

NOTICE

Be advised that this motor vehicle may be equipped with computer / recording devices. Their function is to allow an authorized individual to download data or information relating to the operation or performance of this vehicle.

The stored data or information may be neither downloaded nor retrieved except by the vehicle's registered owner, or, in the alternative, by another individual or entity authorized by the registered owner, such as an International Dealer, who may need this data or information to properly service or diagnose this vehicle for repair or following an accident.

Any access to this information without the owner's consent may be in violation of law and may subject that person or entity to criminal penalties.

CALIFORNIA

Proposition 65 Warning

Diesel engine exhaust and some of its constituents are known to the State of California to cause cancer, birth defects, and other reproductive harm.

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

Wash hands after handling.

Important

The information, specifications, and illustrations contained in this manual are based on data that was current at the time of publication. International reserves the right to make changes and/or improvements at any time without notification or liability, or without applying those changes or improvements to vehicles previously manufactured.

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Make sure your use of this completed vehicle conforms to all federal, state and local requirements and regulations imposed on owners and operators.

Operator's Manual – WORKSTAR® Series

IMPORTANT

IT IS IMPORTANT THAT THE VEHICLE IDENTIFICATION NUMBER (VIN), AND COMPONENT FEATURE CODE AND SERIAL NUMBERS BE RECORDED. THESE NUMBERS ARE REQUIRED TO OBTAIN INFORMATION PERTINENT TO THIS VEHICLE.

VIN (VEHICLE IDENTIFICATION NUMBER) LOCATION

LoneStar®, 9000i, ProStar®, TranStar®, PayStar®, WorkStar®, DuraStar®, and TerraStar™ Series: Located left door opening, rear post

COMPONENT IDENTIFICATION NUMBERS

Component Feature Codes appear on the vehicle line set ticket.

Component serial numbers appear on the components.

Feature Code:

Serial Number:

FRONT AXLE

--	--

REAR AXLE

--	--

TRANSFER CASE

--	--

TRANSMISSION

--	--

ENGINE

--	--

ENGINE SERIAL NUMBER LOCATION

MAXXFORCE®: Stamped on pad – right side of the crankcase, below cylinder head

WORLD HEADQUARTERS

Navistar, Inc.
4201 Winfield Road
Warrenville, Illinois 60555 USA

INTERNATIONAL INTERNET SITE

internationaltrucks.com

SALES REGIONS

MIDWEST

Navistar, Inc.
4201 Winfield Road
PO Box 1488
Warrenville, Illinois 60555
630-753-5900

NORTHEAST

Navistar, Inc.
Cherry Tree Corporate Center
535 Route 38 East, Suite 300
Cherry Hill, New Jersey 08002
856-486-2300

SOUTHEAST

Navistar, Inc.
2400 Commerce Avenue
Building 1100, Suite 100
Duluth, Georgia 30096
678-584-2700

SOUTHWEST

Navistar, Inc.
2595 Dallas Parkway, Suite 203
Frisco, Texas 75034
972-377-1200

WEST

Navistar, Inc.
3017 Douglas Boulevard, Suite 300
Roseville, California 95661
916-774-7526

CANADA

Navistar Canada, Inc.
5500 North Service Road – 4th Floor
Box 5337
Burlington, Ontario L7L 5H7
905-332-3323

MEXICO

Navistar Mexico SA DE CV
Ejército Nacional 904 – 8° Piso
Col, Palmas Polanco 11510 Mexico D.F.
525-262-6666

BRAZIL

International Caminhões do Brasil
Av. Carlos Gomes, 466 conj 1002
Bairro Auxiliadora – CEP 90480-000-
Porto Alegre/RS
55 51 4009-5800

CUSTOMER ASSISTANCE CENTER

1-800-448-7825 (1-800-44-TRUCK)

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All other trademarks are the property of their respective owners.

Service Publications

An Operator's Manual is shipped with this vehicle for customer use. Information on the purchase of other available service publications for this vehicle can be found on the internationaltrucks.com Web site, or by contacting your local International dealer.

It is the policy of Navistar, Inc. to improve its products whenever it is possible and practical to do so. We reserve the right to make changes or add improvements at any time without incurring any obligation to make such changes on products sold previously.

WorkStar® Series

Operator's Manual – WorkStar® Series

Operator's Manual

Form No. 3879634R1

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SECTION 1 — FOREWORD

Preface

Your vehicle has been engineered and manufactured so that it can provide economical and trouble-free service. However, it is the owner's responsibility to see that the vehicle receives proper care and maintenance.

Making modifications to various parts, components, and systems of your vehicle, such as brake, suspension, and steering systems, can adversely affect the quality and reliability of your vehicle. Such modifications must be avoided.

Cautions and Warnings

Throughout this manual, you will find Cautions and Warnings:



Warnings advise you of hazards, the consequences, and what to do to prevent them, not only to prevent damage to your vehicle or property, but to help prevent situations and occurrences, which could result in personal injury or death.



Cautions will advise you of the proper care to be taken to prevent damage to your vehicle or property.

Study this manual carefully. Do not operate your vehicle until you are completely familiar with the contents of this manual. Always retain this manual in your vehicle for reference. If you sell the vehicle, make sure the manual goes with it.

Assistance Guide

When parts are required, always provide the unit code number, vehicle model, and vehicle serial number. Request the salesperson to assist you in obtaining this information upon delivery.

For information not given in this manual, or if you require services of trained service personnel, we urge you to contact a nearby International dealer or phone 1-800-44-TRUCK (87825) for assistance.

Every customer is entitled to the best service, both from the product itself and from the firm that sells and services that product.

If, for any reason, you do not feel you are receiving these services in connection with the operation of your vehicle or the sales transaction, you should return to your selling dealer, so that these matters can be corrected to your satisfaction. If the matter is not resolved at that time, it is suggested that the following steps be taken:

Contact a Member of Management at the Dealer.

Discuss the details of the difficulty. In most instances, any problem can be resolved to your satisfaction by the owner or manager in charge.

Contact Closest Navistar, Inc. Regional Sales Office.

Addresses of Regional Sales Offices are found in the front of this manual. Should you desire to contact any of these offices, it is important to include the following information in your communication:

- Name under which new vehicle was purchased, address, and telephone number of purchaser
- Vehicle model, year, vehicle identification number, component code, and serial number
- Vehicle delivery date and present mileage
- Location where purchased
- Details of the problem

Component Code Numbers

Code numbers are the basis for identifying the components used on International trucks. They are used by sales personnel to order the truck, by manufacturing to build that truck, and by parts personnel to service the truck. Many items in this manual are identified by codes.

Code numbers are a combination of numbers and/or letters. These codes are listed on the Line Set Ticket, which is sometimes known as the vehicle specification card or code sheet.

Line Set Ticket

Each vehicle is provided with a Line Set Ticket (code sheet), which lists identification code numbers of component units used to build the vehicle.

One copy of the Line Set Ticket is included in the literature provided with the vehicle. When replacement parts are required, take this copy with you to positively identify vehicle components to be sure of getting the correct parts.

Be Sure To Return Line Set Ticket To Vehicle After Obtaining Parts.**Vehicle Storage Instructions**

When a vehicle is not used for an extended period of time, precautions must be taken to prevent deterioration of vehicle components. Vehicles that are out of service for extended periods of time can experience corrosion and other undesirable effects. Drive vehicle monthly to exercise the brakes, driveline and steering. Run the vehicle long enough for the engine to reach operating temperature.

NOTE: Losses occurring to a unit while it is in storage will not be considered for warranty reimbursement.

Storage Duration - One Month or Less

1. Wash vehicles as necessary. Always wash vehicles that have been exposed to road salt.

NOTE: Washing Instructions - Wash the vehicle with warm water and mild soap, then wipe wet surfaces with a chamois or soft cloth. DO NOT use hot water or strong soaps or detergents. DO NOT wash the vehicle in direct sun, or when the sheet metal is hot to the touch. This will streak the finish. DO NOT wipe dirt off dry surfaces, as this will scratch the finish.

NOTE: When vehicles are stored outside, particularly in coastal areas (salt water and high humidity atmosphere) or other areas of corrosive environment, paint and bright metal may require frequent washing and waxing to prevent deterioration. Determining washing frequency is the customers responsibility.

NOTE: For vehicles exposed to ultraviolet rays of the sun, apply a coating of Bon-Ami® soap, or similar product, to the inside surfaces of the windshield and windows, to shade the interior and prevent fading of the interior trim.

2. Inspect painted surfaces; touch up all exposed primed or raw metal areas to prevent rust.
3. a thick coat of wax to prevent discoloration from the elements; wax all chrome and stainless steel metal parts.
4. Check the radiator coolant for proper level and adequate freeze protection [-20°F (-29°C) is standard for medium duty models and bus chassis, -40°F (-40°C) is standard for heavy duty models].
5. Cover open ends of vertical exhaust stack(s).
6. Drain air brake reservoirs and close the drain cocks.
7. Lubricate all exposed transmission, auxiliary transmission and PTO shift rails.

8. Check state of charge eye in batteries and re-charge if open circuit voltage is below 12.6 volts. Disconnect battery ground cables to prevent accidental starting, or parasitic electrical loads from discharging the battery.

Storage Duration - Over One Month

Units in storage longer than one month should be driven until the engine reaches operating temperature:

1. Insure all tires are inflated properly, remove vertical exhaust stack covers and reconnect batteries.
2. Check all vehicle fluid levels and fill as required.
3. Start and run the vehicle at fast idle, until it reaches operating temperature. To remove surface charge from the battery, built up from previous start-ups and short idle periods, operate the heater and/or air conditioner, headlights and other accessories for several minutes.
4. Turn off heater and/or air conditioner and any other accessories; shut off the headlights. Park the vehicle and shut off the engine.
5. Perform the procedure for **Storage Duration - One Month or Less**, if returning the vehicle to storage.

NOTE: After every 30 additional days of storage, perform Items 1 through 5.

Foreword

Storage Facilities

- A. Whenever possible, store vehicles indoors, protected from sunlight, in a dry, well ventilated area. If indoor storage is not available, select storage lots to eliminate conditions that cause deterioration.
- B. Park away from transformers and/or electrical motors, because when the protective wax in tire compound cracks, ozone in the air attacks the exposed areas.
- C. Park away from trees, high weeds and/or grass to prevent damage from tree or weed sap, and to minimize bird and insect stains.
- D. Park away from railroad tracks, paint shops, smoky industrial areas, and locations of possible road splash contact.
- E. If a vehicle is parked on an incline, block the wheels.

Exterior Noise Emissions

Many operators and owners of the type of vehicles described herein are subject to *Federal Motor Carrier Safety Regulations and Noise Emission Requirements*. All owners and operators are urged to obtain a copy and comply with these regulations. Copies of these regulations can be purchased from:

Superintendent of Documents
U.S. Government Printing Office
Washington, D.C. 20402

Navistar, Inc. warrants to the first person who purchases this vehicle for purposes other than resale and to each subsequent

purchaser that this vehicle, as manufactured by Navistar, Inc., was designed, built, and equipped to conform at the time it left Navistar, Inc. control with all applicable U.S. Environmental Protection Agency Noise Control Regulations.

This warranty covers this vehicle as designed, built, and equipped by Navistar, Inc. and is not limited to any particular part, component, or system of the vehicle manufactured by Navistar, Inc. Defects in design, assembly, or in any part, component, or system of the vehicle as manufactured by Navistar, Inc., which at the time it left Navistar, Inc. control, that cause noise emissions to exceed Federal standards are covered by this warranty for the life of the vehicle.

Tampering with Noise Control System Prohibited

Federal law prohibits the following acts or the causing thereof: (1) The removal or rendering inoperative by any person, other than for purposes of maintenance, repair, or replacement, of any device or element of design incorporated into any new vehicle for the purpose of noise control prior to its sale or delivery to the ultimate purchaser or while it is in use, or (2) The use of the vehicle after such device or element of design has been removed or rendered inoperative by any person. Among those acts presumed to constitute tampering are the acts listed as follows: A. Air Intake System: Removal of air cleaner, intake silencer, or piping. B. Acoustical Shielding (Body): Removal of wheel well splash shields, cab shields, or acoustical (underhood) insulation. C. Cooling System: 1. Removal or rendering inoperative the fan clutch. 2. Removal of fan shrouds. D. Engine and Driveline System: 1. Removal or rendering engine speed governor inoperative so as to allow engine speed to exceed manufacturer specifications. 2. Removal of engine

block shield, oil sump shield, or transmission enclosures. E. Exhaust System: Removal or rendering inoperative exhaust system components, including muffler, resonator, or tailpipe.

Use the following Maintenance Record – Noise Control form to log Noise Emission Maintenance of, at a minimum, the above systems.

Emission Control Systems

NOTE: Federal and California emission system warranties are found in your Engine Operation and Maintenance Manual.

Maintenance Record – Noise Control

Chassis Model:		Vehicle Identification Number:	
Maintenance Performed	Maintainer (Name)	Location	Date

Reporting Safety Defects

U.S. Registered Vehicles

If you believe that your vehicle has a defect, which could cause a crash or could cause injury or death, you should immediately inform the National Highway Traffic Safety Administration

(NHTSA) in addition to notifying Navistar, Inc. To notify Navistar, Inc., see regional numbers listed in the front of the manual.

If NHTSA receives similar complaints, it may open an investigation and, if it finds that a safety defect exists in a group of vehicles, it may order a recall and remedy campaign. However, NHTSA cannot become involved in individual problems between you, your dealer, or Navistar, Inc.

To contact NHTSA, you may either call the Auto Safety Hotline toll-free at 1-800-424-9393 (or 202-366-0123 in Washington, D.C. area) or write to: NHTSA, U.S. Department of Transportation, Washington, D.C. 20590. You can also obtain other information about motor vehicle safety from the hotline.

Canadian Registered Vehicles

If you believe that your vehicle has a defect, which could cause a crash or could cause injury or death, you should immediately contact Navistar, Inc. Canada and then Transport Canada.

To contact Navistar, Inc. Canada, you may either call the Regional Service Manager (Canadian Sales Region) 905-332-2357 or write to: Navistar, Inc. Canada, 5500 North Service Road, Box 5337, Burlington, Ontario L7L 5H7.

To contact Transport Canada, Defect Investigations and Recalls, you may call 1-800-333-0510 or write to: Transport Canada, ASFAD, Place de Ville Tower C, 330 Sparks Street, Ottawa, Ontario K1A 0N5.

Safety Recalls and Authorized Field Changes

Safety Recalls and Authorized Field Changes are two campaigns that are used to notify owners of modifications

that may involve their vehicle. If you receive such notification, **PLEASE FOLLOW ALL INSTRUCTIONS PROVIDED IN THE CUSTOMER LETTER.** If your vehicle is part of a Safety Recall campaign, the recall service procedure must be completed to ensure safe operation of your vehicle. As a vehicle owner, you must provide International dealers with address corrections and changes to ensure that you receive all notifications. Please verify that your local dealer has your correct address. Dealers will also have a record of any outstanding campaigns that affect your vehicle.

Customer Security Guide for International Trucks

This guide has been prepared to help you protect your vehicle investment from theft. We realize the financial commitment you have made is significant, and that you depend on that vehicle to generate profits and a livelihood. Vehicle theft can be more than an economic crime. Protecting your vehicle from theft or hijacking can be crucial to the safety and security of the country and economy. While no system or device is 100 percent effective, our intention is to provide some tips that you or your drivers can use to reduce the risk of theft.

If you suspect vehicle theft activity, take a minute to tell the National Insurance Crime Bureau (NICB) at 1-800-TEL-NICB. You can make the free call anonymously, and you might be eligible for a reward. To learn more about vehicle theft and how you can protect yourself, visit the NICB's Web site, www.nicb.org.

Add Layers of Protection

Four layers of protection are recommended for your vehicle - the more layers of protection on your vehicle, the more difficult it is to steal.

Layer 1: Common Sense

- Lock your doors.
- Remove your keys from the ignition.
- Close your windows completely.
- Park in well-lit areas.
- Drop a business card with your name on it between the glass and doorframe. This can aid in identifying the truck when it's recovered.
- Keep a copy of the lineset ticket in a location other than your truck for reporting purposes and a copy of the VIN in your wallet.
- Photograph the interior and exterior of your truck from various angles and keep these photographs in a safe nontruck location or send them to your insurance agent.
- Report a theft as soon as it's discovered to the local police and to your insurance company.
- Post a *driver has no cash* sign on your door to discourage a robbery.
- Permanently mount your CB radio or remove it when you will be away from your truck.

- Do not discuss where your vehicle is located when you are not on the road.
- Do not share information about your specific destination or the load you are hauling.
- Be conscious of other vehicles that may be following you over long distances - call the police.
- Be suspicious of motorists that are signaling you to stop or pull over. Call the police, report the incident, and let the police respond.

Layer 2: Visible or Audible Device

- Audible alarm system
- Steering wheel locks
- Steering column collars
- Theft deterrent decals
- Wheel locks
- Window etching
- Mechanical or electronic steering locks that restrict the steering shaft U-joint are easy to use and provide a very high level of affordable theft protection.

Layer 3: Vehicle Immobilizer

- A. Fuse cutoffs
- B. Kill switches
- C. Starter, ignition, and fuel disablers
- D. Fuel cutoff switch

Layer 4: Tracking System

The final layer is a tracking system that emits a signal to the police or a monitoring service when the vehicle is reported stolen. If your vehicle has a tracking system and is stolen, it can oftentimes be recovered faster and with less damage.

VIN:

Model/Year:

Engine Serial Number:

License Number:

Insurance Company:

Policy Number:

Phone Number:

Other:

Optional Diamond Logic® Electronic Application Solutions



This vehicle may be equipped from the factory with electrical switches intended to operate equipment that was installed by a truck equipment manufacturer (TEM). Instructions, Cautions, and Warnings for this additional equipment will NOT be found in this manual. Read and understand the appropriate manual for the specific equipment in question before operating. Failure to observe this warning may cause property damage, personal injury, or death.

NOTE: This vehicle may be equipped with electronic application-specific options not described in this Operator's Manual. Many of these features are supplied with rocker switches that have custom labels applied. The presence of these options as factory-installed can be verified from the Line Set Ticket included with the vehicle. A truck equipment manufacturer (TEM), however, may have installed some of these options after production. In that case, they will not appear on the Line Set Ticket. If installed by a TEM, you should receive an operating guide and/or training for the specific functions provided. Familiarize yourself with all of the switches that control chassis, engine, and body equipment and seek adequate training on the function of all features before operating this vehicle.

SECTION 2 — MODEL DESCRIPTION

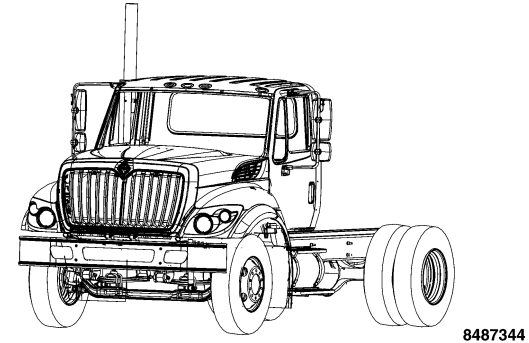
Introduction

The WorkStar® Series Truck is available in a variety of models, including the WorkStar® Series Deluxe and the WorkStar® Series Premium. The WorkStar® Series is available in three cab models, including the standard cab, extended cab, and the crew cab.

This operator's manual covers all versions. Illustrations in this manual are used for reference only, and may differ slightly from the actual vehicle. However, key components addressed in the manual are represented as accurately as possible. Models covered are shown on the following pages.

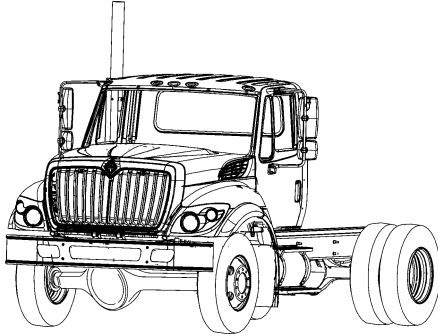
Available Models

4x2



The 4x2 configuration includes these models 7300, 7400, 7500, 7600.

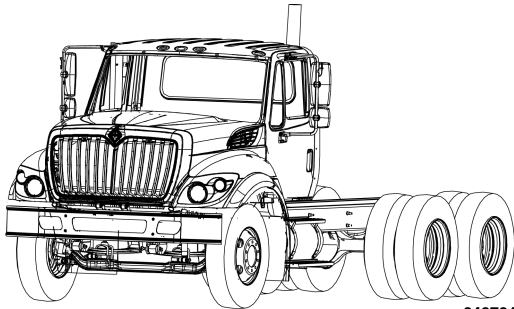
4x4



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The 4x4 configuration includes these models 7300, 7400, 7500.

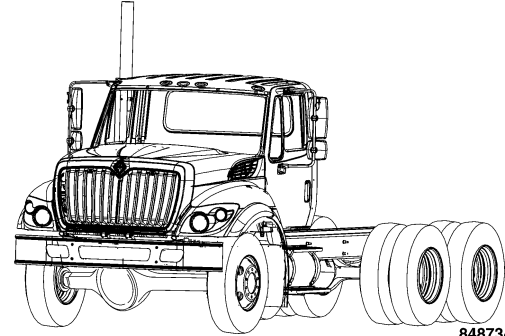
6x4



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The 6x4 configuration includes these models 7400, 7500, 7600.

6x6



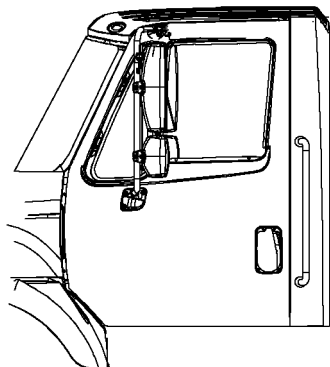
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The 6x6 configuration includes these models 7400, 7500.

Available Cabs

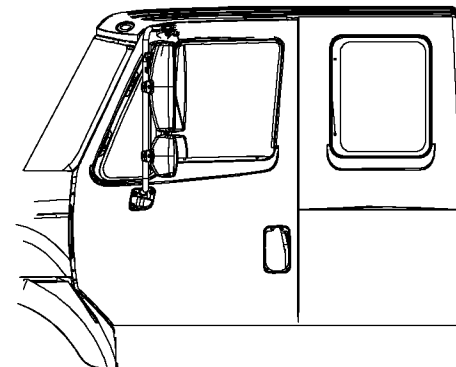
The WorkStar® Series Truck is available with a standard cab, extended cab, or crew cab. Each cab has its own unique features and uses.

Standard Cab



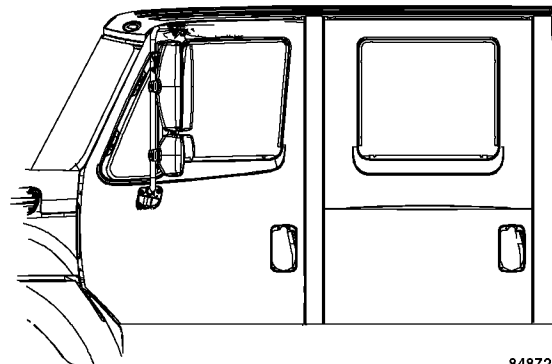
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Extended Cab



8487250

Crew Cab



8487251

Vehicle Identification



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Vehicle Identification Number (VIN)

The Vehicle Identification Number (VIN) is located on the driver side door. The VIN and model description are necessary when ordering replacement parts or service manuals.

Feature Codes

Feature Codes are the basis for identifying the components used on International trucks. They are used by sales personnel to order the truck, by manufacturing to build that truck, and by parts

personnel to service the truck. Many items in this manual are identified by codes.

Feature Codes are a combination of numbers and/or letters. These codes are listed on the Line Set Ticket, which is sometimes known as the vehicle specification card or code sheet.

Engine Serial Number

The engine dataplate provides the engine serial number as well as other engine information. For the location of this plate and more information about engine components and engine identification, refer to the Engine Operation and Maintenance Manual.

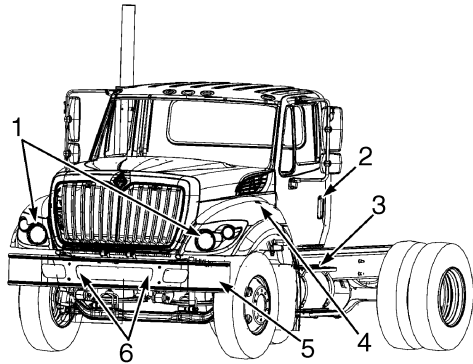
Line Set Ticket

NOTE: Be sure to return the Line Set Ticket to the vehicle after obtaining parts.

Each vehicle is provided with a Line Set Ticket (code sheet) which lists identification code numbers of component units used to build the vehicle.

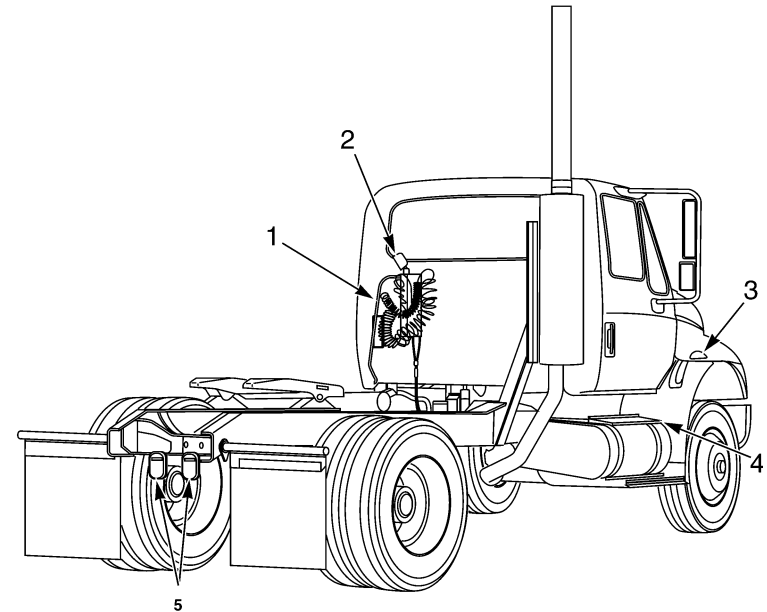
One copy of the Line Set Ticket is included in the literature provided with the vehicle. When replacement parts are required, take this copy with you to positively identify vehicle components to be sure of getting the correct parts.

Exterior Components



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1. Headlight
2. Door Latch
3. Fuel Cap
4. Side Marker/Turn Light
5. Bumper
6. Fog Light



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1. Glad Hand Storage Bracket
2. Work Light
3. Side Marker/Turn Light
4. Fuel Cap
5. Taillights

Cab Entry and Exit



Do not step or climb upon any vehicle surface unless it is slip-resistant and a handhold is provided. Failure to follow this warning could cause you to slip or fall and could result in personal injury or death.



A three-point stance should be used (three out of four extremities should be in contact with the vehicle climbing system) at all times. Face inward towards the cab when entering and exiting. Always keep steps and handholds in continuous good repair. Make sure all attaching bolts and hardware are tight, thus eliminating any movement of steps and handholds. Keep steps, grab handles and shoes free of grease, mud, dirt, fuel, ice and snow. Use extra care during inclement weather. Failure to follow this warning could cause you to slip or fall and could result in personal injury or death.

Tilt Hood



To prevent personal injury or death, never put any part of your body beneath a raised hood unless the hood is all the way forward in its range of motion and is fully settled in the over center position.

Raising the Hood

1. Before opening the hood, make sure that there is enough room in front of the vehicle for the hood to open completely without pinning or pinching yourself between the hood and any other structures.
2. Release the latches on both sides of the cowl.
3. Grasp the hood handle and pull the hood forward over center and allow it to settle into the raised position.
4. Make certain that hood is resting in the open position before releasing hood.

Lowering the Hood

1. Make sure that the hood has no tools/parts/people in its path of motion.
2. Grasp the hood handle and push the hood backward over center and allow it to settle into lowered position.
3. Engage latches at both sides of cowl.

SECTION 3 — INSPECTION GUIDE

Introduction

General Information



To prevent property damage, personal injury or death when servicing the vehicle, park on a flat level service, set the parking brakes, turn the engine off, and chock the wheels.



Exercise care when working on vehicles with running engines that are equipped with an automatic fan clutch. The fan engages when engine coolant reaches a predetermined temperature or the refrigerant pressure (if equipped with air conditioning) reaches a predetermined setting. The fan will start with no advance warning. Failure to observe these precautions could result in vehicle damage, personal injury, or death.



If vehicle is equipped with an automatic transmission, have a qualified technician regularly check operation of transmission neutral start switch. If unit starts in gear, the vehicle may inadvertently move, which could result in property damage, personal injury, or death.

To be sure your vehicle is ready to operate, conduct a pre-trip inspection at the beginning of each work period. This section gives the operator suggested guidelines to be used in performing tractor and trailer pre-trip inspections. Safety is the most important and obvious reason for doing a pre-trip inspection. Depending on the optional features of the vehicle being used and any possible aftermarket items installed on the vehicle, these guidelines should be modified to include other necessary inspection points. Follow the steps in this section and check them off to assure a proper vehicle inspection procedure. The pages in this section may be reproduced locally and used on a regular basis.

If any component or system does not pass this inspection, it must be corrected before operating the vehicle. Take your time going through the pre-trip inspection. Remember that a careful pre-trip inspection saves time by eliminating unscheduled stops to correct a faulty item.

Vehicle Inspection

Preparation

NOTE: Perform the following procedures prior to conducting the pre-trip inspection.

- Apply parking brakes.
- Turn on parking lights and hazard lights.
- Unhook the hood latches and raise the hood.
- Check under the vehicle for oil, fuel, coolant leaks, or other signs of damage.
- Use pull cables or open drain cocks to allow air tanks to expel any existing water. Release pull cables or close drain cocks.
- Chock wheels on tractor and trailer, if attached.
- Start the engine and allow the air pressure to build up to normal operating pressure of 115 to 130 psi (793 to 896 kPa). Stop engine.

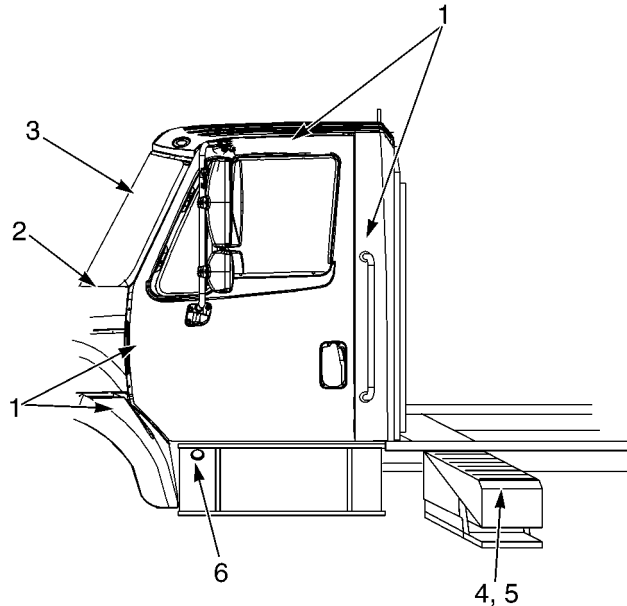
Exterior Lights Check

The optional LMP check switch is used to perform the exterior lights check in the following manner:

1. Place the ignition switch in the ON or ACC position, place the transmission in (N) Neutral, and apply the Parking Brake.

2. Press the optional LMP check switch to activate the system.
3. The exterior light check will now cycle all vehicle lights except the back-up light(s). The test flashes the exterior lights ON and OFF in three, 2-second cycles. The first 2-second period illuminates park lights (clearance, identification, side marker and license plate lights), turn signal lights, low beam headlights, fog lights. The second 2-second period illuminates park lights (clearance, identification, side marker and license plate lights), high beam headlights, brake lights, work lights. The third 2-second period turns OFF all lights. This cycle repeats until deactivated by the operator.
4. Walk around vehicle and inspect illumination of lights.
5. To cancel this feature, do one of the following: either press the brake pedal, manually turn ON any external light, turn the ignition switch to OFF or CRANK, depress the exterior light check switch, or release the parking brake. The feature will automatically cancel approximately 10 minutes after activation if not deactivated by the operator.
6. Checking the backup lights requires two people and the engine running. Depress the clutch (if applicable) and select reverse while the second person observes backup light operation.

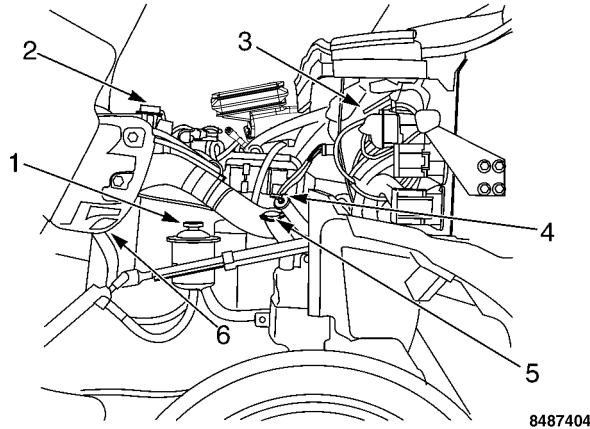
Left Side Cab Area



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1. Cab Structure: Check body panels such as doors, air shield, sunshade, and cab for signs of breaks or damage. Check condition of cab mounting brackets and tilt hood latches.
2. Wipers: Check windshield wiper arms for proper spring tension and wiper blades for damage.
3. Windshield: Check for damage to windshield and clean if dirty.
4. Battery Box: Inspect for damage and secure mounting of battery box. Remove battery box cover.
5. Batteries and Cables: Check that batteries are secured and cases are not broken or leaking. Ensure cables are free from damage. Tops of batteries and terminals must be clean and free from foreign material. Replace battery box cover.
6. Fuel Tank: Check to see that the fuel tank(s) and cap(s) are secured and make sure there is no damage or leaks at the tank(s) or fuel lines. Insure mounting straps are secure and not chafing tank.

Left Engine Compartment



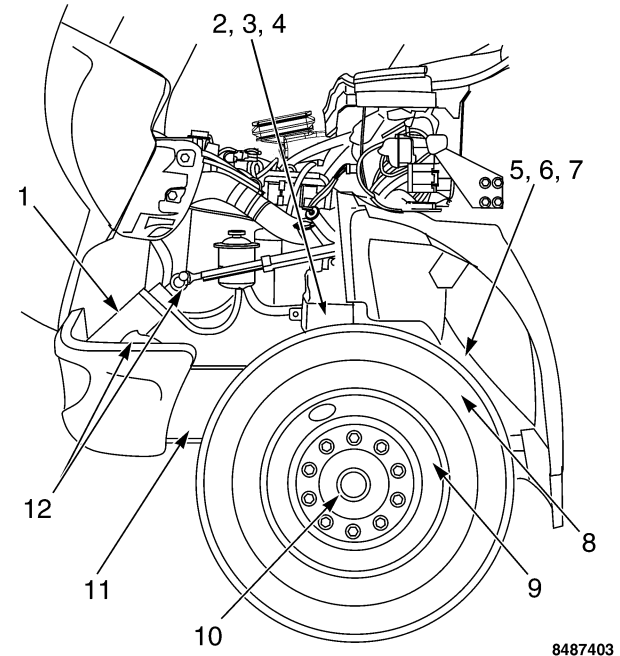
1. Power Steering Fluid: Verify that the fluid level is between the Cold or Hot (as applicable) MIN and MAX marks.
2. Coolant Level: Do not remove pressure cap unless coolant is cool. Ensure fluid level is between the minimum and maximum fluid level range as marked on the plastic translucent reservoir or sight glass .

3. Brake Fluid Level (if equipped): During normal vehicle operation and servicing, the fluid level will vary between the "MIN" and "MAX" lines on the master cylinder mounted "front" reservoir. Do not fill the master cylinder to the top of the reservoir. Over filling may lead to overflow. **DO NOT add fluid above MAX line.**
4. Oil Level: Use dipstick to verify that the oil level is between the full and add marks.
5. Windshield Washer Fluid Level: Inspect the reservoir and verify that the fluid level is not empty and has enough fluid to accomplish the upcoming mission. If additional fluid is required, see Lubricant and Sealer Specifications chart, in the **Specification** section, for the correct fluid type before filling. Do not use water in freezing climates.
6. Radiator and Charge Air Cooler: Check for loose mounting and damage. Inspect condition of all hoses for damage, cracks, and leaks. Inspect for foreign material on face of cooling package. Carefully brush away collected materials without bending cooling fins to maintain proper airflow through cooling package.

- **Fuel/Water Separator:** Check sight globe (if Davco® equipped), inform maintenance personnel if fuel level is at top of globe, which is an indication that the filter is due for replacement) and drain into cup periodically. Check for leaks.
- **Air Lines and Wiring:** Check air Lines and electrical wiring for proper security, and for damage, and chafing. Listen for audible air leaks.
- **Leaks:** Check for signs of fluid puddles under vehicle, or wet components in the engine compartment.

Check that the air dryer heater activates at temperatures below freezing. With the vehicle in a cold environment and before the engine is started, turn on the ignition and touch the air dryer housing. It should be warmer than other metallic items on the vehicle. If some warmth cannot be felt it may indicate that the heater element or the wiring powering it should be serviced.

Left Front of Vehicle



If wheels or tires must be changed, obtain expert tire service help. Mounting and demounting of tires should only be performed by qualified personnel using necessary safety procedures and equipment, otherwise the result could be property damage, personal injury, or death.



Do not operate vehicle if any of the following conditions are evident. Loss of steering or suspension could cause loss of vehicle control and result in property damage, personal injury, or death.



To prevent personal injury or death from hot coolant or steam, use only the following procedure to remove the pressure cap from the radiator or expansion tank. Allow the engine to cool first. Wrap a thick, heavy cloth around the cap. Unscrew the cap slowly to allow pressure to release from under the cap. After the pressure has been released, the pressure cap may be removed.

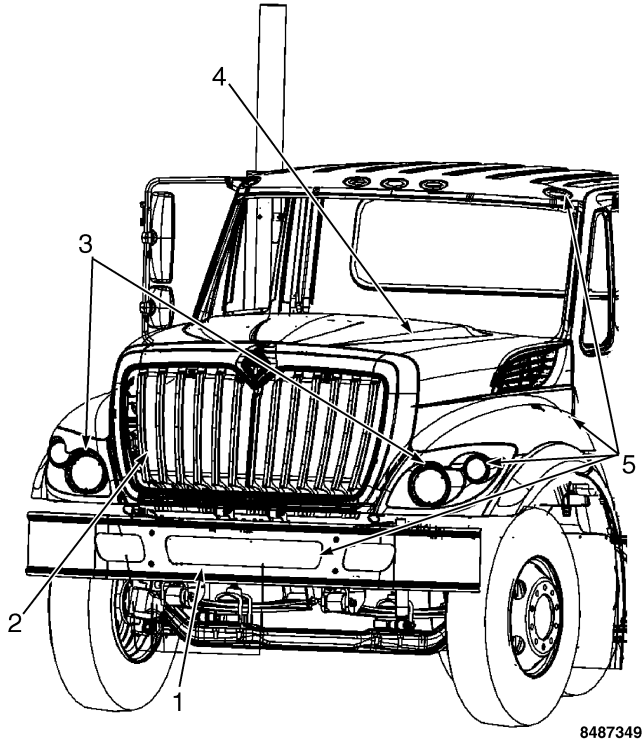
CAUTION

Retread tires are not recommended for use on steering axles of trucks.

1. **Steering Gear:** Look for missing or loose fasteners, power steering fluid leaks, and damage to power steering hoses.
2. **Brake Chamber and Hoses:** Check to see that the brake chambers are not cracked or damaged, and are securely mounted. Check for broken, loose, or missing parts. Check for cracked, worn or frayed hoses, and for secure couplings.
3. **Slack Adjuster:** Check slack adjuster and chamber push rod travel. When pulled by hand, push rod should not move more than approximately one inch. Angle between push rod and adjuster arm should be approximately 90 degrees when brakes are applied.
4. **Brake Lining and Drum:** With brakes released, check to see that brake linings (where visible) are not worn excessively thin [less than 1/4 inch (6mm)] or contaminated by lubricant.
5. **Spring Suspension:** Check condition of spring for cracks, breaks, or shifting. Inspect spring hanger fasteners, shackles, U-bolts, and nuts for wear, damage, and tightness.
6. **Shock Absorber:** Check for cracks, leaks, and missing or broken mounting bolts or bushings.

7. Air Suspension (if equipped): Check for air leaks, loose components, and damage to air bag. Inspect stabilizer bar for worn, loose, or damaged components.
8. Tires: Check tread depth and tire inflation and note if tread is evenly worn. Minimum tread depth is 2/32 inch on all drive tires. Look for cuts or other damage to the tread sidewalls. See if valve caps and stems are missing, broken, or damaged. Check dual spacing to ensure that dual wheels, mounted on the same wheel end, are evenly separated and that tire sidewalls are not touching one another.
9. Wheel and Wheel Nuts: Check for damaged or bent wheel. Check to see that all wheel nuts are present and not loose (look for rust trails around nuts). Ensure that no cracks or damage are present at wheel mount holes.
10. Hub: Check for obvious leaks on outside or inside of wheel. Verify correct oil level in hub.
11. Frame: Check for cracks or bends in frame. Make sure there are no loose, cracked, bent, broken, or missing crossmembers or fasteners.
12. Steering Linkage: Inspect connecting links, arms, rods, and steering intermediate shaft for worn, damaged, loose, or missing components.

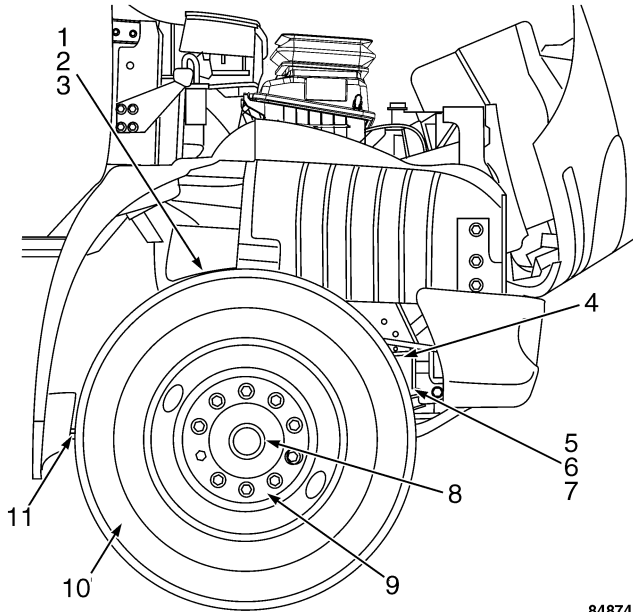
Front of Vehicle



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1. Bumper: Inspect for damage and security.
2. Grille: Inspect for damage and security. Check bug screen for damage and cleanliness.
3. Headlights: Lenses should be clean. If equipped, check daytime running lights.
4. Hood and Fenders: Check hood panels and fenders for signs of breaks or damage. Ensure hood opens and closes properly.
5. Lighting System: Lower hood and inspect parking, clearance, identification lights, turn signals, fog lights, and reflectors on hood, bumper, and cab. They should be clean, operational and the proper color. Inspect for damage and security.

Right Front of Vehicle



8487401



To prevent personal injury or death when performing maintenance and repairs to any turbocharged engine with engine inlet piping disconnected, a turbocharger compressor air inlet protective shield should be installed over the turbocharger air inlet.

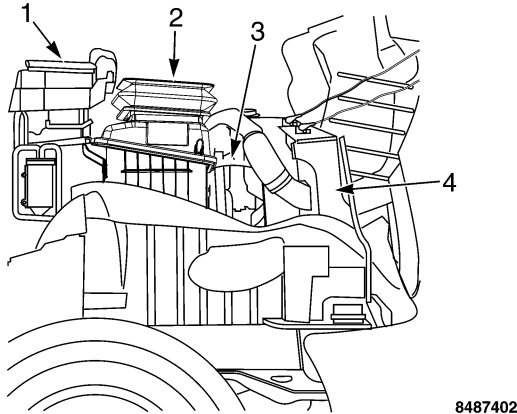


Electrical circuits are designed with a particular wire gauge to meet the fuse and circuit breaker current rating. Do not increase size of fuse or circuit breaker or change type of breaker supplied with your truck. To do so could cause wiring to overheat and possibly burn, resulting in a fire which could cause property damage, personal injury, or death.

1. Spring Suspension: Check condition of spring for cracks, breaks, or shifting. Inspect spring hanger fasteners, shackles, U-bolts, and nuts for wear, damage, and tightness.
2. Shock Absorber: Check for cracks, leaks, and missing or broken mounting bolts or bushings.
3. Air Suspension (if equipped): Check for air leaks, loose components, and damage to air bag. Inspect stabilizer bar for worn, loose, or damaged components.

4. **Frame:** Check for cracks or bends in frame. Make sure there are no loose, cracked, bent, broken, or missing crossmembers or fasteners.
5. **Brake Chamber and Hoses:** Check to see that the brake chambers are not cracked or damaged, and are securely mounted. Check for broken, loose, or missing parts. Check for cracked, worn or frayed hoses, and for secure couplings.
6. **Slack Adjuster:** Check slack adjuster and chamber push rod travel. When pulled by hand, push rod should not move more than approximately one inch. Angle between push rod and adjuster arm should be approximately 90 degrees when brakes are applied.
7. **Brake Lining and Drum:** With brakes released, check to see that brake linings (where visible) are not worn excessively thin [less than 1/4 inch (6mm)] or contaminated by lubricant.
8. **Hub:** Check for obvious leaks on outside or inside of wheel. Verify correct oil level in hub.
9. **Wheel and Wheel Nuts:** Check for damaged or bent wheel. Check to see that all wheel nuts are present and not loose (look for rust trails around nuts). Ensure that no cracks or damage are present at wheel mount holes.
10. **Tires:** Check tread depth and tire inflation and note if tread is evenly worn. Minimum tread depth is 2/32 inch on all drive tires. Look for cuts or other damage to the tread sidewalls. See if valve caps and stems are missing, broken, or damaged. Check dual spacing to ensure that dual wheels, mounted on the same wheel end, are evenly separated and that tire sidewalls are not touching one another.
11. **Steering Linkage:** Inspect connecting links, arms, and rods for worn, damaged, loose, or missing components.

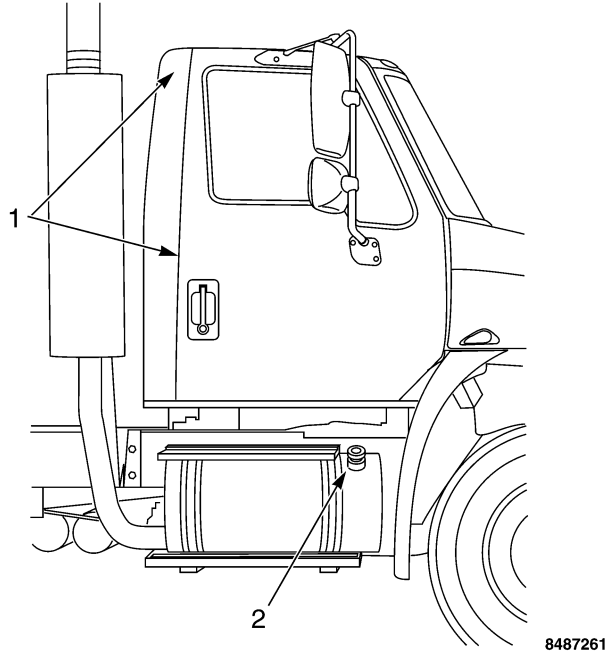
Right Engine Compartment



1. Cowl Vent: Ensure air inlet cover is free of dirt and debris.

2. Air Cleaner: Check air cleaner element, housing, and hoses for loose connections or damage. Check filter minder gauge for restriction reading. For element replacement, see **Air Cleaner Element Service** in the **Maintenance** section.
 3. Drive Belts: Inspect all belts for frays, cracks, loose fibers, or visible signs of wear. With engine off, press on all belts to test for proper belt tensioner performance
 4. Radiator and Charge Air Cooler: Check for loose mounting and damage. Inspect condition of all hoses for damage, cracks, and leaks. Inspect for foreign material on face of cooling package. Carefully brush away collected materials without bending cooling fins to maintain proper airflow through cooling package.
- Air Lines and Wiring: Check air Lines and electrical wiring for proper security, damage, and chafing. Listen for audible air leaks.
 - Leaks: Check for signs of fluid puddles under vehicle, or wet components in the engine compartment.

