

# ROADSIDE ASSISTANCE

Workhorse provides at no charge to you, roadside assistance for three years or 36,000 miles (58 000 kilometers), whichever occurs first, for those repairs covered under the Workhorse Limited Warranty. If you ever experience a concern with your Workhorse chassis while you are on the road, you may contact roadside assistance 24 hours a day, 365 days a year, by calling 1-877-946-7731.

## **NOTICE**

*The Workhorse provided roadside assistance towing coverage is only during the 3 year/36,000 mile, whichever occurs first, chassis warranty for both RV and commercial chassis. There will be an expense limitation to Roadside Assistance coverages such as: lockout, flat tire and towing expenses. Incidental expenses ARE NOT covered.*

TOLL-FREE

**1-877-946-7731**

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**Workhorse on the Internet**

<http://www.workhorse.com>

► Workhorse reserves the right to change or update this publication at any time and without notification. ◀

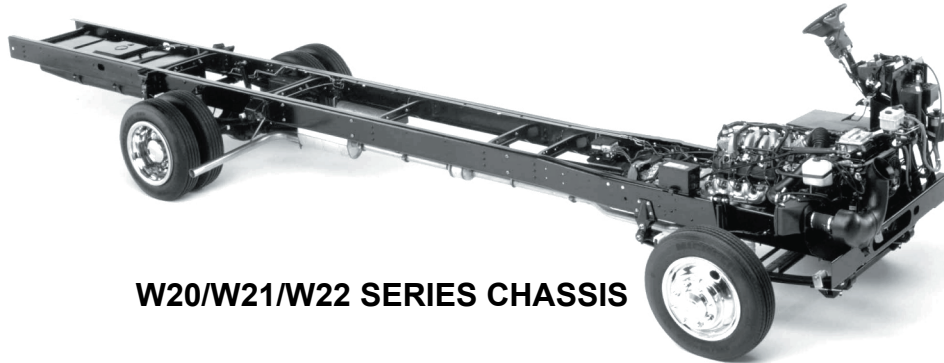
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**W16/W18 SERIES CHASSIS**

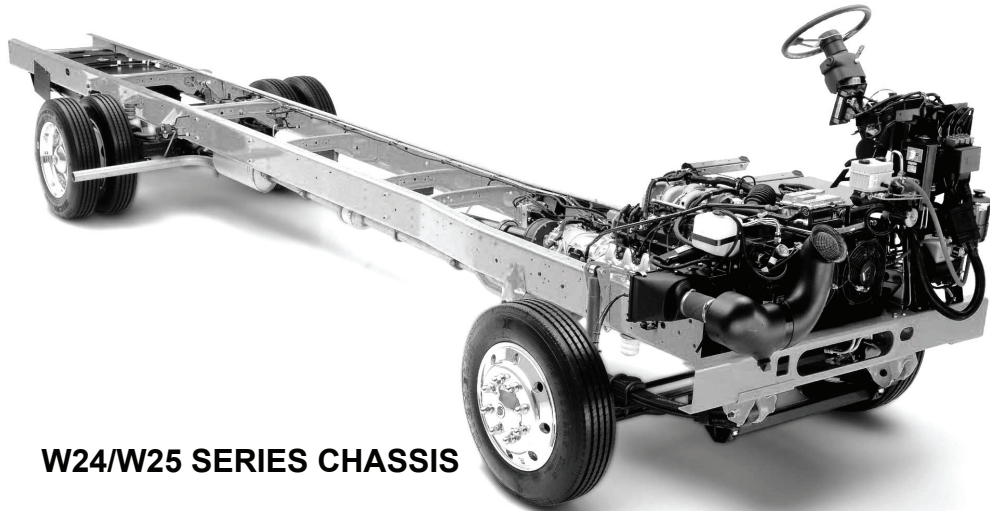
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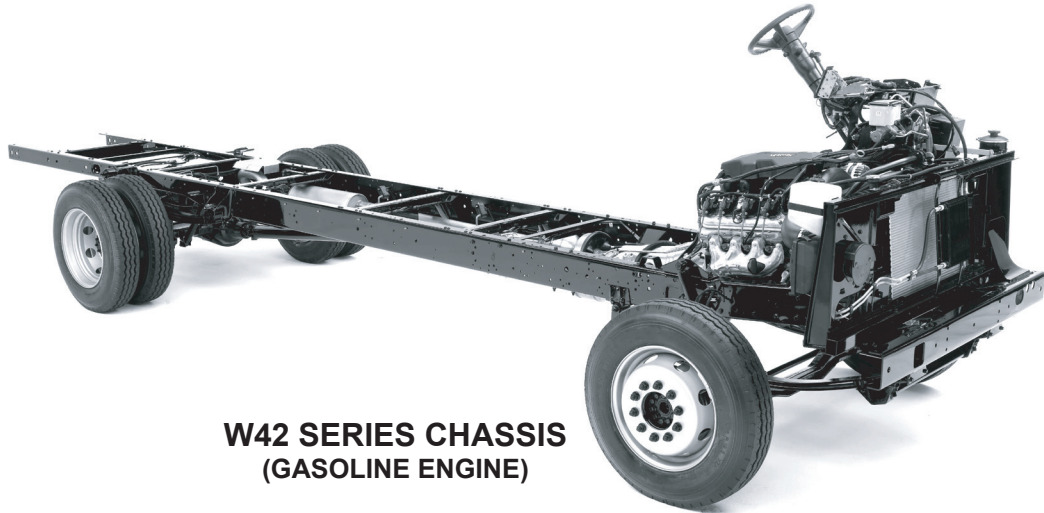
**W20/W21/W22 SERIES CHASSIS**

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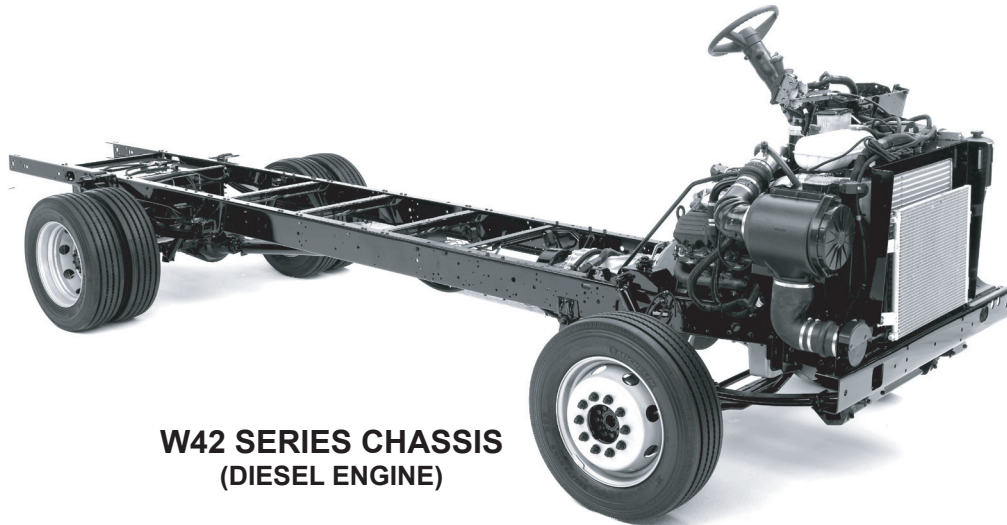
**W24/W25 SERIES CHASSIS**

