TranStar®

8600

Operation and Maintenance Manual

Navistar, Inc.

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IMPORTANT

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

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, (e.g., 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

It is important that the applicable vehicle identification number (VIN), engine serial number and or component feature codes are recorded. These numbers are required to obtain pertinent information for this vehicle or engine.

VEHICLE IDENTIFICATION NUMBER (VIN)

ENGINE

Feature Code:	Serial Number:

FRONT AXLE

Feature Code:	Serial Number:

REAR AXLE

Feature Code:	Serial Number:

TRANSMISSION

Feature Code:	Serial Number:

TRANSFER CASE

Feature Code:	Serial Number:

CUSTOMER ASSISTANCE CENTER
1-800-44-TRUCK (1-800-448-7825)

Navistar, Inc.
2701 Navistar Drive
Lisle, IL 60532 USA
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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.

CAUTION

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.

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, install wheel chocks.

Diesel Exhaust Fluid (DEF) Storage

Diesel Exhaust Fluid has a limited shelf life, both in the vehicle's diesel exhaust fluid (DEF) tank and in storage containers.

The following conditions are ideal for maintaining DEF quality and shelf life during prolonged transportation and storage:

- Storage temperature between 23°F and 77°F (-5°C and 25°C)
- Store in sealed containers to avoid contamination
- Avoid direct sunlight

Long term in vehicle storage (in excess of 6 months) is not recommended. If long term storage is necessary, periodic testing of the Diesel Exhaust Fluid is recommended to ensure proper DEF concentration.

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, was designed, built, and equipped to conform at the time it left Navistar control with all applicable U.S. Environmental Protection Agency Noise Control Regulations.

This warranty covers this vehicle as designed, built, and equipped by Navistar and is not limited to any particular part, component, or system of the vehicle manufactured by Navistar Defects in design, assembly, or in any part, component, or system of the vehicle as manufactured by Navistar, which at the time it left Navistar control, 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 removing or rendering inoperative by any person, other than for purposes of maintenance, repair, or replacement, 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.
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:

1. Air Intake System: Removal of air cleaner, intake silencer, or piping.
2. Acoustical Shielding (Body): Removal of wheel well splash shields, cab shields, or acoustical (underhood) insulation.
3. Cooling System: Removing or rendering inoperative the fan clutch and / or removal of fan shrouds.
4. Engine and Driveline System: Removing or rendering engine speed governor inoperative so as to allow engine speed to exceed manufacturer specifications and / or removal of engine block shield, oil sump shield, or transmission enclosures.
5. Changes in hardware, software, calibration or programmable parameters that increase engine operating speed or horsepower other than those provided by Navistar.
6. Exhaust System: Removing or rendering inoperative exhaust system components, including muffler, resonator, or tailpipe.

NOTE: Refer to Section 7 – Maintenance Instructions for proper maintenance, use and repair of noise emission items.

Emission Control Systems

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

HD-OBD Foreword

Heavy Duty On-Board Diagnostics (HD-OBD) is a U.S. Government mandated standard for all 2013 and later Class 4 and above vehicles with a Gross Vehicle Weight Rating (GVWR) of 14,001 pounds or more. The HD-OBD system monitors the engine and aftertreatment systems to verify they are operating within emissions limits. If an emissions fault is logged, the Malfunction Indicator Lamp (MIL) will illuminate and one or more fault codes will be set.

The HD-OBD system operates similarly to previous power train control systems by storing fault codes and turning on the MIL. If the problem that caused the fault goes away, the code will clear and the MIL will go out after certain operating conditions have been met. The vehicle may have to be operated several times before this takes effect.

Supplemental Federal Emission Control System Warranty

The United States Environmental Protection Agency adopted new heavy-duty Greenhouse Gas (GHG) vehicle regulations on 15 September 2011. This vehicle may be certified to the GHG regulations. For certified vehicles, additional GHG emissions control system warranty covers certain vehicle components. This Supplemental GHG Federal Emission Control System Warranty coverage for these vehicle components will be managed according to current Federal Emission Control System Warranty process. The GHG emission control system warranty applies to the below listed vehicle components if they meet the following two conditions:

1. The vehicle and / or GHG emission control system component is designed, built, and equipped so it conforms at the time of sale to the ultimate purchaser with the requirements of the GHG regulations, and such component is an emission control and appears on the GHG vehicle emission certification label, and
2. The vehicle and / or GHG emission control system component is free from defects in materials and workmanship that cause the vehicle to fail to conform to the GHG requirements during the applicable supplemental warranty period.

GHG Emission Control System Warranty Period

The GHG emission control system warranty period begins on the date the new GHG certified vehicle is delivered to the owner or operator. The period of coverage is the greater of the base mechanical warranty or:

- Five (5) years or 50,000 miles, whichever comes first, for spark-ignition and light heavy-duty diesel vehicles with GVWR below 19,500 pounds.
- Five (5) years or 100,000 miles, whichever comes first, for medium and heavy heavy-duty vehicles with GVWR equal to or greater than 19,500 pounds.
- Two (2) years or 24,000 miles, whichever comes first, for tires.

Additional Components Covered

Applies to all certified models:

The GHG emission-related warranty covers the following components if they meet the two conditions listed above:

- Hybrid system components (where applicable),
- Components whose failure would increase a vehicle's evaporative emissions (for vehicles subject to evaporative emission standards), and
- Tires

Applies only to certain certified Fifth wheel equipped TranStar models:

The GHG emission-related warranty covers:

- Vehicle speed limiters,
- Idle shutdown systems, and

- Fairings to the extent such emission-related components are included in the certified emission controls and are listed on the vehicle GHG certification label. The GHG emission-related warranty covers all components whose failure would increase a vehicle's emissions of air conditioning refrigerants for vehicles subject to air conditioning leakage standards.

Applies only to certified vehicles equipped with innovative technologies

The GHG emission-related warranty covers components certified as innovative technologies that are part of the certified emission controls. Please contact your authorized International Dealer for further information.

Supplemental Federal Emission Control System Maintenance, Repair, and Replacement

Your vehicle may comply with the Greenhouse Gas (GHG) regulations adopted by the Environmental Protection Agency on 15 September 2011. As owner or operator of a GHG compliant vehicle, your vehicle, and GHG emissions control system components should be properly maintained in good working order.

Repair and replacement of GHG emission control system components should be done to original vehicle manufacturers' specifications to ensure proper function of the vehicle. Replacement tires should have GHG emission performance as good or better than tires originally equipped on the vehicle. Consult with the tire manufacturer for tire specifications.

The United States Environmental Protection Agency allows limited modification of your vehicle and its GHG emission control system components. Please refer to applicable regulations for allowable and prohibited modifications.

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. To notify Navistar 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.

To contact NHTSA, you may either call the Auto Safety Hotline toll-free at 1-800-424-9393 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, that could cause a crash or could cause injury or death, you should immediately contact NavistarInc. Canada and then Transport Canada.

To contact Navistar, Canada, you may either call the Regional Service Manager (Canadian Sales Region) 1-905–332–3323 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 door frame. 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 non-truck 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

WARNING

To prevent property damage, personal injury, and / or death, read and understand the appropriate manual for the specific equipment in question before operating. 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.

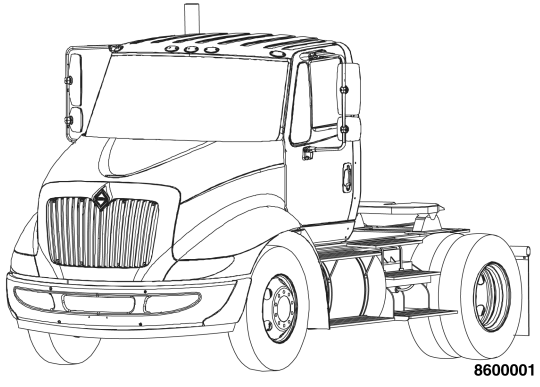
NOTE: This vehicle may be equipped with electronic application-specific options not described in this operator manual. Many of these features are supplied with rocker switches that have custom labels applied. The presence of these options as factory installed can be verified from the Line Set Ticket 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

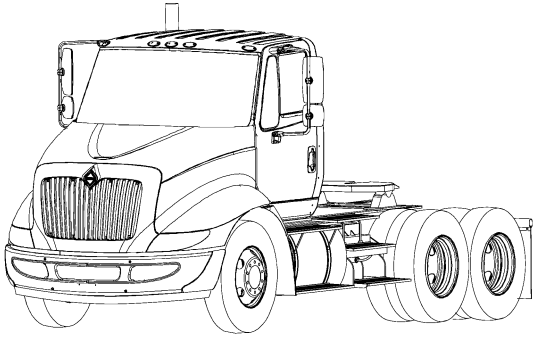
Available Models

4x2



The 4x2 configuration includes the 8600 model.

6x4



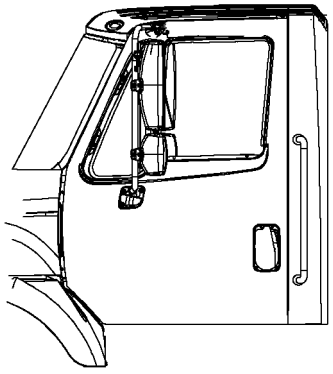
8600004

The 6x4 configuration includes the 8600 model.

Available Cabs

The International® TranStar® Series Truck is available with a standard cab or an extended cab. Each cab has its own unique features and uses.

Standard Cab



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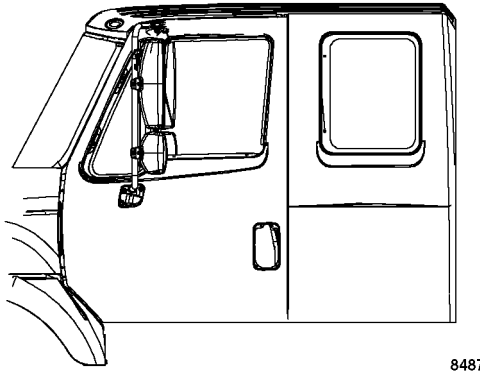
Extended Cab



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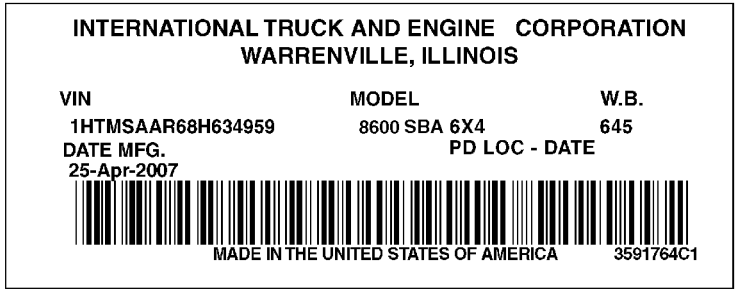
Vehicle Identification

The following illustration represents a typical VIN tag. The actual VIN tag may vary.



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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.

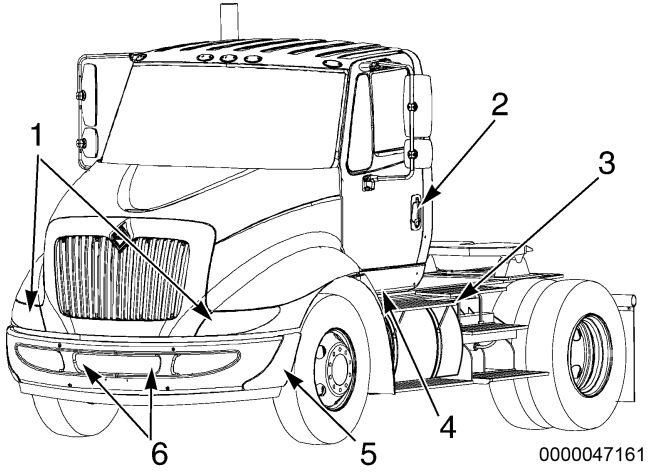
Line Set Ticket

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

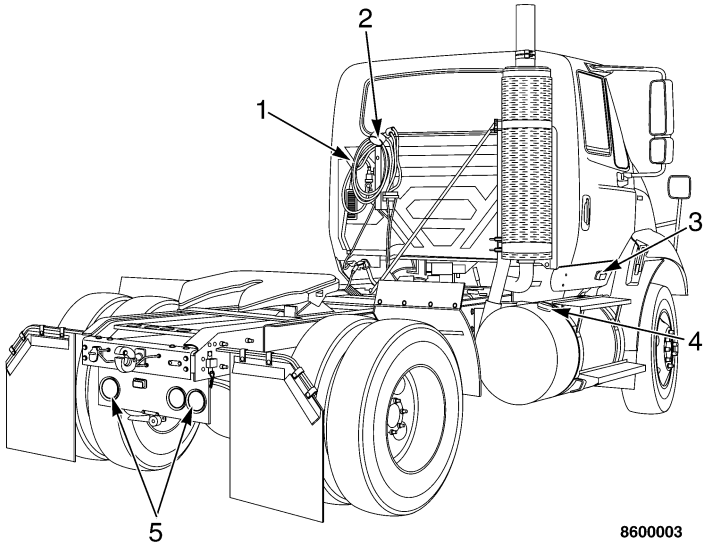
Each vehicle is provided with a Line Set Ticket (code sheet) which lists identification code numbers of component units used to build the vehicle.

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 (For Vehicles Not Equipped with Selective Catalytic Reduction [SCR] System)

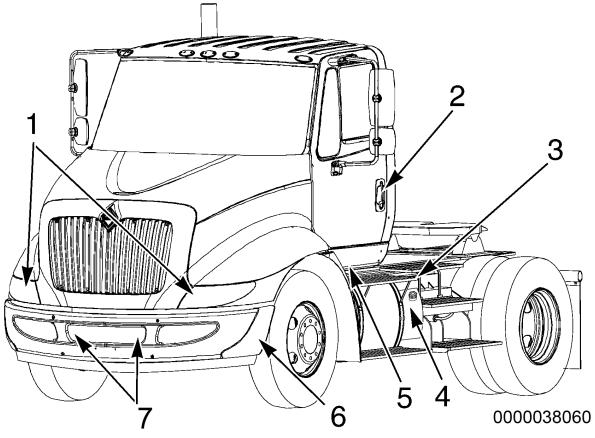


1. Headlights
2. Door Handle
3. Step
4. Side Marker / Turn Light
5. Bumper
6. Fog Lights

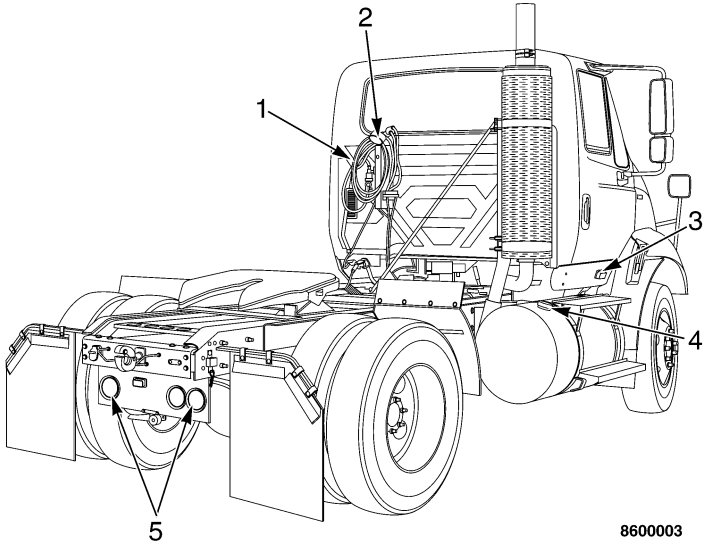


1. Glad Hand Storage Bracket
2. Work Light
3. Side Marker / Turn Light
4. Fuel Cap
5. Taillights

Exterior Components (For Vehicles Equipped with Selective Catalytic Reduction [SCR] System)



1. Headlights
2. Door Handle
3. Step
4. Diesel Exhaust Fluid (DEF) tank
5. Side Marker / Turn Light
6. Bumper
7. Fog Lights



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

Cab Entry and Exit

WARNING

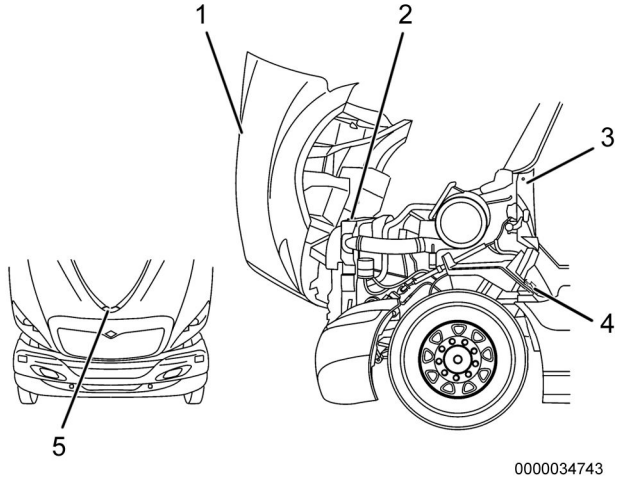
To prevent property damage, personal injury, and / or death, do not step or climb upon any vehicle surface unless it is slip resistant and a handhold is provided.

WARNING

To prevent property damage, personal injury, and / 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.**

Tilt Hood



1. Hood
2. Hood Restraining Shock
3. Cowl
4. Hood Latch
5. Hood Handle

WARNING

To prevent property damage, personal injury, and / 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.

CAUTION

To prevent damage to the windshield wipers, return them to their normal position before opening or closing hood.

CAUTION

To prevent hood and / or painted surfaces, adhere to the following procedure.

NOTE: To avoid pinching, do not lift or lower the hood from the side.

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

WARNING

To prevent property damage, personal injury, and / or death, when servicing the vehicle, park on a flat level service, set the parking brake, turn the engine off, and install wheel chocks.

WARNING

To prevent property damage, personal injury, and / or death, 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.

WARNING

To prevent property damage, personal injury, and / 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.

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 pretrip 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 ensure 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.

Illustrations in this section identify key locations of inspection items. The illustrations herein are typical and may not represent all engine applications.

Vehicle Inspection

Preparation

NOTE: Perform the following procedures prior to conducting the pretrip inspection.

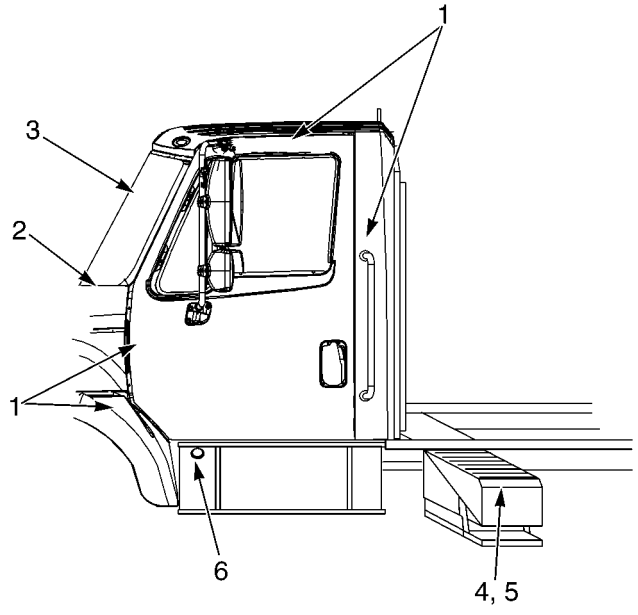
- Set parking brakes.
- Turn on parking lights and hazard lights.
- Unhook the hood latches and raise the hood.
- Check under the vehicle for oil, fuel, coolant leaks, or other signs of damage.
- Use pull cables or open drain cocks to allow air tanks to expel any existing water. Release pull cables or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

Exterior Lights Check

Perform an automatic check of all exterior lights by doing the following steps:

1. Place the ignition switch in the ON or ACC position, place the transmission in (N) Neutral, and set the Parking Brake.
2. Press the LMP check switch to activate the system.
3. The exterior light check will now cycle all vehicle lights except the backup light(s). The test flashes the exterior lights ON and OFF in three two second cycles. The first two-second period illuminates park lights (clearance, identification, side marker, and license plate lights), turn signal lights, low beam headlights, and fog lights. The second two second period illuminates park lights (clearance, identification, side marker, and license plate lights), high beam headlights, brake lights, and work lights. The third two-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 (For Vehicles Not Equipped with Selective Catalytic Reduction (SCR) System)



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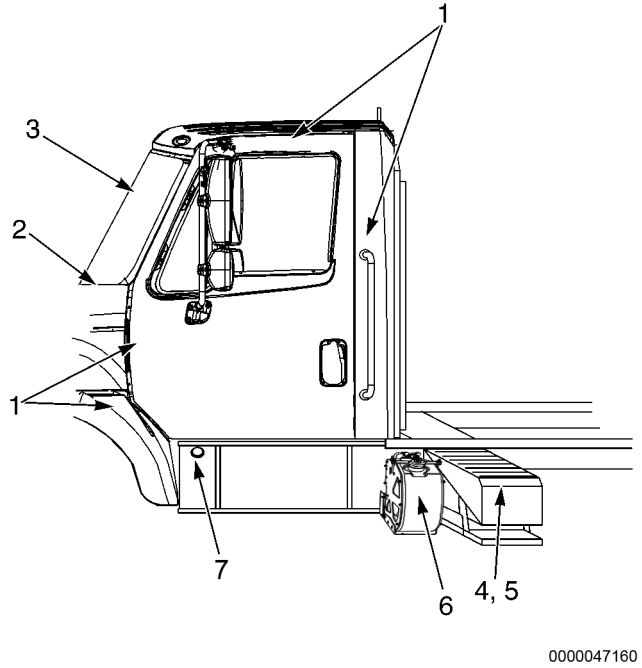
1. Cab Structure: Check body panels, such as doors, air shield, sunshade, and cab for signs of breaks or damage. Check condition of cab mounting brackets and tilt hood latches.
2. Wipers: Check windshield wiper arms for proper spring tension and wiper blades for damage.
3. Windshield: Check for damage 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(s): 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. Ensure mounting straps are secure and not chafing tank.

Left Side Cab (For Vehicles Equipped with Selective Catalytic Reduction (SCR) System)



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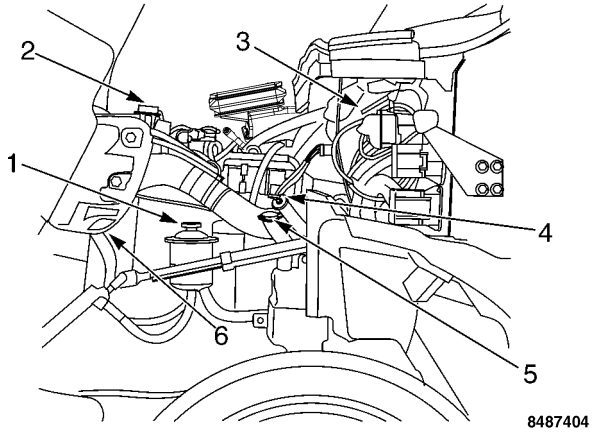
1. Cab Structure: Check body panels, such as doors, air shield, sunshade, and cab for signs of breaks or damage. Check condition of cab mounting brackets and tilt hood latches.
2. Wipers: Check windshield wiper arms for proper spring tension and wiper blades for damage.
3. Windshield: Check for damage 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. Diesel Exhaust Fluid (DEF) Tank: Check to see that the DEF tank and cap are secured and make sure there are no leaks or damage at the tank, DEF lines, or coolant lines.
7. Fuel Tank(s): 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. Ensure mounting straps are secure and not chafing tank.

Left Engine Compartment

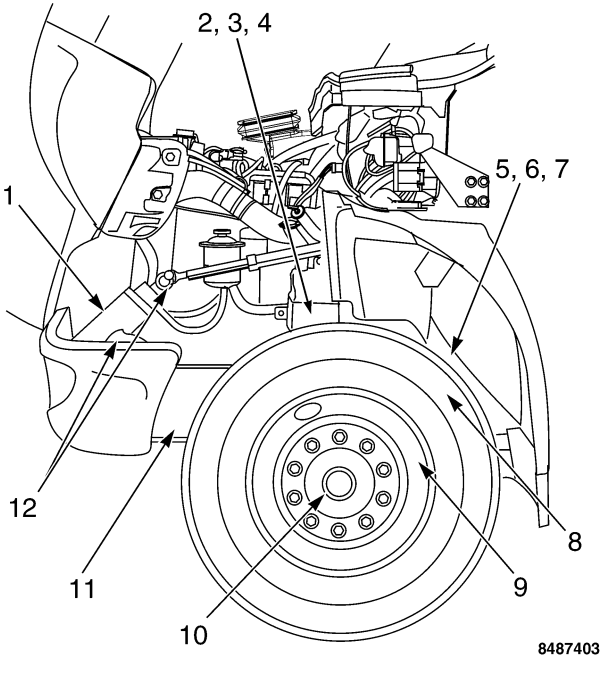


1. Power Steering Fluid: Verify that the fluid level is between the Cold or Hot (as applicable) MIN and MAX marks.
2. Coolant Level: Do not remove pressure cap unless coolant is cool. Ensure fluid level is between the minimum and maximum fluid level range as marked on the plastic translucent reservoir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



WARNING

To prevent property damage, personal injury, and / or death, if wheels or tires must be changed, obtain expert tire service help. Mounting and dismounting of tires should only be performed by qualified personnel using necessary safety procedures and equipment.