Right Side of Cab



CAUTION

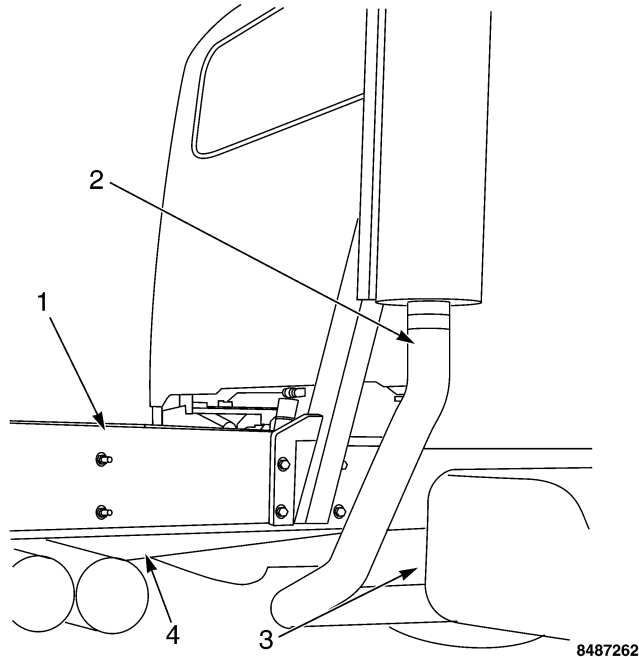
Do not adjust air suspension height to any setting other than the specified setting. Altering the height setting will change the driveline angle and may result in unwarrantable component damage, such as transmission component damage.

1. Cab Structure: Check body panels such as doors, fenders, and cab for signs of breaks or damage. Check condition of cab mounting brackets and tilt hood latches and where the torsion bars are mounted to hood.
2. Fuel Tank: Check to see that the fuel tank and cap are secured and make sure there is no damage or leaks at the tank, fuel lines, or tank mounting hardware is secure .

Right Side Under Vehicle



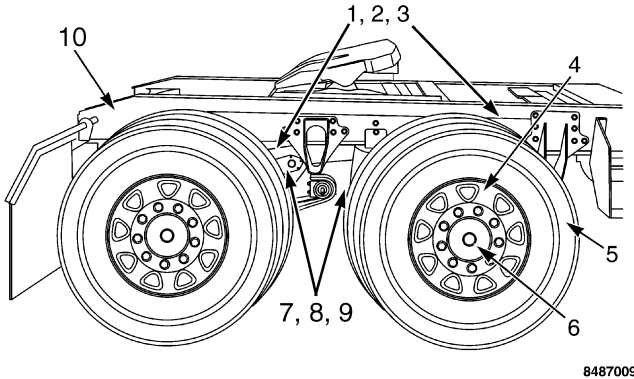
Maintain adequate clearance between all parts of the exhaust system and all hoses, wires and lines for engine cooling, brake system, fuel system, power steering system and electrical system. Heat damage to hoses, wires may cause vehicle malfunction that could result in property damage, personal injury, or death.



1. Frame: Check for cracks or bends in frame. Make sure there are no loose, cracked, bent, broken, or missing crossmembers or fasteners.
 2. Exhaust System: Check to see that all component parts are securely mounted and no cracks, holes, or severe dents are visible. Evidence of soot build up around clamps or connections is a clear indicator of a leak being present. Ensure that all hoses, wires, and air lines are secured away from exhaust components.
 3. Transmission: Inspect for leaks.
 4. Drive Shaft: Ensure that all shaft couplings are secure.
- Air Lines and Wiring: Check air Lines and electrical wiring for proper security, damage, and chafing. Listen for audible air leaks.

Inspection Guide

Right Rear of Vehicle

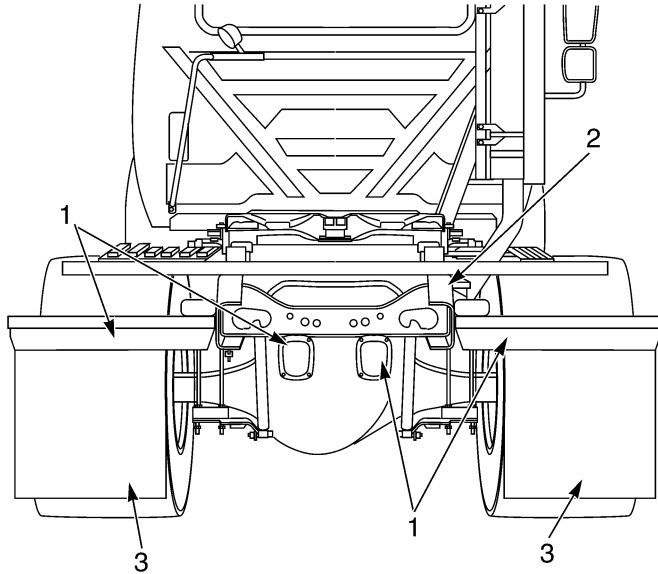


If wheels or tires must be changed, obtain expert tire service help. Mounting and demounting of tires should only be performed by qualified personnel using necessary safety procedures and equipment, otherwise the result could be property damage, personal injury, or death.

1. **Brake Chamber and Hoses:** Check for cracked, worn or, frayed hoses, and for secure couplings. Check to see that the brake chambers are not cracked or dented and that they are securely mounted. Check for broken, loose, or missing parts.
2. **Slack Adjuster:** Check slack adjuster and chamber push rod travel. When pulled by hand, push rod should not move more than approximately one inch. Angle between push rod and adjuster arm should be approximately 90 degrees when brakes are applied.
3. **Brake Lining and Drum:** With brakes released, check to see that brake linings (where visible) are not worn excessively thin [less than 1/4 inch (6mm)] or contaminated by lubricant.
4. **Wheel and Wheel Nuts:** Check for damaged or bent wheel. Check to see that all wheel nuts are present and not loose (look for rust trails around nuts). Ensure that no cracks or damage are present at wheel mount holes.

5. Tires: Check tread depth and tire inflation and note if tread is evenly worn. Minimum tread depth is 2/32 inch on all drive tires. Look for cuts or other damage to the tread sidewalls. See if valve caps and stems are missing, broken, or damaged. Check dual spacing to ensure that dual wheels, mounted on the same wheel end, are evenly separated and that tire sidewalls are not touching one another.
 6. Hub: Check for obvious leaking on outside or inside of wheel. Inspect axle flanges and wheel seals for leaks and loose mounting hardware or broken items. Check lube level, if equipped with sight glass.
 7. Spring Suspension: Check condition of spring for cracks, breaks, or shifting. Inspect spring hanger fasteners, shackles, U-bolts, and nuts for wear, damage, and tightness.
 8. Torque Rods and Shock Absorbers: Check to see that torque rods are not cracked, broken or missing. Check shock absorbers for cracks or leaks. There should be no missing or, broken mounting bolts or worn bushings.
 9. Air Suspension (if equipped): Check for air leaks, loose components, and damage to air bag. Inspect ride height valve and linkage for damage.
 10. Frame: Check for cracks or bends in frame. Make sure there are no loose, cracked, bent, broken, or missing crossmembers or fasteners.
- Air Lines and Wiring: Check air lines and electrical wiring for proper security, damage, and chafing. Listen for audible air leaks.

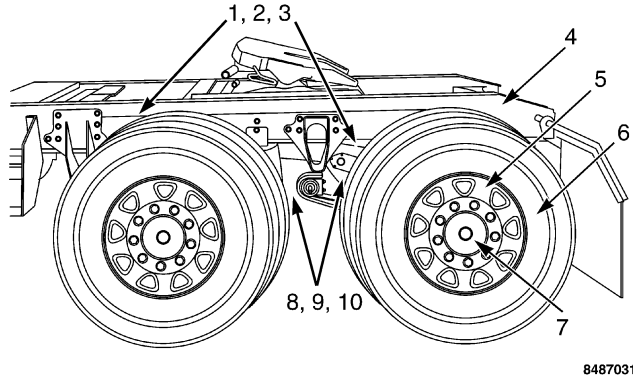
Rear of Vehicle



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1. Lights and Reflectors: Check to see that reflectors and lights are clean. Make sure none are missing or broken. Rear running lights should be clean, not broken, and red in color.
 2. Frame: Check for cracks or bends in frame. Make sure there are no loose, cracked, bent, broken, or missing crossmembers or fasteners.
 3. Mud flaps: Inspect rear mud flaps and mountings for damage and proper security.
- Air Lines and Wiring: Check air Lines and electrical wiring for proper security, and for damage, and chafing. Listen for audible air leaks.

Left Rear of Vehicle

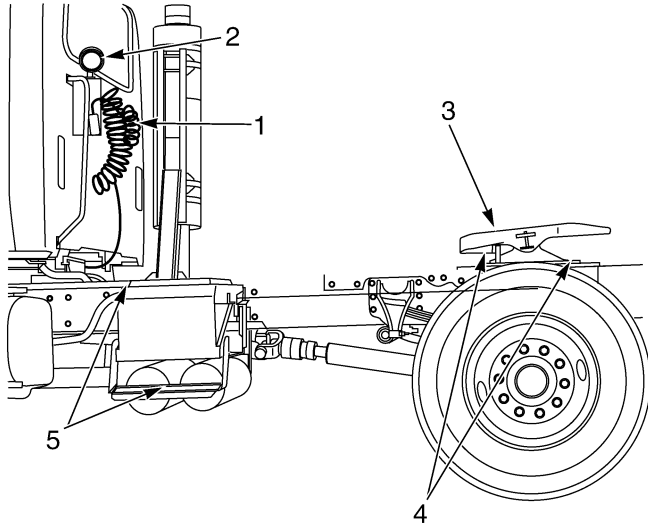


Due to tire manufacturers re-marking tires to conform to the SI (metric) system, tires marked with old and new loads or inflation pressures could be placed on the same vehicle. For field maintenance, only inflate and load tires to the maximum of the least-rated tire on the axle. Failure to adhere to this warning could possibly result in tire malfunction, damage to your vehicle, personal injury, or death.

1. Brake Chamber and Hoses: Check for cracked, worn, or frayed hoses, and for secure couplings. Check to see that the brake chambers are not cracked or dented and that they are securely mounted. Check for broken, loose, or missing parts.
2. Slack Adjuster: Check slack adjuster and chamber push rod travel. When pulled by hand, push rod should not move more than approximately one inch. Angle between push rod and adjuster arm should be approximately 90 degrees when brakes are applied.
3. Brake Lining and Drum: With brakes released, check to see that brake linings (where visible) are not worn excessively thin [less than 1/4 inch (6mm)] or contaminated by lubricant.
4. Frame: Check for cracks or bends in frame. Make sure there are no loose, cracked, bent, broken, or missing crossmembers or fasteners.

5. **Wheel and Wheel Nuts:** Check for damaged or bent wheel. Check to see that all wheel nuts are present and not loose (look for rust trails around nuts). Ensure that no cracks or damage are present at wheel mount holes.
 6. **Tires:** Check tread depth, tire inflation and note if tread is evenly worn. Minimum tread depth is 2/32 inch on all drive tires. Look for cuts or other damage to the tread sidewalls. See if valve caps and stems are missing, broken or damaged. Check dual spacing to ensure that dual wheels are evenly separated, and that tires are not touching one another.
 7. **Hub:** Check for obvious leaking on outside or inside of wheel. Inspect axle flanges and wheel seals for leaks and loose mounting hardware or broken items. Check lube level, if equipped with sight glass.
 8. **Spring Suspension:** Check condition of spring for cracks, breaks, or shifting. Inspect spring hanger fasteners, shackles, U-bolts, and nuts for wear, damage, and tightness.
 9. **Torque Rods and Shock Absorbers:** Check to see that torque rods are not cracked, broken, or missing. Check shock absorbers for cracks or leaks. There should be no missing or broken mounting bolts or worn bushings.
 10. **Air Suspension (if equipped)** Check for air leaks, loose components, and damage to air bag. Inspect ride height valve and linkage for damage.
- **Air Lines and Wiring:** Check air Lines and electrical wiring for proper security, damage, and chafing. Listen for audible air leaks.

Fifth Wheel and Coupling Area



8487264

1. **Trailer Coupling Cords:** Inspect air lines and coupling gaskets, electrical cord for cuts, chafing, damage, and proper security. Check air lines for audible air leaks .
2. **Work Light(s):** Check operation and clean as needed.
3. **Lubrication:** Make sure that top surface (face) of the 5th wheel has a coat of grease.
4. **Mounting Bolts and Release Handle:** Look for loose or missing mounting brackets, clamps, bolts, or nuts. All locking pins must be in place and free of damage. Ensure that release handle is in the engaged position and the safety latch is functioning and free of damage.
5. **Deck Plate and Access Steps:** Check to ensure that the deck plate and steps are clean, securely bolted in place, and clear of loose objects.

Cab Interior Inspection

1. **Safety/Emergency Equipment:** Prior to entering cab, verify that vehicle is equipped with the proper equipment. Walk around vehicle and check that all steps and grab handles, inside and out, as well as behind, are tight and clean. Use extreme caution and maintain 3 point contact at all times.
2. **Doors:** Check door latches for positive closing, latching and locking.
3. **Clutch/Gearshift:** Depress clutch pedal (if present) and verify transmission is in neutral before turning on starter; keep depressed until engine reaches idling speed and vehicle in neutral.
4. **Oil Pressure Builds:** Check to see that oil pressure is building to a normal level. Engine oil pressure gauge should begin a gradual rise to normal operating range.
5. **Low Air Alarm:** The low air pressure alarm may sound immediately after the engine starts but before the air compressor has built up minimum 55 psi pressure. The low air pressure alarm should stop when the air pressure reaches 60 to 76 psi (414 to 524 kPa). Let the air pressure build to governor cut-out pressure, which should occur between 115 and 130 psi (793 and 896 kPa).
6. **Accelerator:** Depress accelerator pedal and verify that it operates smoothly without any binding or irregular feel. Remove foot from accelerator and make sure engine returns to idle immediately.
7. **Voltmeter:** Check the gauge to see if the alternator is charging between 12.5 and 14.5 volts.
8. **Steering Play:** Check for smooth operation. Check for excessive looseness in the steering linkages. The steering wheel should have less than 10 degrees free play (approximately 2 inches at rim of 18 inch steering wheel).
9. **Seats:** Be sure seats are firmly engaged to avoid forward or rearward movement when starting or stopping. Make sure that seats and tether straps are free from damage and secured to floor.
10. **Horn(s):** Check to see that horn(s) operate properly.
11. **Mirrors:** Check mirrors for proper adjustment, damage, cleanliness, and proper mounting. Check (optional) power mirrors and (optional) heated mirrors for proper operation.
12. **Doors:** Ensure windows are clean and operate properly and smoothly in both doors.
13. **Windshield and Wipers:** Check windshield for cracks, dirt, illegal stickers or other obstructions to view. Ensure wipers and windshield washer are functioning properly.
14. **Lighting Indicators:** Check to see that dash indicators illuminate when corresponding lights are turned on.
15. **Heater/Defroster:** Check to be sure that heater/defroster is working. Verify adequate air flow from louvers and vents. Operate Temperature and Mode controls to verify proper operation.

16. Air Brake Check: Check the air brakes in the following manner:

- a. Chock wheels if necessary. Push in parking brake and start engine.
- b. Check for air compressor or governor cut-out pressure at 125 to 135 psi (862 to 931 kPa). Shift into a low gear, and gently pull against service and parking brakes separately to make sure they hold.
- c. Shut off engine and TURN IGNITION BACK ON.
- d. Without brake pedal applied, note air pressure drop for one minute. It should be less than 2 psi (14 kPa).
- e. Depress and hold brake pedal and make sure there is no more than a 3 psi (21 kPa) per minute pressure drop. For combination vehicles, there should be no more than 4 psi (28 kPa) per minute pressure drop.
- f. Step on and off brake pedal and check that warning light and alarm come on at about 60 or 76 psi (414 or 524 kPa).
- g. Step on and off brake pedal and check to make sure the parking brake knobs pop out between 20 and 45 psi (138 and 310 kPa).

SECTION 4 — CONTROLS/FEATURES

Introduction

The controls/features enable the driver to monitor and manage the operation of the majority of the vehicle's functions. This section describes and identifies various components within the Overhead Console, Instrument Panel Gauge Cluster, Center Dash Panel/Wing Panel, Steering Column and Switches, Steering Wheel Controls, Door and Window Controls, and Vehicle Information Display.

Electrical



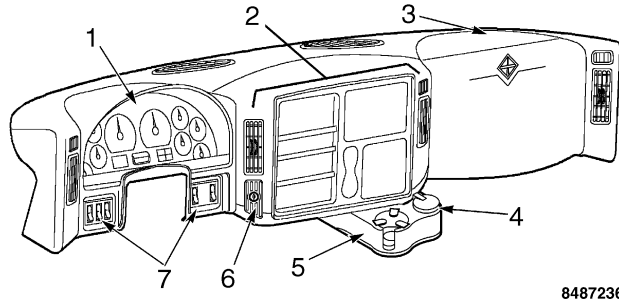
This vehicle may be equipped from the factory with electrical switches intended to operate equipment that was installed by a truck equipment manufacturer (TEM). Instructions, Cautions, and Warnings for this additional equipment will NOT be found in this manual. Read and understand the appropriate manual for the specific equipment in question before operating. Failure to observe this warning may cause property damage, personal injury, or death.

NOTE: This vehicle may be equipped with electronic, application-specific options not described in this Operator's Manual. Many of these features are supplied with rocker switches that have custom labels applied. The presence of these options as factory installed can be verified from the Line Set Ticket included with the vehicle. A truck equipment manufacturer (TEM), however, may have installed some of these options after production. In that case, they will not appear on the Line Set Ticket. If installed by a TEM, you should receive an operating guide and/or training for the specific functions provided. Familiarize yourself with all of the switches that control chassis, engine, and body equipment and seek adequate training on the function of all features before operating this vehicle.

Electrical System

The electrical system provides a means to distribute the electrical power and provide the driver with controls and indications of vehicle performance. Unlike previous electrical systems, this system uses multiplexing for connecting to major functional areas of the truck with much less wiring. The system provides interfaces to a majority of vehicle switches and sensors and communicates with the standard and optional system controllers and modules in the vehicle.

Dash Components

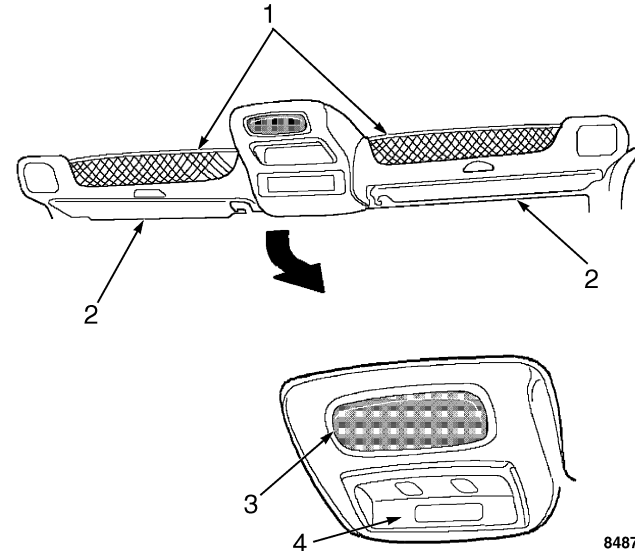


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1. Instrument Panel Gauge Cluster
2. Center Dash Panel/Wing Panel
3. Fuse Panel Cover
4. Ashtray
5. Cup Holder
6. Ignition Switch
7. Lower Panel Switches

Overhead Console

This vehicle is equipped with an overhead console that provides both dome lighting and storage facilities. The overhead storage capacity consists of two netted storage bins large enough to place many items (one for the driver and one for the passenger).



8487235

1. Storage pockets
2. Sun Visors
3. Dome Lamp Switch
4. Optional Compass/Temperature Display

Main Instrument/Control Panel

Instrument Panel Gauge Cluster

The instrument panel gauge cluster includes the instrument gauges, warning indicators, and an Integral Digital Display, that

provide odometer, transmission gear indication, and compass heading and outside temperature displays. This instrument panel gauge cluster displays the crucial operational functions of the vehicle. The following are descriptions and illustrations of the gauges, warning indicators, and integral digital display options.



Warning Indicators

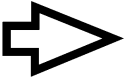
The instrument panel gauge cluster contains 25 individual LED warning indicators. These indicators are used to monitor vehicle operation and indicate a WARNING or STOP condition. These warning indicators are driven by the software in the instrument panel gauge cluster. At ignition, the warning indicators will illuminate for 8 to 10 seconds, as part of the vehicle power-up sequence.

Item No.	Item	Description
1	 3813045	Illuminates Yellow when the intake heaters and glow plugs are in operation and special starting procedures are required. Refer to the Starting Switch paragraph in the Vehicle Operation section for more information.
2	IDLE SHUT DOWN 8487074	Illuminates Yellow to alert driver that vehicle idle shutdown timer will turn engine off in 30 seconds.
3	 8487080	Illuminates Yellow . Used in conjunction with other Warning Indicators or General Text and Warning Messages and may be accompanied by an audible alarm to indicate an Alert condition to the operator.

4	 8487084	Illuminates Yellow . Used in conjunction with other Warning Indicators or General Text and Warning Messages to indicate an Alert condition to the operator.
5	 8487086	Illuminates Red Used in conjunction with other Warning Indicators or General Text and Warning Messages to indicate a red STOP alert.
6	BRAKE (P) PRESSURE 3813046	Illuminates Red when a failure in the service brake system has occurred. If the Brake Pressure warning indicator illuminates, safely stop the vehicle as soon as possible and seek service immediately.
7	PARK (P) 8487075	Illuminates Red when the parking brake is applied. If the brake warning indicator does not illuminate, or if it stays on with the parking brake not engaged, seek service immediately.
8	 8487411	Illuminates Green to assist operators in determining when it is appropriate to shift the transmission to a higher gear in order to maximize driving fuel economy.
9	RANGE INHIBITED 8487070	Illuminates Yellow when the transmission is not engaged in the selected gear. The warning indicator goes out when the gearshift lever is adjusted to the appropriate gear. Refer to the Transmission Operator's Manual for more information.
10		Not used.

11	 3813047	Illuminates Yellow when the traction control system is turned off. It also illuminates momentarily when the traction control system is on and is limiting wheel spin. Indicator blinks if slippery road conditions exist. If this happens, adjust your driving accordingly. Refer to the Operation section for more information.
12		Not used.
13	 3813051	Illuminates Yellow when exhaust system components are operating under normal conditions and exhaust gases are at extremely high temperatures.
14	 3813052	Diesel Particulate Filter (DPF) status indicator. Illuminates Yellow (Solid or Flashing) to indicate the need to regenerate the Diesel Particulate Filter. (See Exhaust Regen in the Vehicle Operation Section).
15	 3813053	Engine Emissions Control System Malfunction Indicator Lamp (MIL) Illuminates Yellow when an emissions problem has occurred.

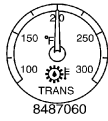
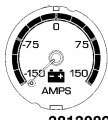
16	SERVICE  8487088	Illuminates Red when a parking brake system malfunction has been detected. If the Service Parking Brake indicator stays illuminated, have the system serviced immediately.
17	 8487073	Optional indicator illuminates Red immediately after ignition is turned on to remind operator to fasten seat belt. Optional Seat Belt Reminder with Seat Belt Monitoring causes initial visual indication, then flashes with audible alarm when ignition is on, parking brake is released, and seat belt is not fastened.
18	BRAKE FLUID  3813054	Illuminates Red when the brake fluid falls below the safe operating level.
19		Not used.
20		Not used.
21	 8487089	Illuminates Yellow when an antilock brake system malfunction has been detected. If the ABS indicator stays illuminated or continues to flash, have the system serviced immediately.
22	ECON 8487091	Illuminates Yellow when transmission Economy Mode is selected. Refer to the Transmission Operator's Manual for more information.

23	 8487092	Flashes Green when the left turn signal or the hazard lights are turned on.
24	 8487094	Illuminates Blue when the high beam head lamps are turned on.
25	 8487093	Flashes Green when the right turn signal or the hazard lights are turned on.

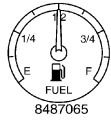
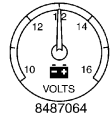
NOTE: If the MIL is illuminated, it is the vehicle owner's responsibility to have the engine repaired or face fines.

Gauges

There are six standard and four optional gauges in the instrument panel gauge cluster to help monitor the vehicle while in service. Most gauges have in-gauge warning indicators which turn ON if the gauge pointer moves into an out-of-acceptable-range condition. When the ignition switch is turned ON, the gauge indicators will be ON. If any indicator fails to go out after starting engine, stop engine and determine cause of the gauge indication that is out of acceptable range. Metric versions of the gauges and speedometer are available as an option.

Item No.	Item	Description
26	 8487060	Transmission Oil Temperature Gauge: Indicates the transmission lubricant temperature in degrees Fahrenheit or Celsius.
27	 8487061	Optional Engine Oil Temperature Gauge: Indicates the engine lubricant temperature in degrees Fahrenheit or Celsius.
27	 3813082	Optional Ammeter: Indicates the rate of charge of electric current supplied by the alternator to the battery, or the rate of discharge from the battery.
28	 8487063	Coolant Temperature Gauge: Indicates engine coolant temperature. The warning indicator indicates the engine coolant temperature has exceeded 230° F when equipped with a 10 psi de-aeration tank, and 235° F when equipped with a 15 psi de-aeration tank. If the warning indicator is activated, stop the vehicle as soon as safely possible, turn off the engine and let the engine cool.

Item No.	Item	Description
29		Engine Oil Pressure Gauge: Indicates engine oil pressure. If the needle falls below the normal range (20–65 psi) at normal operating temperature, stop the vehicle as soon as safely possible, and check the engine oil level. Add oil if needed. If the oil level is correct, have your vehicle checked by a qualified technician. The warning indicator indicates low engine oil.
30		Tachometer: Indicates the engine speed in revolutions per minute.
31		Speedometer: Indicates vehicle speed.

Item No.	Item	Description
32		Fuel Level Gauge: Indicates the approximate fuel level in the fuel tank. If your vehicle is equipped with dual fuel tanks, the fuel gauge reads the fuel level only from the primary (draw) fuel tank. When the fuel level reaches 1/8 full, the gauge warning indicator will illuminate and an audible alarm will sound (5 beeps). (Optional) Special fuel warning: the warning indicator will light when gauge falls below 1/3, and alarm continuously when below 1/10 (close to "E").
33		Battery Voltage Gauge: Indicates the voltage when the key is in the ON or ACCESSORY position. The warning indicator illuminates when the battery voltage is too high or low.

Item No.	Item	Description
34		Air Pressure Gauge 1: Provides indication of air pressure available for the primary air brakes. LED and audible under-limit (less than 57 psi) warning indicators.
35		Air Pressure Gauge 2: Provides indication of air pressure available for the secondary air brakes. LED and audible under-limit (less than 57 psi) warning indicators.

The Instrument Panel Gauge Cluster will sound an audible alarm that accompanies out of range gauge readings along with the particular gauge warning indicators. The cluster alarms will also sound when any engine sensor (sender) unit fails; when there is an electronics system fault; and when the **Red** engine indicator is illuminated. The following chart lists the number of alarm beeps for the above conditions or warning states:

Instrument Panel Gauge Cluster Alarms



When an alarm sounds, stop normal vehicle operation and determine the source of the alarm condition. Failure to observe this instruction could result in property damage, personal injury, or death.

Alarm Conditions	Audible Alarm Pattern	Additional Comments
Fuel Level Gauge low (alarms on each ignition turn-on and low fuel occurrence)	5 BEEPS	Instrument Panel Gauge Cluster warning indicator illuminates.
Voltmeter Gauge out of range reading	5 BEEPS	
Engine Oil Pressure Gauge out of range reading	5 BEEPS	

Controls/Features

Alarm Conditions	Audible Alarm Pattern	Additional Comments
Engine Oil Temperature Gauge out of range reading	5 BEEPS	Instrument Panel Gauge Cluster warning indicator illuminates.
Engine Coolant Temperature Gauge out of range reading	5 BEEPS	Instrument Panel Gauge Cluster warning indicator illuminates.
Transmission Oil Temperature Gauge out of range reading	5 BEEPS	Instrument Panel Gauge Cluster warning indicator illuminates.
Rear-Rear Axle Oil Temperature Gauge out of range reading	5 BEEPS	Instrument Panel Gauge Cluster warning indicator illuminates.
Forward-Rear Axle Oil Temperature Gauge out of range reading	5 BEEPS	Instrument Panel Gauge Cluster warning indicator illuminates.
Auxiliary Air Pressure Gauge out of range reading	5 BEEPS	Instrument Panel Gauge Cluster warning indicator illuminates.
Gauge Sensor Faults	3 BEEPS	Gauge pointer goes to 6 o'clock position and Instrument Panel Gauge Cluster warning indicator illuminates.
Primary Air Pressure Gauge out of range and air pressure sensor fault	REPEATING SINGLE BEEP	Instrument Panel Gauge Cluster warning indicator illuminates.
Secondary Air Pressure Gauge out of range and air pressure sensor fault	REPEATING SINGLE BEEP	Instrument Panel Gauge Cluster warning indicator illuminates.
Red Stop Warning indicator illuminates	REPEATING SINGLE BEEP	Instrument panel warning indicator illuminates.
Turn Signal Alarm (Optional)	CONTINUOUS TONE	Alarm sounds if either turn signal is on for more than one mile. Will not activate when hazard flashers are on.
Low Coolant Alarm	REPEATING SINGLE BEEP	Gauge warning indicator illuminates.

Direct Drive Warning Indicators

The direct drive warning indicators give information to the operator of various conditions of the vehicle. Eight spaces are available for the direct drive warning indicators. Blank cover plates will be used in spaces that do not have direct drive warning indicators installed at those locations.

Item No.	Item	Color	Description
36		Yellow	WINTER/ENGINE INTAKE is set to the Winter position.
37		Yellow	Front rear axle differential is locked.
38		Yellow	Rear rear axle differential is locked.
39		Yellow	FRONT AXLE/ON switch is in the ON position.
40	BLANK		Not used
40	BLANK		Not used
41	BLANK		Not used
41	BLANK		Not used
42		Yellow	AUTO NEUTRAL function enabled.

Item No.	Item	Color	Description
43		Yellow	Optional Transmission Retarder switch is in the ON position.
43		Yellow	Illuminates in conjunction with the (Optional) Qualcomm satellite communication system – see Qualcomm system owner's manual.

Integral Digital Display

The Integral Digital Display is located below the speedometer and the tachometer. It is arranged in four quadrants that display vehicle information. The four quadrants can be individually selected by using the display control button.

Display Control. The Display control is used to scroll to a quadrant and to select the various modes within a quadrant. To navigate between quadrants, turn and release the control either clockwise or counterclockwise. To select the screens within a quadrant, press and release the control. Pressing and holding the control for more than 3 seconds to reset the value of the selected quadrant parameter (if the parameter can be reset). The selected quadrant is identified by a vertical bar located in the far right of quadrant. In quadrant 1, the odometer screen can be toggled between English and Metric, by pressing and holding the control.

Item No.	Quadrant Number and Message Function	Message Description
44	Quadrant 4: Transmission Gear Indication	Transmission gears for the Allison P-R-N-D-L gear selection display, or the Eaton Transmission display.
45	Quadrant 1: Informational Messages	Informational Display Screens: • Odometer • Trip Odometer • Total Engine Hours • Trip Hours • Machine PTO A or B Hours • Machine Trip PTO A or B Hours • Engine PTO Hours • Engine PTO Trip Hours • Instantaneous Fuel Economy • Trip Average Fuel Economy • Machine PTO Fuel Used A or B • Machine PTO Trip Fuel Used A or B • Engine PTO Fuel Used • Engine PTO Trip Fuel Used • Trip Idle Fuel Used • Axle Load Indication (Front and/or Rear) • Diesel Particulate Filter Level

Item No.	Quadrant Number and Message Function	Message Description
46	Quadrant 2: General Text and Warning Messages	Displays a variety of messages ranging in priority necessary for vehicle monitoring and operation, and vehicle malfunction warnings. Some messages are used in conjunction with instrument panel gauge cluster warning indicators (see list of messages in the Integral Digital Display section in Vehicle Operations)
47	Quadrant 3: Compass Heading/Outside Temperature	(Optional) Displays compass heading when vehicle is equipped with a compass module. Displays outside temperature (reading is obtained from the temperature sensor).
48	Display Control	Toggles the information display from one screen to the next when pressed and released.

Switches

Six switches are located on the lower left and right side of the main instrument/control panel. Configurations are optional. Blank cover plates will be used in spaces that do not have switches installed at those locations.

Headlights

The headlights will be at 100 percent brightness with the headlight switch activated. The park lights, tail lights, markers, and clearance lights will be on as well.

Your vehicle may be equipped with an optional headlight warning alarm that sounds immediately after ignition switch is turned to OFF position, when headlight switch is on, and the driver's door is closed. It also sounds when headlight switch is on, ignition switch is in OFF position, and the drivers door is open.

The headlights are operated in a variety of modes:

Daytime Running Lights (DRL)

The daytime running lights feature provides for low beam headlights at 75 percent brightness whenever the Parking Brake is released and the ignition switch is in the ON position. The lights will stay ON until the Parking Brake is engaged.

Lights on with Wipers

This feature allows the headlights (low beam) to be automatically turned ON when the windshield wipers are in steady or intermittent mode (not washer). The low beams will remain ON until the ignition switch is turned to the OFF position or the headlights are cycled ON and then OFF.

Park Lights

The park lights, taillights, markers, and clearance lights will turn ON when the headlight switch is in the park or headlight position.

Marker Interrupt

The marker interrupt function is an optional feature that toggles the park lights and markers when the operator activates the spring-loaded marker interrupt switch. When park lights are ON, activating the interrupt switch will cause the park lights and markers to be turned OFF until the interrupt switch is released. If park lights are OFF, activating the interrupt switch will cause the park lights and trailer markers to be turned ON until the switch is released.

Panel Lighting

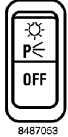
The panel lighting brightness is controlled by the Panel rocker switch. To increase the brightness of the instrument panel lighting, continually press the upper portion of the rocker switch. To dim the instrument panel lighting, continually press the lower portion of the rocker switch.

Dome Lighting

The overhead dome light is used for reading and for illumination when entering and exiting the vehicle. The dome light ON/OFF is also controlled by pushing on the lamp lens. When either entrance door is closed, the courtesy light will remain ON for approximately 20 seconds or until the ignition switch is turned ON. At that time, the lights will dim gradually until the light is OFF. The optional keyless entry key fob also turns ON the light for a time period when its Unlock button is pressed and turns OFF the light (dims gradually to OFF) when its Lock button is pressed.

Courtesy Lights

The optional driver courtesy lights are located under the instrument panel ends for door lighting. This feature is provided with the optional Premium trim package. An optional rear courtesy light can also be provided with the travel crew cab.

Item No.	Item	Description
49	Configured by Customer Request	Switch options for this position include: MIR, Fog Light Switch, and Plow Light switch. NOTE: Refer to switch table in this section for switch functions.
50	 8487243	LMP Check Activates the optional exterior lamp check.
51	 8487053	Headlight/Park Lamp Switch Activates the headlight or parking lights, and illuminates the instrument panel. This switch functions even when ignition switch is turned OFF (a warning will sound when this switch is ON and the ignition switch is OFF).

52	 8487054	Panel Dimmer Adjusts the panel lights brightness.
53	Configured by Customer Request	Switch options for this position include: Lift Gate, Work Light, Mirror Heat, Fog Light, Plow Light, Fan Override, Two Speed Axle, Air Suspension Dump, Auxiliary, Parked Regeneration, Inhibit Regen NOTE: Refer to switch table in this section for switch functions.
54		

Optional Instrument panel gauge cluster Compass Calibration Procedure

All new vehicles with an optional compass must have an initial compass calibration performed. A compass calibration may or may not have been completed at the vehicle assembly plant. If the compass headings are noticeably incorrect, or become noticeably incorrect, or the NO CAL message is displayed, the Declination Zone may need to be reset to agree with the current geographic location, or the Compass Directional Calibration will need to be recalibrated.

The compass direction is displayed in the lower left quadrant of the instrument panel gauge cluster display just below the outdoor temperature reading. Text messages necessary to calibrate the compass can be found in the instrument panel gauge cluster display in the lower right quadrant (quadrant 2) of the display. Twist the instrument panel gauge cluster display knob until the cursor is flashing in the lower right quadrant. Press the instrument panel gauge cluster display knob until the desired text message is displayed. Compass Calibration related text messages include "Calibrate Compass", "Compass Declination", "Declination Zone #", and "End Calibration".

NOTE: The Declination Zone for the location where the Compass Calibration procedure is being performed must be set **first**, and thereafter the Compass Directional Calibration procedure can be performed. Both procedures are listed on the following pages and must be followed **exactly** to ensure proper calibration of the compass.

Compass Declination Zone Set Procedure

The Declination Zone number is used to account for the errors between magnetic North and true North in the vehicle's geographic operating area, and must be set correctly for the compass to display accurate headings.

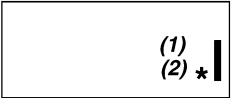
NOTE: When calibrating/recalibrating the compass, you must select the Declination Zone which corresponds to the geographic location where the compass calibration is being performed. It can be reset later to match the Declination zone where the vehicle will be operating.

For vehicles that regularly operate coast-to-coast or in several different Declination Zones, either choose a Declination Zone in the geographic center of the vehicle's operating area, or change the Declination Zone daily to match the present Declination Zone.

To begin the Declination Zone set procedure, the vehicle must be stopped with ignition key ON. Refer to Zone Map for determining the proper Declination Zone number.

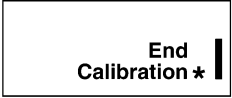
This map shows North America with a low-pressure system centered off the West Coast. Isobars are labeled with values 9, 10, and 11. The low is located near 45°N, 120°W. High-pressure areas are shown over the Arctic and the Atlantic. State and provincial abbreviations are labeled across the continent.

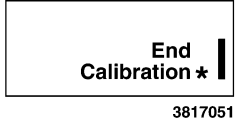
3879634R1

Step	Procedure	Displayed Message
1	Select Quadrant 2 (lower right) on the display by turning the display control knob either clockwise or counterclockwise.	 3817049
2	Select the Compass Declination message by pressing and releasing the display control knob until this message appears.	 3817053
3	Press and hold the display control knob until any Declination Zone number (0 – 10) is displayed.	 3817054
4	Turn the display control knob clockwise or counterclockwise until the desired Declination Zone number is displayed. Refer to Declination Zone Map to determine the proper number for the current geographic location. NOTE: If no Declination Zone number is selected within 15 seconds, the display will return to the Compass Declination message. NOTE: If the compass is being calibrated/recalibrated the Declination Zone must be set to the Zone number for the location where the compass calibration/recalibration is being performed regardless of the location where the vehicle will eventually operate.	 3817055
5	Press and HOLD the display control knob until the Compass Declination message appears (this indicates that the new Declination Zone number has been programmed into the compass).	 3817053

Compass Directional Calibration Procedure

To begin the Compass Directional Calibration Procedure, stop the vehicle in an area large enough to permit driving in complete circles and perform the following steps:

Step	Procedure	Displayed Message
1	Select Quadrant 2 (lower right) on the instrument panel gauge cluster display by turning the display control knob either clockwise or counterclockwise.	 3817049
2	Select the Calibrate Compass message by pressing and releasing the display control knob until this message appears.	 3817050
3	Press and hold the display control knob until the End Calibration command is displayed. NOTE: IF the End Calibration command will not show up, turn OFF the vehicle, restart it, and return to Step 1. NOTE: The following steps (4 through 6) must be completed within 3 minutes to lock-in the new calibration. Do not press the display control knob or turn the key OFF until these steps are completed or the calibration process will be cancelled.	 3817051
4	Immediately following the End Calibration command being displayed, drive the vehicle in 3 complete circles (during this time the compass display will go blank or have dashed lines present).	 3817052

5	Stop the vehicle and wait shortly. The End Calibration message should reappear on the display.	
6	Push and HOLD the display control knob until the End Calibration command disappears. The calibration should now be complete. IMPORTANT!: Just pressing and failing to hold the display control knob inward until the End Calibration command disappears will cancel the calibration procedure and you must start over at Step 1.	
7	Test the compass calibration. Turn the vehicle ignition key OFF and then restart the vehicle. Wait 10 seconds to for the compass to complete its self test. Drive the vehicle in a circle and note the compass readings. If the lower left quadrant of the Instrument Panel Gauge Cluster Display shows the correct compass/vehicle heading, the compass calibration is now complete. If the compass readings are incorrect, inspect for correct Declination Zone number, turn OFF the vehicle, restart the vehicle, wait 10 seconds, and perform another circle while periodically noting the compass readings. If readings are still incorrect restart the compass calibration procedure.	

Integral Digital Display Detailed Information

Quadrant 1: Informational Displays

NOTE: The available display screens are dependant on the configuration of the vehicle.

Quadrant 1 – Display Messages	Description
Odometer	The odometer displays the total distance traveled. Display Format: 100,000.0 MILES KM
Trip Odometer	The trip odometer displays a record of the elapsed distance traveled since the last reset. NOTE: The trip hours and trip miles are independently reset. Display Format: 100,000.0 TRIP MILES TRIP KM
Total Engine Hours	The Engine Hour display provides a record of accumulated engine hours, and will not show any increase unless the engine is running. NOTE: This display function cannot be reset. Display Format: 100,000.0 HOURS
Trip Hours	The Trip Hour display provides a record of elapsed engine hours since the last reset. NOTE: The trip hours and trip miles are independently reset. Display Format: 100,000.0 TRIP HOURS

Quadrant 1 – Display Messages	Description
Machine PTO A or B Hours	This display will provide a record of the total accumulated Machine PTO hours, while PTO function A or B is engaged. Display Format: 100,000.0 PTO HOURS A PTO HOURS B
Machine Trip PTO A or B Hours	This display will provide a record of the total accumulated Machine Trip PTO hours, while PTO function A or B is engaged. Display Format: 100,000.0 PTO TRP HOURS A PTO TRP HOURS B
Engine PTO Hours	This display will provide a record of the Engine PTO hours sent from engine. Display Format: 100,000.0 ENG PTO HOURS
Engine PTO Trip Hours	This display will provide a record of the Engine PTO Trip hours sent from engine. Display Format: 100,000.0 ENG PTO TRP HOURS

Quadrant 1 – Display Messages	Description
Instantaneous Fuel Economy	This display provides a record of the instantaneous fuel economy sent from the engine. The display shall be in miles per gallon or liters per 100 kilometers, corresponding to the units selected while in the odometer mode. Display Format: 30.0 INST MPG INST L/100KM
Trip Average Fuel Economy	The display value shall be the average fuel economy value since the last reset of the trip odometer. The display shall be in miles per gallon or liters per 100 kilometers, corresponding to the units selected while in the odometer mode. Display Format: 30.0 TRIP MPG TRIP L/100KM
Machine PTO Fuel Used A and B	The display value shall be the calculated Machine PTO Fuel Used. Display Format: 100,000.0 PTO GAL A PTO GAL B PTO L A PTO L B

Quadrant 1 – Display Messages	Description
Machine PTO Trip Fuel Used A and B	The display value shall be the calculated Machine PTO Trip Fuel Used. Display Format: 100,000.0 PTO TRP GAL A PTO TRP GAL B PTO TRP L A PTO TRP L B
Engine PTO Fuel Used	The display value shall be the calculated Engine PTO Fuel Used. Display Format: 100,000.0 ENG PTO GAL PTO TRP L
Engine PTO Trip Fuel Used	The display value shall be the calculated Engine PTO Trip Fuel Used. Display Format: 100,000.0 ENG PTO TRP GAL ENG PTO TRP L
Trip Idle Fuel Used	The display value shall be the calculated Trip Idle Fuel Used. Display Format: 100,000.0 TRP IDL GAL TRP IDL L

Quadrant 1 – Display Messages	Description
Axle Load Indication	The instrument panel gauge cluster shall display an approximate value of Axle Load for the front and/or rear axles. NOTE: Axle load readings are most accurate on a level surface with parking brake released. Display Format: approx. 45.0 FT LBSX1000 FT KGX1000 RR LBSX1000 RR KGX1000
Diesel Particulate Filter Level	The instrument panel gauge cluster shall display the relative Diesel Particulate Filter (DPF) Level. The instrument panel gauge cluster displays the following graph: 8487412 With “L” (low) on the left and “H” (high) on the right, the graph is shown by bars each representing a 10 percent increase/decrease in soot level. The instrument panel gauge cluster displays the last received level until a new value is received, or until the instrument panel gauge cluster detects that it has not received a response to the SPN request, in which case it shall display the word “data n/a” within the bar graph.

Quadrant 2 Text and Warning Messages

These messages inform the driver of vehicle conditions. If the message flashes, it will flash for 3 – 5 seconds, and then will be displayed for an additional 3 – 5 seconds. If more than one message is viewable, the displayed message will be followed by

an asterisk “*”, indicating multiple messages. To view additional messages, press and release the Display Control button to proceed to the next message.