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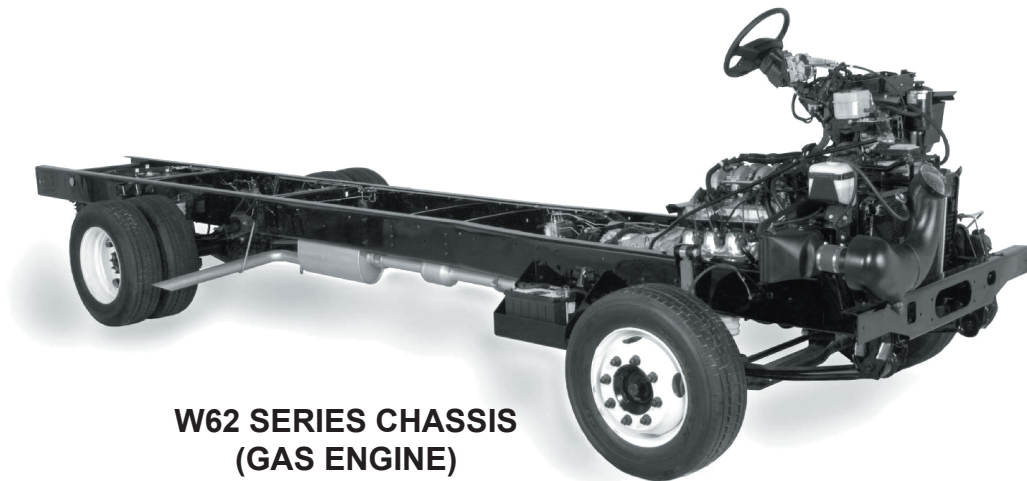
**W42 SERIES CHASSIS  
(GASOLINE ENGINE)**

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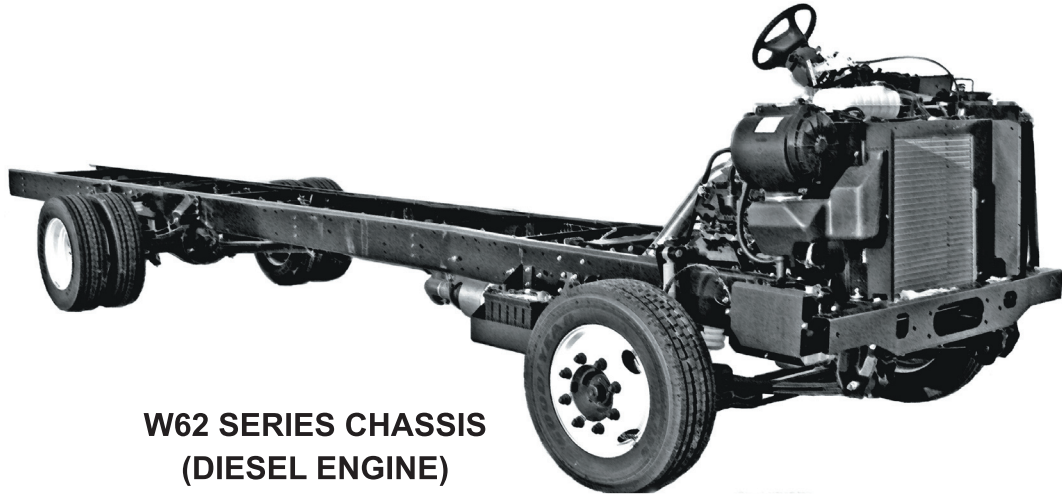
**W42 SERIES CHASSIS  
(DIESEL ENGINE)**

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**W62 SERIES CHASSIS  
(GAS ENGINE)**

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**W62 SERIES CHASSIS  
(DIESEL ENGINE)**

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**SECTION 0 INTRODUCTION**

Identification of general information included in this Owner's Manual.

**SECTION 1 FEATURES AND CONTROLS** **1**

Detailed controls identification, instrument panel indicators identification and the proper use of these controls for monitoring and/or warning. Starting, shifting, and braking are covered to enable initial operation.

**SECTION 2 DRIVING AND THE ROAD** **112**

Information related to driving on different kinds of roads and in varying weather conditions. Many other useful driving tips are included.

**SECTION 3 PROBLEMS ON THE ROAD** **129**

Suggestions and guidance relating to abnormal situations that may be encountered while traveling.

**SECTION 4 SERVICE** **159**

Information about the vehicle's care, beginning with service and fuel information, followed by how to check important fluid and lubricant levels. Vehicle technical information is also presented.

**W0011613**

**SECTION 5 SCHEDULED MAINTENANCE SERVICES 253**

Maintenance required to ensure this vehicle's safety, dependability and emission control performance.

**SECTION 6 CUSTOMER ASSISTANCE AND WARRANTY INFORMATION 291**

Roadside assistance and general customer support contact information. Limited warranty on your Workhorse chassis and emission control systems.

**SECTION 7 DIESEL ENGINE SUPPLEMENT 321**

Service and maintenance information for the International® MaxxForce™ 5 diesel engine can be found in this section.

**SECTION 8 INDEX 396**



***This section contains identification of general information that supports this manual.***

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This information is based on the latest information available at the time of publication. Workhorse reserves the right to make changes to this manual at any time without notice.

Keep this manual in the vehicle so it will be available for use if needed. When selling the vehicle, please leave the manual in the vehicle for the new owner.

Workhorse is proud to be ISO 9001:2000 Certified. NSF-ISR (a subsidiary of NSF International) has found Workhorse to be in compliance to the ISO 9001:2000 Standards.

Initial Registration and Certification was obtained on September 23, 2000.

Certificate Number: 83591-3

Classification:

IAF: 22

SIC: 3714

NACE: DM 34

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## ORGANIZATION AND LAYOUT

There are eight sections to this manual.

## INDEX INFORMATION

A good place to look for what you need is the Index in the back of this manual. It is an alphabetical list of what is in this manual, and the page number where you will find it.

Information pertaining to the International® diesel engine is grouped together at the end of the Index.

## SAFETY WARNINGS AND SYMBOLS

It is important to read this section to fully understand the intent and content of the other sections of this manual. We use a box with the word CAUTION and a gray background to warn you of conditions that could result in injury or damage to persons or property.



## CAUTION

*Contents of the caution box describe conditions that could result in injury or damage to persons or property.*

In the caution box, we tell you what the hazard is. Then we tell you what to do to avoid or reduce the hazard. Please read these cautions to prevent injury or damage to persons or property.

## Vehicle Damage Warnings

### **NOTICE**

*Contents of a NOTICE describe conditions that could damage your vehicle. Please read all information under a "NOTICE!"*


















We use the word NOTICE to tell you about something that can damage your vehicle. Such damage may not be covered by your warranty. The notice will tell you what to do to avoid the damage.
















You will also see warning labels on your vehicle. They use the same words, CAUTION or NOTICE.

## VEHICLE SYMBOLS

These are some of the symbols found on the vehicle. Not all symbols displayed are used on all vehicles.

Different component suppliers may use different but similar symbols.

| For example, these symbols are used on an original battery:   | This symbol is important for you and your passengers whenever your vehicle is driven:                          | These symbols have to do with your lamps:  | These symbols are used on some of your controls:  |
|---|--|--|---|
| <p>CAUTION<br/>POSSIBLE<br/>INJURY</p>  <p>PROTECT EYES<br/>BY SHIELDING</p>  <p>CAUSTIC<br/>BATTERY<br/>ACID COULD<br/>CAUSE BURNS</p>  <p>AVOID SPARKS<br/>OR FLAMES</p>  <p>SPARK OR<br/>FLAME COULD<br/>EXPLODE<br/>BATTERY</p>  | <p>FASTEN SEAT<br/>BELTS</p>  | <p>MASTER LIGHTING<br/>SWITCH</p>  <p>TURN<br/>SIGNALS</p>  <p>PARK LAMPS</p>  <p>HAZARD WARNING<br/>FLASHER</p>  <p>DAYTIME RUNNING<br/>LAMPS</p>  <p>FOG LAMPS</p>  <p>HIGH BEAMS</p>  | <p>WINDSHIELD<br/>WIPER</p>  <p>WINDSHIELD<br/>WASHER</p>  <p>WINDSHIELD<br/>DEFROSTER</p>  <p>CRUISE<br/>CONTROL<br/>ACTIVE</p>  |

| These symbols are used on warning and indicator lights:   |   | Here are some other symbols you may see:  |   |
|---|---|---|---|
| <p>ANTILOCK BRAKE SYSTEM FAILURE </p>      | <p>PARK BRAKE APPLIED OR BRAKE SYSTEM FAILURE </p> | <p>BATTERY OR CHARGING SYSTEM WARNING </p>  | <p>LOW FUEL WARNING </p>                       |
| <p>ENGINE COOLANT TEMPERATURE WARNING </p> | <p>ENGINE OIL PRESSURE WARNING </p>                | <p>TRANSMISSION RANGE INHIBIT </p>         | <p>CRUISE CONTROL ACTIVE </p>                  |
| <p>SERVICE ENGINE SOON </p>                | <p>TRANSMISSION SYSTEM WARNING </p>                | <p>STOP ENGINE WARNING </p>                | <p>WAIT TO START INDICATOR </p>                |
|   | <p>POWER TAKE OFF </p>                             | <p>EXHAUST SYSTEM REGENERATION NEEDED </p> | <p>HOT EXHAUST SYSTEM TEMPERATURE WARNING </p> |

## MODEL REFERENCE

Light and Medium  
Duty Front-Engine  
Forward Control Chassis  
(Commercial and Motor  
Home).