WARNING

To prevent property damage, personal injury, and / 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.

WARNING

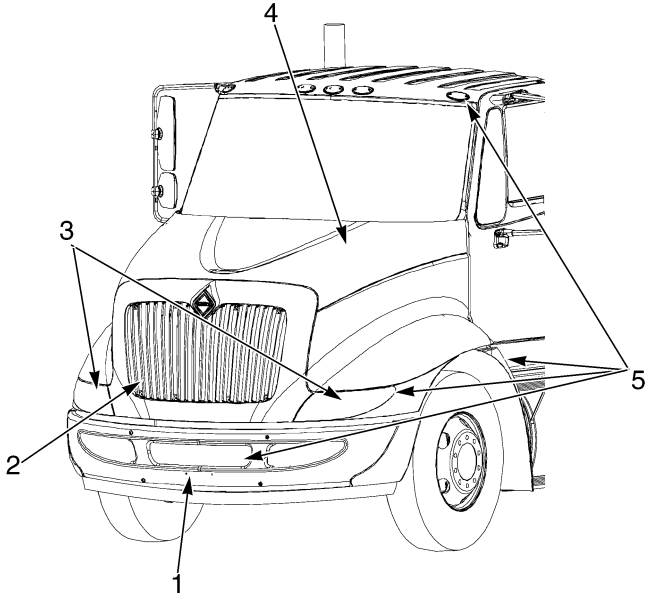
To prevent property damage, personal injury, and / or death, use only the following procedure to remove the pressure cap from the radiator or expansion tank. Allow the engine to cool first. Wrap a thick, heavy cloth around the cap. Unscrew the cap slowly to allow pressure to release from under the cap.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

NOTE: 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. Tire: Check tread depth and tire inflation and note if tread is evenly worn. Minimum tread depth is 4/32 inch on steering tires. Look for cuts or other damage to the tread or sidewalls. Check for missing, broken, or damaged valve cap and stem.
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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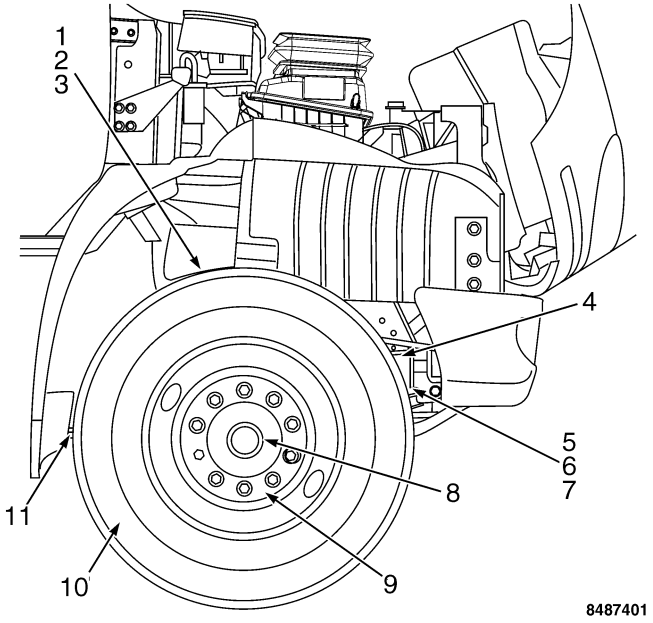
1. Bumper: Inspect for damage and security.
2. Grille: Inspect for damage and security. Check bug screen for damage and cleanliness.
3. Headlights: Lenses should be clean. If equipped, check daytime running lights.
4. Hood and Fenders: Check hood panels and fenders for signs of breaks or damage. Ensure hood opens and closes properly.
5. Lighting System: Lower hood and inspect parking, clearance, and identification lights, and 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



WARNING

To prevent property damage, personal injury, and / 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.

WARNING

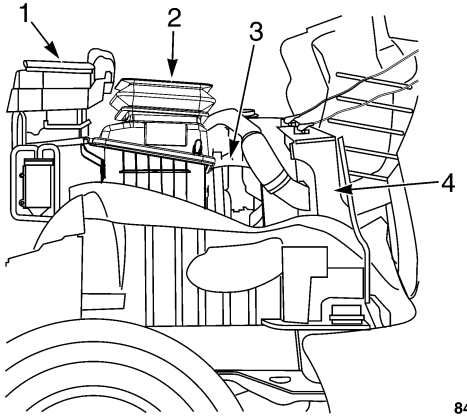
To prevent property damage, personal injury, and / or death, electrical circuits are designed with a particular wire gauge to meet the fuse and circuit breaker current rating. Do not increase size of fuse or circuit breaker or change type of breaker supplied with your truck, because this could cause wiring to overheat and possibly burn.

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. Tire: Check tread depth and tire inflation and note if tread is evenly worn. Minimum tread depth is 4/32 inch on steering tires. Look for cuts or other damage to the tread or sidewalls. See if valve caps and stems are missing, broken, or damaged.
11. Steering Linkage: Inspect connecting links, arms, and rods for worn, damaged, loose, or missing components.

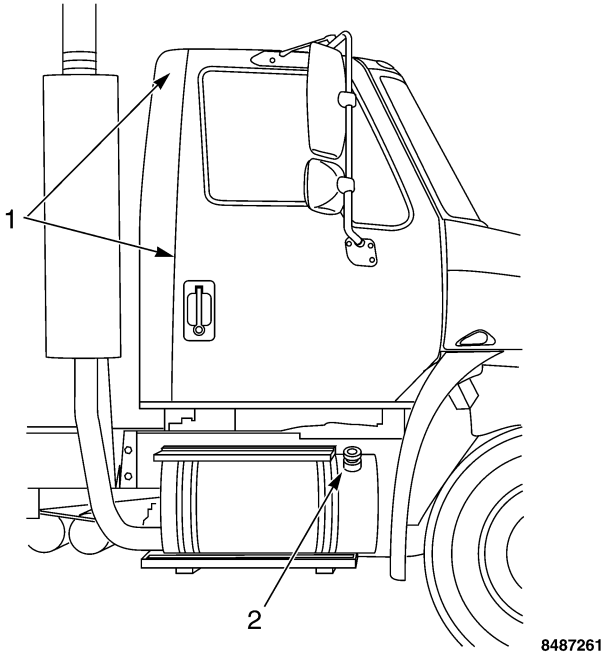
Right Engine Compartment



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

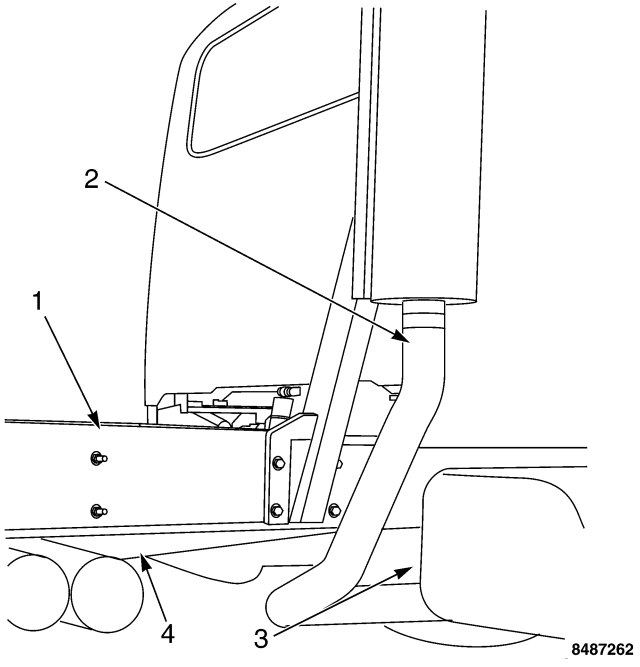


WARNING

To prevent property damage, personal injury, and / or death, 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 and wires may cause vehicle malfunction.

1. Cab Structure: Check body panels, such as doors, fenders, and cab for signs of breaks or damage. Check condition of cab mounting brackets, 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 and fuel lines. Check to see that tank mounting hardware is secure.

Right Side Under Vehicle



WARNING

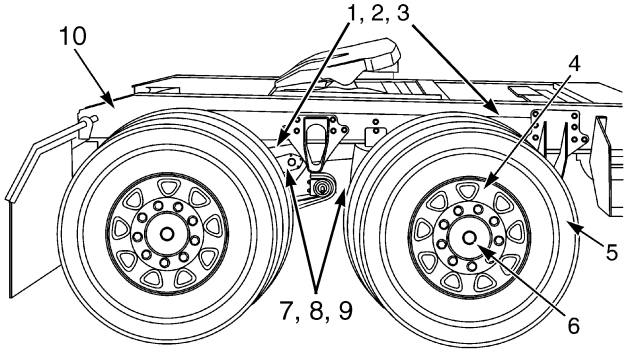
To prevent property damage, personal injury, and / or death, maintain adequate clearance between all parts of the exhaust system and all hoses, wires, and lines for engine cooling, brake system, fuel system, power steering system and electrical system. Heat damage to hoses, wires, or lines may cause vehicle malfunction.

NOTE: The illustration is for reference only and may differ from the actual vehicle.

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 buildup 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.

Right Rear of Vehicle



WARNING

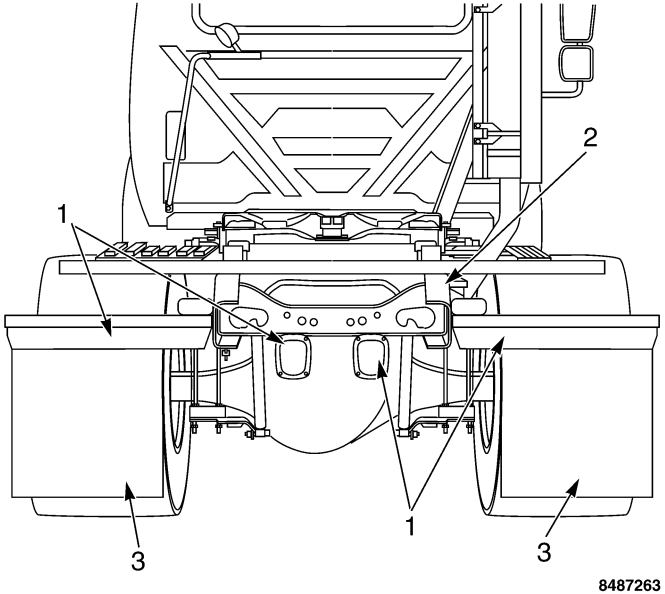
To prevent property damage, personal injury, and / or death, if wheels or tires must be changed, obtain expert tire service help. Mounting and dismounting of tires should only be performed by qualified personnel using necessary safety procedures and equipment.

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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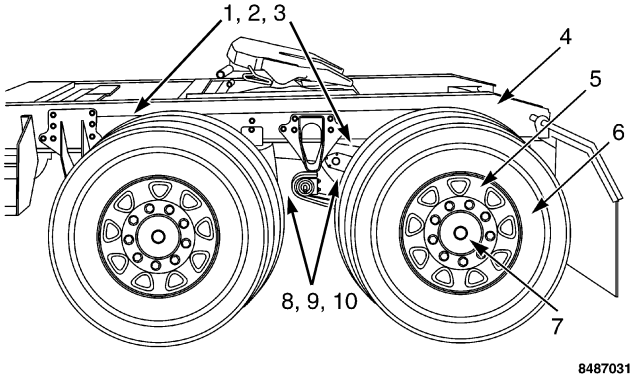
1. Lights and Reflectors: Check to see that reflectors and lights are clean. Make sure none are missing or broken. Rear running lights should be clean, not broken, and red in color.
2. Frame: Check for cracks or bends in frame. Make sure there are no loose, cracked, bent, broken, or missing crossmembers 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, damage, and chafing. Listen for audible air leaks.

Left Rear of Vehicle



WARNING

To prevent property damage, personal injury, and / or death, for field maintenance, only inflate and load tires to the maximum of the least-rated tire on the axle. 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.

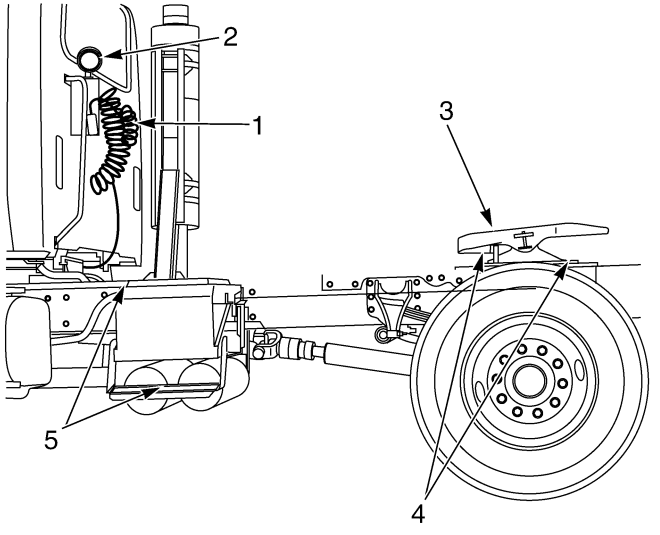
1. Brake Chamber and Hoses: Check for cracked, worn or frayed hoses and for secure couplings. Check to see that the brake chambers are not cracked or dented and that they are securely mounted. Check for broken, loose, or missing parts.
2. Slack Adjuster: Check slack adjuster and chamber push rod travel. When pulled by hand, push rod should not move more than approximately 1 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 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 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



1. Trailer Coupling Cords: Inspect air lines, coupling gaskets, and 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 fifth 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.
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 (379 kPa) pressure. The low air pressure alarm should stop when the air pressure reaches 60 - 76 psi (414 - 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 instrument panel gauge cluster 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 - 135 psi (862 - 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 indicator 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

WARNING

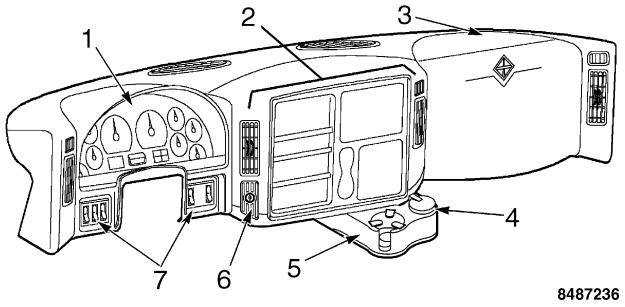
To prevent property damage, personal injury, and / or death, read and understand the appropriate manual for the specific equipment in question before operating. This vehicle may be equipped from the factory with electrical switches intended to operate equipment that was installed by a Truck Equipment Manufacturer (TEM). Instructions, Cautions, and Warnings for this additional equipment will NOT be found in this manual.

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.

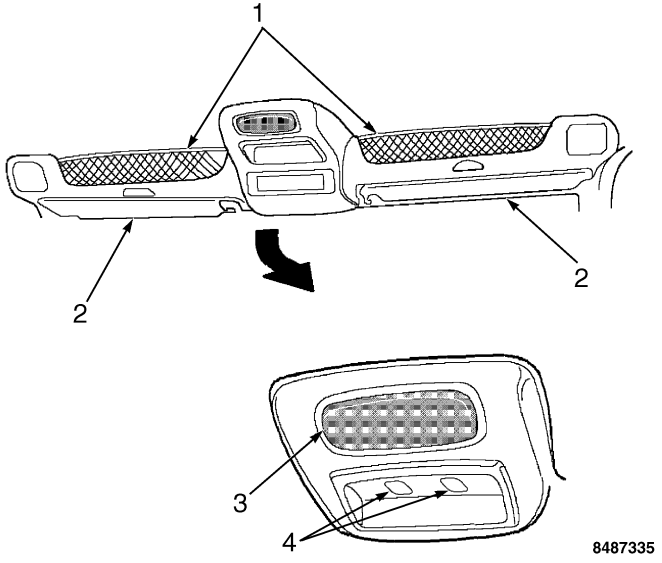
Dash Components



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).

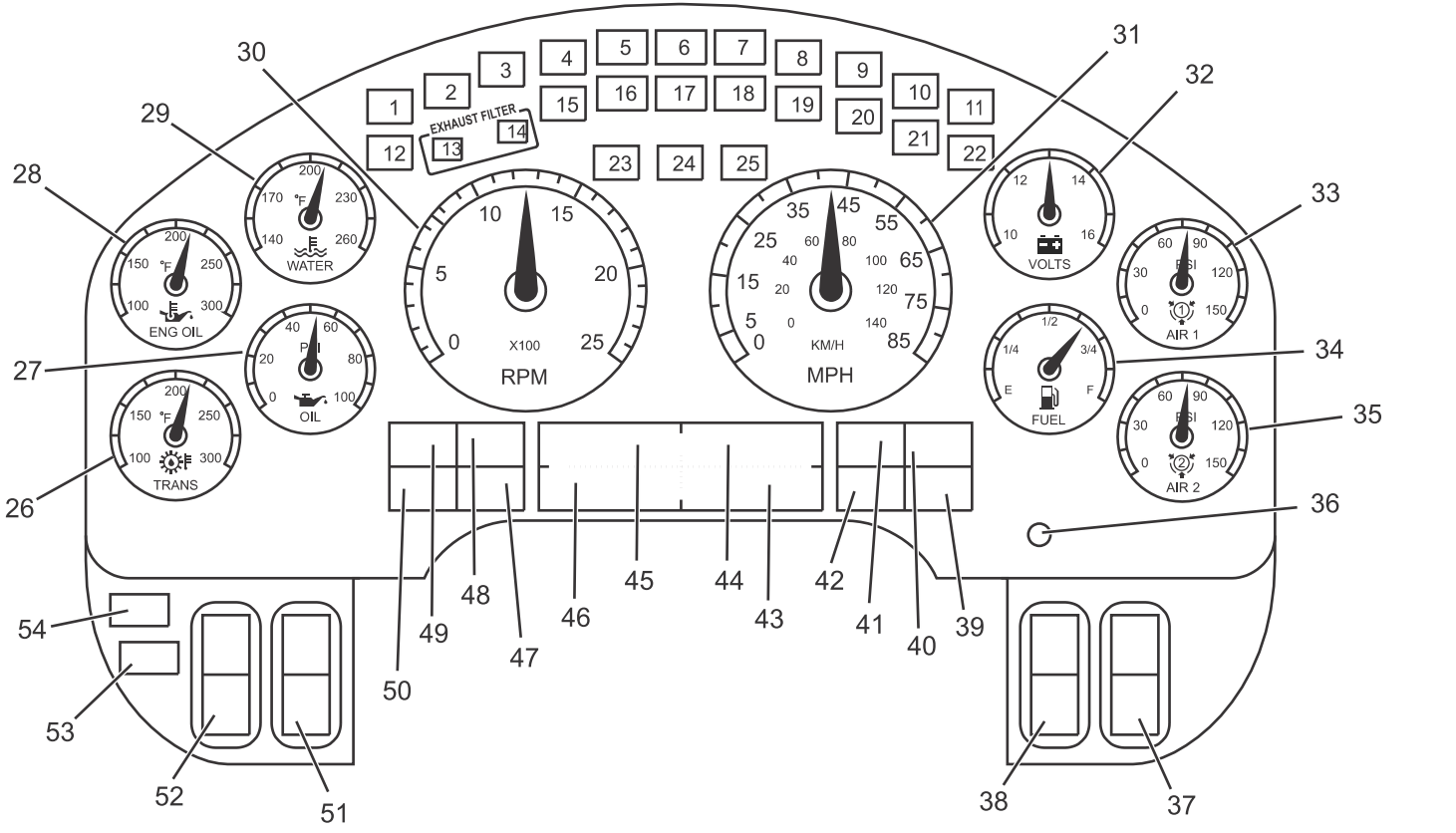


1. Storage pockets
2. Sun Visors
3. Dome Lamp Switch
4. Map Lights

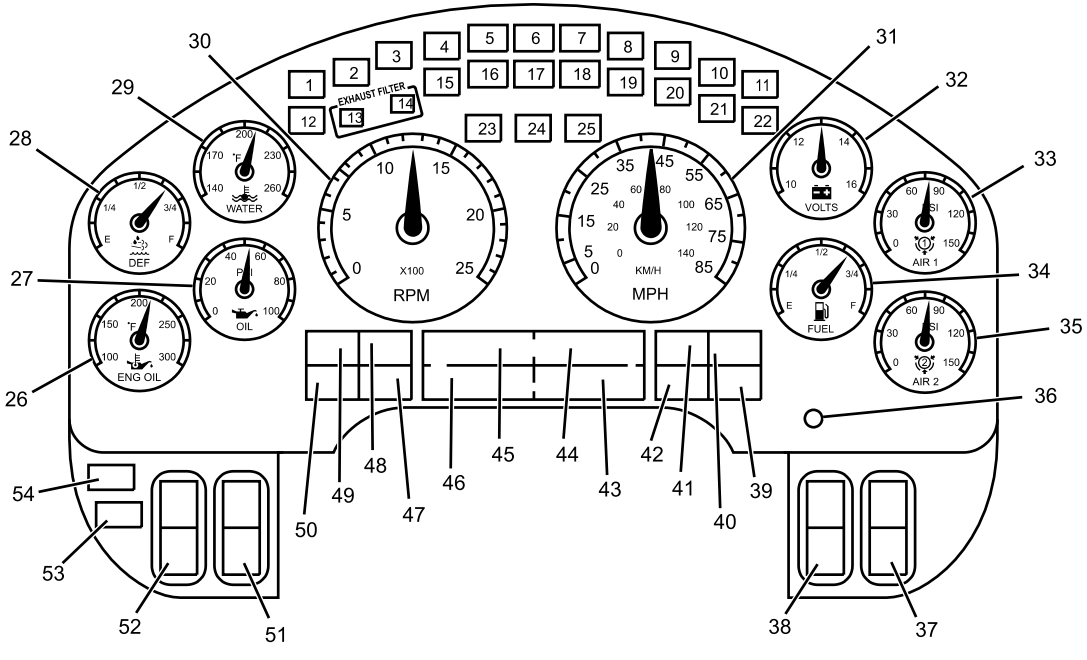
Instrument Panel Gauge Cluster

The instrument panel gauge cluster includes the instrument gauges, warning indicators, and an Integral Digital Display, which provides the odometer reading, transmission gear indication, 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.

For Vehicles Not Equipped with Selective Catalytic Reduction (SCR) System:



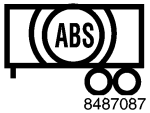
For Vehicles Equipped with Selective Catalytic Reduction (SCR) System:



Warning Indicators

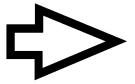
The instrument panel gauge cluster contains 25 individual LED warning indicators. These indicators are used to monitor vehicle operation and indicate a WARNING or STOP condition. These warning indicators are driven by the software in the instrument panel gauge cluster. At ignition, the warning indicators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

Item No.	Item	Description
1	 3813045	Optional Wait to Start Lamp • Illuminates YELLOW when intake air heaters and glow plugs are in operation and special starting procedures are required. Duration of Wait to Start will vary upon ambient air temperature. • Flashes YELLOW when optional engine starting protection activated. Optional feature prevents engine cranking to cool starter motor and prevent burn out. Once starter motor has cooled, normal function is restored.
2	 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	AWL - The Amber Warning Lamp (AWL) illuminates when the vehicle needs to be serviced at the first available opportunity. This lamp may be associated with information found in **Exhaust Aftertreatment** section.
5	 8487086	RSL - The Red Stop Lamp illuminates RED when a serious problem has occurred. This lamp is accompanied by a message on the odometer display and an AUDIBLE ALARM. If the Red Stop Lamp illuminates, immediately pull the vehicle safely off the roadway, turn on flashers, set the parking brake, place warning devices, and stop engine. The engine should not be restarted prior to being serviced.
6	 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	 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		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.
		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		Illuminates YELLOW when a trailer antilock brake system malfunction has been detected. If the ABS indicator stays illuminated or continues to flash, have the system serviced immediately.
11		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		For vehicles equipped with Selective Catalytic Reduction (SCR) system: Illuminates YELLOW (Solid or Flashing) when the Diesel Exhaust Fluid (DEF) level is low. For details, see **Exhaust Aftertreatment > Selective Catalytic Reduction**. For vehicles not equipped with Selective Catalytic Reduction (SCR) system: this field is not in use.
13		Illuminates YELLOW when exhaust system components are operating under normal conditions and exhaust gases are at extremely high temperatures.
14		Diesel Particulate Filter (DPF) status indicator: Illuminates YELLOW (Solid or Flashing) to indicate the need to regenerate the Diesel Particulate Filter. (See **Exhaust Aftertreatment > Exhaust Diesel Particulate Filter Regeneration**).
15		MIL - The Malfunction Indicator Lamp (MIL) illuminates when the On-Board Diagnostics (OBD) detects a Malfunction related to the emissions control system. The illuminated MIL indicates that the vehicle needs to be serviced at the first convenient opportunity. Lamp may remain active after repair until system operation confirms repair.

16	SERVICE (P) 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	PTO 8487082	Illuminates YELLOW when the PTO function (if installed) is activated.
21	ABS 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 fault repaired or face fines.

Gauges

There are 10 gauges in the instrument panel gauge cluster to help monitor the vehicle while in service. Most gauges have in-gauge warning indicators that 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 the cause of the gauge indication that is out of acceptable range. Metric versions of the gauges and speedometer are available as an option.