The following is a list of the **routine** Text and Warning messages that can be displayed:

Quadrant 2 – Display Messages	Description	Flash (Yes/No)	Warning Indicator Association
PARKD REGEN ACTIVE	Message is displayed during a parked regeneration.	No	No
Load Shedding	Message is displayed when electrical load control and shedding feature is implemented.	Yes	No
Washer Fluid Low	Indicates low washer fluid level.	Yes	No
Electrical Fault	When instrument panel gauge cluster's ability to display diagnostic codes is enabled, this message is displayed when there are active diagnostic codes.	Yes	No
Check A/C	Indicates a fault in the HVAC System.	Yes	No
PARKD REGEN INHIBITED	Message is displayed when parked regeneration has been requested, but is not performed due to a vehicle interlock or an engine fault.	No	No
Air Filter Restriction	Message displayed indicates restricted air flow to the engine.	Yes	No
Exterior Lamp Check Active	Message displayed indicates Exterior Lamp Check is in progress.	Yes	No
HVAC Temp Setting	Bar graph displayed show temperature setting in low to high increments.	No	No
Activate HVAC Front Blower	Bar graph displayed show blower speed setting in Off and low to high increments.	No	No

Quadrant 2 – Display Messages	Description	Flash (Yes/No)	Warning Indicator Association
HVAC Sleeper Blower Speed	Bar graph displayed show blower speed setting in Off and low to high increments.	No	No
Air Pressure Diagnostic		Yes	No
Cruise	Indicates that the Cruise Control System is turned On.	No	No
Fuel Filter	Indicates that the fuel filter is clogged.	Yes	No
Check Brake Switch		Yes	No
Check Pupil Warning Indicator		Yes	No
Check Stop Arm/Crossing Gate		Yes	No
Check Exterior Lamps		Yes	No
Engine Control Shutdown		Yes	No
Check Trailer Lights		Yes	No
Engine Control System Error		Yes	No
PARKD REGEN REQUIRED	Indicates parked regeneration is necessary.	No	No
PARKD REGEN INHIBITED ENG TMP	Message is displayed when engine coolant temperature is below 170° F (76.6°C).	No	No
REGEN INHIBIT SWITCH ACTIVE	Message is displayed when Regen Inhibit Switch is “On” and regeneration is disabled.	No	No
PARKED REGEN AVAILABLE		No	No
Low Coolant Level	Message is displayed when coolant level is less than or equal to 80%.	Yes	No

Quadrant 2 – Display Messages	Description	Flash (Yes/No)	Warning Indicator Association
Stop Engine	Message is displayed when Red Stop indicator is illuminated. MaxxForce® engine only.	Yes	Red warning indicator
Warn Engine (Priority 1 or 2)	(1) Message is displayed when MaxxForce, or MaxxForce® 11/13 ECM turn on the Red warning indicator. (2) Message is displayed when MaxxForce, or MaxxForce® 11/13 ECM requests the Yellow warning indicator and not the Red warning indicator.	Yes	(1) Red warning indicator (2) Yellow warning indicator
Stop Hybrid	Message is displayed when Hybrid system turns on and requests the Red warning indicator.	Yes	Red warning indicator
Check Engine	Message is displayed when ECM requests the Yellow warning indicator and not the Red warning indicator.	Yes	Yellow warning indicator
HV Batt Off-Line	Message is displayed when Hybrid system battery is off line.	Yes	No
Check Hybrid	Message is displayed when Hybrid system turns on the Yellow warning indicator while conditions for “HV Batt Off-Line” message are not met.	Yes	Yellow warning indicator
Low Engine Oil Level	Message is displayed when engine oil level is less than or equal to 80%.	Yes	No
Change Engine Oil	Message is displayed when engine oil change is detected as necessary.	Yes	No
Water in Fuel	Message is displayed when water in fuel is present.	Yes	No
Refuel	Message is displayed when fuel level is low. MaxxForce® 11 and 13 engines only.	Yes	No
High Fuel Temp	Message is displayed when fuel temp is high. MaxxForce® 11 and 13 engines only.	Yes	No

Quadrant 2 – Display Messages	Description	Flash (Yes/No)	Warning Indicator Association
Electrical Fault (Priority 1 or 2)	(1) Message is displayed when EGC requests the Red warning indicator. (2) Message is displayed when EGC requests the Yellow warning indicator.	Yes	(1) Red warning indicator (2) Yellow warning indicator
Check Trans	Message is displayed when transmission needs to be serviced.	Yes	Yellow warning indicator
Trans Temp	Message is displayed when transmission turns on the Yellow warning indicator. Not available with all transmissions.	Yes	Yellow warning indicator
Gen Trns Flt	Message is displayed when transmission turns on Red Stop, MIL, or PROTECT, or the Yellow Warning indicator without the conditions to display Check Trans, Trans Temp, Trans Oil Life, Trans Oil Filter, or Trans Service. Not available with all transmissions.	Yes	Yes (see description)
Trans Oil Life	Message is displayed when transmission oil needs changed. Not available with all transmissions.	Yes	No
Trans Oil Filter	Message is displayed when transmission oil filter needs changed. Not available with all transmissions.	Yes	No
Trans Service	Message is displayed when transmission needs service. Not available with all transmissions.	Yes	No
DPF Ash Service Required	Message is displayed when diesel particulate filter ash level requires service/cleaning.	Yes	No
See Visor For Info	Message is displayed indicates the particulate trap indicator must be on or must flash.	Yes	Yes (see description)

Quadrant 2 – Display Messages	Description	Flash (Yes/No)	Warning Indicator Association
ECM, TCM, Shift Selector, ABS, Retarder – Driveline, EGC, Compass Module, ESC, VSM, SD, AGSP, TPMS, Exhaust Module, Telematics, AGSP 2, SIC 2, AGSP 3, SIC 1, PAM, Hybrid, Service Tool, Global	Message is displayed when a module other than the engine requests the red stop warning indicator.	Yes	Red warning indicator
ECM, TCM, Shift Selector, ABS, Retarder – Driveline, EGC, Compass Module, ESC, VSM, SD, AGSP, TPMS, Exhaust Module, Telematics, AGSP 2, SIC 2, AGSP 3, SIC 1, PAM, Hybrid, Service Tool, Global	Message is displayed when a module other than the engine requests the Yellow warning indicator.	Yes	Yellow warning indicator
Retarder Temp	Message is displayed when instrument panel gauge cluster receives signal from the Retarder – Driveline requesting the Yellow warning indicator.	Yes	Yellow warning indicator
Gen Rtrd Flt	Message is displayed when instrument panel gauge cluster receives signal from the Retarder – Driveline requesting the Red warning, MIL, or PROTECT indicator, or the Yellow warning indicator without the conditions to display Retarder Temp..	Yes	Yes (see description)
DRV Reward Expected		No	No
DRV Reward Good		No	No
DRV Reward Excellent		No	No
DRV Reward Penalty		No	No

Quadrant 2 – Display Messages	Description	Flash (Yes/No)	Warning Indicator Association
DRV Reward Increasing		No	No
DRV Reward Decreasing		No	No
VSL Ovrđ Active		No	No
VSL Ovrđ Expiring		No	No
	Blank screen, available only when engine rpm less than or equal to 325 RPM, or vehicle speed less than 2 mph (3 km/h).	No	No
Calibrate Compass	Message is displayed when vehicle speed is less than 2 mph (3 km/h) and the operator has not requested “Calibrate Compass” in the current ignition cycle.	No	No
End Calibration	Message is displayed when vehicle speed is less than 2 mph (3 km/h) and the operator has requested “Calibrate Compass” in the current ignition cycle.	No	No
Calibration Ended	Message is displayed when vehicle speed is less than 2 mph (3 km/h) and the operator has requested “Calibrate Compass” in the current ignition cycle.	No	No
Declination Zone	Message is displayed only when vehicle speed is less than 2 mph (3 km/h).	No	No

Warning Messages

In addition to the Diagnostic Trouble Codes (DTC), the digital display will display a warning message whenever an Engine indicator is illuminated. This warning message will be toggled with the normal DTC as follows:

Yellow Warning indicator: WARN ENGINE message

Red Stop indicator: Stop Engine message

The following chart provides the warning messages that are displayed along with corresponding Instrument panel gauge cluster indicators.

MaxxForce® Engines	
Warning indicator	Warning Message
Red Stop	Stop Engine
Yellow Warning	Warn Engine

Quadrant 3: Display Messages

Outside Temperature and Compass Displays (Optional)

The optional Outside Temperature and Compass Heading is displayed in Quadrant 3. Typical displays for Temperature and Compass Heading are listed in the following table. The display provides both the outside ambient temperature and the relative direction of the vehicle within a particular geographical zone.

Vehicle must be moving to acquire an accurate temperature.

Quadrant 3 – Display Messages	Description
Outside Temperature and Compass Heading	Display Format: 32°F SE 0°C SE 32°F NO CAL 8590030

Outside Temperature Reading

The Outside Temperature is displayed on the first line of Quadrant 3 above the Compass Heading. The temperature sensor is located near the front bumper. Due to its location, the sensor readings can be affected by road or engine heat during idling or prevailing driving conditions (extended slow movement).

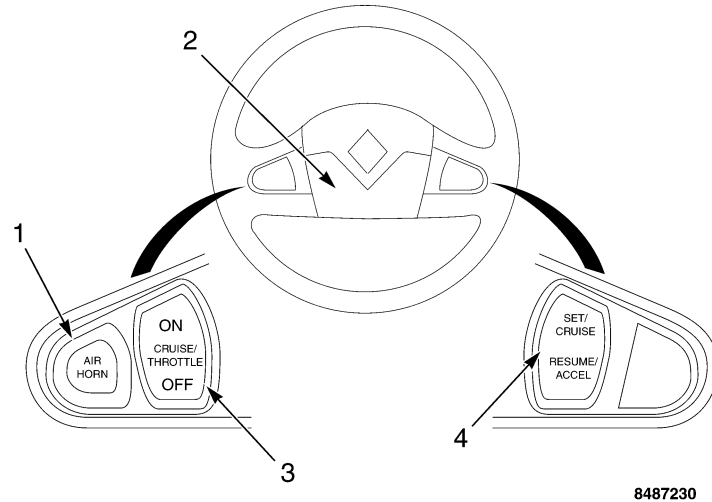
The display will be in °F or °C, depending on the units selected while in the odometer mode.

Quadrant 4: Transmission Gear Displays

Quadrant 4 – Transmission Gear Indications	
Allison P-R-N-D-L gear display	PRND421 8487430
Eaton® Transmission display	↑N2 8590031

Steering Wheel Controls

The steering wheel contains the Electric (city) horn, Optional Air horn control, and Cruise/Throttle controls.



1	 8487234	AIR HORN - Used to activate the air horn.
2	 8487231	HORN - Used to activate the city horn.

3	 8487232	CRUISE/THROTTLE - ON/OFF - Turns the speed control feature ON or OFF. Engine speed does not change when you press the ON position. This control just activates/deactivates the feature. When the OFF position is pressed, the system will be turned OFF.
4	 8487233	RESUME/ACCEL - Used to resume the desired speed set on the cruise control or accelerate to a higher desired speed. When parked, used to increase idle RPM.

Cruise Control

The cruise control systems for all electronic engines function in a very similar manner. The biggest difference is the minimum and maximum allowable cruise control speeds that will vary from vehicle to vehicle.



Do not use the cruise control system when unpredictable driving conditions are present. Such conditions include heavy traffic, roads that are winding, icy, snow covered, slippery, or with a loose surface. These conditions may cause wheel slippage and loss of vehicle control, resulting in property damage, personal injury, or death.

Basic Functions of Steering Wheel Controls

The CRUISE/THROTTLE - ON/OFF control turns the speed control feature ON or OFF. Engine speed does not change when you press the ON position. This control just activates/deactivates the feature. When the OFF position is pressed, the system will be turned OFF.

The left side CRUISE/THROTTLE switch has different labels, depending on which feature was ordered. However, they all perform the same function: to turn ON the basic feature.

The two available options are:

- Throttle - used when only throttle or an engine speed control is ordered;
- Cruise/Throttle - used when cruise control and either a hand throttle or an engine speed control are ordered.

The right switch (SET/COAST - RESUME/ACCEL) actually sets and controls the engine speed. But if the left switch has not been activated, nothing will happen when pushing on this right switch. This switch has the same label in all applications.

Operational Procedures

The following steps will activate and enable each of the four engine speed control features.

Cruise Control – operates like an automotive cruise control.

1. Press the ON position of the CRUISE/THROTTLE - ON/OFF steering wheel control.

2. Bring the vehicle to the desired operating speed (above 35 MPH), and then push the SET/CRUISE position of the steering wheel control.
3. Once in the cruise mode the right side SET/CRUISE – RESUME/ACCEL switch can be used to increase or decrease vehicle speed by pressing and holding the RESUME/ACCEL to increase or the SET/CRUISE to decrease vehicle speed.
4. A slight tap on the brake or clutch pedal will deactivate the cruise but holds the selected speed in memory. To return to this speed, just press RESUME/ACCEL.
5. When you press the OFF (left) position of the CRUISE/THROTTLE - ON/OFF switch, or if the vehicle is shut off, the selected speed setting is canceled.

Throttle

This feature is ordered to provide variable engine speed control primarily for operation of PTO powered equipment. It uses the same Cruise controls as described below.

1. Press the CRUISE/THROTTLE - ON/OFF steering wheel control to ON.
2. Press SET/CRUISE on the steering wheel control.
3. Press and hold RESUME/ACCEL to increase engine speed until the desired engine speed is obtained. Or, you can repeatedly press and release RESUME/ACCEL to increase the speed in small increments.

4. To change from this initial setting, use the appropriate control to raise or lower the engine speed as you would in the cruise control mode. SET/CRUISE reduces engine speed and RESUME/ACCEL increases engine speed.
5. Press the OFF position of the ON/OFF control to turn the throttle off and return the engine to idle.

Stationary Variable Speed Control (12VXT)

This feature is ordered to provide variable engine speed control primarily for operation of PTO powered equipment. It operates the same as the Cruise/ Throttle controls discussed above.

Stationary Pre-Set Speed Control (12VXU)

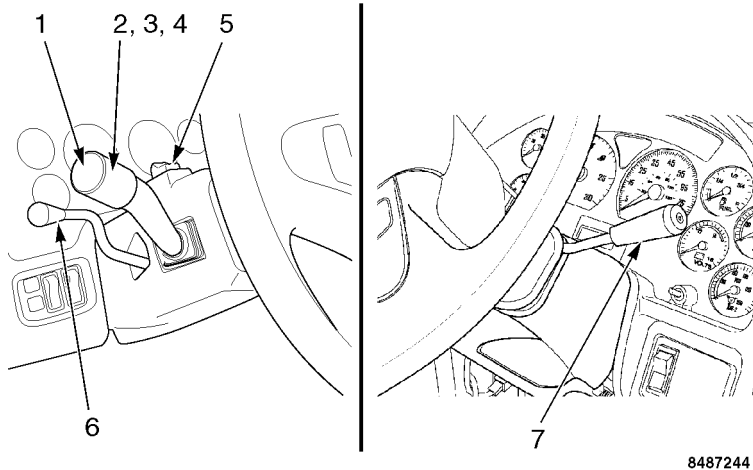
1. To activate this feature, press the ON position on the left side CRUISE/THROTTLE - ON/OFF switch.
2. When ordered, this feature can provide two different predetermined speeds, which are selected with the SET/CRUISE or RESUME/ACCEL positions. You need to know which position to use for your specific operation. Press the right side SET/CRUISE or RESUME/ACCEL switch for the desired pre-set speed.

3. First, press the switch that selects one of the desired speeds.
4. To select the other speed, press the other switch. The engine will immediately return to idle.
5. You must push the switch a second time to go to the second speed. This is done to protect equipment from being inadvertently operated at the wrong speed.

Mobile Variable Speed Control (12VXV)

Operates the same as cruise control, except the engine speed is accurately controlled instead of vehicle speed. The truck could be operated in one of several gears but the truck is limited to a maximum of 20 MPH, or any pre-set lower speed down to 3 MPH.

Steering Column and Switches



The steering column contains switches and levers to aid in the comfort of the operator and to assist the operator while driving the vehicle.

1. Washer/Wiper Control - The windshield washer, along with the windshield wipers, is controlled by the WASHER/WIPER knob on the turn signal switch lever. To operate the windshield washer, push in on the wiper knob to spray solution on the windshield. Wipers will start wiping and continue for two cycles.

Multi-function Switch - The multi-function turn signal switch is mounted on the left side of the steering column below the steering wheel.

2. Signaling For A Turn - When signaling your intention to make a turn, move the turn signal lever up or down to the “full turn” position which is past the point of resistance. On some models the switch will automatically cancel if the steering wheel is turned a large enough degree. On other models the switch does not automatically cancel and will require manual cancellation.

Lane Change – The turn signal lever includes a “lane change” feature which allows the operator to signal the intention to change lanes without locking the switch into the full turn position. To use this feature, move turn signal lever up or down to the point where resistance to movement is felt. The turn signal lever will return to the OFF position when released.

3. Windshield Wiper - The electric wiper has two speeds (hi-low), which can be operated by rotating the WASHER/WIPER knob. The optional intermittent control provides five wiper ON/OFF cycle intervals, varying from 2 to 14 seconds. This is done by rotating the wiper control from the wiper OFF position to the any of the five intermittent wiper interval positions.

Automatic Intermittent Interval Control (Optional) – This feature automatically changes the wiper speed from HIGH or LOW to the slowest intermittent speed when the parking brake has been set, and the wipers have been on for a predetermined length of time. When the parking brake is released, the wipers return to their previous speed.



Do not use the washers in freezing weather without first warming the windshield with the defrosters; otherwise, the washer solution may freeze on the windshield and obscure your vision and cause an accident which could result in property damage, personal injury, or death.

Do not use radiator coolant or anti-freeze in the windshield washer reservoir. Radiator coolant in the washer reservoir can severely reduce visibility when sprayed on the windshield.

Keep the fluid reservoir filled with Fleetrite® Windshield Washer Solvent or equivalent.

4. Low/High Beam - When the turn signal stalk is pulled past the “click” position, lights will switch to Hi-Beam position. When pulled again they will revert to Lo-Beam.

Headlight Flash-To-Pass - When the turn signal lever is pulled with the headlights OFF, the Hi-Beam lights will come on and stay

on as long as the lever is held in the pulled position. When the Lo-Beam headlights are ON, the Hi-Beam lights can be made to flash if the lever is not lifted past the “click” or dimmer position.

5. Hazard Warning Switch - Red rocker switch located above multipurpose turn signal lever. Push switch to forward position to activate. The hazard warning flasher will operate with the ignition switch in the ON or OFF position. Use the warning system any time your vehicle becomes a traffic hazard, day or night. Push switch rearward to deactivate.

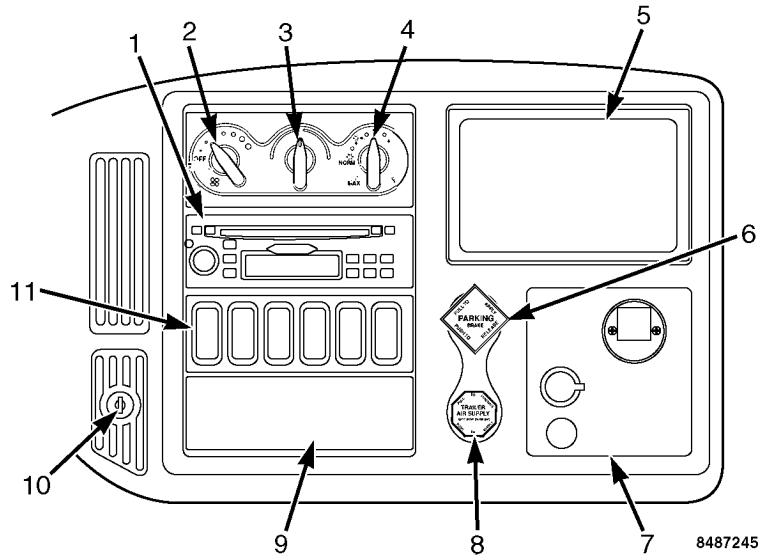
Stop Override Hazard (Optional) - When hazard lights are activated and the brake pedal is depressed, all hazard/turn signal lights on the front, side lights of the truck, and the side trailer lights will continue to flash. The rear lights of the truck or tractor will burn steadily until the brake is released.

6. Tilting Adjustment Lever (Optional) - Allows the steering wheel placement to be adjusted for driver comfort. Pull up to adjust, push down to lock.

7. Trailer Brake Lever - This lever is used to apply and release the brakes to the trailer.

Center Dash Panel/Wing Panel

The Center Control Switch Panel consists of the switches that start the vehicle, control the vehicle's normal operations, vehicle lights, and special mechanical functions. The panel also includes control of the interior comfort levels (HVAC controls), optional parking brake controls and auxiliary electrical power source (see Vehicle Operation for operational details). Refer to the Radio Operator's Manual provided with the vehicle for instructions on operating the radio installed in this Vehicle.

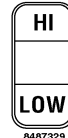
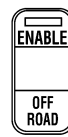


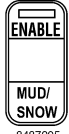
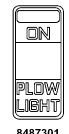
1. Radio
2. Fan Speed Control
3. Temperature Control
4. Mode Control
5. Storage Compartment/Optional Switch Pack Location
6. Parking Brake
7. Optional Component Panel
8. Trailer Air Supply
9. Optional Switch Pack Location
10. Ignition Switch
11. Switch Pack

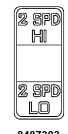
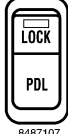
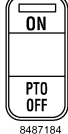
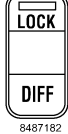
Switches

Up to 25 optional switches can be located in the center and lower right side of the center dash panel. Location of these switches will vary depending on the options installed. Blank cover plates will be used in spaces that do not have switches installed at those locations.

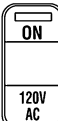
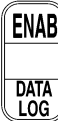
Item	Description
	Marker Interrupt – MKR INTR A momentary switch that turns all trailer marker lights ON or OFF, depending on park light switch position.
	Heated Mirror – ON/OFF A momentary switch that, when pushed and released, turns the mirror heating element ON or OFF.
	ENG BRAKE – ON/OFF Turns engine compression brake ON/OFF.
	ENG BRAKE 1/2/3 A three position switch that selects the amount of engine braking (1 = Low, 2 = Medium, 3 = High)

	Transmission Retarder – RTARDR ON Turns ON transmission retarder to slow down drivetrain.
	Transmission Retarder – HI/LOW Selects the percentage of Transmission Retarder capability. HI = 66%; LOW = 33%.
	FOG LIGHT – ON/OFF Turns ON Fog Lights when the switch is in the ON position, ignition switch is in the “Ignition” or “Start” position, and the headlights are ON and in low beam mode.
	TRAC ENAB/DISAB This switch enables or disables the ABS traction feature.
	OFF ROAD ENABLE As part of the automatic traction control system, this switch, when enabled, allows for greater engine power and more wheel spin on soft road surfaces.

 8487205	MUD/SNOW ENABLE As part of the automatic traction control system, this switch, when enabled, allows for greater engine power and more wheel spin on soft road surfaces.
 8487301	PLOW LIGHT ON/OFF With this feature, the ON position selects the high mounted Plow lights whenever the headlights are ON. If the operator shuts OFF the vehicle with the plow lights ON, they will remain ON.
 8487323	LIFT GATE – ON This switch provides power to the lift gate system. This optional feature provides battery protection and/or programmable time out.
 8487302	AUTO NEUTL – ON When the ON position is selected and the parking brake is applied (vehicle speed is near zero mph), the transmission goes into (auto) neutral.
 8487106	FAN OVRD – ON With the switch in the ON position, the fan mode is switched from “auto” to the constant “on”. The switch indicator will be ON when the ON position is selected.
 8487330	WORK LIGHT – ON This switch is used to turn the back of cab work light ON or OFF.

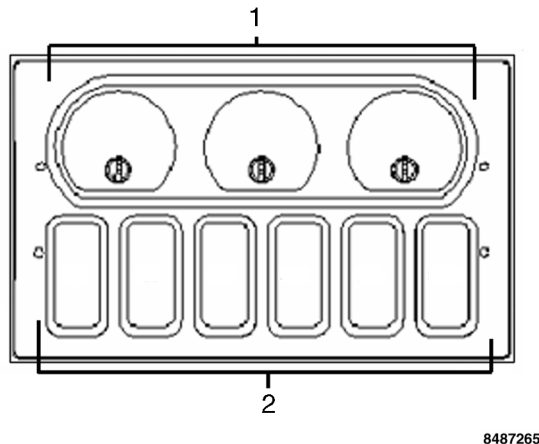
 8487303	2 Speed Axle – 2 SPD LO/ 2 SPD HI A 2 speed switch that allows the operator to select either high or low rear axle ratio.
 8487107	Power Divider lock – LOCK/PDL This switch is used to lock together the front and rear axle of a tandem.
 8487108	SUSP/DUMP This switch allows the operator to release the air from or reinflate the air bags of the air suspension system.
 8487184	PTO OFF/ON Engages Power Take Off when switch is in ON position or disengages Power Take Off when switch is in PTO OFF position.
 8487109	5TH WHEEL SLIDE ON/OFF This switch, when set to ON, releases the sliding 5th wheel (when ignition switch is in “Run” and vehicle speed is less than 2 mph).
 8487182	Differential Lock – DIFF/LOCK This switch, when set to LOCK, engages the locking differential which locks the right and left side tires (only if vehicle is below maximum differential lock engagement speed of 25 mph (40 km).

 8487180	Forward Rear Tandem Axle Differential Lock – DIF FR AXLE LOCK This switch, when set to LOCK, engages the forward rear locking differential for improved traction on poor surfaces (only if vehicle is below maximum differential lock engagement speed of 25 mph (40 km).
 8487181	Rear Rear Tandem Axle Differential Lock – DIF RR AXLE LOCK This switch, when set to LOCK, engages the rear rear locking differential for improved traction on poor surfaces (only if vehicle is below maximum differential lock engagement speed of 25 mph (40 km).
 8487304	Front Axle Differential Lock – FRONT AXLE/ON Engages Front Axle for 4X4 operation.
 8487307	Transfer Case – XFER HI/XFER LOW Selects Transfer Case high or low gear ratio.
 8487305	AIR ASSIST – (OFF) ON Provides inflation or deflation of auxiliary air bag.

 8487306	Engine Shutdown Override – ENG OVRD/ON This momentary switch, when pushed to the ON position, will allow the vehicle to be restarted in the event of an automatic engine shutdown.
 0830806	AC Power Enable – ON 120V AC This switch, when set to the ON position, will provide AC output from the Power Pack 3 inverter.
 8487290	WINTER/ENGINE INTAKE Used to change engine intake air from “outside air” to engine compartment air.
 8487175	PARKD REGEN – ON DPF regeneration activation when parked switch is used for engine after-treatment. Manually initiates DPF regeneration.
 8487176	INHIBT REGEN – ON The Regeneration Inhibit switch is used to prevent the Active Regeneration or Parked Regeneration processes.
 8487434	ENAB/DATA LOG When enabled, allows the driver to log the last five seconds of data group’s operational parameter values into ECM memory.

Auxiliary Gauge/Switch Package (AGSP)
(Optional)

The Auxiliary Gauge/Switch Package provides locations for three additional gauges and six switches for optional customer requirements. The following lists the gauges that are approved for this location.

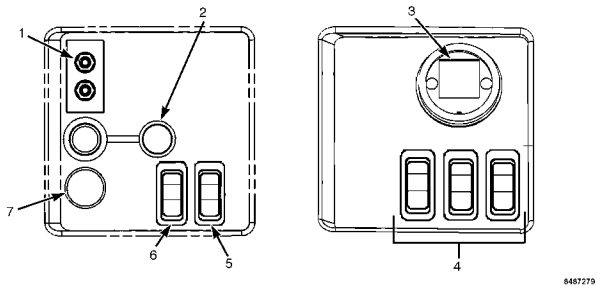


- 1. Auxiliary Gauge Locations
- 2. Auxiliary Switch Locations

Optional Gauge	Function
Air Application Gauge	Provides readings of brake application air pressure. Max pressure of 150 psi.

Optional Gauge	Function
Ammeter Gauge	Provides reading of battery and alternator current in Amps.
Rear-rear Axle Temperature Gauge	Provides monitoring of temperature of axle lubricant. Warning indication at 230°F.
Front-rear Axle Temperature Gauge	Provides monitoring of temperature of axle lubricant. Warning indication at 230°F.
Load Indicating Gauge	Provides reading of rear axle load. *
* Gauge reading is for reference only. DO NOT base legal loading criteria on this gauge reading. Refer to Switches in this section for optional auxiliary switches.	

Panel Component Arrangements (Optional)



Item	Component Description
1	Two Post Power Socket

Item	Component Description
2	Cigar Type Power Socket
3	Optional Filter Minder
4	Three Switch Pack a. Optional Winter/Engine Intake Switch b. Optional Air Horn Switch c. Optional Ether Start Switch d. Optional Engine Start Switch e. Optional Axle Enable Switch f. Optional Axle Up/Down Switch g. Optional Roof Auxiliary Switch

Item	Component Description
5	Telematics No Data Logged Switch
6	Telematics Driver Alert Switch
7	Cigar Lighter

Climate Control



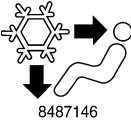
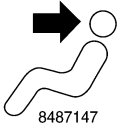
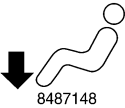
Never drive the vehicle unless the windshield and all other windows are clear. A fogged, ice/snow covered, or dirty windshield or window limits vision, which could cause an accident, resulting in property damage, personal injury, or death. To improve defroster efficiency, remove ice and/or snow by hand from the windshield and windows with a non-metallic scraper.

CAUTION

To clear system of humid air, operate blowers for 30 seconds at high speed, with the AIR FLOW/AIR CONDITIONER knob on the normal heating position before selecting the DEF position. This will prevent fogging the glass, which can occur if humid air is blown onto a cool windshield.

NOTE: The vehicle may be equipped with optional heater shut off valve(s) to prevent hot coolant from circulating through the heater core(s). Closing the valve(s) during hot weather operation will improve A/C system performance. If the valves are shut off, in-cab temperature adjustment may become limited. In addition, when shut off valves are closed, defrosters will only produce cold air.

Item No.	Item	Description
36	Fan Speed Control	Use this control to regulate the amount of air provided to the vents in any mode you select. Turn the knob clockwise to increase fan speed. Turning the control to the OFF position will shut OFF the fan (and the A/C compressor if A/C is selected), but does not prevent outside air from entering the vehicle. On vehicles equipped with A/C, moving the mode knob to the MAX A/C position, with the fan ON, will close the fresh air door eliminating outside air from entering the vehicle.
37	Temperature Control	Use this control to regulate the temperature of the air discharged from the vents. The blue area of the control indicates cooler temperatures, while the red area indicates warmer temperatures.
38	Mode Control	NOTE: The dot between the mode control icons is an additional mix position between the two modes. Use this control to direct the flow of air as follows:

	MAX Air Conditioning Mode In this mode, all airflow is directed to the panel air outlets and the air is recirculated inside the vehicle. Use this mode to block out any outside odors, smoke, or dust and to cool the interior rapidly upon initial start up in very hot or humid weather. NOTE: Continuous use of the recirculation mode may make the inside air stuffy. Use of this mode for longer than fifteen minutes without a window slightly open is not recommended. The A/C compressor turns ON and OFF automatically as needed when in this mode.
	NORM Air Conditioning Mode In this mode, all airflow is directed to the panel air outlets. Fresh (outside) air is used to cool the vehicle in this mode. The A/C compressor turns ON and OFF automatically as needed when in this mode.
	Bi-Level Air Conditioning Mode In this mode 75 percent of the airflow is directed to the panel air outlets and 25 percent of the airflow is directed to the floor air outlets, and fresh (outside) air is circulated inside the vehicle. The A/C compressor turns ON and OFF automatically as needed when in this mode.
	Vent Mode In this mode, all airflow is directed to the panel air outlets, and fresh (outside) air is circulated inside the vehicle.
	Floor Mode In this mode, all airflow is directed to the floor air outlets, and fresh (outside) air is circulated inside the vehicle.

 8487149	Mix Mode In this mode 50 percent of the airflow is directed to the defrost and side demist air outlets and 50 percent of the airflow is directed to the floor air outlets, and fresh (outside) air is circulated inside the vehicle. The A/C compressor turns ON and OFF automatically as needed when in this mode to reduce humidity levels and help reduce moisture buildup on the windshield.
 8487150	Defrost In this mode, all of the airflow is directed to the defrost and side demist air outlets, and fresh (outside) air is circulated inside the vehicle. The A/C compressor turns ON and OFF automatically as needed when in this mode to reduce humidity levels and help reduce moisture buildup on the windshield.
To remove stale air or smoke while air conditioner is operating, you may want to open a vent window for a short period of time. Always park in the shade when possible. If your vehicle has been parked in the sun with the windows up, remove the overheated air inside by driving with windows down and the air conditioner ON for one or two city blocks.	

Air Conditioning

CAUTION

Failure to follow recommended service procedures and maintain adequate air flow through air exchange devices may result in component failure. Cleaning should be performed by a qualified technician.

Keep radiator area free of bugs, leaves, etc. Do not cover the condenser with a wire screen.

At least once or twice a month, turn ON the air conditioner for a few minutes while the engine is running. This periodic operation

keeps all the mechanical parts of your air conditioner in good operating condition.

It is normal for small amounts of water to drain out of the air conditioner module. This water is condensed moisture removed from the air inside the vehicle.

Correct airflow may be restored by either replacing the filter(s), which can be done without tools, or by cleaning the filters. The filter(s) may be cleaned by using a power washer with a soap solution. Keep the spray head at least six inches away from the filter to avoid damage. Rinse thoroughly.

NOTE: If your air conditioning performance seems lower than expected, check the front of the A/C condenser for an accumulation of dirt or insects. Clean with a gentle water spray from behind the radiator and through the condenser as required. Check for dirt and debris in both the cab and sleeper HVAC intake filters that may reduce airflow.

NOTE: The air conditioning system incorporates a low-pressure switch, which disengages the compressor clutch if evaporator outlet pressure falls below a certain set point. To restart the air conditioning system after an automatic shutdown has occurred, the operator must do one of the following:

1. Set A/C control to OFF and then back to ON. Fan speed control knob **MUST NOT** be in the OFF position.
2. Place fan speed control knob in OFF position and then back to the desired speed setting. A/C system must be ON.

NOTE: If the system continues to shut down automatically, have the system checked.

NOTE: The vehicle may be equipped with optional Heater Shut Off Valve(s) to prevent hot coolant from circulating through the heater core(s). Closing the valve(s) during hot weather operation will improve A/C system performance. If the valves are shut OFF, in-cab temperature adjustment may become limited. In addition, when shut off valves are closed defrosters will only produce cold air.

Dehumidification

The heater/defroster systems can be operated simultaneously with the air conditioner during mild weather and high humidity conditions to dehumidify the cab air. Turn the mode button to one of the A/C positions and position the temperature knob at a comfortable temperature location. The air conditioner will remove the humidity while the heater keeps the cab comfortable.

Door and Window Controls

Door Lock/Unlock

Cab Doors and Locks

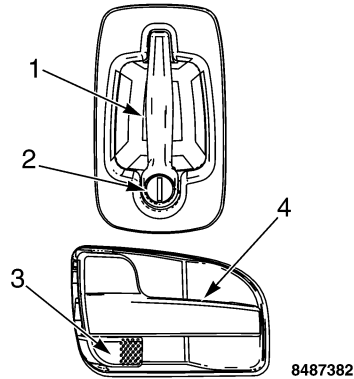
The cab doors can be unlocked with the same key used for the ignition lock. There is also a keyless remote entry available.

NOTE: The vehicle is delivered with two identical keys. If more keys are needed, order them through your authorized International dealer. Record the key code and keep it in a secure place. A new key can be made if the keys are lost.

1. Door Handle
2. Key Lock
3. Interior Lock
4. Interior Door Handle

To open any door from inside, pull out on interior door handle.

To open any door from outside, grab door handle and pull downward.

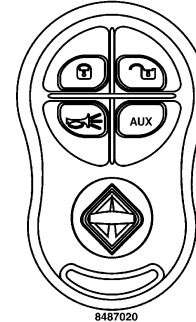


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With mechanical locks, only one door can be locked/unlocked at a time. Electrical locks can lock/unlock both doors by operating either the key, keyless entry fob, or the inner door lock handle on either side.

If equipped with a crew cab, the rear door locks, when engaged, must be unlocked using the mechanical lock release or the switch for electric locks. The rear interior door handle will not disengage the door locks.

Remote Keyless Entry Operation (Optional)



The remote keyless entry key fob is used to lock and unlock all doors from a distance of **30** feet (9 m) or less. Whenever the doors are locked or unlocked using the key fob, the city horn sounds momentarily (chirps). Also, the remote keyless entry key fob turns ON the interior light for a time period when the Unlock button is pressed, and turns OFF the light (dims gradually to OFF) when the Lock button is pressed. The Panic (emergency) button, when pushed, causes the horn to chirp ON/OFF for three minutes in unison with the headlights and park lights flashing. This feature works only when the ignition switch is in the OFF position.

The auxiliary button will be used to toggle the optional work light ON or OFF (if OFF, it will be turned ON, and if ON, it will be turned OFF).

NOTE: This device complies with Part 15 of the FCC Rules and with RSS-210 of Industry Canada. Operation is subject to the following two conditions:

1. This device may not cause harmful interference.
2. This device must accept any interference received, including interference that may cause undesirable operation.

Changes or modifications not expressly approved by the party responsible for compliance could void the user's authority to operate the equipment.

Door Opening/Unlock

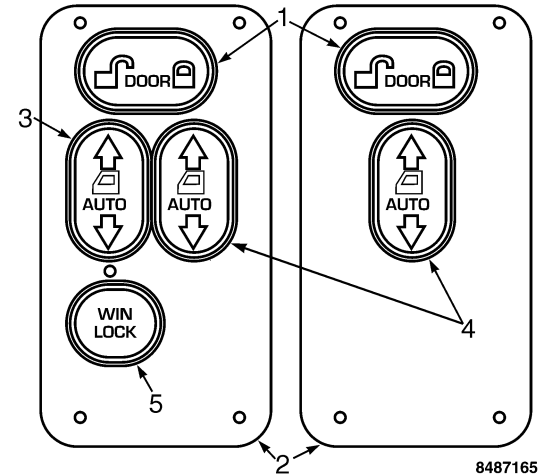
Enter or exit the vehicle by manually pulling on the exterior or interior door handles. To open the door from the interior, if locked, the front door will unlock when the door handle is pulled.

If equipped with a crew cab, the rear door locks, when engaged, must be unlocked using the mechanical lock release.

Lock/Unlock from Interior



To help reduce the risk of personal injury in the event of an accident, keep doors locked when vehicle is in motion.



1. Lock/Unlock Button
2. Door Control Panel
3. Driver Side Power Window Control
4. Passenger Side Power Window Control
5. Window Lock Control

Locking the Door

To lock, push the lock/unlock button on the lock symbol in the door control panel located by the vent window. Pressing the lock/unlock button on the lock symbol once locks both cab doors.

Unlocking the Door

To unlock, push the lock/unlock button on the unlock symbol in the door control panel located by the vent window. Pressing the lock/unlock button once on the unlock symbol unlocks the driver door. Pressing it twice unlocks both doors.

Automatic Door Lock Function

The automatic lock function automatically locks the doors at a predetermined speed.

Windows

Manual Operation

To lower door glass (driver door), turn window regulator handle clockwise. To raise glass, turn handle counterclockwise. Reverse this procedure for the passenger door.

Power Operation

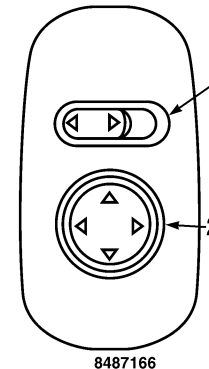
Trucks may have optional electrically-operated driver and passenger windows. Controls for these window lifts are mounted in the door control panels located by the vent windows. The driver side controls regulate window operation for both driver and passenger. To lower or raise driver window, press and hold either “Up” or “Down” direction on the driver side AUTO window control. To lower or raise passenger window, press and hold either “Up” or “Down” direction on the passenger side AUTO window control.

For one-touch windows down operation, press and release the window control in the “Down” direction. The window will then go to the full down position automatically.

Window Lockout Function

The driver also has the ability to prevent passenger window up/down operation by pressing the WINDOW LOCK control.

Mirror Controls



1. Mirror Select Switch
2. Mirror Direction Control Switch

These controls provide the driver with the ability to operate both driver- and passenger-side flat mirrors. Use the mirror select switch to select which mirror is to be adjusted and adjust the mirror using the mirror direction control switch.

Vent Window

Vehicles are equipped with either a fixed or opening vent window. The opening vent window can be opened and closed to allow additional airflow into the cab.

Driver Reward

The driver reward feature is designed to give the operator incentives for driving more efficiently. This is accomplished by measuring the driver's habits based on fuel economy, time at idle, or both. Rewards include higher maximum vehicle speed and higher cruise control speed limit. Lower maximum vehicle speed or cruise control speed limits may result as a penalty for failing to meet the standards.

The following driver reward visual indications appear in the form of text messages in the gauge cluster digital display:

- Expected – Reward indication which results in higher vehicle speed limits.
- Good – Reward indication which results in higher vehicle speed limits.
- Excellent – Reward indication which results in higher vehicle speed limits.
- Penalty – Penalty indication which results in lower vehicle speed limits.
- Increasing – Informs the driver that the vehicle speed limit will soon be increased.
- Decreasing – Informs the driver that the vehicle speed limit will soon be decreased.

SECTION 5 — OPERATION

Operation Safety



Operation of a diesel engine near flammable vapors in the air may cause the engine speed to increase uncontrollably and overspeed. If this situation occurs, mechanical damage, fire, explosion, personal injury or death could result. Turning off the ignition switch will not slow or stop the engine due to uncontrollable fueling of the engine through flammable vapors being drawn into the engine air inlet. Operation of components such as starter, alternator, electric motors, etc. and static electricity could also ignite flammable vapors.

Do not operate the truck in the possible presence of flammable vapors unless both a complete hazard analysis is performed and necessary additional safety processes and/or equipment such as vapor testing, air intake shutoff devices, ventilation, etc. are utilized. The operator is responsible for using those processes and/or equipment to ensure that the diesel engine and all other components on the truck can be operated safely under the specific conditions and hazards that may be encountered.



Do not exceed the truck's gross axle weight, gross vehicle weight, and gross combination weight ratings. Exceeding these ratings by overloading can cause component failure resulting in property damage, personal injury, or death.



Always use occupant restraint system when vehicle is moving. Any location in the vehicle not equipped with a seat belt should not be occupied when the vehicle is being operated. In the event of a vehicle accident or sudden, unexpected movement, failure to properly use an occupant restraint system could result in personal injury or death.



Always use the ashtray(s) provided for disposing of cigar, cigarette, or pipe ashes and tobacco. Failure to use an ashtray is a fire hazard and could result in property damage, personal injury, or death.



When parking your vehicle, do not leave transmission in gear. Always use parking brake. When parking on a grade, chock wheels and turn front wheels to keep the vehicle from rolling into the traveled portion of the roadway. Failure to follow these procedures could cause an unattended vehicle to move, resulting in property damage, personal injury, or death.



Exhaust gases from engines contain hazardous compounds. Do not operate engines in enclosed areas without abundant forced ventilation (with garage doors and windows wide open). Maintain exhaust system in good operating condition. Breathing exhaust gases could result in personal injury or death.



All vehicles have blind spots. Make sure your way is clear in all directions before moving your vehicle. Failure to follow these procedures could result in property damage, personal injury, or death.

This section contains information concerning the safe operation of your vehicle. It is extremely important that this information is read and understood before the vehicle is operated.

Cab Controls

The cab controls and features are described in detail in the **Controls/Features** section of this manual. Read and understand the entire **Controls/Features** section of this manual before operating this vehicle.

Seat Belts



To prevent personal injury or death, do not ride in the vehicle cargo area or on the outside of the vehicle. Ride only in designated seating positions or sleeper berth with seat belts or bunk restraints fastened and properly adjusted.



Failure to properly inspect and maintain seat belts could result in personal injury or death.



Any seat belt in use during an accident must be replaced. When replacement of any part of the seat belt is required, the entire belt must be replaced, both retractor and buckle sides. Belt failure could result in personal injury or death.

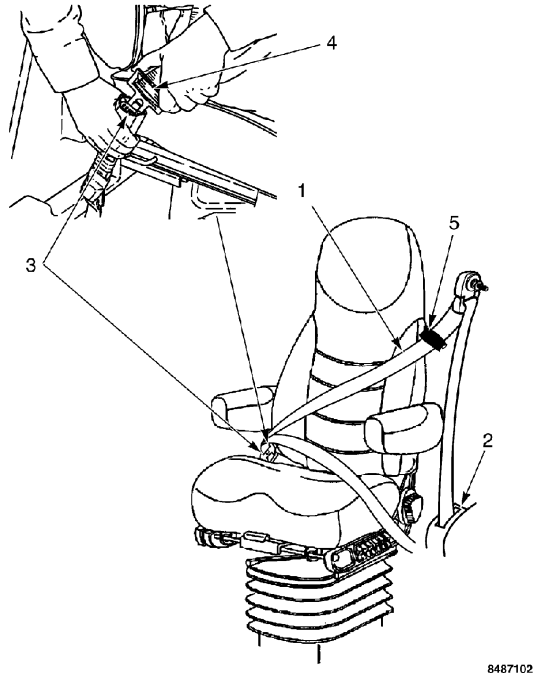
NOTE: Periodically inspect the seat belts for wear and function. Replace any parts whose performance is in doubt.

General

Safety belts must be worn by the driver and all passengers at all times. Before adjusting or fastening the safety belt, move the seat forward or backward and adjust the seat height as necessary. Sit erect and adjust the seat cushion and seat back for a comfortable driving position. In the event of a collision, a correct driving position maximizes the effectiveness of the safety belt.

Tether straps are installed on all suspension-type seats. Tether straps help secure the seat to the floor and are intended to restrain the seat and safety belt in case of an accident or sudden stop. The tethers are not adjustable and do not need any adjustment.

Operation



1. Three-Point Seat Belt
2. Retractor
3. Buckle
4. Tongue
5. Clip

To operate the seat belt follow these steps:

1. Slowly pull the three-point seat belt out of the retractor and slowly pull it across your lap far enough to engage the buckle. If the retractor locks too soon, allow the seat belt to retract slightly, then slowly pull it out again.
2. To fasten the seat belt, insert the tongue into the buckle until it latches. Give the seat belt a firm tug to ensure that the buckle is securely fastened.
3. The seat belt must be free to slide through the tongue, allowing the belt tension to equalize across hips and chest. The retractor is a locking type that allows the seat belt to come out and to adjust for body movement.
4. The seat belt will return to the retractor as the body returns to its original position. The retractor will retain moderate tension across the body in its operation mode.
5. The seat belt is equipped with a clip to eliminate the moderate belt tension across the body. It can be adjusted by pressing the button and sliding the clip along the seat belt.
6. To release the seat belt, push the button release latch on the buckle and give the seat belt a tug to assist the seat belt into the retractor.

Nonretracting Adjustable Seat Belts for Center Passenger – Bench Seat

To adjust: Tip the buckle end downward and pull the buckle until the ends can be joined. Insert tongue into the open end of buckle and snap together. Give it a tug to ensure it is latched.

Shorten the belt after it is connected by pulling on the loose end until the belt is snug and comfortable.

To release: Push in the button release latch to release the seat belt.

Care of Seat Belts



Do not bleach or re-dye seat belt webbing. Bleaching or re-dying may cause a weakening of the webbing, resulting in personal injury or death.

Clean the belts occasionally with mild soap; do not use cleaning solvents or abrasives.

The entire seat belt assembly should be inspected periodically for corrosion, wear, fraying, or weak spots. The retractor, latch, and buckle should be checked for proper function, and all seat belt mounting bolts should be tight at all times.

Seats



Do not adjust driver's seat while vehicle is moving. The seat could suddenly or unexpectedly move causing the driver to lose control of vehicle, which could result in property damage, personal injury, or death.



Reckless operation of this vehicle over rough roads or surfaces can cause loss of vehicle control and result in property damage, personal injury, or death. Use caution and reduce speed. Properly adjusted seats and seating systems may not compensate completely for severe road conditions. Ensure that head clearance will be maintained during all road conditions, as the seat may move up and decrease the available space.

Ensure that head clearance will be maintained during all road conditions, as the seat may move up and decrease the available space.

Bench or bucket type seats have fore and aft adjustment only. Adjust while sitting in seat. Push seat adjustment lever to release mechanism and move seat to desired position. Be sure seats are firmly engaged to avoid forward or rearward movement when vehicle is started or stopped.

The vehicle may be equipped with a suspension type seat. For suspension type seat adjustment refer to the booklet or decal attached to seat frame as supplied by the seat manufacturer.

Extended Cab Bunk (Optional)

International provides an optional bunk for second driver sleep accommodations. The bunk is a full 72" long and, when raised up, provides luggage storage under the mattress. Ventilation is provided by swing out side windows in the bunk area. The Air Ride suspension cushions the cab for a ride that is comfortable for both driver, cab passenger as well as bunk passenger.

Starting Procedures



Never start the engine unless you're sure the transmission selector is in neutral and the brake is applied, otherwise accidental movement of the vehicle can occur, which could result in property damage, personal injury, or death.

CAUTION

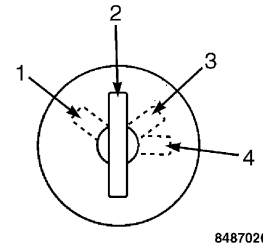
DO NOT crank the engine for more than 30 seconds at a time; wait two minutes after each try to allow the starter to cool. Failure to follow these instructions could cause starter damage.

NOTE: Before starting the engine:

- Read and understand the **Controls/Features** section of this manual.
- Perform the left and right engine compartment inspections outlined in the **Inspection Guide** section of this manual.
- If your vehicle has an optional battery disconnect switch, be sure that it is in the on position. This switch is cab mounted, or mounted on the battery box.

NOTE: Automated manual transmissions must be in (N) Neutral and vehicles with a clutch pedal require the clutch pedal to be depressed before the starter will engage.

Engine Starting



The ignition switch has four key positions as follows:

1. ACC (Accessory)
2. OFF
3. ON
4. START

1. Apply the parking brake and place the transmission in the (N) Neutral position. If equipped with a clutch pedal, the clutch pedal must be depressed.
2. Turn OFF the headlights and all accessories.
3. Turn the key clockwise to the ON position. If the WAIT TO START indicator comes on (the glow plugs or the air intake warmer are warming up), wait until the indicator goes out and then proceed.
4. Turn the key to the START position.
5. When the engine starts, release the key.
6. The key will return to the ON position and the engine will continue to run.
7. To stop the engine, rotate the key counterclockwise to the OFF position.