Workhorse chassis are finished in a variety of configurations by a number of companies. These other manufacturers' and suppliers' guides and manuals will be supplied with the finished vehicle.

This table shows the Workhorse model numbers and their corresponding chassis type as they are referenced in this manual.

| Model Number | GVW (lbs)                         | GCW (lbs)                         | Chassis Type             |
|--------------|-----------------------------------|-----------------------------------|--------------------------|
| W300 18      | 16,000/18,000                     | 22,000                            | W16/W18 Motor Home*      |
| W300 22      | 20,500/21,200/22,000              | 26,000                            | W20/W21/W22 Motor Home** |
| W300 24      | 24,000/25,500                     | 30,000                            | W24/W25 Motor Home***    |
| W300 42      | 9,400/10,000/12,000/14,500/16,000 | 9,400/10,000/12,000/14,500/16,000 | W42 Commercial           |
| W300 62      | 19,500/21,500/23,500              | 26,000                            | W62 Commercial           |

\*Note: All references to the W18 chassis type, in this manual, reference the W16 chassis types as well, except where noted elsewhere.

\*\*Note: All references to the W22 chassis type, in this manual, reference the W20/W21 chassis types as well.

\*\*\*Note: All references to the W24 chassis type, in this manual, reference the W25 chassis types as well.

## INTENT OF THIS MANUAL

This manual offers guidance for the safe operation of the chassis portion of your vehicle.

Some details will be covered more than once in this manual, because of their relationship to other features or components. However, different degrees of information may be available in different explanations. Please do not skip over items just because they have been mentioned elsewhere.

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## Reference/Orientation

Within this manual, all locator references are viewed as from the driver's seat unless otherwise indicated.

Examples:

- Left = Driver's side
- Right = Passenger's side
- Front = Forward of the driver
- Rear = Behind the driver

## 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 Workhorse Custom Chassis at the following address.

Workhorse Custom Chassis, LLC

Customer Relations

850 Stephenson Highway - Suite 510

Troy, MI 48083-1174

1-877-946-7731

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 Workhorse Custom Chassis.



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

### Canadian Registered Vehicles

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

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 assure safe operation of your vehicle. As a vehicle owner, you must provide Workhorse 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.

## ENGLISH/METRIC VALUES

Displayed values are shown in English and Metric. Conversions to Metric, in many instances, are approximate.

## VALUES AND SPECIFICATIONS

Whole number values in this manual are close approximations whether expressed as such or not.

Decimal values reference tables have been calculated to the greatest possible degree of accuracy.

In the event of any inconsistency, consider published data by an item's primary manufacturer as best information.

## GLOSSARY OF ACRONYMS AND ABBREVIATIONS

|      |  |
|------|--|
| ~    | This symbol indicates approximate value  |
| ASTM | American Society for Testing & Materials |
| ABS  | Antilock Brake System                    |
| A/C  | Air Conditioning                         |
| API  | American Petroleum Institute             |
| ATF  | Automatic Transmission Fluid             |
| CAC  | Charge Air Cooler (Diesel)               |
| CAN  | Controller Area Network                  |
| CAP  | Cold Ambient Protection (Diesel)         |
| CKP  | Crankshaft Position Sensor               |

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|      |  |      |   |
|------|--|------|---|
| CMP  | Camshaft Position Sensor                     | kph  | kilometers per hour                                   |
| DCA  | Diesel Coolant Additive (also known as SCA)  | LCD  | Liquid Crystal Display                                |
| ECM  | Engine Control Module (Diesel)               | LED  | Light Emitting Diode                                  |
| ECT  | Engine Coolant Temperature Sensor            | MAF  | Mass Air Flow Sensor                                  |
| EGR  | Exhaust Gas Recirculation System (Diesel)    | MAP  | Manifold Air (or Absolute) Pressure Sensor            |
| EOP  | Engine Oil Pressure Switch (Diesel)          | mph  | miles per hour  |
| EOT  | Engine Oil Temperature Sensor (Diesel)       | OSHA | Occupational Safety & Health Administration           |
| EPA  | Environmental Protection Agency              | PCM  | Powertrain Control Module                             |
| EWPS | Engine Warning Protection System (Diesel)    | psi  | pounds per square inch                                |
| GAWR | Gross Axle Weight Rating                     | rpm  | revolutions per minute                                |
| GVWR | Gross Vehicle Weight Rating                  | SAE  | Society of Automotive Engineers                       |
| HFCM | Horizontal Fuel Conditioning Module (Diesel) | SCA  | Supplemental Coolant Additive (Diesel)                |
| HVAC | Heating Ventilation Air Conditioning         | TCBC | Turbocharger Bypass Control Actuator Control (Diesel) |
| IAH  | Intake Air Heater Assembly (Diesel)          | TCM  | Transmission Control Module                           |
| IAT  | Intake Air Temperature Sensor                | TMC  | Technology & Maintenance Council                      |
| ID   | Identification                               | VDC  | Volts Direct Current                                  |
| IDM  | Injector Driver Module (Diesel)              | WCC  | Workhorse Custom Chassis                              |
| IP   | Instrument Panel                             | WIF  | Water in Fuel Sensor (Diesel)                         |
| IPR  | Injection Pressure Regulator (Diesel)        |      |   |
| IST  | Idle Shutdown Timer (Diesel)                 |      |   |

**NOTES:**

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In this section you will find information about the care of your vehicle. This section begins with service and fuel information, and then it shows how to check important fluid and lubricant levels. There is also technical information about your vehicle.

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## NEW VEHICLE “BREAK-IN”

### Comment

This vehicle does not require an elaborate “break-in” procedure. However, its long term performance will benefit from following these guidelines:

### NOTICE

- *Keep speeds near 55 mph (88 km/h) or less for the first 500 miles (805/km).*
- *Do not drive continuously at a steady speed (fast or slow) for the first 500 miles (805/km).*
- *Do not make full-throttle starts.*
- *Avoid making hard stops for approximately the first 200 miles (322/km). This will allow the new brake linings to wear to a matching contour. Hard stops with new linings can cause premature wear and result in earlier replacement.*

### Comment

Follow the last break-in guideline every time new brake linings are installed.

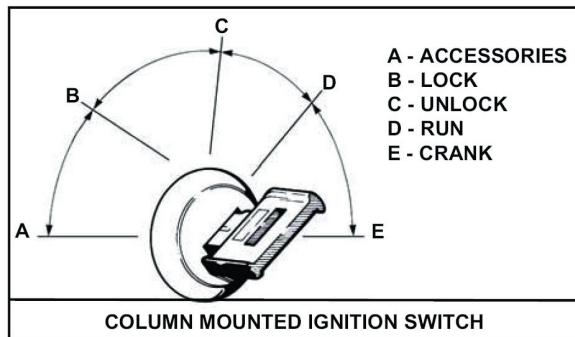


## CAUTION

*Never leave a vehicle with keys in the vehicle if someone is on board. They could start the engine or might operate power accessories, such as suspension controls either of which could cause the vehicle to move.*

## IGNITION CONTROL SWITCH

The ignition control switch is simultaneously unlocked and actuated by the ignition key. Using this key enables the ignition switch to turn to five positions.