26	 0000037141	For vehicles not equipped with Selective Catalytic Reduction (SCR) system: Indicates the transmission lubricant temperature in degrees Fahrenheit (°F) (optional).
	 0000036961	For vehicles equipped with Selective Catalytic Reduction (SCR) system: Indicates the engine lubricant temperature in degrees Fahrenheit (°F) (optional).
27	 0000036962	Indicates engine oil pressure in pounds per square inch (PSI).
28	 0000036961	For vehicles not equipped with Selective Catalytic Reduction (SCR) system: Indicates the engine lubricant temperature in degrees Fahrenheit (°F) (optional).
	 0000037193	For vehicles equipped with Selective Catalytic Reduction (SCR) system: Indicates the approximate DEF level in the DEF tank.
29	 0000036963	Indicates engine coolant temperature in degrees Fahrenheit (°F).

30	 0000037130	The tachometer indicates engine speed (rpm). The engine can be operated between idle speed and high idle speed without damage, but should not be allowed to over-speed (such as when going downhill).
31	 0000037131	The speedometer indicates the vehicle speed in miles per hour (MPH) and kilometers per hour (Km/h).
32	 0000036964	Indicates the battery voltage (VOLTS) when the ignition switch is in the ON position.
33	 0000036966	Provides indication of air pressure available for the primary air brakes in pounds per square inch (PSI).
34	 0000036965	Indicates the approximate fuel level in the fuel tanks.
35	 0000036967	Provides indication of air pressure available for the secondary air brakes in pounds per square inch (PSI).

Instrument Panel Gauge Cluster Alarms

WARNING

To prevent property damage, personal injury, and / or death, when an alarm sounds, stop normal vehicle operation and determine the source of the alarm condition.

The instrument panel gauge cluster will sound an audible alarm that accompanies out-of-range gauge readings along with the particular gauge warning lamps. The instrument panel gauge cluster alarms will also sound when any sensor (sender) unit fails, when there is an electronics system fault, and when the Red Stop Lamp is illuminated. The following chart lists the number of alarm beeps for the above conditions or warning states:

Alarm Conditions	Audible Alarm Pattern	Additional Comments
Fuel level gauge low (only alarms on each ignition turn-on)	5 BEEPS	Instrument panel gauge cluster warning indicator illuminates.
Voltmeter gauge out-of-range reading	5 BEEPS	Instrument panel gauge cluster warning indicator illuminates.
Engine oil pressure gauge out-of-range reading	5 BEEPS	Instrument panel gauge cluster warning indicator illuminates.
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.
Diesel Exhaust Fluid (DEF) level low	1 BEEP	Instrument panel gauge cluster warning indicator illuminates.
Selective Catalytic Reduction (SCR) system fault	1 BEEP	Instrument panel gauge cluster warning indicator illuminates.
Exhaust Diesel Particulate Filter Regeneration	CONTINUOUS TONE	Critical soot level.

Alarm Conditions	Audible Alarm Pattern	Additional Comments
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 gauge 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 Lamp illuminates	REPEATING SINGLE BEEP	Indicates what system is requesting the Red Stop Lamp.
Electrical system fault	10 BEEPS	Electrical system fault 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.
Headlight Warning Alarm	5 BEEPS	Sounds one time immediately after ignition switch is turned to OFF position, when headlight switch is on, and the driver-side door is closed.
	REPEATING SINGLE BEEP	Sounds when headlight switch is on, ignition switch is in OFF position, and the driver-side door is open.
Electrical Load Control and Shedding (ELCS) Alarm (Optional)	CONTINUOUS TONE	The Instrument panel gauge cluster will display the message "Load Shedding" in the LCD display and emit a continuous tone for 5 seconds that coincides with the start of the visual alert.

Direct Drive Warning Indicators

The direct drive warning indicators provide 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 indicator installed at those locations.

NOTE: There are several variations of Direct Drive Warning Indicators for the TranStar®. Actual gauge configuration may vary.

Item No.	Item	Color	Description
39	 8487049	YELLOW	Luggage door is ajar.
40	**BLANK**		Not used
41	**BLANK**		Not used
42	 8487050	YELLOW	Engine brake capability is activated.
47	 8487045	YELLOW	Rear rear axle differential is locked.
48	 8487045	YELLOW	Rear axle differential is locked.
49	 8487044	YELLOW	Forward rear axle differential is locked.
50	 8487043	YELLOW	ICON system is activated.

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 select 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. Press and hold 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
36	Display Control	Toggles the information display from one screen to the next when pressed and released.
43	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 **Instrument Panel Gauge Cluster > Integral Digital Display Detailed Information** section in **Controls / Features**)

Item No.	Quadrant Number and Message Function	Message Description
44	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
45	Quadrant 4: Transmission Gear Indication	Transmission gears for the Allison P-R-N-D-L gear selection display, or the Eaton® Transmission display.
46	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).

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 location where the Compass Calibration procedure is being performed must be set first. 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

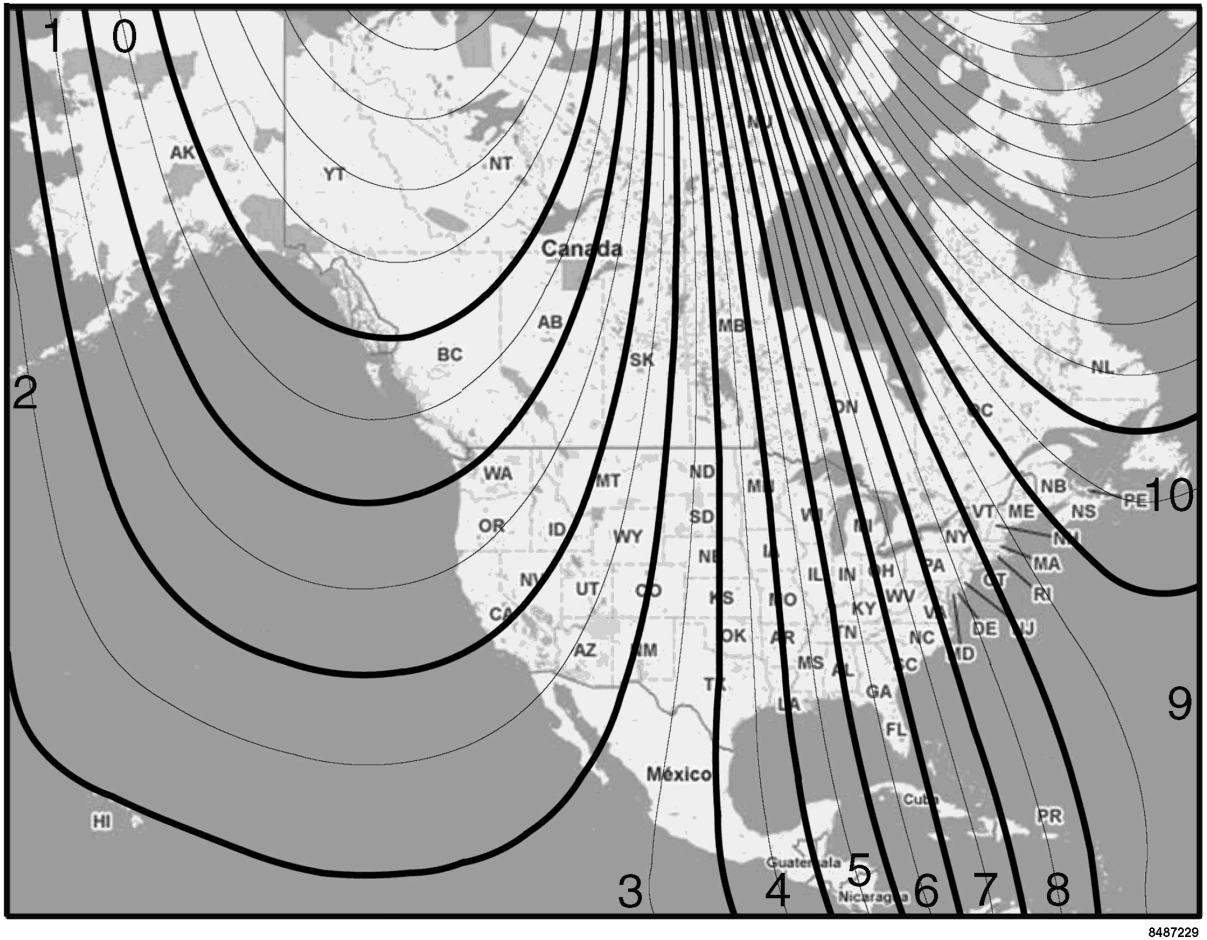
The Declination Zone number is used to account for the errors between magnetic North and true North in the vehicle's geographic operating area, and must be set correctly for the compass to display accurate headings.

NOTE: When calibrating / recalibrating the compass, you must select the Declination Zone that 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.

Declination Zone Map



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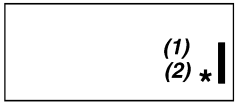
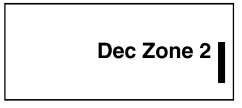
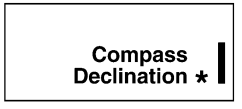
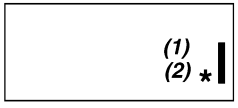
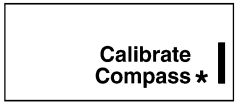
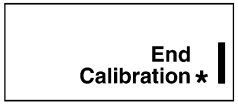
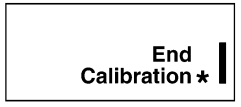
Step	Procedure	Displayed Message
1	Select Quadrant 2 (lower right) on the display by turning the display control knob either clockwise or counterclockwise.	(1) (2) *  3817049
2	Select the Compass Declination message by pressing and releasing the display control knob until this message appears.	**Compass Declination** *  3817053
3	Press and **HOLD** the display control knob until any Declination Zone number (0 - 10) is displayed.	**Dec Zone 2**  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.**	**Dec Zone 6**  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).	**Compass Declination** *  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.	 3817051
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 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.	 3817056

Integral Digital Display Detailed Information

Quadrant 1: Informational Displays

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

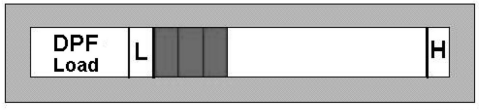
Quadrant 1 – Display Messages	Description
Odometer	The odometer displays the total distance traveled. **Display Format:** 100,000.0 TRIP MILES TRIP KM
Trip Odometer	The trip odometer displays a record of the elapsed distance traveled since the last reset. **NOTE: The trip hours and trip miles are independently 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

Quadrant 1 – Display Messages	Description
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
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

Quadrant 1 – Display Messages	Description
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
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

Quadrant 1 – Display Messages	Description
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
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

Quadrant 1 – Display Messages	Description
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
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

Quadrant 1 – Display Messages	Description
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 graphic:  8487412 With **L** (low) on the left and **H** (high) on the right, the graph is shown by bars each representing a 10% 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	Message Flashes (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	Indicates restricted air flow to the engine.	Yes	No
Exterior Lamp Check Active	Indicates that 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
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

Quadrant 2 – Display Messages	Description	Message Flashes (Yes / No)	Warning Indicator Association
Fuel Filter	Indicates that the fuel filter is clogged.	Yes	No
Check Brake Switch		Yes	No
Check Pupil Warning Indicator		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 that 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 Inhibt Switch is “On” and regeneration is disabled.	No	No
Parkd Regen Available		No	No
Low Coolant Level	Message is displayed when coolant level is less than or equal to 80%.	Yes	No
Stop Engine	Message is displayed when RED Stop Lamp is illuminated.	Yes	RED Stop Lamp
Warn Engine (Priority 1 or 2)	(1) Message is displayed when the RED Stop Lamp goes on. (2) Message is displayed when the AMBER Warning Lamp goes on and the RED Stop Lamp does not.	Yes	(1) RED Stop Lamp (2) AMBER Warning Lamp
Stop Hybrid	Message is displayed when Hybrid system turns on and requests the RED Stop Lamp.	Yes	RED Stop Lamp

Quadrant 2 – Display Messages	Description	Message Flashes (Yes / No)	Warning Indicator Association
Check Engine	Message is displayed when ECM requests the AMBER Warning Lamp and not the RED Stop Lamp	Yes	AMBER Warning Lamp
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 AMBER Warning Lamp while conditions for “HV Batt Off-Line” message are not met.	Yes	AMBER Warning Lamp
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. You should drain water from fuel / water separator.	Yes	No
Refuel	Message is displayed when fuel level is low.	Yes	No
High Fuel Temp	Message is displayed when fuel temp is high.	Yes	No
Electrical Fault (Priority 1 or 2)	(1) Message is displayed when when EGC requests the RED Stop Lamp. (2) Message is displayed when when EGC requests the AMBER Warning Lamp.	Yes	(1) RED Stop Lamp (2) AMBER Warning Lamp
Check Trans	Message is displayed when transmission needs to be serviced.	Yes	AMBER Warning Lamp
Trans Temp	Message is displayed when transmission turns on the AMBER Warning Lamp. Not available with all transmissions.	Yes	AMBER Warning Lamp

Quadrant 2 – Display Messages	Description	Message Flashes (Yes / No)	Warning Indicator Association
Gen Trns Flt	Message is displayed when transmission turns on RED Stop Lamp, MIL, or PROTECT, or the AMBER Warning Lamp 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 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 when the particulate trap indicator is on or flashing.	Yes	Yes (see description)
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 system other than the engine requests the RED Stop Lamp.	Yes	RED Stop Lamp

Quadrant 2 – Display Messages	Description	Message Flashes (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 AMBER Warning Lamp.	Yes	AMBER Warning Lamp
Retarder Temp	Message is displayed when instrument panel gauge cluster receives signal from the Retarder – Driveline requesting the AMBER Warning Lamp.	Yes	AMBER Warning Lamp
Gen Rtrd Flt	Message is displayed when instrument panel gauge cluster receives signal from the Retarder – Driveline requesting the RED Stop Lamp, MIL, or PROTECT indicator, or the AMBER Warning Lamp 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
DRV Reward Increasing		No	No
DRV Reward Decreasing		No	No
VSL Ovrd Active		No	No
VSL Ovrd Expiring		No	No

Quadrant 2 – Display Messages	Description	Message Flashes (Yes / No)	Warning Indicator Association
	Blank screen, available only when engine rpm is less than or equal to 325 rpm, or vehicle speed is 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
DEF Low Refill Soon	Diesel Exhaust Fluid (DEF) needs to be refilled.	No	DEF Level Lamp
DEF Low Eng Derated	Diesel Exhaust Fluid (DEF) level is very low and engine performance is limited.	No	DEF Level Lamp and AMBER Warning Lamp (AWL)
DEF Low Eng Derated 5 mph	Diesel Exhaust Fluid (DEF) level is 0%. Engine performance is limited and vehicle speed is limited to 5 mph (8 km/h).	No	DEF Level Lamp, AMBER Warning Lamp, and RED Stop Lamp
DEF Quality Service Soon	Diesel Exhaust Fluid (DEF) quality problem is detected.	No	AMBER Warning Lamp

Quadrant 2 – Display Messages	Description	Message Flashes (Yes / No)	Warning Indicator Association
DEF Quality Derated	Diesel Exhaust Fluid (DEF) quality problem has been present for 1 hour or longer. Engine performance is limited.	No	AMBER Warning Lamp
DEF Quality Derated 5 mph	Diesel Exhaust Fluid (DEF) quality problem has been present for 3 hours or longer. Engine performance is limited and vehicle speed is limited to 5 mph (8 km/h).	No	AMBER Warning Lamp; RED Stop Lamp

Warning Messages

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

Amber Warning Lamp: FAULT MESSAGE

Red Stop Lamp: Stop Engine message

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

Warning Indicator	Warning Message
Red Stop Lamp	Stop Engine
Amber Warning Lamp	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.

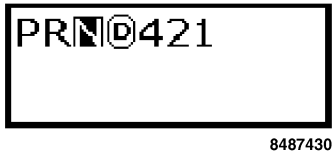
Quadrant 3 – Display Messages	Description
Outside Temperature and Compass Heading	**Display Format:** 32°F SE 0°C SE 32°F NO CAL 8590030

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	 8487430
Eaton® Transmission display	 8590031

Switches

Six switches are located on the lower left and right side of the instrument panel gauge cluster. 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% brightness with the headlight switch activated. The park lights, tail lights, markers, and clearance lights will be on as well. An alarm will sound if the headlight switch is on and the ignition switch is off.

The 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 left side is closed. It also sounds when headlight switch is on, ignition switch is in OFF position, and the driver's 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% 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, tail lights, markers, and clearance lights will turn on when the headlight switch is in the park or headlight position.

Panel Lighting

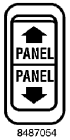
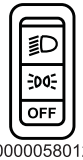
The panel lighting brightness is controlled by the PANEL rocker switch. To increase the brightness of the instrument panel gauge cluster lighting, continually press the upper portion of the rocker switch. To dim the instrument panel gauge cluster lighting, continually press the lower portion of the rocker 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 the Unlock button is pressed, and turns off the light (dims gradually to off) when the Lock button is pressed.

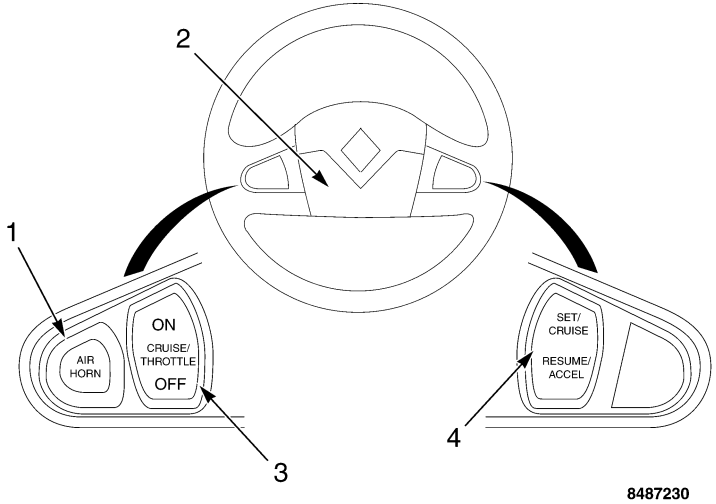
Courtesy Lights

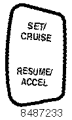
Either the driver or the passenger door activates the door-mounted courtesy lights to add light when getting in or out of the truck.

Item No.	Item	Description
37	Configured by Customer Request	Switch options for this position include: Lift Gate, Work Light, Mirror Heat, Fog Light, Fan Override, Air Suspension Dump, Auxiliary, Parked Regeneration, Inhibit Regen **NOTE: Refer to switch table in this section for switch functions.**
38	 8487056	Used to turn cab dome light on and off and make it possible to activate / deactivate the dome light when opening the doors.
51	 8487054	Panel Dimmer Adjusts the panel lights brightness.
52	 0000058012	Headlight / Park Lamp Switch Activates the headlight or parking lights, and illuminates the instrument panel gauge cluster. This switch functions even when ignition switch is turned off (a warning will sound when this switch is ON and the ignition switch if OFF).
53	 8487052	Used to turn work lights on and off.
54	 8487051	Enables Auto Headlights in vehicles equipped with this feature.

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

WARNING

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

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 / 56 km/h), 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 position.
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

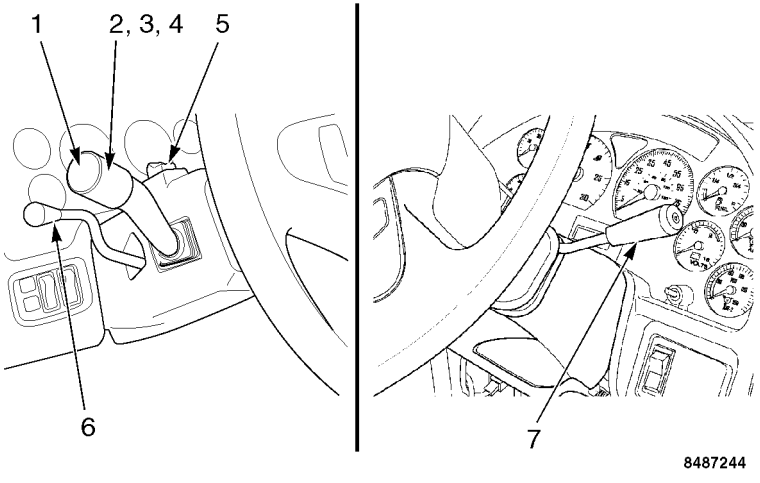
in the cruise control mode. SET/CRUISE reduces engine speed and RESUME/ACCEL increases engine speed.

5. Press the OFF position of the ON/OFF control to turn the throttle off and return the engine to idle. This will also occur when the vehicle moves, the brake pedal is pushed, the clutch is engaged / disengaged, or the automatic transmission is shifted.

Stationary Variable Speed Control (12VXT)

This feature is ordered to provide variable engine speed control. It operates with the Cruise/Throttle controls discussed above.

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 multifunction 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-LO), 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 – 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.

WARNING

To prevent property damage, personal injury, and / or death, 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, which could cause an accident.

Do not use radiator coolant or antifreeze 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. **Lo / 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. When the Hi-Beam headlights are ON, the Lo-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.

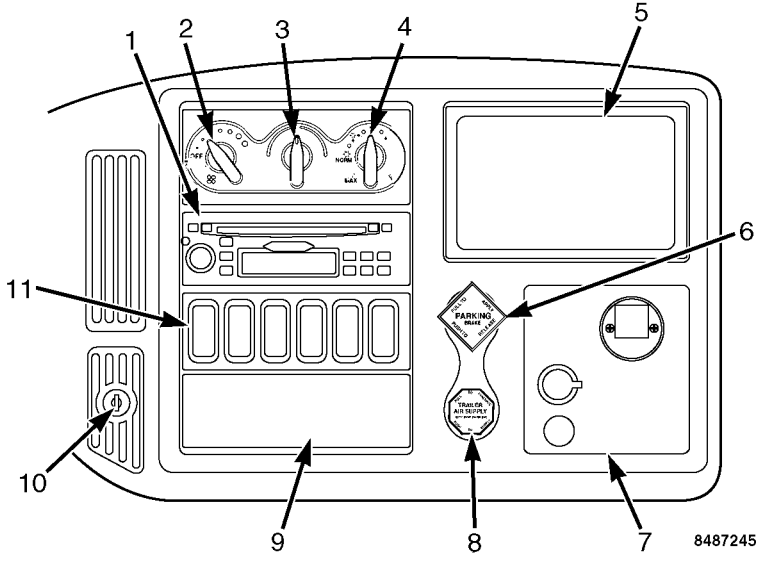
Stop Override Hazard (Optional) – When hazard lights are activated and the brake pedal is depressed, all hazard / turn signal lights on the front, side lights of the truck, and the side trailer lights will continue to flash. The rear lights of the truck or tractor will burn steadily until the brake is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

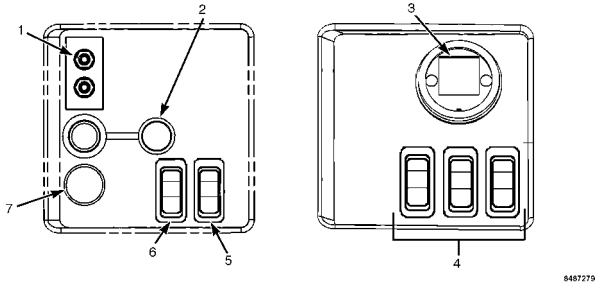
Center Dash Panel / Wing Panel

The Center Control Switch Panel consists of the switches that start the vehicle and 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

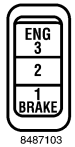
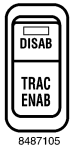
Panel Component Arrangements (Optional)

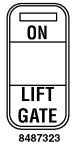
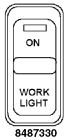
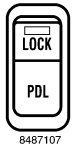
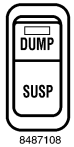


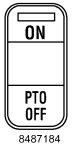
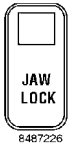
Item	Component Description
1	Two-Post Power Socket
2	Cigar Type Power Socket
3	Air Filter Restriction Gauge
4	Additional Optional Switches
5	Telematics No Data Logged Switch
6	Telematics Driver Alert Switch
7	Cigar Lighter

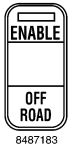
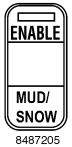
Switches

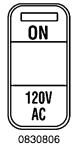
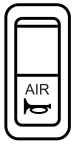
Up to 25 optional switches can be located in the center and lower right side of the center dash panel. Location of these switches will vary depending on the options installed. Blank cover plates will be used in spaces that do not have switches installed at those locations.

Item	Description
 8487267	Marker Interrupt A momentary switch that turns all trailer marker lights ON or OFF, depending on park light switch position.
 8487097	Heated Mirror – ON/OFF A momentary switch that, when pushed and released, turns the mirror heating element ON or OFF.
 8487110	Engine Brake – ON/OFF Turns engine compression brake ON or OFF.
 8487103	ENG BRAKE 1/2/3 A three-position switch that selects the amount of engine braking (1 = Low, 2 = Medium, 3 = High).
 8487104	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.
 8487105	Traction Disable – ON/OFF This switch disables the ABS traction feature.

