brake is not to be used as a substitute for the service brakes. Using this brake frequently, instead of using the foot brake, will cause the trailer brakes to wear prematurely.

DRIVING BOBTAIL OR WITH AN UNLOADED TRAILER

The following information is applicable only to truck and trailer configurations.

Do not use the engine retarder (for example engine brake) to slow the vehicle down when you are bobtail or pulling an empty trailer.

Using engine retarders while bobtailing or with an unloaded trailer can cause a wheel lock-up resulting in less control and/or a jackknife. The trailer may not load the rear truck tyres enough to provide necessary traction. When you are bobtail or unloaded, you can have a serious accident if your wheels lock suddenly during braking.

ENGINE BRAKES



The service brakes must be used in an emergency. The engine brake alone might not stop you fast enough to prevent an accident.

Ideally (on normal road surfaces) you should slow your vehicle with the engine brake (where permitted by law) and use the service brakes only for stopping completely. Operating this way will greatly prolong the life of the brakes.

The engine brake is NOT intended as the primary brake for the vehicle, nor is it an emergency brake. The engine brake only helps the service brakes by using pressure to slow the drivetrain. Use the service brakes for quick stops.

Engine brakes create a braking effect on the drive wheels. These devices use your engine's power to slow your vehicle down. Because they can help keep your vehicle's brakes from overheating, they save wear and tear on the service brakes. However, the engine brake is not an emergency brake.

Your vehicle may be fitted with a two or three-speed engine brake system depending the transmission type fitted. Vehicles with a manual transmission have a two-speed system with LOW and HIGH levels. Vehicles with a PACCAR or UltraShift PLUS transmission have a three-speed system with LOW, HIGH and MAX levels. (MAX = HIGH + Down Shift)



MAX level should only be used for steep or long downhill situation not every day driving.

OPERATING THE REAR/DRIVE AXLE

This section covers the operation of your rear/drive axle. These instructions apply to the most common features of drive axles. Refer to the manufacturer's instructions for further information on the operation of your axle.

DRIVER CONTROLLED DIFFERENTIAL LOCK (DCDL)

When to use the Cross Wheel Differential Lock (can be on Rear/Rear Axle or both Rear Axles)

In the LOCK position, an air-operated clutch positively locks both wheel ends on an axle together, providing greater traction on slippery road surfaces. However, steering around corners and on normal road surfaces is more difficult. Continuous operation on a paved, dry surface stresses the tandem axles, possibly causing internal damage. Only use this feature when driving on surfaces with poor traction, such as heavy mud or loose gravel. Do not use it when going downhill or at speeds greater than 40km.

Lock the differential when you encounter dirt roads, loose sand, mud, or other off-road conditions.



Do not put the differential lock in the LOCK position while the wheels are spinning freely (slipping). You could lose control of the vehicle causing an accident or injury to yourself and/or others. Switch to LOCK only when the wheels are not spinning.

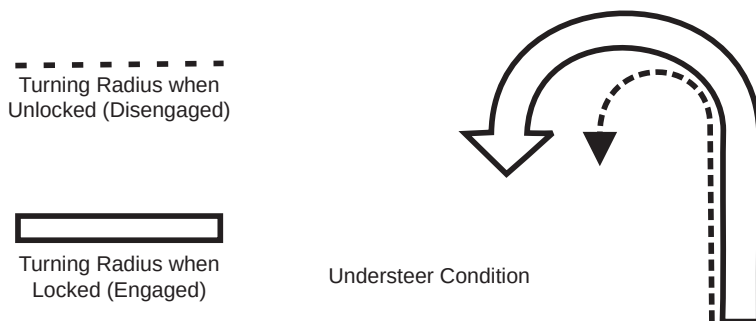
- Look ahead for wet, muddy or icy patches on the road. Stop your vehicle and switch to LOCK ahead of time.



Do not operate the vehicle under normal road conditions with the cross wheel differential locked, as this could lead to an accident. On dry pavement steerability will be reduced with the differential locked. Lock the differential only when operating on surfaces with poor traction, such as wet, slippery roads or loose gravel.



Do not use the cross wheel differential lock during downhill operation or at speeds above 40km. When it is engaged under these conditions, your vehicle will exhibit 'understeer' handling characteristics. This 'understeer' condition will cause your vehicle to not turn as quickly, and more steering effort will be required, which may cause an accident.



INTER-AXLE DIFFERENTIAL LOCK (POWER DIVIDER)

The inter-axle differential, also referred to as the Power Divider, allows each axle to turn independently, which relieves stress on the rear axles and reduces tyre wear. A switch on the accessory switch panel locks the inter-axle differential, which gives you better traction for slippery surfaces. You will notice the switch has a guard to protect you from activating it accidentally.

INTER-AXLE DIFFERENTIAL LOCK OPERATION

To LOCK the inter-axle differential:

1. Anticipate when you might need increased traction, slow down to a steady speed under 40km or stop the vehicle. Do not lock the differential while going down steep grades or travelling faster than 40km, or while wheels are spinning or traction is minimal. Lock the differential before you encounter these conditions.
2. Put the inter-axle differential lock switch in the LOCK position. A light in the warning cluster will turn on, indicating the differential is locked (engaged).
3. If you LOCK or UNLOCK the differential while moving, let up momentarily on the accelerator pedal to relieve torque on the gearing and allow full engagement of the clutch (mechanism that locks the wheels).
4. Drive the vehicle through the poor traction area, keeping your speed under 40km.

The Meritor main differential lock or Dana wheel differential lock is controlled by the switch labelled INTER AXLE DIFF LOCK. By moving the switch, you can LOCK or UNLOCK the main differential when the vehicle is moving or stopped.

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

To UNLOCK the inter-axle differential

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

TRIDEM DRIVE AXLES

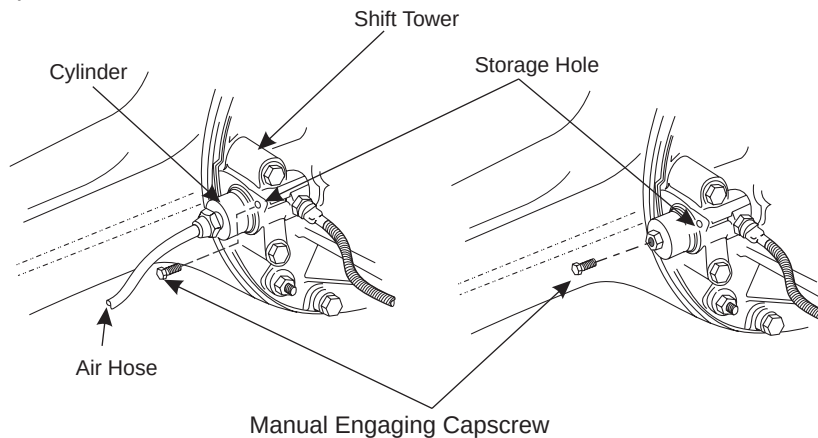
Vehicles with Tridem drive axles with interaxle differential locks installed, operate as follows;

Meritor RZ78 - The forward rear axle is permanently locked mechanically, the centre axle is driver controlled.

Dana T78 - The forward rear axle is locked permanently by air, the centre is driver controlled.

TOWING WITH AXLES FITTED WITH DCDL

If your Kenworth has a Meritor axle with a driver-controlled main differential lock, install the caging bolt before removing the axles for towing. Installation of the caging bolt prevents damage by locking internal axle components in position.



Driver-Controlled Main Differential Lock (Meritor Only)

Use the following procedure to lock the Meritor differential:

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

DUAL RANGE (TWO-SPEED) REAR AXLE

Your vehicle may be equipped with a two-speed or dual range axle (option). You can select two rear axle ratios for operating under heavy loads or rough terrain as well as for over-the-road hauling.

The 'Low Range' provides maximum torque for hauling heavy loads or travelling over rough terrain. The 'High Range' is a faster ratio for highway speeds and over-the-road conditions. A switch on the accessory switch panel controls the dual range rear axle. You will notice the switch has a guard to protect from accidental activation. Always park your vehicle with the range selector in LOW.

DUAL RANGE AXLE OPERATION

The following are important tips on operating a Dual Range Axle with Interaxle Differential:

1. Shift the axle with the interaxle differential in the UNLOCKED position only.
2. When you are driving with poor traction, LOCK the differential. When you have the differential locked, drive with the axle in LOW range only.
3. When you are driving on a surface with good traction, keep the interaxle differential UNLOCKED. You can drive with the axle in the LOW or HIGH range.
4. Always UNLOCK the interaxle differential before shifting the axle speed range.



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

STARTING UP

1. Unlock the interaxle differential before starting.
2. Put the Range Selector in the LOW range. Shift the transmission to start the vehicle moving.
3. When you are driving on rough terrain and secondary roads, or under a very heavy load, keep the axle in the LOW range. Shift the transmission to maintain correct road speed.



Never shift the axle when moving down hill. Engine driveline disengagement may occur, eliminating engine retardation and allowing the wheels to spin faster than the current speed of the engine. This may require severe braking to slow the vehicle down and can result in an accident.

Correct shifting of the axle depends on the synchronisation of engine/driveline and wheel speed. When you shift the axle, the connection between the engine and wheels is momentarily disengaged while the gearing is synchronised. Normally when the axle is shifted, the speed of the engine, axle and wheels adjust, allowing for proper gear engagement.

When the vehicle is going down hill, the wheels will not slow down, but will tend to speed up, which makes gear synchronisation almost impossible. As a result, the axle is neither in HIGH nor LOW range and all engine/driveline retardation is lost. Without engine retardation, it is difficult to slow the vehicle down and greater stress is put on the brake system.



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

LOW to HIGH (Cruising)

When you go from rough terrain to highway driving, shift the axle to the HIGH range, following this procedure:

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

HIGH to LOW (Rough Terrain)

If you need to downshift the axle for more power, or you are driving on rough terrain:

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

DRIVE AXLE TEMPERATURE GAUGE

Optional Axle Temperature gauges may be installed in your Kenworth. Either a set of two gauges, one for each drive axle, or one for both forward and rear axles, indicate the lubricant temperature in each drive axle.

The temperatures indicated will vary with the kind of load you are carrying and the driving conditions you encounter. Very high temperatures signal a need to have the axle lubrication checked. Maximum axle temperature may vary, depending on the axle type and lubricant used.

For information on axle temperature ranges, see the Drive Axle Operation Manual.



Driving with very hot temperatures in the rear drive axles can cause serious damage to axle bearings and seals. Have the axle lubrication checked if you suspect overheating.

DRIVING TIPS AND TECHNIQUES

This section covers additional driving tips and techniques on how to drive your Kenworth more efficiently. It will give you information on starting, shifting and driving your Kenworth vehicle.

Coasting



Do not coast with the transmission in neutral or with the clutch pedal depressed. It is a dangerous practice. Without the use of the retarding power of the drivetrain, your vehicle can reach dangerous speeds. At very high speeds you may not be able to put the transmission in any gear.

At high speeds, you could seriously damage your vehicle or cause an accident when you put the transmission in gear. The engine speed could exceed the maximum governed speed and cause a serious accident due to mechanical failures.

Besides being illegal and dangerous, coasting is also expensive. It causes premature failure of, or damage to, the clutch and transmission and overloads the brake system.

Coasting with the transmission in neutral also prevents proper transmission component lubrication. During coasting the transmission is driven by the rear wheels and the countershaft gear (which lubricates the transmission components by oil splash) will only be turning at idle speed.

Descending a Grade



Do not hold the brake pedal down too long or too often while going down a steep or long grade. This could cause the brakes to overheat and reduce their effectiveness. As a result, the vehicle will not slow down at the usual rate.

To reduce the risk of personal injury and/or an accident, before going down a steep or long grade, reduce speed and shift the transmission into a lower gear to help control your vehicle speed. Failure to follow procedures for correct downhill operation could result in loss of vehicle control.



Climbing and Descending

When approaching an uphill grade, apply light throttle early to build up engine temperature gradually, so that when power is applied for the climb, the engine won't be subjected to a sudden, large heat change. Use the tachometer and pyrometer to maintain optimum power/temperature relationship during the climb.

As you approach the top of the grade, begin easing up on the throttle to allow engine temperature to dissipate gradually. This technique can be a real engine-saver when cresting a hill just prior to beginning a descent down the other side. Running uphill at full throttle, then quickly coming off the throttle entirely as the descent begins, puts punishing stresses on the engine.

Downhill Grades

Gear selection is critical when descending hills. Engine overspeed can occur when using the engine as a brake because the engine governor does not function as a brake. A rule-of-thumb for gear selection is to go down a hill in the same gear used to climb it.

If engine rpm approaches the top limit, apply brakes or shift up to a higher gear. Use regular moderate brake application to bring speed to about 10km below desired speed, and release the brakes to allow the truck to speed up again.

This procedure allows all brakes to contribute to brake performance, whereas a light continuous application can cause one axle to do all the braking.

Mountain Driving

Approaching an uphill grade, apply throttle to build up engine temperature gradually and be in the best power range for the climb. As you approach the summit, shift down one or two gears to allow the engine to cool down slowly, especially if you are going to descend on the other side.

Level Cruising

If the pyrometer indicates excessive temperature while cruising, ease off slightly on the throttle. Normally, on a smooth, level road, there should be no loss of rpm and speed, and the pyrometer should indicate a drop in temperature. If rpm and speed begin to drop, and the temperature remains high, shift down one step to maintain speed and allow the temperature to stabilise. Conversely, if the pyrometer indicates consistently low temperature, then shift up one step and monitor the pyrometer.

Establishing Optimum Operating Temperatures:

- Climb an uphill grade at maximum operating rpm and full throttle for one minute. Record the pyrometer reading at the end of this time interval, then ease up on the throttle.
- Subtract 110°C from the recorded temperature reading. This is your maximum (and optimum) operating temperature.

Use the above method if there is no label on the pyrometer specifying the maximum temperature, and as an occasional check on engine condition. Any large variation in the maximum temperature reading may be an early indication of possible engine trouble.

Different size injectors, or changes in altitude, may affect engine operating temperatures. Turning off the engine while there are high pyrometer temperatures may damage turbo bearings.

Accelerating

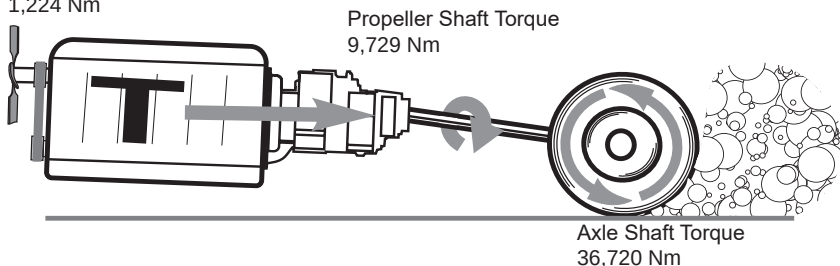
The practice of rapidly accelerating a loaded vehicle from a standstill can cause severe damage to the drive shaft, transmission and rear axle.

Normal service life of these components can be greatly extended by gradual and smooth acceleration.

If the driver were to unnecessarily accelerate a fully loaded vehicle with full throttle in the lower gears, the resulting propeller shaft and axle shaft torques would be tremendous. This would certainly cause greatly reduced service life of all drivetrain components."

It is possible to start any legal load smoothly without creating excessive strain on the driveline components. **ALWAYS ACCELERATE THE VEHICLE GRADUALLY AND SMOOTHLY**, especially when in lower gears.

Engine Crankshaft Torque
1,224 Nm



City Driving — Cruising

Operate the engine in the preferred rpm range to obtain optimum performance, and reduce stresses and wear. Avoid lugging the engine for any extended period of time as this reduces engine life. Consult your engine manufacturer's operation manual for the preferred operating range.

Observe the tachometer and operate the engine within its economical rpm range with a minimum of gear shifting. It is not necessary to keep the engine revving in its high rpm range.

Cruise at partial throttle whenever conditions permit. When approaching an uphill grade, smoothly apply full throttle so that the climb will be started at full power. Downshift as necessary to maintain vehicle speed without lugging the engine.

For your particular engine and operating conditions refer to the engine manufacturer's operating manual.

INSTRUCTIONS TO PREVENT JACKKNIFING

Most truck and semi-trailer jackknifes occur when the roads are wet and the semi-trailer is unladen.

This is because the drive tyres will skid much more easily when there is water between the tread and the road surface.

Also, when the semi-trailer is unladen (50% of the time with tankers and tippers), there is less weight on the drive tyres so less brake pedal travel is required to lock the brakes.

Awareness that wet weather and empty load combination is the most dangerous condition will be sufficient for good drivers to avoid jackknifing.

However, there are also several other factors which should concern drivers and operators since they also influence brake balance and tyre adhesion and hence the possibility of jackknife. The following is a list of these items:

1. Tyre tread pattern must be adequate to remove water under wet conditions. This is particularly important on drive tyres. Rib tread patterns are substantially better than lug type.
2. Tyre tread depth must be sufficient to get water out from under most of the tyre contact patch (3 mm is the minimum tread depth for truck tyres).

3. Engine brakes or other auxiliary brake systems should never be used simultaneously with the foot brake. To do so unbalances the brakes and can cause the drive wheels to skid, resulting in a jackknife.

Operating the engine brakes when the semi is unladen during wet weather should be prohibited because, in an emergency, the driver will instinctively apply the service brakes and possibly skid the drive wheels, which can cause a jackknife.

4. Brakes should be balanced, i.e. brake force generated must be in direct proportion to the load carried on the axle being braked. For this to occur:
 - Brakes should be same type and size.
 - Linings should all be the same material.
 - Pipe lengths, sizes and connections should be appropriate to allow all brakes to apply as near as possible to simultaneously.
5. Semi-trailer suspension roll stiffness should be equal to, or greater than, that of the truck to minimise degradation of brake balance by minimising side-to-side weight transfer when cornering.
6. Semi-tankers should never be operated with less load on each individual drive axle than on each individual semi-tanker axle, i.e. if the semi-tanker combination is to be driven with some tanks empty, the middle compartment should be emptied first, then the rear and lastly the compartment over the drive axles.

The combination should not be operated with the compartment over the drive axles empty and other compartments full.

Typically, an unladen semi-tanker or tipper will skid on wet roads and possibly jackknife at 10% to 15% of normal brake pedal movement. Drivers must be aware of this and must drive at least 2 or 3 times the normal distance behind the vehicle in front under these conditions.

ECONOMICAL DRIVING

The following section includes recommendations for best engine performance and economy.

Engine Overspeed - RPM:

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



To avoid engine damage, do not let the engine rpm go beyond the maximum governed rpm. Valve damage could result if overspeed conditions occur.

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

Use of Tachourmeter

The tachourmeter is an instrument that helps you obtain the best performance of the engine and manual transmission, serving as a guide for shifting gears. Refer to the Engine Operation and Maintenance Manual for optimum engine rpm:

- If the engine rpm moves beyond the maximum governed speed, indicating an overspeed condition, apply the service brake or shift to a higher gear to bring engine rpm within the optimum speed range.
- When driving downhill, shift to a lower gear, use the engine brake (if so equipped), and use the service brake, keeping the engine speed greater than 1200rpm and below 2000rpm.

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

Fuel economy and engine performance is also directly related to driving habits:

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

Fuel - Excessive Consumption

The vehicle's fuel consumption is connected to three important factors - maintenance, driving habits, and general condition of the road (including traffic conditions and vehicle load).

Maintenance Factors Affecting Fuel Consumption

Correct maintenance will keep the vehicle running like new even after long periods of use. The driver must perform daily and weekly checks of the vehicle for:

- engine valves out of adjustment
- injection pump improperly synchronised
- injection nozzles defective or uncalibrated
- improperly inflated tyres
- wheel bearings incorrectly adjusted
- dragging brakes
- clutch incorrectly adjusted or worn (slipping)
- fuel leaks
- clogged up charge air cooler

Driving Habits

Wrong driving habits must be corrected and the recommendations on economic driving should be followed.

Driving Factors Affecting Fuel Consumption:

- excessive speed and unnecessary fast acceleration
- long periods of idling
- driving with foot resting on the clutch pedal (manual transmission)

General Conditions

Other factors affecting fuel consumption are related to loads and the type of roads on which the vehicle operates. It is not always possible to choose the best road, but it must be kept in mind that the ideal road is the one that allows a steady speed in high gear, without requiring frequent braking and acceleration.

The following general conditions can affect fuel consumption:

- overload
- unbalanced load
- very high load
- poorly maintained roads
- traffic conditions

SAFE DRIVING

The following recommendations are merely informative and do not cover all safety precautions. Safe driving is, above all, the responsibility of the driver.

The safe operation of a vehicle is not just following the established traffic rules, but should also include maintaining the vehicle in good mechanical condition and proper operation of the engine, transmission and brakes.

The Following Guidelines Will Help You to Drive the Vehicle Safely:

- Make a thorough inspection of the vehicle, daily and weekly. See Driver's Checklist, page 12.
- Ensure windows, mirrors and lights are clean.
- Check all tyres for damage and correct inflation pressure.
- Adjust the seat to a comfortable driving position for easy access to pedals and vehicle controls.
- Adjust rear-view mirrors.
- Always use seatbelts.
- Do not exceed the GVM/GCM.
- Proportionally distribute loads on the frame.
- Always keep the brakes adjusted and in proper condition. See Checks and Adjustments on page 232.
- Obey speed limits and all traffic signals.
- When driving downhill, select the same gear used to climb the hill. Use the brakes properly - do not ride them.
- Do not exceed maximum governed speed (as specified in the Engine Operation and Maintenance Manual).



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 combined weight rating (GCM), or the maximum front and rear gross axle weight ratings (GVWs) (axle weight ratings are listed on the passenger's seat base).



For your safety and the safety of others, follow routine and periodic maintenance schedules for all components on your vehicle. See Maintenance and Lubrication Schedule, pages 315-342.



AIR SUSPENSION

Air Suspension Height/Air Pressure

Your vehicle may have an air suspension and a deflation switch which allows the air in the suspension to be exhausted using a switch on the dash. The normal purpose of this feature is to allow you to lower the vehicle for loading. On prime movers, the deflate switch allows you to lower the fifth wheel to slide under a trailer. A guard on the switch prevents you from accidentally deflating the suspension.



Do not operate the Air Suspension Deflate Switch (Dump Valve) while driving. Sudden deflation while your vehicle is moving can affect handling and control and could lead to an accident. Use this switch only when your vehicle is not moving.

Operating a vehicle with air suspension bags either overinflated or underinflated may cause damage to driveline components. If a vehicle must be operated under such conditions, do not exceed 8km/h.

Driving with Deflated Air Springs

If an air spring ruptures, there will be enough air pressure to drive the vehicle to a safe stop off the highway to investigate the problem.



Do not drive with ruptured air springs. The air loss can cause the spring brakes to apply. This allows your brakes to drag and may burn up the linings, which could lead to an injury or accident. Do not continue to operate the vehicle in this condition.

Do not tamper with the height adjustment valve on your Airglide rear suspension. The height is factory-set for optimum performance. Consult an authorised Kenworth dealer if the ride height requires adjustment.

Suspension Air Pressure Gauge

The Suspension Air Pressure gauge (optional) indicates the amount of air pressure in the air suspension springs in kilopascals (kPa). Air pressure in the spring is related to the rear axle load. The greater the rear axle load, the greater the air pressure in the air bags. Therefore, the air pressure displayed will vary, depending on the rear axle load.

FIFTH WHEEL

The following applies to prime mover configurations:



Ensure that all fifth wheel maintenance, adjustments and rebuilding are done only by a qualified technician. An improperly maintained fifth wheel can cause a trailer to separate from a truck. This could lead to an injury or accident and damage to property.

FIFTH WHEEL JAW LOCK

To unlock the fifth wheel lock

Pull out on the lever (usually located on the right-hand side of the fifth wheel) until it remains in an overcentre position.

HOOK-UP

After connecting your truck to the trailer, always inspect the jaws to be sure they have locked on the kingpin before you drive the vehicle. Use the trailer hand piece to check that trailer kingpin and 5th wheel jaws are fully engaged.

AIR ACTIVATED 5TH WHEEL RELEASE PROCEDURE

5th Wheels:

1. Apply Parking brake.
2. Switch the 5th Wheel release switch to the UNLOCK position.
3. A warning light on release switch illuminates.
4. Push and HOLD the 5th wheel release switch on the dash for at least 1 second to release the 5th wheel.
5. Switch the 5th wheel release switch to the LOCK position when the trailer has been released.
6. All 5th wheel warning lights must be OFF.

FIFTH WHEEL LUBRICATION

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

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

Apply a water-resistant lithium base grease to the trailer contact surface of the fifth wheel. Apply same to the bearing surface of the support bracket through the grease fittings on the side of the fifth wheel plate.



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

Where fitted, do not grease Teflon fifth wheel wear plates.

TOW HITCH

Your vehicle may be fitted with a tow hitch. This is only designed to be used in an emergency. The tow hitch is only designed to tow an unladen prime mover.



DO NOT ATTEMPT TO TOW A FULLY LADEN VEHICLE USING A TOW HITCH. The tow hitch could snap causing damage to either or both vehicles, resulting in an accident or injury to yourself and/or others plus property damage.

TOWING

All lubricating and transmission application oil pressure is provided by an engine-driven pump. This pump cannot be 'motored' by pushing or towing the vehicle when the engine is stopped. **Whenever the vehicle must be towed, the driveline must be disconnected or the driving wheels must be lifted off the ground.**



To prevent transmission damage when towing a truck, disconnect the driveshaft at the rear U-joint.

Transmission damage occurs rapidly when towing with the driveshaft connected because the transmission countershaft is stationary and no lubricant reaches the main shaft gears and bearings.

Worse, when vehicles are towed at an angle from the front, either by wrecker or piggy-back, the lubricant usually in the top front of a drive axle will drain to the rear, leaving these top components dry.

RETURNING VEHICLE TO SERVICE

Your vehicle may have lost lubricant while being towed. To prevent damage, check the oil level and add oil if necessary.

After adding the specified type and amount of lubricant, drive the vehicle. It should be unloaded. Drive 1.5 to 3km at a speed not exceeding 40km/h. This will thoroughly circulate the lubricant through the assembly.

VEHICLE RECOVERY AND SPRING BRAKES

VEHICLE RECOVERY GUIDELINES

Your vehicle is equipped with removable recovery hitches, designed for short distance recovery purposes only. Use only the provided hitches, according to the following instructions. When using this connection, do not transport your vehicle over long distances. (If your vehicle does not have the correct hitches, contact your dealer.)

All lubricating and clutch application oil pressure is provided by an engine driven pump, which will not work when the engine is stopped. You could seriously damage your vehicle by towing it with the driveline connected and the drive wheels on the ground. Worse, when vehicles are towed, either by wrecker or piggyback, the lubricant in the top front of the drive axle will drain to the rear. This will leave the top components dry. The resulting friction may damage them. Always remove the main drive axle shafts before towing your vehicle.



Remove the drive axle shafts or lift the driving wheels off the ground before towing the vehicle. Towing the vehicle with either the wheels on the ground or the axle shafts in the axles will cause damage to the axle gears.



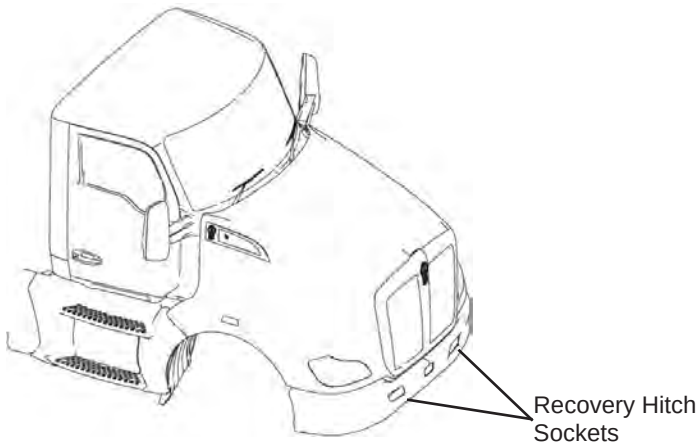
If your vehicle has a Meritor axle with a driver-controlled main differential lock, install the caging bolt before removing the axles for towing, see Driver Controlled Main Differential Lock on page 181. Installing the caging bolt prevents damage by locking internal axle components in position.



Connect only to the recovery hitches, see Vehicle Recovery Guidelines on page 200. Connections to other structural parts could damage the vehicle. Do not attach to bumpers or brackets. Use only equipment designed for this purpose. Failure to comply may result in equipment damage.

Recovery Procedure:

1. Review and understand all the cautions and warnings of this section, see Vehicle Recovery Guidelines on page 200.
2. Install the recovery hitches, see Recovery Hitch Installation on page 201.



3. Disconnect the drive axle shafts and cover the open hubs. This is necessary because if the transmission is driven by the driveshaft (rear wheels on the ground), no lubricant will reach the gears and bearings, causing damage to the transmission.
4. Install the recovery rigging using a safety chain system, see Recovery Rigging on page 204.
5. Make sure the recovered vehicle's parking brakes are released.
6. If you need to use the recovered vehicle's brakes, ensure that the vehicle's air system is connected to that of the recovery vehicle. Ensure that any air line that has been removed from a driver-controlled main differential lock is firmly capped to prevent loss of air pressure from the recovery vehicle if it is supplying air pressure.

If you don't need to use the recovered vehicle's brakes, ensure that you cage the spring brakes before attempting to move the vehicle, see Spring Brake Manual release on page 205.



Before towing a vehicle, test your air brakes to ensure that you have properly connected and inspected the recovery vehicle's brake system. Failure to do so could lead to a loss of vehicle control which may result in an accident involving death or personal injury.