## Ignition Positions (Column Ignition)

**ACCESSORY (A):** This position lets you use accessories when the engine is off. To get into ACCESSORY, push in the key and turn it toward you. Your steering wheel will remain locked, just as it was before you inserted the key.

### NOTICE

*Extended use of accessories in the ACCESSORY position could drain your battery and prevent you from starting your vehicle.*

**LOCK (B):** This position locks your ignition, steering wheel and transmission. You will only be able to remove your key when the ignition is turned to LOCK.

**UNLOCK (C)\*:** This position lets you turn off the engine but still turn the steering wheel. Use UNLOCK if you must have your vehicle in motion while the engine is off.

*\*Note: The Remote Ignition Switch does not incorporate the "C" position.*



**CAUTION**

*Be aware that in position “C” the vehicle has no power brakes and power steering. This could result in loss of ability to steer or stop the vehicle. This could cause a collision.*

**RUN (D):** This is the position for driving.

**CRANK (E):** This starts your engine.

**Clarification**

*The ignition switch throughout this manual may often be referred to as the “key” or “ignition switch.”*

**NOTICE**

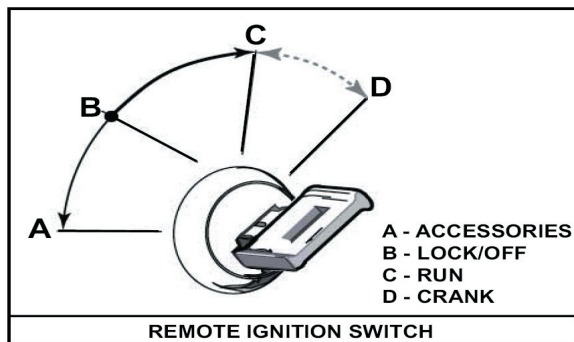
*If your key seems stuck in LOCK and you can not turn it, be sure you are using the correct key; if so, is it all the way in? If it is, then turn the steering wheel left and right while you turn the key hard. But turn the key only with your hand. Using a tool to force it could break the key or the ignition switch. If none of this works, then your vehicle needs service.*

**NOTICE**

*This vehicle cannot be started by pushing or pulling. Trying to do so could damage the transmission.*

## Ignition Positions (Remote Ignition)

The remote mounted ignition control switch is simultaneously unlocked and actuated by the ignition key. Using this key enables the ignition switch to turn to four positions.



**ACCESSORY (A):** This position lets you use accessories when the engine is off. To get into ACCESSORY, push in the key and turn it toward you. Your steering wheel will remain locked, just as it was before you inserted the key.

### NOTICE

*Extended use of accessories in the ACCESSORY position could drain your battery and prevent you from starting your vehicle.*

**LOCK/OFF (B):** You will only be able to remove your key when the ignition is turned to LOCK. Use OFF if you must have your vehicle in motion while the engine is off.

**RUN (C):** This is the position for driving.

**CRANK (D):** This starts your engine.

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## STARTING YOUR GASOLINE ENGINE **NOTICE**

### Preparing To Start Engine

If you have a diesel engine, see “Starting Your Diesel Engine” in the Index.

### Automatic Transmission

**First:** Set the transmission for starting. Column Shift Selector or Remote Shifter: Move your shift lever to PARK (P) or NEUTRAL (N). Your engine will not start in any other position — this is a safety feature. To restart when you are already moving, use NEUTRAL (N) only.

*Note: To move your gear shift selector out of park you must depress your brake pedal first.*

**Push-Button Selector (Optional):** Transmission ranges are selected by pressing the appropriate push-button. A single LED character, digit or letter, will be displayed indicating the range selected.

Ensure PARK is selected by verifying that a “P” is indicated in the digital display. If not, press the button “P,” a “P” should then appear in the display.

*Do not try to shift to PARK (P) if your vehicle is moving. If you do, you could damage the transmission. Shift to PARK (P) only when your vehicle is stopped.*

### **NOTICE**

*If your vehicle is equipped with the Auto-Apply Park Brake, see “Auto-Apply Park Brake” in the Index.*

### **NOTICE**

*The engine will not start until a steady “P” or “N” appears in the display. If the engine starts with any other character displayed, have the problem corrected. This is an important safety feature.*

**Second:** Without pushing the accelerator pedal, turn your ignition key to CRANK. When the engine starts, release the key. The idle speed will go down as your engine gets warm.

**NOTICE**

*Holding your key in CRANK for longer than 15 seconds at a time will cause your battery to be drained much sooner. This may also cause excessive heat that can damage your starter motor. Wait about 15 seconds between each try to help avoid draining your battery or damaging your starter.*

If the engine does not start right away, hold your key in CRANK. If it does not start in 10 seconds, push the accelerator pedal all the way down for five more seconds, unless it starts sooner.

**NOTICE**

*Your vehicle may be wired for “Crank Assist”. This function keeps the starter engaged if the engine has not started when the ignition key is released from the CRANK Position. This is to facilitate starting the engine.*

“Crank Assist” will only keep the starter engaged if all of the following conditions are true:

1. The key must have been in the CRANK position approximately 0.4 seconds.
2. Time since crank started is less than approximately two seconds. This time varies per engine and ambient temperature.
3. The engine has not started at the time the key is released.
4. The key is not turned to the “OFF” position when it is released from the CRANK position, and
5. More than 20 seconds has elapsed after the ignition was last turned off. “Crank Assist” requires 20 seconds, after the ignition was turned off, to reset and be re-enabled.

**NOTICE**

*Your engine is designed to work with the electronics in your vehicle. If you add electrical parts or accessories, you could change the way the engine operates. Before adding electrical equipment, check with your dealer. If you do not, your engine might not perform properly.*

If you ever have to have your vehicle towed, see the part of this manual that tells how to do it without damaging your vehicle. (See “Towing Your Vehicle” in the Index).

*Note: If the engine stalls while moving, it is not necessary to stop the vehicle to re-start the engine. It will require reselecting NEUTRAL by moving the shift lever or by pressing “N” (w/optional push-button selector) before re-starting.*

**STARTING YOUR DIESEL ENGINE**

Your diesel engine’s starting procedures are different than a gasoline engine.

**Preparing To Start Engine**

Your vehicle has a fast warm-up glow plug system. The Wait To Start Light will illuminate for a considerably shorter time than most diesel engines due to the rapid heating of the glow plug system. There are three steps to starting this vehicle’s engine.

**Starting Your Engine**

**First:** Set the transmission for starting.

**Column Shift Selector or Remote Shifter:** Move your shift lever to PARK (P) or NEUTRAL (N). Your engine will not start in any other position — this is a safety feature. To restart when you are already moving, use NEUTRAL (N) only.

*Note: To move your gear shift selector out of park you must depress your brake pedal first.*

**Push-Button Selector (Optional):** Transmission ranges are selected by pressing the appropriate push-button. A single LED character, digit or letter, will be displayed indicating the range selected.

Ensure PARK is selected by verifying that a “P” is indicated in the digital display. If not, press the button “P,” a “P” should then appear in the display.

### **NOTICE**

*Do not try to shift to PARK (P) if your vehicle is moving. If you do, you could damage the transmission. Shift to PARK (P) only when your vehicle is stopped.*

### **NOTICE**

*The engine will not start until a steady “P” or “N” appears in the display. If the engine starts with any other character displayed, have the problem corrected. This is an important safety feature.*

### **NOTICE**

*Holding your key in CRANK for longer than 15 seconds at a time will cause your battery to be drained much sooner. And the excessive heat can damage your starter motor. Wait about 15 seconds between each try to help avoid draining your battery or damaging your starter.*

**Second:** Turn your ignition key to RUN. Observe the WAIT to START indicator lamp. (This light may not come on if the engine is hot.)