8. To place the ignition switch in ACC (Accessory) position, rotate key counterclockwise to the ACC position. Accessory features can now be used without engine operation.
9. To terminate ACC (Accessory) operation, rotate the key clockwise to the OFF position.

After the Engine Starts

- Do not increase engine speed until the oil pressure gauge indicates normal pressure.
- Make sure the engine oil pressure is indicated on the gauge within 20 seconds after starting.
- Operate the engine for three to five minutes before operating at full power.
- Try to limit engine idle to 10 minutes. Excessive idling reduces fuel economy, and may decrease oil life.
- When starting a cold engine, increase the engine speed (RPM) slowly to make sure adequate lubrication is available to the bearings.

Engine ShutDown

Idle the engine for three to five minutes before shutting down. This few minutes of idling allows the lubricating oil and water to carry heat away from components heat-soaked by hot combustion/exhaust gasses.

The larger the engine, the greater the need for this idling period and of course, the length of the idling period should somewhat

follow the size of the engine in order to avoid seals or like features of an engine being damaged by rising heat.

1. Place the transmission in the (N) Neutral position.
2. Apply the parking brake.
3. Turn OFF the headlights and all accessories.
4. Idle a hot engine for 2 to 5 minutes to allow the turbocharger to cool.
5. Rotate the key counterclockwise to the OFF position, and remove key from the ignition switch.

Shut-Down Warning Indicator Or Beeper



In the event engine shutdown occurs, make certain that vehicle is safely off the roadway, the 4-way emergency flashers are on, and traffic warning devices are properly placed. Failure to remove vehicle from roadway could cause an accident and result in property damage, personal injury, or death.

Vehicles may be equipped with an automatic shutdown system that stops the engine in the event of high coolant temperature, low engine oil pressure, or low coolant level. A warning indicator on the instrument panel along with a beeper or bell will indicate high coolant temperature or low oil pressure. If the temperature and/or pressure continue to change beyond the warning point to a predetermined level, the engine will automatically shut down. Vehicles are equipped with an override feature that will allow the

Operation

engine to be restarted so that the vehicle can be moved. The engine should be run no longer than absolutely necessary. A decal located in front of the operator provides instructions on how the override should be operated.

NOTE: After the engine is restarted, it will operate in a derated mode for an additional 30 seconds while conditions causing the shut down are still present.

Engine Idle Shutdown Timer (Optional)

This vehicle may be equipped with an optional Idle Shutdown Timer that will limit engine idle time to comply with certain state and local regulations and/or owner/operator preferences. If the optional Idle Shutdown Timer is enabled, the engine will shutdown after a pre-programmed time of extended idling. This will also shut down all electrical loads except for lights. Allowable idle times may vary from state to state and with owner/operator preferences. Idle times may also be dependent on vehicle conditions, such as Parking Brake status, PTO (if equipped) status, transmission status, and others.

The vehicle owner or operator is responsible for compliance with all state and local regulations.

If the vehicle has this system enabled, the yellow IDLE SHUT DOWN indicator in the instrument panel gauge cluster will turn ON 30 seconds before engine shutdown. This indication will continue until the engine shuts down or the system is reset.

**IDLE
SHUT
DOWN**
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System Operation

The Vehicle Shutdown system operates in the following manner:

1. Bring the vehicle to a stop, place transmission in (N) Neutral or Park position, and apply the parking brake. This starts the Vehicle Idle Shutdown system timer.
2. After a minimum of 90 seconds (or whatever the customer specifies), power is shut off to the engine, transmission, ABS, HVAC, and any other vehicle accessories fed by ignition power.
3. When vehicle is ready to be operated, turn the ignition switch to the START position until the engine starts and then release the ignition switch.

NOTE: If your vehicle is equipped with the Theft Deterrent System, the theft deterrent code must be entered before the vehicle can be safely operated (See the Theft Deterrent System description).

Theft Deterrent System (Optional)

The optional Theft Deterrent System provides a means to prevent unauthorized vehicle drive-away, once the vehicle is started. The driver is required to enter a predetermined code each time the vehicle is started, or when driving is resumed after the vehicle was at idle with the parking brake set. The theft deterrent feature is effective in preventing a vehicle from being driven by unauthorized individuals - whether the vehicle has been hot wired or whether it is parked at a location with the engine idling.

Theft Deterrent Code. The theft deterrent code is any combination of one to eight digits between 0 and 99999999, obtained from the dealer, and kept in a secured location.

Six switches, located in the instrument panel gauge cluster, provide the functions of the Theft Deterrent System. Five of the switches are code digit switches (3-position, center stable momentary switches) numbered 0 to 9. The remaining switch is the ENGINE STOP/CLEAR ENTRY switch, which is a combination switch indicator and a standard momentary switch (see the illustration below).

The red ENGINE STOP indicator portion of the ENGINE STOP/CLEAR ENTRY switch flashes to alert the driver that the theft deterrent code must be entered (within the preprogrammed time delay or the engine will shut down). The momentary CLEAR ENTRY position is pressed whenever the driver needs to clear a failed code entering sequence so that the correct code can be reentered.

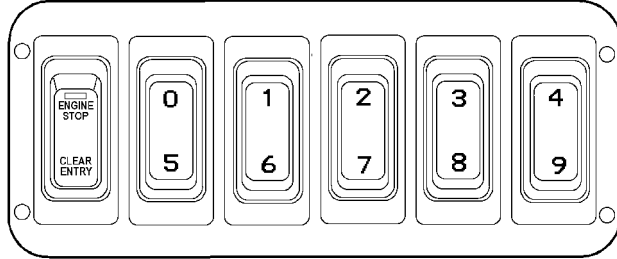
NOTE: The vehicle must be stopped and the parking brake must be set/engaged before the system will clear the previous theft deterrent code entry.

Theft Deterrent Code Entry Procedures

Engine Start/Theft Deterrent Code Entry Sequence. The correct engine start and theft deterrent code entry sequence is as follows:

1. Driver starts vehicle with parking brake set.
2. The driver enters a code supplied by dealer by pressing the switch positions for that code (read from left to right). For example, if the code is 54321, the driver should press switch positions 5–4–3–2–1 in that order. If an error is made, while entering the code, the driver presses the CLEAR ENTRY position of ENGINE STOP/CLEAR ENTRY switch and enters the entire code.
3. When the code is entered, an alarm will sound one short beep and, at the same time, the ENGINE STOP indicator will flash once. If the wrong code is entered, an alarm will sound one long beep and the ENGINE STOP indicator will be illuminated for ~1.5 seconds.
4. Parking brake is released.
5. Vehicle may be driven without interruption.

NOTE: The theft deterrent code must be reentered every time the parking brake is set/engaged or when the ignition switch is cycled from the run position.



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The following table provides a summary of all the possible system responses to various driver attempts to start and drive the vehicle.

#	Driver Action	System Alerts	Engine Operating Status
1.	Engine started with parking brake set	No system alerts	Engine runs without interruption
2.	Correct theft deterrent code entered (vehicle stopped and parking brake set).	An alarm will sound one short beep and, at the same time, the ENGINE STOP indicator will flash once	Engine runs without interruption
3.	Engine started with parking brake released	Warning sequence is begun; an alarm will beep continuously and the red ENGINE STOP indicator will flash slowly	Engine will shut down unless theft deterrent code is entered within programmed delay time
4.	Engine started and driven greater than 3 mph	Warning sequence is begun; an alarm will beep continuously and the red ENGINE STOP indicator will flash slowly	Engine will shut down unless theft deterrent code is entered within programmed delay time
5.	Parking brake is released with engine running	Warning sequence is begun; an alarm will beep continuously and the red ENGINE STOP indicator will flash slowly	Engine will shut down unless correct theft deterrent code is entered within programmed delay time

#	Driver Action	System Alerts	Engine Operating Status
6.	Correct theft deterrent code is entered after the warning sequence has begun (within the programmable delay time)	The continuous alarm beeps and ENGINE STOP indicator flashes and stops after the alarm sounds once and the ENGINE STOP indicator flashes once	Engine runs without interruption
7.	Inadvertent incorrect theft deterrent code is entered	Alarm activated for one long beep and ENGINE STOP indicator turns on for ~ 1.5 second	Engine runs without interruption
8.	Clear switch is depressed with parking brake set	No system alerts. Theft deterrent code must be entered before driving vehicle	Engine runs without interruption
9.	Clear switch is depressed with parking brake released (assumes correct code previously entered.)	No action. Previously entered theft deterrent code is not cleared	Engine runs without interruption
10.	With vehicle stopped while in warning mode, set parking brake (within the programmable delay time)	The ENGINE STOP indicator stops flashing and the alarm stops beeping. The theft deterrent code must be entered before driving vehicle	Engine runs without interruption

Emergency Starting Using Jumper Cables



The following procedures must be performed exactly as outlined, otherwise a fire or a battery explosion could result in property damage, personal injury, or death.

CAUTION

To prevent damage to vehicle electronic components, voltage supplied to a vehicle's electrical system must never exceed 16.0 volts. This voltage must not be exceeded when the ignition switch is in the OFF, ACC, or IGN position, or during engine cranking. The most reliable means for jump starting a vehicle is to use batteries connected so as to provide 12 volts. Never use an electric welder.

1. To prevent shorting of the electrical system, remove metal rings or watches and do not allow metal tools to contact positive terminal of battery.
2. Place transmission in (N) Neutral and set parking brake in both vehicles.
3. Shut off lights, heater, air conditioner and any other electrical loads in both vehicles.
4. Eye protection should be worn if available. If not available, shield eyes when near either vehicle's batteries.
5. Vehicle bodies or bumpers must not be in contact.

6. Connect one end of the first jumper cable to positive (+) terminal of the dead battery or (+) terminal of jump start stud and then the other end to the positive (+) terminal of the booster battery.
7. Connect one end of the second jumper cable to negative (-) terminal of the booster battery and the other end to chassis frame of the vehicle with the discharged battery. Do not attach the other end to the negative (-) battery terminal of the discharged battery, because a spark could occur and cause explosion of gases normally present around the battery.
8. Reverse above procedure when removing the jumper cables.

Cold Weather



Explosion Hazard. Do not use volatile starting aids such as ether, propane, or gasoline in the engine air intake system. Glow plugs and/or grid heater will ignite vapors, which can cause severe engine damage, personal injury, or death.

CAUTION

If vehicle is equipped with the optional heated windshield function, do not scrape the inside of the windshield. Failure to comply may result in permanent damage to the heated windshield components.

Cold Weather Starting

For vehicles frequently operating in cold climates an optional **engine block heater** is available. The block heater utilizes an external power source to keep the engine coolant warm and a 120-volt socket for connecting to the external power source. The 120-volt socket is mounted below the driver's side door.

Cold Weather Operation

In order to operate the engine in temperatures of 32°F (0°C) or lower, observe the following instructions:

- Make certain that batteries are of sufficient size and in fully charged condition. Check that all other electrical equipment is in optimum condition.
- Use permanent type engine anti-freeze solution to protect against damage by freezing.
- At the end of each daily operation, drain water from fuel-water separator, if equipped.
- Fill fuel tank at end of daily operation to prevent condensation in fuel tank.
- Be sure to use proper cold weather lubricating oil, and be sure crankcase is at proper level.
- At temperatures of -4°F (-20°C) and below, it is recommended that you use a crankcase mounted coolant heater to improve cold starting.
- If operating in arctic temperatures of -20°F (-29°C) or lower, consult your International dealer for information about special cold weather equipment and precautions.

Winter/Engine Intake Operation

When the WINTER position is selected, the optional yellow Snow Valve warning indicator in the instrument panel gauge cluster turns on. When the intake valve is fully opened, the yellow warning indicator turns off and the green indicator, on the switch, turns on. When the switch is moved from the WINTER position to the ENGINE INTAKE position, the green indicator on the switch goes out and the yellow Snow Valve warning indicator in the instrument panel gauge cluster turns on as soon as the valve begins to close. When the intake valve is fully closed, the yellow warning indicator turns off.



Engine Idling

CAUTION

Because diesel engines are highly efficient, they use very little fuel while idling. As a result, idling in cold weather will not heat the engine to its normal operating temperature. This in turn can cause a build-up of heavy deposits of carbon and rust on valve stems causing them to stick. Sticking valves can cause significant valve train damage. The colder the ambient temperature, the more likely this will occur.

The following cold weather idling guidelines must be followed:

- Avoid extended idling (beyond 10 minutes) whenever possible.
- Use a minimum 45 Cetane diesel fuel or utilize Cetane Index improvers from a reputable manufacturer.

Operation

- Maintain a minimum of 1250 RPM idle by use of the hand throttle. Always make sure that parking brake is applied and transmission is in (N) Neutral before applying hand throttle.
- Maintain engine cooling system.
- Do not shut engine down after extended idling period. Drive the vehicle under load for several miles at normal operating temperatures to burn off any accumulated carbon in the exhaust DPF.
- Consider use of engine block heaters, approved winter-fronts, and/or radiator shutters where conditions warrant.

Winter Front Usage

Unless extremely cold conditions exist, the use of winter fronts or other air restrictive devices mounted in front of the radiator is not recommended on vehicles which are equipped with engine charge air coolers. Cooling air flow restriction affects emissions and can cause high exhaust temperatures, power loss, excessive fan usage, and a reduction in fuel economy. If you insist on using a winter front, the device should have a permanent opening above or directly in line with the fan hub. The opening's minimum dimension must be at least 120 in. (774 cm).

Hot Weather Operation

1. Keep cooling system filled with clean permanent anti-freeze solution to protect against damage by overheating.

2. Fill fuel tank at end of daily operation to prevent condensation in tank.
3. Keep external surface of engine, radiator, charge air cooler, AC condenser, and accessories clean to avoid dirt build-up.

Excessive coolant temperature could be experienced while driving in a transmission gear ratio, which would lug the engine. To correct the problem, engine speed should be increased by down shifting into the next lower gear to increase engine RPM's which will increase coolant flow through the radiator and increase fan speed.

Starting A Turbocharged Vehicle On A Grade

Once the clutch is engaged on a turbocharged diesel engine, the RPM falls off significantly. This is due to the emission control device that controls the fuel input during first gear acceleration. When engine RPM first falls off, do not disengage the clutch and try to increase engine RPM. Doing so may damage driveline components. After the initial drop in speed, the engine will recover and accelerate in a normal manner.

Proper Starting Procedure

Set the spring brakes or hand brake, if equipped, bring the RPM up slightly and begin to engage the clutch while, at the same time, releasing the spring brakes.

As the RPM begins to fall off, DO NOT disengage the clutch. The RPM will quickly come back and the vehicle will move steadily up the grade.

Operating Instructions



All vehicles have blind spots. Make sure your way is clear in all directions before moving your vehicle. Failure to follow these procedures could result in property damage, personal injury, or death.



Operating an engine beyond the maximum governed speed could result in engine failure and cause vehicle damage, personal injury, or death.

Steering

Be alert to any change (feel) in steering when driving. This change or feel includes increased steering effort, unusual sounds when turning, excessive wheel play, or pulling to either side. If any of the above are detected, have the vehicle inspected and repaired at once by a qualified mechanic.



Do not adjust the steering column while the vehicle is moving. It could suddenly or unexpectedly move, causing the driver to lose control of vehicle which could result in property damage, personal injury, or death.

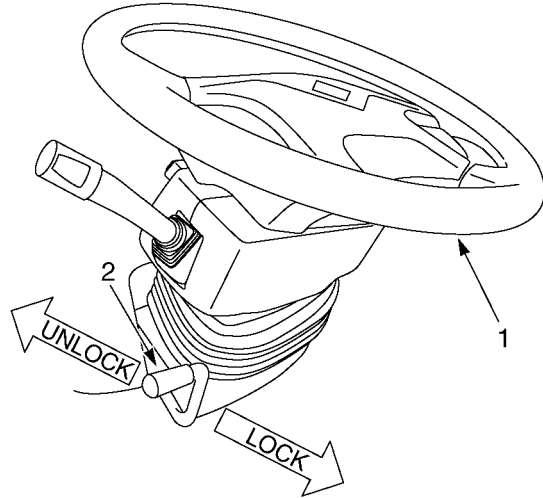


Do not lubricate the tilt or tilt/telescoping steering mechanism.

Tilt Steering Column

The optional tilt steering column has infinite positions allowing adjustment toward or away from the driver through a 20 degree range. The tilt handle is located on the left side of the column. To tilt the column, pull the lever towards the driver and move the steering wheel to the desired position. Release the lever to lock the column in position.

Adjustable Tilt/Telescoping Steering Column



1. Steering Wheel
2. Release Handle

If equipped with the optional tilting and telescoping steering column, the steering wheel can be adjusted as follows:

- Grasp the steering wheel with your right hand and unlock the release handle with your left hand by pushing forward on the release handle.

- Using both hands, grab the sides of the steering wheel and adjust the telescoping feature to the desired position and then the steering wheel tilt to the desired position.
- Hold the steering wheel in the newly-acquired position with your right hand and pull the release handle backward towards you, to the locked position, with your left hand.
- Make certain the steering wheel is in the proper position and the column is locked.

General

- Start the vehicle in motion by utilizing the highest gear speed in the transmission that will enable the engine to easily pull the load without slipping the clutch. Accelerate smoothly and evenly to engine-rated speed. Rapid acceleration will result in high fuel consumption.
- When approaching a hill, depress accelerator smoothly to start the upgrade at full power. Then Shift down, as needed to, maintain vehicle speed.
- Prevent overspeeding of the engine when going down long and steep grades. The governor has no control over engine speed when it is being pushed by the loaded vehicle. Operate in a gear that will permit an engine speed below the maximum governed speed or high-idle RPM (no load).

Electrical



This vehicle may be equipped from the factory with electrical switches intended to operate equipment that was installed by a truck equipment manufacturer (TEM). Instructions, Cautions, and Warnings for this additional equipment will NOT be found in this manual. Read and understand the appropriate manual for the specific equipment in question before operating. Failure to observe this warning may cause property damage, personal injury, or death.

NOTE: This vehicle may be equipped with electronic, application specific options not described in this Operator's Manual. Many of these features are supplied with rocker switches that have custom labels applied. The presence of these options as factory installed can be verified from the Line Set Ticket included with the vehicle. A truck equipment manufacturer (TEM), however, may have installed some of these options after production. In that case, they will not appear on the Line Set Ticket. If installed by a TEM, you should receive an operating guide and/or training for the specific functions provided.

NOTE: Familiarize yourself with all of the switches that control chassis, engine, and body equipment and seek adequate training on the function of all features before operating this vehicle. Additional detailed information on these optional features may be found in the CT-471 Body Builder Manual, Electrical System Component Section, and the Body Builder Electrical Guide, both available through the internationaltrucks.com Web site (Body Builder option, under Customer Support menu).

Electrical System

The Electrical System provides a means to distribute the electrical power and provide the driver with controls and indications of vehicle performance. This system uses multiplexing for connecting to major functional areas of the truck with much less wiring. The system provides interfaces to a majority of vehicle switches and sensors. The system also communicates with the standard and optional system controllers and modules in the vehicle. These include: the Body Controller (BC), the Electronic Gauge Cluster (EGC), the engine Electronic Control Module (ECM), a Transmission Control Module (TCM), the ABS Electronic Control Unit (ECU), panel-mounted switches, and door pods.

Alternator

CAUTION

Before connecting a fast charger or booster battery, or installing a new battery, make sure that the ground polarities of the fast charger, booster battery, or alternator (when installing a battery) are matched to the ground polarity of the vehicle battery. Improper usage of fast charger, hook-up of booster battery, or installing battery can cause damage to the electrical system or to the alternator. Do not attempt to polarize the alternator.

Many alternators used in International® vehicles are of the self-energizing type. Some engines may need to be briefly revved after starting to turn on the alternator. The alternator will then charge at idle. If the vehicle is to be warmed up prior to beginning operation, the operator should observe the voltmeter or ammeter for charging indication before leaving the vehicle.

Ammeter

The optional ammeter indicates the rate of charge of electric current supplied by the alternator to the battery, or the rate of discharge from the battery. At low engine speeds, the ammeter indicator may show a negative or discharge reading. When the battery is fully charged, a very slight charge is indicated during normal vehicle operation.

Battery



Keep lighted tobacco, flames, sparks or other ignition sources away from the batteries. Gas from the battery cells is flammable and can ignite and/or explode. This is particularly true when jumper cables are being used. Battery fires or explosions could cause personal injury, including severe injury to the face, eyes, limbs and body.

In addition, inhaling the hydrogen gas produced by the normal operation of the battery could result in partial or permanent damage to the respiratory system which may result in death.



Whenever disconnecting battery terminals, always disconnect ground terminal first. When reconnecting, always connect ground terminal last. Failure to follow this procedure could result in a short-to-ground and cause property damage, personal injury, or death.

Always wear eye protection when working around batteries. Do not attempt to jump-start a vehicle with a frozen battery because the battery may rupture or explode. If a frozen battery is suspected, thaw out battery and recharge.



Do not check battery condition by shorting (flashing) across terminals. Failure to observe this warning could result in personal injury and/or damage to the vehicle.

When working around the terminals and battery, use extra care to avoid shorting. A good practice is to use insulated pliers and screwdrivers.

Battery Disconnect Switch

This optional switch is used to prevent the batteries from discharging. When a vehicle is not going to be operated for several days, this switch can be used to shut off the system so the electrical components on the vehicle, if left on, will not discharge the batteries.

These features have options that provide a key or lever operated battery disconnect switch, which may be cab mounted or mounted on the battery box. There are also options that completely disconnect the batteries or disconnect everything except the charging circuits.

Circuit Breakers, Fuses, and Fusible Links



Electrical circuits are designed with a particular wire gauge to meet the fuse and circuit breaker current rating. Do not increase size of fuse or circuit breaker or change type of breaker supplied with your truck. To do so could cause wiring to overheat and possibly burn, resulting in a fire, which could cause property damage, personal injury, or death.

Electrical circuits are protected either by the body controller, circuit breakers, fuses, or fusible links. For the size and location of circuit breakers, fuses, and fusible links, please refer to the **Maintenance Intervals And Specification** section of this manual.

Fusible links consist of a length of lighter gauge wire in a circuit. In case of a short or overload, the fusible link opens (burns out) to protect the remainder of the circuit. Repair consists of splicing in a new fusible link with the same gauge wire as the opened fusible link.

Circuit breakers interrupt the circuit when an overload or short occurs. Manual circuit breakers (Type III) can be reset by depressing the reset button on the breaker. Headlamp and wiper circuits are protected by the Body Controller Virtual Fusing system. Type II circuit breakers will reset if the short is removed from the circuit.

The various electrical units in the cab and engine compartments are protected by either fuses or circuit breakers. The power

distribution center is located behind a hand-removable cover on the instrument panel on the passenger side of the vehicle.

Engine

The engine for this vehicle is an electronically controlled diesel engine. A separate electronic control module (ECM) monitors and controls all engine functions. This ECM also communicates with the body electrical system, which will generate or activate the necessary indicators to alert the driver of out-of-range operating conditions.

For complete information on the engine in this vehicle and its optional features, refer to the Engine Operation and Maintenance Manual supplied with this vehicle.

NOTE: For information pertaining to fuel and requirements refer to the Engine Operation and Maintenance Manual provided with the vehicle.

Charge Air Cooler

All MaxxForce® engines are equipped with a charge air cooling system. The function of the charge air cooler is to cool the hot compressed air before it enters the engine's intake manifold. This system uses ambient air as the cooling medium by allowing the intake air to pass through a network of heat exchanging fins and tubes prior to entering the combustion chamber. The resulting cooler intake air is denser than uncooled air and will allow additional fuel to be injected for greater power while helping to reduce emissions.

Engine Brake, Retarder (Optional)



Do not use the vehicle retarder, engine brake on slippery road surfaces. Doing so may cause wheel slippage and/or loss of vehicle control, which could result in property damage, personal injury, or death.



Before operating the Engine brake feature, study the following descriptions and instructions as well as the engine Operator's manual. Failure to do so could result in property damage, personal injury, or death.

NOTE: The engine brake should never be considered a substitute for the vehicle service brakes. The service brakes should always be viewed as the primary vehicle slowing system. Service brakes are always used to bring vehicle to a complete stop.

Engine braking features are used for traffic conditions that require frequent use of the service brake and therefore shortening brake lining life. The features also allow the driver to slow the vehicle down or maintain a constant speed on steep road grades that would otherwise result in prolonged use of the service brake that could cause brake fade.

The optional braking features are controlled by the driver using the ENGINE BRAKE ON/OFF switch, and ENGINE BRAKE

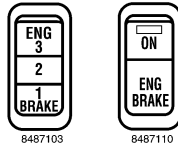
SELECTOR 1/2/3 switches that are located in the center control switch panel. The following paragraphs provide a brief description of these optional braking features.

Engine Brake System Operation

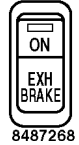
Vehicles, with MaxxForce® DT, 9, or 10 engines, utilize either the optional Diamond Logic® Engine Brake for additional braking in various operating conditions.

The optional **Diamond Logic® Engine Brake** is a compression style brake that utilizes the injection control system pressure and the closed vanes of the turbocharger for maximum braking power. The Engine brake is controlled by the switch panel switches: ENGINE BRAKE ON/OFF, and ENGINE BRAKE SELECTOR 1/2/3. To activate the engine brake, place the ENGINE BRAKE ON/OFF to the ON position (the switch indicator will turn on). The ENGINE BRAKE SELECTOR 1/2/3 switch is used to adjust the amount of braking applied.

NOTE: The ECM will not allow the Diamond Logic® Engine Brake to operate until the engine oil has reached the acceptable minimum temperature, therefore, do not attempt to activate the engine brake until the engine has reached full operating temperature.



NOTE: The engine brake feature will automatically deactivate if either the accelerator or the clutch is pushed, or when the engine speed falls to 1000 RPM.



Operational Modes

The engine brake will operate in one of these two modes. Changes must be reprogrammed, in the engine controller, by an authorized International dealer.

Coast Mode. In the coast mode, with the brake enabled, the brake will activate when the driver hits the service brake (at or above 1200 RPM). The brake will deactivate if the driver releases the brake pedal, or if the engine speed drops below 1200 RPM.

Latched Mode. In the latched mode, with the brake enabled, the braking will activate when the driver's foot is lifted from the accelerator pedal (at or above 1200 RPM). If, however, the cruise ON/OFF switch is in the ON position (with or without a cruise set speed), engine brake function defaults to Coast Mode and braking is activated by pressing the brake pedal and deactivated by releasing the brake pedal.

MaxxForce® 11 and 13 Engine Brake With Eaton AutoShift®/UltraShift® Transmissions Special Driver Instructions

Low or manual transmission mode can be used to maximize engine brake performance.

- Keep engine speed as close to 2250 rpm as possible.
- Maintain brake pedal application until any desired downshifts are completed. Failure to do so may cause missed shifts.

Operation

- The gear display on the shift selector will stop blinking when the downshift is completed, and the driver will notice resumption of engine braking as an indication that the shift is completed.

When the transmission is in manual mode, engine protection upshifts are disabled. This could result in an undesirable engine overspeed condition. It is the operator's responsibility to prevent mechanical damage to the truck. Under these conditions, use service brakes and select the appropriate gear, as required, to keep the engine rpm within operating limits.

Automatic Transmission Operation

With the Allison transmission, when the engine brake is activated, the transmission is programmed to perform shift schedules that maximize braking effects.

The Allison transmission control module is programmed with a pre-selected 4th gear as a default. This means that when the driver selects "D" or Drive, the engine brake will operate down to 4th gear (at or above 1,200 RPM). If the driver manually selects 3rd or 2nd gear, the engine brake will operate down to the manually selected gear (at or above 1200 RPM).

NOTE: Manually selecting 3rd or 2nd gear during braking with no load or during slippery driving conditions could result in a loss of traction, as indicated in the above warning. Manually selecting 3rd gear or 2nd gear will not cause damage to the engine or transmission. The manually selected gear is only for driver intent. The transmission will only downshift according to the pre-programmed shift schedules.

The engine brakes will deactivate when the transmission shifts from converter lock-up to normal torque converter operation.

ABS Operation

When an ABS event occurs, the engine brake will turn OFF and will automatically be turned back ON when the ABS conditions are no longer present.

MaxxForce® Engine Features

The MaxxForce® engines are electronically controlled diesel engines. The engine Electronic Control Module (ECM) monitors and controls the injection process and other engine functions. The ECM also communicates with the Body Controller (BC) and alerts it to out-of-range operating conditions. The BC in turn, generates engine function indicators and warning indicators. Since many of the engine performance features are owner selectable and electronically programmable, some of the operating parameters will vary from vehicle to vehicle. Some of these standard and optional monitored engine operating functions and warning indicators include:

Some standard features:

- Engine Warm-Up Control - (ECM) adjust injector operation as required.
- Cold Ambient Protection (CAP) - to aid engine warm up and maintain engine temperature.
- Cruise Control - provides vehicle speed control.

Some Optional Features:

- Engine Warning System - this system illuminates the **Red** “Engine” indicator and actuates a beeper when warning thresholds for coolant temperature, engine coolant level, and/or low engine oil pressure are exceeded.
- Engine Shutdown System - this system shuts down the engine after 30 seconds of operation beyond critical threshold values for coolant temperature and/or oil pressure.
- Throttle Control for PTO Operation.
- Road Speed Limiting/Governor - programmable maximum speed.
- Idle Shutdown Timer - shuts down engine after 5 minutes of idle time.

Certified Clean Idle

MaxxForce® 11 and 13 engines have been designed to meet the new California Air Resources Board (CARB) idle reduction standards by generating less than 30-g/hr. NOx emissions when idling. These engines can be identified by the Certified Clean Idle decal located on the left side of the hood or driver door.

Self Diagnostics

All MaxxForce® Engine operating parameter Warning Indicators are located on the instrument panel gauge cluster. When the ignition switch is turned ON, the Engine Warning Indicators are illuminated and remain on while the ECM runs normal start-up tests, then goes OFF. If warning indicator stays on or comes on

while operating the vehicle, it is an indication that the vehicle needs service. When the warning indicator is illuminated, a Diagnostic Trouble Code (DTC) will be generated. Take the vehicle to a service center as soon as possible as some optional features and or engine power may be lost while the indicator is lit.

Engine Warning/Protection System (EWPS)

The engine provides three distinct levels of protection:

- Standard Engine Warning System 2-Way
- Optional Engine Warning System 3-Way (08WWJ)
- Optional Engine Protection System 3-Way (08WPP)

Standard Engine Warning System 2-Way

The ECM monitors engine operating conditions for excessive engine speed, low oil pressure, and coolant temperature. If these conditions occur, a fault code will be set, but the **Yellow** Engine Warning indicator or the **Red** Engine Warning Indicator are not turned ON. Standard instrumentation includes an oil pressure and engine coolant temperature gauge.

CAUTION

Allowing water to stay in the fuel system could result in extensive damage to the fuel injection system. Refer to the appropriate Engine Operation and Maintenance Manual for more information.

NOTE: If the Oil/Water Warning Indicator comes ON, bring the vehicle to a safe stop and shut the engine OFF before shutdown occurs.

Optional Coolant Warning Level System – 3 Way (08WWJ)

This option provides a warning if the coolant is below the safe operating level.

NOTE: If the **Red**Engine Warning Indicator comes ON, bring the vehicle to a safe stop and shut the engine OFF.

Optional Engine Protection System – 3 Way (08WPP)



In the event engine shutdown occurs, make certain that vehicle is safely off the roadway, the 4-way emergency flashers are on, and the warning devices are properly placed. Failure to remove vehicle from roadway could result in an accident, personal injury or death.

This system includes the 3-way engine warning system. In addition, if engine oil pressure, excessive engine speed, engine coolant temperature or engine coolant level conditions exceed the warning limits, the appropriate fault codes are set and the **Red** Engine Warning Indicator is turned ON. If the engine oil pressure, engine coolant temperature or engine coolant level conditions exceed the preset critical limit, the engine is shut down. After an automatic shutdown, the engine can be restarted

and will operate in a de-rated mode for an additional 30 seconds if the conditions causing the shutdown are still present (See Automatic Engine Shut-Down and Restarting procedure).

Air Compressor Cycling

The MaxxFace® 11 and 13 Liter engines can be equipped with one of two different types of air compressor and may have one or two cylinders.

- **Direct Line Unloaded (DLU) Air Compressor:** This constantly engaged air compressor works in conjunction with the air governor and air dryer to pump compressed air to the air dryer and air tanks. When additional compressed air is not needed, air is pumped to the atmosphere via the muffler equipped, frame- mounted unloader valve. This system provides relatively lower air compressor cylinder temperatures versus head-unloaded compressors during the unloaded cycle. It is normal to hear a small amount of compressor-created sound during the unloaded cycle.
- **Head Unloaded Air Compressor:** This single cylinder, constantly engaged air compressor works in conjunction with the air governor and air dryer to pump compressed air to the air dryer and air tanks. When additional compressed air is not needed air is shut off from the air compressor discharge line and confined to the air compressor cylinder and its head. This system provides relatively higher cylinder temperatures versus head-unloaded compressors during the unloaded cycle, but does not require the plumbing and complexity of the DLU compressor. It is relatively quieter during the unloaded cycle than the DLU.

- **Clutched Air Compressor:** This high-capacity, two cylinder, air compressor is periodically engaged by using an on-off clutch. It works in conjunction with air governor and air dryer to pump air to the air dryer and air tanks. When additional compressed air is not needed, the clutch is disengaged, compressor speed goes to zero, and all air pumping ceases. This system provides relatively low cylinder temperatures and sound verses other compressors during the unloaded cycle. It is used to promote maximum fuel economy by eliminating pumping energy loss during the unloaded cycle.

As the compressor reaches approximately 120 psi (827 kPa), the air governor will, through various methods stop the air compressor from pumping pressurized air to the air system. When the air pressure reaches approximately 105 psi (724 kPa), the governor signals the air compressor to resume pumping pressurized air to the air system. During normal engine operation, this cycle will be evident by the fluctuation of the primary air tank pressure gauge.

Cooling System



To prevent personal injury or death from hot coolant or steam, use only the following procedure to remove the pressure cap from the deaeration tank. *Allow the engine to cool first. Wrap a thick, heavy cloth around the cap. Depending on the type of cap, push down, loosen cap slowly to its first notch position, or unscrew cap slowly; then pause a moment to allow pressure to release through the overflow tube. After the pressure has been released, the pressure cap may be removed.*



Exercise care when working on vehicles with running engines that are equipped with an automatic fan clutch. The fan engages when engine coolant reaches a predetermined temperature or the refrigerant pressure (if equipped with air conditioning) reaches a predetermined setting. The fan will start with no advance warning. Failure to observe these precautions could result in vehicle damage, personal injury, or death.



Do not exceed the pressure rating on the deaeration tank cap. Ensure that the pressure rating of the deaeration tank cap matches that listed on the side of the tank, or the tank may burst, causing property damage, personal injury, or death.

CAUTION

If the coolant should get extremely low and the engine very hot, let the engine cool for approximately 15 minutes before adding coolant; then, with the engine running, add coolant slowly. Adding cold coolant to a hot engine may crack the cylinder head or cylinder block. Never use water alone.

Antifreeze

The cooling system of your new vehicle is filled at the factory with either a Type II Fully-Formulated (purple) or Type III ELC - Extended Life Coolant (red). The type of coolant depends upon the engine manufacturer and the preference of the purchaser if optional coolants are allowed.

The Type II coolant must meet Type II specs, such as the Fleetrite® Premium 50/50 with SCA (P/N ZJJSCA5550). The Type III coolant must meet Type III specs, such as the Shell Rotella® ELC - Extended Life Coolant (P/N 94042). Refer to the label on the deaeration tank to determine the coolant type.

Consult the Engine Operation and Maintenance Manual for coolant service life details.

For vehicles with MaxxForce® 11 and 13 engines, the cooling system of your new vehicle will be filled at the factory with nitrite-free Shell Rotella® Ultra ELC (YELLOW) coolant. International Truck recommends using only the approved coolant with the 2010 cooling packages, and will not warrant these cooling systems that have not utilized the recommended coolant.

The label on the deaeration tank provides additional coolant/antifreeze information. Consult the Engine Operation and Maintenance Manual for coolant service life details.

Engine Oil

For maximum fuel economy and engine protection, keep oil level between the ADD and FULL marks on the dipstick. Never operate an engine with oil level above the FULL mark or below the ADD mark.

When checking the oil level, the dipstick must be withdrawn and wiped clean, then inserted all the way in and again withdrawn for a true check.

To obtain an accurate engine oil level reading the vehicle must be parked on a level surface with the engine off for at least five minutes before checking the oil level. This will ensure the oil is level in the oil pan, and the circulated oil has had a chance to return to the pan. It is not necessary for the oil to be hot to obtain an accurate reading.

Use only recommended viscosity engine oil. Refer to the Engine Operation and Maintenance Manual for engine oil specifications.

The lubricating oil in a diesel engine becomes dark in color after short periods of engine operation. This discoloration is not harmful to engine parts as long as the oil and oil filter element changes are performed at recommended intervals.

Engine Performance Problems

- Low engine power can be the result of a plugged fuel filter. Fuel filters can plug prematurely due to the use of fuel that is contaminated with a high amount of sediment, microbial growth, or water. Fuel that has been stored for longer periods of time may also reduce engine performance.
- Failure to maintain the vehicle as required in the Maintenance Instructions and Maintenance Intervals and Specifications sections of this manual, as well as any separately available Engine Operation and Maintenance Manual, can cause engine performance problems.

Too low of cetane number could cause hard starting and slower warmup and could increase engine noise and exhaust emissions.

Fuel

Ultra Low Sulfur Diesel Fuel Requirements

Ultra Low Sulfur Diesel (ULSD) fuel is required for all on-highway diesel engines used with advanced after-treatment systems (Diesel Particulate Filters – DPF). For complete details on fuel requirements, see the Engine Operation and Maintenance Manual supplied with the vehicle.

Unacceptable Fuel Blends

Biodiesel blends having more than 5 percent pure biodiesel are not within ASTM D975 diesel specifications.

To determine acceptable biodiesel and biodiesel blends, refer to the Engine Operator and Maintenance Manual for the applicable engine.

Hazards of Diesel Fuel/Gasoline Blends



Never add gasoline, gasohol and/or alcohol to diesel fuel. This mixture creates an extreme fire and explosion hazard which could result in property damage, personal injury, or death.

Blending of gasoline and/or alcohol with diesel fuel is not recommended due to the hazards of fire/explosion and the detrimental effects on engine performance.

As little as two percent volume gasoline mixed with diesel fuel will create a flammable/explosive mixture in the fuel tank vapor space, which will pose an extreme fire/explosion hazard during refueling or engine operation.

Additional Unsafe Practices

CAUTION

To prevent engine damage, do not mix propane with diesel fuel. Warranty claims will not be honored against engines that have used propane.

CAUTION

To prevent engine damage, do not mix engine oil with diesel fuel. Warranty claims will not be honored against engines that have used fuel mixed with oil.

Fuel and Lubricant Additives

International trucks are designed and built to operate satisfactorily on fuels and lubricants of good quality marketed by the petroleum industry. Use of any supplementary fuel or lubricant additives is not recommended. Malfunctions attributed to the use of such additives or failure to follow recommended fuel or lubricant recommendations may not be covered by any applicable warranty.

Fueling Procedures

NOTE: If your vehicle is equipped with dual fuel tanks, be sure to read and understand the following information before refueling the vehicle.

A dual tank system contains a primary and a secondary fuel tank.

With dual fuel tanks, the vehicle will be equipped with a fuel transfer pump system that will pump fuel from the secondary (reserve) fuel tank and send it to the primary (draw) fuel tank. The draw fuel tank must have fuel in it at all times, otherwise the vehicle may stall and may be difficult to restart (the fuel gauge reads the fuel level only from the draw fuel tank).

Therefore, when refueling, be sure that both tanks are filled completely, as it is sometimes difficult to determine which tank is the draw tank and which is the reserve tank.

Fueling Precautions

Federal Motor Carrier Safety Regulations require the driver or any employee of a motor carrier to observe the following requirements:

1. Do not fuel a motor vehicle with the engine running, except when it is necessary to run the engine to fuel the vehicle.
2. Do not smoke or expose any open flame in the vicinity of a vehicle being fueled.
3. Do not fuel a motor vehicle unless the nozzle of the fuel hose is continuously in contact with the intake pipe of the fuel tank.
4. Do not permit any other person to engage in such activities as would be likely to result in fire or explosion.

Reserve Fuel

No extra supply of fuel for the propulsion of the vehicle or for the operation of accessories shall be carried on any motor vehicle, except in a properly mounted fuel tank or tanks.

Exhaust Diesel Particulate Filter Regeneration

This vehicle is equipped with a Diesel Particulate Filter (DPF) to meet 2010 emissions requirements. The DPF traps exhaust particulate matter generated by normal engine usage. Periodically, the engine control system will perform a “cleaning” of the filter, known as Normal Regeneration. This process is transparent to the operator and occurs during normal vehicle operation.

In some cases the engine control system is unable to manage soot levels in the DPF through Normal Regeneration. When this occurs the DPF indicator will illuminate solid YELLOW on the instrument panel gauge cluster advising that action must be taken. At this time the vehicle should then be driven at highway speeds, or pulled over to perform a Parked Regeneration (See Parked Regeneration Procedure). If no action is taken the DPF indicator will begin to flash indicating that the filter is full. The vehicle should then be pulled safely off the roadway and a Parked Regeneration should be performed. If the vehicle is driven beyond the initial two warning stages, a loss of engine performance (de-rate) will occur. Ignoring the need for a Parked Regeneration, when required, can result in a warning for excessive exhaust temperatures, and a requirement to shut the engine off and not restart it until the DPF has been serviced by a technician. It is important to perform a Parked Regeneration when required. Failure to do so could be mission disabling and result in the vehicle being towed.

See the following information for a detailed explanation of DPF indicators and the corresponding procedures that must be followed.



Failure to perform a Parked Regeneration when exhaust filter indicator is ON will cause the engine to lose power and eventually shutdown.

When performing Parked Regeneration, make certain vehicle is safely off of the roadway and exhaust pipe is away from people, or any flammable materials or structures.

Failure to follow these instructions may result in a loss of engine power, vehicle speed, increased exhaust temperatures, and may cause an accident or fire resulting in property damage, personal injury, or death.

There will be three levels of indication that the vehicle's exhaust filter is accumulating soot and needs to be cleaned, each with an increasing urgency for action.

NOTE: A Level 1 indication may disappear or a Level 2 may revert to a Level 1, if the vehicle is driven on highway at highway speeds for an extended period. This process of auto regeneration of the exhaust filter is activated when the engine load is increased as a result of highway driving at highway speeds. If the DPF indicator does not reduce in level or disappear, a Parked Regeneration must be performed.

NOTE: The following table is a typical representation of 2010 DPF emissions procedures (See visor for vehicle federal emissions label).

2010 Federal Emissions Label

Level	Indication	Audible Alarm	LCD Text Message	Vehicle Conditions/Operation	Action Required
1	 DPF 3813052 (Solid)	None	Scrolls between See Visor for info and Parked Regen Required.	Exhaust filter regeneration required.	Drive on highway at highway speeds or start Parked Regeneration to prevent loss of power.
2	 DPF 3813052 (Flashing)	None	Scrolls between See Visor for info and Parked Regen Required.	Exhaust filter is full.	Pull vehicle safely off roadway and start Parked Regeneration to prevent loss of engine power.
3	 DPF 3813052 (Flashing)	An alarm will beep continuously while ignition is on.	Scrolls between See Visor for info and Parked Regen Required.	Exhaust filter is full. Engine performance is LIMITED.	 WARNING Pull vehicle safely off roadway and start Parked Regeneration to prevent engine stopping.
 Exhaust System Temperature is HOT  WARNING Exhaust components are operating under normal conditions and exhaust gases are at extremely high temperatures. When stationary, keep away from people and flammable materials, vapors, or structures or STOP ENGINE					
 A serious problem has occurred. Engine may SHUTDOWN soon. Pull vehicle safely of roadway, turn on flashers, set parking brake, place warning devices, and STOP ENGINE. Seek service immediately.					

Parked Regeneration Procedure

Perform the following steps to initiate Parked Regeneration (cleaning) of the exhaust filter:

1. Park the vehicle safely off the roadway and away from flammable materials.
2. Before initiating parked regeneration (using the ON/PARKD REGEN switch), the following conditions must be in place:
 - a. Parking brake must be set
 - b. DPF indicator illuminated (Solid or Flashing).
 - c. Transmission must be in Neutral (N) or Park (P), if available
 - d. Accelerator, foot brake and clutch (if present) pedals must not be depressed,
 - e. Engine temperature must be at a sufficient level to allow regeneration.

With some engines, this may be as high as 170° F (76.6° C).

NOTE: The engine coolant temperature must be above 170° F (76.6° C) before the parked regeneration procedure can be performed. If the engine coolant temperature is too low, the parked regeneration procedure will not activate.

3. Press the ON position of the ON/PARKD REGEN switch to initiate the regeneration cycle.

The engine speed will automatically ramp up to a preset RPM, PARKD REGEN ACTIVE will be displayed in the

information display, and the switch indicator will illuminate when the cycle is started. If the indicator is blinking, check to be sure that all conditions in step 2 have been met. Once started, the regeneration cycle will last approximately 30 minutes.

NOTE: If any of the above conditions are altered during the Parked Regeneration process, regeneration will be halted, and must be restarted.

4. When the regeneration cycle is complete, the switch indicator will go off, the engine rpm will return to normal idle and all exhaust filter warning indicators will be off. The vehicle may now be driven normally.



NOTE: In the event of an emergency situation where the vehicle must be moved after beginning Parked Regeneration, press PARKD REGEN position of the ON/PARKD REGEN switch to cancel Parked Regeneration.

Regeneration Inhibit Switch

The optional Regeneration Inhibit switch is used to prevent the normal regeneration or parked regeneration processes.

NOTE: There are two versions of the regeneration inhibit switch: the two-position and the three-position switch. Therefore, it's necessary to verify which version is installed in this vehicle. Both versions have the same switch labels.



Operation

Two-Position Regeneration Inhibit Switch

With the optional two-position switch, pressing the ON position of the ON/INHIBIT REGEN switch will inhibit both normal and parked regeneration. Regeneration will be inhibited (latched) when in this position and the switch indicator is turned on.

Three-Position Regeneration Inhibit Switch

The optional three-position switch is a center stable momentary switch. Pressing the ON position inhibits normal regeneration while the engine is running and is reset when the ignition switch is turned off. The Inhibit function is cancelled when the lower position is pressed, or parked regeneration is initiated (PARKD REGEN switch is turned to the ON position).

The switch indicator will be turned on whenever regeneration inhibit is enabled.

Transmission

Manual Transmissions

Vehicles with manual transmissions have a clutch pedal that is used to engage or disengage the clutch or for connecting or disconnecting the engine from the transmission and rear wheels. With the clutch pedal released (extended), the clutch is engaged, driving the transmission and rear wheels. Depressing the clutch pedal releases the clutch, permitting transmission gear changes.

Clutches will last many thousands of miles if properly used and maintained. **EXCESS HEAT IS A CLUTCH'S WORST ENEMY!** Almost every early clutch failure can be traced to excessive friction heat. Do not ride or slip the clutch. Once a clutch is

fully engaged, there is no heat generated and little or no wear. However, during the brief period when the clutch is picking up the load, considerable heat is generated. By riding or slipping the clutch, the period of partial engagement is lengthened, causing unnecessary heat and wear.

Engaging the Clutch

Always start in the proper gear: An empty vehicle can be started in a higher gear than a fully loaded one. But starting in a gear too high for the load can cause too much clutch slippage, generating excessive heat and unnecessary wear. A gear that will start the vehicle moving with the engine at idle speed is usually correct. If the engine must be revved up to prevent stalling, the gear selection is too high. As the clutch pedal is released and the clutch begins to engage, the engine speed will drop slightly. When this happens, increase the engine speed and fully engage the clutch. Increasing the engine speed before fully engaging the clutch can damage the clutch and drive train.