7. The hitch fitted to your vehicle is for low speed unladen prime mover recovery only.
8. Follow state/federal and local laws that apply to vehicles in tow.

RECOVERY HITCH CONNECTION

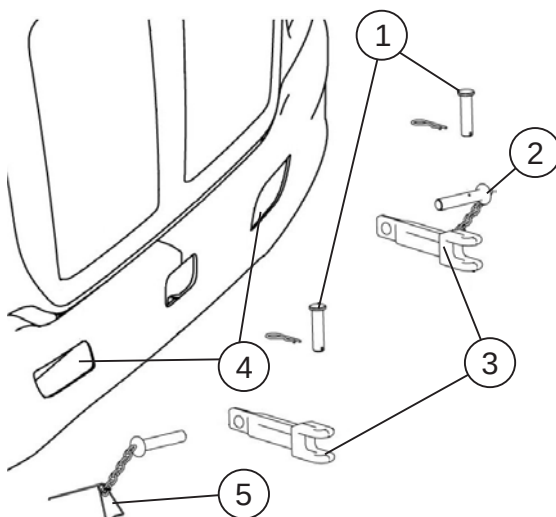
Specially designed hitches are required to recover your vehicle. The recovery hitches attach to the frame, see Recovery Hitch Assembly on page 203.

Two hitch assemblies, are recommended for the proper recovery of your vehicle: see Recovery Hitch Assembly on page 203.



Do not use parts from other trucks or materials from other sources to repair a hitch or to replace a missing hitch. The parts provided for recovery are made of high strength steel specifically designed for vehicle recovery. Failure to use the correct factory equipment may result in an accident involving death or personal injury.

If your vehicle is not equipped with the correct recovery hitch assembly, contact an authorised dealer to obtain the correct equipment.



Recovery Hitch Assembly

1	Tow Pin	4	Square Hitch Socket
2	Lock Pin		
3	Tow Hitch	5	Lock Tab

Recovery Hitch Installation

Use the following procedure to install the Vehicle Recovery Hitches. See Recovery Hitch Assembly illustration for part identification:

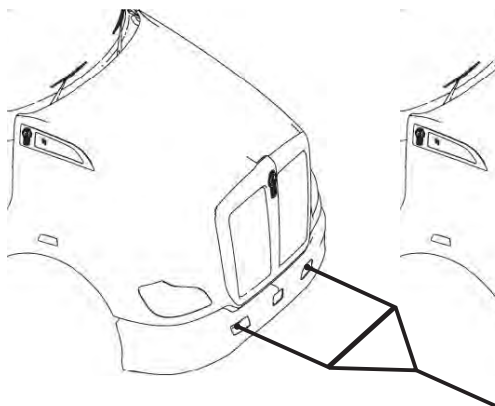
1. Check square sockets behind lower bumper for obstructions, clear if necessary.
2. With lock pins removed, insert hitches through bumper and into the square hitch socket.
3. Align the hole in the tow hitch with the square hitch socket hole.
4. Insert the lock pin into the square hitch socket hole and through the hole in the tow hitch until the lock tab is within the square hitch socket.
5. Rotate the lock pin 90 degrees to secure the pin in place.
6. Remove the hitches and store all parts after recovering the vehicle.

Recovery Rigging

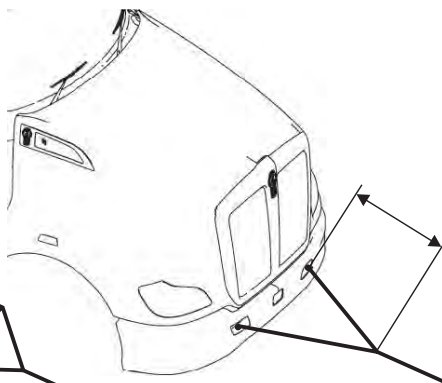
To connect to the vehicle, follow the suggested rigging methods below.

Use a double chain or cable setup that distributes the load equally to both hitches. See illustration below.:

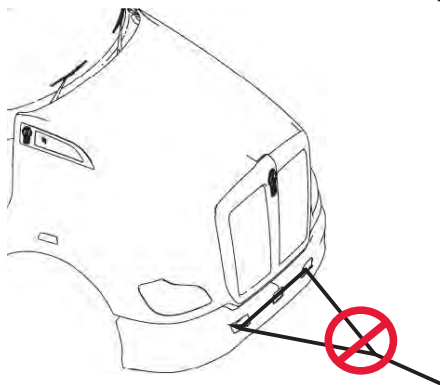
1. Use a spreader or equaliser bar to distribute the load on both hitches.
2. If no spreader bar is available, connect the main tow chain or cable no closer than 2 metres from the vehicle.
3. Never loop a single chain or cable through both hitches.



1. Spreader Bar or Equaliser
Preferred



2. Minimum 2m
Acceptable



3. **NEVER USE SINGLE CHAIN OR CABLE
LOOPEED THROUGH TOW DEVICES**

SPRING BRAKES - MANUAL RELEASE

In order to tow a vehicle, if there is insufficient air to release the parking brake, the spring brakes can be manually released.



Do not drive a vehicle with malfunctioning brakes. If one of the brake circuits should become inoperative, braking distances will increase substantially and handling characteristics while braking will be affected. You could lose control of your vehicle, be severely injured, or cause an accident. Have it towed to the nearest dealer or qualified workshop for repair.

You may sometimes have to release your vehicle's spring brakes by hand. This could happen if the system air pressure does not reach operating pressure because your engine or compressor is not working properly. You will have to release the spring brakes at the spring brake chambers.



Do not disassemble a spring brake chamber. These chambers contain a powerful spring that is compressed. Sudden release of this spring can cause severe injury.



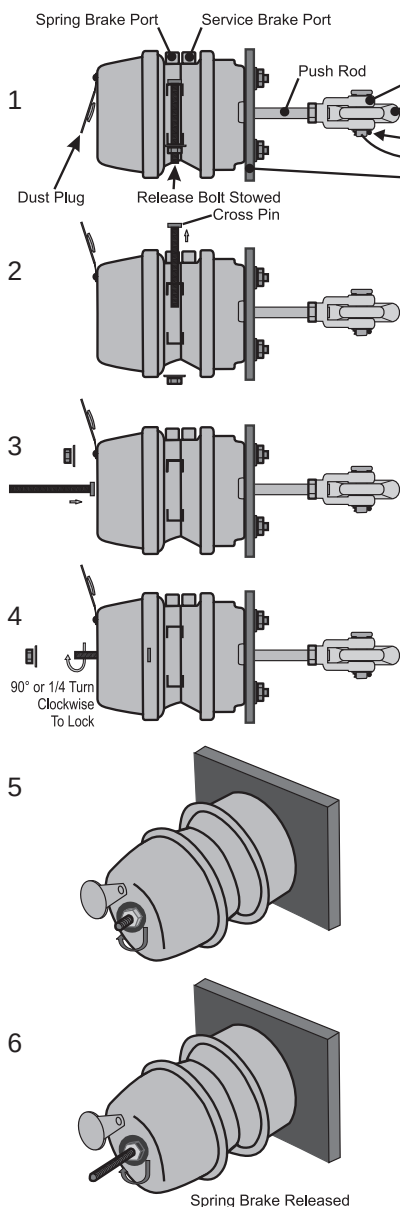
Do not operate a vehicle when the spring brakes have been manually released. Driving a vehicle after its spring brakes are manually released is extremely dangerous. You will probably have no brakes at all. You could have a serious or fatal accident.



Releasing the spring brakes on an unsecured vehicle could lead to an accident. The vehicle could roll, causing severe injury. Always secure the vehicle with wheel chocks, chains, or other safe means to prevent rolling before manually releasing the spring brakes.

When the vehicle has finished being towed, manually lock the spring brakes, returning the brakes back to their normal operating condition. This is a reversal of the release procedure, see steps 1-6 on page 206.

To move a vehicle immobilised by the spring brakes due to loss of air pressure in the brake system, perform the following procedure:



1. Remove the dust plug from the spring chamber.
2. Remove the release bolt assembly from the side pocket. Remove the release nut and washer from the release bolt. Slide out the release bolt.
3. Insert the release bolt through the opening in the spring chamber where the plug was removed, inserting it into the pressure plate.
4. Turn the release bolt $\frac{1}{4}$ turn clockwise in the pressure plate. This secures the cross pin into the cross pin area of the pressure plate and locks it into the manual release position.
5. Assemble the release bolt washer and nut on the release stud.
6. With a spanner, turn the release bolt assembly nut until the compression spring is 90-95 percent caged. While doing this, check to make sure the push rod (adapter push rod or service push rod) is retracting. Do not over-torque the release bolt assembly. (S-Cam type maximum 68Nm.) The spring brake is mechanically released.

Repeat steps 1-6 for all spring brakes on the vehicle

Freeing the Vehicle from Sand, Mud or Ice

If the vehicle gets stuck in sand, mud or ice:

- Move the gearshift lever or selector from First to Reverse.
- Apply light pressure on the accelerator pedal while the transmission is in gear.
- Remove your foot from the accelerator while shifting.
- Do not race the engine.
- For best traction and safety, avoid spinning the wheels.



Do not spin the wheels faster than 55km/h. Spinning a tyre at speedometer readings above this can be dangerous. Tyres can explode from spinning too fast. Under some conditions, a tyre may be spinning at a speed twice that shown on the speedometer. Any resulting tyre explosion could cause severe injury or death to a bystander or passenger, as well as extensive vehicle damage, including tyre, transmission and/or rear axle malfunction.

Comply with the following instructions to avoid transmission damage:

- Always start vehicle in motion with the shift lever in first gear.
- Be sure transmission is fully engaged in gear before releasing the clutch pedal (manual only).
- Do not shift into reverse while the vehicle is moving.
- Do not permit the vehicle to be towed for long distances without removing the driveshaft.

SHUT-DOWN

After you have parked in a safe place, check your vehicle to make sure it will be ready for the next trip. To make sure your vehicle is ready to go after a long stop (such as overnight), follow the suggestions below. Your vehicle will be easier to get going when you are ready, and it will be safer for everyone who might be around it.

BEFORE STOPPING THE ENGINE

Do not shut off the engine immediately. A hot engine stores a great amount of heat and it does not cool down immediately after you shut it off. Always cool the engine down before shutting it off. You will greatly increase its service life.

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

ENGINE IDLE TIMER

If an engine idle timer is fitted to the vehicle, please follow this procedure to activate the system:

1. Vehicle must be stationary and park brake applied.
2. Turn ignition key to the OFF position.
3. A GREEN warning lamp will be illuminated in the main instrument cluster to indicate that the Engine Idle Timer has been activated.
4. The idle timer will automatically turn off the vehicle after 3 minutes.

An override switch located on the dash is available if the vehicle needs to be turned off before the timer reaches 3 minutes.

Final Stopping Procedures

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

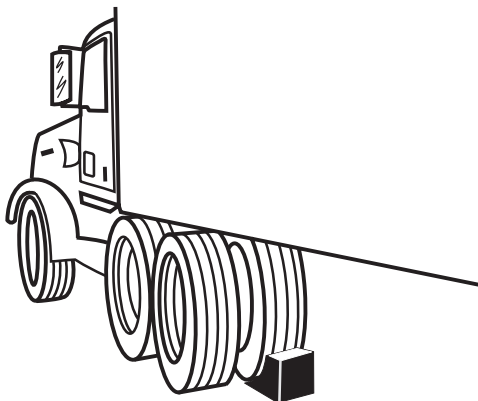
To hold your vehicle while it is parked, DO NOT rely on the following:

- air brakes
- hand control valve for trailer brakes
- engine compression

Always use your parking brakes!



Do not use the trailer hand brake or service brakes to park and hold an unattended vehicle. Use the parking brakes. Because service brakes work with air pressure, these brakes could slowly release. Your vehicle could roll, causing a serious accident.

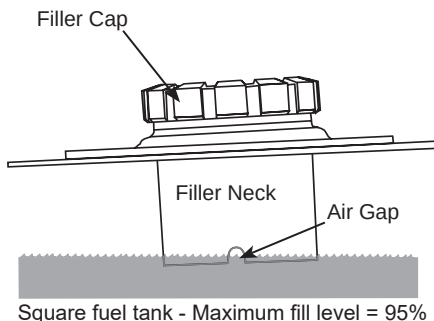
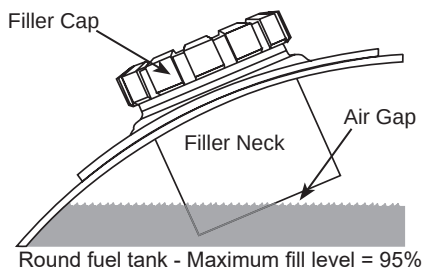


2. If you must park on a steep grade, always chock the wheels.
3. Secure the vehicle, close all windows and lock all doors.

REFUELLING

Air inside the fuel tanks allows water to condense in the tank. To prevent this condensation while the vehicle is parked for extended periods, **do not** overfill the tanks above 95 percent of capacity.

95 percent is to the lower edge of the filler neck so the air gap is still visible, as this provides room for expansion resulting from temperature extremes. When refuelling, add approximately the same amount to each fuel tank on vehicles with more than one tank.



 ***Do not carry additional fuel containers in your vehicle. Fuel containers, either full or empty, may leak or explode and cause or feed a fire.***

Diesel fuel in the presence of an ignition source (such as a cigarette) could cause an explosion. You could be seriously injured. A mixture of gasoline or alcohol with diesel fuel increases this risk of explosion.

 ***Do not remove a fuel tank cap near an open flame. Fuel vapours may be hot and combustible and can cause an explosion or fire. Failure to comply may result in death, personal injury, equipment or property damage.***

 ***Never refuel while engine is idling. Shut down a vehicle before refuelling, this can allow air to enter the fuel system resulting in a possible shutdown.***

- Do not remove a fuel tank cap near an open flame.
- Use only the fuel and/or additives recommended for your engine.

FUEL SPECIFICATION

Use only diesel fuel recommended by engine manufacturers. If you need further information on fuel specifications, consult the Engine Operation and Maintenance Manual.

LOCATION OF FUEL SHUT-OFF VALVES

Fuel shut-off valves for the fuel crossover line are on the bottom of the fuel tank(s) at the crossover line connection.

SECTION TWO PREVENTIVE MAINTENANCE

INTRODUCTION

This section will help you keep your Kenworth in good running condition. There are a number of checks you can do, and you may be able to do some of the service work yourself. Let your authorised Kenworth dealer do any work you do not have the tools or skill to perform. Authorised service technicians are trained in the proper technical and safety procedures to maintain your Kenworth correctly.

Good driving practices, daily and weekly driver maintenance inspections, and periodic service inspections by an authorised Kenworth dealer, will help keep your Kenworth in good working order and provide many years of dependable service.



It is dangerous to work on a vehicle without the proper training and proper tools. People could be seriously injured, damage can be done to the vehicle, or your vehicle could become unsafe to drive. Perform only work you know you are fully able to do, and for which you have the right tools.

ENVIRONMENTAL PROTECTION AND MATERIAL HAZARDS

Some of the ingredients in engine oil, hydraulic oil, brake fluid, transmission and axle oil, engine coolant, diesel fuel, airconditioning refrigerant (R-134a and PAG oil), batteries, etc., may contaminate the environment if spilled or not disposed of correctly. Non-compliance with environmental regulations can result in fines and/or jail terms. Contact your local government agency for information concerning proper disposal.



SAFETY PRECAUTIONS

- Before attempting any procedures in the engine compartment, stop the engine and let it cool down. Hot components can burn skin on contact.
- Be alert and cautious around the engine at all times while it is running.
- If work has to be done with the engine running, always (1) set the parking brake, (2) chock the wheels, and (3) ensure the shift lever or selector is in neutral.
- Exercise extreme caution to prevent neckties, jewellery, long hair, or loose clothing from getting caught in the fan blades or any other moving engine parts.
- 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.
- 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.
- 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 chocked (front and rear) and (4) the engine cannot be started. Remove the ignition key.
- Never start or let the engine run in an enclosed, unventilated area. Exhaust fumes from the engine contain carbon monoxide, a colourless and odourless gas. **Carbon monoxide can be fatal if inhaled.**

Incomplete or improper servicing may cause problems in the operation of the vehicle. If in doubt about any servicing, have it done by an authorised Kenworth service dealer. Improper maintenance during the warranty period may also affect warranty coverage.

Modifying your vehicle can make it unsafe. Some modifications can affect your vehicle's electrical system, stability, or other important functions. Before modifying your vehicle, check with your Kenworth dealer to make sure it can be done safely and correctly.

LUBRICATION SPECIFICATIONS - ENGINE

You will find Engine Lubrication Specifications in the Master Lubrication Chart located on page 331.

One key to keeping your Kenworth running at top economy and to prolonging its life is proper lubrication and servicing. Neglecting this essential aspect of vehicle care can cost time and money in the long run.

In the following section, you will find basic information needed to perform routine vehicle lubrication. Of course you will want to schedule service more frequently if you are operating under severe conditions such as extreme heat or cold, very heavy loads, off-road, etc.



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

LUBRICATION SYSTEM



- Lubricating oil can cause skin irritation or skin injury.
- To prevent skin injury, avoid unnecessary contact with the lubricating oil.
- Wear protective clothing, eyewear and gloves.
- Clean the area before performing maintenance.
- Dirt in the oil system can lead to significant damage to the engine.
- Avoid dirt in the oil system, immediately plug the openings.
- Run the engine at idle speed for at least one minute, directly after maintenance or repairs of the lubrication system, to allow oil to reach all necessary components.
- Increasing engine speed directly after maintenance or repairs of the lubrication system can cause damage in various engine components.
- Increasing engine speed directly after maintenance or repairs of the lubrication system can cause damage in various engine components.
- Check if the red oil pressure warning in the instrument panel disappears within ten seconds; if not, switch off engine and investigate the problem.
- Check oil lines, housing and connections for leaks, damage or deterioration. Leaks could be the result of damaged oil lines or seals.



The lubrication system consists of an oil cooler module mounted on right hand side of engine. This module contains a dual filtration system – centrifugal oil filter and main oil filter.

1. Centrifugal Oil Filter
2. Lock Stop
3. Filter Lock
4. Main Oil Filter

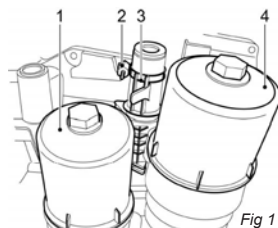


Fig 1

To Change Centrifugal Oil Filter Element

1. Lift the lock up to its stop catch in order to replace the centrifugal oil filter element.
2. Using a single hex socket or ring spanner (to prevent cap damage), undo the screw cap.
3. Remove the centrifugal oil filter element.
4. Remove the O-ring from the screw cap.
5. Fit the new O-ring (1) onto the screw cap (2).
6. Mount the centrifugal oil filter (3) with its top side in the bearing of the screw cap (2).
7. Check if the centrifugal oil filter (3) can rotate freely.
8. Lightly lubricate the O-ring (1) with some engine oil.

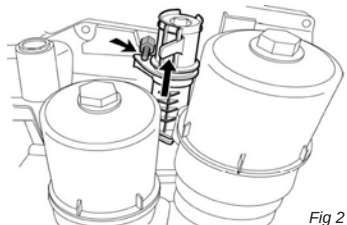


Fig 2

9. Position the screw cap carefully onto the oil module.
10. Tighten the screw cap (1) by hand until it reaches the end position.
11. Tighten the screw cap (1) to the specified tightening torque.
12. Slide the lock (3) over the thermostat housing of the oil module.
13. Make sure the lock slides all the way down and catches the screw cap (4).

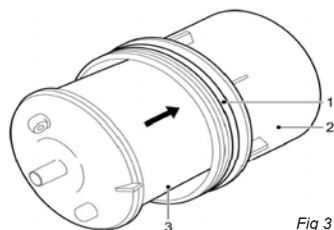


Fig 3



If the rotor is not installed according to this procedure, the oil module will be damaged.

To Change Main Oil Filter Element

1. Lift the lock up to its stop catch in order to replace the oil filter element.

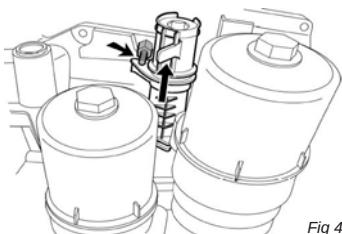


Fig 4

2. Using a single hex socket or ring spanner (to prevent cap damage), loosen the cap.

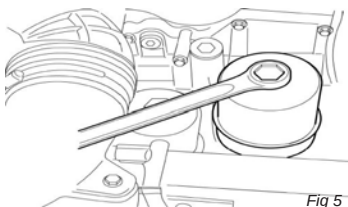


Fig 5

3. Unscrew the cap a few turns to drain the filter housing.
4. Allow to drain for 60 seconds
5. Remove the screw cap (4), with the oil filter element, from the filter housing.
6. Carefully remove the oil filter element avoiding any damage to the screw cap thorn.

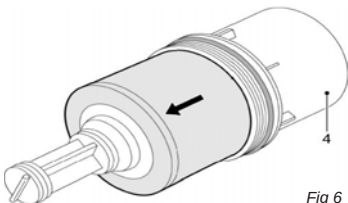


Fig 6

7. Remove the O-ring from the screw cap (4).
8. Install a new O-ring onto the screw cap (4).
9. Lightly oil the new O-ring and threads of the screw cap.

10. Check the O-rings on the thorn of the oil filter element are present and in good condition.

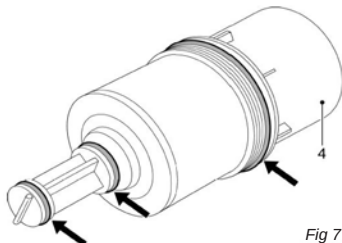


Fig 7

11. Install the screw cap (4), with the oil filter element, onto the filter housing, and tighten it by hand as far as possible ensuring the cap and filter are upright when it picks up the thread.

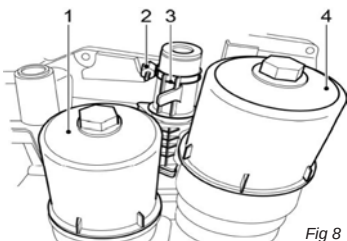


Fig 8

12. Using a single hex socket or ring spanner (to prevent cap damage), tighten the cap to specified tightening torque.
13. Slide the lock (3) over the thermostat housing of the oil module making sure the lock slides all the way down and catches the screw cap (4). If the lock (3) collides with a rib, tighten the screw cap a little further to allow it to pass.

Lubricating System

Check oil lines, housing and connections for leaks, damage or deterioration. Leaks could be the result of damaged oil lines or seals.

Oil Draining



Hot engine oil can be dangerous. You could be seriously burned. Let the engine oil cool down before changing the oil.

- Drain the oil into a container designed for this purpose.
- When draining the oil, remove the plug with the proper size spanner and keep as far away as possible. Always keep your forearm parallel to the ground to help prevent hot oil from running down your arm.

- The oil filler cap must be secured to avoid oil spill causing a potential fire hazard.

Oil Level Check - Check engine oil daily

1. Make sure the vehicle is parked on level ground
2. The engine must be at operating temperature (76 deg. C.) AND the engine switched off for a minimum of 15 minutes.
3. Remove the dipstick and wipe it off with a clean, lint-free rag.
4. Reinsert the dipstick all the way in (until handle bottoms out)
5. Pull the dipstick out and read the oil level.
6. The correct oil level is between the low (L) and high (H) marks on the dipstick

Oil Reservoirs

For oil reservoirs with side filler plugs (transmissions, axles, steering gear boxes, transfer cases etc) the oil must be level with the filler opening. Hub reduction axles may require specific oil volumes to ensure correct levels. (Refer to Electronic Customised Maintenance Manual, rear axle section).

Use care when checking the oil level with your finger. Just because you can reach the oil level with a finger, does not mean the oil level is correct.

Oil Sampling

Analysis of your major components oil is crucial in keeping your truck running smoothly. The health of your engine, gearbox/automatic transmission and drive axles is often identified by the quality and condition of your lubricating oils. All Authorised PACCAR Dealerships can carry out oil sampling of your vehicle.

Oil Sampling can be divided into three categories:

- analysis of oil properties including those of the base oil and its additives
- analysis of contaminants
- analysis of component wear

Your PACCAR Dealer can supply a test kit (Part No DF0SK) to provide a sample of oil for testing.

FUEL SYSTEM

FUEL SPECIFICATION FOR PACCAR MX-13 DIESEL ENGINES

Based on the present status of PACCAR MX-13 engine development, the fuel (compositions) used must meet certain international standards to be assured of the required engine performance, durability and emission goals. Therefore PACCAR prescribes for all its engines that:

Any diesel or alternative fuel mixture must fully comply with European Fuel Standard EN 590. Biodiesel must comply with European Biodiesel Standard EN14214.

Fuel additives are not permitted.

Based on gathered knowledge concerning the effects of alternative fuels, PACCAR supports the following rule:

Alternative fuels and mixtures of diesel fuel for PACCAR MX-13 powered vehicles are allowed, if officially produced diesel or blends with alternative fuel up to a maximum of 7% biodiesel according to standard EN590 are used. Using a fuel with a biodiesel blend will a more regular service schedule, discuss with an authorised Kenworth dealer.

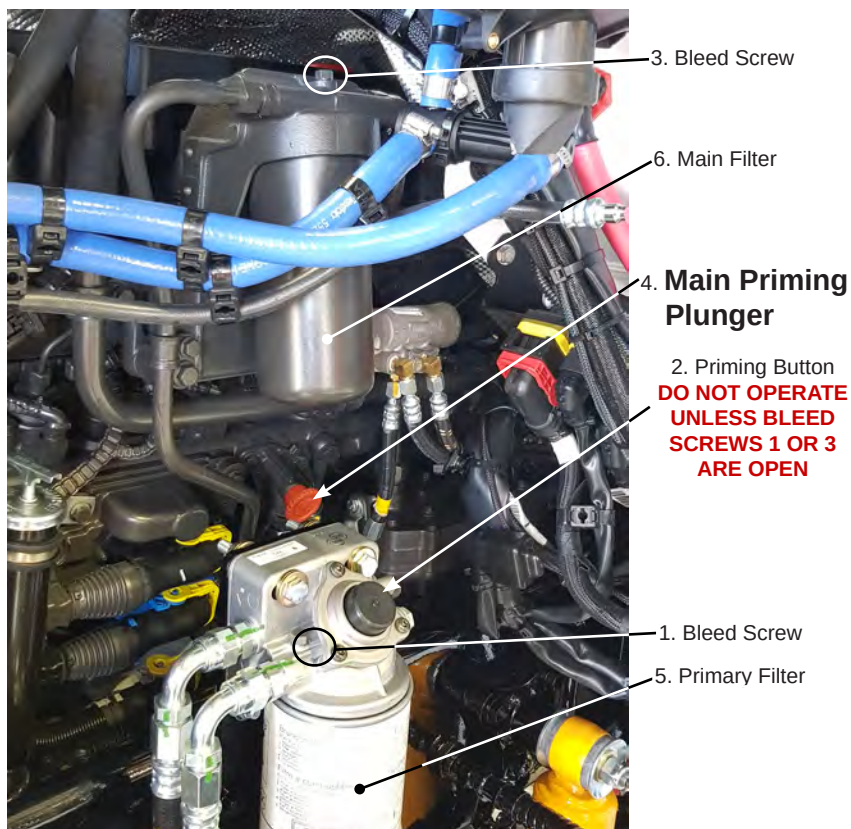
To prevent condensation while the vehicle is parked for extended periods, do not overfill the tanks above 95 percent of capacity, 95 percent is to the lower edge of the filler neck so that air gap is clearly visible, as this provides room for expansion resulting from temperature extremes (see page 209).

FUEL SYSTEM PRIMING

The PACCAR MX-13 fuel system incorporates two filtration units. A fuel/water separator with primary filter mounted to the left hand chassis rail and a main filter cartridge mounted on the left hand side of the engine.

The priming pump button on the primary fuel filter (2), must be used correctly to prevent premature failure. To prime the complete fuel system, ensure the bleed vent (3) on the main fuel filter is open before using the priming pump button on the primary filter.

DO NOT crack injector lines to bleed fuel system. This is not required and will render the fuel lines unserviceable and require replacement.



Fuel System Priming Procedure

- 1 Make sure vehicle has enough fuel for priming.
- 2 Loosen the bleed screw on the primary fuel filter (1)
- 3 Pump the primer button (2) until all air is expelled from the bleed screw (1)
- 4 Tighten bleed screw (1)
- 5 Loosen bleed screw on the main fuel filter (3)
- 6 Pump the primer button (2) until all air is expelled from the bleed screw (3)
- 7 Tighten bleed screw (3)

- 8 Rotate main primer (4) anticlockwise and release
- 9 Pump main primer (4) until pressure increases (approx. 80 ~ 100 pumps)
- 10 Crank the engine for 5 seconds only. If the engine starts, allow it to idle until all cylinders are firing evenly. Once engine starts, it will 'self-bleed' all air from the system.
- 11 If engine does not start, repeat steps 9 & 10.
- 12 Push main primer (4) in and rotate knob clockwise to lock.

WHEN DUAL FUEL TANK PICK-UPS AND RETURNS ARE FITTED



Maintain adequate fuel in both pick-up tanks when using tank isolating valves.

FUEL TANK STRAP TENSION

Ø625mm tank tension for strap: 26-34ft.lb (35-46Nm)

Rectangular fuel tank strap tension: 20 - 30ft.lb (27 - 41Nm)

All other straps to reduced tension: 8 - 12ft.lb (11 - 16Nm)

AIR CLEANER SYSTEMS

AIR CLEANERS AND FILTER REPLACEMENT

Complete disassembly and cleaning is recommended at each 40,000km interval. Under severe operating conditions, this should be done more frequently. Damaged or defective parts should (with the possible exception of mounting brackets) be replaced, not patched or repaired.