 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 Neutral – Auto Neutral (OFF)/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 Override – 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/OFF This switch is used to turn the back of cab work light ON or OFF.
 8487107	PDL (Power Divider Lock) – LOCK/PDL This switch is used to lock together the front and rear axle of a tandem.
 8487108	Air Suspension Dump – SUSP/DUMP This switch allows the operator to release the air from or reinflate the air bags of the air suspension system.

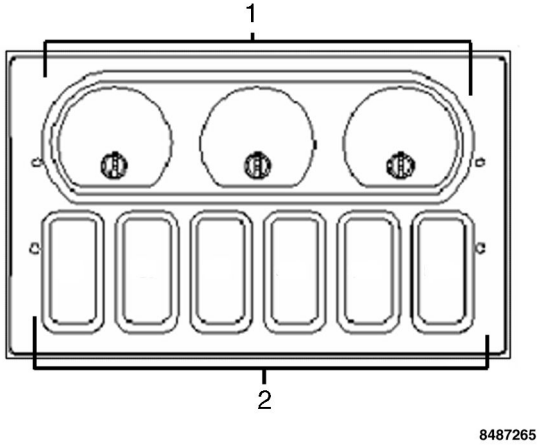
 8487184	PTO (Power Take-Off) – PTO OFF/ON Engages Power Take-Off when switch is in ON position or disengages Power Take-Off when switch is in PTO OFF position.
 8487109	5TH WHEEL SLIDE – ON / OFF This switch, when set to ON, releases the sliding fifth wheel (when ignition switch is in Run position and vehicle speed is less than 2 mph).
 8487209	5TH WHEEL JAW – UNLOCK Press and hold this momentary switch to unlock the fifth wheel jaw. Vehicle must be stationary with parking brake set and ignition switch in the RUN position.
 8487226  8487227	5TH WHEEL JAW MONITORING – LOCK / UNLOCK These switches activate an electronic jaw lock indicator system showing fifth wheel jaw status to the operator.
 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].
 8487183	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.
 **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 / 120VAC This switch, when set to the ON position, will provide AC output from the Power Pack 3 inverter.
 8487175	Parkd Regen – ON / PARKD REGEN Used for 2007 engine aftertreatment. Initiates DPF regeneration.
 8487176	Inhibit Regeneration – ON / INHIBT REGEN Used for 2007 engine aftertreatment. Prevents DPF regeneration.
 8487115	QUAL-COM / PANIC Sends distress signal. Used in conjunction with the (optional) Qualcomm satellite communication system – see Qualcomm System Owner's Manual.
 **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.
 0000058013	AIR HORN Controls solenoid that turns optional Air Horn On or Off.

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 (1,034 kPa)
Ammeter Gauge	Provides reading of battery and alternator current in amps
Rear–Rear Axle Temperature Gauge	Provides monitoring of temperature of axle lubricant at 230°F (110°C)
Front–Rear Axle Temperature Gauge	Provides monitoring of temperature of axle lubricant at 230°F (110°C)
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.	

Climate Control

WARNING

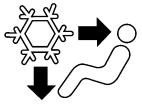
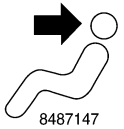
To prevent property damage, personal injury, and / or death, never drive the vehicle unless the windshield and all other windows are clear. A fogged, ice / snow covered, or dirty windshield or window limits vision, which could cause an accident. To improve defroster efficiency, remove ice and / or snow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

CAUTION

To prevent property damage and 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 Diesel Exhaust Fluid (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 heater shutoff 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 shutoff 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:

 8487118	**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.
 8487119	**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.
 8487146	**Bi-Level Air Conditioning Mode** In this mode 75 % of the airflow is directed to the panel air outlets and 25 % 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.
 8487147	**Vent Mode** In this mode, all airflow is directed to the panel air outlets, and fresh (outside) air is circulated inside the vehicle.
 8487148	**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 % of the airflow is directed to the defrost and side de-mist air outlets and 50 % 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 de-mist 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

To prevent property damage, follow recommended service procedures and maintain adequate air flow through air exchange devices. Cleaning should be performed by a qualified technician.

Keep radiator area free of bugs, leaves, and other debris. 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 heater shutoff 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 shutoff 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.

Electronic Vehicle Monitoring

Base Display

8487337

The optional Electronic Vehicle Monitoring Driver Information Display provides trouble code reporting, trip status, vehicle and engine usage, fuel economy information, video inputs for external cameras, and a USB port for loading MP3 audio files that can be played through the radio. This unit also provides an interface for the optional SmartWave® tire pressure management system and a port that is compatible with the optional Qualcomm Omnivision system. Refer to the Driver Information Display Operator Reference Card.

Premium Display

The optional Premium display is the same as the base unit, but with an additional navigation feature. This feature provides mapping features, turn-by-turn directions, and truck points of interest.

SmartWave® Display

The optional SmartWave® tire alerts and warnings display has three automated tire alerts to instantly warn the driver of an under-inflated tire before it becomes dangerous; pressure deviation alert, critical low pressure alert, and high temperature alert. Refer to http://www.smartire.com/support/manuals for complete owner's manual.

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.

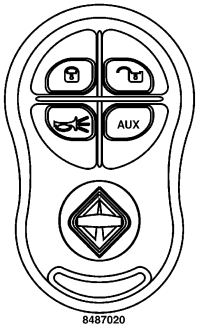
With mechanical locks, only one door can be locked / unlocked at a time. Electrical locks can lock / unlock both doors by operating either the key, keyless entry fob, or the inner door lock handle on either side.

Remote Keyless Entry Operation (Optional)

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.



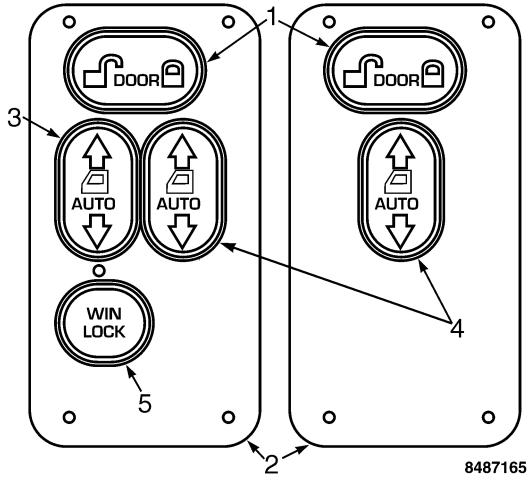
The remote keyless entry key fob is used to lock and unlock all doors from a distance of **30** feet (9 m) or less. Whenever the doors are locked or unlocked using the key fob, the city horn sounds momentarily (chirps). Also, the remote keyless entry key fob turns on the interior light for a time period 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).

Lock / Unlock from Interior

WARNING

To prevent property damage, personal injury, and / or death, and to 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

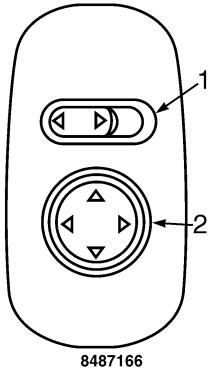
Trucks may have optional electrically operated driver and passenger windows. Controls for these window lifts are mounted in the door control panels located by the vent windows. The driver-side controls regulate window operation for both driver and passenger. To lower or raise driver window, press and 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 programmable 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 that results in higher vehicle speed limits.
- Good – Reward indication that results in higher vehicle speed limits.
- Excellent – Reward indication that results in higher vehicle speed limits.
- Penalty – Penalty indication that 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

General Information

WARNING

To prevent property damage, personal injury, and / or death, observe the following. 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, and static electricity could also ignite flammable vapors.

WARNING

To prevent property damage, personal injury, and / or death, 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, and ventilation 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.

WARNING

To prevent property damage, personal injury, and / or death, 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.

To prevent property damage, personal injury, and / or death, always use occupant restraint system when vehicle is moving. Any location in the vehicle not equipped with a seat belt, bunk restraint belts, or sleeper berth restraint webbing should not be occupied when the vehicle is being operated.

To prevent property damage, personal injury, and / 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.

To prevent property damage, personal injury, and / or death, when parking your vehicle, do not leave transmission in gear. Always use parking brake. When parking on a grade, install wheel chocks 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.

To prevent property damage, personal injury, and / or death, since 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.

WARNING

To prevent property damage, personal injury, and / or death, make sure your way is clear in all directions before moving your vehicle. All vehicles have blind spots.

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

General Information

WARNING

To prevent property damage, personal injury, and / 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.

WARNING

To prevent property damage, personal injury, and / or death, properly inspect and maintain seat belts.

WARNING

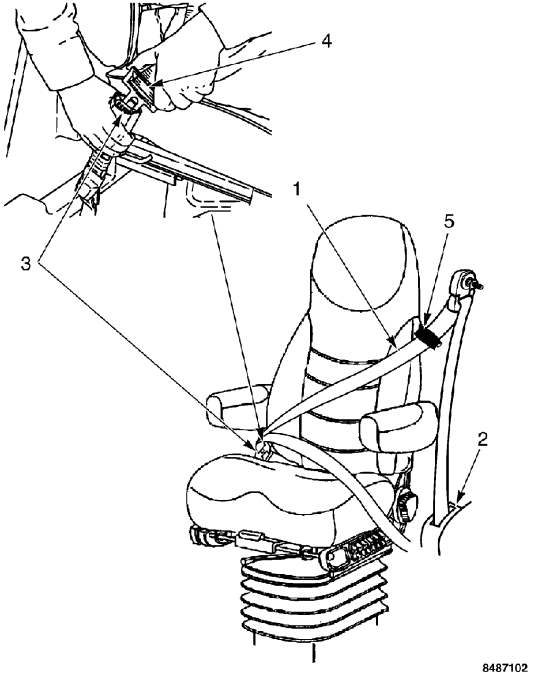
To prevent property damage, personal injury, and / or death, any seat belt in use during an accident must be replaced. When replacement of any part of the seat belt is required, the entire belt must be replaced, both retractor and buckle sides.

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

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 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.

Non-retracting 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

WARNING

To prevent property damage, personal injury, and / or death, do not bleach or re-dye seat belt webbing. Bleaching or re-dyeing may cause a weakening of the webbing.

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

General Information

WARNING

To prevent property damage, personal injury, and / or death, 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.

WARNING

To prevent property damage, personal injury, and / or death, avoid reckless operation of this vehicle over rough roads or surfaces as this 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.

Bucket type seats have fore and aft adjustment. 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)

An optional bunk is provided 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 and cab passenger, as well as bunk passenger.

Starting Procedures

General Information

WARNING

To prevent property damage, personal injury, and / or death, 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.

CAUTION

To prevent starter damage, DO NOT crank the engine for more than 30 seconds at a time; wait 2 minutes after each try to allow the starter to cool.

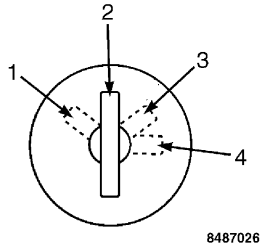
NOTE: Before starting the engine:

- **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.**

NOTE: Automatic manual transmissions must be in neutral and vehicles with a clutch pedal require the clutch pedal to be depressed before the starter will engage.

NOTE: Some automated transmissions will delay engine cranking until the transmission power-up is complete.

Engine Starting



NOTE: For additional information, see Engine Operation and Maintenance Manual.

The ignition switch has four key positions as follows:

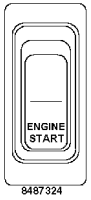
1. ACC (Accessory)
2. OFF
3. ON
4. START

1. Set the parking brake and place the transmission in the 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.

Starting Procedure with ENGINE START Switch (Optional)

NOTE: For additional information, see Engine Operation and Maintenance Manual.



1. Set the parking brake. Place the transmission in the neutral position. Turn off the headlights and all accessories.
2. Turn the ignition switch clockwise to the ON position. If the WAIT TO START indicator comes on, wait until the indicator goes out and then proceed.
3. Press on and hold the top (ON position) of the ENGINE START switch until the engine starts, then release the switch.
4. Engine will continue to run with ignition switch in the ON position.
5. To stop the engine, rotate the ignition switch counterclockwise to the vertical position, marked OFF, and remove key from switch.

After the Engine Starts

NOTE: For additional information, see Engine Operation and Maintenance Manual.

- 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 3 - 5 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

NOTE: For additional information, see Engine Operation and Maintenance Manual.

Idle the engine for 3 - 5 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 gases.

The larger the engine, the greater the need for this idling period. This will help avoid damage to turbocharger seals or like features

of an engine which, after shutdown, will no longer be cooled by the circulation of oil and coolant.

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

Shutdown Warning Indicator or Beeper

WARNING

To prevent property damage, personal injury, and / or death, 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.

Vehicles may be equipped with an automatic shutdown system that stops the engine in the event of high coolant temperature or low engine oil pressure or low coolant level. A warning indicator on the instrument panel gauge cluster, 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 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 shutdown 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 shut down 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.

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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 set 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 pre-programmed 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.

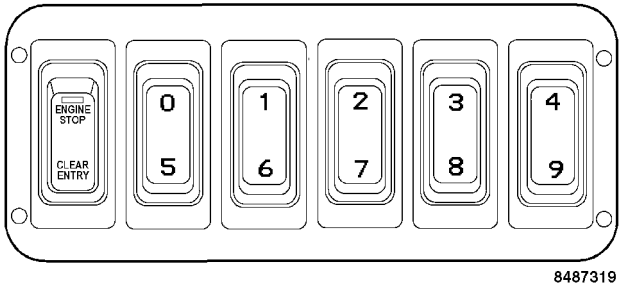
NOTE: The vehicle must be stopped and the parking brake must be set / engaged before the system will clear the previous theft deterrent code entry.

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

#	Driver Action	System Alerts	Engine Operating Status
3.	Engine started with parking brake released	Warning sequence is begun; an alarm will beep continuously and the **RED** Stop Lamp 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** Stop Lamp 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** Stop Lamp will flash slowly.	Engine will shut down unless correct theft deterrent code is entered within programmed delay time
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 seconds.	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

WARNING

To prevent property damage, personal injury, and / or death, the following procedure must be performed exactly as outlined; otherwise, a fire or a battery explosion could result.

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 connect charged 12-volt batteries so as to provide controlled voltage. 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 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 the 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. With the engine running on the booster vehicle, allow the discharged batteries to charge for at least 5 minutes.
9. Attempt to start the discharged vehicle.
10. Reverse above procedure when removing the jumper cables.

Cold Weather

General Information

WARNING

To prevent property damage, personal injury, and / or death, 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 are an explosion hazard.

CAUTION

To prevent property damage, if vehicle is equipped with the optional heated windshield function, do not scrape the inside of the windshield.

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

Refer to the appropriate engine operator's manual for cold weather operation instructions for your specific vehicle.

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 antifreeze 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.

Engine Idling

CAUTION

To prevent property damage, adhere to this 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 buildup 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 to maximize engine and Diesel Particulate Filter life (DPF). See **Exhaust Diesel Particulate Filter Regeneration** in this section for more information.
- Use a minimum 45 Cetane diesel fuel or utilize Cetane Index improvers from a reputable manufacturer.

- 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 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 and varnish 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 that are equipped with engine charge air coolers.

Cooling airflow 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 (305 cm).

Hot Weather Operation

1. Keep cooling system filled with clean permanent antifreeze 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 buildup.

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 downshifting into the next lower gear to increase engine rpms, 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 rpms up slightly and begin to engage the clutch while, at the same time, releasing the spring brakes.

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

Operating Instructions

General Information

WARNING

To prevent property damage, personal injury, and / or death, make sure your way is clear in all directions before moving your vehicle. All vehicles have blind spots.

WARNING

To prevent property damage, personal injury, and / or death, do not operate an engine beyond the maximum governed speed.

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.

WARNING

To prevent property damage, personal injury, and / or death, 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.

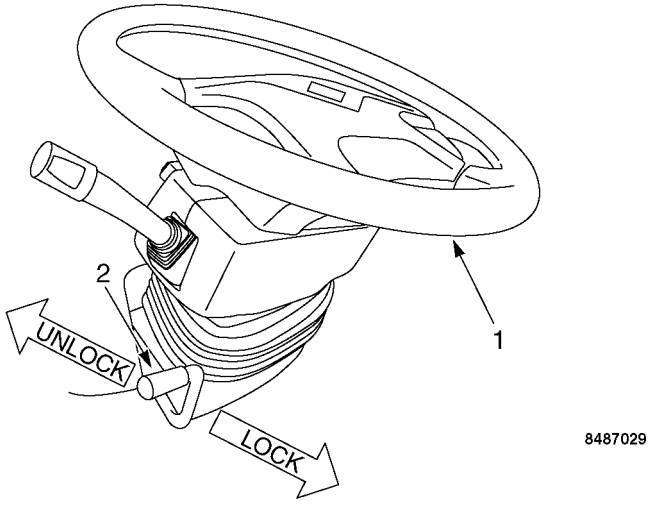
CAUTION

To prevent property damage, do not lubricate the tilt or 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 Information

- 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

WARNING

To prevent property damage, personal injury, and / or death, read and understand the appropriate manual for the specific equipment in question before operating. 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.

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
- Uses multiplexing for connecting to major functional areas of the truck with much less wiring
- Provides interfaces to a majority of vehicle switches and sensors
- 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 Control Module (ECM), a Transmission Control Module (TCM), the ABS Electronic Control Unit (ECU), panel-mounted switches, and door pods.

Alternator

CAUTION

To prevent property damage, improperly using of fast charger, hooking up of booster battery, or installing battery, which can cause damage to the electrical system or to 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

WARNING

To prevent property damage, personal injury, and / or death, 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.

WARNING

To prevent property damage, personal injury, and / or death, whenever disconnecting battery terminals, always disconnect ground terminal first. When reconnecting, always connect ground terminal last. Failure to follow this procedure could also result in a short to ground.

To prevent property damage, personal injury, and / 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.

WARNING

To prevent property damage, personal injury, and / or death, DO NOT check battery condition by shorting (flashing) across terminals.

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 located on the battery box or mounted on the cab floor. There are also options that completely disconnect the batteries or disconnect everything except the charging circuits.

Circuit Breakers, Fuses, and Fusible Links

WARNING

To prevent property damage, personal injury, and / or death, 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, because this could cause wiring to overheat and possibly burn.

- 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 Specifications** 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.

Electrical Load Control and Shedding (ELCS)

Electrical Load Control and Shedding (ELCS) is an optional feature (standard with sleepers) intended to provide a convenient means of automatically shutting down electrical loads overnight in order to conserve energy and deliver sufficient power to start the engine. The system is active when the engine is not running, regardless of key state. The ELCS system does not include provisions for shutting down 120-VAC circuits.

The ELCS will begin a sequence of events when the measured battery voltage is at or below 12.1 VDC for a period of 30 seconds. The sequence of events will first start with providing the visual alert “Load Shedding” to the vehicle operator for at least 30 seconds. An audible alert consisting of a continuous tone 3 - 6 seconds in duration will coincide with the start of the visual alert.

The audible alert can be disabled by a vehicle maintainer if desired. The sequence will then disable a predefined group of features / electrical loads. These will remain disabled until the vehicle's key switch transitions to the Accessory or ON positions, and the measured voltage is above 12.1 VDC.

Engine

The engine for this vehicle is an electronically controlled diesel engine. A separate Engine 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 (CAC)

All of Navistar’s engines are equipped with a charge air cooling system. The function of the Charge Air Cooler (CAC) 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.

Electronic Engine Controller

Each vehicle contains an Engine Operation and Maintenance Manual in the driver's door pocket. Refer to the Engine Operation and Maintenance Manual for detailed information on these engine control systems.

Engine Brake (Optional)

WARNING

To prevent property damage, personal injury, and / or death, do not use the engine brake on slippery road surfaces. Doing so may cause wheel slippage and / or loss of vehicle control.

WARNING

To prevent property damage, personal injury, and / or death, study the following descriptions and instructions as well as the engine Operator's Manual before operating the engine brake feature.

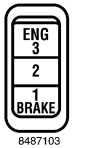
NOTE: The engine brake should never be considered a substitute for the vehicle service brakes. The service brakes should always be viewed as the primary vehicle slowing system. Service brakes are always used to bring vehicle to a complete stop.

Engine braking features are used for traffic conditions that require frequent use of the service brake and therefore shorten 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 Systems Operation

Vehicles with Navistar's 11L or 13L engines utilize the optional Diamond Logic® Engine Brake for additional braking in various operating conditions.



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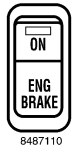

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The optional **Diamond Logic® Engine Brake** is a compression style brake that absorbs energy by releasing compressed air from the power cylinders at the end of the compression stroke to provide vehicle braking power in addition to the service brakes. 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 switch to the ON position (the switch indicator light will turn on). The ENGINE BRAKE SELECTOR 1/2/3 switch is used to adjust the amount of braking applied, with 3 as the most powerful setting.

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 features 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). The braking action will cease if the driver presses the accelerator or the clutch or if the engine speed drops below 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.

Navistar's 11L and 13L 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.
- 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 preselected 4th gear as a default. This means that when the driver selects D (Drive), the engine brake will operate down to 4th gear (at or above 1200 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 lockup 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.

Navistar's Engine Features

Navistar's engines are electronically controlled diesel engines. The engine Engine 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 turns 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)** - Adjusts injector operation as required.
- **Cold Ambient Protection (CAP)** - Aids engine warm up and maintains 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.

HD-OBD Overview

The HD-OBD system uses many individual pre-programmed "monitors" to ensure the vehicle is meeting emissions standards. An HD-OBD monitor is a strategy to evaluate the performance of an emissions related system or component. All monitors are designed for execution in a prescribed frequency; some

monitors run continuously, while some run a specific ratio against the number of drive cycles.

The operator will be alerted to emissions or other system problems when the Malfunction Indicator Lamp (MIL) illuminates. When the MIL illuminates, bring the vehicle in for service at the next available opportunity. The HD-OBD system does not change the way the vehicle should be driven, the recommended driving style, or the way you use the vehicle.

Self-Diagnostics

All Warning Lamps are located on the instrument panel gauge cluster. When the ignition switch is turned ON, the Warning Lamps are illuminated and remain on while the ECM runs normal start-up tests, then goes OFF. If Warning Lamp stays on or comes on while operating the vehicle, it is an indication that the vehicle needs service. When the Warning Lamp 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 AMBER Warning Lamp and / or the **RED** Stop Lamp are not turned on. Standard instrumentation includes an oil pressure and engine coolant temperature gauge.

CAUTION

To prevent damage to fuel injection system, do not allow water to stay in the fuel system. Refer to the appropriate Engine Operation and Maintenance Manual for more information.

Optional Engine Warning System – 3-Way (08WWJ)

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

Optional Engine Protection System – 3-Way (08WPP)

WARNING

To prevent property damage, personal injury, and / or death, 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.

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 derated mode for an additional 30 seconds if the conditions causing the shutdown are still present.

Air Compressor Cycling

Navistar's 11L and 13L Liter engines can be equipped with one of two different types of air compressor and may have one or two cylinders.

- **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 it 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 versus 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

WARNING

To prevent personal injury or death from hot coolant or steam scalding, use the following procedure to remove the pressure cap from the cooling system:

A. Allow the engine to cool.

B. Wrap a thick cloth around pressure cap.

C. Partially unscrew pressure cap slowly while firmly holding cap down, then pause to allow pressure to release.

D. When system pressure is released, fully unscrew pressure cap while continuing to holding cap down. Slowly release downward pressure from pressure cap.

E. Remove cap.

WARNING

To prevent property damage, personal injury, and / or death, 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.

WARNING

To prevent property damage, personal injury, and / 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

To prevent property damage, if the coolant should get extremely low and the engine very hot, let the engine cool for approximately 15 minutes before adding coolant. Then, add coolant slowly with the engine running. Adding cold coolant to a hot engine may crack the cylinder head or crankcase. Never use water alone.

Antifreeze

The cooling system in vehicles with Navistar's 11L and 13L 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.

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 5 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 a cetane number could cause hard starting and slower warm-up 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 % 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

WARNING

To prevent property damage, personal injury, and / or death, never add gasoline, gasohol, and / or alcohol to diesel fuel. This mixture creates an extreme fire and explosion hazard.

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 2% 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.

Dual tank systems are equipped with dual draw and dual return fuel line systems to equalize the fuel temperature and level between the dual tanks.

When refueling, be sure that both tanks are filled completely, as both tanks cannot be filled from one side.

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.

Transmission

Transmission Fluid

Transmission fluid cools, lubricates and transfers hydraulic power. Proper fluid level and condition is critical to operation of the vehicle. If the fluid is low, the torque converter and clutches starve for fluid and the transmission overheats. If the fluid level is too high, the fluid may aerate, which may potentially cause the transmission to overheat.

Periodic transmission fluid checks are recommended by every transmission manufacturer. Refer to the transmission operator's manual for additional information and proper procedures.

NOTE: All transmission manufacturers have guidelines for transmission fluid and filter change intervals. Driving conditions, severity of duty cycle, and other factors impact the service cycle for fluid and filter change intervals. Some manufacturers recommend fluid analysis to determine service requirements. Refer to the transmission operator's manual for more information and proper service procedures.