### **NOTICE**

*If the “WAIT to START” indicator lamp stays illuminated, it means that the vehicle could have a problem. It should be serviced soon.*

**Third:** As soon as the WAIT to START indicator lamp goes off, turn the ignition key to CRANK. When the engine starts, release the key.

## NOTICE

*If the engine fails to start after 15 seconds of cranking, turn the ignition key to the OFF position. Wait one minute for the starter to cool, then try again.*

If trying to start the engine after running out of fuel, follow the steps in “Running Out of Fuel.” (Refer to Section 4, “Diesel Fuel Requirements.”)



## CAUTION

***Diesel engine equipped chassis REQUIRE the use of ULSD (Ultra Low Sulfur Diesel) fuel. Failure to use ULSD will result in severe damage to engine fuel systems and excessive repair costs that will not be covered under warranty.***

After starting a cold engine, let it run for a few minutes before moving the vehicle. This lets oil pressure build. Diesel engines may sound louder when cold.

## NOTICE

*If you are not in an idling vehicle and the engine overheats, you would not be able to see the coolant temperature gauge. This could damage your vehicle. Do not let your engine run when you are not in your vehicle.*

## Cold Weather Starting (Diesel Engine)

Use the recommended engine fuel and lubricating oil when the outside temperature drops below freezing. (Refer to Section 4, “Diesel Fuel Requirements or Engine Oil Requirements.”) Use the engine coolant heater when the outside temperature drops below 0°F (–18°C). (Refer to “Engine Coolant Heater,” in this section.)

If you park your vehicle in a garage, you should not need to use the coolant heater until the garage temperature goes below 0°F (–18°C), no matter how cold it is outside. If you experience longer cranking times, notice an unusual amount of exhaust smoke or are at higher altitudes (over 7,000 ft. or 2,135 m), you may use your engine coolant heater. (See “Engine Coolant Heater” in the Index.)

## Diesel Engine Fails To Start

Check to determine if the engine has run out of fuel. (Refer to Section 4, "Running Out of Fuel.")

If the fuel system has not run out of fuel, try the following:

- Turn ignition key to the RUN position. When the WAIT to START indicator lamp goes off, turn the key to the CRANK position.
- If the WAIT to START indicator lamp does not go off, wait a few seconds, then try starting the engine again.
- If the WAIT to START indicator lamp illuminates and then goes off and the batteries are charged, but the engine still fails to start, the vehicle needs service.
- If the WAIT to START indicator lamp does not illuminate when the engine is cold, the vehicle needs service.
- If the batteries do not have enough power to start the engine, refer to Section 4, "Battery."

- Observe the message center display of the speedometer. Look for the message "WATER IN FUEL." If the message indicates water is present in the fuel system, drain the water at the fuel filter. Try again to start the engine. (Refer to Section 4, Diesel Fuel System.)

Ensure that the correct engine oil is in use and that the oil has been changed as scheduled. Incorrect oil viscosity may make it harder to start.

If the engine starts, runs a short period of time, then stops, the vehicle may need service.



## CAUTION

*Do not use gasoline or starting aids, such as ether, in the engine's air intake, as damage to the engine may result. An engine fire is possible, resulting in damage or serious personal injury.*



## ENGINE BLOCK COOLANT HEATER (OPTIONAL)

### Engine Block Coolant Heater

The engine block coolant heater power cable is located near the front of the vehicle on the curb side.

It should be located in an accessible location. The heater should be connected directly to a grounded 110-volt AC outlet only.

In very cold weather, 0°F (−18°C) or colder, the engine block coolant heater can be helpful. This encourages easier starts and better fuel economy during engine warm-up. The heater may need to be activated four or more hours before a starting attempt.

### Engine Coolant Heater Usage

1. Turn off the engine.
2. Locate and unwrap the electrical cord.
3. Plug cord into a grounded 110-volt AC outlet.



## CAUTION

*Plugging the cord into an ungrounded outlet could cause an electrical shock. Also, the wrong kind of extension cord could overheat and cause a fire. You could be seriously injured. Plug the cord into a properly grounded three-prong 110-volt AC outlet. If the cord will not reach, use a heavy-duty three-prong extension cord rated for at least 15 amps.*

4. Before cranking the engine to start, unplug the heater to protect the heating element from thermal shock and unnecessary replacement.
5. Properly store the cord placing it away from moving engine parts to prevent damaged.

### Duration Of Usage

The length of time the heater should be plugged in depends on the outside temperature, the kind of oil used, and other factors. Contact a local dealer who can give the best advice for that particular area.

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## DRIVING IN SNOW (DIESEL ENGINES)

### Air Cleaner Attention

Swirling snow can get into the air intake system when driving in a heavy snowstorm. Continued driving in these conditions may cause the air cleaner to become restricted causing black smoke and loss of power. Try to clear the restriction from the air cleaner. In an emergency (and only in an emergency), consider removing the air cleaner. Drive to a place of safety then, as soon as possible, service the air cleaner and put it back in place.

### **NOTICE**

*Do not let snow and ice enter the engine intake.*

## AUTOMATIC TRANSMISSION OPERATION

There are three different transmission shifter control systems available:

- Standard Column Shift
- Remote Shift
- Electronic Control Transmission Shifter

The standard column shift lever and the remote shifter operate the transmission via a heavy-duty cable. Vehicles equipped with the optional Electronic Control Transmission Shifter are equipped with a Push-Button Shift Selector (PBSS) panel near the vehicle instrument cluster.

### Shift Selector Control

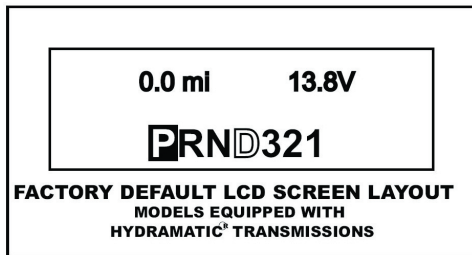
Regardless of the control system, the transmission range selections remain the same. Your instrument panel cluster will have a specific gear range display based on the vehicle transmission model.

## Cluster Display of Gear Ranges

Before covering the specifics of the proper use of the transmission gear selector options, please review the following information which will familiarize you with the meaning of the gear range display on your instrument panel cluster.

## Hydramatic® Transmission Cluster Display

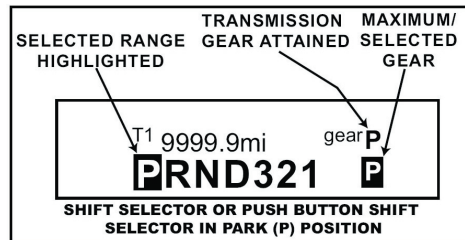
Vehicles equipped with four-speed automatic transmissions use the instrument cluster display shown below. Moving the shift lever will signal the indicator on the cluster to move in relation to the gear range selected.



## Allison™ Transmission Cluster Display

This section describes the display of transmission attained gear and maximum/selected transmission gear. This display is only applicable on vehicles using Allison™ transmissions.

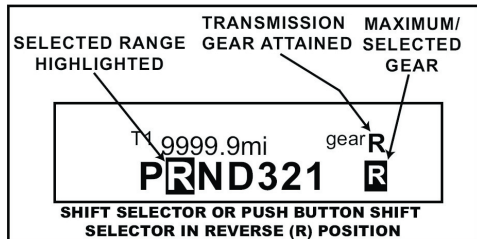
**PARK (P):** With the selector in the PARK (P) position the following will be illuminated on the cluster display.



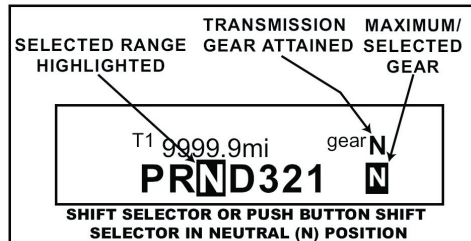
## CAUTION

*Always apply the brakes before shifting the transmission out of PARK (P).*

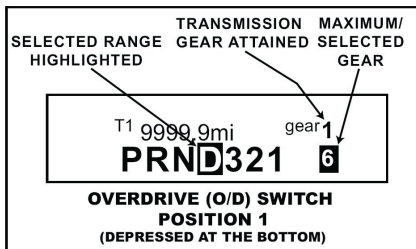
**REVERSE (R):** Moving the shift lever to the REVERSE (R) position or pressing the “R” button on the push button shift selector (PBSS) will result in the following change to the display.