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

1. Filter elements should be serviced when the air cleaner restriction indicator locks in the high position or when the air cleaner restriction gauge (optional) reads 25 inches H₂O or higher. If your vehicle is equipped with a dry-type air cleaner, have the element serviced at an authorised Kenworth dealer.
2. Paper elements require care and proper handling, because they are critical to engine service life.
3. Service the air cleaner periodically. If the vehicle operates in areas with heavy dust, maintenance should be more frequent.
4. Air cleaner elements should be replaced when service indicator pops.

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.

1. Under normal operating conditions, Kenworth recommends complete disassembly and cleaning of the air intake system at each 100,000km. Under severe operating conditions, the disassembly and cleaning should be more frequent. Replace any defective parts. With the possible exception of mounting brackets, do not repair defective parts.
2. Check the charge air cooler for air leaks annually. The air leaks can be caused by cracked tubes or header. For service, see your authorised Kenworth dealer.

ACCESSORY DRIVE BELTS

The reliability and service life of drive belts can be extended with proper attention to installation, adjustment and maintenance. Neglect in these matters could cause belt failure, resulting in potential hazards through loss of the electrical or air system and possible engine damage due to overheating.

SERPENTINE BELTS

A serpentine belt (also known as a Micro-V belt) is a single, continuous belt used to drive multiple ancilliary devices on an automotive engine, such as an alternator, power steering pump, water pump, A/C compressor. The belt may also be guided by an idler pulley and/or a belt tensioner which is usually spring loaded.

The drawback of this single belt is that if the belt breaks, the vehicle loses all of its ancilliary devices; the belt typically gives ample visual warning of impending failure, sometimes even totally shedding several grooves (ribs) while still continuing to function normally.

Many vehicles now have serpentine drive belts this eliminates the need for multiple V-belts. A spring-loaded pulley maintains tension on the serpentine belt. This eliminates the need to re-tension the belt when it is replaced.

PACCAR MX-13 has two serpentine belts which eliminate the need for multiple V-belts. A spring-loaded pulley on each serpentine belt maintains constant belt tension during service and after belt replacement.

On PACCAR MX-13, the two belts are identified as 7PK and 9PK which indicates the number of ribs on the belt. 9PK belt drives the water pump and fan drive whilst 7PK drives the alternator and A/C compressor.

REPLACING 7PK & 9PK SERPENTINE BELTS

Switch off the ignition before disconnecting the battery clamp from the negative pole.

NOTE: Non-observance of this waiting time results in clogging of the AdBlue Lines.

Removing poly-V-belt 9PK - Engine Fan and Coolant Pump

1. Disconnect Battery Clamp, Negative Pole.
2. Move the tensioner against the spring force and lock it with a 4 to 5 mm thick locking pin or drill bit.
3. Remove the poly-V-belt from the pulleys.

Removing Poly-V-belt 7PK - Alternator and A/C Compressor

- 1 Move the tensioner against the spring force and lock it with a 4-5mm thick locking pin or drill bit.
- 2 Remove the poly-V-belt from the guide roller first and then from the alternator and air-conditioning compressor pulleys.
- 3 Move the tensioner against the spring force and lock it with a 4-5 mm thick locking pin or drill bit.
- 4 Remove the poly-V-belt from the guide roller first and then from the alternator pulleys.

PULLEYS:

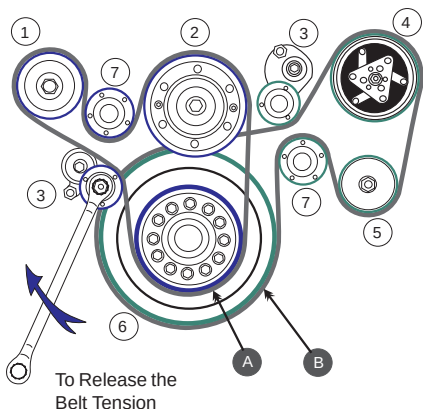
1. Water Pump
2. Engine Fan
3. Spring Loaded Tensioner Pulley x 2
4. A/C Compressor
5. Alternator

6. Crankshaft, Harmonic Balancer

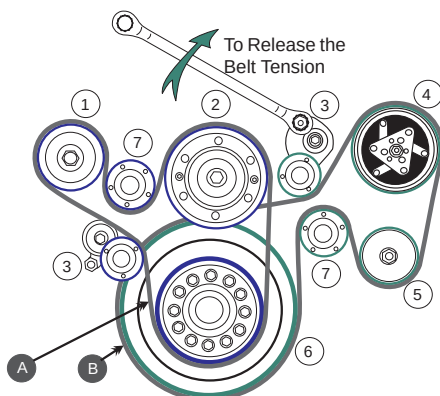
7. Idler Pulleys x 2

BELTS:

- A. Fan & Coolant Pump 9PK Belt
- B. Alternator & A/C Compressor 7PK Belt



Fan & Coolant Pump 9PK Serpentine Belt



Alternator & A/C Compressor 7PK Serpentine Belt

Replacing Poly V belt 7PK - Alternator and A/C Compressor

- 1 Position the poly-V-belt over the alternator and air conditioning compressor pulleys and route it correctly.
- 2 Move the tensioner against the spring tension and remove the locking pin.
- 3 Position the tensioner against the belt.
- 4 Place the poly-V belt (B) over the alternator pulleys.
- 5 Move the tensioner against the spring tension and remove the locking pin.

- ## Replacing Poly V belt 9PK - Engine Fan and Coolant Pump

-
- Diagram of the front of the machine. The front cover (A) is shown with a dashed line indicating its removal. The front panel (B) is shown to the right of the front cover.

COOLING SYSTEM

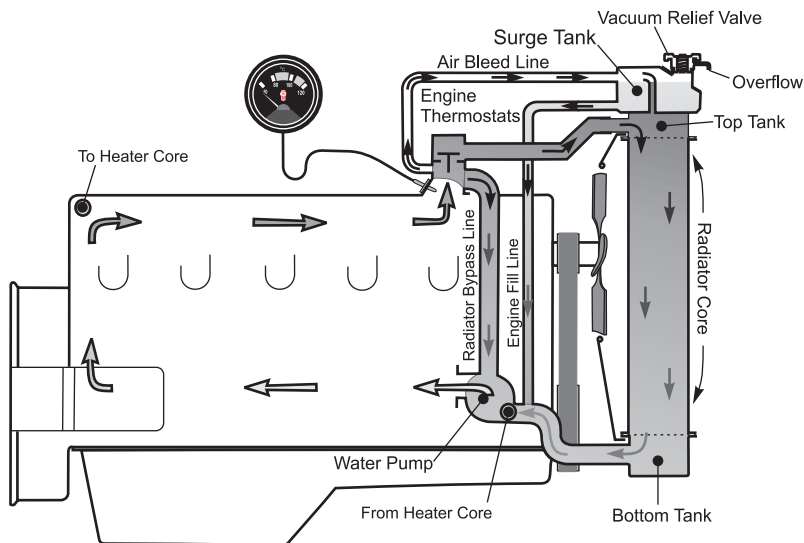
Kenworth trucks come with air-to-air cooling systems as standard. These cooling systems incorporate a radiator to cool engine jacket coolant, a charge air cooler to cool turbocharged engine intake air, and a refrigerant condenser to provide cab airconditioning.

COOLANT

Factory filled coolant for the PACCAR MX-13 engine is PACCAR Genuine ELC30 coolant. The coolant must be clean and free of corrosive and scale-forming chemicals. Drinking water is not suitable, use only coolant approved to DAF MAT 74002. Approved coolant helps neutralise harmful effects on the cooling system. No additives are approved for use in the cooling system.

! UNDER NO CIRCUMSTANCES should you use the “ALLCOOL” coolant with your PACCAR MX-13 engines

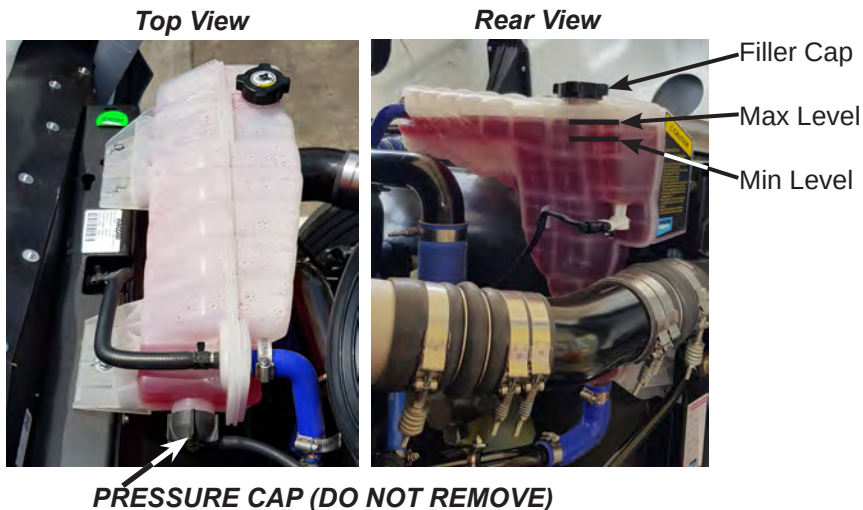
! Use extreme caution when removing the radiator cap if the engine has been in operation within the previous thirty minutes. Scalding hot coolant may cause injury.



Refer to the table (page 333) in the Lubrication Schedule for cooling system capacities.

Topping Up

With the engine cold, top up with premixed ELC30 coolant. Add coolant through the filler cap on top of the surge tank atop the radiator. For correct level, see illustration below.



If frequent topping up becomes necessary and there are no visible signs of coolant leaks when the engine is cold, check for leaks with the engine in operation at normal operating temperature. The system may be leaking when pressurised. Never use 100% antifreeze to top up coolant.



UNDER NO CIRCUMSTANCES REMOVE THE PRESSURE CAP

Do not add stop leak to the cooling system. Stop leak collects around turbulators in the radiator, interfering with proper cooling.

Standard System Refill

1. Verify that the radiator and engine block drains are closed.
2. Move the heater control to maximum heat position.
3. Remove the surge tank filler cap.
4. Fill the system through the surge tank with premixed coolant in an uninterrupted flow until the radiator is full.
5. Start the engine.
6. Idle at low rpm.
7. Complete the filling as quickly as possible.

8. Idle the engine for several minutes.
9. Fill as necessary to raise coolant level to proper level.
10. Replace the surge tank filler cap.

Do not mix coolants of different brands or types. If the brand or type of coolant is changed, the cooling system must be drained and flushed prior to refill.

Check coolant level after each trip when the engine has cooled. Add coolant as necessary. Time must pass for all the trapped air to be purged from the system.



Kenworth radiators with de-aeration system - When installing Kenworth radiators that have a built-in surge tank, the engine fill-line or anti-cavitation line and air bleed line (see illustration on page 228) MUST be connected to the engine, and connected correctly. If these lines ARE NOT connected, it will be impossible to fill the cooling system with coolant and engine failure is inevitable.

The air bleed line connects into the engine side of the engine thermostat. This line allows air to bleed from the running engine when the engine thermostat is closed. It also allows air to bleed from the engine when filling the cooling system.

The anti-cavitation line (1" heater hose) connects into the suction side of the coolant pump. This line supplies non-agitated coolant to the pump, to prevent cavitation. Both the anti-cavitation line and the air bleed line should take a continuous downward route from the radiator to their engine inlets. It also allows the cooling system to be filled with coolant.



Cooling system capacities are provided as a guide only. Actual coolant fill will vary with equipment, i.e. heat exchanger, sleeper heater etc.

Maintain proper coolant concentration levels.

Antifreeze solutions containing antileak additives will quickly restrict a coolant filter and render it ineffective.

Do not add rust inhibitors, radiator sealants or water pump lubricants containing soluble oil to the coolant. The additives can deactivate the anticorrosion chemicals.

For more information on maintenance of the cooling system refer to Cooling System - Section 12 CAT: 8080 in your Electronic Customised Maintenance Manual. Fill quantities are on pages 333.



BRAKE SYSTEM

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

The following areas are interrelated and must conform to original specifications:

- tyre size
- cam radius
- slack adjusters
- drum radius
- brake linings
- brake chambers

Once a brake system is set to specifications, changing any of its components may cause system degradation. All parts have to work together to perform as they should. Because your brake system is air-operated, see Air Supply System on page 237 for more information on checking your brakes. Any replacement components in the brake system should be the same or better than the original components. Any changes from the original specifications can affect the performance of the entire system.



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 serious personal injury or damage to the vehicle.

- Use wood blocks (100mm × 100mm or larger) against the front and rear surfaces of the tyres. Be sure the vehicle cannot move.

Lubrication

Cam-actuated brake components such as anchor pins and brake camshafts are subjected to high temperatures. They must be lubricated with non-melting, water resistant brake grease meeting R-S Specification 0-616 (NLGI-Grade 2).

- Lubricate according to Recommended Maintenance Schedules, pages 315-342.

 ***Do not apply too much lubricant to brake components - lubricate sparingly. Excessive amounts of lubricant could contaminate brake linings, which could reduce brake effectiveness and cause an accident.***

Brake and Slack Adjuster Lubrication

According to the interval, pressure lubricate the slack adjuster and brake camshaft (bracket/tube). Two grease fittings are provided for both the slack adjuster and camshaft (bracket/tube).

- Use standard chassis lubricant which meets No. 2 grade high temperature, waterproof specifications.
- Do not use moly-sulphide loaded grease or oil as it may shorten the service life of the slack adjuster.

Checks and Adjustments

Brakes should be checked regularly.

Always adjust the brakes when they are cool:

- Park the vehicle on a level surface and block the wheels before attempting any brake checks or adjustments.

BRAKE LININGS

Brake linings should be inspected by a qualified technician at an authorised service centre for wear. See Maintenance Schedule, pages 315-342. In severe service applications, inspect the linings more frequently.

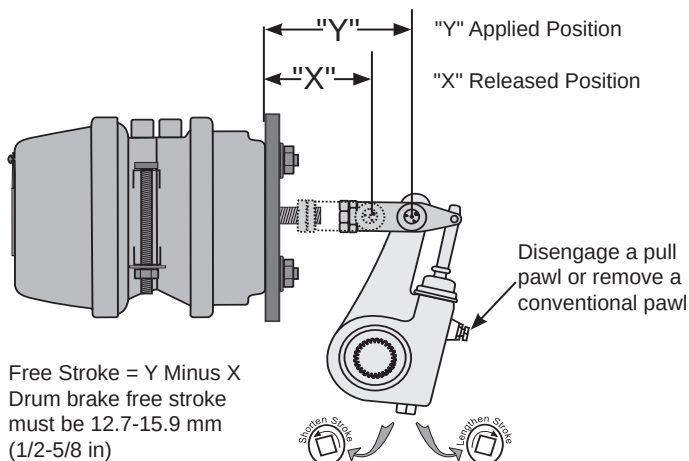
AUTOMATIC SLACK ADJUSTERS

During preventive maintenance on an in-service brake, check/measure both the free stroke as described below and the adjusted chamber stroke as described on page 234.

FREE STROKE MEASUREMENT

Your Kenworth may be equipped with automatic brake (slack) adjusters. Periodically, brake adjustment should be checked using the following procedure:

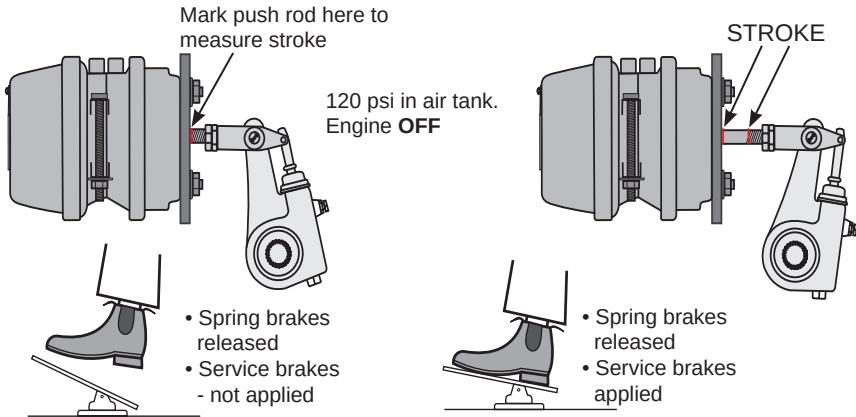
1. Check brakes when the temperature of the brake linings are cool and the system air pressure is at 827kPa (120psi) maximum.



2. Release the parking brakes to allow the slack adjusters to retract.
3. Measure the retracted pushrod length from the face of the brake chamber to the centre of the pushrod pin.
4. Have another person apply and hold the brakes one full application, measure the same distance.
5. The difference is the pushrod travel distance (applied stroke).

Verify the result is within the correct range (see Table on page 234 - Brake Adjuster Application). Correctly installed and functioning brakes (automatic slack adjusters) will produce the strokes listed for each chamber type. Test the vehicle to ensure that the brake system is working correctly before returning a vehicle into service.

ADJUSTED CHAMBER STROKE



Automatic Brake Adjuster Application

Air Chamber Type (size)	Brake	Pushrod Travel (applied stroke)
20-24	Front	25-44mm
16	Front	19-34mm
30	Rear	38-51mm

If the pushrod travel reaches the above specifications, check the slack adjuster installation. Inspect brake adjuster and anchor bracket for damage. The anchor bracket should be tight.

With the air system at 827kPa (120psi), apply the brake.

If adjustment is necessary and the slack adjuster is working, the adjusting hex nut will rotate during the chamber return stroke. Installing a spanner on the hex nut will make this easier to see. On each stroke after the first, the amount of adjustment and chamber travel will be less.

Constant manual adjustment of automatic slack adjusters can shorten the life of your internal clutch. If the installation appears to be free of damage, but the applied stroke range could not be achieved, the slack adjuster must be replaced.

The brake adjuster alone does not ensure proper brake operation. Inspect all brake components. All brake components work together and must be checked periodically to ensure the brake system works properly. See the Electronic Customised Maintenance Manual for more information on brake maintenance.

ANTI-LOCK BRAKING SYSTEM (ABS)

Below are some general notes on your Kenworth anti-lock braking system. For detailed service information see the Kenworth Maintenance Manual. All service work should be performed by a qualified technician at an authorised service centre. The foundation brake system must be in proper working order to ensure the best ABS performance.



Before welding anywhere on the vehicle detach the ABS Electronic Control Unit (ECU) connector and all other electronic control units. Never detach the ECU connector with the ignition turned ON.

ABS FAULT CODES

For fault codes related to the ABS system refer to Bendix publications BW2428 or SD-13-4983 'EC-80 ABS/ATC Controllers' (system specific) under Air System section on your Electronic Customised Maintenance Manual Section 4 - Braking, in the Driver Information Pack.

Check ABS wiring harnesses and piping periodically for chafing or other problems. No regular maintenance is required on the ABS components. During wheel balancing, dyno testing, or any time the ignition is ON with part of the ABS disconnected, a failure code will be recorded. Consult your authorised Kenworth dealer for information on clearing the failure code.



If one wheel on any driven axle continues to slip or spin for approximately 4 seconds, this will cause the anti-lock controller for that axle to go into the fail-safe mode, and the warning light will give a shutdown signal.

In this case the anti-lock system can be turned back on, and the warning light extinguished by turning the key switch OFF and ON, after the vehicle has been brought to a full stop. When the key switch is turned back on, the warning light will illuminate and remain on for 3 to 5 seconds. This is a built-in function test of the warning light.

If, due to operating conditions, a brake application causes either wheel on the same axle to begin skidding, wheel speed sensors immediately signal the anti-lock controller in the modulator assembly. The controller responds instantly by signaling the solenoids in the modulator, which activate the air valves, reducing application pressure as needed to prevent the wheels from locking up. If this over-riding correction is effective, application pressure is allowed to build up to the original input.



Any malfunction of the ABS system on one or more axles will cause the system to fail-safe, and the panel-mounted amber warning light will illuminate, indicating both a malfunction and automatic shut-down of the system. If the air system is intact (indicated by the pressure gauges), the service brakes will continue to function normally, but without benefit of the ABS feature.



Do not attempt to recycle the ABS system by turning the keyswitch OFF and ON until the vehicle has been brought to a full stop and the parking brakes set. Failure to do so could adversely affect steering and braking control, and may result in loss of vehicle control causing an accident.

Do not operate the vehicle in the event of a malfunction in any air circuit. Such a malfunction may prevent the brake system from operating properly and could result in an accident. The vehicle should not be operated until the system is repaired and both braking circuits, including all pneumatic and mechanical components, are working properly.

AIR SUPPLY SYSTEM



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 a vehicle to roll unexpectedly resulting in an accident and/or injury. Keep hands away from chamber push rods and slack adjusters; they may apply as system pressure drops:

- 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.
- 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.
- Never attempt to disassemble a component until you have read and understood recommended procedures. Some components contain powerful springs and injury or death can result if they are not properly disassembled. Use only proper tools and observe all precautions pertaining to the use of those tools.
- Do not release the parking brake or attempt to move the vehicle until air pressure in both circuits is at least 690kPa, the level required for normal brake operation.
- Do not use the control to hold vehicle while parked. This control utilises air pressure for brake application. Because acceptable air leakage levels cause all truck air systems to gradually lose pressure, vehicle rollaway could occur, resulting in an accident and/or injuries.
- Always apply the tractor and trailer parking brakes when the vehicle is unattended.

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.

Air containing excessive moisture/water can cause premature failure of the Engine Aftertreatment System resulting in expensive repairs.

AIR SYSTEM FUNCTION TEST

Scheduled maintenance should be performed on the Kenworth air system, as outlined in the Kenworth Maintenance Manual Section 5 CAT: 8047. In addition, perform an Air System Function Test at least every 3 months or if there is any indication of a potential problem.

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.

WATER EJECTION VALVES

Daily

The supply and service air tanks must be drained on a daily basis. Operate air devices daily to drain moisture within the unit. Manual drain valves are located on each tank operated by a pull action on the appropriate cable

Periodically

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

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.

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 by-pass. See the Kenworth Maintenance Manual for maintenance details.

AIR COMPRESSOR

OPERATION

All compressors, regardless of make or model, run continuously while the engine is running. System pressure is controlled by the governor which (acting in conjunction with the unloading mechanism in the compressor cylinder block) starts and stops compression of air by loading or unloading the compressor when pressure in the system reaches a minimum of 690kPa or a maximum of 827kPa (100-120psi).

Preventive Maintenance

The following service checks are provided for your information only and should be performed by a certified technician. Contact your authorised Kenworth dealer or consult the Kenworth Maintenance Manual and 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 into active service:

- Inspect compressor air filter element, if so equipped, and replace element if clogged. Check compressor mounting and drive for alignment. Adjust if necessary.
- Check compressor discharge line for carbon build-up, and clean or replace the discharge line if necessary.

AIR GAUGES AND AIR LEAKS

Your Kenworth comes with two separate 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 kilopascals (kPa).



Do not operate the vehicle if a leak in the air system is detected. Conduct the following procedure and contact an authorised Kenworth dealer (or any other properly equipped service centre) 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.

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 414kPa (60psi)), a warning light on the gauge will glow and the audible alarm will sound.

Follow the procedure below to check the compressed air system for leaks, periodically or after maintenance or replacement of air system components:

1. Build up air pressure in the system to the governor cut out point or until 827kPa (120psi) is reached.
2. Stop the engine and release the service brakes.
3. Without applying the brake pedal, observe the rate of air pressure drop. This rate should not exceed 14kPa (2psi) per minute.
4. Start the engine and build up the air pressure again.
5. 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 21kPa (3psi) per minute.
6. If you detect excessive leakage (air pressure loss greater than 21kPa (3psi) 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.

TURBOCHARGER

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

Lubricating System - Check 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 authorised Kenworth dealer investigate this immediately. Delay could lead to severe and expensive damage to your vehicle.



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 seriously injured.

Always keep the intake piping connected when running the engine.

TYRES

TYRE INFLATION AND LOADING

Regular and frequent inspection, and proper care will give you the assurance of safe, reliable tyre operation.

Most tyre wear problems are caused by under inflation as the result of slow leaks. Low pressure is the tyres worst enemy; it allows tyres to flex badly and this causes high temperatures to build up. Heat causes early tyre damage such as flex breaks, radial cracks and ply separation. Furthermore, low tyre pressures can affect control of your vehicle, particularly at the front wheels.

TYRE INSPECTION AND REPLACEMENT

Visually inspect your tyres frequently for any abnormal conditions such as scrapes, bulges and uneven wear. This must be done immediately after known or suspected contact with an object on the road, pothole, road irregularity or after severe braking. Refer these conditions to an authorised tyre service centre for repair or replacement. Never drive on a tyre if such conditions appear.

If the tyre looks underinflated, stand off to the side and check for damage to the wheel assembly. This can be done by visually comparing the wheel in question to other wheels on the vehicle. For dual wheel assemblies, check between the wheels for damage. If any damage is found, or you suspect damage, do not attempt further repair. Call for expert tyre service.



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

Tyre thumping during the walk around inspection will tell if a tyre is deflated. The correct way to check tyre pressure is with an accurate gauge. This should be done regularly; at least once a week if operating on a heavy schedule.

TYRE INFLATION

Most tyre wear problems are caused by underinflation. So you will want to check tyre pressure regularly. Give the tyres a visual test every day and check inflation with a gauge every week. When checking tyre pressure, inspect each tyre for damage to sidewalls, cuts, cracks, uneven wear, rocks between dual wheels (tyres) etc. If a tyre appears underinflated, check for damage to the wheel assembly. Do not forget to check between dual wheels. If you find wheel damage, have an expert tyre service repair it.

Pressure should be checked when the tyres are cool. Warm or hot tyres cause pressure buildup and will give you an inaccurate reading. **Never deflate a warm tyre to the specified pressure.** Underinflated tyres will adversely affect the operation of the vehicle and tyres:

- making steering difficult
- causing extra strain on the tyre sidewalls
- reducing the tread life of tyres due to the high temperatures generated from excess flexing of the tyre

Recommended maximum vehicle operating speed, 100km/h.

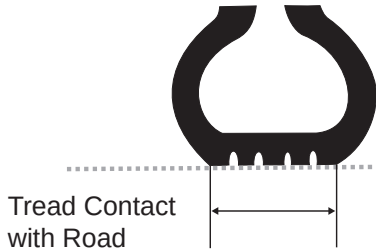
Recommended Laden Tyre Pressures		
Application Rim Size	Tyre Size	Cold Inflation Pressure
Steer Tyres Except	All Sizes 385/65R22.5	827kPa (120psi) 620kPa (90psi)
Drive Tyres	All Sizes	689kPa (100psi)
Trailer Tyres	All Sizes	689kPa (100psi)

For full tyre pressure specifications laden and unladen, refer to the tyre manufacturer for details.

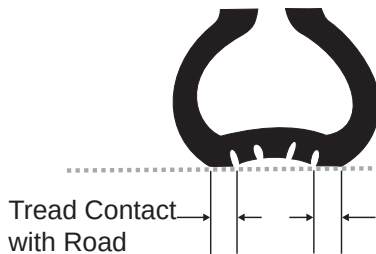
Inflate tyres to the manufacturer's cold-air pressure specification moulded into the tyre sidewall. Do not exceed these specifications.

It is also important to regularly have a wheel alignment:

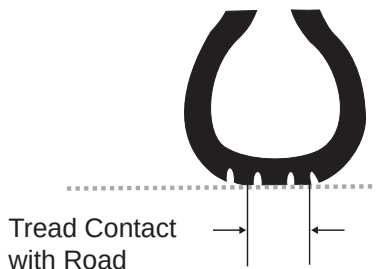
- Too much air pressure reduces the tyre tread contact area and results in rapid wear in the centre of the tyre. It also causes tyres to run hard and makes them more vulnerable to impact and other road hazard damage.



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



Underinflation - Causes abnormal tyre deflection, which builds up excessive heat, running the risk of failure. It also causes irregular wear.



Overinflation - Reduces the tread contact area with the road surface, concentrating all of the vehicle weight on the centre of the tread. This causes premature wear of the tyre.



Overinflated tyres can cause accidents. They wear more quickly than properly inflated tyres 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 injury and/or accident. Be sure all tyres are inflated correctly according to the manufacturer's recommendations.

If overinflation is noted during travel, do not deflate tyres. The increased pressure is caused by temperature build-up during operation. This condition has been taken into account during manufacturing. Allow tyres to cool, then recheck and adjust if necessary.

Tyre Loading



Do not exceed the load rating of your tyres (moulded on the sidewall of your tyre) or the maximum vehicle load rating, whichever is less. Overloading could result in premature tyre failure causing you to lose control of your vehicle resulting in injury and/or accident. The Gross Combined Mass (GCM) load rating is found on the tyre placard decal located on the vehicle.

Overloading your vehicle is as damaging to the tyres as underinflation. It significantly affects the expected life (total mileage) of a tyre. The tyre inflation table below shows how neglect or deliberate abuse can affect the life of your vehicle's tyres.

Maximum Vehicle Load Rating		
Vehicle Load	Tyre Pressure	Expected Total Tyre Mileage
Normal	Normal	Normal
20% Over	20% Low	70%
40% Over	30% Low	50%
60% Over	35% Low	40%
80% Over	45% Low	30%
100% Over	55% Low	25%

REPLACING TYRES

Front tyres should be replaced before less than 3mm of tread remains. This does not include tie-bars or tread wear indicators. Replacement tyre and rim sizes must conform with those listed on the 'Tyre Placard', which is located in the cab (see pages 299-300).