Transmission Fluid Temperature

CAUTION

To prevent property damage, observe the following: Transmission malfunction or damage may occur if the transmission is operated with fluid temperature either above or below the fluid temperature specification limits. Continued operation when transmission fluid is out of temperature specification may constitute contributory negligence, and resultant damage may not be regarded as a warrantable condition.

Cold Weather

On certain automatic and automated manual transmissions, if the transmission fluid temperature is below a certain preset range, the Transmission Control Module (TCM) may limit transmission operation until the sump temperature rises to allow the transmission to perform a normal shift schedule. Certain transmission may have a preheating requirement to raise transmission temperature to a point at which the transmission may be safely operated. Refer to the transmission operator's manual that came with the truck at initial purchase for proper procedures and temperature ranges.

High Fluid Temperature

If the transmission gauges indicate transmission overheating during normal operation, stop the engine and verify that the transmission fluid level is correct and that the engine temperatures are within normal limits. If the high transmission

or engine temperatures persist, stop the engine and contact your nearest International Dealer for further assistance.

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.

The International® TranStar® Series has many transmission options available. Refer to the Transmission Manual for information on the transmission available in your truck.

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 drivetrain.
- **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.
- **When approaching a hill,** depress accelerator smoothly to start the upgrade at full power, then downshift as needed to maintain vehicle speed.
- **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.

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 (such as clutch, transmission, driveshaft(s), rear axle).

Hydraulic Clutch Actuation System

Clutch brake engagement occurs in the last 2 inches (50 mm) of pedal travel after initial clutch setup adjustment. Clutch wear will move the pedal position at clutch brake engagement toward the physical limit of travel. The hydraulic clutch system must have proper fluid bleeding before operating, usually performed at the factory, or at field servicing. Hydraulic clutch fluid should be drained and refilled every 2 years of service or after 200,000 miles (322,000 km) service interval.

CAUTION

To prevent vehicle and / or engine component damage, clutch pedal must engage clutch brake before the physical limit of pedal travel. When the clutch pedal position at clutch brake engagement is less than 0.5 inch (12.7 mm) from the physical travel limit, manual clutch adjustment is required for all Eaton® Easy Pedal® (EP) clutches.

If non-self adjusting clutches are used in this application, it is important that clutch adjustments be maintained. Adjustment intervals should be every 20,000 miles (32,000 km). When utilizing an Eaton® EP clutch with a hydraulic clutch actuator, the cab clutch pedal cannot be used to indicate when clutch adjustment is required. Drivers may not notice the need for clutch adjustment and continue to drive in such condition. Lack of adjustment will eventually lead to yoke interference with the clutch cover causing extensive clutch and or transmission damage.

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 2 inches (50 mm) of pedal travel.

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 (25 mm) 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 (25 mm) of pedal travel.

Hill Start Aid (Optional)

Some transmissions are equipped with a hill start aid or hill start assist. These devices are activated when the vehicle comes to a complete stop on a gradient sufficient for the transmission grade sensor to initiate. These devices will assist the operator to resume controlled forward movement on an incline without rolling backwards. Refer to equipment manufacturer for specific instructions and safety precautions for proper use.

Double Clutch Procedures, Non-synchronized

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.
- 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 1 - 2 seconds to match gear speeds. Steady pressure on shift lever will help the synchronizer perform its job faster. 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.

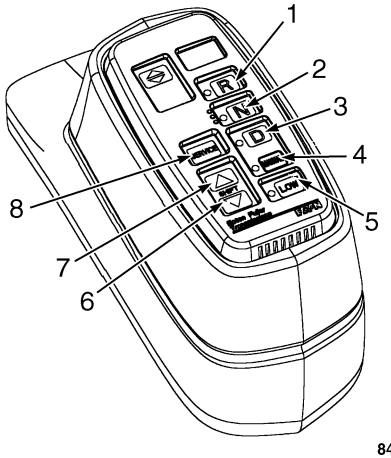
Shifting with Non-synchronized Transmission

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

Operation of the Eaton AutoShift® Transmission and Shifter

WARNING

. To prevent property damage, personal injury, and / or death, 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.



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

WARNING

To prevent property damage, personal injury, and / or death, always use the parking brake IN ADDITION TO leaving the transmission in gear and perform the following:

- **Bring the vehicle to a complete stop using the service brake pedal.**
- **Put transmission selector in N – Neutral.**
- **Set the parking brake and ensure that it is holding properly.**
- **Turn off engine when you leave vehicle. NEVER LEAVE THE VEHICLE UNATTENDED WITH ENGINE RUNNING.**

NOTE: For Allison automatic transmissions, refer also to separate Allison Transmission Operator's Manual.

Releasing the Parking Brake

WARNING

To prevent property damage, personal injury, and / or death, hold the brake pedal down while you move the gearshift from position to position to avoid unexpected vehicle movement.

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

With Manual Parking Brake

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

With foot still on brake pedal, push and hold shift selector button while moving the selector to 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.

Park with Air Brakes

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 desired transmission operating position.

With foot still on brake pedal, push in on parking brake control to release air parking brake, then lift foot from brake pedal to allow the vehicle to move.

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 gauge cluster, 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.

WARNING

To prevent property damage, personal injury, and / or death, 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.

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

WARNING

To prevent vehicle damage, personal injury, and / 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

To prevent property damage, do not operate the vehicle with the Power Divider Lock (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.

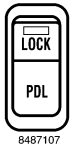
The PDL should be engaged, which prevents interaxle differential action, when backing under a trailer with a tractor, starting on a slippery surface (poor traction), operating off highway in mud, (poor traction), or when traveling on slippery highways (poor traction). Failure to lock the power divider 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

To prevent vehicle and / or component damage, engage the Power Divider Lock (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 interaxle 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 or other issues.

Driver-Controlled Differential Lock

8487182

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.

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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 under-steer 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

To prevent property damage, 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)

WARNING

To prevent property damage, personal injury, and / or death, pay strict attention to the following:

If your vehicle is equipped with a locking 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.

WARNING

To prevent property damage, personal injury, and / 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

(such as 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.

Axles and Suspensions

Gross Weight (Axle – Vehicle)

WARNING

To prevent property damage, personal injury, and / or death, 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.

Axle Operating Temperature

Normally, axle operating temperature will not exceed more than 100ºF (38ºC) above ambient temperature. However, intermittent operation (5 % of time) at higher temperatures under extreme loads (long pulls) will not harm the axle. Operating temperatures above 230ºF (110ºC) 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 230ºF (110ºC).

International® Ride Optimized Suspension (IROS) (Optional)

CAUTION

To prevent property damage, the vehicle must not be operated on the road without air in the suspension bags. This will prevent suspension damage and ride degradation.

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:

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

WARNING

To prevent property damage, personal injury, and / or death, when operating a loaded vehicle, always keep all adjustable axles in the down position supporting their share of the load. This can prevent overloading other axles, tires, wheels, springs, brakes, and frames, causing early component failure and loss of vehicle control.

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 (such as air lift axles).

Exhaust Aftertreatment

Selective Catalytic Reduction (SCR) System (If Equipped)

Introduction

Selective Catalytic Reduction (SCR) is the aftertreatment technology that treats exhaust gas downstream of the engine. It uses a urea-based Diesel Exhaust Fluid (DEF) and a catalyst to significantly reduce nitrogen oxide (NOx) emissions.

Diesel Exhaust Fluid (DEF)

Diesel Exhaust Fluid (DEF) is nontoxic, nonflammable, and biodegradable. It is a carefully blended aqueous urea solution of 32.5% high-purity urea and 67.5% deionized water.

If stored between 10° and 90°F (-12° and 32°C), DEF has shelf life of 12 months minimum. For best shelf life, DEF containers should be stored in a controlled environment out of direct sunlight.

The amount of DEF consumption depends on engine speed and load; therefore, it differs from vehicle to vehicle.

CAUTION

To prevent property damage, Navistar, Inc. requires the use of Diesel Exhaust Fluid (DEF) that meets or exceeds ISO-22241-1. There is no acceptable substitute.

Navistar recommends using Fleetrite® brand Diesel Exhaust Fluid.

DEF Tank

The DEF tank is located on the driver side of the vehicle. For reference, see Figure Exterior Components in section **Model Description > Exterior Components**.

The filler neck inlet on a DEF tank has a blue cap, and has a smaller diameter (19 mm) than that of a filler neck on the diesel fuel tank.

The SCR system is designed to operate normally also under freezing conditions while containing DEF. Though DEF freezes

at approximately 10°F (-12°C), no operator interaction is necessary when operating in cold temperatures.

Under cold or very dry conditions, water vapor can be seen coming from the vehicle's tailpipe. This is normal system operation. The water vapor will disappear within a few minutes of normal vehicle operation.

After the key is turned OFF on a vehicle with SCR system, a pumping sound may be heard from underneath the vehicle. The sound is made by the Aftertreatment DEF dosing unit while it purges any unused DEF from the system, and returns it to the DEF tank. This is normal system operation. It takes about 60 seconds to complete.

CAUTION

To prevent property damage, after turning the key OFF on a vehicle with Selective Catalyst Reduction (SCR) system, do not disconnect the vehicle batteries while you can hear a pumping sound from underneath the vehicle. The sound may last for about 60 seconds.

Low DEF Level

WARNING

To prevent property damage, personal injury, and / or death, remember the following: Failure to maintain the adequate Diesel Exhaust Fluid (DEF) level may result in a loss of engine power and vehicle speed, which may cause an accident.

On the instrument panel, you can monitor the fluid level using the DEF Level Gauge. You will see additional warnings if the DEF is too low. If DEF level decreases to 2.2% or lower, the engine performance will start to be derated by at least 25%. If the DEF level decreases to 0% and remains at 0% for an extended time, the vehicle speed will be limited to 5 mph (8 km/h). Refill the DEF tank with approved DEF at any point, and the vehicle will resume normal operation.

See the following table for a detailed explanation of indicators about low DEF level.

Indicators About Low DEF Level (For Vehicles Equipped with Navistar's Engines)

Level	Indication	Audible Alarm	LCD Text Message	Vehicle Conditions / Operation
1	 0000036013 (Solid)	1 Beep	DEF LOW REFILL SOON.	Initial Warning - normal engine operation. DEF level is 5.6% or lower.

Indicators About Low DEF Level (For Vehicles Equipped with Navistar's Engines) (cont.)

Level	Indication	Audible Alarm	LCD Text Message	Vehicle Conditions / Operation
2	 0000036013 (Flashing)	1 Beep	DEF LOW REFILL SOON.	Initial Warning - normal engine operation. DEF level is 2.2% or lower.
3	 0000036013 (Flashing)  8487086 (Solid)	1 Beep	DEF LOW ENG DERATED 40%.	Engine performance is progressively derated by up to 40%. DEF level is 0%.

Indicators About Low DEF Level (For Vehicles Equipped with Navistar's Engines) (cont.)

Level	Indication	Audible Alarm	LCD Text Message	Vehicle Conditions / Operation
4	 0000036013 (Flashing)  8487086 (Solid)	1 Beep	DEF LOW ENG DERATED 5MPH.	Engine performance is derated by 40%. Vehicle speed is limited to 5 mph (8 km/h). DEF level is 0%.

DEF Contamination or SCR System Fault

WARNING

To prevent property damage, personal injury, and / or death, seek service immediately at the nearest International Truck service location once Diesel Exhaust Fluid (DEF) contamination or Selective Catalyst Reduction (SCR) system fault is detected.

- **Failure to resolve the problems may result in a loss of engine power and vehicle speed, and may cause an accident.**

If incorrect liquid is in the DEF tank, or if some other fault is detected within the SCR system, the Amber Warning Lamp or Malfunction Indicator Lamp will illuminate. If no action is taken in the initial warning stages, engine performance will be derated by at least 25%, and eventually vehicle speed may be limited to 5 mph (8 km/h).

See the following tables for detailed explanation of DEF or SCR system indicators.

Indicators About DEF Quality Problem (For Vehicles Equipped with Navistar's Engines)

Level	Indication	Audible Alarm	LCD Text Message	Vehicle Conditions / Operation
1	 8487084	None	DEF QUALITY SERVICE SOON.	Initial Warning - fault code has been set.
2	 8487084	None	DEF QUALITY ENG DERATE.	Engine performance is progressively derated by at least 25%.
3	 8487084	1 Chime	DEF QUALITY ENG DERATE.	Engine performance is derated by up to 40%.
4	 8487084  8487086	1 Chime	DEF QUALITY ENG DERATE.	Engine performance is derated by up to 40%. Vehicle speed is limited to 5 MPH (8 km/h).

Warnings of SCR System Fault (For Vehicles Equipped with Navistar's Engines)

Level	Indication	Audible Alarm	Vehicle Conditions / Operation
1	 3813053	1 Beep	Initial Warning - fault code has been set.
2	 3813053	1 Beep	Engine performance is derated by at least 25%.
3	 8487086  3813053	1 Beep	Engine performance is progressively derated by up to 40%.
4	 3813053  8487086	1 Beep	Engine performance is derated by 40%. Vehicle speed is limited to 5 mph (8 km/h).

Exhaust Diesel Particulate Filter (DPF) 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 (derate) 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.

WARNING

To prevent property damage, personal injury, and / or death, performing a Parked Regeneration when DPF indicator is ON will cause the engine to lose power and eventually shut down.

When performing Parked Regeneration, make certain the 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.

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).

Diesel Particulate Filter (DPF) Regeneration Table

Level	Indication	Audible Alarm	LCD Text Message	Vehicle Conditions / Operation	Action Required
1	 (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	 (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	 (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** **Failure to observe the following warning may cause property damage, personal injury, or death. Pull vehicle safely off roadway and start Parked Regeneration to prevent engine stopping.**

Diesel Particulate Filter (DPF) Regeneration Table (cont.)

Exhaust System Temperature is HOT

WARNING

To prevent property damage, personal injury, and / or death, keep exhaust components away from people and flammable materials, vapors, or structures, and STOP ENGINE. Exhaust components, operating under normal conditions, and exhaust gases are at extremely high temperatures.

A serious problem has occurred. Engine may **SHUT DOWN** 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.

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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.

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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.

Two-Position Regeneration Inhibit Switch

With the optional two-position switch, pressing the ON position of the ON/INHIBT 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.

Brakes

General Information

WARNING

To prevent property damage, personal injury, and / or death, always check and maintain brakes in proper condition and adjustment. Out-of-adjustment brakes could cause reduced braking ability.

Downhill Operation

WARNING

To prevent property damage, personal injury, and / or death, 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.

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 (3 - 5 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

General Information

WARNING

Failure to observe the following warning may cause property damage, personal injury, or death. 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.

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

WARNING

To prevent property damage, personal injury, and / 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 64 - 76 psi (441 - 524 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.

Reservoir Moisture Draining

The Bendix® AD-IS® air dryer automatically drains the wet tank. Daily draining is not required.

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.

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

WARNING

To prevent property damage, personal injury, and / or death, under no circumstances should the spring brake chamber be disassembled. Disassembly will release a powerful spring.

WARNING

To prevent property damage, personal injury, and / or death, always install wheel chocks when manually releasing the spring brakes, or the vehicle could 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.

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 set 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 - 45 psi (138 - 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.

Parking Brake Alarm

If the parking brake alarm sounds **(horn continuously blows when driver's door is opened),** press the service brake pedal. Then, after turning the ignition switch to the ON or ACC position, make sure that the parking brake is set. For a more detailed description of the alarm, see the **Parking Brake Alarm** in the **Electrical** section above.

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

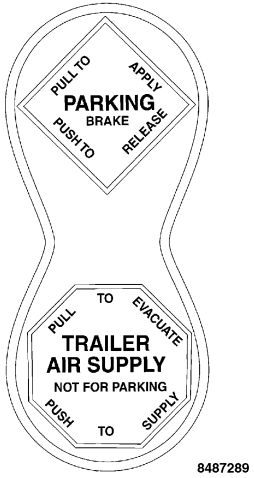
WARNING

To prevent property damage, personal injury, and / 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.

The trailer brake hand control is used to apply the trailer service brakes independently of the tractor service brakes. This 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 - 40 psi (138 - 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 setting 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 set the trailer's parking brakes and keep it stationary while the tractor is moved forward or reverse.

Parking Brake Indicator

WARNING

To prevent property damage, personal injury, and / or death, avoid driving with the parking brakes applied, which can lead to excessive heat buildup and possibly a fire.

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.

Bobtail Proportioning System

Bobtail proportioning is available with tractor air brake systems (for export only with code 04092) with or without ABS or ABS / Traction Control Systems. The proportioning valve senses when trailer brakes are not connected to the vehicle air brake system, and automatically adjusts rear 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 when in a brake system without bobtail proportioning.

Antilock Brake System (ABS)

General Information

WARNING

To prevent property damage, personal injury, and / or death, Antilock Brake System(s) (ABS) 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.

WARNING

To prevent property damage, personal injury, and / or death, do not rely on the Antilock Brake System (ABS) to interrupt vehicle 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.

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

WARNING

To prevent property damage, personal injury, and / or death, if the Antilock Brake System (ABS) warning indicator comes on, have the ABS repaired immediately as stopping distances may increase under certain braking conditions. Take every precaution to prevent wheel lockup, which could result in loss of vehicle control.

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

An Amber Warning Lamp 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 devices until the lockup situation has stopped.

If the ABS warning indicator on the instrument panel gauge cluster 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

WARNING

To prevent property damage, personal injury, and / or death, DO NOT pull double or triple trailers with vehicles equipped with Stability Control as it will have reduced effectiveness.

WARNING

To prevent property damage, personal injury, and / 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.

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 prevents wheel lock-up 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)

WARNING

To prevent property damage, personal injury, and / or death, drivers operating a Traction Control equipped vehicle should employ safe driving practices and assume no additional driving risks. 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.

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 TRAC CTRL 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 TRAC CTRL 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.

Automatic Traction Control (ATC) System

General Information

The Automatic Traction Control (ATC) feature is an available option on some models. Automatic Traction Control is an integrated addition to the ABS. This system utilizes input from the individual wheel sensors to determine if drive axle wheel slip is occurring during vehicle acceleration. If drive axle wheel slippage is occurring, the Controller Relay initiates action to reduce engine power and / or to selectively apply rear brakes to transfer power from the slipping wheel to the opposite wheel. This enables the vehicle to gain momentum and move torque to road surfaces providing more traction. The system

instantly blinks an indicator to advise the driver that wheel spin is occurring.

If wheel spin occurs at speeds above 25 mph (40 km/h), the indicator blinks and, using its link to the engine control module, the ATC reduces engine torque to a level suitable for the available traction. The brakes are not applied, even slightly, at any speed above 25 mph (40 km/h).

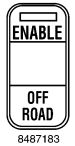
Both the ABS and ATC are features added to the basic air brake system, and the loss of either or both should in no way affect the basic brake system. ABS and ATC require no changes in driving style and it is best not to change your usual, careful driving habits. Other than during initial start-up, when the TRAC CTRL indicator flashes and then goes out, the ATC system should not be noticed until it's needed. Routine operation of the brakes and accelerator are unchanged.

ATC System Check

At ignition turn-on, the TRAC CTRL 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.



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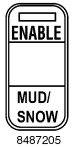
NOTE: Be sure to turn the ATC OFF ROAD or MUD/SNOW switch off when you return to a firm surface.

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.



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Stability Control Systems – Bendix® RSP / WABCO RSC / Bendix® ESP

WARNING

To prevent property damage, personal injury, and / or death, DO NOT pull double or triple trailers with vehicles equipped with Stability Control as it will have reduced effectiveness.

WARNING

To prevent property damage, personal injury, and / 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.

CAUTION

To prevent property damage, modification to vehicles equipped with stability control systems require prior approval through Navistar or the stability control system manufacturer. Unapproved modifications may result in diminished stability control performance.

The optional stability control system provides the core ABS function as well as ATC and Roll Stability functions.

Core ABS Functions: The core ABS reduces wheel lock-up to help drivers maintain steering control while braking. ABS uses 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.

Roll Stability Functions: The control system (RSP or RSC) helps to mitigate rollovers through advanced sensing, engine torque control, and automatic application of the vehicle brakes. RSP is an all-axle ABS solution that helps reduce vehicle speed by applying all vehicle brakes as needed, reducing the tendency to roll over. RSC is a rear-axle ABS solution that helps reduce vehicle speed by applying rear vehicle brakes as needed, reducing the tendency to roll over.

RSP or RSC focuses on reducing the vehicle's speed below the critical roll threshold during direction-changing maneuvers, (such as at exit ramps) lane changing, cornering, or obstacle avoidance. It is most effective on dry, high-friction surfaces.

Advanced Stability Functions (ESP): 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 (ESP only): 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 (RSP and ESP) 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 is given "priority" at the wheel ends to manage wheel slip for optimal braking. The ABS

functions similarly whether the stability system or the driver applies the brakes.

Towing Instructions

WARNING

To prevent property damage, personal injury, and / or death, always use both tow hooks to prevent possible overloading and breaking of individual hooks. This vehicle may be equipped with (optional) dual tow hooks for recovery purposes only.

WARNING

To prevent property damage, personal injury, and / or death:

- **Always install wheel chocks 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 set 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.**

CAUTION

To prevent property damage, observe the following: Due to many variables that exist in towing, positioning and lifting, towing is the sole responsibility of the towing operator.

Refer to the differential and transmission equipment manufacturer for specific instructions on towing your vehicle. Further information can be located in the component owner manual that came with this truck on delivery for original sale.

Damage caused by improper towing procedures is not a warrantable failure.

Remove tow hooks from their installed position in the front of the vehicle before operating the vehicle. Failure to do so could result in the tow hooks becoming unintentionally detached from the vehicle.

NOTE: Important factors to keep in mind when using tow hooks:

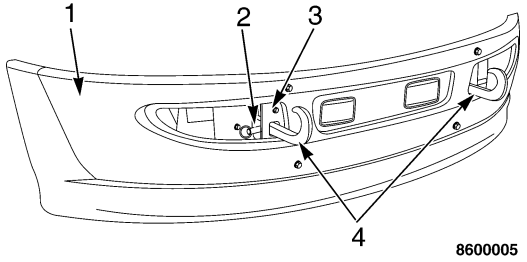
- **Use both tow hooks when retrieving vehicle.**
- **Use a slow steady pull and do not jerk on hooks.**
- **Tow hooks are not designed for towing but for retrieval only.**

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.

Tow Hooks

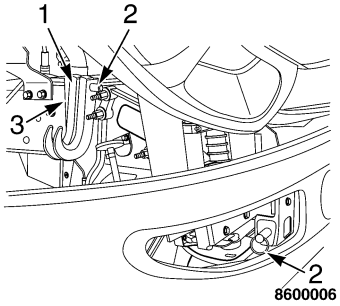
Two removable front tow hooks are available on International® TranStar® Series trucks. When in use the tow hooks are inserted directly into the receivers and secured with a separate retaining pin, and can be conveniently stored on the right side frame bracket when not in use. Tow hooks provide a convenient attachment point from which to recover the vehicle in emergency situations.



1. Front Bumper
2. Pins
3. Receivers
4. Tow Hooks

Insert tow hooks through the front bumper and into the receivers (tow hooks must have the point of hooks up or down while inserting into receivers). Push on each tow hook until it bottoms in its receiver. Reach behind the bumper and insert the retaining pin until it snaps into place.

NOTE: Do not leave tow hooks in receivers when not in use.



1. Tow Hooks
2. Pin
3. Right Side Frame Bracket

The tow hooks are stored on the right side frame bracket using one of the retaining pins as their retainer. The other pin may be stored in one of the receivers.

Towing Vehicle with Front Wheels Suspended

CAUTION

To prevent 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 axles 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.

Towing Vehicles with Driver Controlled Differential Lock

Removing Axle Shafts Before Towing

CAUTION

To prevent differential and / or transmission damage, on 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

To prevent property damage, 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: On vehicles equipped with a driver controlled differential lock, before air pressure is lost the differential lock must be manually caged prior to removing the axle shaft. Failure to do so may make reinstallation of the axle shaft extremely difficult, time consuming, and potentially expensive.

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 5 - 6 lb 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

WARNING

To prevent property damage, personal injury, and / or death, whenever possible, make trailer connections while standing on the ground. Provide adequate lighting of working areas. Inclement weather and accumulated road contamination deposits on handholds and stepping surfaces require extra care to prevent slips and falls, which could cause personal injury or death.

To prevent personal injury and / or death, do not climb on the back of a tractor unless it has been equipped with a deck plate and handholds. 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 (8 km/h) 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 kingpin 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

WARNING

To prevent property damage, personal injury, and / or death, always follow the fifth wheel manufacturer's instructions for hooking and unhooking as well as sliding the fifth wheel.

To prevent property damage, personal injury, and / 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.

WARNING

To prevent property damage, personal injury, and / 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 relock it once the desired position is attained.

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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 (3 km/h)]. 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

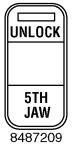
1. Fifth wheel jaws must be opened fully.
2. Tilt fifth wheel back to prevent body damage when tractor is backed under trailer.
3. Install wheel chocks on trailer wheels and be sure trailer spring brakes are adjusted and applied. Never "chase" a trailer.
4. Make sure brake hoses and light cords are clear 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 kingpin 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.

Unhook

1. Try to keep tractor and trailer in straight line.
2. Set tractor and trailer parking brakes.
3. Lower trailer landing gear, making sure it is on solid, level ground. The weight of trailer must be on landing gear.
4. Install wheel chocks on 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.