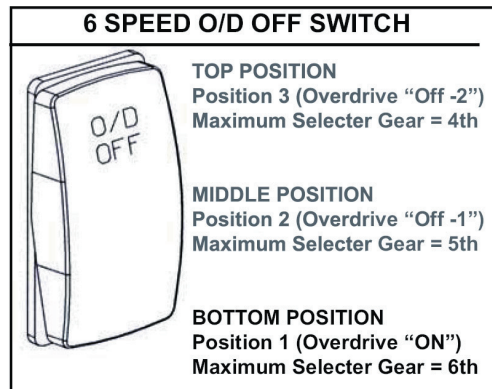
**NEUTRAL (N):** Accordingly, moving the shift selector to NEUTRAL (N) or pressing the “N” button on the Push Button Shift Selector (PBSS) will change the display to indicate NEUTRAL (N).



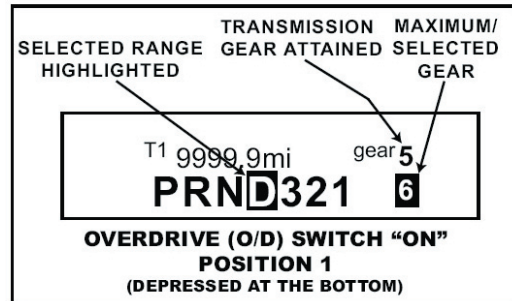
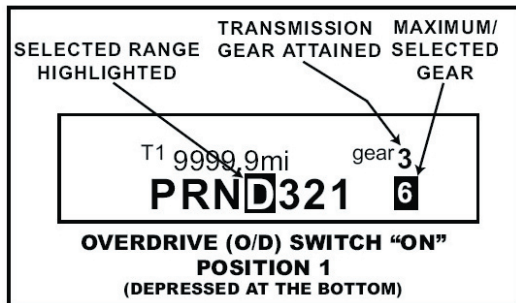
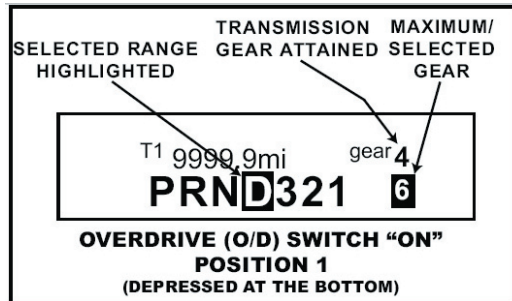
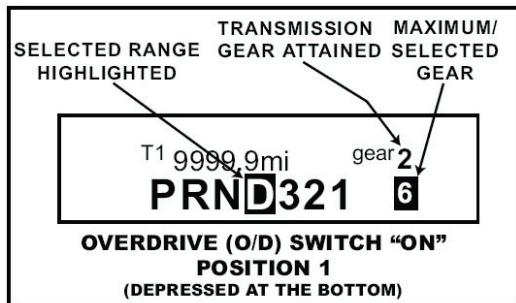
DRIVE (D): When you select DRIVE (D) the display will read “gear 1” in normal condition with the vehicle at a stand still.



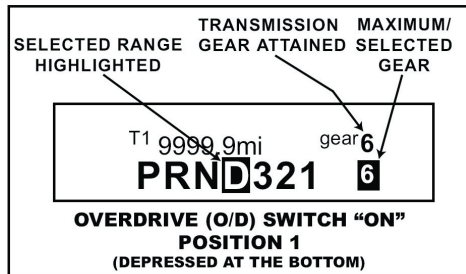
The “gear 1” display will change to read “gear 2”, “gear 3”, “gear 4”, “gear 5”, and “gear 6” respectively as the vehicle speed increases and the transmission shifts through the gears. On a six-speed transmission, the maximum attainable gear is six (6) when the shift lever is in the DRIVE (D) position and the “OD OFF” switch is in the ON position (**Position 1**).



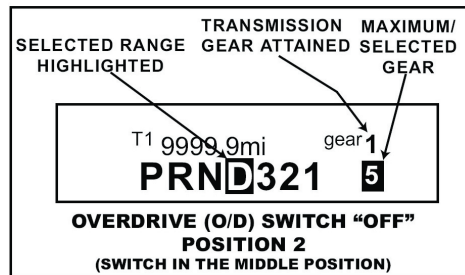
The transmission current gear will also decrement when the transmission downshifts.

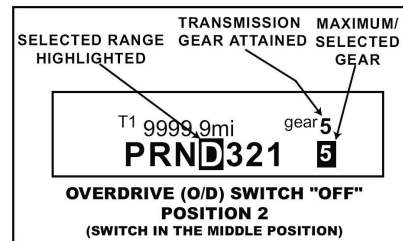
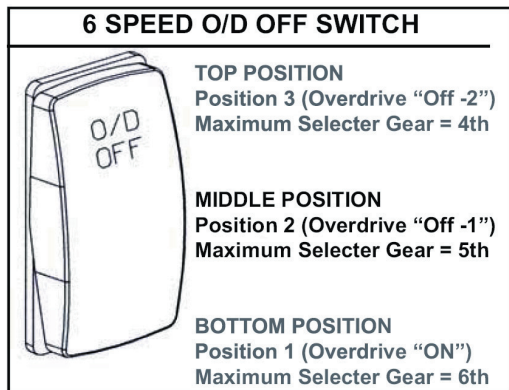


When your vehicle reaches normal road speed the maximum selected gear and the gear attained will both indicate sixth (6th) gear. This is what you will see on the display during normal driving at highway speeds.



**FIFTH (5th):** With the maximum/selected gear as fifth (5th), selected by using PBSS or shift lever in DRIVE (D) position and the "OD OFF" switch set to the middle position (Position 2), your display will look like this with the vehicle at a stand still.

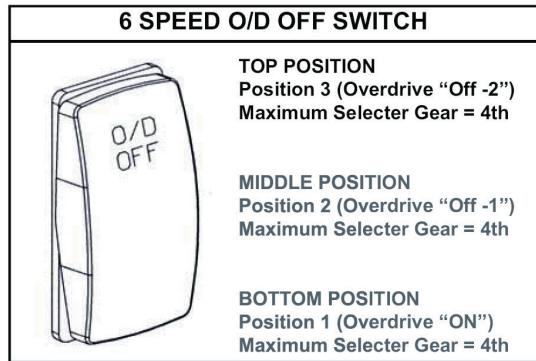
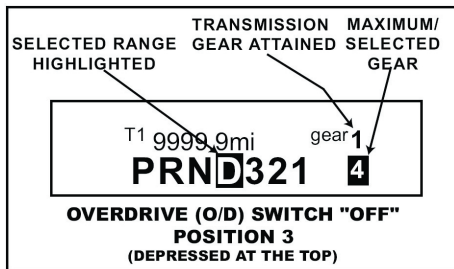




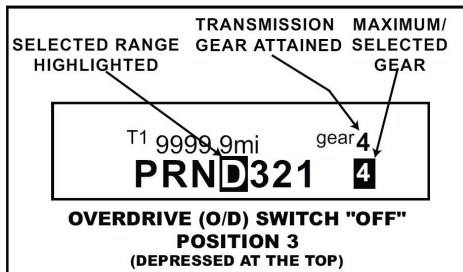
As you accelerate the display will change to reflect the attained gear range up to fifth (5th) gear which is the highest gear available with the overdrive off (O/D OFF) switch in the middle position (Position 2).