For vehicles built after January 1st 2005, cold inflation tyre pressure limit is marked on tyre sidewall. Recommended laden tyre pressures are listed on page 243.

Check tread depth in any major tread groove at three locations around the tyre, spaced 120° apart.

Tyres on drive axles or trailer must be replaced when less than 1.5mm of tread depth remains in any major groove, as checked at 120° locations around tyre.

 Regrooved tyres, or tyres with reinforcement repairs, should never be used on steering axles.

MATCHING TYRES

In addition to having tyres balanced, and having their radial and lateral run-out checked, we recommend that you have an authorised Kenworth dealer match your tyres, particularly on the rear axles. Mismatched tyres can cause interaxle conflict and unusually high axle lubricant temperatures. Matched tyres will help lengthen driveline service life and mileage.

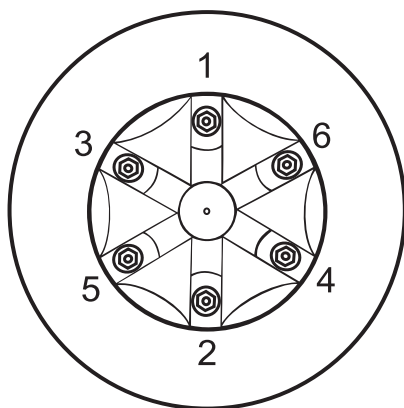
WHEEL NUT TORQUE

At the first scheduled lube interval, have all wheel nuts torqued to their specified value. Thereafter, wheel nuts **MUST** be checked at least once a week. Contact the service department at any authorised Kenworth dealership for information on torque values applicable to the wheels installed on your truck or see the table below.

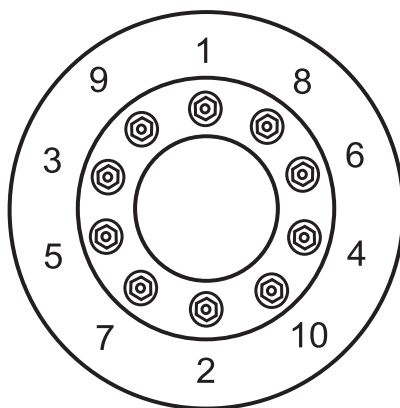
The tightening sequence applies to all wheels except Gunitite rims. Wheel nuts must be tightened in three stages, in the sequence shown below, for the particular wheel type, using a suitable calibrated torque wrench, making sure not to rotate captive washers.

Tightening sequence must be strictly adhered to or misalignment may occur. Never tighten nut fully while others are loose.

WHEEL MOUNTING AND FASTENING



6-Spoke



Hub-Piloted

SIX SPOKE WHEEL NUT TORQUE		
Stud Threads	N.M.	Ft.Lb
Lightly Lubricated	305–332	225–245
STEEL/ALUMINIUM DISC WHEEL NUT TORQUE		
Stud Threads	N.M.	Ft.Lb
Lightly Lubricated	610-678	450-500

VEHICLE JACKING

Ordinary pedestal jacks are designed ONLY to LIFT a vehicle. Once lifted, the vehicle should be supported by other appropriate means, such as stands. **NEVER** get under, or work under, a vehicle supported ONLY by a jack. Only work under a vehicle supported by stands and with wheels chocked.

20 TONNE HYDRAULIC BOTTLE JACK

Complies with AS/ANZ 2693:2007

Minimum height 'lowered' 278mm

Maximum height 'raised' 458mm

Your 20 tonne hydraulic jack is supplied with an ISO 15 grade Hydraulic Oil. ALLLube Diesel Engine Oil may also be used in your hydraulic jack.

 ***Use only oils that meet the manufacture's recommended specifications. Never mix different types or different specification oils.***



ANY JACK SHOULD BE USED ON LEVEL FIRM GROUND WHEREVER POSSIBLE.

NO PERSON SHOULD PLACE ANY PORTION OF THEIR BODY UNDER A VEHICLE THAT IS SUPPORTED BY A JACK; USE VEHICLE SUPPORT STANDS.

WHEELS NOT BEING JACKED SHOULD BE 'CHOCKED'. NO PERSON SHOULD REMAIN IN A VEHICLE THAT IS BEING JACKED.

INCORRECT USE MAY RESULT IN POSSIBLE LOSS OF LOAD, DAMAGE AND PERSONAL INJURY.

When the jack leaves the factory the oil chamber contains the correct amount of oil. Before using for the first time, stand jack on base on a level surface, remove the oil reservoir plug and check the oil level. The oil level should be within 3mm of the bottom of the filler hole when the ram is completely lowered.



Sometimes during shipment, or when changing the oil, air may get trapped in the hydraulic system causing poor performance. To purge any air from the system place the jack in an upright position, open the oil reservoir plug, place a cloth over the filler hole and pump the handle 7 to 10 times in quick succession. This will purge any air from the system.



JACK OPERATING INSTRUCTIONS

Before use, visually inspect the jack for any abnormal conditions and refer to the preceding WARNINGS, SAFE USAGE STATEMENTS and NOTES below.



There may be circumstances where dirt or residue on the ball seat may cause the jack to lower quickly and the jack handle to fly up in force. This may result in damage to the jack handle or personal injury. Where ever possible the jack should be positioned to ensure that the jack handle does not come into contact with any part of the vehicle whilst it is being used. Check that there is a sufficient gap between the jack handle at its highest point and the vehicle before pumping the handle up and down to raise the load.

FOR SAFE USE, IT IS RECOMMENDED THAT:

1. Ensure the vehicle's parking brakes are applied.
2. Chock all road wheels that are to remain on the ground.
3. Remove the key from the ignition, or turn OFF the electrical master switch.
4. No person should remain in a vehicle that is to be jacked.
5. Position the jack beneath the axle to be lifted. A 20 tonne jack will be required when changing a road wheel. Do not use road springs as a jacking point. Position the jack under the axle of, and as close as practicable to, the wheel to be changed.
6. The jack must be seated on a level, flat hard surface, such as concrete, bitumen or compacted road metal.
7. NEVER use a jack as a sole means of support. Position suitable stands or supports under chassis frame.
8. Vehicles either jacked up or hanging up on chain hoists should be blocked with axle stands or substantial timber blocking.

Ordinary pedestal jacks are designed ONLY to LIFT a vehicle. Once lifted, the vehicle should be supported by other appropriate means, such as stands.

NEVER get under, or work under, a vehicle supported ONLY by a jack. Only work under a vehicle supported by stands and with wheels chocked.

To raise the load

1. With the jack in the lowered position, turn the release valve with the end of the jack handle in a clockwise direction until it is firmly closed.

2. To maximise the lifting height, unscrew the extension screw/head cap to the required height.
3. Insert the handle into the handle sleeve. Check that the handle or any part of your hand or arm does not come into contact with the vehicle when the handle is at its highest point. If it does, change the position of the jack under the load or lifting point. Raise the ram by operating the handle up and down until contact is made with the lifting point.
4. Position the head cap centrally under the load or lifting point and ensure the load is applied through the centre of the head cap.



Off-centre loads and loads lifted while jack is not sitting level may result in damage and/or injury.

5. Pump the handle up and down to raise the load to the required height.
6. Place support stands in the correct position under the load.
7. Slowly turn the release valve counterclockwise, just sufficiently to allow a gradual decent of the load onto the support stands.

To lower the load:

1. Close the release valve. Operate the jack to raise the ram to the correct position under the vehicle. Raise the load until the support stands are free. Remove the stands clear of the load.
2. Slowly turn the release valve counter clockwise using the end of the handle just sufficiently to allow a gradual descent of the load. If the ram is still partially raised after the load has fully descended, slowly open the release valve one full turn and push the ram down to its lowest position.

General care of your jack:

1. To add oil with the ram fully lowered, set the jack in an upright position. Wipe away any oil or foreign matter from around the oil reservoir plug then remove it. The oil level should be 3mm below the filler hole.
2. When jack is not in use, the ram, handle sleeve and extension screw should be in the fully lowered position. This will protect precision machined surfaces from corrosion.

3. Keep your jack clean and lubricate the pumping collar and extension screw.
4. Operate your jack at least twice per year. This will keep the seals moist.
5. Service kits are available and comprise the necessary washers and seals which would be required for a general overhaul of the hydraulic unit.
6. For best performance and longest life, replace the complete oil supply at least once per year. Do **NOT** overfill. Lay the jack on its side and allow the oil to run out into a suitable container. The oil will run slowly as air must enter as the oil drains out. Be careful not to let dirt or foreign matter enter the system.

STORAGE OF THE VEHICLE JACK

The vehicle jack **must** be stored upright and securely clamped in the location provided.

The main cause of 'Air in the Hydraulic System' and 'Oil Level too Low' are both due to poor maintenance or jacks being stored incorrectly, i.e. laid on their side.

VEHICLE JACKING POINTS

Primary Jacking Points

Position the jack under the axle and as close as practicable to the wheel to be changed. Do not jack under differential housings, see Electronic Customised Maintenance Manual for location of jacking points.

Secondary Jacking Points

Jack front springs immediately in front of the axle only if the jack cannot be located safely under the front axle beam.

**'WARNING' DO NOT GET UNDER
A VEHICLE THAT IS SUPPORTED
BY A JACK - USE VEHICLE
SUPPORT STANDS.**

BATTERIES

Battery Care

Regular attention to the charging system will help prolong the service life of batteries. Following are some of the common causes for battery failure.

Isolation Switch

Essential for vehicles carrying dangerous loads i.e. petroleum products, gases, acids, explosives etc. The switch is designed to shut off all battery power, this will disable the Remote Keyless Entry and radio pre-sets in order to maintain total emergency electrical isolation.

Field Isolated Alternator

A field isolated alternator is fitted to the vehicle when battery isolation switch is installed. Field isolated alternator must be used when replacing alternator in service.

Batteries

If a hydrometer check indicates that a battery is less than 80% charged, the battery should be recharged to full capacity (See table on page 256 Hydrometer Readings).

Overcharge

Improper voltage regulator setting results in overheating, warped plates and 'boiling off' of electrolyte.

Undercharge

A faulty or improperly set voltage regulator, slipping drive belt, long periods of standing idle or short-distance driving may result in battery plates becoming 'sulphated' with a hard coating.

Vibration

Loose battery hold-downs can result in battery plate failure.

Dirty or Loose Connections

These can stop the flow of electrical power to and from the battery.

Short Circuits

These will discharge the battery through electrical 'leaks'.

Heat

Heat from other adjacent components can cause overheating of batteries, resulting in warped plates and 'boiling off' of electrolyte. Check that any necessary heat shields are in place and that adjacent components are not overheating.

BATTERY CHARGING

Except for using small trickle chargers (slow battery charge, as explained on page 255) to maintain battery condition, you should have your vehicle's batteries charged by a qualified service facility.



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.

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.
- Maintain the full level of electrolyte in the batteries. This reduces the volume of gas in the cells. The electrolyte level should always be between 10 and 15mm above plates. Fill with distilled water only. After distilled water has been added, wait at least 30 minutes to measure solution density (specific gravity). The specific gravity should be between 1.258 and 1.265 or the electrolyte level within 'MIN' and 'MAX' marks.
- When fast charging, remove the battery caps so pressure does not accumulate.
- Always make sure the battery charger is OFF before connecting or disconnecting the cable clamps.

- To avoid short circuits and damage to yourself or the vehicle, 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

1. Use protective eyewear.
2. Keep all batteries away from children.
3. Do not disconnect batteries when engine is running.
4. Never reverse battery poles.
5. Never attempt to place the vehicle in motion, or run the engine with batteries disconnected.
6. Keep the battery clean and dry.
7. Look for any signs of damage.

 ***Never use a metal funnel to add distilled water. It could come in contact with a terminal, creating a short circuit, and resulting in severe personal injury or damage to your vehicle.***

 ***Always shield your eyes and avoid leaning over the battery whenever possible. Electrolyte in batteries could splash up into your eyes causing severe burns and/or serious personal injury.***

- Battery terminals should not be coated with improper grease. Use petroleum jelly or commercially available, non-corrosive, non-conductive terminal coatings.
- Battery acid that may spill during charging should be washed off with a solution of warm water and baking soda to neutralise the acid. If you accidentally get acid in your eyes or on your skin, immediately rinse with cold water for several minutes and call a doctor.
- Do not charge a frozen battery; allow it to thaw out first. Always allow the battery to thaw gradually. Do not apply direct heat. Gas trapped in the ice may cause an explosion.
- Never use a fast charger as a booster to start the engine. This can seriously damage sensitive electronic components such as engine management systems, radio, etc., as well as the battery charger. Fast charging a battery is dangerous and should only be attempted by a competent technician with the proper equipment.

Slow Battery Charging

If a battery has lost charge gradually over a long period of time, recharge at 6 to 8 amps for about 8 to 10 hours.

- Follow the instructions that come with your battery charger.
- It is not necessary to remove the battery from the compartment.



Charger cables must be connected positive to positive (+ to +) and negative to negative (- to -). If connected incorrectly, batteries could explode causing serious personal injury.

1. Always make sure the battery charger is OFF before connecting or disconnecting the cable clamps. To reduce the danger of explosions and resulting personal injury, do not connect or disconnect charger cables while the charger is operating.
2. Make sure the electrolyte level in each cell is between the 'MIN' and 'MAX' marks. If the fluid level is below the mark, correct the condition.
3. Disconnect the battery cables.
4. Connect charger cables.
5. Start charging the battery at a rate not over 6 amps. Normally, a battery should be charged at no more than 10 percent of its rated capacity.
6. After charging is complete, switch off charger and disconnect charger cables from the batteries.

Fast Battery Charging

If the battery(s) has lost its charge rapidly, from cranking an engine that failed to start, recharge at 30 to 40 amps for 1 to 2 hours.



A rapid charge rate generates an explosive mixture of hydrogen and oxygen gases. A spark or flame near a battery on charge could cause the battery to explode with considerable force. When fast-charging, remove caps so that pressure does not build up.

Use care when fast-charging. Watch for gassing. Check electrolyte. If it starts gassing violently, reduce the charging rate. Battery voltage should not exceed 14.2 volts. This is the recommended alternator voltage setting.

HYDROMETER READINGS AT 27°C	
Minimum Specific Gravity	Percentage of Charge
1.260	100 %
1.235	80 %
1.230	75 %
1.200	50 %
1.170	25 %
1.140	Very little charge left
1.110	Completely discharged

Removing and Installing Batteries:

1. Be sure all switches on vehicle are turned OFF.
2. Disconnect ground cable FIRST when removing battery.
3. Connect ground cable LAST when battery is installed.

MAINTENANCE-FREE BATTERIES

Use applicable procedures as for standard batteries, but observe the following precautions:

1. Do not attempt a jump-start if the charge indicator lamp is yellow. Yellow colour indicates battery requires replacement.
2. If charge indicator is dark, and a green dot is visible in the centre, check the starter motor and wiring. This colour condition does NOT indicate a discharged battery.
3. If the charge indicator is dark, and the green dot is not visible, this indicates a low-charge condition. The engine can be started with jumper cables.

ELECTRICAL SYSTEMS - 12 VOLT

JUMP STARTING VEHICLES

Introduction

Jump starting a vehicle is not a recommended practice due to the various battery installations and electrical options. However, if your battery is discharged, you may be able to start it by using energy from a good battery in another vehicle. This is termed jump starting. Be sure to follow the precautions and instructions below.



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



Never jump start a battery near fire, flames, or electrical sparks. Batteries generate explosive gases that could explode. Keep sparks, flame, and lighted cigarettes away from batteries. Failure to comply may result in death, personal injury, equipment or property damage.



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

Be careful that metal tools (or any metal objects) do not contact the positive battery terminal and any other metal on the vehicle at the same time. Remove metal jewellery and avoid leaning over the battery.

To Jump Start Your Vehicle



When jump starting, it is best to jump start with an equivalently powered vehicle. Verify that the battery has the same voltage and CCA specifications as the discharged battery before attempting to jump start. Failure to comply may cause an explosion resulting in death, personal injury, equipment or property damage.



Applying a higher voltage booster battery may cause expensive damage to sensitive electronic components, such as relays, electronic control units or electronics in general. Failure to comply may result in equipment damage.



Improper hook-up of jumper cables or not following these procedures can damage the alternator or cause serious damage to both vehicles.



Heed all warnings and instructions of the jumper cable manufacturer. Failure to comply may result in death, personal injury, equipment or property damage.



When jump starting, it is advisable to use surge protected jumper cables.

 **NEVER** start the vehicle by means of a fast/boost-charging device. The high voltage levels may cause damage to the electronic components. Best method is to remove the batteries for charging and refit when fully charged. Always observe battery safety.

Preparing the vehicles

1. Remove any personal jewellery that may come in contact with the battery terminals.
2. Select a jumper cable that is long enough to attach to both vehicles in a way that ensures neither vehicle touches each other.
3. Position the two vehicles together, but do not allow them to touch.
4. Turn OFF all lights, heater, radio and any other accessory on both vehicles.
5. Set the parking brakes: pull out the Yellow button located on the dash.
6. Shift the transmission into park position or neutral for manual transmissions.
7. If either vehicle is equipped with a battery isolation switch ensure they are in the OFF position prior to connecting the two vehicles.

Connect the batteries

1. Attach one end of a jumper cable to the positive (+) terminal of the discharged battery. This will have a large red + or P on the battery case, post, or clamp.
2. Attach the other end of the same cable to the positive (+) terminal of the good battery.
3. Attach the remaining jumper cable FIRST to the negative (-) terminal (black or N) of the good battery.
4. Attach the other end of the negative cable to a bare metal part not bolted to the engine block at least 30cm from the battery.

 Always connect positive (+) to positive (+) and negative (-) to negative (-).

5. If either vehicle is equipped with a battery isolation switch, ensure that they are in the ON position.
6. Start the vehicle that has the good battery first. Let it run for 5 minutes.

7. Start the vehicle that has the discharged battery. If the engine fails to start, do not continue to crank the starter but contact the nearest authorized dealer.



When the batteries are fully discharged and the engine is running, it is important that the jump leads are not immediately disconnected. The engine must run for at least 10 to 15 minutes before the jump leads are disconnected to prevent damage to the electrical system.

8. As soon as the engine in the vehicle with the discharged battery starts running, switch on as many power consumers as possible (for example: headlights, fog lamps, heater fan, and so on) in both vehicles before disconnecting jumper cables.

Remove jumper cables



When disconnecting jumper cables, make sure they do not get caught in any moving parts in the engine compartment. Failure to comply may result in death, personal injury, equipment or property damage.

Reverse the above procedure exactly when removing the jumper cables. With engine running, disconnect jumper cables from both vehicles in the exact reverse order, making sure to first remove the negative cable from the vehicle with the discharged battery, e.g. negative last on, first off.

WELDING PRECAUTIONS

To prevent damage to gauges, interface modules and other electronic and electrical equipment, disconnect the battery cables before electric arc welding on a vehicle. If arc welding of any frame-mounted components is required, ensure the welding ground lead is connected directly to the component, preferably directly adjacent to the weld groove. Bearings and other parts will be damaged if electric current must pass through them when completing the circuit.



Welding to frame rails will void the frame rail warranty.



Observe these recommended procedures to protect electronic systems during welding operations.

If ABS system is installed, disconnect ECU. Servicing Systems and Units refer to Electronic Customised Maintenance Manual, Section 4 - Braking, Bendix Manuals BW2428 or SD-13-4983.

1. With the engine turned OFF, disconnect all electronic connections to the vehicle batteries.
2. Remove battery power cable and insulate it from the vehicle.
3. Disconnect all Electronic Control Modules (ECM) connectors (on electronic engines and transmissions).
4. Do not use the ECM or engine ground stud for the ground of the welding probe.
5. Ensure the ground connection for the welder is as close to the weld point as possible. This ensures maximum weld current and minimum damage to electrical components on the vehicle.

CHASSIS AND CAB – FINISH, APPEARANCE AND CLEANING

CHASSIS AND CAB

THE ENAMEL ON THIS VEHICLE IS NOT YET HARDENED. DO NOT STEAM CLEAN, WAX, POLISH, OR RUB THE FINISH UNTIL A MINIMUM 45 DAYS AFTER DELIVERY. CLEAN WITH COLD WATER AND SPONGE ONLY.



High pressure water washers and steam cleaners can dislodge seals and enter electrical circuits causing serious damage to the vehicle's systems.

Painted Surfaces

PACCAR and PPG recommend the following precautions in the first thirty (30) days:

- Do not use waxes or polishes containing silicone.
- Only apply decals or stickers to fully cured finishes.
- Do not use a high pressure lance any closer than 450 mm or 18 inches from the paint surface.
- Do not use a commercial car wash. Stiff brushes or coarse sponges could mar the finish and damage the surface. Wash the vehicle by hand with cool water and a very mild car wash solution. Be sure to use a soft cloth or soft sponge.
- Wash the vehicle in the shade - never in the sun.
- Do not 'dry wipe' the vehicle - always use clean fresh water. Dry wiping could scratch the finish.
- Extreme heat and cold should be avoided. Keep the vehicle parked in the shade wherever possible.
- Try to avoid gravel roads. Stone chipping the finish is easily done in the first thirty (30) days.
- Do not park under trees, which drop sap, or near factories with heavy smoke fallout. Sap and industrial fallout can mark or spot a freshly painted surface.

- Trees are also likely to attract birds. Bird droppings have a high acid content and will damage a freshly painted surface. Droppings should be washed off as soon as possible.
- Try to avoid spilling petrol, oil, anti-freeze, transmission fluid, brake fluid and windscreen solvent on the new finish. If this happens wash it off immediately.
- If the vehicle is to be stored, avoid using non-breathing covers on finishes under 30 days old.

Wash frequently to remove grime and caustic deposits which could stain the finish. Use cool or lukewarm water. A mild soap may be used. Avoid washing in bright sunlight. Road tar can be removed with a special commercial tar remover or mineral spirits. Waxing offers added protection against staining and oxidation. Wait approximately 90 days after date of manufacture before waxing to give the finish a chance to cure. Do not wax in hot sun. If a buffing machine is used, take care not to friction-burn the paint.

Aluminium and Chrome Surfaces

Aluminium wheels and bumpers can be cleaned with warm water. Tar remover will take off heavy deposits of road grime. For added appearance, wipe aluminium surfaces dry after washing to prevent spotting. Under corrosive conditions such as driving on salted roads, clean aluminium pans with steam or high-pressure water from a hose. A mild soap solution will help. Rinse thoroughly.

Chrome surfaces are best cleaned with fresh water. Wipe dry to preserve lustre. Light rust can be successfully removed with any commercial chrome cleaner. After cleaning, wax flat surfaces and apply a thin coat of rust preventive lubricant around bolts or other fasteners.

Interior

Vinyl upholstery and lining should be wiped clean with any good grade commercial vinyl upholstery cleaner. DO NOT use chemicals such as acetone or lacquer thinner. Fabric upholstery can be cleaned with upholstery shampoo specially formulated for this purpose. Follow instructions on the container.

Cleaning of Cabin Trim

Aside from its classic aesthetic appearance, one of the features of the vinyl trim used inside all Kenworth cabs is the material's ease of maintenance. The vinyl offers exceptional service life if given proper care.

For the material to be maintained properly, it is important that you are aware of the correct methods for cleaning the trim so as to avoid any accidental damage which may occur if the wrong cleaning products are used.

The procedures used for cleaning depend on the nature of the spill or stain. Below are some common stains which are likely to be encountered in a truck environment.

Everyday Spillage

In general, most common stains can easily be cleaned using a mixture of mild soap and warm water. Wash the area to be cleaned with a soft cloth or sponge, rinse thoroughly and dry. If stubborn dirt remains in the grain of the vinyl, use a soft brush to scrub the area.

Ink

Work quickly! Permanent solvent-based markers and ball point pen ink will affect the pigments and for the most part are difficult to remove from any vinyl if allowed to dry. A solution of water and methylated spirits should be applied with a soft cloth as soon as possible to remove the stain.

Paint

Cautious use of turpentine will remove fresh paint. Immediately rinse with a soap and water solution.

Oil & Grease

Petroleum based products will stain all vinyls if allowed to stand too long. Clean as soon as possible using a soft cloth and eucalyptus oil to wipe clean. Rinse with a soap and water mixture.

Blood

Rub out any spots with a clean cloth soaked in cool water. If stubborn spots remain, use household ammonia and rinse repeatedly with a clean wet cloth. Do not use hot water or soap as this will set the stain.



Use of harsh solvents, cleaners containing abrasives, steel wool and industrial strength cleaners are not recommended on vinyl materials. Use of these products will adversely affect the material finish.

Only use small quantities of mild solvent-based cleaners such as turpentine when they are required. After use of any solvent-based cleaner or other cleaning product, it is important to immediately wash the vinyl surface with a mild soap and water solution. Continual use of solvent-based cleaners will shorten the life of the vinyl material.

Weather-stripping

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

It is good practice to hose dirt and grime from the whole chassis. If an oil leak develops, it will be more easily detected.

Engine

Do not spray high-pressure water onto the engine's electronic control module or wiring harnesses. Moisture can enter the harness connectors resulting in poor electrical contact and subsequent electronic failures.

SMART (STEERING) WHEEL

CARE/MAINTENANCE

Special care and attention must be taken to prolong the life of your steering wheel.

Do not use the steering wheel as a means of support for entering the cab, do not wear oily/greasy gloves whilst driving and be aware of the destructive nature of hand jewellery, i.e. rings, chains and wristwatches.

CLEANING

Clean only with a warm soapy cloth (do not use solvent based or wax based cleaning products).

For further washing information refer to your Electronic Customised Maintenance Manual, Section 11, CAT: 8051.

CAB HEATER/AIRCONDITIONING

The combination heater/airconditioner 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/airconditioner performance at an optimal level.



Keep the vehicle's ventilation system, engine exhaust system and cab/sleeper joints properly maintained. It is recommended the vehicle's exhaust system and cab/sleeper be serviced as follows:

- Inspected by a competent technician every 10,000 kilometres.
- Whenever a change is noticed in the sound of the exhaust system.
- Whenever the exhaust system, underbody, cab or sleeper is damaged.

To allow for proper operation of the vehicle ventilation system:

- Keep the inlet grille clear of leaves and other debris at all times.
- Inspect and clean fresh air inlet filter and recirculation filter to HVAC unit at 10,000 kilometre intervals. This inspection is dependant on the vehicle's service application and may need to occur more often if operating in dusty conditions.
- Keep the exhaust pipe area clear to help reduce the buildup of exhaust gas under the vehicle.

SPECIAL PRECAUTIONS



Excessive heat may cause the pressurised components of the airconditioning system to explode. Never weld, solder, steam clean or use a blowtorch near any part of the airconditioning system.

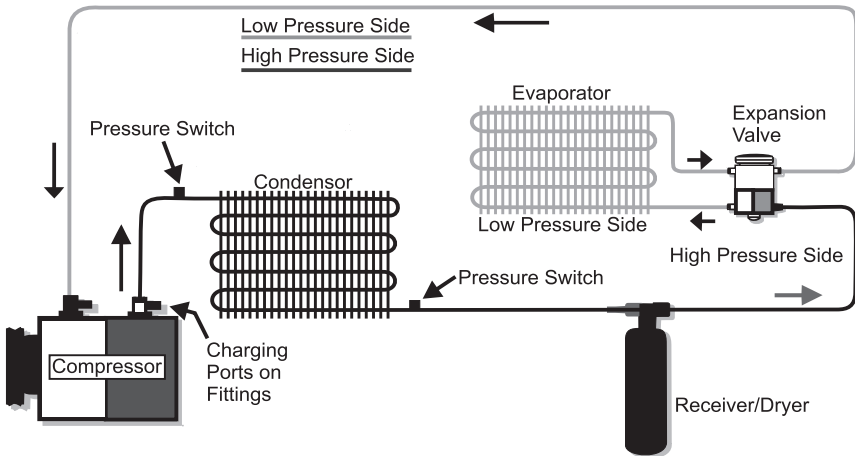
If a refrigerant leak develops in the presence of excessive heat or an open flame, hazardous gases may be generated. **These gases may cause unconsciousness or death.** If you become aware of a refrigerant leak on your vehicle, have your system serviced immediately and observe any warnings.

CAB HEATER/AIRCONDITIONER

The combination heater/airconditioner uses R-134a (also known as HFC 134a) refrigerant and provides comfort for the operator through accurate control of the cab environment in all weather conditions. Regular attention to the following items will help ensure its reliable operation. Take special note of the safety precautions.

Heater

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



Check heater core for debris blocking airflow and clean if necessary. If heater is not operating properly and the blower and air controls function normally, probable causes could be the heater core clogged internally or the hot-water valve clogged or closed.

AIRCONDITIONER



Any servicing that requires depressurising and recharging the airconditioning system should be conducted by a qualified licensed technician with proper facilities.

Check compressor and drive clutch for noise and vibration. If problems exist, have the system checked thoroughly. A bad clutch usually indicates troubles elsewhere in the system.

Check the condenser core for debris restricting air flow and clean if necessary. Small particles can be removed with compressed air blown through the core in reverse of normal air flow.



Use eye protection when blowing air through the core.

Check recirculation filter for blockage. The recirculations filter is located behind the hinged fuse and relay panel in the cabin.

Check all hoses for kinks, deterioration, chafing and leaks. Kinked hoses must be replaced with new hoses and the cause of kinking eliminated.

Check all components and connections for refrigerant leaks. Do not attempt to tighten a connection if a leak exists. This usually indicates other problems, and tightening a fitting could cause a worse leak. Have the problem corrected by a qualified technician.



Have the airconditioning system fully serviced annually by your authorised Kenworth dealer, as it requires evacuating and recharging the system, using specialised equipment.

Keep any open flame away from the area. Even a match or cigarette lighter can generate a hazardous quantity of phosgene gas.