Fifth Wheel Jaw Unlock Control



Your vehicle may be equipped with an optional Fifth Wheel Jaw Unlock feature. A guarded switch mounted in the cab allows the operator to unlock the fifth wheel jaw from inside the vehicle. There are two available versions for the system, with monitoring or without monitoring. The version with monitoring capabilities includes additional indicators to show the driver fifth wheel jaw status.

NOTE: Fifth Wheel Jaw Unlock is operational only when vehicle is stationary, parking brake is set, and ignition switch is in the RUN position.

NOTE: Outside (roadside), mechanical jaw release mechanism is still operable regardless of in-cab control.

To unlock the fifth wheel jaw, perform the following:

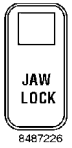
- Depress and **hold** the UNLOCK FIFTH JAW switch.
- If the switch is only pressed **momentarily**, jaw unlock **will not occur**.
- A continuous tone alarm will sound while the jaw is unlocking.
- The continuous tone will then change to a repetitive beep indicating jaw unlocking is complete.
- The RED indicator in the switch will turn on when jaw unlocking is complete.

- Release the UNLOCK FIFTH JAW switch and release the parking brake to silence the alarm.
- The RED indicator will then turn off.
- If the RED indicator flashes fast, this indicates a fifth wheel control system error or failure.
- If the RED indicator flashes slowly, this indicates an interlock problem such as a parking brake not set.

NOTE: If the continuous tone alarm shuts off before the repetitive beep is heard, jaw unlocking was incomplete.

Fifth Wheel Jaw Monitoring

The optional fifth wheel jaw monitoring feature is an electronic jaw lock indicator system with two indicators to show fifth wheel jaw status to the driver.



One indicator, JAW LOCK, has a green indicator that illuminates when the trailer is fully locked onto the fifth wheel. The other indicator, JAW UNLOCK, has a red indicator that illuminates when the trailer is not fully locked onto the fifth wheel. If neither indicator is illuminated, this indicates the jaw is unlocked and the tractor is not connected to a trailer and is in bobtail mode. If the JAW UNLOCK indicator is flashing, this indicates the jaw is locked and the trailer is not connected to the fifth wheel. If both indicators are flashing, this indicates a system error or failure. Both indicators will illuminate briefly when the key is turned to the ON position as a check of indicator function.

SECTION 6 — MAINTENANCE INSTRUCTIONS

Introduction

To prevent property damage, personal injury, and / or death, if the owner / operator of the vehicle is a skilled technician and intends to perform the vehicle maintenance and servicing, they are strongly urged to purchase and follow the appropriate International® service manuals or OnCommand™ Service Information DVD. Ordering information is included at the back of this manual.

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

To prevent property damage, personal injury, and / or death, perform proper and timely maintenance and service to your vehicle.

To prevent property damage, personal injury, and / or death, do not make modifications to any part, component, or system of the vehicle, as that can adversely affect the quality and reliability of your vehicle.

To prevent property damage, personal injury, and / or death, use only genuine International® Truck service parts. The use of inferior parts can adversely affect the quality and reliability of your vehicle.

WARNING

To prevent property damage, personal injury, and / 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.

WARNING

To prevent property damage, personal injury, and / or death, when servicing the vehicle, park on a flat level service, set the parking brake, turn the engine off, and install wheel chocks.

WARNING

To prevent property damage, personal injury, and / or death, 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.

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 install wheel chocks.
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

WARNING

To prevent property damage, personal injury, and / or death, always use floor stands to support the vehicle before working under it. Using only a jack could allow the vehicle to fall.

When performing service repairs on a vehicle, first:

1. Park vehicle on level concrete floor.
2. Set parking brake and / or install wheel chocks 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, and other debris. Replace if necessary. Vehicles

operating in unusually dusty conditions may require inspecting and replacing the air filter(s) more often.

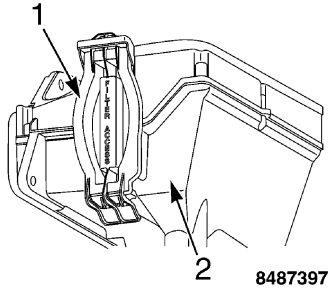
To reduce costs, the filter(s) may be carefully power-washed with a soap solution and reused. Be sure to wash and rinse both sides and be sure to keep the spray head at least six inches away from the filter to prevent damage.

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

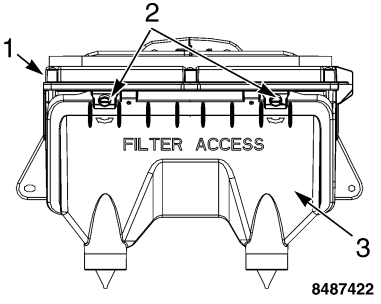


1. Filter access door
2. Air intake housing

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. Screw (2)
3. Filter access door

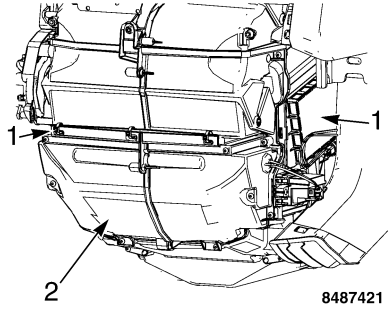
Cab HVAC Filter Replacement – Front Access

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

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.

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 lube 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 lube level by removing the rubber fill / vent plug and insert a finger into the hole.

The specified lube level for clear window-type hubcaps is from the minimum line to 5/16 inch above the minimum line.

If the lube level suddenly drops dramatically below the minimum level, see the Service Manual for diagnostic procedure.

Alignment

Maintaining front axle alignment is very important to achieve 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.

Rear Axle

Inspection and Lubrication

Check to make sure that the rear axle mounting U-bolts, attaching or mounting bolts, and nuts are securely tightened. Loose or misaligned rear axles will affect vehicle alignment, tire wear, and handling. Refer to **SECTION 7 — MAINTENANCE INTERVALS AND SPECIFICATIONS** 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 level inspection hole when the vehicle is on level ground. Add oil as necessary.

Refer to **SECTION 7 — MAINTENANCE INTERVALS AND SPECIFICATIONS** for additional information.

Locking Differential

Vehicles that have a locking differential have the appropriate operator’s manual supplied with the vehicle. Refer to that manual for maintenance checks.

Brakes

General Information

WARNING

To prevent property damage, personal injury, and / or death, avoid breathing brake lining fiber dust. Always use a respirator while performing brake maintenance. Follow precautions listed below.

WARNING

To prevent property damage, personal injury, and / or death, always check and maintain brakes in proper condition and adjustment. Out-of-adjustment brakes could cause reduced braking ability.

All new International® vehicles use non-asbestos 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

WARNING

To prevent property damage, personal injury, and / or death, always install wheel chocks when manually releasing the spring brakes, or the vehicle could roll.

WARNING

To prevent property damage, personal injury, and / or death, under no circumstances should the spring brake section of the spring and service brake chamber be disassembled. Disassembly will release a powerful spring.

WARNING

To prevent property damage, personal injury, and / or death, excessive stroke indicates that a problem exists with the foundation brake, Automatic Slack Adjusters (ASAs), brake actuator, other brake system components, or their installation or adjustment. ASAs should not need to be manually adjusted in service. ASAs should not routinely have to be adjusted to correct excessive push rod stroke.

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.

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. 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.
2. Condition of drums, brake chambers, and slack adjusters for wear, corrosion, maladjustment, cracks, missing components.
3. For air leaks. **No air leakage is permissible.** Also, check for air leaks with parking brake disengaged and install wheel chocks.
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 and 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.

The Bendix® AD-IS® air dryer has an integral wet / purge tank that automatically purges itself and the desiccant of collected water at the end of each compressor cycle.

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 (such as grilles and bumpers) 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 - 1 1/2 inch (25 - 38 mm)** range, it must be adjusted to ensure that it 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 non-asbestos clutch linings. However, exposure to excessive amounts of clutch material dust (whether asbestos or non-asbestos, fiberglass, mineral wool, aramid, ceramic, or carbon) may be a potentially serious health hazard.

WARNING

To prevent property damage, personal injury, and / or death, do not breathe 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.

Hydraulic Clutch

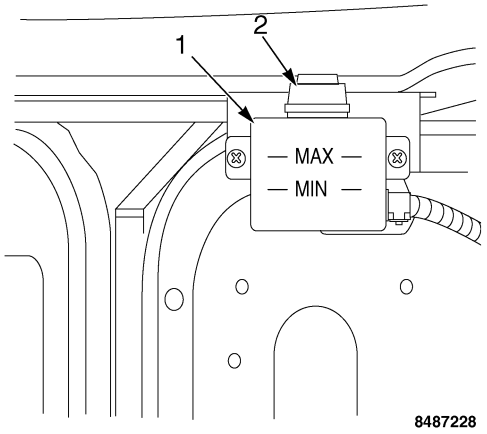
Your vehicle is equipped with a hydraulic clutch actuation system. The reservoir is located just below the cowl, left of center on the firewall.

CAUTION

To prevent vehicle and / or engine component damage, use only approved hydraulic clutch fluid (DOT 3 or DOT 4 brake fluid) in the clutch hydraulic system. Do not mix different types of brake fluid. The wrong fluid will damage the rubber parts of the system, causing loss of clutch function.

CAUTION

To prevent vehicle and / or engine component damage, do not allow the fluid level in the reservoir to go below the MIN line. If too much air enters, the hydraulic system will not operate correctly, and the clutch could be damaged.



1. Reservoir
2. Cap

If the fluid level is below the MIN line, remove cap and fill the reservoir with DOT 3 or DOT 4 brake fluid until the level reaches the MAX line.

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, andstarter. 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 - 24 hours in a warm garage during the cold winter months.

CAUTION

To prevent property damage, do not allow batteries to become heavily discharged and exposed to subfreezing weather that 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

To prevent property damage, 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 Preventative Maintenace (PM) service 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

WARNING

To prevent property damage, personal injury, and / or death, 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, because this could cause wiring to overheat and possibly burn.

Vehicle electrical systems are complex and often include electronic components, such as engine and transmission controls, instrument panels, and antilock brakes. 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 lights 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

General Information

NOTE: For complete operation and maintenance information pertaining to your engine, refer to the Engine Operation and Maintenance Manual provided with the vehicle.

For effective emission control and low operating cost, it is important that maintenance operations be performed at the specified periods or mileage intervals indicated 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.

The required maintenance operations may be performed at a service establishment. Any replacement parts used for required maintenance services or repairs should be genuine OEM service parts. Use of inferior replacement parts hinders operation 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 (such as filters and 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, and belt tensioners, as well as inspection and adjustment of items like valve lash. refer to the Engine Operation and Maintenance Manual supplied with the vehicle.

Air Induction System

WARNING

To prevent property damage, personal injury, and / 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.

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 buildup 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 sure 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.

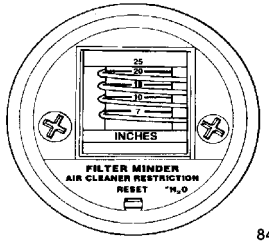
- Check for loose hoses and clamps.
- Check for ruptured, bulging, or collapsed pipes.
- Check air cleaner housing and air restriction gauge for cracks.

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 shut down.

The gauge is mounted on the forward side of the air cleaner housing, or optionally on the center dash panel / wing panel.

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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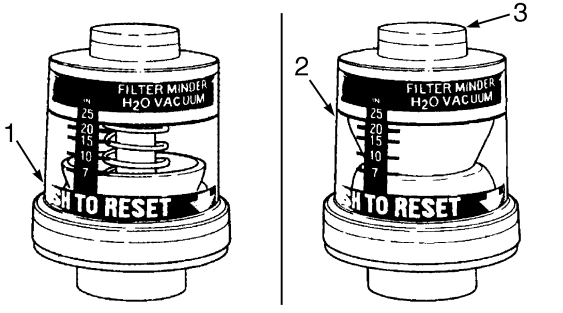
Both gauges have a push-type reset button. The reset on the dash panel-mounted gauge is on the face of the gauge. The reset on the air cleaner-mounted gauge is on the end of the gauge. See illustrations below.



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1. Low Restriction

2. High Restriction
3. Reset Button

The initial restriction with a new air filter element will vary with air cleaner design and installation.

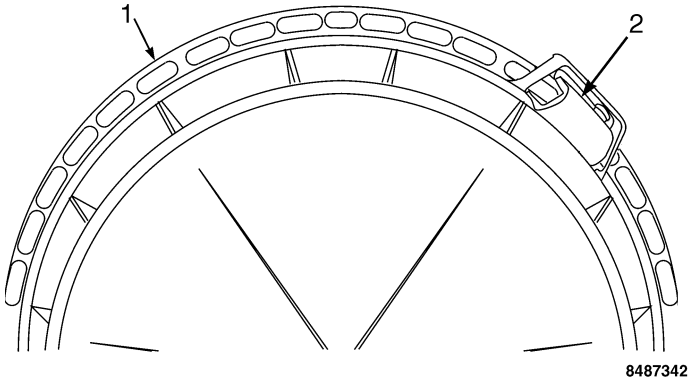
After servicing the filter element, reset the YELLOW indicator by pushing the reset button and releasing it. The YELLOW indicator will drop to near or below the window so the air restriction gauge can be reused.

NOTE: After starting engine, indicator may be seen in lower part of window. This is normal and should not be mistaken as a signal for element service.

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.



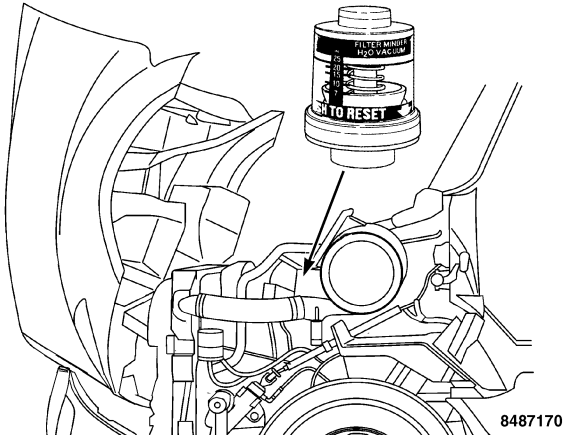
1. Air Cleaner Housing Cover
2. Tab

NOTE: Be careful not to bump the filter while in the housing; this can raise a cloud of dust that can enter the clean side piping to the turbocharger.

1. Lift and hold the locking tab (located at the 2 o'clock position). Rotate the cover counterclockwise (in direction of unlock symbol on cover) to release cover tabs and pull to remove the cover. Remove the filter element(s) carefully and slowly, then discard the old element(s).
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. With the air cleaner cover latch at the 1 o'clock position, align cover tabs with corresponding slots. Push the cover into the slots. Rotate the cover clockwise (in direction of lock on cover) until the locking tab snaps into its locked position.
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.



NOTE: After starting engine, the indicator may be seen in the lower part of the window. This is normal and should not be mistaken as a signal for element service.

Troubleshooting

No Restriction Reading.

POSSIBLE CAUSES	HOW TO CHECK
Plugged fitting or vacuum line	Apply vacuum to gauge until locked up at red zone. Reconnect 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. Reconnect gauge and close end of line airtight. Hold in reset button. Indicator will drop slighty and then not move unless vacuum line has a leak.
Leak in gauge	Repeat above, except close gauge connection airtight.
Engine airflow too low to generate a restriction reading after being reset	Rev engine from idle to full rpms multiple times to increase airflow enough to create an initial reading.
Air cleaner element split open	Visually inspect element.

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 snowstorm, 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 (CAC) 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

Coolant Level Check

WARNING

To prevent personal injury or death from hot coolant or steam scalding, use the following procedure to remove the pressure cap from the cooling system:

A. Allow the engine to cool.

B. Wrap a thick cloth around pressure cap.

C. Partially unscrew pressure cap slowly while firmly holding cap down, then pause to allow pressure to release.

D. When system pressure is released, fully unscrew pressure cap while continuing to holding cap down. Slowly release downward pressure from pressure cap.

E. Remove cap.

WARNING

To prevent property damage, personal injury, and / 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

To prevent property damage, if the coolant should get extremely low and the engine very hot, let the engine cool for approximately 15 minutes before adding coolant. Then, add coolant slowly with the engine running. Adding cold coolant to a hot engine may crack the cylinder head or crankcase. Never use water alone.

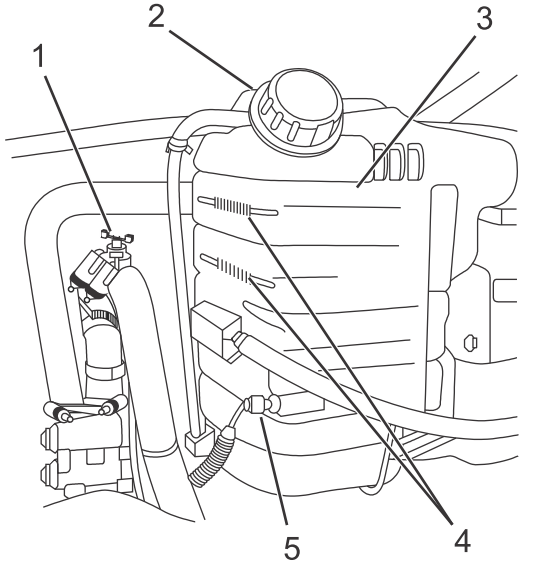
Gravity-Fill Coolant Fill Method

This is a traditional gravity-fill-only method that involves pouring or pumping the coolant into the deaeration tank of the cooling system and using a combination of gravity and engine operation to purge the system of air. This method includes the disadvantage of a requirement to temporarily disconnect the EGR wiring harness to protect the EGR from heat damage prior to being completely deaerated (freed of trapped air). This process may generate a fault code that might require further investigation by an authorized International dealer.

Filling Instructions

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 having a higher percentage (75%) of coolant concentrate is advised in order to achieve a final mixture close to 50/50.

Make sure that coolant level is maintained between the COLD MIN and COLD MAX lines on the deaeration tank when engine is cold.



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1. Cooling system vent valve
2. Vented fill cap
3. Deaeration tank
4. COLD MIN and COLD MAX lines
5. Low coolant sensor

NOTE: Vented fill cap may differ slightly in location on tank between engine sizes.

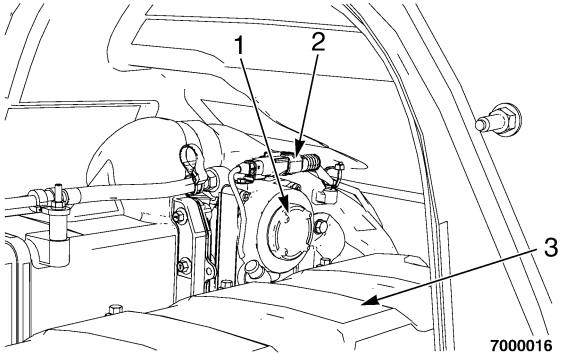
To function properly, the coolant system must be completely filled with coolant and all air must be expelled. To accomplish this, the following procedures should be carefully completed:

1. Open any shutoff valve in the heater circuit, in-transit heat circuit, or Auxiliary Power Unit (APU) circuit.
2. Close the drain valve on the Low Temperature Radiator (LTR).
3. Close the drain valve on the High Temperature Radiator (HTR). This step is not necessary if the drain valve has been replaced with a quick connect fitting.
4. Turn on the ignition without starting the vehicle. This opens the electrically actuated LTR coolant flow valve.
5. Fully open the cooling system vent valves.

NOTE: If the vehicle cooling system has been flushed with water prior to filling, use a portion of undiluted coolant concentrate to assist in achieving a 50/50 mixture after filling, or use a 75/25 mixture for the fill process.

6. Remove deaeration tank cap and pour a 50/50 mixture (75/25 if it has been flushed with water) of Extended Life 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. The first pour should reach to the top of the deaeration tank fill neck.

7. Because the radiator fills slowly, it is important to continue to top off the system up to the fill neck for two minutes following the initial fill.



Engine right rear view

1. Exhaust Gas Recirculation (EGR) Valve
2. EGR Valve Electrical Connector
3. Engine

8. Disconnect the EGR valve electrical connector.
9. When solid coolant starts to pour from the cooling system vent valve, close the cooling system vent valve, and fill the deaeration tank to the top.
10. 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.
11. Run the engine at governed speed until the engine fan has fully engaged for 5 minutes. Do not exceed 220°F (104°C).

NOTE: The fan may not stay engaged for a full five minutes. If the fan cycles off and on, make sure total engagement time is at least 5 minutes. Do not exceed 220°F (104°C).

12. Turn off the engine and reconnect the EGR valve electrical connector.
13. Let the engine completely cool to ambient temperature. Recheck the coolant level and concentration / freeze point with a refractometer and top off as needed using the appropriate concentration of water or concentrated coolant to achieve the proper final coolant mixture.
14. Inspect and adjust the coolant level as necessary, prior to daily operation.

Coolant and Optional Coolant Filter

The cooling system in vehicles with Navistar's 11L and 13L 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 (SCAs) as SCAs 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.

Coolant Concentration Freeze Point

Cooling systems should be checked twice a year to ensure proper coolant water concentrations. A 53/47 coolant / water mixture from the factory provides freeze protection down to minus -40°F (-40°C) as well as excellent corrosion protection. A 50/50 mixture can be easily created in the shop using undiluted coolant and water, and it will provide freeze protection down to -34°F (-36.7°C) if no further dilution is experienced during installation.

Concentrations greater than 67% are not recommended. The use of Shell Rotella® Ultra ELC pre-mixed to make up for coolant loss will ensure the glycol / water concentrations stay in balance.

CAUTION

To prevent property damage, always use Shell Rotella® Ultra Extended Life Coolant (ELC) or equivalent to top-off Ultra ELC-equipped cooling systems. Failure to do so may result in the loss of extended life properties. Should top-off occur with conventional coolant(s) exceeding 10% of the total cooling system capacity, drain and refill with Shell Rotella® Ultra ELC or an equivalent nitrite-free, heavy-duty ELC.

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.

Start cold engine and view fan to see that it is rotating more slowly than the fan pulley (fan clutch is disengaged). Achieve operating temperature and observe that the fan is engaged.

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 – Maintenance, Use, and Repair

Instructions for Proper Maintenance

In order to comply with federal exterior noise regulations, your vehicle may be equipped with noise emission items that must be properly maintained, used, and repaired. 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 maintenance record (Maintenance Record – Noise Control, page 195) form provided.

Maintenance Record – Noise Control

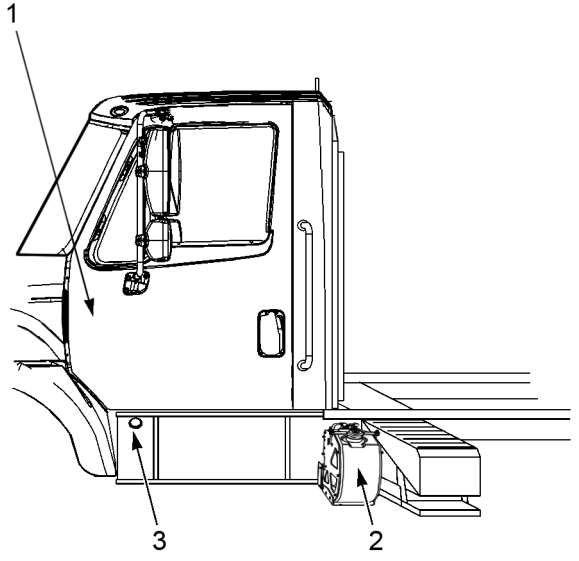
Chassis Model:		Vehicle Identification Number:	
Maintenance Performed	Maintainer (Name)	Location	Date

Diesel Exhaust Fluid (DEF) Tank Filling

CAUTION

To prevent property damage, proper care should be taken when handling, dispensing, or transporting Diesel Exhaust Fluid (DEF), as it is corrosive to some metals and materials.

The DEF filler cap on this vehicle is blue in order to differentiate it from the fuel filler cap. Use only ISO 22241-1 approved DEF to ensure proper purity and concentration.



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1. Drivers-side door
2. DEF filler cap
3. Fuel filler cap

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 non-regenerable soot or the ash residue removed, please take the vehicle to an International dealer.

Transmission

NOTE: For specific transmission fluid and filter change interval recommendations refer to the equipment manufacturer service and operation manual that was provided with the truck at initial sale.

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

To prevent property damage, 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.

Refer to SECTION 7 — MAINTENANCE INTERVALS AND SPECIFICATIONS for proper U-bolt torque values.

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 (such as brackets, bushings, fasteners) 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).

Front Suspension

The front suspension should be regularly inspected for loose, worn, or broken components. Front suspensions / axles should be checked periodically for proper alignment to promote maximum tire life.

On vehicles equipped with the optional front air suspension, the air suspension components, including air bags, height control valves, air lines, and fittings should be inspected for wear, damage, and audible air leaks.

Rear Suspension

The rear suspension should be regularly inspected for loose, worn, or broken components. Rear suspensions / axles should be checked periodically for proper alignment to promote maximum tire life. The optional International® Truck Ride Optimized Suspension (IROS) components, including air bags, height control valves, air lines, and fittings should be inspected for wear, damage, and audible air leaks.

Steering

General Information

WARNING

To prevent property damage, personal injury, and / or death, always follow recommended procedures for steering system maintenance. Maintain the steering system in proper condition; otherwise, reduced steering ability could result.