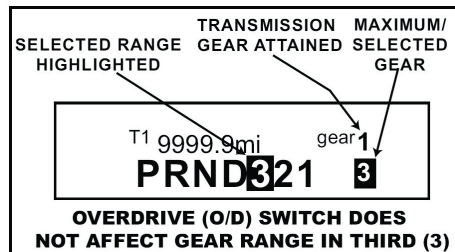
FOURTH (4th): With the maximum/selected gear as fourth (4th), selected by using PBSS or shift lever in DRIVE (D) position and the “OD OFF” switch depressed at the top (POSITION 3), your display will look like this with the vehicle at a stand still.



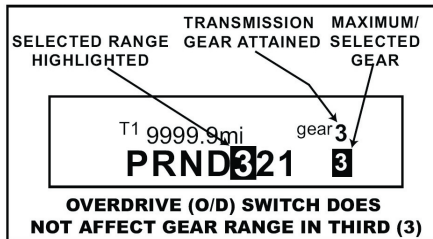
As you accelerate the display will change to reflect the attained gear range up to fourth (4th) gear which is the highest gear available with the overdrive off (O/D OFF) switch depressed at the top, **(Position 3)**.



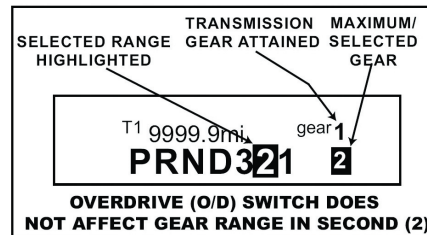
**THIRD (3rd):** Shifting your transmission to THIRD (3rd) using the PBSS or shift lever will change your display to look like this with the vehicle at a stand still.



Again, as your vehicle speed increases the display will increment up to the maximum selected range.



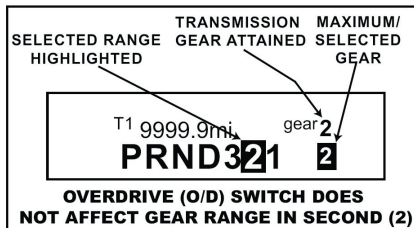
**SECOND (2nd):** Shifting your transmission to SECOND (2nd) using the PBSS or shift lever will change your display to look like this with the vehicle at a stand still.



## NOTICE

*The Overdrive Off switch has no effect on transmission range selection with the selector in THIRD (3).*

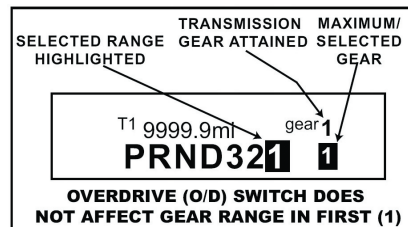
As your vehicle speed increases the display will increment up to the maximum selected range.



### NOTICE

The Overdrive Off switch has no effect on transmission range selection with the selector in SECOND (2).

**FIRST (1st):** Shifting your transmission to FIRST (1) using the PBSS or shift lever will change your display to look like this with the vehicle at a stand still.



Your transmission will not upshift when FIRST (1) gear is selected.

### NOTICE

The Overdrive Off switch has no effect on transmission range selection with the selector in FIRST (1).

## Selecting Gear Ranges

### Standard Column Shift Operation

**PARK (P):** This position locks your rear wheels. It is the best position to use when you start your engine. Ensure the shift lever is fully in PARK (P) before starting the engine.

From Model year 2008, all chassis will have a Brake-Transmission Shift Interlock (BTSI) system. Fully depress the brake pedal before attempting to shift from PARK (P) when the ignition key is in RUN. If you cannot shift out of PARK (P), ease pressure on the shift lever and push the shift lever all the way into PARK (P) as you maintain brake application. Then move the shift lever into the gear you wish. (See “Shifting Out of PARK” in the Index).



## CAUTION

*Always apply the brakes before shifting the transmission out of PARK (P).*



## CAUTION

*It is dangerous to get out of your vehicle if the shift lever is not fully in PARK (P) with the park brake firmly set. Your vehicle can roll.*

*Do not leave your vehicle when the engine is running. If you leave the engine running, the vehicle can move suddenly. You or others could be injured. To be sure your vehicle will not move, even when you are on fairly level ground, always set your park brake and move the shift lever to PARK (P). See “Shifting into PARK” in the Index.*

If you have a W18 Series motor home your transmission does not lock when in PARK (P). For these series chassis an automatic park brake will apply whenever your transmission shifts to PARK (P). Wait five or six seconds for the park brake to fully apply, then release the brake pedal. When your transmission is shifted from PARK (P), the automatic park brake will release.

All chassis have a transmission park position that locks when in PARK (P), except the W18 Series.

**REVERSE (R):** Selection will display an “R.” This selection provides one range for backing the vehicle.

### **NOTICE**

*Shifting to REVERSE (R) while your vehicle is moving forward could damage your transmission. Shift to REVERSE (R) only after your vehicle is stopped.*

To rock your vehicle back and forth to get out of snow, ice or sand without damaging your transmission, see “Stuck in Sand, Mud, Ice or Snow” in the Index.

**NEUTRAL (N):** In this position, your engine is not connected with the wheels. To restart your vehicle when you are already moving, use NEUTRAL (N) only. Also, use NEUTRAL (N) when your vehicle is being towed.

*Note: If your vehicle is equipped with the Auto-Apply Park Brake, see “Auto-Apply Park Brake” in the Index.*



## **CAUTION**

*Shifting out of PARK (P) or NEUTRAL (N) while your engine is “racing” (running at high speed) is dangerous. Unless your foot is firmly on the brake pedal, your vehicle could move very rapidly. You could lose control and hit people or objects. Do not shift out of PARK (P) or NEUTRAL (N) while your engine is racing.*

## **NOTICE**

### **(HYDRAMATIC® TRANSMISSIONS ONLY)**

*Damage to your transmission caused by shifting out of PARK (P) or NEUTRAL (N) with the engine racing is not covered by your warranty. (The Allison™ transmissions will not shift into gear when the engine speed is too high).*

**AUTOMATIC OVERDRIVE:** This position is for normal driving. If you need more power for passing, and you are:

- Going less than about 35 mph (55 km/h), push your accelerator pedal about halfway down.
- Going more than 35 mph (55 km/h), push the accelerator pedal all the way down.

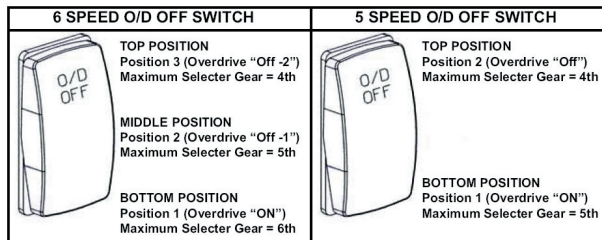
The transmission will downshift into the next lower gear range and provide more power.

*Note: For the four-speed automatic transmission (W16/W18 Series chassis) the driver should select third gear when driving on steep hills or when towing heavy loads.*

## Allison™ Transmission Applications

The W20/W21/W22/W24/W25 Series motor home has a six-speed Allison™ transmission while the W42/W62 Series commercial chassis has a five-speed transmission. In both cases, four gears can be selected with the shift lever. These are overdrive (D), third (3), second (2), and first (1).

| GEAR   | 6-SPEED Allison™   | 5-SPEED Allison™ | 4-SPEED Hydramatic®                            |
|--------|--|------------------|--|
| Sixth  | O/D Switch "On"  | —                | —  |
| Fifth  | O/D Switch in "OFF -1"   | O/D Switch "ON"  | —  |
| Fourth | O/D Switch in "OFF -2"   | O/D Switch "OFF" | O/D  |
| Third  | 3  | 3                | D  |
| Second | 2  | 2                | 2  |
| First  | 1  | 1                | 1  |
|        | Overdrive Switch Position with 5-Speed or 6-Speed Transmission |                  | Shift Lever Position with 4-Speed Transmission |





## Motor Home Chassis (Six-Speed) Operation

When overdrive is enabled, overdrive (D) and third (3) correspond to sixth and third gears respectively. Overdrive can be disabled using the O/D Off switch.