Do not smoke in the area. People have become violently ill just from inhaling gaseous refrigerant through a lighted cigarette.

SAFETY RESTRAINT SYSTEM

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



Failure to properly inspect and maintain restraint systems can lead to serious 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:

- High mileage - Heavy trucks often accumulate mileage in excess of 1,000,000 kilometres during the vehicle lifetime. This is much greater than a typical passenger car, which frequently will not exceed 200,000 kilometres.
- Seat and cab movement - In trucks, there is 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 contribute to the wear of the entire system.
- Environmental conditions, such as dirt and ultraviolet rays from the sun, will reduce the life of the seatbelt system.

Due to these factors, the three-point seatbelt system installed in your vehicle requires thorough inspection every 30,000km. If the vehicle is exposed to severe environmental or working conditions, more frequent inspections may be necessary.

Any seatbelt system that shows cuts, fraying, extreme or unusual wear, significant discolouration due to UV (ultraviolet) exposure, abrasion to the seatbelt webbing, or damage to the buckle, latch plate, retractor hardware or any other obvious problem should be replaced immediately, regardless of mileage.

INSPECTION GUIDELINES

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



It is important to remember that any time a vehicle is involved in an accident, the entire seatbelt 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, which could result in severe injury or even death. 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, which could result in severe injury or even death. The following points refer to the illustration on page 270.

- 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.
- The shoulder web guide is the area where almost constant movement of the seatbelt webbing occurs because of relative movement between the seat and web.
- Inspect the seatbelt reel/retractor, which is mounted on the side or rear of the seat, 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.



The KAB554B retractor is designed to automatically lock when the cab is not level. The truck should be on level ground and the angle of the belt relative to the seat needs to be correct to ensure the automatic lock does not engage.

Web cut/frayed at
web guide



Web cut/frayed or
extremely worn at
latch area

- Check buckle and latch (not shown) for proper operation and to determine if latch plate is worn, deformed or damaged.
- Check web in areas exposed to ultraviolet rays from the sun. If the colour of the web in these areas is grey to light brown, the physical strength of the web may have deteriorated due to exposure to the sun's ultraviolet rays. If signs of deterioration are detected, replace the system.

Once the need for replacement of the seatbelt has been determined, ensure it is only replaced with an authorised PACCAR Parts replacement seatbelt. If the inspection indicates that any part of the seatbelt system requires replacement, the entire system must be replaced.

An installation guide is attached to every replacement belt. Utilise 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 the fasteners are torqued to specification. This will maintain the design integrity of the mounting points for the seatbelt assembly.

Contact your authorised Kenworth dealer if you have any questions concerning seat belt replacement.

TRANSMISSION AND CLUTCH

Follow the procedures below to ensure parts are properly lubricated:

- maintain oil level, check it regularly
- change oil regularly
- use the correct grade and type of oil
- buy oil from a reputable dealer

ALL TRANSMISSIONS

Initial Change - Drain and replace according to Recommended Service Maintenance Schedules on (pages 315-342). 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 in your Electronic Customised Maintenance Manual). Select from the appropriate lubricant for varying ambient (outside air) temperatures.



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

Manual and Automated Transmission Oil Level

The vehicle must be parked on level ground. See the Transmission Operator's Manual for information on checking the transmission oil level.

Manual Transmissions



Before checking level, engine must be idling in neutral for at least 2 minutes and lubricant temperature must be between 15.5°C and 48.8° C.

Check lubricant level using the fill hole or sightglass (if fitted) usually located on the right side of the transmission. Inspect oil filter for leaks, rust or damage. Replace as necessary.

Check fluid levels and inspect for leaks at regular service intervals, not to exceed 20,000km:

1. Turn engine off.
2. Remove fill hole plug.
3. Lubricant must be level with the bottom of the inspection hole.



TRANSMISSION SERVICE INTERVALS

For recommended types and brands of all lubricants, see the transmission manufacturer's Service Manual and Recommended Service and Maintenance Schedules pages 315-342 and fluid quantities, page 333.

Maintain the oil level and check it regularly. Oil should be level with the bottom of the filler plug hole with Manual, PACCAR and UltraShift PLUS Transmissions.

CLUTCH SYSTEM

GENERAL INFORMATION

The hydraulic clutch system consists of a clutch pedal, which contains a push rod that is mounted on the fire wall of the cab. This push rod extends through the cab fire wall and engages the hydraulic master cylinder mounted to the clutch pedal assembly, on the fire wall in the engine compartment. This hydraulic clutch pivots approximately 13mm to engage the clutch.

Pressing in the clutch pedal will apply pressure to the hydraulic fluid. The fluid pressure applies force to an air servo, in addition to applying force to the clutch fork actuator, in the clutch servo mounted to the transmission. When the air servo is opened, compressed air is allowed to assist the hydraulic pressure and move the clutch fork actuator.

When the clutch pedal is released, the air servo will close and compressed air will exhaust out the exhaust port.

Clutch adjustment (at the clutch pressure plates) is needed when the pedal reaches the furthest down/stop position in the pedal assembly, followed by a decreased effectiveness of the clutch brake.



Always disconnect the air supply from the clutch servo before removing the clutch servo from the transmission. Do not install and pressurise the air system until the clutch servo is secured back onto the transmission. Failure to do so may result in a buildup of air pressure against the back plate which may lead to personal injury or death.



Brake fluid may be a hazard to human health and the environment. Always dispose of brake fluid in accordance with applicable regulations.



Make sure both of the button head socket screws that mount the master cylinder to the fire wall/clutch pedal assembly are started in their threads before final torque to avoid damaging the threads in the aluminum clutch pedal casting.



Always maintain a minimum of 0.5 mm clearance between the push rod of the clutch pedal and the hydraulic master cylinder piston. Equipment damage may occur if this clearance is not properly maintained.



Do not allow brake fluid to spill or come in contact with painted surfaces. In case of contact, flush the area with water.

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 discs in the clutch. This is called release travel.

And, finally, as the pedal is pushed to the last 25mm to 40mm 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.

MANUAL CLUTCH ADJUSTMENT - NORMAL WEAR

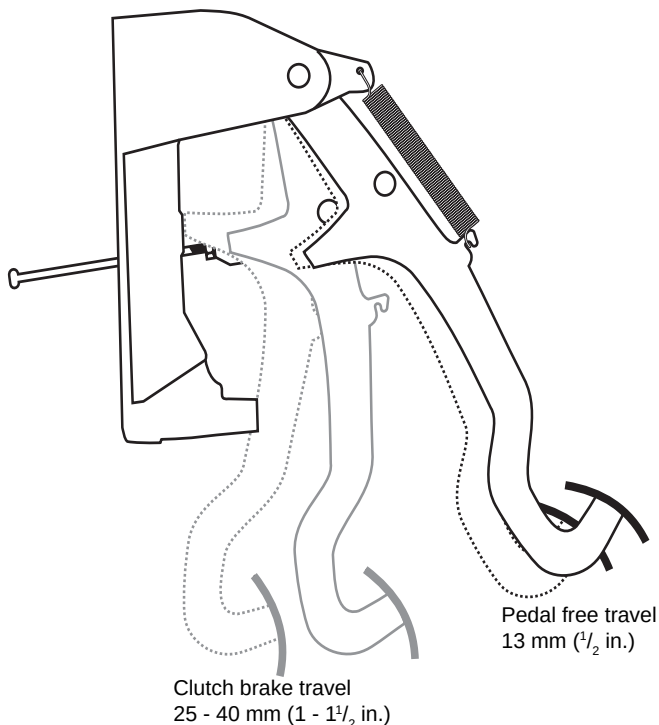
Clutch pedal free travel is normally 13mm. This should be your guide to determining if clutch adjustment is necessary. The clutch pedal will need adjustment when your clutch pedal stroke seems to get longer and its effectiveness at a seamless shift becomes less.

Another sign of the clutch needing adjustment is the level of fluid in the reservoir. If the hydraulic brake fluid is not leaking but the fluid level is getting lower, then the clutch may need adjusted. You should have an authorised Kenworth dealer adjust the clutch before pedal free travel is reduced to the minimum allowable 13mm.



MANUAL CLUTCH ADJUSTMENT

See the clutch manufacturers service manual on the Customised Maintenance Manual on the USB in the Driver Information Pack supplied with your vehicle for the correct adjustment procedures.



See the clutch manufacturer's Service Manual in the Electronic Customised Maintenance Manual for the correct adjustment procedures.



This procedure is all that is required for normal clutch adjustment. Adjustment of any other components is not required.

CLUTCH LUBRICATION

To ensure long life and proper operation of the release mechanism of the clutch it is important to properly lubricate the following areas.

Release Bearing

The cast iron bearing housing will be equipped with either a standard grease fitting or a lube tube extension. If a lube tube is not present it is necessary to remove the inspection cover to gain access to the grease fitting. Apply grease until it purges from the rear of the housing. Grease on the transmission input shaft will extend the life of the clutch brake and bronze bushings inside the release sleeve. If your vehicle is equipped with an Eaton Fuller Solo XL (Extended Lube) there will be roller bearings at the end of the clutch release yoke. These bearings are permanently lubed and do not require maintenance.

Release Bearing Wear Pads

Where the release fork contacts the bearing housing there are small hardened steel pads. Apply a small amount of grease to the wear pads where the clutch release fork contacts.

Clutch Brake

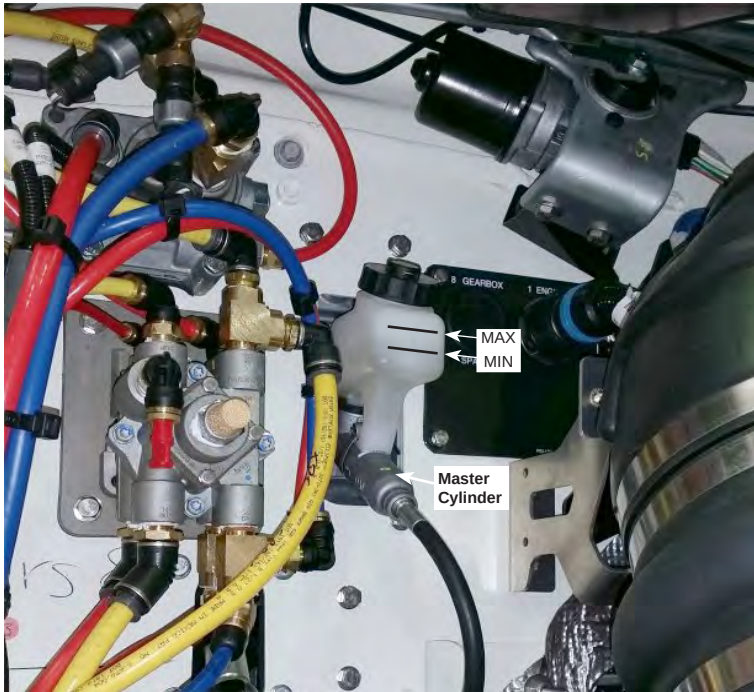
The clutch brake friction material is designed to operate with lubricant. While lubricating the release bearing, grease should purge from the housing and contact the clutch brake. This is beneficial for long clutch brake life. If desired, a small amount of grease could be applied to both sides of the clutch brake.

Cross-Shaft Bushings

Lubricate both the left and the right cross-shaft bushings as per OEM recommendations.

Pilot Bearing

The pilot bearing inside the flywheel is a sealed for life bearing and requires no lubrication. Use a premium pilot bearing to prevent clutch drag and early bearing failures (C-4 or C-5 Suffix).



The fluid reservoir for the hydraulic clutch system is located on the engine side of the firewall, adjacent to the dual brake foot valve and below the windscreen wiper motor.

STEERING

Frequent visual checks of the steering gear and components are vital to driving safety. Check the crosstube for straightness. Check draglink ends, ball joints and steering U-joints for looseness.

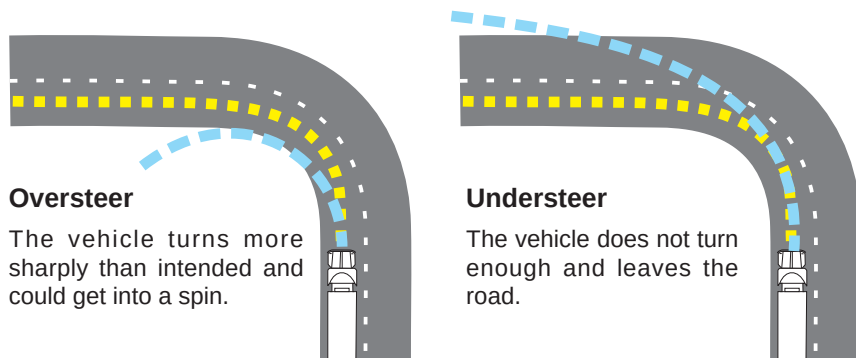
Check draglink for evidence of tyre rubbing and draglink clamp for looseness or interference. Check steering wheel free play. It is good practice to make a special check of these components after a hard trip over rough roads.

If the steering feels awkward, check the simplest probable causes first, for example unequal tyre pressures, loose cap nuts, bent crosstube or lack of lubrication. If these checks do not reveal the problem, have the problem diagnosed and corrected by an authorised Kenworth dealer.

While operating the vehicle, the driver should avoid deep ruts or obstructions which cause a binding condition on front wheels. If the front wheels are in a rut or against a curb, the vehicle should be driven out under its own power, rather than lifted out by turning the wheels while the vehicle is stopped.

UNDERSTEER AND OVERSTEER

Are vehicle dynamics terms used to describe the sensitivity of a vehicle to steering. Simply put, oversteer is what occurs when a vehicle turns (steers) by more than (over) the amount commanded by the driver. Conversely, understeer is what occurs when a vehicle steers less than, or 'under' the amount commanded by the driver.



AXLE STOPS

Your vehicle is equipped with power steering, have an authorised Kenworth dealer make axle stop adjustments. The power steering pressure relief valves must be adjusted in conjunction with the axle stops to prevent damage to the steering gear.

After front axle alignment, it is recommended that axle stops and steering gear poppets are checked for proper relief on turns.

HYDRAULIC POWER STEERING

FILTER SERVICE AND PARTS - RESERVOIR ASSEMBLY

The original filter element should be replaced after a maximum of 50 hours of operation. Thereafter, the element and cover gasket should be replaced after every 40,000km (1,000 hours of operation), or more often, depending upon operating conditions.



When replacing an element, drain the reservoir and clean the screen at the bottom of the reservoir.

STEERING DRIVELINE

The following are common torque specifications for most steering drivelines:

- U-joint pinch bolt and $\frac{7}{16}$ " locknut, lubricated, torque to 37 to 43lbft.
- Pitman arm clamp bolt and $\frac{3}{4}$ " nut, phosphate and lightly oiled, torque to 230 to 290lbft.
- For off-highway vehicles, tighten the U-bolts after the first day or two of operation. Then check weekly.

For your particular driveline, see the electronic Customised Kenworth Maintenance Manual.

DRIVESHAFT

Greasable slip joints and universal joints of the drive shaft should be lubricated periodically.

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

For towing guidelines and returning a towed vehicle to service see page 163.

U-JOINTS

The slip joints and universal joints of the drive shaft should be lubricated according to Recommended Maintenance Schedules, pages 315-342.

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



Improper lubrication of U-joints can cause them to fail prematurely. The driveshaft could separate from the vehicle and result in an injury accident and/or vehicle damage. 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.

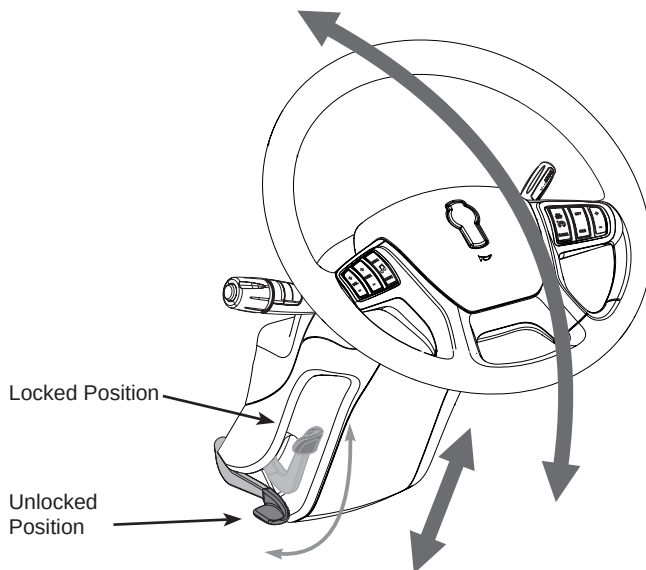


ADJUSTABLE STEERING COLUMN



Never adjust your steering column when the vehicle is in motion. Loss of steering may cause an accident.

The steering column is fully adjustable, height and tilt are both controlled by the easy access lever on the lower left hand side of the column housing.



Height and Tilt Adjustment:

- Push down on the lever on left side of steering column.
- Adjust column tilt angle fore and aft when holding lever.
- Adjust column height by pushing down or pulling up at the same time
- Raise lever to its fully locked position assuring proper locking.



Use of excessive force to lock may create difficulties with further adjustments.

FRONT AXLE AND SUSPENSION

AXLE LUBRICATION

- Change bearing lubrication when seats are replaced, or brakes are relined. See Recommended Maintenance Schedules, pages 315-342.
- 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 Recommended Maintenance Schedules, page 315-342. Lack of lubrication causes premature wear and hard steering. Lubrication schedule may be shortened if necessary.



The grease fitting for the front drive pins faces inboard to prevent interference with the drag link.

SUSPENSION LUBRICATION

Each standard spring anchor pin has a grease fitting. Pressure lubricate spring pins as specified. See Recommended Maintenance Schedules, page 315-342:

- At regular service intervals, the spring leaves may be lubricated with 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.



Do not spray the suspension with chemical products or mineral oil. It can cause damage to the bushings.

VISUAL INSPECTION

- For all vehicles mandatory maintenance procedures include re-tightening 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, including 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. See the Electronic Customised Maintenance Manual for further information on servicing the front suspension.

U-BOLT TENSION FOR FRONT AND REAR AXLES

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

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 tyre wear.

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 tyre wear and poor alignment.

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 authorised Kenworth dealer.

For on-highway vehicles, tighten U-bolts after the first service (10,000km), and then every 40,000km thereafter. For off-highway vehicles, tighten U-bolts after the first day or two of operation, then check weekly. Re-torque the front spring pinch bolts and shackle pinch bolts. See the Electronic Customised Maintenance Manual for torque values.

Tighten U-bolt nuts to the specified torque value with the vehicle loaded to its normal gross weight.

The torque values below apply to U-bolts and nuts with clean threads lubricated with Chevron zinc lubricant SAE 20 or 30 oil.



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 injury or accident. Loose U-bolts can also cause uneven tyre wear and poor alignment.



Torque all fasteners on the nut end. For off-highway vehicles, tighten the U-bolts after the first day or two of operation. Then check weekly. Load the vehicle to its normal gross weight before tightening U-bolts. Loading the vehicle ensures proper adjustment of the U-bolt and spring assembly. 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.



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.

Never re-use a self-locking nut.

Spring Suspension U-Bolts Grade 8

U-BOLT Size Diameter (Inch Dimensions)	Torque	
	ft.lb.	Nm
3/4" UNF Dry	284-340	386-461
3/4" UNF Lubricated	245-300	333-408
7/8" UNF Lubricated	440-540	598-734
1" UNF Lubricated	680-780	925-1060

WHEEL ALIGNMENT

FRONT WHEEL ALIGNMENT

For driving safety and comfort and to prolong the life of your vehicle, it is important to have wheels correctly aligned. Check tyre wear frequently. Uneven tyre wear is a sign the wheels may be misaligned. If you see uneven wear, take your vehicle to a service centre familiar with aligning wheels on Kenworth vehicles. Consult the table below for alignment specifications for each type of axle.

Camber - Camber figures shown are at unladen chassis weight.

Front Wheel Alignment Kenworth Australia – Specifications

Axle Model	Caster (Degrees Positive)	Camber	Toe-in
	All Models	All Models	All Models
MFS66-122 MFS 73 E-1462 I	$3.5^{\circ} \pm 1^{\circ}$	Left $-1\frac{1}{4}^{\circ} \pm 3\frac{3}{8}^{\circ}$ Right $+1^{\circ} \pm 3\frac{3}{8}^{\circ}$	0 - +1.5 mm/m

WHEEL BEARING ADJUSTMENT

For safe, reliable operation and adequate service life, wheel bearings must be checked and properly adjusted. Your authorised Kenworth dealer is best equipped to do this.

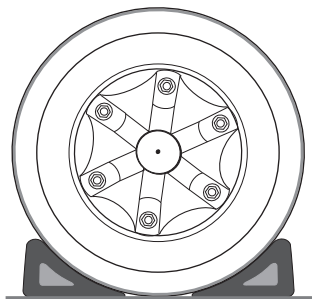
REAR AXLE AND SUSPENSION

GENERAL MAINTENANCE

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.



Do not work on the vehicle without the parking brake set and wheels chocked securely, using rubber wheel chocks against the front and rear surfaces of the tyres. Be sure the vehicle cannot move. If the vehicle is not secured to prevent uncontrolled vehicle movement, it could roll and cause serious personal injury or damage to the vehicle.



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 tyre wear. (See the Fastener Torque Tables pages 284 for proper torque specifications.)

REAR SUSPENSION FASTENERS

To maintain the performance of the air suspension, check fastener torque values after the first 10,000km of service and every 40,000km thereafter.

Torque recommendations apply to fasteners supplied and installed by Kenworth. The values listed in the tables on pages 290 are for cadmium-plated or phosphate and oil fasteners only. See the Kenworth Maintenance Manual for complete details on Suspension Maintenance.

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 authorised technician.

VISUAL INSPECTION

For all vehicles, mandatory maintenance procedures include re-tightening of U-bolts and complete inspection. However, even with proper maintenance, many factors affect the service life of springs and suspension components, for example 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. 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 Kenworth.

After the first 1,000km of operation, inspect the suspension periodically, as noted below:

- Visually check for loose or missing fasteners, cracks in hanger or axle connection brackets.
- Check springs are centred 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.



Failure to follow these recommendations could void warranty. See the Kenworth Maintenance Manual for further information on servicing the rear suspension.

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.

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

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

DANA REAR AXLE

 Petroleum-based lubricants must be drained within the first 10,000km if converting to an approved synthetic lubricant.

For recommended types and brands of lubricants, contact your Kenworth dealer or authorised service centre. See the Kenworth Maintenance Manual and the axle manufacturer's Service Manual for further information on servicing drive axles.

Initial Change - See Recommended Maintenance Schedules (pages 315 - 342), for standard rear axle service schedules. Change mineral-based lubricant in other Dana axle assemblies (new or rebuilt) within the first 10,000km.

For petroleum-based axles, use lubricants meeting MIL-L-2105-C/D grade specifications or approved synthetic lubrication. Do not use oil additives.

All Vehicles with Dana Axles - See TRSM 0670 service manual in the electronic Customised Maintenance Manual. Contact your Kenworth dealer or authorised service centre for approved synthetic lubricant brands.

MERITOR REAR AXLE

See Meritor Lubrication Maintenance Manual (MM1) in the electronic Customised Maintenance Manual.

On-Off Highway - Check every 250 hours of operation.

Change every 2,500 hours of operation thereafter or yearly whichever occurs first.

AXLE HOUSING BREATHER VENT (ALL AXLES)

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

REAR AXLE ALIGNMENT

Continual road shock and load stresses may force the rear axles out of alignment. If you detect rapid tyre wear on the rear axles, you may have misaligned axles. If you suspect rapid tyre wear, have your rear axle alignment checked and adjusted by an authorised Kenworth dealer. In addition to pre-delivery inspections, suspension alignment should be checked when any one of the following conditions exist:

- Loose suspension fasteners (loose is defined as any torque below the recommended torque value).
- Elongated holes in a suspension component.
- Bushing replacement.
- Excessive or abnormal tyre wear.

Rear Axle Alignment Kenworth Australia - Specifications SINGLE - REAR AXLE

Item	Specification
Toe	0 ± 3mm/m
Off Track	0 + 2mm/m (to the left)

TANDEM - REAR AXLE

Item	Specification
Toe	0 ± 3mm/m
Off Track (Forward Rear)	0 - 2mm/m (to the right)
Off Track (Rear Rear)	0 + 2mm/m (to the left)
Out of Parallel - Maximum	1.5mm/m

TRIDEM - REAR AXLE

Item	Specification
Toe	0 ± 3mm/m
Off Track (Forward Rear)	0 - 2mm/m (to the left)
Off Track (Centre Rear)	0 ± 1mm/m
Off Track (Rear Rear)	0 + 2mm/m (to the left)
Out of Parallel - Maximum	1.5mm/m

REAR SUSPENSION ALIGNMENT

Check and adjust as necessary (refer to Maintenance Manual for your specific suspension).

These torque limits are valid **ONLY** when the U-Bolt and nut threads are clean and have been lubricated with an SAE 20 or SAE 30 oil.

Never re-use a self-locking nut.

TORQUE REQUIREMENTS FRAME FASTENERS		
Bolt Size Imperial	Grade 8 Nylon Insert Nuts	
	Nm	ft. lb.
$\frac{3}{8}$ "	41-54	30-40
$\frac{7}{16}$ "	75-88	55-65
$\frac{1}{2}$ "	109-122	80-90
$\frac{9}{16}$ "	156-190	115-140
$\frac{5}{8}$ "	224-265	165-195
$\frac{3}{4}$ "	394-462	290-340
$\frac{7}{8}$ "	517-626	380-460
1"	925-1129	700-830
$1\frac{1}{8}$ "	1346-1591	990-1170
$1\frac{1}{4}$ "	1822-2217	1380-1630



NOISE CONTROL SYSTEM

Kenworth Trucks warrants to the first owner who purchases this vehicle (for purpose other than resale) and to each subsequent purchaser that this vehicle, as manufactured by Kenworth Trucks, was designed, built and equipped to conform, at the time it left Kenworth's control, with all applicable Australian Design Rules and Noise Control Regulations.

The warranty covers this vehicle as designed, built and equipped by Kenworth, and is not limited to any particular part, component or system of the vehicle manufactured by Kenworth. Defects in design, assembly or in any part, component or system of the vehicle manufactured by Kenworth, which at the time it left Kenworth's control caused noise emissions to exceed Australian Design Rules or the Noise Control Regulations are covered by this warranty.

TAMPERING WITH NOISE CONTROL SYSTEM IS PROHIBITED

Australian Design Rules prohibit the following acts or the causing thereof:

1. The removal or rendering inoperative by any person other than for 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 operation 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 following:

Air Intake System

Removing or rendering inoperative the air cleaner or intake piping.

Engine Cooling System

Removing or rendering inoperative the fan clutch.

Removing fan shroud.

Engine

Removing or rendering engine speed governor inoperative so as to allow engine speed to exceed manufacturer's specifications.

Exhaust System

Removing or rendering inoperative the exhaust system components.

The exhaust system is part of the noise control system. Periodically check the exhaust for wear and loose or missing parts.

Inner Fender Shields and Cab Skirts

Removing shields or skirts.

Cutting away parts of shields, skirts or damaged or loose portions of shields or skirts.

Noise-insulation 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.

AIR SYSTEM SILENCERS

Certain air components in the vehicle's Braking System are fitted with silencers. These silencers need to be inspected on a regular basis, with particular attention being paid to the Air Dryer Purge Tank (if fitted). This can block internally, due to the air supply coming from the engine intake side.

As a routine check it is good practice to apply heavy braking, when stationary, at the start of the day when the truck has warmed up and before entering public roads. This action will ensure higher exhausting pressure.

Road trains and vehicles driving on unmade roads and dusty conditions, need to check and clean the silencers more frequently.

Do not remove these silencers from the system, they can only be removed for cleaning or replacement.

To clean the silencers, use a warm soapy solution, or soak in kerosene or similar product, blowing dry using a low pressure compressed air nozzle. Care must be taken when using compressed air.

INSPECTION AND MAINTENANCE

Use the following procedures to check the Noise Control System for sources of noise or deterioration that results in noise. Preventive maintenance and repair information is supplied.

Wherever other systems are involved, such as electrical or cooling, reference is made to the applicable sections for more specific information.

Exhaust System



Check for exhaust leaks and condition of gaskets. Replace any blown gaskets.

Check all cap-screws using a torque wrench, 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.

Piping

Check exhaust piping for rust, corrosion and damage. Replace deteriorated piping before holes appear. If piping is perforated at any point, temporary patching or lagging is acceptable until permanent repairs can be made.



On turbocharged engines, check joints at flanges and mounting brackets for tightness.

Mufflers

Check muffler clamps and mounting brackets for security. Check internal baffling for security. This can be accomplished by listening for rattling sounds while tapping the muffler with a rubber mallet or by revving the engine up and down through its normal operating range.

Do not replace a damaged muffler with a non-genuine part, as it may affect engine back pressure and/or noise levels, thus exceeding ADR limits.

Exhaust Extension

Check for security of mounting. The opening at the top of the tail pipe must be facing the rear of the vehicle. Do not modify the end of the exhaust extension in any way.

Engine-mounted Noise Insulators

Depending on the method of attaching noise insulators on engine and around oil pan (bolts, snap fasteners or straps), check for condition and security. Tighten loose fasteners and repair or replace any worn or damaged fasteners.

Check insulators around fasteners and stress points, particularly where they may be affected by engine vibration. Repair any cracked or damaged mounting points with suitable reinforcing plates to ensure the insulators will remain in position.

Air Intake System

All the maintenance procedures listed under Engine Air Intake System and Air Cleaner in this manual are applicable.