Do not shift until vehicle has reached proper speed. Upshifting before the vehicle has reached the right speed is almost as bad as starting off in too high a gear. When the difference between the vehicle speed and the engine speed is too great, the clutch is forced to slip. The result is extra heat and wear.

Never hold a vehicle on a hill with the clutch. To hold on a hill with the clutch requires that the clutch be purposely slipped. By doing this, enough heat can be generated to burn up the clutch.

Never coast with the clutch disengaged. This can cause clutch failure by the very high RPM encountered when coasting in gear with the clutch released. In this situation, the rear wheels

are driving the disc through the multiplication of the rear axle and transmission ratios. This can result in over 10,000 RPM, which is beyond the burst strength of the facing material. Something as simple as coasting down an unloading ramp can burst a driven disc.

Never engage the clutch while coasting. Reengaging a clutch after coasting causes tremendous shock to the clutch and the whole drivetrain. It can result in internal engine damage and/or clutch and flywheel failure. Always report unusual clutch operation promptly. Proper maintenance, performed on time, will greatly extend the life of the clutch. The driver should report any change in free-pedal (free-travel), slippage, or any strange feel to the clutch operation.

Helpful Hints to Operate Vehicles with Ceramic Clutch Facings

1. Driver must start vehicle in first gear.
2. While operating a ceramic clutch, the driver has to engage the clutch before giving the engine any fuel (at idle).
3. The driver should not try to slip the ceramic clutch by raising engine RPMs and riding or feathering clutch pedal, since the vehicle will experience erratic engagement.

Erratic engagement can cause engine stalling and potential serious damage to your vehicle's drivetrain components (i.e., clutch, transmission, driveshaft(s), rear axle).

Clutch Brake (Vehicles with Nonsynchronized Transmission) – Vehicle Not Moving

A clutch brake is used to stop transmission input shaft rotation so that the initial first or reverse gear selection can be accomplished

when the vehicle is at a standstill and the engine running at idle speed. Clutch brake application occurs in the last 1 inch (25mm) of pedal travel.

When using the clutch brake, fully depress the clutch pedal and shift the transmission into either first or reverse gear. If the transmission does not go into first gear or reverse, toothbutting may be occurring. Slowly release the clutch pedal while applying light pressure on the shift lever until the transmission goes into gear. This will provide for a smooth shift into either a forward or reverse gear.

NOTE: After engagement of first gear, DO NOT use the clutch brake for upshifting and downshifting. To do so will shorten the service life of the clutch brake, and gear selection shift efforts may be increased. Clutch brake application occurs in the last 1 inch (25mm) of pedal travel.

Double Clutch Procedures, Nonsynchronized

In order to properly upshift or downshift be sure to do the following:

- Depress the clutch pedal to disengage the clutch.
- Shift the transmission into neutral.
- Release the clutch pedal.
- If upshifting, wait until the engine speed matches the transmission speed of the gear you desire to shift into.
- If downshifting, accelerate the engine until the engine speed matches the input speed of the gear you desire to shift into.

Operation

- Depress the clutch pedal immediately and shift into the desired gear.
- Release the clutch pedal to engage the clutch.

Clutch Precautions

Maintain specified clutch adjustment. Regularly inspect clutch control linkage for tightness.

When adjustment of the clutch is necessary, it is extremely important that the work be properly performed; otherwise, early failure of the clutch will result and a costly clutch overhaul becomes necessary.

To avoid needless delay and expense, allow only competent and experienced mechanics to perform these operations.

Shifting with Synchronized Transmission

With the clutch released (pedal depressed), use second speed gear synchronizer to stop clutch disc rotation. This will allow smooth engagement of first or reverse gear selection. In order to complete gear engagement, it may be necessary to apply light pressure to the shift lever during initial engagement of the clutch. It takes one to two seconds to match gear speeds.

Steady pressure on shift lever will help the synchronizer perform its job quicker. If the shift lever is forced into gear it is possible to override a blocker and defeat the purpose of the synchronizer, causing gear clash.

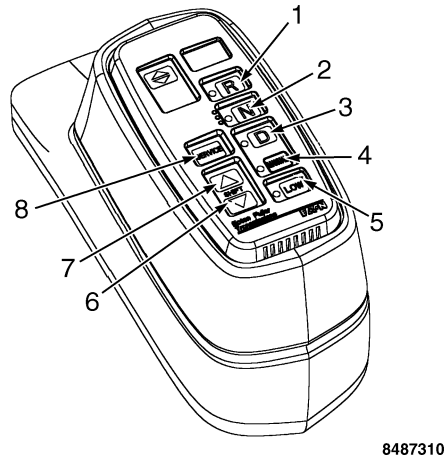
Shifting with Nonsynchronized Transmission

Refer to Clutch Brake (vehicles with nonsynchronized transmission) and Double Clutch Procedures in this section (above).

Operation of the Eaton AutoShift® Transmission and Shifter



To prevent unexpected vehicle movement, hold the brake pedal down while you move the gearshift from position to position. Hold down both brake and clutch pedal while pushing the “R” or “D” button. If you do not hold the brake pedal down, your vehicle may move unexpectedly and cause property damage, personal injury, or death.



1. Reverse Button
2. Neutral Button
3. Forward Gear Selector Button
4. Hold Button
5. Low Gear Button
6. Downshift Button
7. Upshift Button
8. Service Indicator

The Eaton AutoShift® is a partially automated transmission that automatically selects and engages the proper transmission gears. Some vehicles are equipped with an optional clutch pedal that must be used when starting and stopping the vehicle.

To shift the Eaton® transmission into Reverse (R) or Drive (D), first place foot on the brake and optional clutch pedal. When in Drive (D), the transmission selects the starting gear and automatically selects the proper gears for operating loads. To select a higher or lower gear, first press the Hold button and use either the up arrow or down arrow shift buttons. If LO is selected while the vehicle is stopped, the transmission will remain in LO gear until another gear is selected. If selected while in motion, the transmission will downshift when it is safe to do so. To place the transmission in Neutral, press the (N) button.

Eaton UltraShift® Transmissions (Optional)

The optional Eaton UltraShift® transmission is an automatic transmission that can automatically select and engage the proper transmission gears. Vehicles equipped with this transmission do not have a clutch pedal. For operating instructions, refer to the Transmission Manual.

Automatic Transmissions

Allison Transmissions

NOTE: For a complete description of the Allison Automatic Transmissions, refer to the Allison Transmission Operator's Manual, supplied with this vehicle.

Allison Transmission with "P" – (Park) Park Pawl Mechanism or "PB" – Parking Brake Position

"P" – Park Pawl. A park pawl transmission effectively grounds the output shaft, thereby preventing rotation of the driveline. If the vehicle is stationary, selecting the "P" (Park) position on

Operation

the shift selector places the transmission in “N” (Neutral) and engages the park pawl (always use with the Parking brake).

NOTE: If you attempt to engage “P” position while vehicle is in motion (1 mph, 2 km/hr) or higher, the park pawl mechanism will ratchet, and will not hold the vehicle.

“PB” – Parking Brake. For the transmissions with the Auto-Apply Parking Brake – “PB” position, selecting PB places the transmission in “N” (Neutral) and automatically engages the Air or Hydraulic parking brake.

CAUTION

Do not apply the parking brake with the vehicle in motion. Transmission and/or driveline damage can result. In the event of a dynamic brake apply, recheck the torque of all brake mounting bolts to verify the integrity of the mount.

CAUTION

Sustained use of the parking brake with the engine running and the transmission in range can cause an overheating failure of the transmission. The instrument panel gauge cluster contains a Parking Brake indicator that illuminates when the ignition switch is “ON”, the parking brake is applied, and the transmission selector is in range.

Parking The Vehicle

The following WARNINGS provide the methods of parking the vehicle using the various transmission shift selectors.



To prevent sudden, unexpected vehicle movement and property damage, personal injury or death, always use the parking brake **IN ADDITION TO** leaving the transmission in gear.

To prevent sudden, unexpected vehicle movement and possible property damage, personal injury or death, perform the following:

- Bring the vehicle to a complete stop.
- Put transmission selector in “P” – Park Pawl, “PB” - Auto Apply Parking Brake , or N – Neutral.

For the park pawl (P – Park) transmissions, slowly lift foot from brake pedal to engage transmission park pawl mechanism.

- Apply the parking brake (either lever or Parking Brake dash control) and ensure that it is holding properly. (For the “P” – Park Pawl transmissions, do not rely solely upon the parking mechanism of the transmission).



- **For the Auto Apply Parking Brake (“PB” transmissions), make sure that the “PB” selection has applied the Parking Brake (Parking Brake indicator should be turned On) by slowly releasing the service brake and verifying that the vehicle will not roll.**
- **Chock the wheels and take any other steps necessary to keep the vehicle from moving.**
- **Turn off engine anytime you leave the vehicle. Never leave the vehicle unattended with the engine running.**

Preparing to Drive the Vehicle



To prevent unexpected vehicle movement, hold the brake pedal down while you move the gearshift from position to position. Failure to follow this warning could result in property damage, personal injury, or death.

Read and perform the following steps for the particular vehicle Parking brake whenever you prepare to drive away.

Parking Brake Interlock. To shift from P (Park) or PB (Parking Brake), the shifter is equipped with a Parking brake Interlock. The ignition switch must be in the ON position and brake pedal depressed before the gear selector can be moved from the P (Park) or PB (Parking Brake) position into the desired operational position.

Manual Parking Brake

After starting the engine, place foot firmly on brake pedal.

With foot still on brake pedal, select the desired transmission operating position.

With foot still on brake pedal, push manual Parking Brake lever down to release, then lift foot from brake pedal to allow the vehicle to move.

Air Parking Brake or Power Parking Brake

After starting the engine, place foot firmly on brake pedal.

With foot still on brake pedal, push and hold shift selector button and move selector to the desired transmission operating position.

With foot still on brake pedal, push in on Parking Brake control knob to release parking brake (Air Brake) or push and release the control knob (Power Parking Brake), then lift foot from brake pedal to allow the vehicle to move.

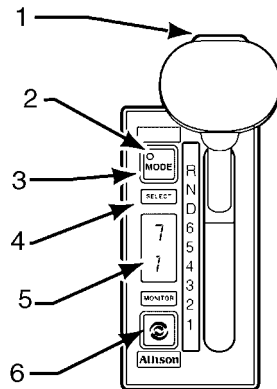
Operation of the Allison Generation IV Gearshift Controls



To prevent unexpected vehicle movement, hold the brake pedal down while you move the gearshift from position to position. Failure to follow this warning could result in property damage, personal injury, or death.

Both the T-Bar gearshift control and the Push-button gearshift control are available with the Allison automatic transmissions. They provide the same gear shift functions and control the transmission in the same manner.

Allison Generation IV T-Bar Gearshift Control



8487297

1. Hold Override Button
2. Mode Indicator (Led)
3. Mode Button
4. Mode Id
5. Digital Display
6. Display Mode Diagnostic Button

When the vehicle is started, the transmissions are designed to operate in the standard performance mode. Pressing the Mode button on the shift tower will switch the transmission to Economy mode and illuminate Mode ON in the shift tower display. Economy mode provides operation at a lower engine RPM while maintaining adequate performance.

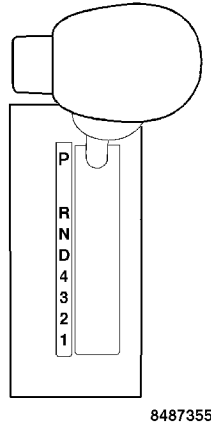
If the engine speed is above idle when a gear is selected with the shift tower, the vehicle will not move. To move the vehicle, the shift tower must be moved to re-select a gear after the engine comes down to idle.

For further information on the Allison transmission, refer to the separate Allison vocational transmission model Operator's Manual.

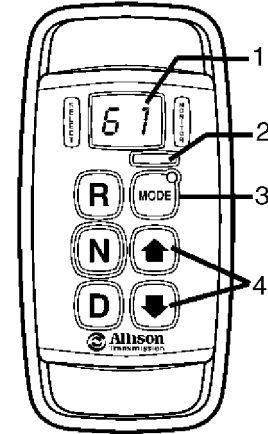
Torque Lock

If the vehicle is parked on an incline and P (Park) is properly engaged, the weight of the vehicle may generate an excessive amount of torque on the park pawl in the transmission. In this situation, it may be difficult to shift the transmission out of the P (Park) position. To drive the vehicle out of the torque lock, perform the following:

- Push the vehicle uphill a small amount to release the pressure on the park pawl and permit the shift out of P (Park). At this point, place foot on brake pedal.
- Hold foot on brake pedal while shifting the transmission out of P (Park).
- Release the parking brake.



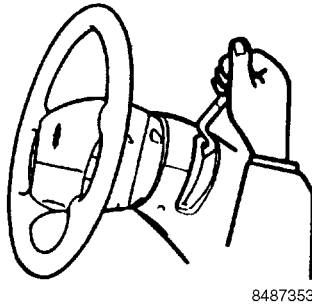
Operation of the Allison Generation IV Push-button Shift Selector



1. Digital Display
2. Mode Id
3. Mode Button
4. Range Selector Buttons

To shift the Allison transmission into Reverse (R) or Drive (D), first place foot on brake pedal. With foot on brake pedal, press either R or D, release the Parking Brake, and then release the brake pedal. When in Drive, to select a lower range press and release the down arrow button. To select a higher range, press and release the up arrow button. To place the transmission in Neutral, press the (N) button.

Operation of the Column-Mounted Shifter



A Column-mounted shifter is used with some Allison transmissions. The selected gear positions will be indicated, on the instrument panel gauge cluster's LCD display, by a dash directly under R, N, or gear number.

NOTE: When using the column-mounted shifter, while the transmission is not in "P" – Park or "PB" – Parking Brake, the LCD display will indicate the selected gear at all times, even if the ignition switch is in the **OFF** position. With the ignition switch in the OFF position, when the transmission is shifted to the park position, the dash indicator shall disappear and the instrument panel gauge cluster will complete its shutdown.

To shift the transmission out of "P" – Park or "PB" – Parking Brake, first read and then perform the following:

- First press foot on service brake pedal (see Park Position Interlock section).

- For reverse, pull on shift control lever and move lever to "R" position (as indicated on LCD display), and then release column shift lever.
- Release the Parking Brake.
- Lift foot from service brake pedal to allow the vehicle to move backward.
- To select a forward gear (while holding service brake pedal down), pull on shift lever and move down thru "N" - Neutral and stop at "D" – Drive or any of the available gears as indicated on the LCD display.
- Release service brake pedal and allow vehicle to move forward.

Main Transmission Controls

Main transmission, auxiliary transmission, transfer case, and power take off control shift patterns can be found on a placard or decal on the driver's visor door, on the instrument panel, or on the shift control itself. In certain cases, the shift pattern, for a component added by a Body Builder, will be in the Body Builder's manual.

The main transmission control is used to select the various gear ratios or speeds provided within the transmission.

Selection of the D (direct drive) gear does not change the gear ratio provided by the main transmission but is used where the gear ratios in the main transmission are adequate to handle the vehicle operation.

Selection of the OD (overdrive) gear in the auxiliary transmission permits increased road speeds in the various transmission ratios.

A loaded vehicle should not be operated with the auxiliary transmission in OD (overdrive) with the main transmission in either of the two lowest speed gears. Doing so could cause damage to either the transmission or propeller shaft.



Before backing up, check to see that area behind vehicle is clear of people, animals and objects. Use a spotter whenever possible and always keep that person in sight. Failure to do so may result in property damage, personal injury, or death. If so desired, backup alarms are available through your International dealer. However, they are never a substitute for the above procedures.

Backup Alarm

An optional backup alarm feature is available and provides an audible warning signal whenever the vehicle is operated in reverse gear.

Auto Neutral

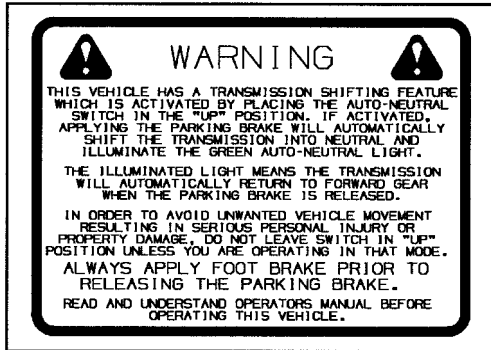


When using the AUTO NEUTRAL feature, always hold the brake pedal down when releasing the parking brake since the transmission will automatically return to forward gear. Failure to follow this warning could result in unexpected vehicle movement causing property damage, personal injury, or death.

The optional Auto Neutral feature is available for applications involving frequent starts and stops that also require exiting the vehicle, such as refuse and concrete truck operations.

This feature is activated by placing the AUTO NEUTRAL switch in the UP position. When activated, the transmission automatically shifts to Neutral when the parking brake is applied, and the AUTO NEUTRAL indicator is illuminated. This feature also causes the transmission to automatically shift into the forward gear when the parking brake is released.

The mode, that is installed in your vehicle, is identified by a decal, located near the shifter. There are TWO possible Auto Neutral modes that are available for this vehicle. The two modes are described below.



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Temporary Neutral – 13AAZ. To activate this Auto Neutral feature, perform the following:

1. To enable Auto Neutral , place the AUTO NEUTL/ON switch in the ON position (the switch indicator will then turn On).
2. When the Parking Brake is applied, the transmission automatically shifts to Neutral, and the AUTO NEUTRAL indicator in the instrument panel gauge cluster will turn on.

3. The transmission shifter's digital display shows a blinking "N", indicating the transmission is in Neutral, and the instrument panel gauge cluster LCD display will indicate Neutral gear.

When the parking brake is released, the transmission will go back to the gear originally selected, the shifter's digital display will show that gear, the LCD display will also indicate that gear, and the AUTO NEUTRAL indicator will go off.

Note: The Auto Neutral switch indicator will still be On – indicating that the Auto Neutral function is still enabled – and will remain on until the switch is placed in the Off position.

4. Repeat these steps as long as the Auto Neutral mode is desired. To turn off the Auto Neutral mode, place the AUTO NEUTL/ON switch to the off (AUTO NEUTL) position. This will turn Off the switch indicator.

Neutral gear Remains (Hard Neutral) – 13WUA. To activate this Auto Neutral feature, perform the following:

1. To enable Auto Neutral feature , place the AUTO NEUTL/ON switch in the ON position (the switch indicator will turn On).
2. When the Parking Brake is applied, the transmission automatically shifts to Neutral, and the AUTO NEUTRAL indicator in the instrument panel gauge cluster will turn on.

3. The transmission shifter's digital display will show a non-blinking "N", indicating the transmission is in Neutral.

T-Bar shifter: when the parking brake is released, **the shift lever has to be moved to Neutral and then back to the desired forward gear**. The AUTO NEUTRAL indicator will go off.

Pushbutton shifter: when the parking brake is released, **press the shifter button for the desired transmission gear**.

Note: The Auto Neutral switch indicator will still be On – indicating that the Auto Neutral function is still enabled – and will remain on until the switch is placed in the Off position. The AUTO NEUTRAL indicator will go off.

4. Repeat these steps as long as the Auto Neutral mode is desired. To turn off the Auto Neutral mode, place the AUTO NEUTL/ON switch to the off (AUTO NEUTL) position. This will turn Off the switch indicator.

Power Take Off Control

If your vehicle is equipped with a power take off (PTO), refer to the PTO equipment manufacturer's instructions.

If vehicle is equipped with an Allison Automatic Transmission, refer to separate Allison Transmission Operator's Manual.

Automatic Transmission Operating Temperature

For the Allison transmissions, the sump/fluid reservoir temperatures (indicated by optional gauge or warning indicator) should not exceed 250°F (121°C). The converter temperature (indicated by optional gauge or warning indicator) should not exceed 300°F (149°C). For the transmissions with retarder, the converter temperature (indicated by optional gauge or warning indicator) should not exceed 330°F (166°C).

Rear Drive Axles

Locking Differentials



To prevent vehicle damage, personal injury, or death, pay strict attention to the following:

If your vehicle is equipped with any type of locking or limited slip differential, power will be transmitted to the opposite wheel should one of the wheels slip. Both wheels must be raised free of the ground should it be necessary to operate one wheel with the vehicle stationary; otherwise the wheel that is not raised will pull the vehicle off its support, possibly resulting in personal injury or death.

Care should be taken to prevent sudden accelerations when both drive wheels are on a slippery surface. This could cause both drive wheels to spin, and allow the vehicle to slide sideways, resulting in loss of vehicle control.

Tandem Axle Power Divider Lock (PDL) Control

CAUTION

Do not operate the vehicle with the PDL engaged on dry pavement (good traction) continuously. This will result in excessive tire wear and premature axle wear.

Never engage the PDL when the wheels are spinning.

The PDL should be engaged, which prevents interaxle differential action, when backing under a trailer with a tractor, starting on a slippery surface (poor traction), operating off highway in mud, (poor traction), or when traveling on slippery highways (poor traction). Failure to lock the power divider under these conditions may result in power divider failures. If you encounter wheel spin conditions, the PDL switch should be moved to the LOCK position.

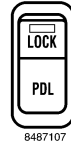
CAUTION

Engage the PDL only when stopped or moving at low speed. Never try to engage the PDL while the wheels are spinning, as this may result in shock damage to the power divider components.

When encountering slippery highway conditions (poor traction), the PDL can be engaged at a low, even speed. Momentarily letting off the accelerator will engage the differential lock. A warning indicator on the instrument panel gauge cluster indicates when the inter-axle differential is locked.

When highway conditions improve (good traction), the PDL should be disengaged, again at a low, even speed. Letting up on the accelerator momentarily will unlock the interaxle differential.

Tandem axle power dividers or interaxle differentials in the forward rear axle are controlled by the dash-mounted power divider lock (PDL LOCK) switch.

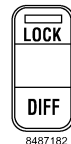


The switch indicator will turn on when the PDL is engaged (locked). The vehicle may be electronically programmed to provide an alarm when a speed is reached where it is not appropriate to have the power divider locked. In this event, an alarm will sound (5 beeps) and the switch indicator will flash slowly (once per second). A fast flashing (twice per second) switch indicator signifies a problem in the PDL system.

Under normal highway conditions (good traction), the PDL should be disengaged, which allows differential action between the forward rear axle and the back rear axle, preventing interaxle differential wear due to unequally worn or mismatched tires, etc.

Driver-Controlled Differential Lock

The differential lock feature locks together the axle's left and right axle shafts for improved traction on reduced traction surfaces.



Some vehicles are equipped with this optional driver-controlled differential lock feature (DIFF LOCK). The air-actuated traction device can be manually shifted from the vehicle cab. By actuating a switch,

mounted on the instrument panel gauge cluster, the driver can lock or unlock the rear axle differential(s) when the vehicle is moving or stopped.

Other vehicles with tandem rear axles (6X4) are equipped with two optional driver-controlled differential lock features (DIFF FR AXLE/LOCK and DIFF RR AXLE/LOCK). The air-actuated traction devices can be manually shifted from the vehicle cab. By actuating the switches, mounted on the instrument panel gauge cluster, the driver can independently lock or unlock the forward-rear and/or rear-rear axle differentials when the vehicle is moving or stopped.



When the differential is fully locked, the vehicle will have a slight understeer condition. This will increase the turning radius of the vehicle.

On vehicles with multiple drive axles, the differential lock can be used in conjunction with the Power Divider Lock (PDL) to achieve maximum available traction in adverse road surface conditions.

To limit stress on the axle and tires during vehicle turning maneuvers and improve stability, the use of the differential lock must be limited to low vehicle speeds, under 25 mph (40 km/h). Also, to maintain vehicle stability, the differential must not be locked when the vehicle is traveling down steep grades and traction is minimal. DIFF LOCK will automatically disengage when vehicle speeds exceed approximately 25 mph (40 km/h).

Do not engage the locking differential when the tires are spinning.

The vehicle may need to be decelerated or turned once or twice for the differential lock to fully disengage.

Controlled Traction Differential

Some Eaton drive axles are equipped with a controlled traction differential. This is a differential assembly incorporating a friction plate assembly designed to transfer torque to both rear wheels.

The unit is basically a multiple disc clutch designed to slip above predetermined torque values. This controlled slipping characteristic at higher torque values enables the vehicle to negotiate turns in a normal manner. Resistance to slippage at lower torque values enables the vehicle to maintain an appreciable amount of tractive effort when one wheel encounters relatively poor traction.

A control valve in the cab is actuated by the driver to engage and disengage the controlled traction feature.

Disengaged, the axle has differential action all the time. One wheel will spin independently of the other, if slippery conditions are encountered.

Engaged, wheel slippage and spin-out are minimized.

CAUTION

Tire sizes on both rear wheels should be the same on axles equipped with a traction equalizer. If not, excessive wear may occur to the traction equalizer.

Locking Differential (Optional)



Axles equipped with locking differentials can deliver power to both wheels even when only one wheel is on the ground. To prevent unexpected vehicle movement when servicing wheels, tires, or brakes, turn engine off and raise all driving wheels of locking differential equipped axle. Failure to observe this warning could cause the vehicle to move unexpectedly resulting in property damage, personal injury, or death.



To prevent vehicle damage, personal injury, or death, pay strict attention to the following:

Care should be taken to prevent sudden accelerations when both drive wheels are on a slippery surface. This could cause both drive wheels to spin, and allow the vehicle to slide sideways, resulting in loss of vehicle control.

The optional locking (limited slip) differential is designed to function as a conventional differential during normal driving conditions, and, when a loss of traction occurs at one wheel, it will provide transfer of power to prevent that wheel from spinning.

NOTE: These differentials require a certain amount of resistance in order to start the power transfer. If the spinning wheel is off the ground, transfer may not begin. If spinning occurs, often a light application of the brakes, while carefully applying power, will slow the spinning wheel enough to allow the differential to transfer power to the other wheel.

The performance of a vehicle equipped with locking differential is somewhat different from that of a vehicle equipped with a conventional differential.

For example: Light noise and mild shuddering may be evident while turning the vehicle on high coefficient of friction surfaces (i.e., concrete). Vehicle and operating conditions can add to the level of this noise and vibration:

- Tight slow continuous turns, as encountered in tight parking/delivery areas.
- Higher axle ratios as compared to lower axle ratios.
- Uneven tire air pressure and/or uneven tire wear.
- Heavy vehicle loads and/or uneven side-to-side distribution of load.

Anything that improperly causes a difference in individual wheel speeds, such as mismatched tire diameters (due to differences in tire wear or tire pressure), unbalanced loading of the vehicle, or operating the vehicle on a side slope, may cause the locking differential to deliver power to only one side of the vehicle, thus affecting directional stability. Always maintain matched tire sizes, pressures, and balanced loads and avoid operation on side slopes.

Two Speed Rear Axle



Never attempt to shift a two-speed axle when descending a hill as the axle may not complete the shift, remain in neutral, and cause a loss of vehicle speed control and result in property damage, personal injury, or death.

Do not attempt to shift a Two-Speed rear axle when the rear tires are spinning as this could cause a loss of vehicle control and result in property damage, personal injury, or death.

The two-speed rear axle switch permits selection of either the high or low axle ratio.

Axle Shift Only

TO DOWN SHIFT: Select lower ratio position, release and depress accelerator pedal as quickly as possible, or while holding the accelerator down, disengage and re-engage clutch as quickly as possible.

NOTE: Clutch method recommended for slower speeds.

TO UPSHIFT: Keep accelerator down, select a faster ratio position, release accelerator pedal and pause until axle shifts.

NOTE: De-clutch for smoother axle upshifts at slow speed.

Operation

Split Shifting

Combined Axle and Transmission Shift

To Downshift the axle to a slower ratio and upshift or downshift the transmission, shift the transmission and just before the clutch is re-engaged, move the control switch to the slower ratio position.

To Upshift the axle and downshift or upshift the transmission, move the control switch to a faster ratio position and make the transmission shift in the usual manner.

NOTE: In all axle upshifts, move the control switch to position first. When split shifting to a slower axle ratio, do not move the control switch until just before re-engaging the clutch.

Axles and Suspensions

Gross Weight (Axle – Vehicle)



Do not exceed the truck's gross axle weight, gross vehicle weight, and gross combination weight ratings. Exceeding these ratings by overloading can cause component failure resulting in property damage, personal injury, or death.

Axle Operating Temperature

Normally, axle operating temperature will not exceed more than 100°F (38°C) above ambient temperature. However, intermittent operation (5 percent of time) at higher temperatures under extreme loads (long pulls) will not harm the axle. Operating temperatures above 230°F (110°C) significantly increase the rate of lubricant oxidation and shorten the effective life of the lubricant and seals, making more frequent changes necessary. Extreme Pressure (EP) lubricants should not be run consistently at temperatures above 230°F (110°C).

Front Axle (4X4, 6X6)



To prevent vehicle damage, personal injury or death, pay strict attention to the following:

Should it be necessary to operate the rear wheels (with engine power) with the vehicle stationary and the rear wheels raised from the ground, first disengage the front axle, otherwise the front wheels will pull the vehicle off its support. Always chock front wheels under these conditions.

CAUTION

Do not keep the front axle engaged when operating on dry, hard surfaced roads. Operating on hard, dry surfaces with both the front and rear axle engaged creates a build-up of torque between the axles resulting in excessive tire wear and strain on the entire drive unit.

When operating with both the transmission and transfer case in low gear, the front axle must be engaged to prevent excessive torque loads on the rear axle.

When front axle is engaged and the transmission is in low gear, the transfer case must be in low gear to provide wheel slip protection.

Transfer Case

The transfer case transmits power to the front driving axle for operation over rough terrain, steep grades, or slippery surfaces (i.e., mud, gravel, snow, etc.) where improved traction is required.

Operation

The transfer case is actuated by control switches on the center control panel. The ON/Front AXLE switch, containing an in-switch indicator, is used to toggle the solenoid that causes the air-actuated transfer case to engage or disengage the front axle from the drive train. The XFER HI/XFER LOW switch controls either of two solenoids that cause the air-actuated transfer case to operate in either the high or low gear ratio.

In-Switch Indicator

The ON/Front AXLE switch contains an indicator that will be lit steadily when switch is in the ON position and the front axle has been safely engaged. When the driver attempts to engage or disengage the front axle at speeds faster than 10 mph with the ON/Front AXLE switch in the ON position, the indicator will blink until the proper speed is reached. When the driver attempts to engage or disengage the front axle when the tires are slipping and the ON/Front AXLE switch is in the ON position, the indicator will blink until the tires regain proper traction.

**Front Axle Engagement when Vehicle is in Motion**

To engage the front axle, the following steps are required:

NOTE: Ensure that the wheels are not slipping while performing these steps, and that there are no error conditions or indicators displayed.

1. The vehicle must be operating on a level surface.
2. Slow the vehicle to a speed below 10 miles per hour.
3. Place the ON/Front AXLE switch in the ON position.
4. The front axle will be engaged and the indicator will be lit.

Front Axle Disengagement when Vehicle is in Motion

To disengage the front axle, the following steps are required:

Operation

NOTE: Ensure that the wheels are not slipping while performing these steps, and that there are no error conditions or indicators displayed.

1. The vehicle must first be operating on a level surface.
2. Slow the vehicle to a speed below 10 miles per hour.
3. Place the ON/FRONT AXLE switch in the FRONT AXLE (Off) position.
4. The front axle will disengage and the indicator will go out.

Shifting Transfer Case From High to Low or Low to High Gear Ratio

The system will only allow the transfer case to be shifted to the low gear ratio if the following steps are performed:

NOTE: Ensure that there are no error conditions or indicators displayed.

1. The vehicle must be stopped and the parking brake applied (Ignition switch still in the 'run' position).
2. Place the transmission in Neutral.
3. Place the XFER HI/XFER LOW switch in the XFER HI position for the high gear ratio or XFER LOW position for the low gear ratio.



Front Axle Engagement and Transfer Case Gear Ratio Shifting with Vehicle Stopped

The transfer case gear ratio can be selected and the front axle can be engaged at the same time by performing the following steps:

NOTE: Ensure that there are no error conditions or indicators displayed.

1. The vehicle must be stopped and the parking brake applied (Ignition switch still in the 'run' position).
2. Place the transmission in Neutral.
3. Place the ON/FRONT AXLE switch in the ON position.
4. The front axle will be engaged and the indicator will be lit.
5. Place the XFER HI/XFER LOW switch in the position required for the desired gear ratio.

Vehicles with Transfer Case Oil Temp(eration) Sender

CAUTION

To prevent damage to transfer case, pull vehicle off the road immediately when overheating condition is detected.

If the transfer case lubricant exceeds its maximum allowable temperature, damage to the transfer case may result. If this occurs, the transfer case overheat indicator will be lit, alerting the driver. In the event of a transfer case overheating condition, proceed with the following:

1. Pull off the highway as soon as possible.
2. Inspect the transfer case and cooling system for leaks.

3. If no leaks are found, resume driving at 15 mph slower than when the indicator came on.
4. Resume safe speed if indicator stays off.

International® Ride Optimized Suspension (IROS) (Optional)

CAUTION

The vehicle must not be operated on the road without air in the suspension bags. This will prevent suspension damage and ride degradation. Failure to observe this may cause property damage.

The International® Ride Optimized Suspension (IROS) is a variable rate suspension system that automatically adjusts to different loads to maintain constant frame height. The system provides improved vehicle ride and increased driver comfort. This feature also allows the rear of the vehicle to lower several inches for cargo loading and unloading.

The system may be controlled by an optional two-position SUSP/DUMP switch with an indicator in the DUMP position. This switch controls solenoids, which directs air to the suspension dump and height valve.

Air Suspension Dump (ASD) Switch (Optional)

NOTE: The suspension will dump when the ignition switch is in either ACC or ON position, but will only fill when the ignition switch is in the ON position.

NOTE: To lower the suspension (dump operation), the vehicle speed must be less than 5 mph (8 km/h).

When the SUSP/DUMP switch is in the DUMP position and the vehicle speed is below 5 mph (8 km/h), air supplied to the air suspension is released, lowering the frame for loading.



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Placing the switch in the SUSP position causes air to fill or remain in the air suspension for proper operating ride height. The SUSP/DUMP switch will operate the IROS system only if the ignition switch is in either ACC or ON positions and the air tanks have sufficient pressure to fill the suspension. When the ignition switch is turned OFF, power to the solenoid will be removed. Therefore, the suspension will remain in the state last set by the SUSP/DUMP switch.

NOTE: The SUSP/DUMP switch functions will be inhibited by either a Traction Control or ABS event. In either event for either SUSP or DUMP operation, the ASD switch will have to be manually recycled after the event has passed in order to complete the operation.

The following is the operation of the optional air suspension dump (SUSP/DUMP) switch in controlling the vehicle ride height:

Operation

NOTE: The system will automatically switch from DUMP to SUSP if, while the system is commanding a DUMP operation, the vehicle speed exceeds 5 mph (8 km/h). Once this occurs, the only means to deflate the suspension will be to slow the vehicle to 5 mph (8 km/h) and recycle the SUSP/DUMP switch to the DUMP position.

- When the SUSP/DUMP switch is pushed to the DUMP position, the system releases air from the air suspension bag. The switch indicator comes on and remains on while the suspension is being lowered.
- When the SUSP/DUMP switch is pushed to the SUSP position, the system fills the air suspension bag, which raises the vehicle. The switch indicator will then turn off.

Air Suspension System Faults

- The instrument panel gauge cluster will issue an audible 10-beep alarm whenever the driver pushes the DUMP position of the SUSP/DUMP switch and the vehicle exceeds 5 mph (8 km/h).
- The SUSP/DUMP switch indicator will blink rapidly in the event of a system component failure or a bad system signal status when the SUSP/DUMP switch is in the DUMP position.
- The SUSP/DUMP switch indicator will blink slowly in the event of a system command fault, regardless of the position of the SUSP/DUMP switch.

Axle and Suspension Conversions



When operating a loaded vehicle, always keep all adjustable axles in the down position supporting their share of the load. Failure to do so can overload other axles, tires, wheels, springs, brakes, and frames, causing early component failure and loss of vehicle control, which could result in property damage, personal injury, or death.

Axle and suspension conversions are not recommended or approved; however, on occasion, aftermarket add-on axles and suspensions are installed by others on International truck chassis, which allow operator control for weight transfer from other axles (i.e., air lift axles).

Lift Axle Options



To prevent the unintentional lowering of a lift axle(s), set all UP/DOWN switches to the UP position before turning system on. Be aware, lift axle(s) will automatically rise to the UP position when the key is turned off. Ensure lift axle(s) are clear of people, animals and objects before turning system on, or turning ignition off. Failure to follow this warning may cause property damage, personal injury, or death.

NOTE: The “Down” indicator on the UP/DOWN switch signals that the axle, controlled by that switch, is in the lowered position, and is operational.

NOTE: The use of International Truck installed Lift Axles provides improved vehicle load-carrying capability. However, the lift axles do not increase the vehicle’s GVWR. The lift axle system is made up of two axle types and the lift axle system controls.

Lift Axle Locations

The vehicle can be equipped with as many as three lift axles. The two lift axle designations are either a “pusher” or “Tag” axle, as determined by its location. The “pusher” axle is one that is mounted ahead of the rear driving axle(s), and a “tag” axle is one that is mounted behind the last rear drive axle.

Lift Axle Types



On systems with self-steering lift axles, the axle will automatically rise to the UP position any time the transmission is shifted into reverse, and back down when the transmission is shifted out of reverse. Before backing up, check to see that area behind vehicle is clear of people, animals and objects. Use a spotter whenever possible and always keep that person in sight. Failure to do so may result in property damage, personal injury, or death.

The two lift axle designs are (1) “Fixed” (Rigid) and (2) “Self-Steering” lift axles.

Fixed lift axle. The fixed lift axle design provides 20,000 pounds maximum load carrying capacity. The design does not allow the wheels to steer when cornering, thereby causing increased tire wear due to tire scrubbing while cornering. The advantage of this design is its simplicity, less components, which requires less maintenance.

Self-Steering Lift Axle. The self-steering lift axle design contains a spring-loaded self-centering mechanism that keeps the axle tires tracking straight ahead with the vehicle’s straight ahead movement. When the vehicle is turned, the drag on the tires, caused by cornering, causes the tires to steer in the direction that creates the least rolling resistance. As the vehicle direction straightens out, the self-centering mechanism returns the tires to their straight ahead position. The advantage of this design is the reduction in tire wear. The self-steering lift axle provides 13,000 pounds of load carrying capacity.

The self-steering lift axles can only operate properly while the vehicle is moving forward. Placing the truck in reverse while the lift axle(s) is in the down position, will cause the axle to automatically raised to the lifted (up) position. The axle will immediately return to the down position when the transmission is shifted out of reverse.

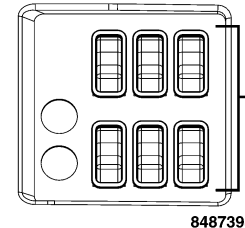
Lift Axle Controls

The lift axle system controls consist of all the controls, regulators, and gauges needed to raise and lower the lift axle(s) and to monitor the load air bag pressures for each axle. These controls are available in three possible configurations and are the same for all configurations. The three configurations are “Instrument Panel”, “In-cab”, and “Mixed” controls. These are the same for both lift axle types. The system controls are as follows:

1. The one **AXLE ENABLE** system switch, which is used to activate all of the controls for any lift axles that are installed on the vehicle (NOTE: The ignition switch must be in the ON or RUN position).
2. The **UP/DOWN** switch is used to raise and lower the lift axle (one control for each lift axle installed).
3. The **Air Pressure Regulator** is used to control the amount of air pressure supplied to the load air bag for the lift axle (one regulator for each lift axle installed).
4. The **Air Pressure Gauge** indicates the air pressure in the load air bags for the lift axle (one gauge per lift axle installed for in-cab control arrangement; two gauges per lift axle installed for mixed control arrangement).

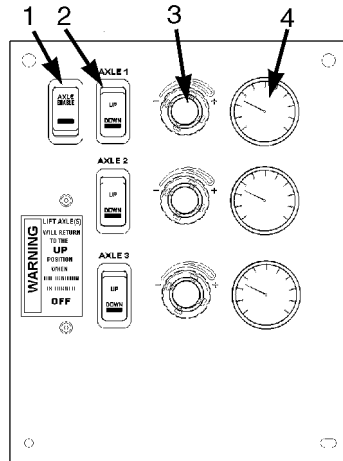
NOTE: When lift axle switches are installed in the instrument panel, the Air Pressure Gauge and Air Pressure Regulators are located outside of the cab, as shown in the “Mixed Controls” configuration.

Instrument Panel Controls



1. Optional Location For Lift Axle Switches

In-Cab Controls



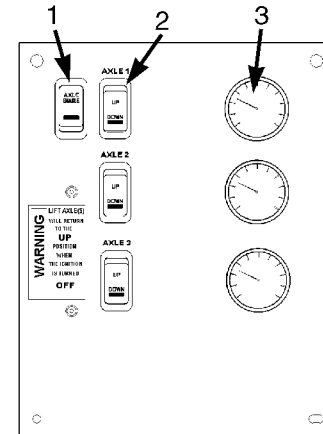
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1. Axle Enable System Switch
2. UP/DOWN Switch
3. Air Pressure Regulator
4. Air Pressure Gauge

In this configuration, all lift axle controls are located and accessible from the floor-mounted pedestal next to the driver's

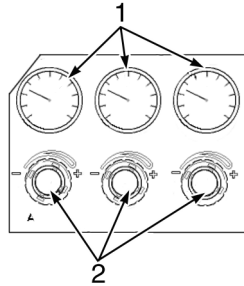
seat. This system's controls consist of one AXLE ENABLE system switch, an UP/DOWN switch, an air Pressure Regulator control, and an air Pressure Gauge for each lift axle.

Mixed Controls



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1. Axle Enable System Switch
2. UP/DOWN Switch
3. Air Pressure Gauge



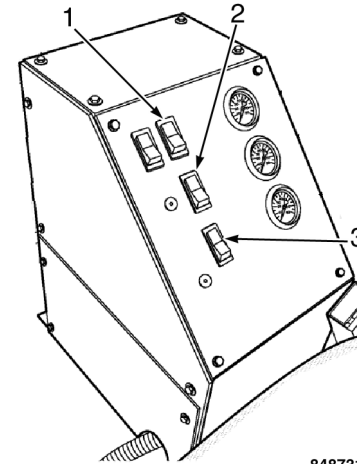
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1. Air Pressure Gauge
2. Air Pressure Regulator

In this configuration, the lift axle controls are located on the floor-mounted pedestal and on a panel that is mounted externally on the rear of the cab. The controls on the floor-mounted pedestal are the AXLE ENABLE system switch, an UP/DOWN switch, and an Air Pressure Gauge for each axle. The controls on the external panel are an Air Pressure Regulator, and a second Air Pressure Gauge for each lift axle.

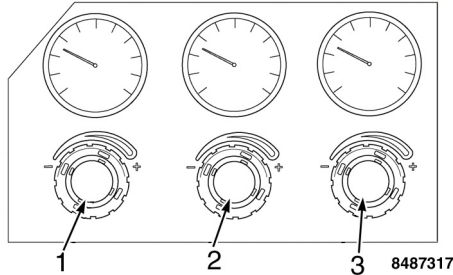
Lift Axle Control Identification

Each lift axle has its own set of controls labeled “1” thru “3” counting the axles from the front of the truck. See the illustrations below:

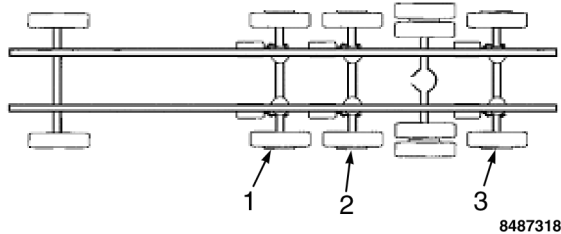


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1. UP/DOWN Switch – Axle 1
2. UP/DOWN Switch – Axle 2
3. UP/DOWN Switch – Axle 3



1. Air Pressure Regulator – Axle 1
2. Air Pressure Regulator – Axle 2
3. Air Pressure Regulator – Axle 3



1. Axle 1
2. Axle 2
3. Axle 3

Lift Axle System Operation



To prevent the unintentional lowering of a lift axle(s), set all UP/DOWN switches to the UP position before turning system on. Be aware, lift axle(s) will automatically rise to the UP position when the key is turned off. Ensure lift axle(s) are clear of people, animals and objects before turning system on, or turning ignition off. Failure to follow this warning may cause property damage, personal injury, or death.

Enabling the Lift Axle System

NOTE: Before pressing the AXLE ENABLE switch, ensure that all UP/DOWN switches are in the UP position.

The ignition switch must be in the “Run” or “On” position in order to enable the lift axle system. After this is done, the lift axle system is enabled by momentarily pressing the AXLE ENABLE switch. This will cause the indicator for this switch to be illuminated. The Axle Enable switch need only to be pressed once after ignition on operation. If the lift axle(s) will not be used, there will be no need to press the AXLE ENABLE switch. The only way to disable the system is to turn the ignition switch to the “off” position. When the ignition switch is turned to the “Off” position, the axle(s) will go to the “up” position, regardless of the position of any Lift Axle switches.

Lowering the Lift Axles

With the lift axle system enabled, when the DOWN position of the UP/DOWN switch is selected, air is vented from the lift bags, thus causing the axle to be lowered. At the same time, air is applied to the axle load bags through the air pressure regulator for adjustment of the proper axle load carrying capacity. The amount of air pressure applied to the load bags is monitored by the air pressure gauge. The switch DOWN indicator will be lit indicating that the axle is in the operational position. **Refer to the load capacity charts to determine the air pressure needed for the desired load capacity for both axle designs.**

Raising the Lift Axles



On systems with self-steering lift axles, the axle will automatically rise to the UP position any time the transmission is shifted into reverse, and back down when the transmission is shifted out of reverse. Before backing up, check to see that area behind vehicle is clear of people, animals and objects. Use a spotter whenever possible and always keep that person in sight. Failure to do so may result in property damage, personal injury, or death.

When the UP position of the UP/DOWN switch is selected, air is vented from the axle load air bag and, at the same time, pressurized air is routed to the lift bag, raising the axle.

For system with self-steering axles, when the transmission is shifted into Reverse, +12 VDC is removed from the air solenoid,

venting air from the axle load air bag and supplying air to the lift bag. This lifts the axle (s) regardless of the position of the UP/DOWN switch.

Load Capacity Chart for 20,000 Pound Fixed Lift Axle

	Mounting Height		
Ground Axle Load	9 in.	10 in.	11 in.
5,000 lbs	15 psi	15 psi	15 psi
10,000 lbs	36 psi	36 psi	36 psi
15,000 lbs	58 psi	58 psi	58 psi
20,000 lbs	79 psi	79 psi	79 psi
1. This table is approximate. To obtain an accurate load vs. air pressure reading, it is necessary that the unit be calibrated over a flat and accurate scale. 2. This table assumes 1500 lbs ground weight with 0 psi air pressure.			

Load Capacity Chart for 13,200 Pound Steerable Lift Axle

	Mounting Height		
Ground Axle Load	10 in.	11 in.	12 in.
5,000 lbs	29 psi	31 psi	34 psi
6,000 lbs	37 psi	39 psi	43 psi
7,000 lbs	44 psi	47 psi	52 psi

Ground Axle Load	Mounting Height		
	10 in.	11 in.	12 in.
8,000 lbs	52 psi	56 psi	60 psi
9,000 lbs	60 psi	64 psi	69 psi
10,000 lbs	67 psi	72 psi	78 psi
11,000 lbs	75 psi	80 psi	87 psi
12,000 lbs	82 psi	88 psi	96 psi
13,000 lbs	90 psi	97 psi	105 psi
14,000 lbs	98 psi	105 psi	114 psi

1. This table is approximate. To obtain an accurate load vs. air pressure reading, it is necessary that the unit be calibrated over a flat and accurate scale.

2. These values are approximations and will vary, especially with different mounting heights and or bag heights.

3. These Run Heights are based on units with no axle/bag shim and a 3.50 in offset axle.

4. The values above are based on the standard axle assemblies with bag heights of 12 in, 13 in, and 14 in respectively.

5. These weights are based on the axle and wheel equipment weighing 1200 lbs ground weight with no (0 psi) air pressure.

Brakes



Always check and maintain brakes in proper condition and adjustment. Out of adjustment brakes could cause reduced braking ability and result in property damage, personal injury, or death.