Have a technician 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.

Regularly inspect steering column joint bolts and steering linkage, particularly for body-to-chassis clearance.

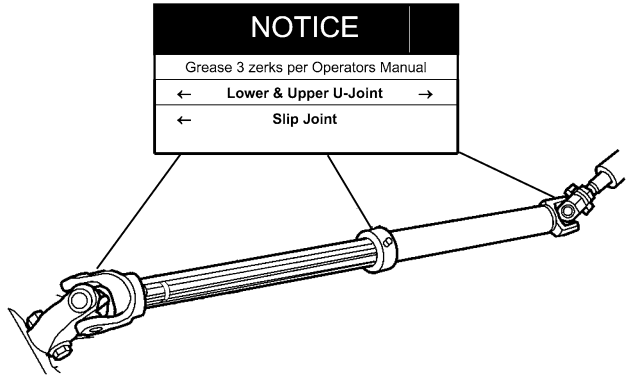
NOTE: Have any steering problems corrected at once by a qualified service technician.

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.

With time, the large square-cut reservoir cap O-ring seal may shrink slightly. To assist in reinstallation of the cap, the O-ring may need to be stretched. To stretch the O-ring, pull on it while pinching it between your thumb and finger. It must be large enough to stay completely in the shallow groove in the top edge of the reservoir prior to cap installation. Replace cracked or damaged O-rings.

Refer to **SECTION 7 — MAINTENANCE INTERVALS AND SPECIFICATIONS** for the fluid and filter replacement intervals.

Tires

Tire Warnings

WARNING

To prevent property damage, personal injury, and / or death, for field maintenance, only inflate and load tires to the maximum of the least-rated tire on the axle. 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.

WARNING

To prevent property damage, personal injury, and / 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.

WARNING

To prevent property damage, personal injury, and / 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 rims approved 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.**

WARNING

To prevent property damage, personal injury, and / or death:

- **Do not mix stud-piloted wheels or fasteners with hub-piloted wheels or fasteners. Mixing wheel types may cause premature wheel failure.**
- **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.**

WARNING

To prevent property damage, personal injury, and / or death, do not mount tube-type tires on tubeless wheels or tubeless tires on tube-type wheels.

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 - 15 psi (69 - 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 also is strongly recommended to avoid moisture in the high-pressure air used for tire inflation.

Underinflation

Tires should not be allowed to become under -inflated. Increased flexing due to under inflation causes heat buildup within the tire components. This leads to reduced strength, breakdown of the rubber compounds and possible separation of the tire components (such as 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.

SmartWave® Tire Pressure Monitoring System (TPMS)

CAUTION

To prevent property damage, follow specific instructions to avoid breaking SmartWave® tire sensors when mounting and dismounting a tire. If tire work is done by a non SmartWave® authorized facility, please let them know that a tire pressure monitoring system is installed on the vehicle before they remove a tire from a wheel. Refer to http://www.smartire.com/support/manuals for complete owner's manual.

The optional SmartWave® Tire Pressure Monitoring System (TPMS) warns the driver that tire pressure is below set pressure. Air pressure sensors are installed on the inner rim of each wheel. The standard user interface is a round display located in the center dash panel. If the vehicle is equipped with the optional Electronic Vehicle Monitoring Driver Information Display (DID), the DID will act as the user interface and the round SmartWave® display is not provided. Refer to the Driver Information Display operator reference card, supplied in the vehicle, for product information.

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

WARNING

To prevent property damage, personal injury, and / or death, do not load tires beyond their rated capacity as this 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.

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 that 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.
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 Re-Groovable molded on the sidewall can be regrooved. A minimum of 3/32 (2.38 mm) of under-tread 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. Over inflation 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.

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.
- Maintaining 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

WARNING

To prevent property damage, personal injury, and / 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 rims approved 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.**

WARNING

To prevent property damage, personal injury, and / or death:

- **Do not mix stud-piloted wheels or fasteners with hub-piloted wheels or fasteners. Mixing wheel types may cause premature wheel failure.**
- **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.**

WARNING

To prevent property damage, personal injury, and / 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.

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

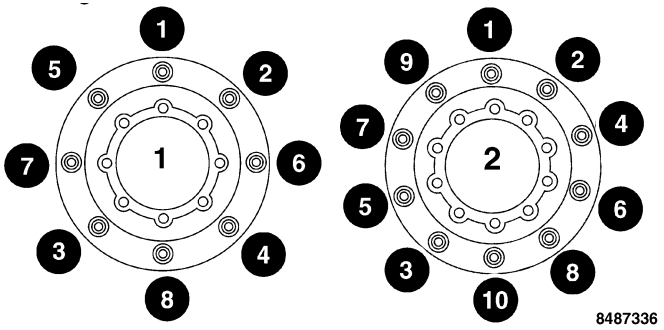
WARNING

To prevent property damage, personal injury, and / or death, use only the same type and style wheels and mounting hardware to replace original parts. Failure to do so may result in an assembly that looks fine but does not fit together properly. This could cause wheel or fastener failures.

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 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.

Transmission

NOTE: For specific transmission fluid and filter change intervals recommendations refer to the equipment manufacturer service and operation manual that was provided with the truck at initial sale.

Check lubricant level. With the vehicle on level ground, verify that transmission lubricant level is even with the bottom of the inspection plug in the side of the transmission. Check shifter for proper operation.

- Check operation of transmission neutral safety switch. Try to start the vehicle in all shift selector positions other than neutral. The starter should ONLY operate when the shift selector is in Neutral.
- Refer to **SECTION 8 — MAINTENANCE INTERVALS AND SPECIFICATIONS** for information on transmission fluids and fluid and filter change intervals.

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. The use of Fleetrite® lubricants is recommended 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.

NOTE: The maintainer is advised to refer to the Original Equipment Component Manufacturer for the most up-to-date specific service instructions, required capacities and lubricating oils.

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.

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.

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	
	City < 59,000 mi/yr	**Highway > 60,000 mi/yr**
A	10,000 miles (16,000 km) 300 hours 6 months	15,000 miles (24,000 km) 450 hours 9 months
B	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 the wheels and tires.

NOTE 3: Certain services are performed at Special Intervals or in addition to A or B Service Intervals when the interval dictates.

NOTE: Refer to the Original Equipment Component Manufacturer for the most up-to-date specific service instructions, required capacities, and lubricating oils.

Lubrication and Maintenance Interval – Recommended Synchronized Intervals

System	Item	Intervals	Special Interval (3): miles (km) / hours / months
Pretrip Inspection	Pretrip Inspection Items listed in Section 3 – Check All	Daily, A, B	
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		100,000 (160,000 km) / – / 12
	Wheel Bearing – Grease Type – Repack		30,000 (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 mi (58,000 km) thereafter

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 Oil – Change		60,000 miles (96,000 km) / – / 12
	Rear Axle Wheel Ends – Inspect for leaks, lube level / condition, and check end play with dial indicator.		100,000 miles (160,000 km) / – / 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 Oil – Change		120,000 miles (192,000 km) / – / 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 (800,000 km) / – / 5 Years
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	B	
	Electrical lines routing and clipping (lines are not tangled, crimped, pinched, or rubbing against surfaces); not spliced or taped; insulation not cut, cracked, chafed, or worn – Inspect	B	

Lubrication and Maintenance Interval – Recommended Synchronized Intervals (cont.)

System	Item	Intervals	Special Interval (3): miles (km) / hours / months
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		50,000 miles (80,000 km) / 1500 / 24
	Power Steering Fluid – Change		40,000 miles (64,000 km) / – / 12
	Power Steering Filter – Replace		500,000 miles (800,000 km) / 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 miles (8,000 km) / – / 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	A, B	AD–9 Model: 250,000 miles (400,000 km) / – / 24 Other Models: 125,000 miles (200,000 km) / - / 12
	Air Dryer Heater & Purge Valve – Check	A, B	AD-IP: 1 year; AD-9: 2 Years
	Air Compressor Discharge Line – Check Blockage	A, B	50,000 miles (80,000 km) / 1,500 / 24

Lubrication and Maintenance Interval – Recommended Synchronized Intervals (cont.)

System	Item	Intervals	Special Interval (3): miles (km) / hours / months
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		150,000 miles (240,000 km) / 6,000 / 30
	Extended Life Coolant – Replace		300,000 miles (480,000) / – / 60
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 iIndication 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	
	Non-Davco Fuel / Water Separator Filter – Replace	A, B	
	Davco Fuel/Water Separator Filter – Replace		As required by fuel level reaching top of globe
	Fuel Filter – Replace	Refer to Engine Operation and Maintenance Manual	
Fuel Tank	Fuel Tank(s) Drain and Flush (Note 3)		100,000 miles (160,000 km)/–/12
	Fuel Sender, Hose Connections – Check for Loose Connectors		12 months

Lubrication and Maintenance Interval – Recommended Synchronized Intervals (cont.)

System	Item	Intervals	Special Interval (3): miles (km) / hours / months
Exhaust System	Pipes / Muffler – Inspect for Leakage / Looseness	A, B	
	Diesel Particulate Filter (DPF) Cleaning	As required by warning indicator.	
	Diesel Exhaust Fluid (DEF) Tank		As required by DEF gauge.
	Diesel Exhaust Fluid (DEF) Supply Module Filter – Replace		200,000 miles / 322,000 km or 6,500 hours
Hydraulic Clutch	Release Bearing / Shafts / Fork – Lubricate		Highway: – 10,000 (16,000) / – / 1 City / Severe Service: – /250/1
	Hydraulic Clutch Fluid – Drain and Refill		200,000 miles (322,000 km) / – / 2 years
	NOTE: Refer to original equipment manufacturer for specific service instructions and recommendations.		
Transmission	Trans Fluid, Automatic / 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 Operator's Manual	
	Manual Trans, Synthetic Oil – Replace	Refer to Transmission Operator's Manual	
	Automatic / Manual Trans Fluid / Filter – Replace	Refer to Transmission Operator's Manual	
	NOTE: Refer to the original equipment transmission manufacturer for specific service instructions and recommendations, required capacities, and transmission oils.		
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

Lubrication and Maintenance Interval – Recommended Synchronized Intervals (cont.)

System	Item	Intervals	Special Interval (3): miles (km) / hours / months
Cab Components	Door Hinges / Latches / Strikers – Lubricate, Check Link (Use Multipurpose 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: Components requiring lubrication and fluid check and fill diagrams are typical representations.

Lubrication Notes

CAUTION

To prevent property damage, avoid unapproved lubricants, which can cause premature component failure. Refer to the Lubricant and Sealer Specifications 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.

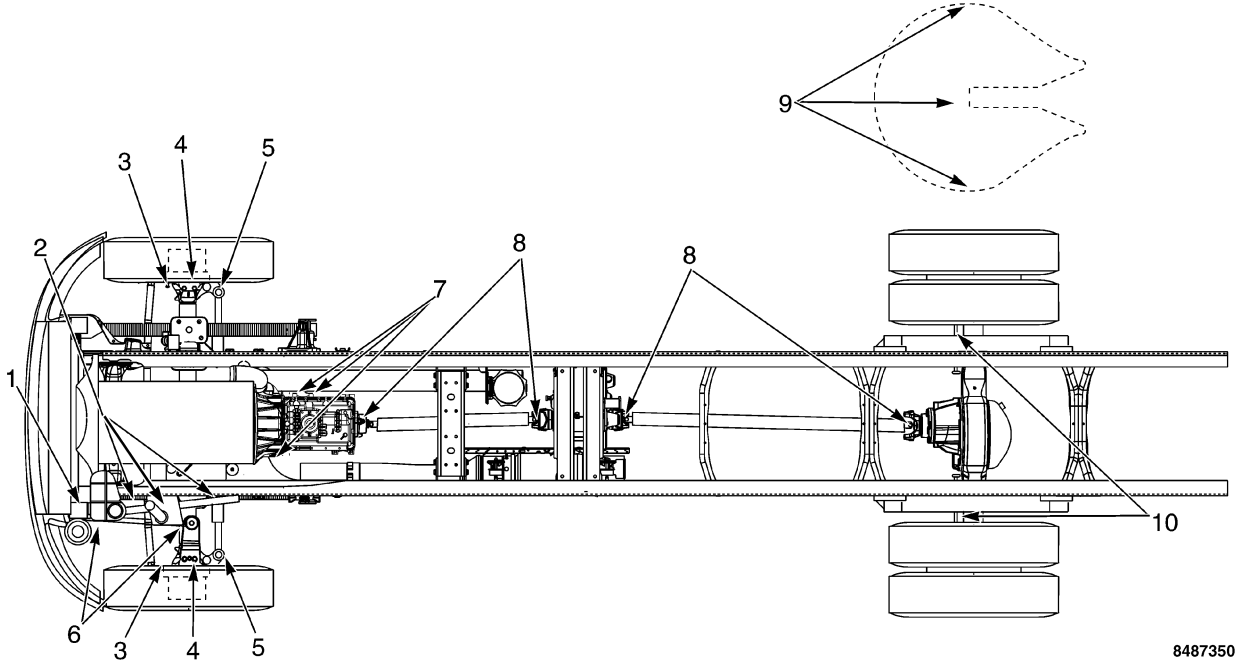
Fluid Check and Fill Notes

CAUTION

To prevent property damage, use only recommended viscosity engine oil. Refer to the Engine Operation and Maintenance Manual for engine oil specifications.

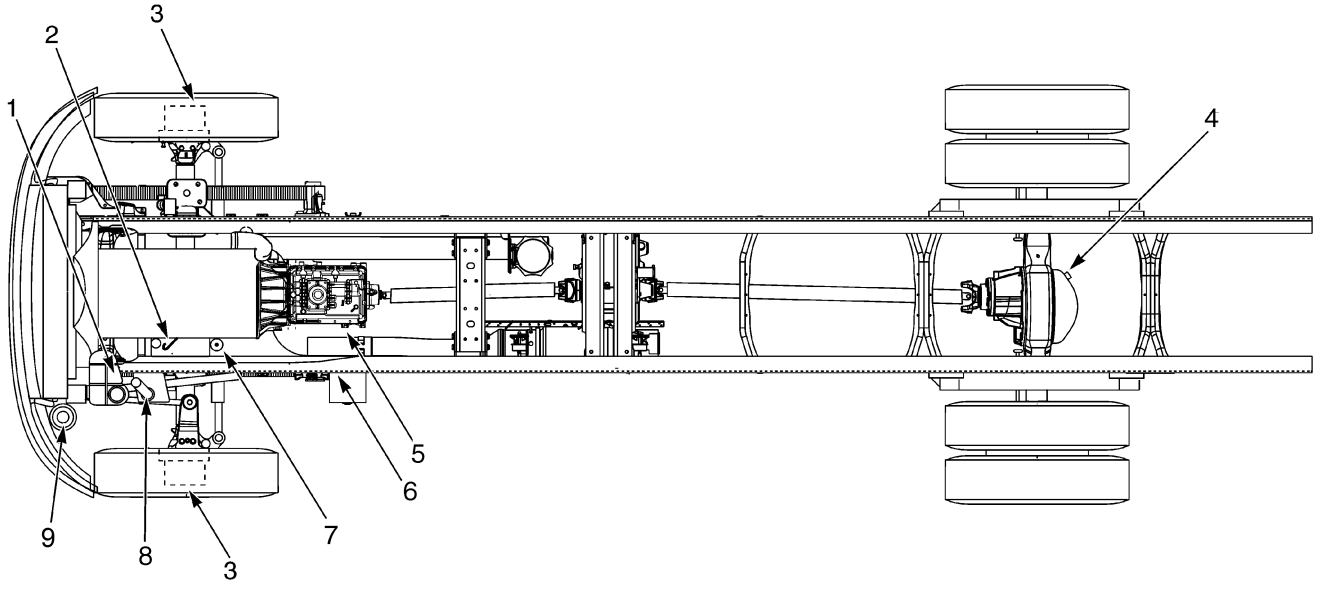
- Wait 5 minutes after shutting off the engine before checking the oil level. This gives the oil time to drain back to the oil pan.
- Clean all caps and fill plugs prior to removal to prevent dirt and debris from entering system.
- Filling the power steering fluid above the MAX COLD mark when cold will 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



1. Steering gear
2. Steering intermediate shaft
3. Front S-Cam and slack adjuster (2)
4. Kingpin bushing and thrust bearing (2)
5. Tie rod end (2)
6. Steering drag link end (2)
7. Clutch cross-shaft and release bearing (3)
8. Drive shaft U-Joint and slip joint (4)
9. Fifth wheel pivot point and top plate (If equipped) (3)
10. Rear S-Cam and slack adjuster (2)

Components Requiring Fluid Check and Fill



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1. Coolant make-up tank
2. Engine oil dipstick
3. Front axle oil-filled hub (2)
4. Drive axle oil fill / level check plug
5. Manual transmission oil fill / level check plug
6. Diesel Exhaust Fluid (DEF) tank (on vehicles equipped with Selective Catalytic Reduction (SCR) system)
7. Automatic transmission oil fill / level check plug
8. Windshield washer fluid bottle
9. Power steering fluid reservoir

Unit Refill Capacities

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 - 22 gallons (23 - 83 liters).

If system has been drained:

- Fill with a 50/50 mixture of Nitrite-free Shell Rotella® Ultra Extended Life Coolant (ELC) (yellow) concentrate and de-mineralized or distilled water, or Nitrite-free Shell Rotella® Ultra ELC 50/50 Premix (yellow).

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 - 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.

Diesel Exhaust Fluid (DEF) Tank

Diesel Exhaust Fluid (DEF) tank refill capacity varies depending on the vehicle models. Its total capacity may range from 16 - 23 gal (61 - 87 L).

Crankcase and Oil Filters

For specific engine crankcase capacities, refer to separate Engine Operation and Maintenance Manual provided with vehicle.

Hydraulic Clutch System

Description	Fl-Oz	Liters
Reservoir Capacity	8.45	.25
System Capacity	16.6	.49
NOTE: Use only approved DOT 3 or DOT 4 brake fluid.		

Power Steering Systems

Gear	Power Steering Fluid Volume (in^3 / pints / liters)
TAS–65 Steering Gear	240 / 8.4 / 3.9
M–100 Steering Gear	240 / 8.4 / 3.9

Transmission

NOTE: A variety of transmissions are available for your vehicle. Refer to the Original Equipment Transmission Manufacturer for the most up-to-date specific service instructions, required capacities and transmission oils.

Description	Transmission Type	Feature Code
Allison Automatic 3000 HS 5-Speed	Automated	13ATL
Allison Automatic 3000 RDS P 5-Speed	Automated	13AVJ
Allison Automatic 4000 HS 5-Speed	Automated	13AUZ
Allison Automatic 3000 HS 6-Speed	Automated	13AVE
Allison Automatic 3000 RDS P 6-Speed	Automated	13AVR
Allison Automatic 4000 HS 6-Speed	Automated	13AVB
Allison Automatic 4000 RDS P 6-Speed	Automated	13ATR
Allison Automatic TC10 10-Speed	Automated	13AWD
Eaton® Fuller® Advantage 10-Speed	Manual	13GXM, 13GXN, 13GXR, 13GXU, 13GXV
Fuller® 10-Speed	Manual	13GAH, 13GHA, 13GHB, 13GHC, 13GHJ, 13GHK. 13GHL, 13GHN, 13GHP, 13GHR, 13GHS
Eaton® Fuller® UltraShift+ 10-Speed	Manual	13GVW, 13GVY, 13GVZ, 13GWC, 13GWE, 13GWG, 13GWL
Fuller® 11-Speed	Manual	13GMZ
Fuller® 13-Speed, if equipped	Manual	13GKJ, 13GRE
Eaton® Fuller® 13-Speed	Ultrashift®	13GWS, 13GWY, 13GWZ, 13GXA
Fuller® 15-Speed	Manual	13GHY
Eaton® Fuller® 18-Speed	Manual	13GPT
Eaton® Fuller® 18-Speed	Ultrashift®	13GXC
Fuller® 18-Speed	Manual	13GKK, 13GKL

Description	Transmission Type	Feature Code
A variety of transmissions are available for the International® TranStar® Series truck. Refer to the Original Equipment Transmission Manufacturer for specific service instructions, required capacities, and transmission fluids.		

Rear Axle Unit Refill Capacities

	Forward		Rear	
Axle Model No.	**Liters**	**Pints**	**Liters**	**Pints**
Dana Spicer® S23-170, S23-170D	17.5	37		
Meritor RS-23-160	18.5	39		
Meritor RS-23-186	22.5	47.5		
TANDEM				
14GSX, 14GRB, 14GRC, 14GRN	14	30.5	12	26
Dana Spicer® DS405/RS405	14.7	31	13	28
Dana Spicer® DS404/RS404	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® DST40/RST40	14.7	31	17	36
Meritor RT-40-145, RT-40-145A, RT-40-145P	14	30.2	12	25.8

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

Lubricant and Sealer Specifications

NOTE: Refer to the Original Equipment Manufacturer for up-to-date specific service instructions, required capacities, and lubricating oils.

Component	Component Vendor / Lubrication Type	Viscosity / Ambient Temperature / Notes
Non-driving Front Axle		
Front Axle Wheel Bearing Oil	Eaton-Dana® axle (**Generic**)	75W: -40°F to - 15°F (-40°C to -26°C) 75W-80: -40°F to 80°F (-40°C to 27°C) 75W-90: -40°F to 100°F (-40°C to 38°C) 75W-140: -40°F and above (-40°C and above) 80W-90: -15°F to 100°F (-26°C to 38°C) 80W-140: -15°F and above (-26°C and above) 85W-140: 10°F and above (-12°C and above)
	Eaton-Dana® axle: multipurpose EP gear lube of API GL-5 quality meeting MIL-PRF-2105E specs including *synthetic lubricants. *** Do Not Mix conventional lube with synthetic lube.**	75W: -40°F to 32°F (-40°C to 0°C) 75W-90: -40°F to 100°F (-40°C to 38°C) 75W-140: -40°F and above (-40°C and above) 80W: -15°F to 70°F (-26°C to 21°C) 80W-140: -15°F and above (-26°C and above) 90W: 10°F to 100°F (-12°C to 38°C) 85W-140: 10°F and above (-12°C and above) 140W : 40°F and above (4°C and above)
	Meritor: Synthetic from factory with Cognis Emgard® 75W-90 will have a tag attached to fill plug that reads as follows: **Filled with synthetic lube. Do Not Mix**.	75W-90

Component	Component Vendor / Lubrication Type	Viscosity / Ambient Temperature / Notes
	Meritor petroleum	
	0-76-A Hypoid Gear Oil	85W-140: 10°F and above (-12°C and above)
	0-76-D Hypoid Gear Oil	80W-90: -15°F and above (-26°C and above)
	0-76-E Hypoid Gear Oil	75W-90: -40°F and above (-40°C and above)
	0-76-J Hypoid Gear Oil	75W: -40°F to 36°F (-40°C to 2°C)
	Petroleum oil: Engine Oil API-CJ or CI	SAE 40 or 50: 10°F and above (-12°C and above)
		SAE 30: -15°F and above (-26°C and above)
Front Axle Wheel Bearing Grease, Tie Rod Ends, Drag Link, Kingpin and Bushing	Eaton-Dana® axle, Meritor axle: Fleetrite® NLGI #2 Lithium Complex-Based Moly grease P/N 991044C2 or equivalent GC/LB NLGI #2 Multipurpose Lithium Complex grease	**NOTE: Eaton-Dana® and Meritor Easy Steer® axles: With chassis load on axle, force grease thru thrust bearings; then with axle lifted clear of floor, force grease between kingpin and bushing surfaces.**
Brakes		
Caliper Pin Slide Lubricant	Shell Albida® PPS-1 grease, 3-oz. tube, P/N 2585384C1	See Diamondlife® (Bosch pinslide) Disc brake service manual section and TSI # 03–04–01
Engine		
Engine Lubricating Oil	API Classification CJ-4 or later	15W-40: 10°F and above (-12°C and above) Below 10°F (-12°C) See Engine Operation and Maintenance Manual
Electrical		
Terminals – Lubricant Sealing Grease	Fleetrite® 472141-C1	

Component	Component Vendor / Lubrication Type	Viscosity / Ambient Temperature / Notes
Connectors – Dielectric Grease	NYOGEL® 760 G	
Aftertreatment		
Diesel Exhaust Fluid (DEF)	Fleetrite® brand DEF or equivalent, which meets or exceeds ISO-22241-1	

Component	Component Vendor / Lubrication Type	Viscosity / Ambient Temperature / Notes
Steering		
Power Steering Fluid	15W40 CJ-4 or CI-4 Engine Oil	
Strg. Gear Ross TAS – Output Seal – Lubricant	Fleetrite® Lithium NLGI #2 Complex Based Moly grease P/N 991044C2 or equivalent GC/LB NLGI #2 Multipurpose Lithium Complex grease	
Strg. Intermediate Shaft U-Joints / Slip Joint – Lubricant	Fleetrite® Lithium NLGI #2 Complex Based Moly grease P/N 991044C2 or equivalent GC/LB NLGI #2 Multipurpose Lithium Complex grease	
Drive Shaft		
U-Joint – Lubricant	Fleetrite® Lithium NLGI #2 Complex Based Moly grease P/N 991044C2 or equivalent GC/LB NLGI #2 Multipurpose Lithium Complex grease	
Clutch		
Release Bearing / Shafts / Fork – Lubricant	Fleetrite® Lithium NLGI #2 Complex Based Moly grease P/N 991044C2 or equivalent GC/LB NLGI #2 Multipurpose Lithium Complex grease	
Cooling System		
Coolant	Refer to Engine Operation and Maintenance Manual	
	Shell Rotella® Ultra Extended Life Coolant (ELC)	50:50 mix equals -34.6°F (-37°C) freeze protection 53:47 mix equals -40°F (-40°C) freeze protection 60:40 mix equals -60°F (-51°C) freeze protection

Component	Component Vendor / Lubrication Type	Viscosity / Ambient Temperature / Notes
Transmission		
Eaton-Dana® (Nonsynchronized) (Lubricants are listed in order of preference)	Mineral Gear Oil API-GL-1 (Rust and Oxidation Inhibited) Fleetrite® P/N 991061C1 Petroleum Oil: Engine Oil API-CH or CI	SAE 90: Above 0°F (-18°C) SAE 80: Below 0°F (-18°C) SAE 50: Above 0°F (-18°C) SAE 40: Below 0°F (-18°C)
	* EP Gear oils are not recommended for use in manual transmissions.	
	Synthetic Oil: Synthetic SAE 50 Manual Transmission Oil Meeting API MT-1 Fleetrite® P/N 991884C1	SAE 50 − All Temperatures SAE 75W-90 − All Temperatures
Eaton-Dana® (Synchronized) (Lubricants are listed in order of preference)	Mineral Gear Oil API-GL-1 (Rust and Oxidation Inhibited) Fleetrite® P/N 991061C1 Petroleum Oil: Engine Oil API-SJ, SH or API-CI, CH or MIL-PRF-2104G	SAE 90: Above 10°F (-12°C) SAE 80: Below 10°F (-12°C) SAE 50: Above 10°F (-12°C) SAE 40: Below 10°F (-12°C)
Eaton-Dana® (Synchronized) – (Cont)	Synthetic Oil: Synthetic SAE 50 Manual Transmission Oil Meeting API MT-1 Fleetrite® P/N 991884C1	SAE 50 − All Temperatures
	Synthetic Oil: API MT-1*	SAE 50 − All Temperatures
	* Do not use multiweight and GL-5 EP gear oils because they may cause transmission failure or damage.	
Allison – Conventional Automatic Transmission Fluid (ATF) Fill/Change	Meets the requirements for Allison TES 389 specification. Contact Allison Transmission for details on approved fluids.	Below -13°F (-25°C), preheat is required.