Check the induction tubing, elbow connections, clamps, brackets and fasteners for deterioration, cracks and security. If an air leak exists anywhere between the air cleaner and the engine, it should be repaired immediately. This condition not only causes excessive noise, it can result in serious damage to the engine.

Engine Fan and Shroud



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 seriously 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 blades.

Check the fan assembly mounting bolts for tightness. Inspect the blades for damage. The blade assembly should be replaced if damaged.

Check clutch operation by starting the engine when it is cold, then idling it at about 800rpm. Check that the fan remains disengaged while the engine is warming up. When the fan clutch does engage, note the reading on the vehicle's panel-mounted coolant temperature gauge. If the fan clutch engages at low engine temperatures or cycles ON and OFF more frequently than it should (i.e. receives 'false signals'), have the problem repaired at an authorised Kenworth dealer.

Transmission and Driveline

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

Hood Insulation Blanket

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

Check for chafing, tears etc. Patch if necessary. Determine cause of damage. If any component or accessory is causing wear or damage and can't be relocated, place reinforcing pads on the blanket at the wear spots.

Inner Fender Shields and Cab Skirts

Check all fasteners for security, particularly the self-tapping hex-head screws. Remove and replace any loose rivets.

Check shields and skirts for cracks of mounting stress points. Check fender shields for tyre marks, worn spots or damage from objects thrown from tyre treads. Cracked or damaged fibreglass fender shields can be repaired with fibreglass and resin.

If damage is found at a fastening point, additional strength can be gained by using a suitable reinforcing plate, drilled to accept a rivet and laminating it to the shield with fibreglass and resin. Cab skins, sills and brackets should be checked for overall condition, and repaired as necessary. This work can be accomplished at an authorised Kenworth dealership.



Damaged rubber fender shields or cab skirting must be replaced.

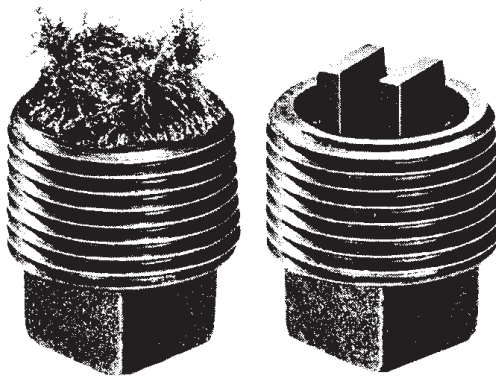
MAGNETIC DRAIN PLUGS

Engines, Gear Boxes and Differentials that have metal on metal contact create friction wear as the metal surfaces wear, giving off a fine greyish metal dust that contaminates the oil. All the contaminants cannot be removed by the oil filter alone, an oil filter is only capable of catching particles over 35 microns as these particles are extremely fine

Magnetic drain plugs on Engines, Gear Boxes and Differentials perform the vital function of trapping the small metallic particles that circulate in the lubricant.

These abrasive particles can cause rapid wear and premature failure of engine components, gears and bearings. The oil drain plug is a good place to catch these particles and should be cleaned off every time an oil change is performed. The magnets can lose their effectiveness as material collects on the poles and 'shorts' the magnetic field. Check the effectiveness of your drain plugs, and change plugs before this occurs.

It may be necessary to change plugs one or more times between complete lubrication intervals, particularly during the initial break-in period. We recommend that spare plugs be kept on hand for replacement. Replacement plugs are listed in the Dealer Master Parts Catalogue.



Removed for
Inspection & cleaning

Ready for
Installation

To facilitate the cleaning of a magnetic drain plug, a piece of key stock, or any other convenient steel slug, may be used to 'short' the magnetic field.

TORQUE SPECIFICATIONS

GRADE 5 FASTENERS

The table below shows torques for assemblies of Grade 5, cadmium-plated, nylon insert nuts; plain cadmium-plated Grade 5 bolts or studs (with cadmium or zinc/chromate plated hardened washers).

SAE GRADE 5 FASTENERS – NON LUBRICATED			
FASTENER		TORQUE	
Size	Thread	N.m.	ft.lb
1/4"	28 UNF	12-14	9-10
	20 UNC	9-11	7-8
5/16"	24 UNF	24-26	18-19
	18 UNC	22-23	16-17
3/8"	24 UNF	45-47	33-35
	16 UNC	38-41	28-30
7/16"	20 UNF	68-75	50-55
	14 UNC	61-68	45-50
1/2"	20 UNF	115-122	85-90
	13 UNC	95-102	70-75

GRADE 8 FASTENERS

The table below shows torques for assemblies of Grade 8, cadmium-plated, nylon insert nuts; plain cadmium-plated Grade 8 bolts or studs (lightly lubricated; with cadmium or zinc/chromate-plated hardened washers).

SAE GRADE 8 FASTENER TORQUE REQUIREMENTS		
FASTENER SIZE	TORQUE	
	N.m.	ft.lb
$\frac{5}{16}$ "	22-30	16-22
$\frac{3}{8}$ "	41-54	30-40
$\frac{7}{16}$ "	75-88	55-65
$\frac{1}{2}$ "	109-122	80-90
$\frac{9}{16}$ "	156-190	115-140
$\frac{5}{8}$ "	224-265	165-195
$\frac{3}{4}$ "	394-462	290-340
$\frac{7}{8}$ "	517-626	380-460
1"	952-1129	700-830
1 - $\frac{1}{8}$ "	1346-1591	990-1170
1 - $\frac{1}{4}$ "	1877-2217	1380-1630

 The torque values apply to both UNF and UNC threads of corresponding diameters.

CUSTOMER INFORMATION AND VEHICLE IDENTIFICATION

Each vehicle manufactured by Kenworth Trucks Australia will have a certification label fixed to the cab as required by Australian Motor Vehicle Certification.



The compliance plate is located inside the driver's side door frame below the latch mechanism.



The vehicle identification placard is located inside the passenger's side door rebate below the latch mechanism. See next page for detailed view.

KENWORTH
 A DIVISION OF PACCAR AUSTRALIA PTY. LTD.

TRUCK MODEL

VIN

FRONT AXLE ASSY RATING

REAR AXLE ASSY RATING

GROSS VEHICLE MASS
 k.g.

GROSS COMBINATION MASS
 k.g.

APPLICATION APPROVED GCM
 k.g.

APPROVED FOR

DATE OF MANUFACTURE

(ALL INFORMATION VALID AT TIME OF MANUFACTURE)
CAUTION
 OVERLOADING OR OVERSPEEDING
 WILL VOID YOUR WARRANTY.

P53-1267

Vehicle Identification Placard

KENWORTH
 A DIVISION OF PACCAR AUSTRALIA PTY. LTD.

TRUCK MODEL

FRONT AXLE ASSY RATING

ROAD TRAINS OR B-DOUBLE
 DENOTES SUITABILITY OF THIS
 VEHICLE TO OPERATE AS ROAD-
 TRAIN AND/OR B-DOUBLE

VIN

REAR AXLE ASSY RATING

GROSS VEHICLE MASS
 K.g.

GROSS COMBINATION MASS
 K.g.

(ALL INFORMATION VALID AT TIME OF MANUFACTURE)
CAUTION
 OVERLOADING OR OVERSPEEDING
 WILL VOID YOUR WARRANTY.

K281-4450-1

A Vehicle Identification Number (VIN) or chassis number is stamped on the top flange of the right hand side chassis rail (all models), approximately one metre from the front of the rail, in the vicinity of the turbo.



VEHICLE IDENTIFICATION NUMBER (VIN)

All trucks are required to have a unique identifying number.

ADR43/01, effective 1 January 1989, requires that the format of the VIN comply with ISO standards.

These vary slightly from US SAE standards with regard to year codes.

WMI

AAA +

A- Alpha character

VDS

AAAAAA +

NNN +

N-Numeric character

VIS

AANNNNNN

NNNNNNN + NNNN

WMI (World Manufacturer Index)

A A A

A A A

| | |

| |

|

Manufacturer, e.g. Kenworth

Country, e.g. Australia

Geographic Region, e.g. Oceania

VDS (Vehicle Descriptor Section)

AAAAAA

NNNNNN

Use of VDS is optional, but generally it is used to describe manufacturer specified vehicle attributes.

VIS (Vehicle Indicator Section)

AANNNNNN

NNNN

| |

|

Year of Manufacture/Model Year (I,O,Q,Z not used)

Manufacturer's Plant

eg 6F5000000FA400000

Kenworth/Australia/Oceania/Nil Data/2015/Bayswater Plant/Unit
Number 400000

SERIAL NUMBERS AND CAPACITIES

VIN / Chassis No: **V** - **I** - **N** / **CHASSIS**

Air comp: Serial No:

Unit Trans. Model:

Unit Trans. Serial No:

Aux. Trans. Model:

Aux. Trans. Serial No:

Rear Suspension:

Rear Axle Model: Ratio:

Fwd. Rear Axle Serial No:

Fwd. Carrier Serial No:

Centre Rear Axle Serial No:

Centre Carrier Serial No:

Rear Rear Axle Serial No:

Rear Carrier Serial No:

Rear Axle Capacity: Fwd: Rear:

Electrical System 12 Volt, Negative Ground:

Total Fuel Capacity: Litres

Engine Crankcase Capacity: Litres

Radiator Coolant Capacity: Litres

Transmission Capacity: Unit: Litres. Aux: Litres

Rear Axle Capacity:

Wheel Size: Front: Rear:

Fan Belt Part No:

Alternator Belt Part No:

Airconditioner Pump Belt Part No:

AUSTRALIA WIDE ROADSIDE ASSISTANCE

For Australian Kenworth or DAF owners, if you need Australia wide [roadside assistance](#) simply call **1800 4 PACCAR** (1800 472 222). Trained operators are available 24-7 to connect you with your nearest PACCAR dealer for support.

1800 4 PACCAR

Have your chassis serial number ready when calling this service. Your chassis number should be recorded inside the front cover of this Driver's Handbook.

Insert the last 5 digits from your VIN number,
this is your individual Chassis Number.

4					
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ROADSIDE ASSISTANCE 1800 4 PACCAR

SECTION THREE MAINTENANCE & LUBRICATION SCHEDULES

THE ENVIRONMENT

Pollution forms a serious threat to the environment. In order to keep pollution to a minimum, you are recommended to take the following measures:

- Never discharge used oil, hydraulic fluids, or coolants via drains, sewers or onto the soil. Such practices are not only illegal, but also contribute considerably to environmental pollution.
- Used oils, coolants and hydraulic fluids should be returned to the appointed organisation, for re-use. Ensure all used liquids are separated.
- Ensure your vehicle is regularly maintained. A correctly maintained vehicle contributes to maximum fuel saving and reduces pollutant exhaust gases.

Tear along perforation

CHANGE OF ADDRESS/OWNERSHIP

Please assist Kenworth Trucks to keep vehicle records up to date. If you change any of your details (i.e. trading name or address) or subsequently sell this vehicle, please complete and return this form to the address on the reverse. This notification is important even after the original vehicle warranty in case Kenworth need to contact you.

NOTICE OF NAME/ADDRESS OWNERSHIP DETAILS

Name/Address Change New Owner: Date Ownership Changed: (Delete not applicable)

Business Name:

ABN:

Title Mr/Mrs/Ms: Owner's Name

Address: Town:

State: Postcode:

Phone No: VIN (Product Serial No):

Tear along perforation

Delivery Address:
64 Canterbury Road
BAYSWATER VIC 3153



Attention: Customer Service
Kenworth Trucks
Reply Paid 64847
BAYSWATER VIC 3153

No stamp required
if posted in Australia



INTRODUCTION

This Service Section is provided to help keep your vehicle operating at optimum performance. It should be used with the Operating Instructions and Preventive Maintenance Sections of this handbook, and in conjunction with your Electronic Customised Maintenance Manual supplied with your vehicle. The service schedules specified are for all models of Kenworth trucks in operation throughout Australia, New Zealand and Papua New Guinea.

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CHANGE OF ADDRESS/OWNERSHIP

To assist Kenworth Trucks to keep vehicle records up to date. If you change any of your details (i.e. trading name or address) or subsequently sell this vehicle, please complete and return the pre-paid card provided opposite page to the reply paid address on the reverse. This notification is important even after expiration of the original vehicle warranty in case Kenworth need to contact you.

WARRANTY QUESTIONS

This section will assist you to understand the terms of the warranty provided with your new vehicle. The following are some of the more frequently asked questions:

1. **Q. Where are authorised Kenworth Trucks dealers located?**
 - A. Authorised Kenworth Trucks/PACCAR Parts dealers are located throughout Australia, New Zealand and Papua New Guinea. Visit www.kenworth.com.au for your nearest location.
2. **Q. What parts are covered under Kenworth Trucks warranty?**
 - A. Any part, other than engines manufactured by, and for PACCAR fitted to your vehicle at the Kenworth factory is covered by warranty. This includes all original equipment supplied by manufacturers including Eaton, Meritor, Dana.
3. **Q. How do I go about obtaining warranty service?**
 - A. It is the responsibility of the selling Kenworth dealer to provide warranty service. You can therefore take your vehicle to that Dealer whenever service is required. However, if it is not possible for you to take your vehicle to the selling dealer you may take your vehicle to any other authorised Kenworth dealer. The owner and vehicle identification details recorded on the inside front cover of this handbook are required by the authorised Kenworth servicing dealer in connection with the provision of warranty service. Therefore, you should present this handbook to the authorised Kenworth service dealer whenever you request warranty service.

 Labour for the 10,000 kilometre/First Service is a free service (see Question 10, page 312 & Service Inspection Records page 345) and should be carried out by an authorised Kenworth service dealer.

4. **Q. What should I do if emergency warranty service is required, and an authorised Kenworth service dealer is not available?**
 - A. If, in an emergency, a repair, replacement or adjustment covered by the New Vehicle Warranty is required to enable your vehicle to be operated safely, and it is not practicable for you to have that service performed by an authorised Kenworth service dealer, the service, but only to the extent that it is necessary to enable your vehicle to be operated safely, may be performed by any other qualified service technician or repairer.

A warranty claim for the reasonable cost of such service may be made through your authorised Kenworth service dealer. When such emergency service has been performed by someone other than an authorised Kenworth service dealer, you should take your vehicle to an authorised Kenworth dealer for inspection and/or the completion of any required warranty service as soon as possible.

5. **Q. What should I do if my vehicle becomes unsafe or inoperative as a result of a defect which is covered by the New Vehicle Warranty?**
 - A. If, as a result of a defect which is covered by the New Vehicle Warranty, your vehicle cannot be driven or is unsafe to drive, you should contact the nearest authorised Kenworth service dealer as soon as possible, and arrange for that dealer to carry out the required warranty service.
6. **Q. Will I have to pay for any costs or expenses in connection with the provision of warranty service?**
 - A. All parts and labour used and supplied in carrying out warranty service at the premises of an authorised Kenworth servicing dealer are free of charge (except consumables such as oil and filters). Whenever warranty service is to be carried out by an authorised Kenworth service dealer, it is your responsibility to deliver your vehicle to the service dealer's premises. If, as a result of a defect which is covered by the New Vehicle Warranty, your vehicle cannot be safely driven, you may arrange for the nearest authorised Kenworth service dealer to carry out the required Warranty Service on site. Remember, if in doubt, call your authorised Kenworth dealer.
7. **Q. Is damage or injury, loss of time, inconvenience, commercial or other direct or indirect loss covered by the New Vehicle Warranty?**
 - A. No, these items are not covered. The New Vehicle Warranty covers only the repair, replacement or adjustment at the service dealer's premises of those parts of your vehicle which are found to be defective in materials or workmanship during the warranty period. No other types of claim for compensation of whatever nature will be recognised.

8. Q. Are my tyres covered by New Vehicle Warranty?

- A. The tyres fitted to your vehicle are covered by a separate warranty provided by the tyre manufacturer. Your authorised Kenworth service dealer will assist you by discussing any queries you may have with respect to the tyre with the tyre manufacturer's representatives.

9. Q. Are PACCAR/Kenworth Truck parts and accessories covered by warranties?

- A. If you purchase a PACCAR supplied part or accessory from an authorised Kenworth parts dealer, it will be warranted by that dealer under the PACCAR Parts warranty against defects in materials or workmanship for a period of 12 months from the date on which you purchased it. Where the part or accessory has been installed in a vehicle by an authorised Kenworth service dealer, the cost of labour will also be covered for a period of 12 months from the date of installation.

Warranty on parts fitted as part of a warranty repair expires 12 months from the vehicle's date in service.

10. Q. Will I have to pay maintenance costs during the warranty period?

- A. Maintenance costs, since they do not arise from defects in materials or workmanship, are not covered by the New Vehicle Warranty. However, labour for the scheduled 10,000 kilometre/ First Service specified in this handbook is free of charge (**except for any lubricants and filters used**), provided your vehicle has been operated under normal conditions, and no modification (other than a modification made by, or at, the direction of Kenworth) has been made to your vehicle which adversely affects the performance and/or compliance of your vehicle. The Maintenance Schedules in this handbook specify the minimum maintenance requirements for your vehicle operating under normal conditions.

If you operate under extreme conditions, your vehicle may require more frequent maintenance services. See your servicing dealer for advice on these matters.

The maintenance items, except where they are required as a result of defects in materials or workmanship, for which you will be required to pay, include:

- Engine tune-up (includes replacing injectors/injector nozzles).
- Replacement of all filters.
- Cleaning or flushing of fuel, AdBlue, cooling, engine, transmission, differential or power steering systems - after 10,000 kilometres.
- Adding to, or replacing, lubricants.
- Adjustments to drive belts, transmission, clutch, parking brake etc.
- Replacing wiper blade rubber elements.
- Wheel balancing after 10,000 kilometres.
- Wheel alignment (front and rear).
- De-dusting or de-glazing of brake linings or pads after 10,000 kilometres.
- Brake lining wear or damage.
- Battery recharging.
- Paint, bright metal finish and trim, due to normal deterioration.
- Door adjustments.
- Glass or channel adjustments after 90 days.
- Body rattles, squeaks and general tightening of bolts, fastenings and fittings after 90 days.
- Chipped glass or breakage.
- Torn or damaged floor mats or carpets.

KENWORTH DEALER NETWORK

Kenworth trucks are sold and supported by a national network of dealers. Each has been selected for their experience and commitment to supporting the truck industry. Each one is required to carry set levels of spare parts, and maintain a trained service facility. You can be assured that all Kenworth trucks are supported by Australia's most professional truck dealer network.

MAINTENANCE SERVICES ARE THE OWNER'S RESPONSIBILITY

It is the owner's responsibility to ensure that all scheduled maintenance services specified on the vouchers in this book are carried out at the recommended intervals. The owner should also retain evidence that these services have been performed. It is important to note that any claims made during the warranty period will not qualify under the terms of the New Vehicle Warranty if resulting from failure to carry out proper maintenance services. We therefore strongly recommend that your vehicle be serviced by an authorised Kenworth service dealer. These dealerships are equipped with facilities, trained personnel and Kenworth parts to service and maintain your vehicle to factory recommendations.

LUBRICATION SCHEDULES

SAE 15W-40, API CK-4 Lubricant may be used providing it meets specifications

Schedule service intervals more frequently for severe operational conditions.

Do not mix lubricants of different brands or types. If brand or type of lubricant is changed, the unit must be drained and flushed out prior to refill.

Do not mix coolants of different brands or types. If brand new coolant is used, or the type of coolant is changed, the cooling system must be drained and flushed prior to refill.

For special service requirements, consult your lubricant supplier. In all cases, the lubricant supplier assumes full responsibility for the performance of the product and for product and patent liability.

The Preventive Maintenance Program really starts with the daily checks that you perform. These checks are itemised in Section 1, in the Driver's Checklists on pages 12-17.

The service schedules starting on page 315 covers the periodic maintenance which must be performed on your vehicle. Service intervals are for normal on-highway operations.

For First Service details, refer to the Maintenance and Lubrication Schedule.

T410 - MX ENGINE SERVICE SCHEDULE

Maintenance Groups

- * Depending on the use to which the vehicle is put, the vehicle is placed in maintenance group I, II or III. PTO (ESC) hours must also be incorporated into schedule.
- * The following schedule states maximum service intervals only. More frequent servicing may be required depending on specific vehicle application.
- * Service schedule below is based on diesel fuel with a sulphur content < 50 ppm. For sulphur content ≥ 50 ppm, halve stated service intervals below.
- * If using Bio-Diesel greater than 7%, halve duration of servicing schedules.

See next page for Groups	Service Schedule		
	1st Service/A Service	B Service	C Service
Group I	"Every Fortnight ** Change transmission and rear axle oil at first service"	"Every 30,000 kms (Maximum) OR Every 250 hrs OR Every 6 Months (Which ever comes first)"	"Every 90,000 km (Maximum) OR Every 1500 hrs OR Yearly (Which ever comes first)"
Group II	"Every 10,000 kms (Maximum) OR Every Fortnight (Which ever comes first) ** Change transmission and rear axle oil at first service"	"Every 40,000 kms (Maximum) OR Every 500 hrs (Which ever comes first)"	"Every 90,000 km (Maximum) OR Every 1500 hrs OR Yearly (Which ever comes first)"
Group III	"Every 10,000 kms (Maximum) OR Every Fortnight (Which ever comes first) ** Change transmission and rear axle oil at first service "	"Every 70,000 kms (Maximum) OR Every 600 hrs (Which ever comes first)"	"Every 100,000 km (Maximum) OR 1800 hrs OR Yearly (Which ever comes first)"

Notes:

- ① At first service, transmissions below 2000 ftlb can be filled with either mineral or synthetic oil. Transmissions above 2000 ftlb AND Ultrashift transmissions MUST be filled with synthetic oil.
- ② Oil analysis is required to determine exact oil change interval which can vary depending on the application. Oil samples should be taken from the center of the transmission with oil at operating temperature using a suitable syringe. Samples must be taken every 'C' service.

Maintenance Group I Total fuel consumption < 1.66 kms / Ltr AND/OR Operation on building sites, in quarries, etc. AND/OR Operation on gravel roads AND/OR Traffic in dusty conditions AND/OR Sanitation department vehicles AND/OR With an annual mileage of up to 90,000 km Service Sequence: A (Every Fortnight), B, A (Every Fortnight), B, A (Every Fortnight), B, A (Every Fortnight), B, A (Every Fortnight), C (Repetative)		
Maintenance Group II Fuel consumption ≥ 1.66 km/Ltr and ≤ 2.2 km/Ltr Service Sequence: A,A,B,A,A,B,A,A,C (Repetative)	Maintenance Group III Fuel consumption > 2.2 km/Ltr Service Sequence: A,A,A,A,B,A,A,A,A,C (Repetative)	
Service Schedule cont...		
Transmission ①	Rear Axle	
"Mineral Oil: 90,000 km (Maximum) Synthetic Oil: ②④ *For Severe Duty, Refer OEM Literature "	"Meritor Mineral Oil: 90,000 kms OR Yearly (Maximum) Synthetic Oil: ③ 150,000 kms OR Yearly (Maximum) (Which ever comes first)"	"Dana ** Use only Dana approved oils ③④ 250,000 kms OR 3 Years (Maximum) (Which ever comes first)"
"Mineral Oil: 90,000 km (Maximum) Synthetic Oil: ②④ 360,000 km (Maximum) "	"Meritor Mineral Oil: 120,000 kms (Maximum) OR Yearly (Which ever comes first) Synthetic Oil: ③ 360,000 kms (Maximum) OR 3 Years (Which ever comes first)"	"Dana ** Use only Dana approved oils ③④ 250,000 kms OR 3 Years (Maximum) (Which ever comes first)"
"Mineral Oil: 100,000 km (Maximum) Synthetic Oil: ②④ 400,000 km (Maximum) "	"Meritor Mineral Oil: 150,000 kms (Maximum) OR Yearly (Which ever comes first) Synthetic Oil: ③ 400,000 kms (Maximum) OR 3 Years (Which ever comes first)"	"Dana ** Use only Dana approved oils ③④ 250,000 kms OR 3 Years (Maximum) (Which ever comes first)"
Notes continued...		
③ Oil analysis is required to determine exact oil change interval which can vary depending on the application. Oil samples should be taken from the center of the axle with oil at operating temperature using a suitable syringe. Samples must be taken every 'C' service. Dana rear axles use synthetic oil only.		
④ Transmissions above 2,000 ftlb, Ultrashift transmissions and Dana rear axles must use synthetic oil from first service.		

LUBRICATION SCHEDULE (T4 SERIES – MX ENGINE)

1st SERVICE

1	FULL SYSTEM DOWNLOAD: Download and archive log file recording all active/inactive fault codes and engine/EAS system statistics, ie. fuel burn figures, overspeeds, etc.
2	CHECK OIL LEVELS: Top up as necessary: Engine, transmission, rear carrier(s), power steering reservoir and oil lubricated wheel bearings.
3	BELTS AND PULLEYS: Check condition of belts.
4	AD-BLUE SYSTEM: Check for leaks – air and ad-blue.
5	EMERGENCY SHUT DOWN: Check operation of ISO switch, remote switches and rollover devices.
6	ENGINE COOLANT: Check for leaks. Check level and top up where necessary. Use only PACCAR Genuine ELC30 Coolant.
7	CLUTCH: Check and adjust where applicable. Lubricate release bearing sparingly.
8	TRANSMISSION: With Mineral oil – Check oil level. With Synthetic Oil – Drain mineral oil and fill with synthetic oil. Change oil filter.
9	STEERING SYSTEM: Check sector shaft, steering shaft u-joints, slip joint, pinch bolts, drag link and pitman arm, steering wheel free play and centralisation, steering gear mounting bolts, hoses and fittings, fluid level and operation.
10	FRONT SUSPENSION: Check and lubricate (where applicable) spring shackle and hanger brackets, spring pins, shackle pins and bushes, spring leaves, king pins, bushings, thrust bearings and spindles, u-bolt torque, steering and tierod arms/joints, steering stops and general inspection for wear.
11	REAR AXLES: Meritor: With Mineral Oil – Drain and refill with mineral oil. With Synthetic Oil – Drain and refill with synthetic oil. Change oil filter. Check wheel bearing freeplay and adjust where applicable. Dana: Drain and refill with synthetic oil. Change oil filter. Check wheel bearing freeplay and adjust where applicable.
12	DRIVELINES: Check and lubricate universal joints and slip joints. Ensure all 4 caps of each joint purge correctly.
13	CHASSIS: Grease all lube points. Check torque of chassis/frame fasteners, suspension to frame bolts, cab/sleeper mounting points, transmission mounting bolts, suspension u-bolts, torque rod mounting bolts and fuel tank mountings. Check routing of fuel, air and electrical. Check operation of air dryers, moisture ejectors and air tank check valves. Check hood alignment and clearance. Check and drain water from air and fuel tanks where applicable. Check and lubricate 5th wheel.
14	BRAKES – FRONT AND REAR: Check brake adjustment, wheel seals for leaks, operation of spring brakes, brake pedal free play and hoses and fittings. Lubricate camshafts and slack adjusters sparingly.



1st Service Continued...

15	WHEELS AND TYRES: Check torque of all wheel nuts. Check for missing valve caps and stem locks, cracked or loose wheel lugs (cleats) and tyre pressures.
16	CAB: Check glass for scratches, window mechanism operation and general interior condition/appearance. Check seat mounting and restraints for condition and tightness. Check cab and sleeper panels/joints. Check interior trim for condition. Check operation of wipers/washers, horns (air and electric), mirrors, all warning lights and gauges. Fill washers. Lubricate door locks, hinges, latches and striker plates sparingly., Check low air pressure warning devices
17	ROAD TEST: Check operation of steering gear shifting, service brakes, engine, throttle, air seat, HVAC, all exterior lights, speedo/odo, tacho/hourmeter, warning lights, instruments, gauges, instrument illumination and interior lights.

LUBRICATION SCHEDULE (T4 SERIES – MX ENGINE)	
A SERVICE	
1	FULL SYSTEM DOWNLOAD: Download and archive log file recording all active/inactive fault codes and engine/EAS system statistics, ie. fuel burn figures, overspeeds, etc.
2	CHECK OIL LEVELS: Top up as necessary: Engine, transmission, rear carrier(s), power steering reservoir and oil lubricated wheel bearings.
3	BELTS AND PULLEYS: Check condition of belts.
4	INTAKE AND EXHAUST SYSTEM: Check air filter for restriction. Check for leaks and damage. Check all hose clamps. Check 'clean' side of intake system for leaks. Check rubber elbows, hump hoses and clamps for integrity and tension. Check material integrity of intake pipes, including welds on fabricated parts, other sealing and mating surfaces as applicable and general pipe clearances to other components.
5	COMPRESSOR: Check hoses and pipes for condition and clearance
6	AD-BLUE SYSTEM: Check for leaks – air and ad-blue.
7	ELECTRICAL CONNECTIONS: Check integrity and mounting of electrical harnesses and connections
8	EMERGENCY SHUT DOWN: Check operation of ISO switch, remote switches and rollover devices.
9	COOLING SYSTEM: Check radiator, CAC and A/C condensor for fouling or damage. Pressure test cooling system and check for leaks. Check coolant level and top up where necessary. Use only PACCAR Genuine ELC30 Coolant
10	CLUTCH: Check and adjust where applicable. Lubricate release bearing sparingly.
11	TRANSMISSION: Check oil level.
12	STEERING SYSTEM: Check sector shaft, steering shaft u-joints, slip joint, pinch bolts, drag link and pitman arm, steering wheel free play and centralisation, steering gear mounting bolts, hoses and fittings, fluid level and operation.
13	FRONT SUSPENSION: Check and lubricate (where applicable) spring shackle and hanger brackets, spring pins, shackle pins and bushes, spring leaves, king pins, bushings, thrust bearings and spindles, u-bolt torque, steering and tierod arms/joints, steering stops and general inspection for wear.
14	REAR SUSPENSION: General inspection for wear.
15	REAR AXLES: Check oil level. Check wheel bearing freeplay and adjust where applicable.
16	DRIVELINES: Check and lubricate universal joints and slip joints. Ensure all 4 caps of each joint purge correctly.