Downhill Operation



Do not attempt to gear down if the engine is at or near maximum speed (RPM). Under these conditions it will be impossible to shift into a lower gear and could result in possible vehicle runaway, resulting in property damage, personal injury, or death.

Always descend hills with extreme care, relying primarily on the engine braking effect to control vehicle speed. Heed warning signs posted for any grade. Stop and check brakes for condition and adjustment at available pull-off areas before starting a descent.

Observe the following precautions:

- Never coast downhill. Service brakes alone should not be used to control speed on major downgrades. Brakes will fade from overuse.

- Downhill speed is controlled by removing one's foot from the accelerator pedal (engine running with closed throttle) and putting the transmission/rear axle in reduced gear. If the transmission/rear axle is in a gear that results in more than the appropriate speed, a proper downshift should be made to avoid overuse of the brakes. If the proper gear selection was not made and the brakes were overused, then stop the vehicle and wait for the brakes to cool. After the brakes have cooled, continue down grade in a lower gear range.
- The common rule to follow in using the engine and transmission/rear axle to control vehicle speed is to select a lower gear going down the hill than would be required to ascend the hill. There are some exceptions, such as going down a short hill with good visibility and no hazards.
- The service brakes should be used to supplement available vehicle retardation methods. When descending long grades requiring use of the brakes, short applications (three to five seconds duration) should be made rather than long, continuous applications. This minimizes temperature rise, brake fade, and air consumption of air brake system.

Air Brakes



Stopping distance may increase under the failed condition since only one section of the brake system is operating. Reduce speed and employ safe driving practices. Have brake system repaired immediately. Loss of braking capability could cause an accident and result in property damage, personal injury, or death.

NOTE: The function of the air compressor is to provide and maintain air under pressure to supply the air brake system and other air powered devices. Certain air compressors in vehicles with MaxxForce® 11 and 13 engines, while in operation, may cause fluctuation of the needle in the air pressure gauge.

The truck types covered in this manual are equipped with a split brake system.

The purpose of this split system is to provide a means of stopping the vehicle should a failure occur in either the primary or secondary brake system. In the event air pressure loss occurs in one system, the remaining system continues to provide braking action.

When a failure is detected, the air dryer is provided with a limp home feature to allow the vehicle to be driven to a service center.

If vehicle has been parked for an extended period in cold weather, always check to be sure all wheels are rolling free (brakes are not frozen) when starting out. Always clean accumulated ice and snow from brake linkage.

Air Gauge, Low Air Pressure Beeper and Warning Indicator



To prevent loss of vehicle braking or control resulting in property damage, personal injury, or death, never operate the vehicle when insufficient air pressure (less than 70 psi [483 kPa]) is indicated for either the primary or secondary air system. The volume of air required to stop the vehicle may be greater than that available. Have the brake system checked and repaired before returning the vehicle to service.

Should air pressure in either section of the split air brake system be reduced to 70 ± 6 psi (483 ± 41 kPa) the warning beeper will sound and the red BRAKE PRESSURE warning indicator on the instrument panel gauge cluster will glow. Also, the air gauge(s) will indicate low air pressure in at least one of the independent systems.

The warning beeper and red indicator will automatically shut off when the air pressure in both systems is sufficient (approximately 70 psi [483 kPa]) to operate the vehicle.

Should the red indicator and beeper not shut off soon after startup, the air pressure gauge(s) should also indicate at least one section of the split system has low air pressure.

If the red indicator, beeper, and gauge indicate a loss of pressure while driving, the vehicle still has a portion of the braking capability, because one-half of the split system braking capability is retained. In the event of primary pressure system loss, the spring brakes will assist the front brakes in stopping the vehicle. However, the distance required to stop the vehicle will be increased.

Brake Application

Rapid successive brake applications and release, sometimes referred to as fanning or pumping the pedal, should be avoided. This is an inefficient way of slowing or stopping a vehicle and inefficient use of air pressure. It also defeats the proper operation of the ABS.

Parking Brake



Failure to comply with the following may result in property damage, personal injury, or death.

Under no circumstances should the spring brake chamber be disassembled. Disassembly will release a powerful spring which could result in property damage, personal injury, or death.



Always chock the wheels when manually releasing the spring brakes, or the vehicle could roll causing property damage, personal injury, or death.

For towing, make sure the vehicle is securely connected to tow vehicle and tow vehicle parking brakes are applied before releasing the disabled vehicle's spring brakes.

All vehicles with air brakes are equipped with spring brake chambers for parking. The parking system is operated manually by a single valve, which in the case of a tractor also controls the parking system on the trailer.

The purpose of this brake is to hold the vehicle in a parked position and to assist in bringing it to an emergency stop. The parking brake should not be used to brake the vehicle during normal driving.

To apply the parking brake, pull out control. To release the parking brake, push in control.

On single-unit trucks and tractors with independent parking and trailer controls: if air pressure is reduced to approximately 20 to 45 psi (138 to 310 kPa) in both the primary and secondary systems, the parking brakes will automatically apply.

On tractors with the modular control system: if air pressure is reduced to approximately 20 to 45 psi (138 to 310 kPa) in both the primary and secondary systems, the parking brake control will automatically apply. For the exact air pressure set points, refer to the Service Manual.

It should be noted that upon loss of air pressure, partial spring brake application will occur prior to automatic application of the control valve.

To release, recharge system to 70 psi (483 kPa) and push in the parking brake control. If the system cannot be recharged and the vehicle must be moved, the spring brake must be manually released (caged).

In the event it is necessary to move the vehicle after an emergency application (before air pressure can be restored), the parking spring can be compressed mechanically to release the brake. A release stud spring caging tool is furnished with the brake chamber assembly. The release stud engages in the spring pressure plate and its nut is tightened to compress and cage the spring and release the brake.

Remove release stud assembly from carrying pocket.

Apply a light coat of antiseize compound to the threads of the release stud to avoid any unnecessary wear of the threads. Remove the access plug from the end of the spring chamber. Insert the release stud through the opening in the chamber and into the spring pressure plate.

Turn the release stud one-quarter turn to engage the tangs on the release stud into the slot in the pressure plate. Install the nut on the release stud. Be sure tang on release stud stays engaged with slot on pressure plate while installing the nut. Tighten the nut with a wrench to compress the spring.

Parking Brake Reset

Charge spring brake chambers with air pressure. Loosen nut and remove the release stud and nut from the spring housing and

reinstall the access plug in the chamber opening. Reinstall the release stud and nut in the carrying pocket on the brake chamber housing.

Reservoir Moisture Draining

Moisture taken in with the air through the compressor inlet valves collects in the reservoirs and necessitates draining each reservoir periodically. This is done by opening the drain cocks located at the end of all tanks (optional pull-cable-operated drain valves may be present). If the drain cock is opened in the end of the tank, there must be some air pressure in the system to ensure proper drainage. Be sure to close the drain cocks after all moisture has been expelled.

On vehicles so equipped, the reservoir automatic drain valve ejects moisture and contaminants from the reservoir in which it is connected. It operates automatically and requires no manual assistance or control lines from other sources. The reservoir should be drained and the valve should be examined periodically to ensure that the drain passage is not obstructed.

Air Dryer

The function of the air dryer is to collect and remove moisture and contaminants before the compressed air reaches the air reservoirs. This protects the air system components from malfunctioning including blockage, corrosion, and freezing. For air tank draining requirements, refer to the Maintenance Instructions section as well as local regulations.

The air dryer is installed in the discharge line between the air compressor and the air system reservoirs. The air dryer includes

a replaceable desiccant cartridge and oil blocking filter that is periodically serviced. It also may include a heater to prevent the discharge valve from freezing in cold weather.

Trailer Brake Hand Control

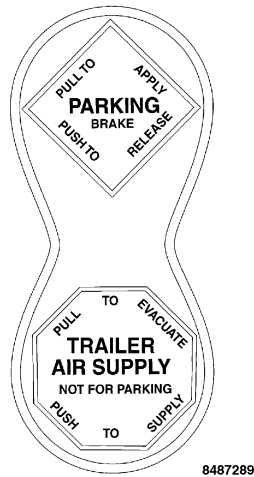


The hand control valve should never be used to apply the trailer brakes when the tractor and trailer are parked. Air pressure may leak from the system, and the vehicle could roll away, resulting in property damage, personal injury, or death.

The trailer brake hand control is used to apply the trailer service brakes independently of the tractor service brakes. The trailer brake hand control operates a valve that provides gradual control of air pressure applied to the trailer service brakes. The trailer service brakes can be fully or partially applied, but when in a partial position, can be overridden by pressing fully on the brake pedal.

To apply the trailer service brakes utilizing the hand control, move the lever clockwise (down). The further the handle is moved clockwise, the greater the air pressure applied to the trailer brakes. The trailer hand brake handle will remain in place with the desired brake pressure applied until the handle is manually moved. To release the trailer brakes, move handle counterclockwise (up) until trailer moves freely.

Trailer Air Supply and Parking Brake Modular Controls



- TRAILER AIR SUPPLY (red octagonal knob)
- PARKING BRAKE (yellow diamond knob)

The PARKING BRAKE valve knob (yellow) should be pushed in first, after sufficient air pressure is built up (apply foot brake to prevent vehicle from rolling). The TRAILER AIR SUPPLY valve knob may then be pushed in.

The TRAILER AIR SUPPLY valve knob (red) and PARKING BRAKE valve knob will automatically pop out if the system pressure (both front and rear circuits) drops to 20 to 40 psi (138 to 276 kPa). The tractor protection valve will then close,

the tractor spring brakes will apply, and the trailer emergency system will be activated.

On vehicles equipped with the standard two-valve system, the operation of one valve together with the other permits the operator to select the desired functions described below:

Red Valve (Trailer Air Supply)	Yellow Valve (Parking Brake)	Function (Mode)
Out	Out	System Park
In	Out	Trailer Charge
In	In	Normal Running
Out	In	Bobtail/Sliding Fifth Wheel Adjustment/Sliding Trailer Tandems Adjustment

The PARKING BRAKE valve (yellow knob) controls the spring brakes on the tractor and when pulled out simultaneously causes the trailer supply valve to pop out, thus applying both tractor and trailer parking brakes. The trailer brakes may be independently released by pushing only the TRAILER AIR SUPPLY valve (red knob) in.

The TRAILER AIR SUPPLY valve (red knob) delivers air to the trailer supply and will automatically pop out, shutting off the trailer supply if pressure is decreased to approximately 35 psi (241 kPa). For exact air pressure set points, refer to the Service Manual.

NOTE: When attempting to readjust/slide the position of the tractor fifth wheel or the trailer's tandem axles with the tractor and trailer fully connected, leave the tractor's PARKING BRAKE pushed in and pull the TRAILER AIR SUPPLY out. This will apply the trailer's parking brakes and keep it stationary while the tractor is moved forward or reverse.

Parking Brake Indicator



Driving with the parking brakes applied can lead to excessive heat build up and fire resulting in property damage, personal injury, or death.

The parking brake indicator is operated in conjunction with the parking brake. With the ignition switch on and the parking brake set, the PARK indicator will illuminate. If the indicator does not illuminate with the parking brake set, the indicator may be inoperative.

Parking Brake Alarm

The parking brake alarm is used to alert drivers when they have failed to set the parking brake when exiting the vehicle. The alarm is a continuous sounding of the electric (city) horn. The conditions that allow this to occur are:

1. The ignition switch is in the OFF position.
2. The parking brake is not set.
3. The driver's door (**any cab**) is opened.

To turn off the alarm, press the service brake pedal. Then, after turning the ignition switch to the RUN or ACC position, make sure that the parking brake is set.

Antilock Brake System (ABS)



Antilock brake systems are designed to enhance overall vehicle safety when a vehicle is driven within its safe operating limits. ABS cannot compensate for a vehicle that is being driven beyond the physical limits of control. Drivers operating an ABS equipped vehicle should employ safe driving practices and assume no additional driving risks. Failure to do so could result in property damage, personal injury, or death.



Do not rely on the ABS system to interrupt vehicle retarder, engine brake on slippery road surfaces. Turn these devices off during hazardous driving conditions. Failure to follow this warning may cause wheel slippage and/or loss of vehicle control, which could result in property damage, personal injury, or death.

The antilock brake system is a mandated feature added to the standard air brake system. It electronically monitors vehicle wheel speed at all times, and only engages when wheel lock

is imminent. The standard air brake system controls normal braking when the ABS is not engaged.

ABS Operation



If the ABS warning indicator comes on, stopping distances may increase under certain braking conditions. Have the ABS system repaired immediately. Take every precaution to prevent wheel lockup, which could result in loss of vehicle control causing property damage, personal injury, or death.

The antilock brake system electronically monitors vehicle wheel speed at all times and only engages when wheel lock is imminent. The standard hydraulic brake system controls normal braking when the ABS is not engaged.

ABS requires no changes in driving practices. For the best stopping performance with or without ABS, modulate - **do not pump** - the brake pedal until the vehicle slows to desired speed or stops. Be aware that ABS on a towing vehicle does not control brakes on towed vehicles. Towed vehicles may or may not have ABS. ABS will prevent lockup of controlled wheels if you overbrake for existing road conditions. Optimum vehicle control for existing road conditions will be provided as a result of the ABS preventing wheel lockup at speeds above approximately 4 mph (6 km/h). The ABS cannot provide any better braking and steering capability than the available road traction will permit. If the road is slippery it will take longer to stop than on a dry road. Steering maneuverability will be

similarly limited. Vehicle speed must be reduced to compensate for the extended time and distance required to stop or slow the vehicle on slippery roads.

The wheel hubs carry exciter rings used by axle-mounted sensors to transmit wheel speed information to the ABS electronic control unit located on the chassis frame. The control unit monitors and compares all wheel speed inputs to determine if any wheel(s) is about to lock. If wheel lockup is about to occur, the control unit commands the appropriate modulator valve to adjust air pressure delivery to prevent wheel lockup.

ABS Self-Check

A yellow warning indicator on the instrument panel gauge cluster indicates the antilock system status. The indicator comes on and the system goes through an ABS self-checkout sequence each time the ignition is turned on. The system is working normally when: ignition is turned on, indicator comes on, then flashes twice and remains on for several seconds before going out.

During the self-checkout, the modulator valves will cycle around the vehicle twice in the following pattern:

1. Right Front
2. Left Front
3. Right Rear
4. Left Rear

A fault has been detected in the ABS if the indicator does not come on with ignition, does not flash, fails to go off, or comes on again at any other time.

If overbraking causes wheel lockup on the rear drive axles while retarding devices are in operation, the ABS will interrupt and disable the retarder until the lockup situation has stopped.

If the ABS warning indicator is lit, consult your nearest International truck service center for further assistance in maintaining and repairing your ABS.

Antilock Driving Tips

Brake just the way you always have. Apply brakes as normal to stop in time. The ABS monitors the brake application electronically and automatically controls the brakes, much faster than a driver could do by pumping the brake pedal.

Always remember that you are the most important factor to safe operation of your vehicle. Steer clear of traffic, pedestrians, animals, or other obstacles while you are in an emergency braking situation. The antilock tractor and truck brake system will allow you to steer the vehicle during braking while it comes to a full stop. ABS is not an excuse to take unnecessary risks. Always drive carefully and stay a safe distance away from the vehicle in front of you.

When driving with a single trailer, double, or triple: Brake as necessary and watch your trailer(s) through your mirrors and correct steering as necessary to keep in straight lines.

If only your tractor has ABS: Use your tractor's ABS brakes. Steer clear of obstacles and watch the trailer through your mirrors to make sure it follows your tractor properly. Tractor ABS will help prevent tractor jackknife, but will not prevent trailer swing out.

Air Brake Bendix® ABS-6



Vehicles equipped with Stability Control cannot be used to pull double or triple trailers. Failure to follow this warning could result in property damage, personal injury, or death.



Stability Control systems are designed to enhance overall vehicle safety by automatically reducing vehicle speed under certain conditions. Drivers operating a Stability Control equipped vehicle should employ safe driving practices and assume no additional driving risks. Failure to follow this warning could result in property damage, personal injury, or death.

ABS-6 advanced with RSP provides the core ABS function as well as Automatic (ATC) and Roll Stability Program (RSP) functions.

Core ABS Functions

The core ABS system prevents wheel lockup to help drivers maintain steering control while braking. Bendix® Antilock Braking Systems (ABS) use wheel speed sensors, ABS pressure modulator valves, and an Electronic Control Unit (ECU) to control either four or six wheels of a vehicle. Bendix® ECUs optimize slip between the tire and the road surface by

monitoring individual wheel turning motion during braking. For a complete description of the core ABS system, see the ABS section above.

Traction Control (If Equipped)

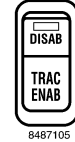


Traction Control systems are designed to enhance overall vehicle safety when a vehicle is driven within its safe operating limits. Traction Control cannot compensate for a vehicle which is being driven beyond the physical limits of control. Drivers operating a Traction Control equipped vehicle should employ safe driving practices and assume no additional driving risks. Failure to do so could result in property damage, personal injury, or death.

Your vehicle may be equipped with an optional traction control system, which helps you maintain the stability and steerability of your vehicle, especially on snow or ice-covered roads and gravel roads. It reduces engine power and/or selectively applies the rear brakes. The system allows your vehicle to make better use of available traction in these conditions by also limiting the engine RPM when you push farther on the accelerator, which limits wheel spin. The traction control indicator will illuminate steadily if the system is malfunctioning.

NOTE: The traction control braking (ATC action) to limit wheel spin does not occur at vehicle speeds above approximately 31 mph (50 km/h). Therefore, at speeds above 31 mph (50 km/h), all ATC events are controlled only by engine power limiting.

The Traction Control switch for Air Brake-equipped vehicles. If the system is enabled (traction control switch in the TRAC ENAB position), the traction control indicator on the instrument panel gauge cluster will flash during a Traction Control event, and the engine may not increase RPMs when you push farther on the accelerator. If the traction control switch is in the DISAB position, the traction control system is disabled.



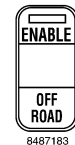
ATC System Check

At ignition turn-on, the traction control indicator will illuminate steadily for 2.5 seconds and then turn off. If not, the system is defective or inoperative.

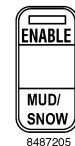
ATC OFF ROAD or MUD/SNOW Switch

The optional ATC system comes equipped with one of two switches that perform the same functions of enabling and disabling the ATC system.

NOTE: Be sure to turn the ATC OFF ROAD or MUD/SNOW switch off when you return to a firm surface.



The function of this switch is to allow greater engine power and more wheel spin. When operating on soft road surfaces, place the OFF ROAD or MUD/SNOW switch in the ENABLE position. The switch indicator will flash slowly to indicate that this function has been selected and will flash rapidly whenever ATC is operating to control excessive wheel spin.



Stability Control Systems – Bendix® ESP



Vehicles equipped with Stability Control have reduced effectiveness when pulling double or triple trailers. Failure in understanding this warning could result in property damage, personal injury, or death.



Stability Control systems are designed to enhance overall vehicle stability by automatically reducing vehicle speed under certain conditions. Drivers operating a Stability Control equipped vehicle should employ safe driving practices and assume no additional driving risks. Failure to follow this warning could result in property damage, personal injury, or death.

CAUTION

Modification to vehicles equipped with ESP require prior approval thru Navistar's Tech Services # 1-(800)-336-4500. Unapproved modifications may result in diminished stability control performance.

The optional stability control system provides the core ABS function as well as Automatic Traction Control (ATC) and roll stability functions.

Core ABS Functions: The core ABS system reduces wheel lockup to help drivers maintain steering control while braking. Antilock Braking Systems (ABS) use wheel speed sensors, ABS pressure modulator valves, and an Electronic Control Unit (ECU) to control either four or six wheels of a vehicle. ECUs optimize slip between the tire and the road surface by monitoring individual wheel turning motion during braking.

Advanced Stability Functions: This function enhances stability by sensing actual vehicle dynamics. ESP-equipped vehicles add yaw control to the basic roll stability feature.

Vehicle Stability Control Speed Reduction: In the case of a potential roll event, the stability system will remove the throttle and quickly apply brake pressure to slow the vehicle combination below the threshold.

Steering Angle Sensor: This sensor enables the advanced stability system to capture the driver's steering input and intervene if a yaw correction is needed. The sensor also provides the earliest indication of an increase in lateral acceleration that might cause a potential roll event. A steering angle sensor provides a greater stability margin than a vehicle that is not equipped with this sensor.

Brake Demand Sensors: The stability control system was designed to supplement the driver's actions. By directly measuring driver brake demand, the system can transition seamlessly between driver-intended and system-intended braking pressure. For example, if in a certain maneuver, the system calculates 40 psi (276 kPa) is needed and the driver is only applying 20 psi (138 kPa), the system compensates automatically to deliver the needed 40 psi (276 kPa). If, however, during the same maneuver, the driver steps on the

brake pedal quickly to apply a higher [above 40 psi (276 kPa)] braking level, the driver's braking input overrides the temporary change made by the system.

ABS/Stability System Interaction: With the ABS-based stability control system, the ABS system is given priority at the wheel ends to manage wheel slip for optimal braking. The ABS system functions similarly whether the stability system or the driver applies the brakes.

Bobtail Proportioning System

Bobtail proportioning is available with tractor air brake systems (for export only with code 04092) with or without ABS or ABS/systems. The proportioning valve senses when trailer brakes are not connected to the vehicle air brake system and automatically adjusts braking power when operating in the bobtail mode, then returns full braking power when a trailer is attached. When operating in the bobtail mode, bobtail proportioning provides more braking control and shorter stopping distances, particularly on wet and slippery road surfaces.

It should be noted that there is a noticeably different brake pedal feel on tractors with this feature while operating in the bobtail mode. Higher brake pedal efforts will be experienced by the driver than in a brake system without bobtail proportioning.

Towing Instructions



This vehicle may be equipped with (optional) dual tow hooks for recovery purposes only. Always use both tow hooks to prevent possible overloading and breaking of individual hooks. Failure to follow this warning could result in property damage, personal injury, or death.



Failure to comply with the following may result in property damage, personal injury, or death:

- **Always chock the wheels when manually releasing the parking brakes, or the vehicle can roll.**
- **For towing, make sure the vehicle is securely connected to tow vehicle and tow vehicle parking brakes are applied before releasing the disabled vehicle's parking brakes.**
- **To ensure release of parking brake, always cage the spring in the brake chamber.**
- **Under no circumstances should the spring brake chamber be disassembled for the purpose of releasing the parking brake.**

NOTE: Important factors to keep in mind when using tow hooks:

- use both tow hooks when retrieving vehicle
- use a slow steady pull, do not jerk on hooks
- tow hooks are not designed for towing, retrieval only

Before moving the towed vehicle, check for adequate road clearance of vehicle components. Unload the towed vehicle prior to towing to reduce any abnormal loads to the vehicle components resulting from the towing procedures. Before towing, be sure to fully release the parking brake. The spring-actuated type parking brake can be released by recharging the air system with at least 64 psi (441 kPa) of air. If brake system will not retain air pressure, then the spring brakes must be held in the released position (caged) manually. See **Parking Brake** section.

Towing Vehicle with Front Wheels Suspended

CAUTION

To prevent vehicle, engine, or transmission damage, vehicles should not be towed, even short distances, without suspending rear wheels or removing the axle shafts or propeller shaft.

In the event the chassis is equipped with tandem axle and the vehicle is to be towed from the front, the forward rear axle may be raised to clear the road surface and secured to the frame by chains or U-bolts, allowing only rear axle to contact road surface. Axle shafts must be removed from rear axle assembly. The wheel hub ends must be covered to prevent loss of axle lubricant and entrance of contaminants. Use extreme care in securing the chains or U-bolts to prevent possible damage of brake lines, hoses or other components.

When it is necessary to tow a vehicle with the front wheels suspended, extra precautions must be taken to avoid transmission or differential damage. Proceed as follows.

Remove axle shafts from axle assembly to prevent the wheels from driving the differential and the transmission. The wheel hub ends must be covered to prevent loss of axle lubricant and entrance of contaminants. If axle shafts are not removed, removal of propeller shafts at rear axle will be required.

Operation

Towing Vehicles with Driver Controlled Differential Lock

Removing Axle Shafts Before Towing

CAUTION

To prevent differential and/or transmission damage, vehicles that must be towed to a service facility with the drive axle wheels on the ground, it is necessary to remove the axle shafts before the vehicle is towed.

CAUTION

Do not use a chisel or wedge to loosen axle shafts and dowels. The chisel or wedge can damage hub, axle shafts, and oil seals if used.

NOTE: One of the axle shafts has two sets of splines. One set to engage with differential side gear and one set to engage with shift collar for the differential lock. It may be necessary to rotate shaft slightly to align side gear spline teeth with clutch collar teeth in order to remove axle shaft.

1. Shift main differential to the locked (engaged) position.

Applicable RR DIFF or FR DIFF ENGAGE indicator must be illuminated in instrument panel gauge cluster to validate DIFF LOCK is FULLY engaged and axle shaft can be removed. Failure to fully engage axle DIFF LOCK will allow DIFF LOCK shift collar to fall slightly and block, or temporarily resist axle shaft reinsertion.

2. Remove cap screws and washers or stud nuts and washers from flanges of both axle shafts.
3. Loosen tapered dowels in flanges of both axle shafts by holding a 1-1/2 inch-diameter brass drift or hammer against axle shaft center and hitting it with a five to six pound hammer.
4. Remove tapered dowels and both axle shafts from axle assembly.
5. Assemble a cover over openings of both wheel ends to prevent loss of lubricant and keep dirt from the wheel bearing cavities.

Installing Axle Shafts

1. Remove covers from wheel ends.
2. Shift differential lock to the locked (engaged) position.

Applicable RR DIFF or FR DIFF ENGAGE indicator must be illuminated in the instrument panel gauge cluster to validate DIFF LOCK is FULLY engaged and axle shaft can be removed. Failure to fully engage axle DIFF LOCK will allow DIFF LOCK shift collar to fall slightly and block, or temporarily resist axle shaft reinsertion.

3. Install right-hand and left-hand axle shafts as follows:
 - a. Place gaskets on wheel hub studs.
 - b. Push right-hand axle shaft into wheel end and housing until shaft stops against differential shift collar.
 - c. Push axle shaft farther into housing until shaft stops against differential side gear.
 - d. Push down on axle shaft flange and rotate shaft until splines of shaft and side gear are engaged.
 - e. Push axle shaft completely into housing until axle shaft flange and gasket are flush against wheel hub.
 - f. Install left-hand axle shaft and gasket into wheel end.
4. If tapered dowels are required, install them at each stud and into flange of axle shaft. Use a punch or drift and hammer if needed.
5. Install fasteners and tighten to correct torque value. Refer to the appropriate Service Manual Section.

Towing Vehicle with Rear Wheels Suspended

CAUTION

To prevent damage to cab roof or air deflector when towing the vehicle backwards (rear wheels suspended) the air deflector must be removed.

Whenever possible, it is preferable to tow a disabled vehicle from the rear by raising the rear of the chassis by the rear axles.

When towing a vehicle with rear of the chassis suspended, the front wheels must be locked in the straight ahead position.

Vehicles with manual shift transmissions must have at least one (1) pint of transmission lubricant drained from the case. This will prevent transmission lubricant from entering the clutch housing and lubricant saturating the clutch discs. Make sure that the transmission lubricant is replaced before the vehicle is returned to service.

Tractor-Trailer Connections



Whenever possible, make trailer connections while standing on the ground. Provide adequate lighting of working areas. Inclement weather and accumulated road contamination deposits on hand holds and stepping surfaces require extra care to prevent slips and falls which could cause personal injury or death.

Do not climb on the back of a tractor unless it has been provided with a deck plate and hand holds. Use a three-point stance when climbing up and down from a deck plate. Do not jump from vehicle.

Connecting/Disconnecting a Trailer to a Vehicle with Air Suspension

The Air Suspension has a dump valve system option (Code 14899) that permits exhausting air from the suspension system, thus lowering the frame when connecting, disconnecting, or loading the trailer. The vehicle speed must be below 5 mph before the switch will operate the valve.

When connecting to a trailer, switch the SUSP/DUMP switch, located on the instrument panel gauge cluster, to the DUMP position and air will exhaust from the suspension system lowering the tractor. This will permit backing under the trailer without undue loading of suspension system. After making the connection to the trailer, return the switch to the SUSP position, then raise landing gear.

When disconnecting the trailer, lower the landing gear, disconnect the brake hoses and rear light connectors from the trailer, and pull the release lever on the fifth wheel. Slowly pull the tractor forward just far enough to release the king pin from the fifth wheel and stop. Switch the SUSP/DUMP switch to the DUMP position and pull the tractor away from the trailer.

The SUSP/DUMP switch must be returned to the down SUSP position before operating with a trailer or operating in the bobtail mode.

Fifth Wheel Operation



Always follow the fifth wheel manufacturer's instructions for hooking and unhooking as well as sliding the fifth wheel. Failure to follow this warning could result in property damage, personal injury, or death.

The hand control valve should never be used to apply the trailer brakes when the tractor and trailer are parked. Air pressure may leak from the system, and the vehicle could roll away, resulting in property damage, personal injury, or death.



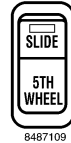
When using an assistant to reposition a sliding fifth wheel, the driver must be ready to stop as soon as the fifth wheel moves to the desired position. The assistant must keep feet, hands and body clear of the vehicle's tires and other moving parts to prevent personal injury or death. The driver must not begin to move the vehicle until the assistant is clear and signals the driver to move the vehicle.

Fifth Wheel Slide Switch (Optional)

An optional Fifth Wheel Slide switch may be present. This switch allows the operator to electronically unlock the fifth wheel to

allow it to be moved forward or backward and re-lock it once the desired position is attained.

To unlock the fifth wheel, press the top portion of the switch in. The switch indicator will illuminate steadily when the fifth wheel is unlocked.



NOTE: The fifth wheel cannot be unlocked above a preset speed (normally 2 mph). Attempting to unlock the fifth wheel at any higher speed will cause the switch indicator to flash slowly (once per second). The fifth wheel lock automatically engages if it has been unlocked and the vehicle speed exceeds the preset value.

To lock the fifth wheel once the desired position is reached, press the lower portion of the switch. The switch indicator will turn off when the fifth wheel is locked.

NOTE: A fast flashing (twice per second) switch indicator signifies a problem in the fifth wheel lock system.

Hook-Up

1. Fifth wheel jaws must be opened fully.
2. Tilt fifth wheel back to prevent body damage when tractor is backed under trailer.
3. Block trailer wheels and be sure trailer spring brakes are adjusted and applied. Never chase a trailer.
4. Make sure brake hoses and light cords are clear of the fifth wheel.

5. Back tractor squarely under trailer, engaging fifth wheel jaws on trailer kingpin. Always back slowly, making sure trailer is neither too high nor too low. Avoid backing under trailer from an angle.
6. Connect service and parking brake hoses and trailer light connector. Refer to the Warning located in the **Tractor-Trailer Connections** information. Use a three-point stance when connecting and disconnecting trailer.
7. Inspect fifth-wheel jaws to be sure they have closed on trailer king pin and the trailer plate is resting securely on the fifth wheel.
8. Be sure the coupler release lever is in the locked position.
9. Charge trailer brake system. Set trailer brakes, either with the hand valve or tractor protection valve. Pull against trailer for an additional check of hook-up. Do not pull hard enough to damage or strain the equipment.
10. Set tractor parking brakes and fully raise trailer landing gear. Refer to **Brakes** segment of this section for Operation of Parking Brakes and Trailer Brakes.
11. Check operation of all trailer lights and correct faulty lights.

Un-Hook

1. Try to keep tractor and trailer in straight line.
2. Apply tractor and trailer parking brakes.

Operation

3. Lower trailer landing gear, making sure it is on solid, level ground. The weight of trailer must be on landing gear.
4. Block trailer wheels.
5. Disconnect brake hoses and light cords. Be sure hoses and cords are clear.
6. Pull coupler release lever to disengage fifth wheel jaws.
7. Release tractor parking brakes.
8. Pull out from trailer slowly, allowing landing gear to take load gradually.

SECTION 6 — MAINTENANCE INSTRUCTIONS

Introduction



If the owner/operator of the vehicle is a skilled technician and intends to perform the vehicle maintenance and servicing, he/she is strongly urged to purchase and follow the appropriate International® service manual. Ordering information is included at the back of this manual. Failure to properly perform maintenance and servicing procedures could result in property damage, personal injury, or death.

Your vehicle has been engineered and manufactured to provide economical service. However, it is the owner's responsibility to see that the vehicle receives proper care and maintenance to ensure high performance.

Quality International truck service parts are available through your International dealer. If International truck service parts are not used, the owner must make sure that the parts used are equivalent to International truck service parts.

As with any vehicle, care should be taken to avoid being injured when performing maintenance or repairs or making any checks. Improper or incomplete service could result in the vehicle not working properly, which, in turn, may result in personal injury or damage to the vehicle or its equipment. If you have any question

about performing some service, consult your International dealer or have the service done by a skilled technician.

Maintenance Guidelines



Failure to perform proper maintenance and service could result in property damage, personal injury, or death.



Making modifications to any part, component, or system of the vehicle, can adversely affect the quality and reliability of your vehicle and must be prevented. Modifications to systems could result in property damage, personal injury, or death.



Use only genuine International truck service parts. The use of inferior parts can adversely affect the quality and reliability of your vehicle, which could result in property damage, personal injury, or death.



To prevent property damage, personal injury, or death, take care when performing any maintenance or making any check or repair. Some of the materials in this vehicle may also be hazardous if used, serviced, or handled improperly. If you have any questions pertaining to the service, have the work done by a skilled technician.



To prevent property damage, personal injury, or death when servicing the vehicle, park on a flat level surface, set the parking brake, turn off the engine, and chock the wheels.



Always disconnect the ground battery terminal first, then the positive cable. When reconnecting the battery cables, connect the positive cables first, and then reconnect the negative cables. Failure to follow this warning may result in a direct battery short which is a fire or explosion hazard which could result in property damage, personal injury, or death.

CAUTION

To prevent damage to electrical components during electric welding operations, follow these cautions: Prior to electric welding, disconnect any negative and positive battery cables that connect the batteries to the vehicle. Be sure the detached connectors are not touching the vehicle. If welding close to an electronic component, temporarily remove that component. Attach the welder ground cable as close as possible to the part being welded.

When servicing your vehicle always:

1. Turn off the ignition switch, unless the procedure calls for a running engine.
2. Set the parking brake and chock the wheels.
3. Use support stands, not a jack, whenever you must be under a raised vehicle.
4. Do not smoke.
5. Wear safety glasses for eye protection.
6. Operate engine only in a well-ventilated area.
7. Do not work on brakes or clutch unless proper precautions are taken to avoid inhaling friction material dust.
8. Do not wear loose clothing, hanging jewelry, watches or rings. Tie up long hair and avoid rotating machinery.
9. Avoid contact with hot metal parts; allow hot components to cool before working on them.

10. Correct any problems that were revealed during inspection prior to operating the vehicle.

Supporting Your Vehicle for Service



Always use floor stands to support the vehicle before working under it. Using only a jack could allow the vehicle to fall resulting in property damage, personal injury, or death.

When performing service repairs on a vehicle, first:

1. Park vehicle on level concrete floor.
2. Set parking brake and/or block wheels to prevent vehicle from moving.
3. Select jack with a rated capacity sufficient to lift the vehicle.
4. Raise vehicle with jack applied to axle. (**Do not** use bumper as a lifting point.)
5. Support vehicle with floor stands under axle(s).

If axle or suspension components are to be serviced, support vehicle with floor stands under frame side members, preferably between the axles.

Chassis Lubrication

New vehicles are lubricated at the factory and again during the predelivery inspection. After the vehicle is placed in operation, regular lubrication and maintenance intervals, based on the type of service and road conditions, should be established. The loads carried, speed, road, and weather conditions all contribute to the frequency of lubrication intervals. Thorough lubrication and maintenance at the specified intervals will ensure Outstanding Life Cycle Value and will reduce overall operating expense.

In some types of operation, and where operating conditions are extremely severe (such as road salt or corrosive chemical environments, in deep water, mud, or unusually dusty conditions), the vehicle may require relubrication after every 24 hours of operation.

Only lubricants of superior quality, such as Fleetrite® lubricants, should be used. The use of inferior products will reduce the service life of the vehicle or result in failure of its components. The use of Fleetrite® lubricants and OEM original equipment parts is recommended.

The lubrication intervals specified should be performed at whatever interval occurs first, whether it is miles (kilometers), hours, or months.

These intervals are provided in **SECTION 7 — MAINTENANCE INTERVALS AND SPECIFICATIONS**

Air Conditioning Service Checks

Have your air conditioning system serviced each spring. The refrigerant charge, cleanliness of condenser-evaporator cores, cab filter, and belt condition are essential to air conditioning performance.

Remove the fresh air filter(s) once each season and check for dirt, lint, etc. Replace if necessary. Vehicles operating in unusually dusty conditions may require inspecting and replacing the air filter(s) more often.

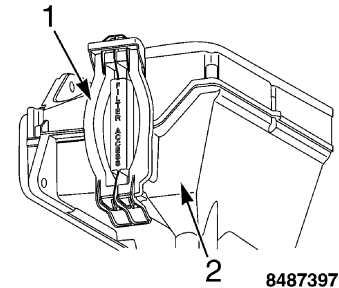
To reduce costs, the filter(s) may be carefully power-washed with a soap solution and reused. Be sure to wash and rinse both sides and be sure to keep the spray head at least six inches away from the filter to prevent damage.

Correct airflow may be restored by either replacing the filter(s), which can be done without tools, or by cleaning the filters.

HVAC Filters

NOTE: There are two possible cab HVAC filter configurations; side access and front access HVAC filter housings.

Side Access HVAC Filter

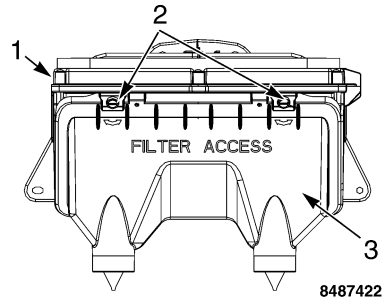


1. Filter Access Door
2. Air Intake Housing

Cab HVAC Filter Replacement – Side Access

1. Unlatch and remove filter access door.
2. Remove filter by pulling filter out of air intake housing.
3. Install new filter by sliding filter into air intake housing.
4. Install filter access door and latch in place.

Front Access HVAC Filter



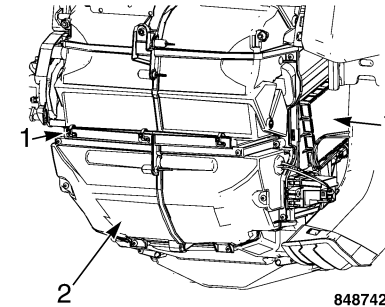
1. Air Intake Housing
2. Screws
3. Filter Access Door

Cab HVAC Filter Replacement – Front Access

1. Turn screws counterclockwise one quarter turn and open filter access door.
2. Remove filter by pulling filter out of air intake housing.
3. Install new filter into air intake housing.
4. Close and secure filter access door by turning screws clockwise one quarter turn.

Recirculation Filters

The recirculation filters are mounted on the left and right sides of the HVAC unit which is located in-cab under the left side dash.



1. Recirculation Filter
2. HVAC Unit

Cab HVAC Filter Replacement

1. Remove by gently pulling filter away from HVAC unit.
2. Install new filter onto HVAC unit.

Axles

Front Axle

Inspection and Lubrication

Check to make sure that the front axle mounting U-bolts, attaching or mounting bolts and nuts are securely tightened. Loose or misaligned front axles will affect vehicle alignment, front tire wear, and handling.

Re-torque the U-bolt nuts after the first 1,000 miles (1,600 km) and every 36,000 miles (58,000 km) thereafter.

Observe the following when checking the front axle for damaged, binding, or worn parts, and adequate lubrication:

- Kingpin wear inspection requires that no weight is on the tires.
- Kingpin and kingpin bushing lubrication requires that the vehicle weight is off tires and the front wheels be turned fully to the left or right prior to installing grease distribution.
- Kingpin thrust bushing lubrication requires that the vehicle weight is resting on the tires. Therefore, add additional grease to the lower kingpin grease zerk after vehicle weight is once again resting on the tires.
- Power grease guns may be used: however, a hand-pumped grease gun is recommended for optimal grease distribution within each component joint.

- Inspect, lubricate and adjust the wheel bearings at regular intervals. Refer to **SECTION 7 — MAINTENANCE INTERVALS AND SPECIFICATIONS** for the correct intervals, lubricants, and torques.

Normal Maintenance

During operation, the air and oil inside the hub/wheel cavity expands. It is normal for a mist of oil to be present on the outside of the hubcap around the vent slit or hole. Over time, if not wiped off, this film may collect dust and appear unsightly. If the entire face and end of the hubcap become wet with oil, investigate the cause. Refer to the Service Manual axle section for repair procedures.

Routinely clean the hubcap to ensure that the lubricant level can be easily observed through the clear window as intended. In situations where the window is clean on the outside but discolored on the inside, check the lubricant level by removing the rubber fill/vent plug and insert a finger into the hole.

The specified lubricant level for International® clear window type hubcaps is from the minimum line to 5/16 inch (7.9 mm) above the minimum line.

If the lubricant level suddenly drops dramatically below the minimum level, see the Service Manual for diagnostic procedure.

Alignment

Maintaining front axle alignment is very important to achieving maximum tire life and vehicle control. Inspecting steer axle tires daily will generally show if tires are wearing normally.

- Rapid outside shoulder wear on both tires indicates too much toe-in.
- Rapid inside shoulder wear on both tires indicates too much toe-out.
- Excessive wear on the inside or outside of one steer tire, but not the other, can indicate a toe-in or toe-out condition coupled with a misaligned front or rear axle.
- Pulling to the right or left can indicate misalignment of the front or rear axle, unequal tire pressures, or a damaged/mismatched tire.

Refer to the **Tires** subsection for additional related information.

Front Drive Axle and Transfer Case (Optional)

Inspection and Lubrication

In addition to the checks outlined for the non-drive front axle, proper lubrication and inspections of the front drive components must be followed. Both the front drive axle and the transfer case oil level must be checked periodically and also inspected for possible oil loss. The proper lubrication level is to the bottom of the 'oil fill hole' with the vehicle on level ground.

Make sure the axle mounting U-bolt nuts, attaching or mounting bolts and nuts, are securely tightened. Loose or misaligned rear axles will affect vehicle alignment, front tire wear, and handling.

Re-torque the U-bolt nuts after the first 1,000 miles (1,600 km) and every 36,000 miles (58,000 km) thereafter. Refer to the LUBRICATION AND MAINTENANCE INTERVAL CHART for recommended service intervals.

Rear Axle – Inspection and Lubrication

Make sure the axle mounting U-bolt nuts, attaching or mounting bolts and nuts, are securely tightened. Loose or misaligned rear axles will affect vehicle alignment, tire wear, and handling. Refer to AXLE U-BOLT NUT TORQUE CHART for torque specifications.

Check the rear axle oil level. Proper oil level minimizes gear wear, heat, and damage to the wheel bearings and seals. The oil level should be at the lower edge of the oil fill hole when the vehicle is on level ground. Add oil as necessary.

Refer to the LUBRICATION AND MAINTENANCE INTERVAL CHART and the LUBRICANT AND SEALER SPECIFICATIONS CHART for additional information.

Lift Axle System



Always lower lift axles before servicing the axle, controls, or air lines. Failure to follow this warning may cause a sudden loss of air pressure and the unintentional lowering of the lift axle resulting in property damage, personal injury, or death.

The mechanical items of the lift axle system require periodic maintenance to maintain reliable operation. Drain cocks, in the bottom of each air tank, are installed to provide a convenient means of periodically draining condensation from the tank. Refer to the Lift Axle System maintenance chart **SECTION 7 — MAINTENANCE INTERVALS AND SPECIFICATIONS** for periodic maintenance information.

Brakes

General Information



To prevent personal injury or death, prevent breathing brake lining fiber dust. Always use a respirator while performing brake maintenance. Follow precautions listed below.



Always check and maintain brakes in proper condition and adjustment. Out of adjustment brakes could cause reduced braking ability and result in property damage, personal injury, or death.

All new International® vehicles use nonasbestos brake linings. However, exposure to excessive amounts of brake material dust may be a potentially serious health hazard.

Follow these precautions:

- Always wear a respirator approved by National Institute of Occupational Studies of Health (NIOSH) or Mine Safety and Appliance (MSA) during all brake service procedures. Wear the respirator from removal of the wheels through assembly.
- **Never** use compressed air or dry brushing to clean brake parts or assemblies.
- Clean brake parts and assemblies in the open air. During disassembly, carefully place all parts on the floor to avoid getting dust into the air. Use an industrial vacuum cleaner with a HEPA filter system to clean dust from the brake drums, backing plates, and other brake parts. After using the vacuum, remove any remaining dust with a rag soaked in water and wrung until nearly dry.
- **Never** use compressed air or dry sweeping to clean the work area. Use an industrial vacuum cleaner with a HEPA filter system and rags soaked in water and wrung until nearly dry. Dispose of used rags with care to avoid getting dust into the air. Use an approved respirator when emptying vacuum cleaners and handling used rags.
- **Worker cleanup.** Wash your hands before eating, drinking, or smoking. Vacuum your work clothes after use and then launder them separately, without shaking them, to prevent fiber dust from getting into the air.

Air Brakes

Inspection and Adjustment



Always chock the wheels when manually releasing the spring brakes, or the vehicle could roll causing property damage, personal injury, or death.



Under no circumstances should the spring brake section of the spring and brake chamber be disassembled. Disassembly will release a powerful spring which could result in property damage, personal injury, or death.



Brake Automatic Slack Adjusters (ASA's) should not need to be manually adjusted in service. ASA's should not routinely have to be adjusted to correct excessive push rod stroke. Excessive stroke indicates that a problem exists with the foundation brake, ASA, brake actuator, other brake system components, or their installation or adjustment.

In the event that a manual adjustment must be made (although this should not be a common practice), a service appointment and full foundation brake, ASA, and other brake system component inspection must be conducted as soon as possible to ensure the integrity of the overall brake system prior to returning the vehicle to service.

Failure to follow this warning may result in property damage, personal injury, or death.

A regular schedule for periodic cleaning, lubrication, adjustment and inspection should be established, based on the type of vehicle operation. It is difficult to predetermine an exact maintenance interval (time or mileage), since vehicles will be used in a wide variety of applications and conditions. If you are uncertain of the proper schedule and procedures for your vehicle, contact your International dealer.

Periodic checking of push rod travel or brake adjustment is essential for good braking. Push rod travel should be checked every service interval to determine if adjustment is necessary.

Maintenance Instructions

Brake chamber push rods on original equipment chambers now incorporate an overstroke indicator (an orange paint marker near the base of the push rod) to aid adjustment checks. If the push rod is clean and the orange marker can be seen protruding from the chamber when the brakes are applied, the brakes require adjustment.

Slack adjusters should also be checked to ensure proper operation of the adjuster mechanism at every interval. Push rod travel should be less than the maximum allowed stroke without brakes dragging.

Inspect brake linings every maintenance interval. When brake shoes (or pads) are worn to within 1/16 inch (1.6 mm) of rivets (or backing plates), as indicated by a line or other feature on the edge of most brake shoes (or pads), brake shoes (or pads) must be replaced.

This inspection or adjustment should only be performed by qualified service personnel and must be in accordance with instructions provided by the Service Manual.

NOTE: Do not overlook the brakes on the trailer either. Brake condition on a trailer is just as important as the tractor. Proper brake balance on trucks and tractor trailers is essential for good braking.