Component	Component Vendor / Lubrication Type	Viscosity / Ambient Temperature / Notes
Allison – Synthetic Automatic Transmission Fluid (ATF) Fill/Change (optimal - recommended)	Fleetrite® Synthetic ATF (P/N: FATF27101Q), or Allison/Castrol® TRANSYND® synthetic ATF, or fluids meeting Allison TES 295 specification. Approved Synthetic ATF Suppliers website: http://www.allisontransmission.com/service/autoapp/172/viewpage.jsp?ThisPage=3	All temperatures. Recommended for highest transmission durability and lowest maintenance costs.
NOTE: Refer to the Original Equipment Transmission Manufacturer for specific service instructions and recommendations, required capacities and transmission oils.		
Rear Axle		
Single-Speed	Gear oil meeting MIL-PRF-2105E, API MT-1, GL-5	75W: -40°F to -15°F (-40°C to -26°C) 75W-80: -40°F to 80°F (-40°C to 27°C) 75W-90: -40°F to 100°F (-40°C to 38°C) 75W-140: -40°F and above (-40°C and above) 80W-90: -15°F to 100°F (-26°C to 38°C) 80W-140: -15°F and above (-26°C and above) 85W-140: 10°F and above (-12°C and above)

Component	Component Vendor / Lubrication Type	Viscosity / Ambient Temperature / Notes
Single Speed − Cont.	Eaton-Dana® axle: multipurpose EP gear lube of API GL-5 quality meeting MIL-PRF-2105E specs including synthetic lubricants.	75W: -40°F to 32°F (-40°C to 0°C) 75W-90: -40°F to 100°F (-40°C to 38°C) 75W-140: -40°F and above (-40°C and above) 80W: -15°F to 70°F (-26°C to 21°C) 80W-140: -15°F and above (-26°C and above) 90W: 10°F to 100°F (-12°C to 38°C) 85W-140: 10°F and above (-12°C and above) 140W: 40°F and above (4°C and above)
	Meritor: Synthetic from factory with Cognis Emgard® 75W-90 will have a tag attached to fill plug that reads as follows: "**Filled with synthetic lube. Do Not Mix**."	
	Meritor petroleum: 0-76-A Hypoid Gear Oil 0-76-B Hypoid Gear Oil 0-76-D Hypoid Gear Oil 0-76-E Hypoid Gear Oil 0-76-L Hypoid Gear Oil	 GL-5, SAE 85W-140: Above 10°F (-12°C) GL-5, SAE 85W-140: Above -15°F (-26.1°C) GL-5, SAE 80W-90: Above -15°F (-26.1°C) GL-5, SAE 75W Max outside temp. 35°F (1.6°C): Above -40°F -40°C) GL-5, SAE 75W-140: Above -40°F -40°C)

Torque Specifications

Disc Wheel Torque Specifications

DISC WHEELS			
Size	**Nut Mounting**	**Torque**	
		lb – ft	**N•m**
11/16 In	Flange	350 - 400	475 - 542
22 mm	Flange: Motor Wheel - 37.5 mm Across Flats	450 - 500	610 - 678
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 Specifications

Feature Code	Rear Suspension Type	Torque	
		lb - ft	**N • m**
14SAM	20,000-lb Capacity, RR, Springs, Vari-Rate	260 - 300	353 - 407
14SAN	23,500-lb Capacity, RR, Springs, Vari-Rate	260 - 300	353 - 407
14SAU	20,000-lb Capacity, RR, Springs Multileaf with Single Torque Rod	258 - 295	350 - 400
14SAW	23,000-lb Capacity, RR, Springs Multileaf with Single Torque Rod	260 - 300	353 - 407

Feature Code	Rear Suspension Type	Torque	
		lb - ft	N • m
14TBJ	20,000-lb Capacity, International® Air Suspension (IROS) for axles 14ADN, 14ADP, 14AJC, 14AJE, 14ATP, and 14ATR	260 - 300	353 - 407
	20,000-lb Capacity, International® Air Suspension (IROS) for all other axles.	370 - 400	502 - 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
14VAG	20,000-lb Capacity, RR, Springs, Vari-Rate, with 4,500-lb Auxiliary Rubber Spring	260 - 300	353 - 407
14VAH	23,500-lb Capacity, RR, Springs, Vari-Rate, with 4,500-lb Auxiliary Rubber Spring	260 - 300	353 - 407
NOTE: For all other vendor supplied suspensions, refer to vendor's Web site for proper torque specifications.			

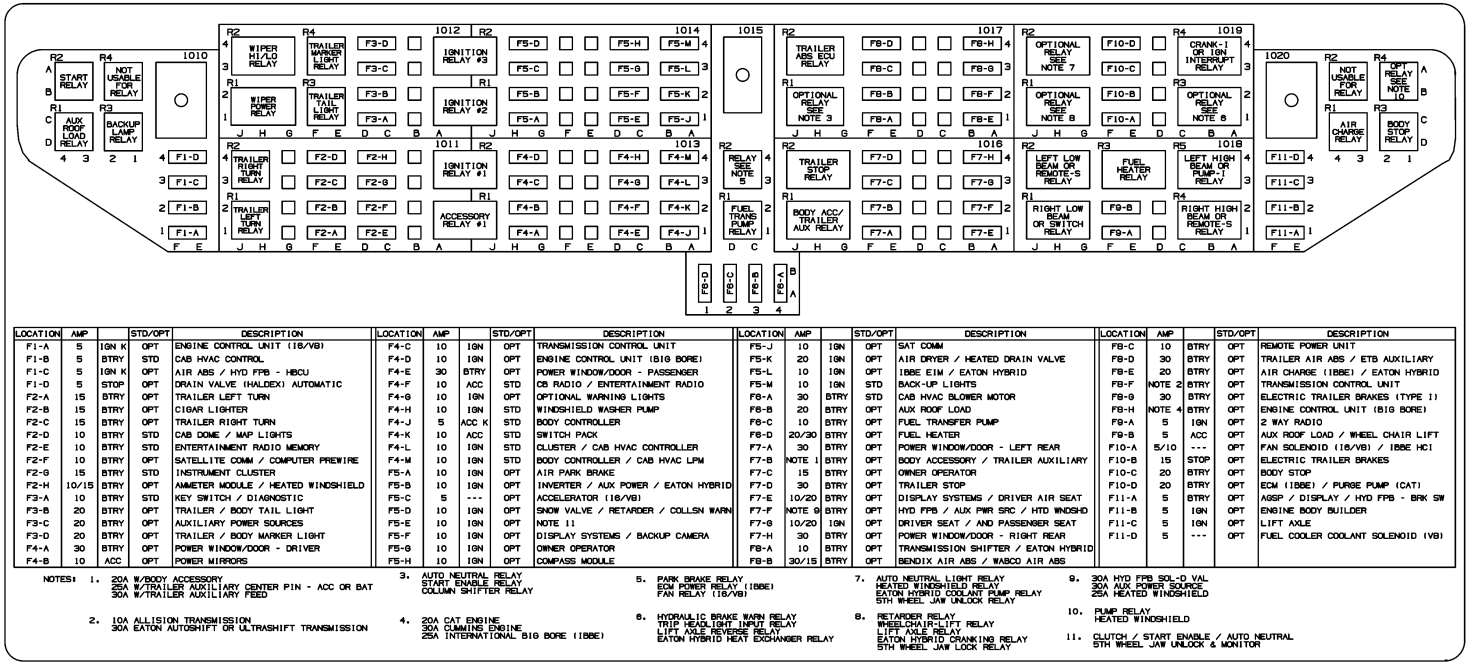
Feature Code	Front Suspension Type	Torque	
		lb - ft	N • m
3ADB	10,000-lb Capacity, Parabolic Taper Leaf	325 - 400	441 - 542
3ADC	12,000-lb Capacity, Parabolic Taper Leaf	260 - 300	353 - 407
3ADD	14,000-lb Capacity, Parabolic Taper Leaf	260 - 300	353 - 407
3AGS	13,000-lb Capacity, Parabolic Taper Leaf	350 - 400	475 - 542
3AGV	12,000-lb Capacity, Monoleaf (Hendrickson Softek)	260 - 300	353 - 407

Spring U-Bolt Checks

Check U-bolt nuts and retorque every 36,000 miles (58,000 km)
after initial 1,000 miles (1,600 km) retorque.

Fuse Chart

The following fuse illustrations represent typical fuse panel layouts. The actual vehicle fuse panels will vary depending on the vehicle options.



LOCATION	AMP		STD/OPT	DESCRIPTION
F1-A	5	IGN K	OPT	ENGINE CONTROL UNIT (I6/V8)
F1-B	5	BTRY	STD	CAB HVAC CONTROL
F1-C	5	IGN K	OPT	AIR ABS / HYD FPB - HBCU
F1-D	5	STOP	OPT	DRAIN VALVE (HALDEX) AUTOMATIC
F2-A	15	BTRY	OPT	TRAILER LEFT TURN
F2-B	15	BTRY	OPT	CIGAR LIGHTER
F2-C	15	BTRY	OPT	TRAILER RIGHT TURN
F2-D	10	BTRY	STD	CAB DOME / MAP LIGHTS
F2-E	10	BTRY	STD	ENTERTAINMENT RADIO MEMORY
F2-F	10	BTRY	OPT	SATELLITE COMM / COMPUTER PREWIRE
F2-G	15	BTRY	STD	INSTRUMENT CLUSTER
F2-H	10/15	BTRY	OPT	AMMETER MODULE / HEATED WINDSHIELD
F3-A	10	BTRY	STD	KEY SWITCH / DIAGNOSTIC
F3-B	20	BTRY	OPT	TRAILER / BODY TAIL LIGHT
F3-C	20	BTRY	OPT	AUXILIARY POWER SOURCES
F3-D	20	BTRY	OPT	TRAILER / BODY MARKER LIGHT
F4-A	30	BTRY	OPT	POWER WINDOW/DOOR - DRIVER
F4-B	10	ACC	OPT	POWER MIRRORS

LOCATION	AMP		STD/OPT	DESCRIPTION
F4-C	10	IGN	OPT	TRANSMISSION CONTROL UNIT
F4-D	10	IGN	OPT	ENGINE CONTROL UNIT (BIG BORE)
F4-E	30	BTRY	OPT	POWER WINDOW/DOOR - PASSENGER
F4-F	10	ACC	STD	CB RADIO / ENTERTAINMENT RADIO
F4-G	10	IGN	OPT	OPTIONAL WARNING LIGHTS
F4-H	10	IGN	STD	WINDSHIELD WASHER PUMP
F4-J	5	ACC K	STD	BODY CONTROLLER
F4-K	10	ACC	STD	SWITCH PACK
F4-L	10	IGN	STD	CLUSTER / CAB HVAC CONTROLLER
F4-M	10	IGN	STD	BODY CONTROLLER / CAB HVAC LPM
F5-A	10	IGN	OPT	AIR PARK BRAKE
F5-B	10	IGN	OPT	INVERTER / AUX POWER / EATON HYBRID
F5-C	5	---	OPT	ACCELERATOR (I6/V8)
F5-D	10	IGN	OPT	SNOW VALVE / RETARDER / COLLSN WARN
F5-E	10	IGN	OPT	NOTE 11
F5-F	10	IGN	OPT	DISPLAY SYSTEMS / BACKUP CAMERA
F5-G	10	IGN	OPT	OWNER OPERATOR
F5-H	10	IGN	OPT	COMPASS MODULE

LOCATION	AMP		STD/OPT	DESCRIPTION
F5-J	10	IGN	OPT	SAT COMM
F5-K	20	IGN	OPT	AIR DRYER / HEATED DRAIN VALVE
F5-L	10	IGN	OPT	I6BE EIM / EATON HYBRID
F5-M	10	IGN	STD	BACK-UP LIGHTS
F6-A	30	BTRY	STD	CAB HVAC BLOWER MOTOR
F6-B	20	BTRY	OPT	AUX ROOF LOAD
F6-C	10	BTRY	OPT	FUEL TRANSFER PUMP
F6-D	20/30	BTRY	OPT	FUEL HEATER
F7-A	30	BTRY	OPT	POWER WINDOW/DOOR - LEFT REAR
F7-B	NOTE 1	BTRY	OPT	BODY ACCESSORY / TRAILER AUXILIARY
F7-C	15	BTRY	OPT	OWNER OPERATOR
F7-D	30	BTRY	OPT	TRAILER STOP
F7-E	10/20	BTRY	OPT	DISPLAY SYSTEMS / DRIVER AIR SEAT
F7-F	NOTE 9	BTRY	OPT	HYD FPB / AUX PWR SRC / HTD WNDSHD
F7-G	10/20	IGN	OPT	DRIVER SEAT / AND PASSENGER SEAT
F7-H	30	BTRY	OPT	POWER WINDOW/DOOR - RIGHT REAR
F8-A	10	BTRY	OPT	TRANSMISSION SHIFTER / EATON HYBRID
F8-B	30/15	BTRY	OPT	BENDIX AIR ABS / WABCO AIR ABS

LOCATION	AMP		STD/OPT	DESCRIPTION
F8-C	10	BTRY	OPT	REMOTE POWER UNIT
F8-D	30	BTRY	OPT	TRAILER AIR ABS / ETB AUXILIARY
F8-E	20	BTRY	OPT	AIR CHARGE (I6BE) / EATON HYBRID
F8-F	NOTE 2	BTRY	OPT	TRANSMISSION CONTROL UNIT
F8-G	30	BTRY	OPT	ELECTRIC TRAILER BRAKES (TYPE I)
F8-H	NOTE 4	BTRY	OPT	ENGINE CONTROL UNIT (BIG BORE)
F9-A	5	IGN	OPT	2 WAY RADIO
F9-B	5	ACC	OPT	AUX ROOF LOAD / WHEEL CHAIR LIFT
F10-A	5/10	---	OPT	FAN SOLENOID (I6/V8) / I6BE HCI
F10-B	15	STOP	OPT	ELECTRIC TRAILER BRAKES
F10-C	20	BTRY	OPT	BODY STOP
F10-D	20	BTRY	OPT	ECM (I6BE) / PURGE PUMP (CAT)
F11-A	5	BTRY	OPT	AGSP / DISPLAY / HYD FPB - BRK SW
F11-B	5	IGN	OPT	ENGINE BODY BUILDER
F11-C	5	IGN	OPT	LIFT AXLE
F11-D	5	---	OPT	FUEL COOLER COOLANT SOLENOID (V8)

NOTES:
1. 20A W/BODY ACCESSORY
25A W/TRAILER AUXILIARY CENTER PIN - ACC OR BAT
30A W/TRAILER AUXILIARY FEED
2. 10A ALLISION TRANSMISSION
30A EATON AUTOSHIFT OR ULTRASHIFT TRANSMISSION
3. AUTO NEUTRAL RELAY
START ENABLE RELAY
COLUMN SHIFTER RELAY
4. 20A CAT ENGINE
30A CUMMINS ENGINE
25A INTERNATIONAL BIG BORE (I6BE)
5. PARK BRAKE RELAY
ECM POWER RELAY (I6BE)
FAN RELAY (I6/V8)
6. HYDRAULIC BRAKE WARN RELAY
TRIP HEADLIGHT INPUT RELAY
LIFT AXLE REVERSE RELAY
EATON HYBRID HEAT EXCHANGER RELAY
7. AUTO NEUTRAL LIGHT RELAY
HEATED WINDSHIELD RELAY
EATON HYBRID COOLANT PUMP RELAY
5TH WHEEL JAW UNLOCK RELAY
8. RETARDER RELAY
WHEELCHAIR-LIFT RELAY
LIFT AXLE RELAY
EATON HYBRID CRANKING RELAY
5TH WHEEL JAW LOCK RELAY
9. 30A HYD FPB SOL-D VAL
30A AUX POWER SOURCE
25A HEATED WINDSHIELD
10. PUMP RELAY
HEATED WINDSHIELD
11. CLUTCH / START ENABLE / AUTO NEUTRAL
5TH WHEEL JAW UNLOCK & MONITOR

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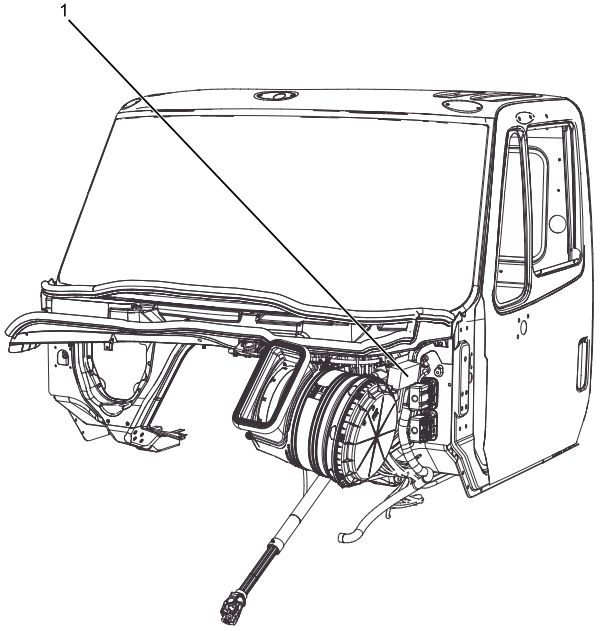
Typical Under-Hood Power Distribution Module (PDM) Fuse Panel Layout

On certain TranStar® models, you can find a Power Distribution Module (PDM) under the hood in the driver's side. It is mounted on the air cleaner bracket, immediately underneath the cowl panel. See the following illustration about the location of the under-hood PDM.



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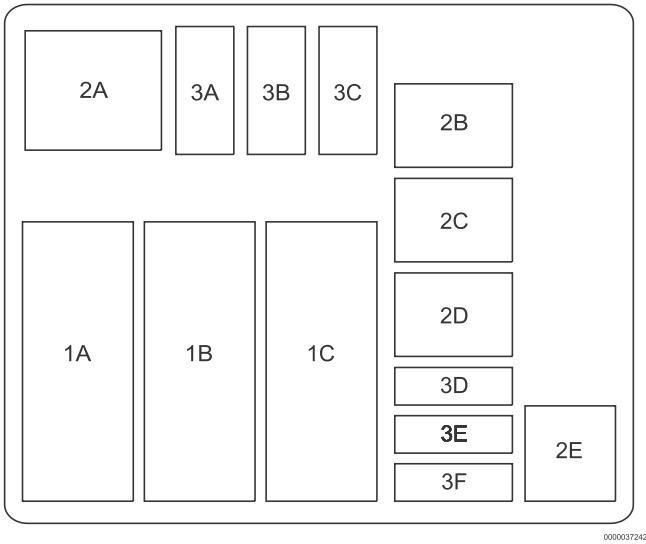
1. Under-hood Power Distribution Module (PDM)

If you cannot find the PDM in this location, it means that your vehicle has in-line fuses instead of a PDM fuse panel.

The following illustration shows the typical layout of the fuse panel in the under-hood PDM.

CAUTION

To prevent electrical component damage, when replacing a fuse, always use one with the same amp rating.



1. 1A: Cold Start Aid, 80A
2. 1B: Cab PDC-1, 100A
3. 1C: Cab PDC-2, 100A
4. 2A: not in use
5. 2B: not in use
6. 2C: Eaton® clutch, 40A
7. 2D: not in use
8. 2E: ECM 25A
9. 3A: not in use
10. 3B: Aftertreatment PDM (for vehicles equipped with SCR system), 30A
11. 3C: not in use
12. 3D: TCM (30A for Eaton transmissions, 10A for Allison transmissions)
13. 3E: ACM, 15A
14. 3F: Engine timer, 5A

TranStar® 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
Tail / Brake / Turn Light / License Plate Light	32/3 CP	1157
Backup Light	32 CP	GE1156
Ashtray Light	N/A	N/A
Work Light	35 Watts	4411

Filter List

Filter part numbers and / or specifications may change during the lifecycle 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 ensured through proper servicing. This can be accomplished in several ways.

International Truck Dealers … Your local International Truck dealer provides an excellent resource – through their 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 http://www.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 **Service Portal℠ Web site**, or via the **OnCommand™ Service Information DVD**. Information on the Service Portal℠ 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 OnCommand™ Service Information DVD contains Navistar branded truck, engine, and bus information including service and diagnostic manuals, technical letters / service bulletins, diagnostic trouble code indices, troubleshooting guides, circuit diagram manuals, new vehicle processing manual, and a help screen.

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

- They extend warranty protection to specified length and component coverage to suit individual needs
- They are honored at over 1,000 International Truck Dealer locations in North America
- Owner has stabilized and predictable maintenance costs
- Owner has Increased confidence and peace of mind
- Vehicle has improved resale value – International® Truck Warranties may be transferable for a nominal fee. Contact the Service Contract Center 1-800-336-4500 option 5 for transferability
- Most coverage is 100% parts and labor with **NO DEDUCTIBLES.**
- Customized warranty programs are offered to suit your needs, specification, vocation
- Navistar, Inc, 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 ensure the lowest possible cost of ownership, are also available
- **Published 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 181 - 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!

SECTION 9 — LIST OF ACRONYMS

Acronyms

ABS	Antilock Brake System
ASA	Automatic Slack Adjusters
ASD	Air Suspension Dump
ATC	Automatic Traction Control
ATF	Automatic Transmission Fluid
AWL	Amber Warning Lamp
BC	Body Controller
CAP	Cold Ambient Protection
DEF	Diesel Exhaust Fluid
DID	Driver Information Display
DPF	Diesel Particulate Filter
DRL	Daytime Running Lights
DTC	Diagnostic Trouble Codes
ECM	Engine Control Module
ECU	Electronic Control Unit
EGC	Electronic Gauge Cluster
EGR	Exhaust Gas Recirculation
ELC	Extended Life Coolant
ELCS	Electrical Load Control and Shedding
EWPS	Engine Warning Protection System

GAWR	Gross Axle Weight Rating
GHG	Greenhouse Gas
HD-OBD	Heavy Duty On-Board Diagnostics
HSLA	High Strength Low Alloy
IROS	International Ride Optimized Suspension
MIL	Malfunction Indicator Lamp
MSA	Mine Safety Appliance
NHTSA	National Highway Traffic Safety Administration
NICB	National Insurance Crime Bureau
NIOSH	National Institute of Occupational Studies of Health
OBD	On-Board Diagnostics
OD	Overdrive
PDL	Power Divider Lock
PDM	Power Distribution Module
PTO	Power Take-Off
RSL	Red Stop Lamp
RSP	Roll Stability Program
SCA	Supplemental Coolant Additive
SCR	Selective Catalyst Reduction
TCM	Transmission Control Module
TEM	Truck Equipment Manufacturer
TPMS	Tire Pressure Monitoring System

ULSD	Ultra Low Sulfur Diesel
VIN	Vehicle Identification Number

SECTION 10 — INDEX

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