A Service Continued...

17	CHASSIS: Grease all lube points. Check torque of chassis/frame fasteners, suspension to frame bolts, cab/sleeper mounting points, transmission mounting bolts, suspension u-bolts, torque rod mounting bolts and fuel tank mountings. Check routing of fuel, air and electrical. Check operation of air dryers, moisture ejectors and air tank check valves. Check hood alignment and clearance. Check and drain water from air and fuel tanks where applicable. Check and lubricate 5th wheel. Check all air valve silencers and clean/replace as necessary. Drain water from fuel/water separator if present.
18	BRAKES – FRONT AND REAR: Check brake adjustment, wheel seals for leaks, operation of spring brakes, brake pedal free play and hoses and fittings for leaks, condition and attachment/support. Lubricate camshafts and slack adjusters sparingly. Check drum condition. Check air pressure build up time and maximum pressure. Record maximum pressure and adjust governor if required. Check air pressure drop - service brakes applied and service brakes not applied.
19	WHEELS AND TYRES: Check torque of all wheel nuts. Check for missing valve caps and stem locks, cracked or loose wheel lugs (cleats) and tyre pressures. Check for uneven tyre wear.
20	CAB: Check glass for scratches, window mechanism operation and general interior condition/appearance. Check restraints for condition and tightness. Check cab and sleeper panels/joints. Check interior trim for condition. Check operation of wipers/washers, horns (air and electric), mirrors, all warning lights and gauges. Fill washers. Lubricate door locks, hinges, latches and striker plates sparingly., Check low air pressure warning devices. Clean HVAC fresh air filter.
21	ROAD TEST: Check operation of steering gear shifting, service brakes, engine, throttle, air seat, HVAC, all exterior lights, speedo/odo, tachometer, warning lights, instruments, gauges, instrument illumination and interior lights.

LUBRICATION SCHEDULE (T4 SERIES – MX ENGINE)	
B SERVICE	
1	FULL SYSTEM DOWNLOAD: Download and archive log file recording all active/inactive fault codes and engine/EAS system statistics, ie. fuel burn figures, overspeeds, etc.
2	ENGINE: Change engine oil and oil filters (including centrifugal filter). Change primary and secondary fuel filters. Check A/C compressor mounting for tightness. Check engine mounts - condition and torque.
3	CHECK OIL LEVELS: Top up as necessary: Engine, transmission, rear carrier(s), power steering reservoir and oil lubricated wheel bearings.
4	VALVE CLEARANCE ADJUSTMENT: Adjust valve clearances - 1st 'B' service only, then 1st, 2nd, 4th, 6th, 8th, 10th, etc. 'C' service.
5	COMPRESSOR: Check hoses and pipes for condition and clearance
6	BELTS AND PULLEYS: Check condition of belts.
7	INTAKE AND EXHAUST SYSTEM: Check air filter for restriction - change element if restriction indicator has popped. Check for leaks and damage. Check all hose clamps. Check 'clean' side of intake system for leaks. Check rubber elbows, hump hoses and clamps for integrity and tension. Check material integrity of intake pipes, including welds on fabricated parts, other sealing and mating surfaces as applicable and general pipe clearances to other components. Check mounting bolts for tightness.
8	AD-BLUE SYSTEM: Check for leaks – air and ad-blue.
9	EMERGENCY SHUT DOWN: Check operation of ISO switch, remote switches and rollover devices.
10	ELECTRICAL CONNECTIONS: Check integrity and mounting of electrical harnesses and connections.
11	STARTER MOTOR AND ALTERNATOR: Check operation and output. Remove and inspect alternator brushes. Check and record output voltage. Check battery electrolyte level. Check and tighten battery box and hold down bolts. Check wiring for routing and chaffing. Correct as necessary.
12	COOLING SYSTEM: Check radiator, CAC and A/C condensor for fouling or damage. Pressure test cooling system and check for leaks. Check coolant level and top up where necessary. Use only PACCAR Genuine ELC30 Check coolant concentration levels. Check tension of radiator mounting bolts and shroud clearances.
13	CLUTCH: Check and adjust where applicable. Lubricate release bearing sparingly. Check clutch brake operation and adjust if necessary
14	TRANSMISSION: Check oil level.
15	STEERING SYSTEM: Check sector shaft, steering shaft u-joints, slip joint, drive line pinch bolts (75-80 Nm lubricated), drag link and pitman arm, steering wheel free play and centralisation, steering gear mounting bolts, hoses and fittings, fluid level and operation. Check front wheel free play (.001 - .005") and adjust if necessary.

B Service Continued...

16	FRONT SUSPENSION: Check and lubricate (where applicable) spring shackle and hanger brackets, spring pins, shackle pins and bushes, spring leaves, king pins, bushings, thrust bearings and spindles, u-bolt torque, steering and tierod arms/joints, steering stops and general inspection for wear.
17	REAR SUSPENSION: General inspection for wear.
18	REAR AXLES: Check oil level. Check wheel bearing freeplay and adjust where applicable. Ensure axle housing breathers are clear.
19	DRIVELINES: Check and lubricate universal joints and slip joints. Ensure all 4 caps of each joint purge correctly. Check condition of centre bearing where fitted.
20	CHASSIS: Grease all lube points. Check torque of chassis/frame fasteners, suspension to frame bolts, cab/sleeper mounting points, transmission mounting bolts, suspension u-bolts, torque rod mounting bolts and fuel tank mountings. Check routing of fuel, air and electrical. Check operation of air dryers, moisture ejectors and air tank check valves. Check hood alignment and clearance. Check and drain water from air and fuel tanks where applicable. Check and lubricate 5th wheel. Check all air valve silencers and clean/replace as necessary. Drain water from fuel/water separator if present.
21	BRAKES – FRONT AND REAR: Check brake adjustment, wheel seals for leaks, operation of spring brakes, brake pedal free play and hoses and fittings for leaks, condition and attachment/support. Lubricate camshafts and slack adjusters sparingly. Check drum condition. Check air pressure build up time and maximum pressure. Record maximum pressure and adjust governor if required. Check air pressure drop - service brakes applied and service brakes not applied.
22	WHEELS AND TYRES: Check torque of all wheel nuts. Check for missing valve caps and stem locks, cracked or loose wheel lugs (cleats) and tyre pressures. Check for uneven tyre wear.
23	CAB: Check glass for scratches, window mechanism operation and general interior condition/appearance. Check seat mounting and restraints for condition and tightness. Check cab and sleeper panels/joints. Check interior trim for condition. Check operation of wipers/washers, horns (air and electric), mirrors, all warning lights and gauges. Fill washers. Lubricate door locks, hinges, latches and striker plates sparingly., Check low air pressure warning devices. Clean HVAC fresh air filter.
24	ROAD TEST: Check operation of steering gear shifting, service brakes, engine, throttle, air seat, HVAC, all exterior lights, speedo/odo, tacho/hourmeter, warning lights, instruments, gauges, instrument illumination and interior lights.

LUBRICATION SCHEDULE (T4 SERIES – MX ENGINE)

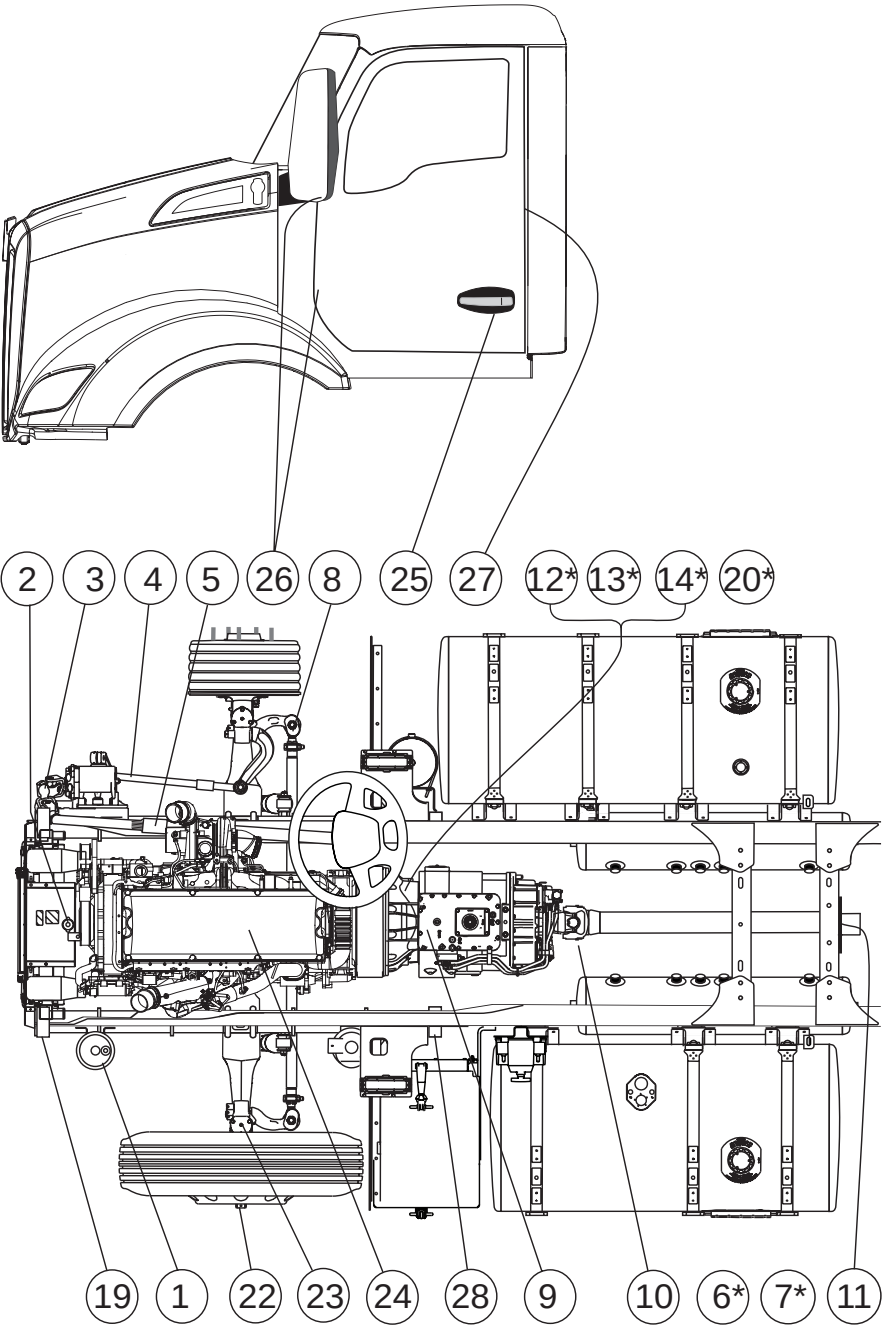
C SERVICE (Minimum 1 x Year)

1	FULL SYSTEM DOWNLOAD: Download and archive log file recording all active/inactive fault codes and engine/EAS system statistics, ie. fuel burn figures, overspeeds, etc.
2	ENGINE: Change engine oil and oil filters (including centrifugal filter). Change primary and secondary fuel filters. Check A/C compressor mounting for tightness. Check hose and pipe condition and clearance. Check engine mounts - condition and torque. Replace drive belts.
3	CHECK OIL LEVELS: Top up as necessary: Engine, transmission, rear carrier(s), power steering reservoir and oil lubricated wheel bearings.
4	VALVE CLEARANCE ADJUSTMENT: Adjust valve clearances - 1st 'B' service, then 1st, 2nd, 4th, 6th, 8th, 10th, etc. 'C' service.
5	COMPRESSOR: Check hoses and pipes for condition and clearance.
6	BELTS AND PULLEYS: Check condition of belts.
7	INTAKE AND EXHAUST SYSTEM: Change air filter element. Check for leaks and damage. Check all hose clamps. Check 'clean' side of intake system for leaks. Check rubber elbows, hump hoses and clamps for integrity and tension. Check material integrity of intake pipes, including welds on fabricated parts, other sealing and mating surfaces as applicable and general pipe clearances to other components. Check mounting bolts for tightness. Check exhaust system for leaks.
8	AD-BLUE SYSTEM: Check for leaks – air and ad-blue. Change 'in tank' filter and air filter.
9	EMERGENCY SHUT DOWN: Check operation of ISO switch, remote switches and rollover devices.
10	ELECTRICAL CONNECTIONS: Check integrity and mounting of electrical harnesses and connections.
11	STARTER MOTOR AND ALTERNATOR: Check operation and output. Remove and inspect alternator brushes and slip rings. Check and record output voltage. Check battery electrolyte level. Check and tighten battery box and hold down bolts. Check wiring for routing and chaffing. Correct as necessary.
12	COOLING SYSTEM: Check radiator, CAC and A/C condensor for fouling or damage. Pressure test cooling system and check for leaks. Check coolant level and top up where necessary. Use only PACCAR Genuine ELC30 Coolant. Check coolant concentration levels. Check tension of radiator mounting bolts and shroud clearances.
13	CLUTCH: Check and adjust where applicable. Lubricate release bearing sparingly. Check clutch brake operation and adjust if necessary.
14	TRANSMISSION: Mineral Oil: Change oil. Synthetic Oil: Check oil level. Change filter. Ensure vehicle on flat ground and using ServiceRanger 4 Re-calibrate grade sensor and conduct electronic clutch adjustment.
19	DRIVELINES: Check and lubricate universal joints and slip joints. Ensure all 4 caps of each joint purge correctly. Check condition of centre bearing where fitted.



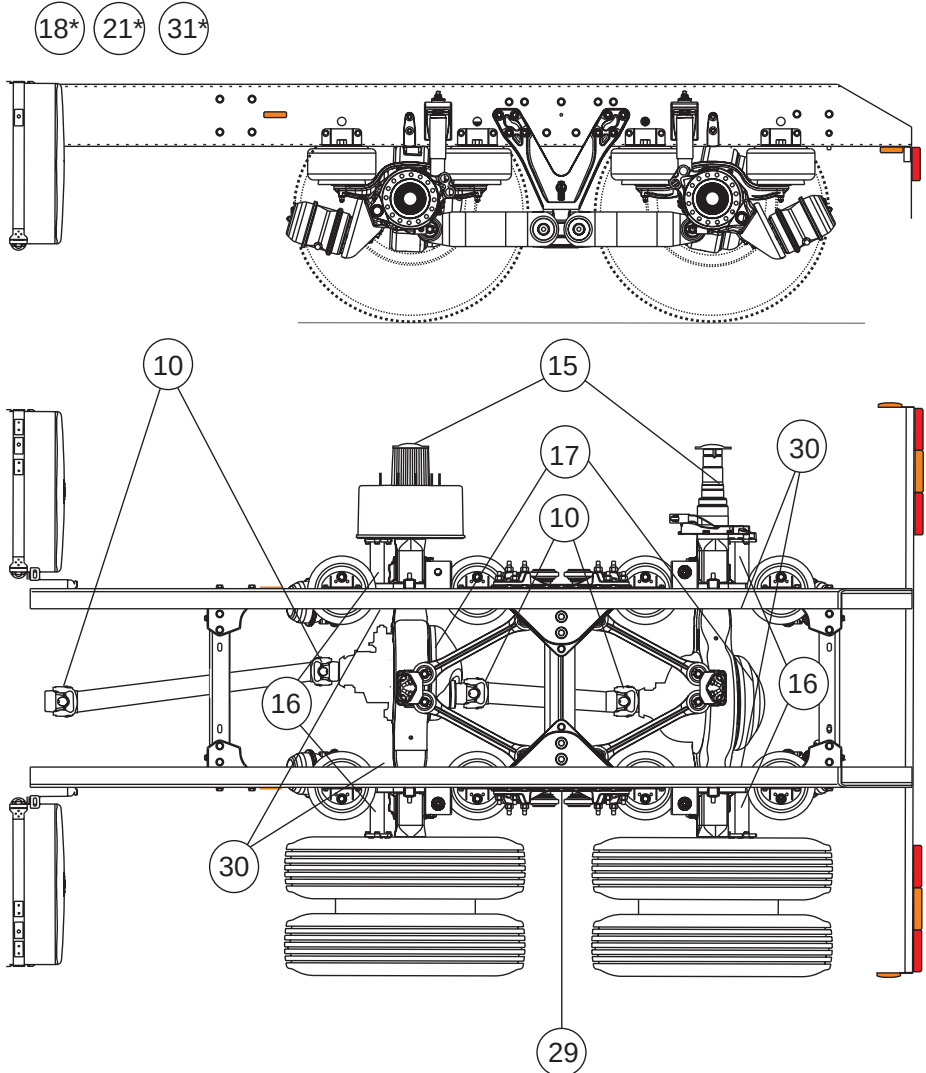
C Service Continued...

15	STEERING SYSTEM: Check sector shaft, steering shaft u-joints, slip joint, drive line pinch bolts (75-80 Nm lubricated), drag link and pitman arm, steering wheel free play and centralisation, steering gear mounting bolts, hoses and fittings, fluid level and operation. Check front wheel free play (.001 - .005") and adjust if necessary. Change reservoir filter.
16	FRONT SUSPENSION: Check and lubricate (where applicable) spring shackle and hanger brackets, spring pins, shackle pins and bushes, spring leaves, king pins, bushings, thrust bearings and spindles, u-bolt torque, steering and tierod arms/joints, steering stops and general inspection for wear. Change front wheel bearing oil. Check front end alignment dependant on tyre wear.
17	REAR SUSPENSION: General inspection for wear. Check rear axle alignment dependant on tyre wear."
18	REAR AXLES: Meritor: Mineral oil: Change oil / change oil filter. Synthetic oil: Check oil level / change oil filter. Dana: Synthetic Oil: Check oil level / change filter. Check wheel bearing freeplay and adjust where applicable. Ensure axle housing breathers are clear. Change rear axle hub oil.
20	CHASSIS: Grease all lube points. Check torque of chassis/frame fasteners, suspension to frame bolts, cab/sleeper mounting points, transmission mounting bolts, suspension u-bolts, torque rod mounting bolts and fuel tank mountings. Check routing of fuel, air and electrical. Check operation of air dryers, moisture ejectors and air tank check valves. Change air dryer filter(s). Check hood alignment and clearance. Check and drain water from air and fuel tanks where applicable. Check and lubricate 5th wheel. Check all air valve silencers and clean/replace as necessary. Drain water from fuel/water separator if present.
21	BRAKES – FRONT AND REAR: Check brake adjustment, wheel seals for leaks, operation of spring brakes, brake pedal free play and hoses and fittings for leaks, condition and attachment/support. Lubricate camshafts and slack adjusters sparingly. Check drum condition. Check air pressure build up time and maximum pressure. Record maximum pressure and adjust governor if required. Check air pressure drop - service brakes applied and service brakes not applied.
22	WHEELS AND TYRES: Check torque of all wheel nuts. Check for missing valve caps and stem locks, cracked or loose wheel lugs (cleats) and tyre pressures. Check for uneven tyre wear.
23	CAB: Check glass for scratches, window mechanism operation and general interior condition/appearance. Check seat mounting and restraints for condition and tightness. Check cab and sleeper panels/joints. Check interior trim for condition. Check operation of wipers/washers, horns (air and electric), mirrors, all warning lights and gauges. Fill washers. Lubricate door locks, hinges, latches and striker plates sparingly., Check low air pressure warning devices. Check operation of HVAC system and clean HVAC fresh air filter.
24	ROAD TEST: Check operation of steering gear shifting, service brakes, engine, throttle, air seat, HVAC, all exterior lights, speedo/odo, tacho/hourmeter, warning lights, instruments, gauges, instrument illumination and interior lights.



VEHICLE LUBRICATION POINTS

Legend on page 328.



VEHICLE LUBRICATION POINTS

Key# ITEM..... Lube

1. POWER STEERING GEAR/RESERVOIR

Refer to the Engine/Steering Gear

Manufacturer's Manuals for change intervals

Change fluid and filter

Ross (integral) or Sheppard (integral) ATF

Grease fitting provided in housing trunion CL
(lubricate by hand NOT by pressure gun)

Sector Shaft and Input Shaft CL

2. ENGINE COOLANT Check level EC

Check coolant concentration EC

Replace/clean strainer, Pressure test cooling system..... EC

Drain and replace coolant EC

3. STEERING U-JOINTS (one fitting each end) CL

4. DRAG LINK (one fitting each end) CL

5. STEERING SLIP JOINT CL

6. FRONT BRAKE CAMSHAFT

(lubricate sparingly, one fitting each side) BG

7. *CLUTCH Master cylinder hydraulic fluid reservoir BF

8. TIE ROD ENDS (one fitting each side) CL

9. MAIN and AUX TRANSMISSION

MANUAL TRANSMISSIONS

Check EO

Drain and refill (except synthetic) EO

PACCAR and ULTRASHIFT PLUS TRANSMISSIONS

TRANSMISSIONS - Check SO

Drain and Refill (Dependant on Oil Sample) SO

10. DRIVESHAFTS Slip Joint, U-Joints

(one fitted each end) CL

11. CENTRE BEARING (if fitted)..... CL

12. *CLUTCH RELEASE BEARING

Remove Trans inspection plate for access..... BB

13. *CLUTCH CROSS SHAFT (one fitting each side)..... CL

14. *ECA CLUTCH (with UltraShift) Lube..... SO

Key#	ITEM.....	Lube
15.	REAR WHEEL BEARINGS	GO
16.	REAR BRAKE CAMSHAFTS (Lube sparingly) one fitting each brake	BG
17.	REAR AXLES Mineral Check oil level	GO
	Drain, flush and refill.....	GO
	REAR AXLES Synthetic Check	SO
	Drain and refill (Dependent on Oil Sample).....	SO
18.	*FIFTH WHEEL	CL
19.	SPRING PINS (one fitting each end both sides).....	CL
20.	*FAN DRIVE (inspect and drain).....	
21.	* FRONT SLACK ADJUSTERS (lube sparingly).....	BG
22.	FRONT WHEEL BEARINGS Oil lubricated	GO
23.	KING PIN (two fittings each side)	CL
24.	ENGINE LUBRICATING OIL Check oil level	EO
	Change oil, fuel and coolant filters	EO
	(Refer to engine manual for intervals)	
25.	DOOR LOCK CYLINDERS	LL
26.	DOOR HINGES	EO
27.	DOOR LATCHES and STRIKER PLATES	PG
28.	SPRING SHACKLE PINS (two fittings each side/end of spring).....	CL
29.	*SUSPENSION KW6-60A	CL
30.	REAR SLACK ADJUSTERS (lube sparingly)	BG
31.	*TRANSFER CASE See lube specifications	EO

(*) Denotes item not shown on illustration

Legend to Lubrication Schedule

*	Items not shown on illustration
#	See Operator's Manual for Off-Highway Conditions
BF	Brake Fluid
BG	Brake Grease (See Lube Specs)
CL	Chassis Grease NLGI-2
EC	PACCAR Genuine ELC30 Coolant
EO	Castrol Vecton 15W-40 CK-4/E9
GO	Drive Axles Gear Oil
MO	Mineral Oil
SO	Synthetic Oil (Requires Periodic Sampling) Major Components Require Different Specific Oils
ATF	Automatic Transmission Fluid (Hydraulic fluid)
STF	Synthetic Transmission Fluid (Requires oil sampling)
SL	Silicone Lubricant
LL	Lock Lubricant
PG	Polyethylene Grease Stick



MASTER LUBRICATION CHART

COMPONENT	LUBRICANT	CHECK	NORMAL SERVICE INTERVAL
ENGINE	LUBRICATION	CHECK	NORMAL SERVICE INTERVAL
PACCAR MX-13	Castrol Vecton 15W-40 CK-4/E9 Castrol Vecton Long Drain 10W-40 E6/E9	Daily	Refer to A, B & C Service Intervals for oil and filter changes
TRANSMISSION	LUBRICATION	CHECK	NORMAL SERVICE INTERVAL
PACCAR Transmissions	Castrol Transmax Manual E Long Life 40 (Synthetic Oil)	40,000km	DRAIN AND REPLACE: FACTORY FILLED WITH SYNTHETIC OIL - CASTROL TRANSMAX MANUAL E LONG LIFE 40: Oil samples at 80,000km, Drain and refill at 400,000km Maximum.
All UltraShift PLUS 18***/20***/22*** Series Manual			
< 18*** Series Manual with Extended Warranty			
< 18*** Series Manual with Standard Warranty	Castrol Transmax Manual E Long Life 40 (Synthetic Oil) Castrol TFC 450 (Mineral Oil)		MINERAL OIL: Drain and refill at 80,000km to 100,000km
HYDRAULIC CLUTCH	LUBRICATION	CHECK	NORMAL SERVICE INTERVAL
PACCAR Clutch	CASTROL BRAKE FLUID DOT 3	Daily	DRAIN & REPLACE: ON-HIGHWAY every 2 years
DRIVING AXLES	LUBRICATION	CHECK	NORMAL SERVICE INTERVAL
Dana	Castrol Axle AP 85W-140 (Mineral Oil)	40,000km	FACTORY FILLED WITH AP 85W-140 MINERAL OIL: 80,000km or every 1 year whichever comes first
	Castrol Dynadriver 80W-90 (Semi-Synthetic Oil)		DYNADRIE 80W-90 SEMI-SYNTHETIC: 200,000km or every 1 year whichever comes first
	Castrol Syntrax E 80W-140 (Synthetic Oil) ¹		SYNTHETIC OIL - SYNTHETIC 80W-140: Maximum 300,000km or 2 years whichever comes first Oil samples at 80,000km
Meritor	Castrol Axle AP 85W-140 (Mineral Oil)	40,000km	FACTORY FILLED WITH AP 85W-140 MINERAL OIL: 80,000km or every 1 year whichever comes first
	Castrol Dynadriver 80W-90 (Semi-Synthetic Oil)		DYNADRIE 80W-90 SEMI-SYNTHETIC: 200,000km or every 1 year whichever comes first
	Castrol Syntrax E 80W-140 (Synthetic Oil) ¹		SYNTHETIC OIL - SYNTHETIC 80W-140: Maximum 300,000km or 2 years whichever comes first Oil samples at 80,000km
Power Steering/Gear	Castrol ATF Heavy Duty	10,000km	Drain and replace at 250,000km or 12 months whichever occurs first

MASTER LUBRICATION CHART https://truckmanhelp.com/

COMPONENT	LUBRICANT	CHECK	NORMAL SERVICE INTERVAL
Non-Driving Steer Axle Knuckle Pins	Castrol Premium Heavy Duty (NLGI-2)	-	10,000km
Steering Drive Axle, U-Joints, bearings and Knuckle Pins			
Chassis Fittings Suspension Fittings Universal Joints Fifth Wheels Clutch Throwout and Driveshaft Centre Bearing			
S-Cam Brakes & Manual Slack Adjusters			
S-Cam Brakes & Automatic Slack Adjusters, Anchor Pins (where fitted)			
Hood Support Pads	Castrol Red Rubber Grease	-	10,000km
Door Latches	Castrol Sphero PH Grease	-	10,000km
Front Wheel Bearings	Castrol Axle AP 85W-140 (Mineral Oil)	40,000km	10,000km
KENWORTH TRUCKS recommends the use of the lubricants specified in these charts. Schedule service intervals more frequently for severe operational conditions. For special service requirements, consult your lubricant supplier. In all cases, the lubricant manufacturer assumes responsibility for the performance of their product and patent liability.			
³ For best performance and long life, replace the complete oil supply at least once every 2 years. Refer Electronic Customised Maintenance Manual for details.			