At least once a year, the entire brake system must be inspected by a trained mechanic. Deteriorated components or components worn outside of specifications must be replaced. Check:

1. Rubber components for condition, cracks, tears, wear, missing components, etc.

2. Condition of drums, brake chambers, and slack adjusters for wear, corrosion, maladjustment, cracks, missing components, etc.
3. For air leaks. **No air leakage is permissible.** Also, check for air leaks with parking brake disengaged and wheels chocked.
4. Hose or pipes for rust, damage, deterioration.
5. Proper operation of service, parking, and trailer brake controls.
6. The condition and full insertion of the ABS wheel speed sensors, wiring, and connectors.
7. Proper ABS wheel speed sensor-to-exciter teeth gap.

Air Dryer

General Information

NOTE: The use of an air dryer does not eliminate the need to periodically drain the air tanks.

The air dryer removes humidity (water), air compressor oil, and dirt from the incoming compressed air, thus protecting the air system against deterioration and restriction.

The air dryer is installed between the air compressor discharge line and the air tanks. The air dryer has a desiccant cartridge and a filter which is serviced as an assembly. Moisture from the air collects on the desiccant and is automatically discharged.

Life and performance of the air dryer depends on usage, air humidity levels, environmental temperatures, air compressor oil

control, and desiccant quantity. Regularly check the desiccant, purge valve and air dryer heater performance.

Desiccant Filter

Open reservoir drain valves and check for presence of water. Small amounts of water due to condensation is normal. If the wet, primary, or secondary tanks are collecting an abnormally high amount of water between regular air tank drain intervals, replace the air dryer desiccant.

The air dryer desiccant replacement interval may vary; it is generally recommended that the desiccant be replaced every 12 months for small air dryers, like the Bendix AD-IP®, or every 24 months for large air dryers, like the Bendix AD-9® or Bendix AD-IS®. If experience has shown that extended or shortened life has resulted for a particular installation, then the interval should be increased or reduced accordingly.

Purge Valve

Check that the purge valve opens and expels moisture when the air governor shuts off the air compressor. Air should escape rapidly and then quickly stop. If the purge valve does not open or you can hear a slight audible air leakage past the valve for longer than 30 seconds, the valve may be sticking and should be rebuilt. Purge valves may also stick if the air dryer heater has failed and ice is clogging the valve.

Heater

Check that the air dryer heater activates at temperatures below freezing. With the vehicle in a cold environment and before the

engine is started, turn on the ignition and touch the air dryer housing. It should be warmer than other metallic items on the vehicle. If some warmth cannot be felt, it may indicate that the heater element or the wiring powering it should be serviced.

Air Reservoir/Tanks Moisture Draining

Moisture taken in with the air through the compressor inlet valves collects in the air tanks. The wet tank is the first tank to receive air from the air drier and therefore collects most of the remaining moisture that was not removed by the air dryer. Drain the wet tank reservoir every day at the end of the trip. Drain the primary and secondary tanks periodically. Periodically, manually drain each reservoir by opening the drain cock located either on the bottom of the tank or in the end of the tank. Make sure the drain passage is not plugged. For ease of draining, some or all air tank drain valves may be equipped with optional pull cords. There must be some air pressure in the system to ensure proper drainage. Close the drain cocks after all moisture has been expelled. Drain the wet tank daily at the end of each trip to purge collected water and prevent ice formation inside the tank when the vehicle is shut off in cold weather. If you are unsure which tank is the wet tank, drain all tanks daily.

On vehicles equipped with automatic drain valve(s), moisture and contaminants are automatically removed from the reservoir to which it is connected. It operates automatically during each compression cycle and requires no manual assistance or control lines from other sources.

ABS Connections and Sensors

Periodically, push together the ABS wiring connections to ensure they are fully-seated. Press the wheel speed sensors into their mounting collars to ensure they are fully-seated.

Cab

Care of Vehicle

Washing and Waxing

Frequent and regular washing will lengthen the life of your new vehicle's painted finish and bright metal trim.

Wash your vehicle often with warm or cold water to remove dirt and preserve the original luster of the paint. Never wash the vehicle in the direct rays of the hot sun or when the sheet metal is hot to the touch, as this may cause streaks on the finish. Do not use hot water or strong soaps or detergents, as this may etch the paint or exposed metal/bright surfaces. Do not wipe off dirt when the surface is dry, as this will scratch the paint or exposed metal/bright surfaces.

Always make sure that steps and grab handles are clean and free of road grime, grease, ice, and other debris.

Prior to using any wax or polish, the vehicle must be thoroughly washed to avoid scratching the finish.

Bright Metal Care

To preserve the bright look of your vehicle's trim (grilles, bumpers, etc.) use only mild detergents and lukewarm water

for cleaning. Damage to these parts can occur if cleaning solutions having excessive acidity or alkalinity (pH) are used. Also, the higher the solution temperature ranges, the more caustic the cleaner's chemical compounds become. However, if high-pressure washing equipment and washing compounds are used, satisfactory results can be achieved, if the solution has a pH value between 4 and 8 and the temperature does not exceed 160°F (71°C). Solutions that are more acidic or more alkaline will attack the metallic coating.

If you are having difficulty with your washing compound, contact your local supplier for the acidity/alkalinity (pH) specification.

A nonabrasive chrome cleaner may be used sparingly to clean the bright metal. Do not use steel wool. Use of automobile wax or polish on bright metal usually will restore the original brightness.

Upholstery Care

Use a whisk broom and vacuum cleaner to remove loose dust and dirt from upholstery and floor. Vinyl and woven plastic upholstery can be washed with warm water and mild soap. Remove soap residue and wipe dry. If commercial cleaners are used, follow instructions supplied with cleaner.

Exposed Rubber and Unpainted Plastic Parts

To better protect plastic surfaces from fading, use Meguiar's #40 vinyl and rubber cleaner/conditioner. Spread evenly with sponge or towel and allow to penetrate. Buff off excess product with clean cloth.

Clutch

Pedal Free-Travel

Each time the vehicle chassis is lubricated, check clutch pedal free-travel. If clutch pedal free-travel is outside the **1 to 1 1/2 inch (25 to 38 mm)** range, the clutch must be adjusted to ensure that the clutch is fully engaging and the clutch brake will activate.

NOTE: Proper clutch pedal free-travel adjustment will provide adequate release yoke fingers-to-release bearing clearance, as well as release bearing-to-clutch brake clearance.

New International® vehicles use nonasbestos clutch linings. However, exposure to excessive amounts of clutch material dust (whether asbestos or nonasbestos, fiberglass, mineral wool, aramid, ceramic, or carbon) may be a potentially serious health hazard.



To prevent personal injury or death, prevent breathing clutch lining fiber dust. Always wear a respirator when doing clutch lining maintenance.

Persons who handle clutch linings should follow the same precautions as outlined for handling brake linings.

Electrical

Batteries

Battery life and performance varies greatly depending on duty cycle. Conditions such as short runs between starts, low ambient operating temperatures, using battery current without the engine running, and vibration will reduce battery life. Battery life is also affected by the condition of interrelated components, such as alternators, battery cables, connections, engine startability, starter, etc. To maximize battery life, it is important to keep electrical components, battery boxes, and the engine in top condition and to minimize or eliminate electrical loads when the engine is not running.

Battery life can be extended by keeping the batteries fully charged at all times. Periodically charging the batteries with a battery charger may be able to charge the batteries more completely than the vehicle's alternator in certain severe applications. Use a battery charger (float charger) that automatically reduces amperage or shuts off when the batteries are fully charged. Use of a Midtronics 55-Amp Power Supply/Smart (Battery) Charger, Model Number PCX550, Part Number PSC550CCKIT (or equivalent), available through your International dealer, is recommended.

Cold batteries resist charging. Battery performance can be improved by regularly or even periodically storing vehicles and charging batteries with an automatic float charger for 8 to 24 hours in a warm garage during the cold winter months.

CAUTION

Allowing batteries to become heavily discharged and exposed to subfreezing weather will cause them to freeze and become damaged.

Your vehicle utilizes maintenance-free batteries, which will not require the periodic addition of water. Wipe the tops of the batteries clean to avoid a slow current flow through the dirt, resulting in a loss of charge. Be sure the terminals are clamped tightly and that the battery is clamped securely in the battery box.

For best results:

- Do not mix and match battery models/manufacturers in the same battery pack.
- Do not use batteries with differing CCA ratings in the same battery pack.
- Do not use batteries with more than one year difference in the installed age of batteries in the same battery pack.

Battery Cables

CAUTION

When working around the terminals and battery, use extra care to prevent shorting. A good practice is to insulate pliers and screwdrivers. Do not check battery condition by shorting (flashing) across terminals.

Battery cable terminals must be clean and tight. Use a mixture of hot water and common baking soda for removing terminal

corrosion and for cleaning the top of the battery. Brighten the contact surfaces with steel wool, apply a light coat of lubricant sealing grease, such as Fleetrite® 472141-C1 or equivalent or a spray protectant, and reassemble. Be sure the terminals are clamped tightly.

Electrical Charging and Starting System Test

At every PM fully charge the batteries using an automatic float charger. Then, have a qualified technician perform an electrical system test using an International® Electronic System Tester (Midtronics inTELLECT EXP HD Expandable Electrical Diagnostics Platform available through your local International dealer) to catch electrical system problems before they cause further damage to the batteries and prevent a stranded vehicle. The test will check for alternator amperage output, starter current draw, and battery amperage capacity. This type of testing will detect weaknesses that may not yet be apparent during normal daily operations.

Terminal Inspection-Cleaning-Corrosion Protection

Periodically inspect electrical connectors on the engine, battery, and frame for corrosion and tightness. Inspect exposed cables for fraying or signs of abrasion. Exposed terminals, such as cranking motor, alternator, and feed-through studs should be cleaned and recoated with a dielectric grease, such as Fleetrite® 472141-C1 or equivalent paste or spray protectant. The inspection/cleaning/corrosion protection should include feed-through connections, power and ground cable connections for batteries, engines, and the starter stud.

Connectors that are more subject to corrosion may be disassembled and sprayed internally with a light coating of dielectric grease. Use grease sparingly, as too much grease will not allow air to escape from the connection and this compressed air will push out the seals in the electrical connectors.

Accessory Feed Connections



Electrical circuits are designed with a particular wire gauge to meet the fuse and circuit breaker current rating. Do not increase size of fuse or circuit breaker or change type of breaker supplied with your truck. To do so could cause wiring to overheat and possibly burn, resulting in a fire which could cause property damage, personal injury, or death.

Vehicle electrical systems are complex and often include electronic components, such as engine and transmission controls, instrument panel gauge clusters, antilock brakes, etc. While most systems still operate on battery voltage (12 volts), some systems can be as high as 90 volts or as low as 5 volts. Refer to the Electrical Circuit Diagram manuals, available from your International dealer, to ensure that any body s and accessories are connected to circuits that are both appropriate and not overloaded. No modification should be made to any vehicle control system without first contacting your International dealer.

Fuses and Relays

Fuses and relays are located inside the cab within the fuse panel cover. Refer to the schematic located on the fuse panel cover in the cab, the schematic on the fuse cover in the luggage compartment, or the **Fuse Panel Schematic** located in **SECTION 7 — MAINTENANCE INTERVALS AND SPECIFICATIONS** of this manual for fuse or relay replacement.

Engine

CAUTION

To prevent damage to the Engine Control Module it should never be spray-washed directly. Never spray any connector.

NOTE: Information in this section pertains to MaxxForce® engines only. For complete operation and maintenance information pertaining to your MaxxForce® engine, refer to the MaxxForce® Engine Operation and Maintenance Manual provided with the vehicle. Information pertaining to other engines will be found in separate manuals provided with the vehicle.

General

For effective emission control and low operating cost, it is important that maintenance operations be performed at the specified periods or mileage intervals indicated (kilometers, miles, hours, gallons of fuel, or months, whichever occurs first) in the Engine Operation and Maintenance manual.

Service intervals are based upon average operating conditions. In certain environments and vocations, more frequent servicing will be required.

Any replacement parts used for required maintenance services or repairs should be genuine International® service parts. Use of inferior replacement parts hinders operations of engine and emission controls and can reduce engine life and/or jeopardize the warranty.

Receipts covering the performance of regular maintenance should be retained in the event questions arise concerning maintenance. The receipts should be transferred to each subsequent owner of the engine (vehicle).

Engine fluids and contaminated material



GOVERNMENT REGULATION: Engine fluids (oil, fuel, and coolant) may be a hazard to human health and the environment. Handle all fluids and other contaminated materials (e.g., filters, rags) in accordance with applicable regulations. Recycle or dispose of engine fluids, filters, and other contaminated materials according to applicable regulations.

Scheduled Maintenance

For information regarding routine scheduled maintenance such as replacement of oil, filters, coolant, belts, belt tensioners, etc.,

and inspection and adjustment of items such as valve lash, etc., refer to the Engine Operation and Maintenance Manual supplied with the vehicle.

Air Induction System



To prevent property damage, personal injury, or death when performing maintenance and repairs to any turbocharged engine with engine air inlet piping disconnected, a turbocharger compressor air inlet protective shield should be installed over the turbocharger air inlet. Order protective shield J-26554 for MaxxForce® engines from your local International dealer.

Once each year perform a complete inspection of the air induction system. In areas where road salt is used, the inspection consists of disassembling the joints of each metal component and inspecting for salt build-up that can cause particles to flake off and enter the engine combustion chambers.

If evidence of corrosion is found (usually appears at the pipe connections), use a wire brush and cloth to clean the inside of the pipes and rubber/plastic pipes.

If the intake pipes are pitted at the joint ends, use RTV Silicone to seal the joints. Be certain that no excess material that can be pulled into the engine is on the inside of the pipe. If the service condition of the pipes, hoses, or clamps is questionable, replace those parts.

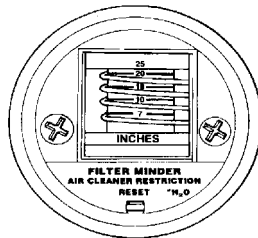
- Check for loose hoses and clamps.

- Check for ruptured, bulging, or collapsed pipes.
- Check air cleaner housing and air restriction gauge for cracks.

Air Restriction Gauge

The air restriction gauge indicates how much engine air cleaner filter capacity has been used and how much filter capacity remains. It measures maximum restriction of the filter element when the engine is operated at full load and locks at that point. This feature gives the operator the capability of reading maximum restriction with the engine shutdown.

The gauge is mounted on the forward side of the air cleaner housing, or optionally on the center dash panel/wing panel.

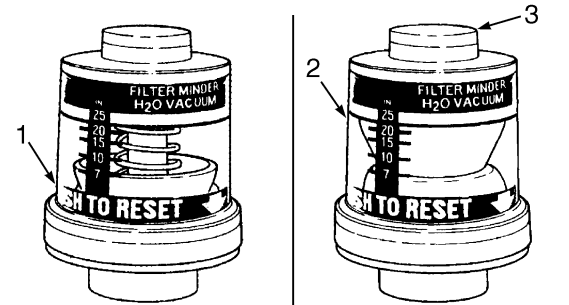


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Both gauges have a push type reset button. The reset on the dash panel mounted gauge is in the face of the gauge. The reset

on air cleaner mounted gauge is on the end of the gauge. See illustrations below.

It is recommended that the operator NOT reset the gauge until after it has been determined if the air filter element must be replaced.



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1. Low Restriction
2. High Restriction
3. Reset Button

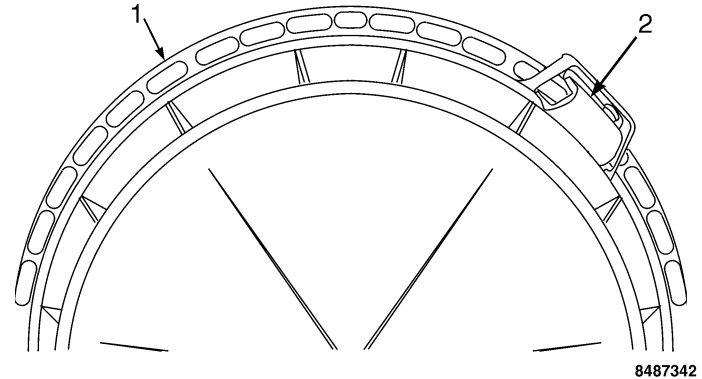
NOTE: If the yellow indicator is at its maximum reading, replace the air filter element and reset the gauge (refer to the Troubleshooting table).

Air Cleaner Element Service

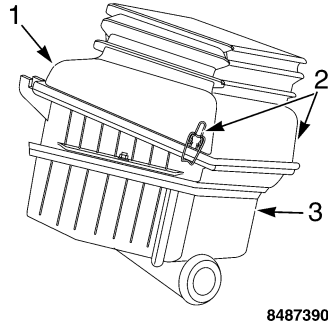
This vehicle comes with a selection of two air cleaner options. The first option is a single element. The second option is a dual element air cleaner that is available for applications in excessively dusty environments that may require more frequent service intervals. The secondary element is inside the primary element and prevents contaminants from entering the engine air intake system during service of the primary element, or in cases where the primary element becomes damaged. Both options are serviced in a similar manner.

NOTE: Do not change the air cleaner element configuration from the factory installed configuration. If equipped with a single element or dual element that configuration must stay with the vehicle. Failure to comply may affect engine performance.

Your vehicle has either a round or square type air cleaner, refer to the following for air cleaner element service.



1. Air Cleaner Housing Cover
2. Tab



1. Inlet Lid
2. Holddown Latch
3. Air Cleaner Housing

NOTE: Be careful not to bump the air filter element while it is in the housing; this can raise a cloud of dust that can enter the clean side of the piping to the turbocharger.

1. For round air cleaner housings, lift the tab on the air cleaner housing cover and rotate the cover counterclockwise to unlatch and remove the cover. For square air cleaner housings, unhook the holddown latches and remove the inlet lid from air cleaner housing. Remove the filter element carefully and slowly, then discard the old element.
2. Wipe the inside of the air cleaner housing with a clean, damp cloth. Be sure to clean the gasket sealing surface. Be sure to wipe out any dust that has fallen into the port to the turbocharger. DO NOT use compressed air for this cleaning!

3. Visually inspect the air cleaner housing for damage or distortion, which could allow unfiltered air to enter the engine. Inspect to be sure that the rubber dust unloader valve at bottom of housing is in place, free of debris, and not cracked.
4. Inspect the new air filter element for a damaged or nonresilient rubber gasket. Inspect the air filter element body for dents or excessive pleat bunching. If any of the mentioned conditions exist, obtain and install an alternate new air filter element from your International® dealer.
5. Carefully install the new air filter element into the air cleaner housing.
6. For round air cleaner housings, install the air cleaner end cover onto air cleaner housing, making sure that the cover seats squarely on housing, and rotate cover clockwise and latch tabs. For square air cleaner housings, seat and install the inlet lid squarely onto air cleaner housing, hook and latch inlet lid to air cleaner housing with holddown latches.
7. When servicing is completed, reset air restriction gauge by pushing and holding the reset button and releasing it. The yellow indicator will drop below the window. The air restriction gauge is now ready for the next operating cycle.

Troubleshooting

Problem: No Restriction Reading

POSSIBLE CAUSES	HOW TO CHECK
Plugged fitting or vacuum line	Apply vacuum to gauge until locked up at red zone. Re-connect line and hold in reset button. Indicator will fully return unless line or fitting is plugged. A slow return is normal due to safety filter in fitting.
Leak in vacuum line	Apply vacuum to gauge until locked up at red zone. Re-connect gauge and close end of line air tight. Hold in reset button. Indicator will drop slightly and then not move unless vacuum line has a leak.
Leak in gauge	Repeat above except close gauge connection airtight.
Engine air flow too low to generate a restriction reading after being reset	Rev engine from idle to full RPM multiple times to increase air flow enough to create an initial reading.
Air cleaner element split open	Visually inspect element.

Problem: High Restriction Reading

POSSIBLE CAUSES	EXPLANATION
Plugged main air filter element	Normal operation will cause particles to collect in the air filter element. If observed, replace main air filter element.
Plugged inner element (if equipped)	Normal operation will cause particles to collect in the air filter element. If observed, replace inner air filter element.
Plugged inlet screens or ducts	Check system upstream from air filter restriction gauge port for debris, damage or improper installation.
Heavy snow or rain	Temporary high restriction can occur during a rain or snow storm and it disappears after the air filter element dries out. COLD AIR MAY BE SO DENSE THAT HIGH RESTRICTION MAY NOT REDUCE ENGINE POWER BEFORE ELEMENTS ARE DAMAGED FROM HIGH VACUUM. If gauge is locked up at red zone, check elements for damage.

Charge Air Cooler And Radiator Core Inspection And Cleaning

Inspection and Cleaning

With the engine off, visually inspect the charge air cooler core and radiator core assembly for debris and clogging of external fins. Prior to engine operation, remove any debris blocking the core.

The cores may be cleaned by externally backflushing them with compressed air and/or water. Use high pressure air or water Thexton radiator cleaning wand with 90-degree tip P/N 4106-NAV available from your International dealer for best results.

NOTE: A visual inspection of the area between the condenser and radiator should also be done at this time. Remove debris as necessary.

Cooling System

The cooling system of your new vehicle is filled at the factory with either a Type II Fully-Formulated Coolant (Purple), Type III ELC - Extended Life Coolant (Red), or nitrite-free Shell Rotella® Ultra ELC (YELLOW) coolant. The type of coolant depends upon the engine manufacturer and the preference of the purchaser, if optional coolants are allowed.

The Type II coolant must meet International® Type II specifications, such as the Fleetrite® Premium 50/50 with SCA (P/N: ZJJSCA5550). The Type III coolant must meet International® Type III specifications such as the Shell Rotella®

ELC - Extended Life Coolant (P/N 94042). Refer to the label on the deaeration tank to determine the coolant type. If no label is present, use Type II Fully-Formulated Coolant (Purple) and maintain the Supplemental Coolant Additives (SCA's) accordingly. Consult the Engine Operation and Maintenance Manual for coolant service life details.

Coolant Level



To prevent personal injury or death from hot coolant or steam use only the following procedure to remove the pressure cap from the deaeration tank. Allow the engine to cool first. Wrap a thick, heavy cloth around the cap. Depending on the type of cap, push down, loosen cap slowly to its first notch position, or unscrew cap slowly; then pause a moment to allow pressure to release through the overflow tube. After the pressure has been released, the pressure cap may be removed.



Do not exceed the pressure rating on the deaeration tank. Ensure that the pressure rating of the deaeration tank cap matches that listed on the side of the tank, or the tank may burst, causing property damage, personal injury, or death.

Maintenance Instructions

CAUTION

If the coolant should get extremely low and the engine very hot, let the engine cool for approximately 15 minutes before adding coolant; then, with the engine running, add coolant slowly. Adding cold coolant to a hot engine may crack the cylinder head or cylinder block. Never use water alone.

NOTE: If excessive amounts of coolant must be added and coolant system is equipped with bleeder valves, contact an International® dealer for special instructions on filling the coolant system.

For vehicles equipped with an opaque deaeration tank and two sight glasses with engine COLD:

- Ensure coolant level fully covers lower sight glass, but covers none or only part of upper sight glass.
- If coolant level fully covers upper sight glass, remove coolant until top of coolant level can be seen in upper sight glass.

For vehicles equipped with an opaque deaeration tank and two sight glasses with engine HOT:

- Assure coolant level fully covers lower sight glass.
- Coolant covers part or all of upper sight glass. Do not add additional coolant if coolant is visible in upper sight glass.

For vehicles equipped with a translucent deaeration tank with engine COLD:

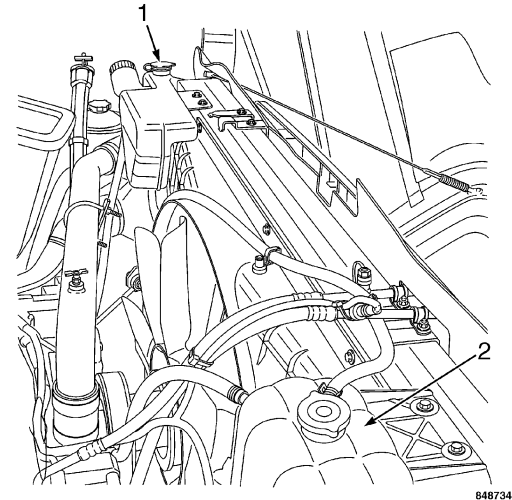
- Assure coolant level is between ADD and MAX marks on tank.

- If coolant level is above MAX mark, remove coolant until coolant level is between ADD and MAX marks on tank.

For vehicles equipped with a translucent deaeration tank with engine HOT:

- Assure coolant level is above the ADD mark on the tank. It may exceed the MAX mark.
- Add a 50/50 coolant concentrate/water mixture if low. Hot coolant needs room to expand. **Do not overfill.**

Filling Instructions



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1. Coolant Make-up Tank
2. Coolant Deaeration Tank

To function properly, the system must be completely filled with coolant and all air must be expelled. To accomplish this, the following procedures should be carefully completed:

1. Fully open the heater shut-off valves and coolant system pipe vent (if present).
2. Pour a 50/50 mixture of the proper (ethylene glycol based) coolant concentrate and demineralized or distilled water into the deaeration tank. A 50/50 coolant mixture will achieve a -34°F (-37°C) freeze point. A 53/47 coolant mixture will achieve a -40°F (-40°C) freeze point.

NOTE: If system has been drained, fill with fresh 50/50 diluted concentrate coolant or 50/50 pre-mixed coolant. If the system has been flushed with water, a significant amount of the freshwater flush will remain in the system. In this case refilling with a mixture with a higher percentage (60 to 66%) of coolant concentrate is advised in order to achieve a final mixture close to 50/50.

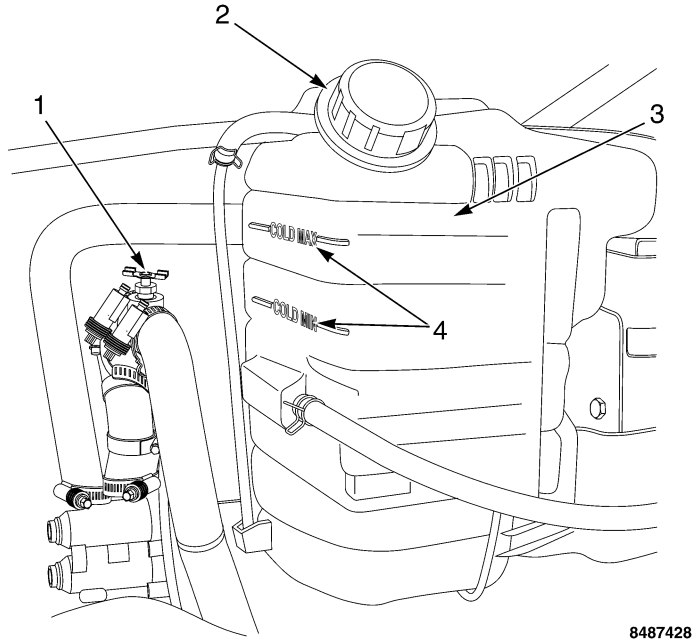
3. Start the engine, and continue to add enough coolant to keep the coolant deaeration tank completely full.

NOTE: Do not add any coolant to the coolant make-up tank, as that volume will be necessary to adjust the coolant concentration/freeze point later.

4. After adding coolant over a period of two minutes and keeping the coolant deaeration tank full, replace the coolant deaeration tank cap tightly.
5. With the system filled, operate the engine at various speeds until coolant reaches normal operating temperature. Let engine completely cool.
6. Slowly open the (pressurized) coolant deaeration tank cap and measure the coolant concentration/freeze point. Top off as needed with the correct top-off fluid (coolant concentrate, 50/50 coolant pre-mix, or demineralized water) necessary to achieve a -34°F to -40°F (-37°C to -40°C) freeze point. Make sure the coolant deaeration tank is completely full and the coolant make-up tank (on the opposite side of the vehicle) is at or within ¼ inch (6 mm) over the "MAX" line.

Filling Instructions (MaxxForce® 11 and 13 Engines)

NOTE: If system has been drained, fill with fresh 50/50 diluted concentrate coolant or 50/50 pre-mixed coolant. If the system has been flushed with water, a significant amount of the freshwater flush will remain in the system. In this case refilling with a mixture with a higher percentage (75%) of coolant concentrate is advised in order to achieve a final mixture close to 50/50.



1. Coolant System Vent Valve
2. Vented Fill Cap
3. Deaeration Tank
4. COLD MIN and COLD MAX Lines

To function properly, the coolant system must be completely filled with coolant and all air must be expelled. To accomplish this, the following procedures should be carefully completed:

1. Turn on ignition without starting the vehicle. This opens the electrically actuated LTR coolant flow valve.
2. Fully open cab heater coolant shut-off valves and coolant system vent valve.
3. Remove fill cap and pour a 50/50 mixture (75/25 if it has been flushed with water) of the proper (Nitrite-Free Shell® Ultra Extended Life Coolant) coolant concentrate and demineralized or distilled water into the de-aeration tank. A 50/50 coolant mixture will achieve a -34° F (-37° C) freeze point. A 53/47 coolant mixture will achieve a -40° F (-40° C) freeze point. The first pour should reach to the top of the reservoir fill neck.
4. Because the radiator fills slowly, it is important to continue to top off the system for two minutes following the initial fill.
5. Close coolant system vent valve, start the engine, and continue to add enough coolant to keep the coolant level between the COLD MIN and COLD MAX levels marked on the deaeration tank. Replace the deaeration tank cap tightly after adding make-up coolant for two minutes.
6. Run engine at governed speed until engine fan has fully engaged for 5 minutes. Do not exceed 220° F (104° C).
7. Let engine completely cool. Re-check coolant level and concentration/freeze point with a refractometer and top off as needed to achieve a coolant level at the COLD MAX line when cold.

Coolant and Optional Coolant Filter

The cooling system in vehicles with MaxxForce® 11 and 13 engines, is filled at the factory with Nitrite-free Shell Rotella®

Ultra ELC (Yellow) coolant. International Truck recommends using only the approved coolant with the 2010 cooling packages, and will not warrant these cooling systems that have not utilized the recommended coolant.

The label on the deaeration tank provides additional coolant/antifreeze information. Consult the Engine Operation and Maintenance Manual for coolant service life details.

Some engines are ordered with an optional coolant filter that should be replaced periodically.

For Ultra ELC equipped vehicles use only water filters **without** Supplemental Coolant Additives (SCA's) as SCA's are not necessary with Ultra ELC. Any time a silicone gasket/seal exposed to the coolant is replaced while using Ultra ELC, a fresh charge of silicates must be added to the coolant to protect the new gasket/seal.

International® truck recommends Ultra ELC due to its ease of maintenance and lower long-term cost of operation. Any system using or contaminated with more than 10% conventional coolant must be maintained like conventional coolant and receive regular tests for Supplemental Coolant Additive (SCA) levels.

AntiFreeze

For cooling system capacities coolant part numbers, and other information, refer to **SECTION 7 — MAINTENANCE INTERVALS AND SPECIFICATIONS** of this manual.

Fan Clutch

Inspect for proper operation, secure electrical connections, and air supply as appropriate. See the Service Manual for details.

Fuel System



GOVERNMENT REGULATION: Diesel fuel sold for use in 2007 and later highway vehicles must be limited to a sulfur content of 15 parts per million (ppm).

Frequently inspect condition of fuel tanks and mounting hardware, fuel tank cap and vent, fuel lines, clips and routing. At every PM (or daily if necessary) drain water and sediment from the fuel/water separator filter (if equipped). If the vehicle is equipped with an optional Davco® fuel/water separator, inspect the level of the fuel in the see-through globe and replace the fuel/water separator filter element if the fuel level has reached the top of the globe. In all cases, be sure to use the proper fuel/water separator filter element with the correct part number and filter efficiency rating.

Fuel Tank Draining and Cleaning

Periodically (annually is recommended) drain water and sediment from the fuel tank via the drain plug on the bottom of the fuel tank. Drain and flush sediment from fuel tank at least every 12 months or more frequently if fuel quality or type of fuel dictates.

Since Ultra-Low Sulfur Diesel (ULSD) fuel tends to absorb more water and engines are operating at higher temperatures, microbe growth in the fuel tanks has become more prevalent. Microbe growth results in more contaminants in the fuel and reduces fuel filter life. Since fuel tank draining does not remove

all microbes, fuel tank draining alone will not eliminate the problem. For vehicle operators experiencing microbe growth in their fuel, the following is recommended:

1. Drain and clean the fuel tank(s) every 12 months or more often. Clean the tanks with a professional fuel tank cleaning system (available through your International dealer) or have your local International dealer perform the service for you.
2. Treat your vehicle fuel tanks and bulk tanks regularly with a biocide from a reputable vendor.
3. Purchase fuel only from vendors that pretreat their fuel with biocides.
4. Periodically test the fuel supplied by your fuel vendor for the presence of microbes.

Frame

International truck chassis are manufactured with frame rails of either mild carbon steel or HSLA (High Strength Low Alloy) steel, and each must be handled in a specific manner to ensure maximum service life. Before attempting frame repair or modification, consult the Service Manual or your International dealer.

Tow Hooks, Tow Pins, and Pintle Hooks

Permanent or removable tow hooks as well as pintle hooks (if present) should be inspected for functionality, damage, or a loose mounting. Removable tow hooks and or pins should be stored in such a way that they will not be lost, dislodged, or damaged.

Noise Emissions – Exterior

Instructions for Proper Maintenance

In order to comply with federal exterior noise regulations, your vehicle may be equipped with noise emission items. Depending upon the vehicle configuration, it may incorporate all or some of the following:

Air Intake System

- **Air Cleaner** – should be inspected and its location should not be altered. Do not alter inlet and outlet piping.

Body

- **Wheel Well** – splash shields, cab shields, and underhood insulation should be inspected for deterioration, dislocation, and orientation and repaired or replaced as necessary.

Cooling System

- Check fan for damage to blades. Replace, if damaged, with manufacturer's recommended parts. Inspect for fan-to-shroud interference and any damage to shroud, such as cracks and holes.
- Fan speed ratio should not be changed and fan spacer dimensions and position should not be altered.
- Inspect for proper operation of fan clutch, making sure that the fan is disengaged when cooling of engine is not required.

Engine Noise Shields/Blankets

- Engine valve covers, oil pans, and block covers are made to damp out engine mechanical noise and, if needed, should be replaced with original equipment parts.

Exhaust System

- Inspect for leaks at various joint connections and tighten clamps. Make visual inspection for cracks or holes in muffler and tailpipe. Always replace with manufacturer's recommended parts. Tailpipe elbow or offset tailpipe orientation must not be changed from standard position as originally received.
- To avoid abnormal changes in vehicle sound level, it is necessary for the owner to perform inspections and necessary maintenance at the intervals shown in the maintenance schedules, and record them on the inspection verification form provided.

Diesel Particulate Filter (DPF)

Regeneration

Collected soot particles in the Diesel Particulate Filter (DPF) are automatically burned off through normal regeneration (initiated by normal exhaust heat during the normal operation of the vehicle). If conditions for normal regeneration cannot be achieved, it may be necessary to perform a parked regeneration as indicated by the instrument panel gauge cluster warning indicators. See the Parked Regeneration Procedure in **SECTION 5 — OPERATION**.

Cleaning

If on-vehicle regeneration is unsuccessful at removing soot from the DPF, the DPF may need to be removed from the vehicle and be cleaned with the appropriate machinery and processes.

Ash residue in the DPF comes primarily from fuel and oil additives and will not burn or pass through the DPF. Ash residue accumulates very slowly in the DPF, but must eventually be removed to prevent excessive exhaust backpressure. If the DPF needs to have nonregenerable soot or the ash residue removed, please take the vehicle to an International dealer.

Transmission

Check fluid level. For manual or automated manual transmissions, during the PM schedule, ensure that the fluid level is at the bottom of the fill hole. For Allison Automatic Transmissions, check the fluid level on a daily basis using the transmission dipstick.

Check gear shift/shift linkage for proper operation.

Refer to the LUBRICATION AND MAINTENANCE INTERVAL CHART and the LUBRICANT AND SEALER SPECIFICATIONS chart for information on transmission fluids and fluid and filter change intervals.

Neutral Start Switch

Manual/Automated Manual Transmissions

Check operation of the safety start switch. The starter should **ONLY** operate when the clutch pedal is depressed.

Automatic Transmissions

Check operation of the transmission neutral safety switch. Try to start the vehicle in all shift selector positions. The starter should ONLY operate when the shift selector is in Neutral or Park (if equipped).

Drive Shafts

At the regular lubrication interval, check universal joints, slip joints, slip joint boot, and carrier bearings for any evidence of wear or looseness. Should drive shaft vibrations occur, stop the vehicle immediately to avoid possible hazardous consequences or damage to other components.

Suspension (Air and Steel Springs)

CAUTION

Do not adjust air suspension height to any setting other than the specified setting. Altering the height setting will change the driveline angle and may result in unwarrantable component damage, such as transmission component damage.

Verify drive axle air suspension height at the PM interval. See the appropriate Service Manual for suspension height specifications.

NOTE: Suspension alignment must be maintained at all times.

Periodically:

- Check condition of spring leaves for evidence of fatigue, bending, or breakage.
- Check condition of suspension mounting brackets and bushings.
- Check that suspension mounts (brackets, bushings, fasteners, etc.) are tight.
- Check that torque rod mounting fasteners are tight.
- Check U-bolts as follows:
 1. After the chassis has been operating under load for 1,000 miles (1,600 km) or six months, whichever comes first, the U-bolt nuts must be retorqued.
 2. Thereafter, the U-bolt nuts must be retorqued every 36,000 miles (58,000 km).

NOTE: See U-Bolt Nut Torque Chart in the Maintenance Intervals and Specifications section.

Steering

General Information



Always follow recommended procedures for steering system maintenance. Failure to maintain the steering system in proper condition can cause reduced steering ability resulting in property damage, personal injury, or death.

Ask your service technician to examine the steering mechanism. Minor adjustments could head off further problems.

Check tie rod ends, drag link ends, and kingpins. Joints and fasteners must be tight. Articulating joints must be well lubricated.

Check for installation and spread of cotter pins and tightness of nuts at both ends of tie rod and drag link.

Check that pitman arm (steering arm at steering gear) mounting is tight and locked. Check system for leaks or hose chafing. Repair any concerns at once.

Maintain proper steering gear and power steering pump fluid levels.

CAUTION

To prevent power steering fluid overflow when hot, be sure to utilize the appropriate HOT or COLD fluid temperature-specific level marks if displayed on power steering reservoir.

Regularly inspect steering column joint bolts and steering linkage, particularly for body-to-chassis clearance.

NOTE: Have any steering problems corrected at once by a qualified service technician.

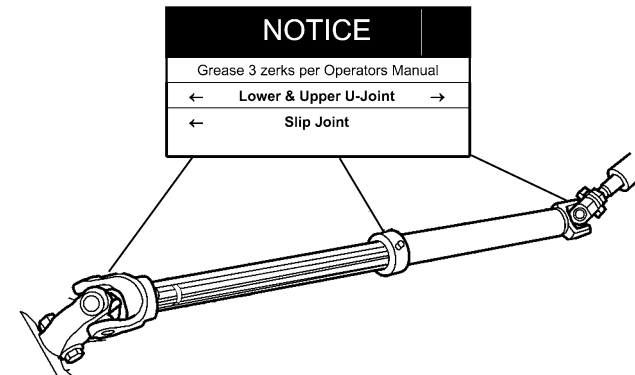
Tightening Steering Intermediate Shaft Joint Bolts

As a good maintenance practice, it is recommended that steering intermediate shaft joint bolts be checked for tightness every "B"

PM interval or annually, whichever occurs first. Tighten bolts to torque specified in the Torque Specification chart at the end of this section. **DO NOT OVERTIGHTEN.**

Lubrication Points

The steering shaft is lubricated at the three points shown in the illustration below. For the correct maintenance interval, refer to **SECTION 7 – MAINTENANCE INTERVALS AND SPECIFICATIONS.**



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Power Steering

Whenever the power steering system has been drained and refilled for any reason, air must be bled from the system before returning the vehicle to service. Failure to properly bleed the hydraulic system can result in degradation of power system performance.

Consult your International dealer for proper procedures of filling and bleeding the system.

The power steering fluid filter is located inside the power steering reservoir. To remove the filter, unscrew the large cap on the power steering reservoir and unscrew the filter. Reverse the procedure to install the new filter.

Refer to **SECTION 7 — MAINTENANCE INTERVALS AND SPECIFICATIONS** for the fluid and filter replacement intervals.

Tires

Tire Warnings



Due to tire manufacturers re-marking tires to conform to the SI (metric) system, tires marked with old and new loads or inflation pressures could be placed on the same vehicle. For field maintenance, only inflate and load tires to the maximum of the least-rated tire on the axle. Failure to adhere to this warning could possibly result in tire malfunction, damage to your vehicle, personal injury, or death.



Always maintain your tires in good condition. Frequently check and maintain correct inflation pressures as specified by tire manufacturers. Inspect periodically for abnormal wear patterns and repair/replace cut or broken tire casing. Always use experienced, trained personnel with proper equipment and correct procedures to mount or remove tires and wheels. Failure to adhere to these warnings could result in wheel or tire malfunction, damage to your vehicle, personal injury, or death.



To prevent personal injury or death, always follow these instructions when mounting tires on wheels:

- Only personnel who have had proper training and experience should mount or remove tires from rims or wheels.
- Use only heavy-duty rims or approved rims for radial tires. It may be necessary to contact your wheel and rim distributor to determine if your rims are approved for radial tires.
- If a tube is to be used, make sure special radial tire tubes are used because of the increased flexing of the sidewalls on radial tires.
- Never use antifreeze, silicones, or petroleum-based lubricants when mounting radial tires. Only an approved lubricant should be used as an aid for mounting tires.
- Always inflate tires in a safety cage.



- Do not mix stud-piloted wheels or fasteners with hub-piloted wheels or fasteners. Premature wheel failure can result in property damage, personal injury, or death.
- Do not change from steel wheels or a steel inner and aluminum outer wheel combination to aluminum wheels without changing the mounting hardware since the thicker aluminum wheels require longer studs. In some cases with flange nut mounting systems, changing the hub and stud assembly may be required. Improperly mixing components could cause wheel or fastener failures and result in property damage, personal injury, or death.



Do not mount tube-type tires on tubeless wheels or tubeless tires on tube-type wheels. To do so could result in tire or wheel failure and cause property damage, personal injury, or death.

Tire Maintenance

Preserving proper inflation pressure is a very important maintenance practice to ensure safe vehicle operation and long life for the tires.

Failure to maintain correct inflation pressure may result in sudden tire destruction, improper vehicle handling, and may cause rapid and irregular tire wear. Therefore, inflation

pressures should be checked daily and always before long-distance trips.

Follow the tire manufacturer's recommended cold inflation pressure for the tire size, type, load range (ply rating), and axle loading typical for your operation. (Each steer axle tire load will equal 1/2 steer axle loading; each drive tire load will be 1/4 the axle loading, if fitted with four tires.)

Checking Inflation

Always check inflation pressure when tires are cold. Never bleed air from hot tires to relieve normal pressure buildup. Normal increases in pressure during operation will be 10 to 15 psi (69 to 103 kPa), which is allowable in truck tires. Tires on the same axle should have the same air pressure as the corresponding other tire(s) on that axle. Steer tires should be within a 3 psi (21 kPa) pressure range. All drive tires should be within a 5 psi (34 kPa) pressure range. Tag or pusher axle tires on the same axle should be within a 5 psi (34 kPa) pressure range.

To minimize rim corrosion, it is particularly important to keep moisture from the inside of tires and proper selection of air compressor equipment, proper air line routing, and the use of shop air dryers is strongly recommended to avoid moisture in the high-pressure air used for tire inflation.

Underinflation

Tires should not be allowed to become underinflated. Increased flexing due to underinflation causes heat buildup within the tire components. This leads to reduced strength, breakdown of the rubber compounds and possible separation of the

tire components (i.e., ply and tread separation and reduced retreadability).

Underinflation is also the primary cause of blowouts. In addition, low inflation causes an increase in rolling resistance. This results in reduced fuel mileage, a loss in tread life, and uneven wear due to increased tread movement. To determine proper inflation, refer to the tire inflation range stated on the tire sidewall and the tire manufacturer's tire load-pressure charts.

Inspection

Check condition of tires for abnormal wear patterns and proper inflation pressures. Cut or broken tire casings must be repaired or replaced.

Tires should be inspected for the following conditions. If any are present, the tire should be removed and repaired, retreaded, or scrapped as the condition indicates.

- Any blister, bump, or raised portion anywhere on the surface of the tire tread or sidewall (other than a bump made by a repair). These indicate the start of internal separation.
- Any cut that reaches to the belt or ply cords or any cut that is large enough to grow in size and depth.
- Any nail or puncturing object.
- If any stone or object is held by a tread groove and is starting to drill into the tread base, remove the object.

Proper tire inflation, toe-in adjustment, loads, and road speeds are important factors governing tire life, steering ease, maneuverability, fuel economy, and ride quality.

Loads



Loading tires beyond their rated capacity decreases tire life requiring more frequent replacement of tires. Overloading creates an unsafe condition that may result in sudden air loss from a tire failure resulting in an accident that could cause property damage, personal injury, or death.

NOTE: The load rating of the tires installed on your vehicle at the time of your vehicle's production is at or in excess of the Gross Axle Weight Rating (GAWR) generally found on a label on the B-pillar of your vehicle. When replacing tires, be sure that the replacement tire load rating (listed separately in pounds and kilograms on the tire sidewall for single or dual applications) multiplied by the number of tires on that axle is equal to or higher than the specific listed Steer Axle or Drive Axle GAWR. Failure to do so will adversely affect maximum load-carrying capacity. Tires with the same size specification do not always have the same load specification.

Dual Tires Matching

Dual tires should be matched using tires of equivalent size. Tires which differ more than 1/4 inch (6 mm) in diameter or 3/4 inch (19 mm) in circumference should not be mounted on the same dual wheel assembly.

Dual Tires Mixing

NOTE: Never mix bias and radial tires on this vehicle.

It is recommended for best overall performance that only radial tires be used on this vehicle.

Never mix different tire sizes or constructions on the same axle.

Rotation

- Steer tires that have developed some type of irregular wear pattern can be rotated to drive axles if rib tires are being used on all wheel positions. Applying steer tires to a drive position will often wear off the irregularities and they can be moved back to the steer axles or run out to retread stage on the rear axle.
- Another rotation possibility for fleets with rib tires in all wheel positions is to break in the new steer tires in the drive axle positions, then move them to steer axles. This will wear away tread rubber relatively quick in the early life of a tire when it is most likely to develop an unusual wear pattern.
- Drive axle tires may be placed on the other end of the same axle so that direction of rotation is reversed. This is often helpful if a heel and toe or alternate wheel nut wear pattern has developed.

Rotation Is Advisable

1. If front (steering) axle tires become irregularly worn, move to rear position.

Maintenance Instructions

2. In a dual assembly, reverse the position of the tires if one tire wears much faster than its mate.
3. On the drive axle, if heel and toe wear or alternate wheel nut wear occurs, rotating the tires from one end of the axle to the other end of the axle may help even out this wear.

Tire Replacement

NOTE: Retread tires are not recommended for use on steering axles of trucks.

- **Front (Steering) Axle** - Tires must be removed when tread is worn to 4/32 inch (3 mm) or less. Retread or rotate worn tires to drive position.
- **Rear Axles** - Tires must be removed when tread is worn to 2/32 inch (2 mm).

If rib tire is used on front axle and lug- or off-road-type on rear axle positions:

- **Front (Steering) Axle** - Replace tires at front wheels when tread is worn to 4/32 inch (3 mm) or less.
- **Rear Axles** - Tires must be removed when the tread is worn to 2/32 inch (2 mm) or less. Tires identified with the word regroovable molded on the sidewall can be regrooved. A minimum of 3/32 (2.38 mm) of undertread must be left at the bottom of the grooves.

Wheel and Tire Balancing

Out-of-round or out-of-balance wheels or tires can cause vehicle vibration and bounce, and shimmy. Replace damaged or out-of-round wheels. Out-of-round tires and wheel assemblies can be corrected by rechecking the tire relative to the wheel. The tire and wheel assembly should thereafter be dynamically balanced and reinspected while spinning for an out of round condition.

Wear

Radial tires can exhibit three types of normal wear patterns, even, erosion, or chamfer.

Even Wear is a sign that the tire is being properly used and maintained.