Component		T410
Engine Oil		
PACCAR MX-13 460hp		34 ltrs
PACCAR MX-13 510hp		34 ltrs
Refill quantities include oil filter change		
Transmission Oil		
RTLO18918B		13 ltrs
RTLO20918B		13 ltrs
FO-18E318-MXP		13 ltrs
FO-20E318-MXP		13 ltrs
PO-18F112C PACCAR Transmission		7.5 ltrs (9.1 with PTO)
plus Remote Filter		0.5 ltrs
plus Oil Cooler		Approx 1.1 ltr of oil per 7 metre run including oil cooler and standard size 10 hose
Clutch		
Hydraulic Clutch		320cc
Cooling System		
PACCAR MX-13 460hp		45 ltrs
PACCAR MX-13 510hp		45 ltrs
Dana Rear Axles (Use only Synthetic oils)		
DSH40P	Forward	18.5 ltrs
	Rear	13.2 ltrs
DS/RDH40P	Forward	18.5 ltrs
	Rear	13.2 ltrs
DD/RDH40P	Forward	18.5 ltrs
	Rear	13.2 ltrs
D46-170	Forward	19.9 ltrs
	Rear	18.5 ltrs
Wheel Hubs (each)		1.2 ltrs
plus Oil Cooler		Approx 0.5 ltr of oil per 3 metre run including oil cooler and standard size 10 hose
Meritor Rear Axles		
MT-20-14XG	Forward	14.3 ltrs
	Rear	12.2 ltrs
MT-20-14XGP	Forward	14.3 ltrs
	Rear	12.2 ltrs
RT40-145GP	Forward	14.3 ltrs
	Rear	12.2 ltrs
RT46-160GP	Forward	18.5 ltrs
	Rear	16.3 ltrs
Wheel Hubs (each)		2 ltrs
plus Oil Cooler		Approx 0.5 ltr of oil per 3 metre run including oil cooler and standard size 10 hose
Power Steering		
TRW Ross Single		5 - 5.5 ltrs
Sheppard Single		5 - 5.5 ltrs
Sheppard Dual		8.5 - 9 ltrs
plus Oil Cooler		Approx 0.5 ltr of oil per 3 metre run including oil cooler and standard size 10 hose

	1 st	A	B	C	
ENGINE GENERAL					
Oil Levels	✓	✓	✓	✓	Check oil levels and top up as necessary: Engine, transmission, rear axle(s), front drive axle (if applicable), power steering reservoir and oil lubricated front wheel bearings
Engine Oil			✓	✓	Change engine oil
Engine Filters			✓	✓	Replace engine oil filter (including centrifugal filter), fuel filters (including fuel water separator)
Air Compressor		✓	✓	✓	Check hose and pipes for clearance and condition
Air Conditioner Compressor Mounting			✓	✓	Check for tightness
Engine Mounts			✓	✓	Check condition and torque
Belts and Pulleys	✓	✓	✓	✓	Check condition of belts. Replace if required. Replace belts at every 'C' Service or yearly
Engine Air Cleaner	Replace element when service indicator 'pops' or every 'C' service - whichever comes first				
Mounting bolts			✓	✓	
Air Intake System		✓	✓	✓	Check for leaks and damage. Examine all intake components on the 'clean side'. Condition and sealing of rubber elbows and hump hoses, clamp tensions and orientation, material integrity of intake pipes, including welds on fabricated parts, other sealing and mating surfaces as applicable and general pipe clearances to other components
Exhaust System		✓	✓	✓	Inspect system for leaks
Ad-Blue System	✓	✓	✓	✓	Check for leaks - Air and Ad-Blue
Ad-Blue System Filters				✓	Change air filter cartridge and pump filter
Ad-Blue In-tank Filters	Replace filter yearly				
Valve Clearance Adjustment			✓	✓	Adjust valve clearances - 1st 'B' service, 1st 'C' and then every 2nd 'C' service thereafter.. i.e. 1st B, 1st 'C' , 2nd, 4th. 6th. 8th, 10th, 12th, etc. 'C' Service
Emergency Shutdown	✓	✓	✓	✓	Check operation of ISO switch, roll-over devices, etc...
Electrical Connections		✓	✓	✓	Check integrity and mounting of electrical harnesses and connections
Starter Motor & Alternator			✓	✓	Check operation and output

A, B & C SERVICE INTERVALS

	1 st	A	B	C	
System Download	✓	✓	✓	✓	Complete system download for active / inactive faults, ECU statistics, etc...
RADIATOR					
Engine Coolant	✓	✓	✓	✓	Check for leaks. Check level and top up as necessary. Use only PACCAR Genuine ELC30 Coolant or coolant approved to DAF MAT 74002
Coolant and Strainer				✓	Replace coolant and strainer every 4 years
Coolant Concentration			✓	✓	Check coolant concentration levels.
Cooling Package		✓	✓	✓	Check radiator, CAC and A/C condensor for fouling or damage
Pressure Test Cooling System		✓	✓	✓	
Radiator			✓	✓	Check radiator mounting bolts and replace as required. Check shroud clearance and adjust as required. Pressure test the cooling system
Radiator Hoses		✓	✓	✓	Inspect hoses for routing, chafing and leaks. Check all hose fittings for tightness
CLUTCH					
Release Bearing	✓	✓	✓	✓	Lubricate sparingly. Requires extended fittings
Clutch	✓	✓	✓	✓	Check clutch pedal for free play, operation and adjustment. Check and lubricate cross-shaft bushings and control linkages
Clutch Brake Operation		✓	✓	✓	Check and adjust as necessary
TRANSMISSIONS					
Manual Transmission - Eaton <20918 series (Mineral Oil)					
Check Oil Level	✓	✓	✓	✓	
Manual / Ultrashift Transmission - Eaton 20918, 22918 series (Synthetic Oil)					
Change oil				✓	Take oil samples to determine correct oil change interval. For severe service, refer to OEM's Service Manuals
Change oil filter				✓	

	1 st	A	B	C	
PACCAR Transmission (Synthetic Oil)					
Change oil				✓	Take oil samples to determine correct oil change interval. For severe service, refer to OEM's Service Manuals
Change oil filter				✓	
POWER STEERING					
Sector Shaft	✓	✓	✓	✓	More frequent under Severe Working Conditions
Steering U-Joints	✓	✓	✓	✓	Check for wear and lubricate with chassis lube (where applicable)
Steering Driveline	✓	✓	✓	✓	Check torque on U-joint pinch bolt and nut (75-80 Nm lubricated). Check steering for excessive play and adjust as necessary
Drag Link & Pitman Arm	✓	✓	✓	✓	Check clamp torque
Steering Pinch Bolts	✓	✓	✓	✓	
Steering Wheel Free Play and Centralise	✓	✓	✓	✓	Check and adjust if required
Steering Box Bracket and Mounting Bolts	✓	✓	✓	✓	Check torque of bolts
Hoses and Fittings	✓	✓	✓	✓	Check for leaks and fittings for tightness. Check for clearance
Operation and Damage	✓	✓	✓	✓	Check for correct operation and any damage to system
Fluid Level	✓	✓	✓	✓	
Change Fluid	Drain and replace Power Steering fluid every 150,000 kms				
Change Filter				✓	
FRONT WHEEL BEARINGS					
Front Wheel Bearings - Oil Level	✓	✓	✓	✓	
Front Wheel Bearings - Oil Change				✓	More frequent under Severe Working Conditions
Front Wheel Bearing - End Play			✓	✓	More frequent under Severe Working Conditions
FRONT AXLES					
Spring Shackle & Hanger Brackets	✓	✓	✓	✓	Lubricate. More frequent under Severe Working Conditions
Spring Pins	✓	✓	✓	✓	

A, B & C SERVICE INTERVALS

	1 st	A	B	C	
Shackle Pins & Bushes	✓	✓	✓	✓	Check for wear and lubricate with truck weight lifted from suspension
Spring Leaves for Damage	✓	✓	✓	✓	Clean of dirt and debris. Lightly lubricate. More frequent under Severe Work Conditions
King Pins, Bushings, Thrust Bearings & Spindles	✓	✓	✓	✓	More frequently under Severe Working Conditions
Suspension U-Bolt Torques	✓	✓	✓	✓	
General Inspection for Wear		✓	✓	✓	
Steering & Tie Rod Arms (inc. Tie Rod Ends)	✓	✓	✓	✓	
Front Axle Steering Stops	✓				Check for clearance between tyres and frame/components
Front End Alignment	As required dependent on tyre wear				
DRIVE SHAFTS					
U-Joints	✓	✓	✓	✓	Lubricate. More frequent under Severe Working Conditions
Slip Joint	✓	✓	✓	✓	
Centre Bearing (if fitted)	✓	✓	✓	✓	Inspect only as non-greaseable sealed unit
REAR AXLES					
Check Oil Level	✓	✓	✓	✓	
Rear axle breathers	✓	✓	✓	✓	Check to ensure they are clear
Meritor - With Mineral Oil					
Change Oil			✓	✓	Under Severe Working Conditions, change oil every 'B' service
Change Oil Filter				✓	
Meritor / Dana - With Synthetic Oil					
Change Oil	✓			✓	Drain mineral oil on first service or 10,000 km. Which ever occurs first. Refill with Synthetic oil. Take oil samples to determine correct oil change interval. For Severe Working Conditions, refer to OEM's service manuals
Change Oil Filter	✓		✓	✓	

	1 st	A	B	C	
REAR SUSPENSION					
Rear Suspension Alignment				✓	As required dependent on tyre wear
General Inspection for wear		✓	✓	✓	More frequently under Severe Working Conditions
REAR WHEEL BEARINGS					
Check Play and Adjust	✓	✓	✓	✓	More frequently under Severe Working Conditions
Drain and Refill Rear Hubs				✓	
CHASSIS					
All Chassis Lube / Grease Points	✓	✓	✓	✓	More frequently under Severe Working Conditions
Chassis Bolts / Frame Fasteners	✓	✓	✓	✓	
Suspension to Frame Bolts	✓	✓	✓	✓	
Cab and Sleeper Mounting Points	✓	✓	✓	✓	
Engine Mounting Bolts	✓	✓	✓	✓	
Transmission Mounting Bolts	✓	✓	✓	✓	
Suspension U-Bolt Torques	✓	✓	✓	✓	
Torque Rod Mounting Bolts	✓	✓	✓	✓	
Hood Pivots, Alignment and Clearance	✓	✓	✓	✓	
Air and Electrical Routing	✓	✓	✓	✓	
Air Dryers and Moisture Ejectors	✓	✓	✓	✓	
Air Dryer Filters	Replace air dryer filter every 350,000 kms or 12 months. Which ever occurs first				
Air Valve Silencers		✓	✓	✓	More frequently under Severe Working Conditions
Drain Water from Fuel and Air Tanks	✓	✓	✓	✓	
Air Tank Check Valves	✓		✓	✓	
Fuel Tank Mounting	✓		✓	✓	

	1 st	A	B	C	
FIFTH WHEEL					
Check and Lubricate	✓	✓	✓	✓	
BATTERY AND ELECTRICS					
Visual Inspection / Loose Connections	✓	✓	✓	✓	
Remove and Inspect Alternator Brushes			✓	✓	Replace worn brushes as required
Output Voltage : Volts	Check every service - Normal 27.6 to 28.4 Volts				
Battery Electrolyte Level	✓	✓	✓	✓	
Clean and Tighten Terminals, Connections and Earth	✓	✓	✓	✓	
Check for Signs of Overcharging / Undercharging				✓	
Load Test Batteries	Check every 6 months				
Hold Down and Battery Box Mounting Bolts	✓		✓	✓	
Wiring for Chaffing and Loose Terminals	✓		✓	✓	
Visual Inspection / Loose Connections	✓	✓	✓	✓	
Starter Draw : Volts	Check every service				
Wiring for Chaffing and Loose Terminals	✓		✓	✓	
Operation of Lights and Instruments	✓	✓	✓	✓	
Accessories, ie. Heater / Airconditioner, Radios, Power Outlet, etc.	✓		✓	✓	

	1 st	A	B	C	
BRAKES - FRONT AND REAR					
Brake Adjustment	✓	✓	✓	✓	
Wheel Seals	✓	✓	✓	✓	
Check Drum Condition		✓	✓	✓	
Brakes: Linings Remaining (replace if required)		✓	✓	✓	
Emergency Operation of Spring Brakes	✓	✓	✓	✓	
Air Pressure Buildup Time		✓	✓	✓	Record in minutes
Governed Air Pressure		✓	✓	✓	Record in kPa
Air Pressure Drop - Brakes Not Applied		✓	✓	✓	
Air Pressure Drop - Brakes Applied		✓	✓	✓	
Brake Pedal Free Play	✓	✓	✓	✓	
Hoses / Fittings for Damage and Leaks	✓	✓	✓	✓	
Brake Camshafts	✓	✓	✓	✓	Lubricate sparingly
Slack Adjusters	✓	✓	✓	✓	
BRAKE TREADLE					
Hinge and Roller	✓		✓	✓	
WHEELS AND TYRES					
Wheel Nut Torque	✓	✓	✓	✓	
Cracked and Loose Wheel Lugs	✓	✓	✓	✓	
Missing Valve Caps & Stem Locks	✓	✓	✓	✓	
Wheels and Tyre Inspection	Daily and Weekly Checks				
Tyre Pressure and Uneven Tyre Wear					
Air Pressure Adjusted to: kPa	Recorded in kPa				

A, B & C SERVICE INTERVALS

	1 st	A	B	C	
CABS, DOORS, WINDOWS AND ANCILLARIES					
Glass for Cracks and Scratches	✓	✓	✓	✓	
Window Operation and Mechanism	✓	✓	✓	✓	
Cab and Sleeper Panels / Joints	✓	✓	✓	✓	Check no exhaust leaks enter the cab area
Interior Condition / Appearance	✓	✓	✓	✓	
Seats Condition / Mounting Bolts	✓		✓	✓	
Safety Restraints / Mounting Points	✓	✓	✓	✓	
HVAC System		✓	✓	✓	Check no exhaust leaks enter the cab area
HVAC Fresh Air Filter		✓	✓	✓	More frequently under Severe Working Conditions
Floor Mats		✓	✓	✓	
Door Panels		✓	✓	✓	
Headlining		✓	✓	✓	
Sleeper		✓	✓	✓	
Dash / Console		✓	✓	✓	
Covers		✓	✓	✓	
Mirrors	✓	✓	✓	✓	
Horns, Air and Electric	✓	✓	✓	✓	
Door Weather Stripping	✓	✓	✓	✓	
Door Lock, Hinges, Latches and Striker Plates	✓	✓	✓	✓	Lubricate sparingly
Windscreen Wipers and Washer Operation	✓	✓	✓	✓	Fill washer bottle
MISCELLANEOUS					
CR2000 Air Filter				✓	
Fuel Filters / Water Separators			✓	✓	

	1 st	A	B	C	
ROAD TEST VEHICLE					
Steering / Steering Play	✓	✓	✓	✓	
Gear Shifting	✓	✓	✓	✓	
Brake Operation	✓	✓	✓	✓	
Engine Operation (Noise, Surging, Black Smoke)	✓	✓	✓	✓	
Throttle Operation	✓	✓	✓	✓	
Air Seat Operation	✓	✓	✓	✓	
Seat Belts and Operation	✓	✓	✓	✓	
Cab HVAC (and Sleeper HVAC if fitted)	✓	✓	✓	✓	
Radio / Antenna / CD Player / CB Radios	✓	✓	✓	✓	
Headlights Hi / Lo, Tail, Stop, Reverse and Indicators	✓	✓	✓	✓	
Speedometer / Odometer	✓	✓	✓	✓	
Tachometer / Hourmeter	✓	✓	✓	✓	
All Instruments and Gauges	✓	✓	✓	✓	
Instrument Illumination	✓	✓	✓	✓	
Cabin Interior Lights	✓	✓	✓	✓	
ABS Warning Lights	✓	✓	✓	✓	
Low Air / Brake Pressure Warning Devices	✓	✓	✓	✓	
Hydraulic Vehicle Jack	Check fluid level before each use - change oil annually				

SECTION FOUR

SERVICE RECORDS

MAINTENANCE SERVICE RECORDS

The remainder of this book contains a separate record for each of the scheduled maintenance services recommended for vehicles operating under normal conditions. Printed on each voucher is a list of all the items requiring attention for that particular service. As each service is performed and the record removed, the following service record is readily visible to remind you when the next service is due.

Sequence of service with PACCAR MX-13 is as follows:

First 10,000 kilometre (First Service) will be performed without cost for labour by the Selling Dealer. This replaces the first "A" Service.

For full Service Schedules, refer to page 316.

What the owner should do

When service, according to the time or distance interval is due, the owner should present this voucher book to an authorised Kenworth service dealer as an authority to have the items listed attended to. After the service is completed, the owner should ensure the validation record is stamped and signed by the servicing dealer. This is important as it will enhance the value of the vehicle whenever resale is contemplated.

What the Servicing Dealer has to do

Your service dealer must attend to all items listed for the particular service, and see that both copies of the validation record are signed. Tear out the perforated top copy and keep with dealership file. The second copy remains in this handbook. All operations listed on the service records should be carried out following the procedures set out in the appropriate current Maintenance and Lubrication Schedules.

Recommended Preventative Maintenance

The following components are recommended to be replaced at the intervals listed below to ensure vehicle uptime is maintained. The items below are to be used as a guide as vehicle condition, application and maintenance procedures can vastly vary, having significant effects on components.

- Replace Idler & Pulleys Every 500,000 km or 250,000 Litres of Fuel Burn or 7,500 Hours (Whichever comes first)
- Replace Air Compressor Every 500,000 km or 250,000 Litres of Fuel Burn or 7,500 Hours (Whichever comes first)
- Replace Coolant Pump Every 500,000 km or 250,000 Litres of Fuel Burn or 7,500 Hours (Whichever comes first)
- Replace Turbo Charger Every 750,000 km or 375,000 Litres of Fuel Burn or 11,250 Hours (Whichever comes first)

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FIRST SERVICE INSPECTION RECORD
PLEASE USE BLOCK LETTERS

Chassis No:	Model:	Kilometres:	Date Inspected:
Owner:		Servicing Dealer:	
Owner's Address:			
Mechanic to inspect, make adjustments, tighten, correct or add fluids on all operations listed. Consult applicable service information for adjustments and specification.			

#	Action	Service Item	Result
1	Download	System download with DAVIE unit	DMCI & EAS Systems
2	Check*	AdBlue system for leaks	Air and AdBlue
3	Change*	Transmission Oil (Synthetic at customers request)	See Below①
4	Change*	Forward Rear Axle Oil (Synthetic at customers request)	
5	Change*	Rear Rear Axle Oil (Synthetic at customers request)	
6	Change	Transmission Filter	
7	Change	Rear Axle filter	
8	Check	Power Steering Oil Filter & Gasket	
9	Check	Air Cleaner Element(s) are Sealing Correctly/Condition	
10	Check	Engine Oil Level After Starting	
11	Check or Repair	Any Oil, Coolant & Air Leaks	
12	Check	Radiator Coolant Level	
13	Check/Record	Radiator Antifreeze Concentration	Concentration level %
14	Check/Record	Radiator Inhibitor Concentration	Concentration level %
15	Check/Record	Battery Electrolyte Level & Tighten Terminals	See Reverse
16	Check	Power Steering Oil Levels	
17	Check & Adjust	Front Wheel Bearing End Play (if Outside Specs)	.001" - .005"
18	Check & Adjust	Front Axle Steering Stops (if Tyres Rubbing)	
19	Check & Adjust	Front and Rear Brakes	
20	Lubricate/Purge	Grease Points, Suspension, Driveline & Strg Components	
21	Check	Steering inc. King Pins	
22	Check Tension	Chassis Bolts	
23	Check Tension	Cab & Sleeper Mount Bolts	
24	Check	Hood Bolts (Tension) Hood Alignment (Adjust)	
25	Check/Re-Tension	U Bolts: <i>Refer page * of this Drivers Handbook</i>	
26	Check Tension	Rear Suspension Bolts	
27	Check Tension	Steering Drag Link Pinch Bolts	
28	Check Tension	Engine Mount Bolts - Front & Rear	
29	Check Tension	Radiator Mount Bolts - inc Upper Stabiliser Alignment	
30	Centralise	Steering Wheel - in Straight Ahead Position	
31	Top Up	Windscreen Washer Bottle & Test Washers	
32	Drain	Air Tanks - Remind Operator of Daily Routine	If Moisture Present
33	Check Routing	Electrical Wiring & Air Lines, Eliminate Chaffing	
34	Check Routing	Coolant, CAC & Air Intake Hoses, Eliminate Chaffing	
35	Check Tension	Radiator Hoses with Torque Wrench	50 - 60 in-lbs (6 - 7 Nm)
36	Check Tension	C.A.C. Hoses with Torque Wrench	105 - 115 in-lbs (11.8 - 13 Nm)
37	Check/Lube	Door Locks, Latches & Wedge Blocks	
38	Check	Operation of Lights, Gauges, Wipers & Horns	
39	Check	All Appointments & Accessories for Correct Operation	
40	Check & Adjust	Clutch & Operation	
41	Check & Adjust	Belts & Idler Pulleys Alignment, Fan/Cowl Clearance	
42	Clean Down Vehicle	Report Any Damage	
43	Road Test & Report	Carry out Additional Work	

* Fill in accordance with procedure - DO NOT OVERFILL
Components specified with synthetic oils, are to be installed at this service

First Service Inspection Record

This is a free service (except for any lubricants and filters used).

All other major components (Gearbox, Drive axles etc...) specified with synthetic oil must be drained and filled with synthetic oils at this service interval

CHECK AND RECORD BELOW

Radiator Coolant Condition: %

Battery Electrolyte Level & Tighten Terminals:

1

2

3

4

Technician's Notes: Use separate sheet of paper if necessary.

DEALERSHIP STAMP

Technician to Sign:

Date:

B-SERVICE - SERVICE INSPECTION RECORD

Carry out this service in conjunction with B Service on page 322.

Check Boxes - Tick = OK A = Adjust R = Repair

Full System Download	Clutch	
Engine	Transmission*	
Check all Oil Levels	Steering System*	
Valve Clearance Adjustment	Front Suspension	
System Compressor	Rear Suspension	
Belts and Pulleys	Rear Axles*	
Intake and Exhaust Systems	Drivelines	
AdBlue System	Chassis	
Emergency Shutdown	Brakes, Front and Rear	
Electrical Connections	Wheels & Tyres	
Starter Motor and Alternator	Cab	
Cooling System	Road Test	

See pages 228-237 in this Driver's Handbook for full description of work to be carried out during these inspections.

For Technician's comments, please use reverse side.

* Refer to Original Equipment Manufacturers for their recommended service intervals

DEALERSHIP STAMP

Technician to Sign:

Date:

B-Service Inspection Record

Technician's Notes: Use separate sheet of paper if necessary.

A-SERVICE - SERVICE INSPECTION RECORD

Carry out this service in conjunction with A Service on page 320.

Check Boxes - Tick = OK A = Adjust R = Repair

Full System Download	Steering System*	
Check all Oil Levels	Front Suspension	
Belts and Pulleys	Rear Suspension	
Intake and Exhaust Systems	Rear Axles*	
System Compressor	Drivelines	
AdBlue System	Chassis	
Electrical Connections	Brakes, Front and Rear	
Emergency Shutdown	Wheels & Tyres	
Cooling System	Cab	
Clutch	Road Test	
Transmission*		

See pages 228-237 in this Driver's Handbook for full description of work to be carried out during these inspections.

For Technician's comments, please use reverse side.

* Refer to Original Equipment Manufacturers for their recommended service intervals

DEALERSHIP STAMP

Technician to Sign:

Date:

A-Service Inspection Record

CHECK AND RECORD BELOW

Battery Electrolyte Level & Tighten Terminals: 1 2 3 4 _____

Technician's Notes: Use separate sheet of paper if necessary.

C-SERVICE - SERVICE INSPECTION RECORD

Carry out this service in conjunction with C Service on page 324.

Check Boxes - Tick = OK A = Adjust R = Repair

Full System Download	Clutch	
Engine	Transmission*	
Check all Oil Levels	Steering System*	
Valve Clearance Adjustment	Front Suspension	
System Compressor	Rear Suspension	
Belts and Pulleys	Rear Axles*	
Intake and Exhaust Systems	Drivelines	
AdBlue System	Chassis	
Emergency Shutdown	Brakes, Front and Rear	
Electrical Connections	Wheels & Tyres	
Starter Motor and Alternator	Cab	
Cooling System	Road Test	

See pages 228-237 in this Driver's Handbook for full description of work to be carried out during these inspections.

For Technician's comments, please use reverse side.

* Refer to Original Equipment Manufacturers for their recommended service intervals

DEALERSHIP STAMP

Technician to Sign:

Date:

C-Service Inspection Record

Technician's Notes: Use separate sheet of paper if necessary.

A-SERVICE - SERVICE INSPECTION RECORD

Carry out this service in conjunction with A Service on page 320.

Check Boxes - Tick = OK A = Adjust R = Repair

Full System Download	Steering System*	
Check all Oil Levels	Front Suspension	
Belts and Pulleys	Rear Suspension	
Intake and Exhaust Systems	Rear Axles*	
System Compressor	Drivelines	
AdBlue System	Chassis	
Electrical Connections	Brakes, Front and Rear	
Emergency Shutdown	Wheels & Tyres	
Cooling System	Cab	
Clutch	Road Test	
Transmission*		

See pages 228-237 in this Driver's Handbook for full description of work to be carried out during these inspections.

For Technician's comments, please use reverse side.

* Refer to Original Equipment Manufacturers for their recommended service intervals

DEALERSHIP STAMP

Technician to Sign:

Date:

A-Service Inspection Record

CHECK AND RECORD BELOW

Battery Electrolyte Level & Tighten Terminals: 1 2 3 4 _____

Technician's Notes: Use separate sheet of paper if necessary.

B-SERVICE - SERVICE INSPECTION RECORD

Carry out this service in conjunction with B Service on page 322.

Check Boxes - Tick = OK A = Adjust R = Repair

Full System Download	Clutch	
Engine	Transmission*	
Check all Oil Levels	Steering System*	
Valve Clearance Adjustment	Front Suspension	
System Compressor	Rear Suspension	
Belts and Pulleys	Rear Axles*	
Intake and Exhaust Systems	Drivelines	
AdBlue System	Chassis	
Emergency Shutdown	Brakes, Front and Rear	
Electrical Connections	Wheels & Tyres	
Starter Motor and Alternator	Cab	
Cooling System	Road Test	

See pages 228-237 in this Driver's Handbook for full description of work to be carried out during these inspections.

For Technician's comments, please use reverse side.

* Refer to Original Equipment Manufacturers for their recommended service intervals

DEALERSHIP STAMP

Technician to Sign:

Date:

B-Service Inspection Record

Technician's Notes: Use separate sheet of paper if necessary.

A-SERVICE - SERVICE INSPECTION RECORD

Carry out this service in conjunction with A Service on page 320.

Check Boxes - Tick = OK A = Adjust R = Repair

Full System Download	Steering System*	
Check all Oil Levels	Front Suspension	
Belts and Pulleys	Rear Suspension	
Intake and Exhaust Systems	Rear Axles*	
System Compressor	Drivelines	
AdBlue System	Chassis	
Electrical Connections	Brakes, Front and Rear	
Emergency Shutdown	Wheels & Tyres	
Cooling System	Cab	
Clutch	Road Test	
Transmission*		

See pages 228-237 in this Driver's Handbook for full description of work to be carried out during these inspections.

For Technician's comments, please use reverse side.

* Refer to Original Equipment Manufacturers for their recommended service intervals

DEALERSHIP STAMP

Technician to Sign:

Date:

A-Service Inspection Record

CHECK AND RECORD BELOW

Battery Electrolyte Level & Tighten Terminals: 1_____ 2_____ 3_____ 4_____

Technician's Notes: Use separate sheet of paper if necessary.

C-SERVICE - SERVICE INSPECTION RECORD

Carry out this service in conjunction with C Service on page 324.

Check Boxes - Tick = OK A = Adjust R = Repair

Full System Download	Clutch	
Engine	Transmission*	
Check all Oil Levels	Steering System*	
Valve Clearance Adjustment	Front Suspension	
System Compressor	Rear Suspension	
Belts and Pulleys	Rear Axles*	
Intake and Exhaust Systems	Drivelines	
AdBlue System	Chassis	
Emergency Shutdown	Brakes, Front and Rear	
Electrical Connections	Wheels & Tyres	
Starter Motor and Alternator	Cab	
Cooling System	Road Test	

See pages 228-237 in this Driver's Handbook for full description of work to be carried out during these inspections.

For Technician's comments, please use reverse side.

* Refer to Original Equipment Manufacturers for their recommended service intervals

DEALERSHIP STAMP

Technician to Sign:

Date:

C-Service Inspection Record

Technician's Notes: Use separate sheet of paper if necessary.

A-SERVICE - SERVICE INSPECTION RECORD

Carry out this service in conjunction with A Service on page 320.

Check Boxes - Tick = OK A = Adjust R = Repair

Full System Download	Steering System*	
Check all Oil Levels	Front Suspension	
Belts and Pulleys	Rear Suspension	
Intake and Exhaust Systems	Rear Axles*	
System Compressor	Drivelines	
AdBlue System	Chassis	
Electrical Connections	Brakes, Front and Rear	
Emergency Shutdown	Wheels & Tyres	
Cooling System	Cab	
Clutch	Road Test	
Transmission*		

See pages 228-237 in this Driver's Handbook for full description of work to be carried out during these inspections.

For Technician's comments, please use reverse side.

* Refer to Original Equipment Manufacturers for their recommended service intervals

DEALERSHIP STAMP

Technician to Sign:

Date:

A-Service Inspection Record

CHECK AND RECORD BELOW

Battery Electrolyte Level & Tighten Terminals: 1 2 3 4 _____

Technician's Notes: Use separate sheet of paper if necessary.

B-SERVICE - SERVICE INSPECTION RECORD

Carry out this service in conjunction with B Service on page 322.

Check Boxes - Tick = OK A = Adjust R = Repair

Full System Download	Clutch	
Engine	Transmission*	
Check all Oil Levels	Steering System*	
Valve Clearance Adjustment	Front Suspension	
System Compressor	Rear Suspension	
Belts and Pulleys	Rear Axles*	
Intake and Exhaust Systems	Drivelines	
AdBlue System	Chassis	
Emergency Shutdown	Brakes, Front and Rear	
Electrical Connections	Wheels & Tyres	
Starter Motor and Alternator	Cab	
Cooling System	Road Test	

See pages 228-237 in this Driver's Handbook for full description of work to be carried out during these inspections.

For Technician's comments, please use reverse side.

* Refer to Original Equipment Manufacturers for their recommended service intervals

DEALERSHIP STAMP

Technician to Sign:

Date:

B-Service Inspection Record

Technician's Notes: Use separate sheet of paper if necessary.

A Service Inspection Servicing Dealer Date of Service Odometer..... Signed Additional Services Performed: 	C Service Inspection Servicing Dealer Date of Service Odometer..... Signed Additional Services Performed:
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A		Automatic traction control	154
A-Service	320	Automated transmissions	120
Accelerating	190	indicator	29
Accessory drive belts	225	operating	120
remove & installation	225	oil change	272
serpentine belts	225	oil sampling	220
Active warnings	31	parking brake	120
AdBlue (DEF)	109	Automatic slack adjusters	233
DEF AdBlue level	108	free stroke measurement adjusted	233
AdBlue filling	110	chamber stroke	234
DEF filter service	324	Axle stops	279
air filter service	324	Axle, cross wheel differential lock	181
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