Erosion Wear has also been called rolling wear, channel, or river wear. Erosion wear is found more often at free rolling tires. This is an indication that the tire is being used in a slow wearing operation. What happens is that the belt plies are held very rigid and the tread is not allowed to distort as it passes through the contact area. Wear will only occur at the edge of the tread. No corrective action required. If erosion gets to be 1/16 inch (2 mm) or more, the tire may be rotated to a drive axle.

Chamfer or Shoulder Wear, with tires inflated properly, is a normal tendency of most radial tire designs. If both inside and outside shoulders are wearing evenly around the tire, no further action is required. Overinflation is not effective in correcting this effect.

Irregular Wear

If irregular wear is present, check the axle alignment, tire pressure, wheel balance, shock and suspension component condition, and wheel bearing end play.

This condition not only shortens tire life, but will adversely affect the handling of your vehicle.

Rotating tires from one wheel position to another is a way often used to even out many types of irregular wear or to avoid it altogether. See **Tires – Rotation** for more information. Some of the more effective tire rotation programs are:

Irregular wear can be minimized by:

- Using the right inflation pressure for the load being carried.
- Maintaining proper front wheel alignment - **especially toe-in** - to specifications.
- Maintaining proper tire and wheel balance.
- Maintaining shock absorbers and suspension components.
- Maintain proper wheel bearing adjustment .

Use of Tire Chains

Refer to chain manufacturer's recommendation for correct tire chain usage, installation, and removal.

Wheels

Wheel and Wheel Nut Maintenance and Installation



To prevent personal injury or death, always follow these instructions when mounting tires on wheels:

- **Only personnel that have had proper training and experience should mount or remove tires from rims or wheels.**
- **Use only heavy-duty rims or approved rims for radial tires. It may be necessary to contact your wheel and rim distributor to determine if your rims are approved for radial tires.**
- **If a tube is to be used, make sure special radial tire tubes are used because of the increased flexing of the sidewalls on radial tires.**
- **Never use anti-freeze, silicones, or petroleum based lubricants when mounting radial tires. Only an approved lubricant should be used as an aid for mounting tires.**
- **Always inflate tires in a safety cage.**



- **Do not mix stud piloted wheels or fasteners with hub piloted wheels or fasteners. Premature wheel failure can result in property damage, personal injury, or death.**
- **Do not mix foreign (not made in North America) wheel mounting parts with domestic (made in North America) parts. Many foreign wheel components look similar to, but are not exactly the same as domestic made components. Mixing components can cause wheel or fastener failures and result in property damage, personal injury, or death.**
- **Do not change from aluminum wheels to steel wheels, or vice-versa, without changing the mounting hardware. In some cases with flange nut mounting systems, changing the hub and stud assembly may be required. Mixing components could cause wheel or fastener failures and result in property damage, personal injury, or death.**



When installing the tire and rim assembly on disc - brake equipped axles, make sure the tire valve stem clears the brake caliper. The use of either an International truck valve stem retainer or a tire manufacturer's stem forming tool is the only acceptable method of obtaining clearance when necessary. Failure to obtain proper clearance may result in rapid tire deflation and cause property damage, personal injury, or death.

Wheel Nut Torque Maintenance

Tighten and maintain wheel and rim mounting nuts to the proper torque. Loose nuts or overtightened nuts can lead to premature wear and possible failure of the wheel, rim, and/or mounting hardware.

Hub-Piloted Wheel Installation Procedures



Use only the same type and style wheels and mounting hardware to replace original parts. Failure to do so may result in an assembly, which looks fine, but does not fit together properly. This could cause wheel or fastener failures and result in property damage, personal injury, or death.

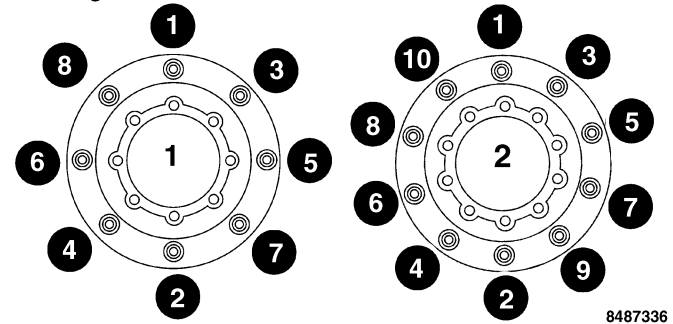
Out-of-round tires and wheel assemblies can sometimes be corrected by reclocking the tire relative to the wheel.

Tightening procedure for disc wheels with flange nuts (hub-piloted).

1. Clean the mating surfaces of the hub, drum, and wheel(s) as well as the wheel studs and wheel nuts with a wire brush prior to assembly.
2. Lubricate the two-piece wheel nuts by putting two drops of oil in the slot between the nut and washer and spin the washer to spread the oil around the nut-to-washer contact surface.
3. Carefully lubricate the wheel stud threads by wiping them with a freshly oiled cloth. Do not get the oil on any other

surfaces or the wheel clamping effectiveness will be reduced!

4. To prevent aluminum wheels from getting stuck on the hub due to corrosion, apply a thin coat of antiseize compound or disc brake corrosion control grease to the hub pilot pads only.
5. Slide the inner wheel (if duals) or steer wheel over the wheel studs and onto the pilot pads of the hub. Care must be taken to avoid damage to the stud threads while positioning the wheel. Ensure that the wheel is resting on the pilot pads and is against the brake drum.
6. Hand-start all wheel nuts to avoid cross-threading.
7. Starting with the nut at the 12:00 o'clock position and using the appropriate star or crisscross pattern (see wheel nuts torque sequence diagram), run the wheel nuts down the wheel studs with an impact wrench until they are snug against the wheel. The purpose of this step is to snug the wheel(s) in the correct position, not to apply the final torque. The tightening of each nut should be stopped immediately when the wheel is contacted, resulting in a wheel nut torque well below the final specified torque.
8. Use a calibrated torque wrench to apply the specified torque to each wheel nut in the sequence specified in the wheel nuts torque sequence diagram above. Refer to **SECTION 7 — MAINTENANCE INTERVALS AND SPECIFICATIONS** for proper torque values.



1. Flange Nut Mount – 8 Stud

2. Flange Nut Mount – 10 Stud

9. All wheels undergo a process called joint settling when placed in service after a wheel installation has been performed. This process results in a reduction in the torque on the wheel nuts. To correct this condition, operate the vehicle normally for approximately 50 miles (80 km), then use a calibrated torque wrench to retorque the wheel nuts to specification using the appropriate pattern shown in the wheel nuts torque sequence diagram.
10. As part of a daily pretrip inspection, look for loose or missing wheel nuts. Also look for rust streaks extending outward from the wheel nuts; this can be an indicator that one or more wheel nuts are loose, even if they cannot be turned by hand. Normal periodic maintenance should also include checking the wheel nut torque with a torque wrench.

SECTION 7 — MAINTENANCE INTERVALS AND SPECIFICATIONS

Lubrication and Maintenance Intervals

All new vehicles are factory-lubricated. Once the vehicle is in operation, regular lubrication and maintenance intervals (based on the type of service and road conditions) must be established and performed. Load weight, vehicle speed, road conditions, and weather conditions all contribute to lubrication frequency. Performing thorough lubrication and maintenance at the specified intervals will ensure an outstanding vehicle life and will reduce overall operating expense.

The LUBRICATION AND MAINTENANCE INTERVAL CHART contains an extensive list of components and systems. Listed items and systems must be regularly inspected, serviced, and/or replaced to maximize vehicle availability and minimize unexpected failures. Recommended synchronized intervals are shown for each item. This chart can serve as a convenient one-stop reference to research most maintenance needs.

Only lubricants of superior quality, such as Fleetrite® lubricants, should be used. The use of inferior products will reduce the service life of the vehicle or result in failure of its components. International® recommends the use of Fleetrite® lubricants for optimum performance.

Maintenance Intervals

Maintenance intervals provided in this manual are for normal highway and environmental service conditions.

These intervals may be expressed in miles (kilometers), hours of operation, and/or months of operation. It is important to note that in high duty cycle types of operation and/or where operating conditions are extremely severe (such as in deep water, mud or unusually dusty conditions), the vehicle may require lubrication much more frequently than specified in this manual.

The synchronized “A” and “B” service intervals are designed to coordinate maintenance activities and to provide the appropriate levels for servicing components. Following the service intervals minimizes the number of times per year that the vehicle must be brought into the shop. In addition to the “A” and “B” service intervals, the “Special” Service Interval column is provided for items that need infrequent servicing. In most cases, these service intervals represent the recommended maximum intervals. For some components, however, the manufacturer’s recommended maintenance intervals may have been shortened to allow synchronization with other maintenance tasks.

The maintainer may wish to synchronize engine related items with other lubrication/maintenance intervals in order to reduce downtime, even though the recommended intervals in the Engine Operation and Maintenance Manual may be longer. **Engine Operation and Maintenance Manual maximum intervals (based on the actual operating conditions specified in that manual) must never be exceeded.**

Lubrication and Maintenance Interval Chart Symbols Key

Symbol	Interval Definition		
	Severe Service < 20,000 mi/yr	City < 59,000 mi/yr	Highway > 60,000 mi/yr
A	5,000 miles (8,000 km) 135 hours 3 months	10,000 miles (16,000 km) 300 hours 6 months	15,000 miles (24,000 km) 450 hours 9 months
B	10,000 miles (16,000 km) 300 hours 6 months	20,000 miles (32,000 km) 600 hours 12 months	30,000 miles (48,000 km) 900 hours 18 months

Lubrication and Maintenance Interval Chart Notes

NOTE 1: A hand-pumped grease gun should be used for optimal grease distribution within the component joint.

NOTE 2: Kingpin thrust washers must be lubricated with vehicle weight on tires. Kingpins and kingpin bushings must be lubricated with weight off of the wheels and tires.

NOTE 3: Certain services are performed at Special Intervals or in addition to A or B Service when the interval dictates.

Lubrication and Maintenance Interval — Recommended Synchronized Intervals

System	Item	Intervals	Special Interval (3) : miles (km) / hours / months
Pre-Trip Inspection	Pre-trip Inspection Items listed in Section 3 – Check All		
Front Axle	Wheel Bearing-Oil Type – Check Level	A, B	
	Suspension Fasteners / Components – Check	A, B	
	Tie Rod Ends – Lubricate (1)	A, B	
	Drag Link – Lubricate (1)	A, B	
	King Pins and Bushings – Lubricate (1,2)	A, B	
	Shock Absorbers – Inspect	A, B	
	Wheel Bearing-Oil Type (including synthetic) – Change Oil		Severe Service and City: 60,000 miles (96,000 km)/–/6 On-Highway: 100,000 miles (160,000 km)/–/12
	Wheel Bearing-Grease Type – Repack		Severe Service and City: 30,000 miles (48,000 km)/–/6 On-Highway: 30,000 miles (48,000 km)/–/12
	Wheel Bearings – Check End-play	B	
	Axle U-bolts – Retorque		At first 1,000 miles (1,600 km) then every 36,000 miles (58,000 km) thereafter.
	Drive Axle (4X4 and 6X4 vehicles) – Check Oil Level		5,000(8,000)/–/1
	Drive Axle with Petroleum (4X4 and 6X4 vehicles) – Change Oil (clean magnetic plug and breather)		25,000(40,000)/–/12
	Drive Axle with Synthetic (4X4 and 6X4 vehicles) – Change Oil (clean magnetic plug and breather)		50,000(80,000)/–/12

Lubrication and Maintenance Interval — Recommended Synchronized Intervals (cont.)

System	Item	Intervals	Special Interval (3) : miles (km) / hours / months
Rear Axle	Suspension Fasteners/Components – Check	A, B	
	Axle Flange Nuts – Retorque	B	
	Ride Height – Check	B	
	Axle U-bolts – Retorque		At first 1,000 miles (1,600 km) then every 36,000 miles (58,000 km) thereafter.
	Rear Axle with Petroleum Change Oil (clean magnetic plug and breather as necessary)		60,000(96,000)/–/12
	Rear Axle Wheel Ends – inspect for leaks, lube level/condition, and check end play with dial indicator.		100,000(160,000)/–/12. Also at brake lining service. If wheel end play is found to be outside the 0.001 in. to 0.005 in. specification, or lube condition is contaminated or low, then perform a full wheel end tear down. Inspect bearings, spindle, and spindle nuts for excessive wear and replace as necessary.
	Rear Axle with Synthetic Change Oil (clean magnetic plug and breather as necessary)		120,000(192,000)/–/12
	Rear Axle Wheel Ends – Full tear down inspection of all wheel end components, regardless of condition of lube and wheel bearing end play.		500,000 miles (800,000km)/–/5 Years

Lubrication and Maintenance Interval — Recommended Synchronized Intervals (cont.)

System	Item	Intervals	Special Interval (3) : miles (km) / hours / months
Electrical	Engine Start and Gauge/Warning Indicators – Check	A, B	
	Instrument Readings Proper – Check	A, B	
	ABS Wiring Connections & Sensors – Reseat	A, B	
	Alternator-Starter-Battery – Check	A, B	
	Electrical lines routing and clipping (lines are not tangled, crimped or pinched or rubbing against surfaces); not spliced or taped; insulation not cut, cracked, chafed or worn – Inspect	A, B	
Steering	Power Steering Fluid – Check Level	A, B	
	Steering System – Check Tightness	A, B	
	Steering Gear – Lubricate	A, B	ATTN: Install grease slowly at low pressure. Power grease guns may blow out seals.
	Steering Intermediate Shaft U-Joints/Slip Joint – Lubricate	A, B	
	Steering Intermediate Shaft U-Joints – Retorque		60,000(96,000)/1,500/24
	Power Steering Fluid – Change		100,000(160,000)/3000/12
	Power Steering Filter – Replace		500,000(800,000)/15,000/60
Drive Shaft “SPL”	U-Joints – Lubricate; Slip Joint Boot – Inspect	B	
Drive Shaft “Non-booted Slip Joint”	U-Joints and Slip Joint – Lubricate		5,000(8,000)/–/3

Lubrication and Maintenance Interval — Recommended Synchronized Intervals (cont.)

System	Item	Intervals	Special Interval (3) : miles (km) / hours / months
Air Brakes	Air Wet Tank – Drain Water	A, B	
	Service Brakes Operation – Check	A, B	
	Parking Brakes Operation – Check	A, B	
	Governor Cut-in/Cut-out Pressure – Check	A, B	
	Low Air Pressure Warning Alarm – Check	A, B	
	Air Tanks (all) – Drain Water	A, B	
	S-Cam Bushings – Lubricate	A, B	
	Shoes – Check for wear and drag	A, B	
	Drums, Chambers, Hoses, etc. – Check for wear/damage	A, B	
	Brake Chamber Rod Travel – Check	A, B	
	Air Dryer Desiccant-Replace		AD-IP: 1 year; AD-9: 2 Years
	Air Dryer Heater & Purge Valve – Check		AD-IP: 1 year; AD-9: 2 Years
	Air Compressor Discharge Line – Check Blockage		50,000 miles (80,000 km)/1,500/24
Cooling System	Coolant – Check Level	A, B	
	Radiator & CAC Fins – Check for Blockage	A, B	
	Fan Clutch – Check	A, B	
	Fan Blade/Shroud – Check Damage/Contact	A, B	
	Coolant Filter (if equipped) – Replace	B	
	Extended Life Coolant – Replace	Refer to Engine Operation and Maintenance Manual.	

Lubrication and Maintenance Interval — Recommended Synchronized Intervals (cont.)

System	Item	Intervals	Special Interval (3) : miles (km) / hours / months
Engine	Engine Oil Level – Inspect	A, B	
	Fan Belt – Inspect	A, B	
	Air Filter – Check Restriction	A, B	
	Air Induction System – Check looseness/leaks	A, B	
	Air Filter – Replace		At Restriction Indication or 60 months.
	Engine Oil and Filter(s) – Replace	Refer to Engine Operation and Maintenance Manual.	
	Fan Belt Auto Tensioner – Inspect	Refer to Engine Operation and Maintenance Manual.	
	Fuel Filter – Drain Separated Water	Refer to Engine Operation and Maintenance Manual.	
	Fuel Filter – Replace	Refer to Engine Operation and Maintenance Manual.	
Fuel Tank	Fuel Tank(s) – Drain and Flush (Note 3)		100,000(160,000)/–/12
	Fuel Sender, Hose Connections – Check for Loose Connectors		12 months
Exhaust System	Pipes/Muffler – Inspect for leakage/looseness	A, B	
	Diesel Particulate Filter (DPF) – Clean out ash	Refer to Engine Operation and Maintenance Manual	
Clutch	Release Bearing/Shfts/Fork – Lubricate		Highway – 10,000 miles (16,000 km)/–/1 City/Severe Service: – /250/1

Lubrication and Maintenance Interval — Recommended Synchronized Intervals (cont.)

System	Item	Intervals	Special Interval (3) : miles (km) / hours / months
Transmission	Trans Fluid, Automated/Manual – Check Level	A, B	
	Shift Selector/Linkage – Check Function	A, B	
	Neutral Start Switch – Check Function	A, B	
	Manual Trans, Petroleum Oil – Replace	Refer to Transmission Operators Manual.	
	Manual Trans, Synthetic Oil – Replace	Refer to Transmission Operators Manual.	
	Automated/Manual Trans Fluid/Filter – Replace	Refer to Transmission Operators Manual.	
Transfer Case (4X4 only)	Change Oil	A	Initial Oil Change at 5000 miles (9000 km)
	Meritor Synthetic Oil Change		Initial Oil Change at 2,500 miles (4,000 km) or 125 hours whichever comes first. Thereafter 25,000 miles (40,000 km), 1,250 hours or 12 months, which ever comes first.
Tires/Wheels	Air Pressure – Check	A, B	
	Wear and Condition – Check	A, B	
	Wheel Stud Nuts – Retorque	A, B	
	Spin Balance		At time of tire mounting or as needed.
Cab Components	Door Hinges/Latches/Strikers – Lubricate, Check Link (Use Multi-purpose lithium grease or light engine oil. Do Not use silicone lubricant).	A, B	
	Door Lock Cylinders – Lubricate	A, B	
	Seat Adjuster Slides – Lubricate	A, B	

Lubrication and Fluids Charts

NOTE: The components requiring lubrication and fluid check shown in this manual are typical representations.

Lubrication Notes

CAUTION

Unapproved lubricants can cause premature component failure. Refer to the Lubricants and Sealer Specification table for proper lubricants.

- Wipe clean all dirt and debris from grease fittings before applying grease. If the fitting is not cleaned, dirt can be pushed into the component with the grease. Always fill grease to the point where old grease and contaminants are forced out from the part and only new grease comes out. If a fitting does not accept lubrication due to damage or internal stoppage, replace with a new fitting. Remove excess grease from fittings and other surfaces after applying grease.
- Some vehicles may have optional remote mounted grease zerks for the clutch cross-shafts. These fittings reduce service time by providing convenient access to clutch cross-shaft bushing grease zerks. Grease may be applied through two remote mounted grease zerks mounted to the bottom of the transmission bell housing.

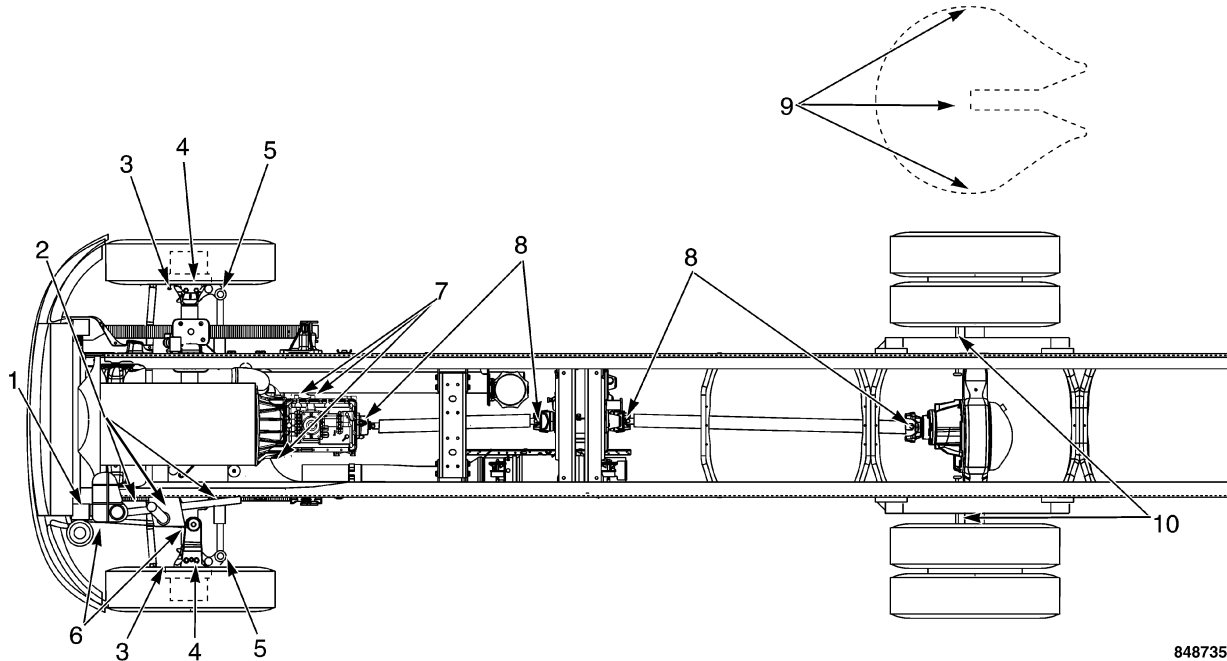
Fluid Check and Fill Notes

CAUTION

Use only recommended viscosity engine oil. Refer to the Engine Operation and Maintenance Manual for engine oil specifications.

- Wait five minutes after shutting off the engine before checking the oil level. This gives the oil time to drain back to the oil pan.
- Clean all caps and fill plugs prior to removal to prevent dirt and debris from entering system.
- Filling the power steering fluid above the MAX COLD mark when cold will result in fluid overflow when hot.
- If engine is cold and coolant is above the MIN/ADD line, no additional coolant is needed. Excessive filling when cold can cause tank to overflow when hot.
- When checking the axle hub fluid level, maintain fluid level to fill line on hubcap.
- Check the rear axle(s) vent for blockage. Blockage can cause excessive pressure in the axle and create leaks.

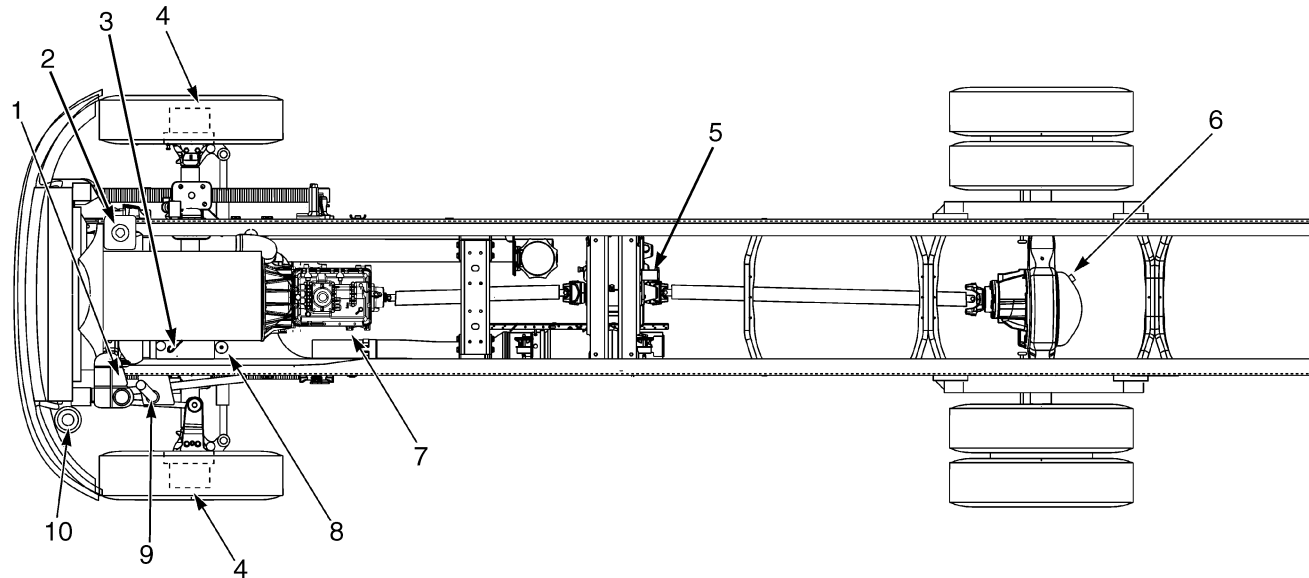
Components Requiring Lubrication



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- | | |
|--|---|
| 1. Steering Gear | 6. Steering Drag Link Ends |
| 2. Steering Intermediate Shaft | 7. Clutch Cross Shafts and Release Bearing |
| 3. Front S-Cams and Slack Adjusters | 8. Drive Shaft U-joints and Slip Joint |
| 4. King Pin Bushings and Thrust Bearings | 9. Fifth Wheel Pivot Points and Top Plate (If Equipped) |
| 5. Tie Rod Ends | 10. Rear S-Cams and Slack Adjusters |

Components Requiring Fluid Check and Fill



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- | | |
|--------------------------------|--|
| 1. Coolant Make-up Tank | 6. Drive Axle Oil Fill/Level Check Plug |
| 2. Coolant Deaeration Tank | 7. Manual Transmission Oil Fill/Level Check Plug |
| 3. Engine Oil Dipstick | 8. Automatic Transmission Dipstick/Fluid Fill |
| 4. Front Axle Oil-Filled Hubs | 9. Windshield Washer Fluid Bottle |
| 5. Transfer Case (if equipped) | 10. Power Steering Fluid Reservoir |

Unit Refill Capacities

Front Drive Axles

Model	Liters	Quarts
Meritor MX-10–120, MX-12–120, MX-14–120	7.6	8
Meritor MX-16–120	17	18

Rear Axle Unit Refill Capacities

Axle Model No.	Forward		Rear	
	Liters	Pints	Liters	Pints
Meritor MS-21-14X-4DCR	15.9	33.6		
Dana Spicer® 17060S, 19060S, 21060S, 21060D, 21060T	13	28		
Meritor RS-19-224	14.7	31		
Meritor RS-21-145, RS-17-144, RS-19-144	15	32.3		
Meritor RS-19-145, RS-21-162	16	33.5		
Meritor RS-17-145	16	34		
Dana Spicer® 19060T	16.6	35		
Dana Spicer® 23082T	17.5	37		

Axle Model No.	Forward		Rear	
	Liters	Pints	Liters	Pints
Meritor RS-21-160, RS-21-230, RS-23-160	18.5	39		
Meritor RS-21-162	18.7	39.5		
Dana Spicer® S23-170, S23-170D, S23-190, S23-190D, S26-190, S26-190D	17.5	37		
Meritor RS-23-161	18	37.5		
Meritor PRC-674	19	40		
Meritor RH-23-186	27.9	59		
Meritor RS-26-185	22.2	47		
Meritor RS-30-185	22	46.5		
Meritor RS-30-185	25	53.5		
Meritor RS-30-380	28	58.5		
Meritor RS-38-380	22.5	47.5		
Tandem				
{Dana Spicer® DS344/RS344	15	31	13	28
Meritor RT-34-144	14	30.2	12	25.8
Dana Spicer® DS405/RS405	14.7	31	13	28
Meritor RT-40-145	14	30.2	12	25.8

Axle Model No.	Forward		Rear	
	Liters	Pints	Liters	Pints
Dana Spicer® DS405P/RS405	14.7	31	13	28
Dana Spicer® DS405/RD405	14.7	31	13	28
Dana Spicer® DD405/RD405	14.7	31	13	28
Dana Spicer® DD405P/RD405	14.7	31	13	28
Dana Spicer® DS405P/RD405	14.7	31	13	28
Dana Spicer® DST41/RST41	14.7	31	17	36
Dana Spicer® DST41P/RST41	14.7	31	17	36
{Dana Spicer® DT402P	17.5	37	16	34
Dana Spicer® D46-170HP/R46-170H	18.5	39	17.5	37
Dana Spicer® D46-170HP/R46-170DH	18.5	39	17.5	37

Axle Model No.	Forward		Rear	
	Liters	Pints	Liters	Pints
Dana Spicer® D46-170DHP/R46-170DH	18.5	39	17.5	37
Dana Spicer® D46-170P/R46-170	18.5	39	17.5	37
Dana Spicer® D46-170P/R46-170D	18.5	39	17.5	37
Dana Spicer® D46-170D/R46-170D	18.5	39	17.5	37
Dana Spicer® D46-170/R46-170	18.5	39	17.5	37
Meritor RT-46-160, RT-46-160P	18.5	39	16.3	34.4
Meritor RT-46-164EH	18	38.1	15.7	33.2
Meritor RT-46-164P	18	38.1	15.7	33.2
Meritor RT-52-185	26.5	56	17	36
Meritor RT-52-185P	26.5	56	17	36

Cooling System Refill Capacities

Cooling system refill capacities vary considerably due to differences in engine models, variations in chassis, and body options, in addition to the amount of coolant remaining in the system after draining. Total capacity may range from 6 to 22 gallons (23 to 83 liters).

If system has been drained, fill with fresh 50/50 diluted concentrate coolant or 50/50 premixed coolant. If the system has been flushed with water, a significant amount of the freshwater flush will remain in the system. In this case refilling with a mixture with a higher percentage (60 to 66 percent) of coolant concentrate is advised in order to achieve a final mixture close to 50/50.

Fill the system and run the vehicle until the thermostat opens. Check the coolant concentration and add additional water or concentrated undiluted coolant to adjust the concentration. Run the vehicle and retest.

Crankcase and Oil Filters

For specific engine crankcase capacities, refer to separate Engine Operation and Maintenance Manual provided with vehicle.

Power Steering Systems

Steering Gear	Power Steering Fluid Volume (in ³ /pints/liters)
TAS-85	240/8.4/3.9*
M-100	240/8.4/3.9*
M-100/ M-80	346/12/5.7*
M110	240/8.4/3.9*
M110/M100	346/12/5.7*
M-110/M-90	346/12/5.7*
* Approximate refill quantity, refer to power steering reservoir for proper fill marks.	

Transfer Case

Model	Liters	Pints
Dana Spicer® 792	5.2	11
Meritor T-4208, T-4210, and T-4213	4.3	9
Fabco® TC-38	6.6	14

Transmission

Model	Liters	Pints
Manual		
Fuller® 5 Speed: 6305A	8.8*	18.5*
Fuller® 6 Speed: FS-5406N; FS-6406N; FSO-8406	9*	19.5*
International® 7 Speed: ES 56-7B; ESO 66	10*	22*
Spicer® 7 Speed: PS110-7B	23*	48*
Fuller® FR-11210B —10 Speed — wet clutch	11*	23.5*
Fuller® 10 Speed: FR-9210B; FRO-11210C; FRO-12210B; FRO-13210B; FR-9210B; FRO-11210B; FRO-12210B; FRO-13210B ; FRO-14210B; FRO-12210C; FRO-13210C; FRO-14210C; FRO-15210C; FRO-16210C	11*	23.5*
Fuller® 10 Speed: RTO(F)-11908L; RTO(F)-14908LL; RTO(F)-16908LL;	13*	28*
Fuller® 10 Speed: RT-8908LL;	13*	28*
Fuller® 10 Speed: RTO-12910B-AS3; RTO-16910B-AS3; RTO-14910B-AS3;	12.8*	27*
Fuller® 10 Speed:RTO-14910C-AS3; RTO-16910C-AS3	12*	26*
Fuller® 11 Speed: RTO(F)-11909ALL; RTO(F)-14909ALL; RTO(F)-16909ALL	13*	28*
Fuller® 13 Speed: RTLO(F)-12913A; RTLO(F)-14913A; RTLO(F)-16913A; RTLO-18913A	13*	28*
Fuller® 15 Speed: RTO(F)-16915	13*	28*
Fuller® 18 Speed: RTLO(F)-14918B; RTLO(F)-16918B	13*	28*
RTLO-1898A-AS3	13*	28*

Model	Liters	Pints
Automatic		
Allison Automatic: 2500_HS, RDS P 5 Speed **	18*	38*
Allison Automatic: 3000_HS, EVS P, RDS P 5 & 6 Speed; **	27*	58*
Allison Automatic: 3500_EVS P, RDS P 5 & 6 Speed; **	27*	58*
Allison Automatic: 4000_HS, EVS P, RDS P 5 & 6 Speed **	47*	100*
Allison Automatic: 4500_HS, EVS P, RDS P 5 & 6 Speed **	47*	100*
* Approx. refill quantity; less than initial fill and fluids remain in external circuits and transmission cavities. ** Check at operating temperature and topped off as required. *** See Lubricant and Sealer specifications for these transmission lubes.		

Tire and Rim Combinations

Approved Tire and Rim Combinations

Tubeless					
Tire Size	Rim Width	Tire Size	Rim Width	Tire Size	Rim Width
9R22.5	6.75, 7.50	225/70R19.5	6.75	265/70R19.5	6.75, 7.50, 8.25
10R22.5	6.75, 7.50	235/80R22.5	6.75, 7.50	275/80R22.5	7.50, 8.25
11R22.5	7.50, 8.25	245/70R19.5	6.75, 7.50	295/75R22.5	8.25, 9.00
12R22.5	8.25, 9.00	255/70R22.5	7.50, 8.25	315/80R22.5	9.00

Lift Axle System

Maintenance Chart

Procedure	Interval
Check for proper brake operation	Daily/Per operation
Inspect for signs of structural damage, cracks or wear in all components of suspension parts (arms, hangers, axle seats, etc.)	Daily
Check for air leaks	Daily/Per operation
Check bushings for excessive wear or movement	Every 30 days
Drain condensation from tank	Dry climate – Monthly Wet climate – Daily
Torque U-bolts and all fasteners (see lift axle Torque charts)	Every 6 months
Drain interior of axle-mounted air tank	Same as other vehicle air tanks

Torque Specifications

DISC WHEEL TORQUE CHART

DISC WHEELS			
Size	Nut Mounting	Torque	
		lbf – ft	N•m
11/16 Inch	Flange	350-400	475-542
22 mm	Flange: Motor Wheel - 37.5 mm Across Flats	450-500	610-678

DISC WHEELS			
22 mm	Flange: International®/Budd - 33 mm Across Flats	450-500	610-678
NOTE: Do not use lubrication on dry threads. Where excessive corrosion exists, a light coat of lubricant on first three threads of stud on bolt is permitted. Keep lubricant away from: • hex nut and rim clamp contact surfaces; • flange nut washer surface and flat on disc wheel.			

U-BOLT NUT TORQUE CHART

Feature Code	Rear Suspension Capacity and Type	Torque	
		lbf - ft	N • m
14SAB	23,000-lb Capacity, RR, Spring, Single, with 3 Torque Rods	400-425	542-576
14SAH	18,500-lb Capacity, RR, Spring, Single Vari-Rate	370-400	502-542
14SAL	31,000-lb Capacity, RR, Spring, Single Vari-Rate, with 4,500-lb Auxiliary Multileaf Springs	370-400	502-542
14SAM	20,000-lb Capacity, RR, Springs, Vari-Rate	370-400	502-542
14SAN	23,500-lb Capacity, RR, Spring, Single, Vari-Rate	370-400	502-542
14SBM	31,000-lb Capacity, RR, Spring, Single with 3 Torque Rods	400-425	542-576
14SZB	4,500-lb Capacity, Rear Auxiliary Multileaf Springs	370-400	502-542
14TBJ	20,000-lb Capacity, International Air Suspension (IROS)	370-400	502-542
14TBZ	23,000-lb Capacity, Single, Air (Hendrickson PRIMAAX EX)	350-400	475-542
14UNW, 14UNX, and 14UNY	46,000-lb Capacity, Tandem, Air (Hendrickson PRIMAAX EX), with 72 inch, 55 inch, and 60 inch axle spacing.	350-400	475-542
14UNA	40,000-lb Capacity, International 4-Spring, Multileaf	260-300	353-407
14UNL, 14UNM, 14UNN, 14UNS, 14UNT, and 14UNU	40,000-lb Capacity, International Air Suspension (IROS)	370-400	502-542
14VAD	18,500-lb Capacity, RR, Springs, Vari-Rate, with 4,500-lb Auxiliary Rubber Spring	370-400	502-542
14VAG	20,000-lb Capacity, RR, Springs, Vari-Rate, with 4,500-lb Auxiliary Rubber Spring	370-400	502-542
14VAH	23,500-lb Capacity, RR, Springs, Vari-Rate, with 4,500-lb Auxiliary Rubber Spring	370-400	502-542
14VAJ	31,000-lb Capacity, RR, Springs, Vari-Rate, with 4,500-lb Auxiliary Rubber Spring	370-400	502-542
NOTE: For all other vendor supplied suspensions, refer to vendor's website for proper torque specifications.			

Feature Code	Front Suspension Capacity and Type	Torque	
		lbf - ft	N • m
3ACP	12,000-lb Capacity, Multileaf , Shackle Type	260-300	353-407
3ACR	18,000-lb Capacity, Multileaf , Shackle Type	260-300	353-407
3ACS	20,000-lb Capacity, Multileaf , Shackle Type	260-300	353-407
	20,000-lb Capacity, Multileaf , Shackle Type, (with SBA and CAT Engine)	325-400	441-542
3ADB	10,000-lb Capacity, Parabolic Taper Leaf	260-300	353-407
	10,000-lb to 20,000-lb Capacity, Parabolic Taper Leaf, (with SBA and CAT Engine)	325-400	441-542
3ADC	12,000-lb Capacity, Parabolic Taper Leaf	260-300	353-407
3ADD	14,000-lb Capacity, Parabolic Taper Leaf	260-300	353-407
3ADE	16,000-lb Capacity, Parabolic Taper Leaf	260-300	353-407
3ADG	18,000-lb Capacity, Parabolic Taper Leaf	260-300	353-407
3AGA	20,000-lb Capacity, Parabolic Taper Leaf	260-300	353-407
	20,000-lb Capacity, Parabolic Taper Leaf, (with Set Back Axle and CAT Engine)	325-400	441-542
3AGU	14,000-lb Capacity, Multileaf , Shackle Type	260-300	353-407
3AHL	22,000-lb Capacity, Parabolic Taper Leaf	325-400	441-542
3WAJ	Auxiliary Air Bag Springs (Right Side)	260-300	353-407
3WAK	Auxiliary Air Bag Springs (Left Side)	260-300	353-407

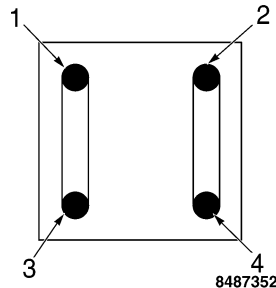
For vehicles with Hendrickson suspension (14UHK only), the torque value of the four suspension saddle bolts, if applied at the head, are 500 ft-lbs.(678 N•m). If applied at the nut, the torque value is 400 ft-lbs.(543 N•m).

See Lubrication and Maintenance Interval Chart, Axle U-bolts – Retorque, for maintenance retorque interval.

SPRING U-BOLT CHECKS

Check U-Bolt Nuts and re-torque every 36,000 miles (57, 936 km) after initial 1,000 mile re-torque.

LIFT AXLE TORQUE CHARTS



Fixed Axle U-Bolt Torque

The U-Bolts must be tightened and torqued using the following cross pattern sequence and illustration. The U-Bolt Torque chart applies only to Fixed lift axles.

1. Tighten 1 and 4 to partial torque.
2. Tighten 2 and 3 to partial torque.
3. Repeat steps 1 and 2 tightening all four bolts to full torque.

Lift Axle U-Bolt Nut Torque Chart

U-Bolt Size (UNF – Grade 8) Size in inches	3/8	1/2	5/8	3/4	7/8	1	1 1/8
Min. Torque (lbf-ft)	15	40	120	200	400	650	800
Max. Torque (lbf-ft)	20	60	150	250	450	750	900
NOTE: Torque values DO NOT apply to air springs or lower grade fasteners.							

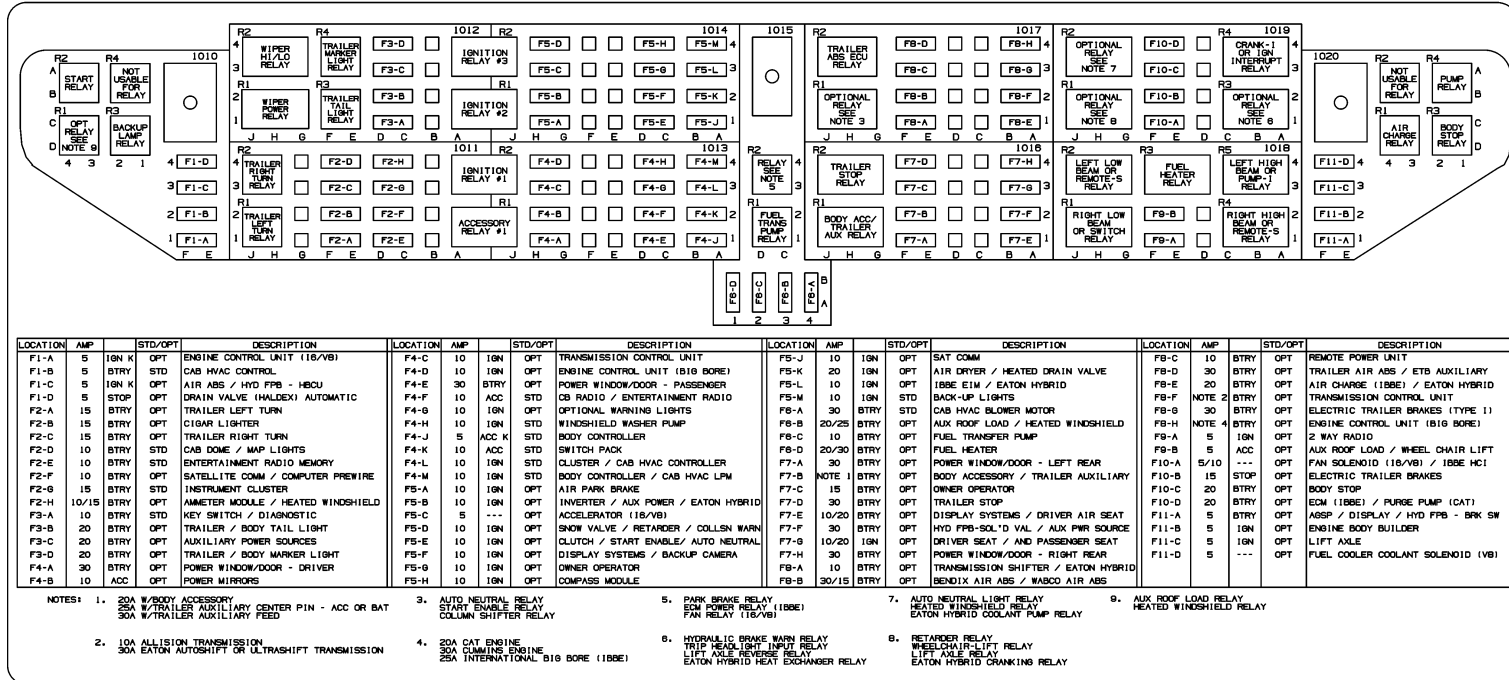
The following chart applies to both Steerable and Fixed Lift Axles.

Capscrew/Bolt Torque Chart

Capscrew-Bolts (UNF – Grade 8) Size in inches	3/8	1/2	5/8	3/4	7/8	1	1 1/8
Min. Torque (lbf-ft)	25	50	150	300	500	700	900
Max. Torque (lbf-ft)	35	75	200	350	550	800	1000
NOTE: Torque values DO NOT apply to U-BOLTS.							

Fuse Charts

The following fuse illustrations represent the fuse panel layouts. The actual vehicle fuse panels will vary depending on the vehicle options.



8487321

WorkStar® Series Light Information

Lamp Description	Candlepower or Watt	Bulb P/N
Cab Dome Light	12 Watts	211-2
Cab Mount Clearance/Marker Light	3 CP	GE193
Headlight	65 Watts	GE9007
Fog Light	56 Watts	VH550
Front Park/Marker/Turn Light		2356
Side Marker Light		2548
Tail/Brake/Turn Light	32/3 CP	1157
Back-up Light	32 CP	GE1156
Ashtray Light	N/A	N/A

Filter List

Filter part numbers and/or specifications may change during the life-cycle of this vehicle. Current information on the appropriate

chassis and engine filters for your vehicle can be obtained by contacting your local International dealer parts department. If you need assistance finding a local International dealer, use the Dealer Locator at internationaltrucks.com.

SECTION 8 — CUSTOMER ASSISTANCE

Service Information

The continued premium performance of this International® chassis can best be assured through proper servicing. This can be accomplished in several ways.

International Truck Dealers ... Your local International Truck dealer provides an excellent resource – through his knowledgeable, experienced, and well equipped service staff – to handle all your maintenance, repair, and replacement work.

Service Publications ... Those persons who are properly trained technicians with the facilities, equipment, tools, safety instructions and know-how to properly and safely service a bus, medium duty and/or heavy duty chassis can purchase the appropriate service manual sections applicable to specific vehicle components or areas of this International® vehicle. Engine diagnostic manuals and engine service manuals for all current International® diesel engines are also available to these trained persons for purchase. Information on the purchase of available service publications for this chassis can be found on the internationaltrucks.com Web site, or by contacting your local International dealer.

These service resources are also available via the Internet, by an annual subscription to the **Fleet ISIS® Web site**, or via the **iService DVD**. Information on the Fleet ISIS Web site's content,

availability, and fee structure can be obtained by contacting your local International Truck dealer or, in the case of a National Account, an International Fleet Service Manager.

The iService DVD contains all currently available chassis and component service information, including TSI letters, Electrical Circuit Diagrams, Electrical System Troubleshooting and other technical information, for virtually all International® models and MaxxForce® engines.

International Truck Warranty Program

Standard Warranty • Optional Service Contracts • Custom Service Contracts • Performance PM® Service

The International Truck Warranty Program provides International customers with a better choice when it comes to Standard Warranty and Service Contract Coverage. The **Standard Warranty** is the first tier of the International Truck Warranty Program. It provides the foundation for all extended coverages.

Vehicle Coverage, Towing, Engine and Engine Electronics, Major Component, and Pre-Packaged System Component protection can be obtained under the International Warranty Program through **Optional Service Contracts**.

Custom Service Contracts, the most flexible aspect of the International Truck Warranty Program, can provide extended protection that is specifically tailored to meet each customer's specific requirements.

Finally, through **Performance PM® Service**, customers can obtain a comprehensive preventative maintenance program designed to ensure consistency in pricing and the level of service received.

ADVANTAGES of International Truck Warranties

- Extends warranty protection to specified length and component coverage to suit individual needs
- Honored at over 1,000 International Truck Dealer locations in North America
- Stabilized and predictable maintenance costs
- Increased owner confidence and peace of mind
- Improved resale value on your vehicle – International Truck Warranties may be transferable for a nominal fee. Contact the Service Contract Center 1-800-346-4429 option 1 for transferability
- Most coverage is 100% parts and labor with **NO DEDUCTIBLES**.
- Customized warranty programs are offered to suit your needs - your specification - your vocation

- International®, North America's leader in truck manufacturing, is also North America's leader in warranty value
- Optional Service Contracts, Custom Service Contracts, and Performance PM® Service, designed to assure the lowest possible cost of ownership, are also available
- **Optional Service Contracts** have been pre-packaged to fit most common applications
- **Custom Service Contracts** are designed to meet your individual needs

HOW TO OBTAIN International Truck Warranties

- **Standard Warranty:** Your new International vehicle is automatically registered in the International Truck Warranty system at the time of delivery. No further action on your part is required.
- **Optional Service Contracts, Custom Service Contracts, or Performance PM® Service:** These programs are sold exclusively through your International dealer. The vehicle must also have coverage remaining under the Standard Warranty. For extended warranty purchases between, 181 through 365 days from DTU and <100,000 miles (160,000 km) an additional fee will be assessed. If you would like the predictable cost of ownership and peace of mind provided by the International Truck Warranty Program, please contact your International dealer today!

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