The O/D Off switch has three positions. With the switch depressed at the top, fourth gear is selected and held. The O/D Off lamp on the instrument cluster will illuminate. The “D” on the indicator now corresponds to fourth gear. With the switch position in the middle, fifth gear is selected and held. The O/D Off lamp on the instrument cluster will illuminate. The “D” on the indicator now corresponds to fifth gear. With the switch depressed at the bottom overdrive is selected. The “D” on the indicator now corresponds to sixth gear.

The O/D Off switch thus enables you to manually select fourth and fifth gear. Fourth gear should be selected when driving on steep hills or heavy towing. Fifth gear should be used when driving on rolling hills or when facing gusty strong head wind.

## Commercial Chassis (Five-Speed) Operation

When overdrive is enabled, overdrive (D) and third (3) correspond to fifth and third gears respectively. Overdrive can be disabled using the O/D Off switch.

The O/D Off switch has two positions. With the switch depressed at the top, fourth gear is selected and held. The O/D Off lamp on the instrument cluster will illuminate. The “D” on the indicator now corresponds to fourth gear. With the switch depressed at the bottom overdrive is selected. The “D” on the indicator now corresponds to fifth gear.

*Note: The O/D Switch is available on most chassis models.*

## All Allison™ Transmission Applications

Fourth gear position on the five-speed or six-speed transmission can be used for normal driving offering more power but lower fuel economy than AUTOMATIC OVERDRIVE. You should use fourth gear position on the five-speed or six-speed transmission when driving on steep hills.

Selecting lower gear positions increases power but lowers fuel economy and can be useful to control speed as you go down steep mountain roads, but you would also want to use your brakes off and on intermittently.

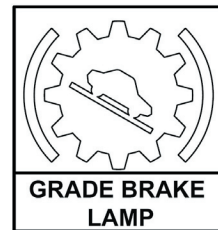
First gear position provides the most tractive effort but lowest fuel economy. You can use it on very steep hills or in mud or snow. If the selector lever is put in first, the transmission will not shift until the vehicle is going slow enough.

## Transmission Grade Braking

The grade-braking feature's primary purpose is to utilize engine braking to help slow your vehicle on steep grades in order to reduce wear on the traditional braking system. The method used to slow the vehicle is by overriding the PRNDL position, effectively pre-selecting the next lower gear range automatically. The downshift will always be to the next lower range, it will not 'skip' ranges.

Because the transmission is electronically controlled and there is no mechanical linkage that needs to be moved for a pre-select downshift, implementation of this feature can be done completely in software with no hardware modifications.

Switching the Grade Brake control switch to the ON position will put the grade brake system in the ready mode and illuminate the grade brake icon on the instrument panel.



The Transmission Grade Brake feature takes into consideration several factors before commanding a pre-select downshift. These are the primary inputs to the Transmission Control Module (TCM):

- Throttle position
- Service brake state
- Vehicle acceleration/deceleration
- Grade/Load
- Vehicle speed

These factors are continually calculated to determine when a pre-select downshift is commanded. Grade Braking can be exited by depressing the throttle or moving the Grade Brake control switch to the OFF position.



## CAUTION

*Grade Braking is not intended to reduce the need for great care by the driver when driving a motor home down a grade. Drivers should continue to take all normal and appropriate actions to keep the vehicle under control at all times.*



## CAUTION

*Switch the grade brake control switch to the OFF position anytime you are driving on wet or icy roads.*

The grade brake option does not provide any additional engine braking than what is available without the option. It does however select the next lower gear automatically such that the driver does not have to manually select it. The result is more precise use of engine braking, but not increased engine braking.

There is no fixed shift point for an automatic grade brake downshift. The shift will never occur such that engine speed exceeds guidelines. Thus, an automatic downshift will not occur if vehicle speed is such that a downshift would over-speed the engine.

The transmission will actually up shift if there is danger of engine over speeding. In such cases, the vehicle brakes must be used to lower the vehicle speed to the point that a safe automatic downshift will occur. The shift will never occur without first depressing the brake pedal.

The grade braking switch must be ON and the brake pedal depressed before the automatic downshifting will occur. It will not normally operate on level ground.

### NOTICE

*The grade brake system does not operate like diesel exhaust or valve engine brakes as some customers expect. These type brakes will not work on throttle controlled gasoline engines.*

## Electronic Control Transmission Shifter (ECS) (W22/W24/W25 Series Chassis)

The Electronic Control Transmission Shifter (ECS) is a state-of-the-art control developed for use with Allison™ 1000/2000 Series transmissions. This shift selector has been designed to provide for easier driver operation, and features:

- Push-button operation
- Integrated safety features
- Diagnostic capabilities
- Solid-state construction for reliable operation

The system consists of two major components:

### ***Push-Button Shift Selector (PBSS)***

The Push-Button Shift Selector (PBSS) is a compact, solid-state shift selector. The shift selector is mounted in a convenient location near the vehicle operator. The shift selector is a self-contained electronic control that contains the push-button system, Interface Control Module, and Actuator Control Module.

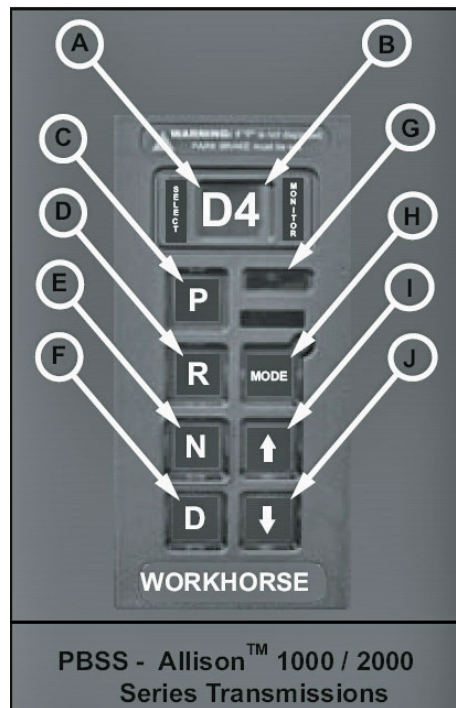
The push-button pad provides quick, easy operation of the system functions. The Interface Module communicates electronically with Allison™ Transmission Control Module (TCM). The Actuator Control communicates with the ECS actuator and the integrated position sensor.



## Electronic Control Transmission Shifter Actuator

The Electronic Control Transmission Shifter Actuator is a motor-operated shift actuator mounted on the Allison™ transmission. The actuator shifts the transmission as directed by commands from the shift selector and within the operating guidelines of the Allison™ transmission. The ECS system works in conjunction with the Allison™ “adaptive shifting” electronic control system to provide optimized shift quality. The ECS system components also have a unique redundant electronic system, which prevents single point electrical failures in the system and ensures long life, trouble-free operation of the ECS system and the Allison™ transmission.

- (A) **SELECT DISPLAY:** An LED character shows what gear has been selected.
- (B) **MONITOR DISPLAY:** An LED character shows what gear the transmission is actually in.
- (C) **PARK (P):** An LED character shows that the transmission is locked in PARK (P).



Ensure the PBSS displays PARK (P) before starting the engine. You have to fully apply your regular brakes before you can shift from PARK (P) when the ignition key is in RUN.



## CAUTION

*It is dangerous to get out of your vehicle if the PBSS is not fully in PARK (P) with the park brake firmly set. Your vehicle can roll.*



## CAUTION

*Do not leave your vehicle when the engine is running. If you leave the engine running, the vehicle can move suddenly. You or others could be injured. To be sure your vehicle will not move, even when you are on fairly level ground, always set your park brake and select PARK (P) on the PBSS. See “Shifting into PARK” in the Index.*

If the vehicle is equipped with an Allison™ transmission (W20/W21/W22/W24/W25) the park pawl will engage when the “P” is selected. The foot apply park brake should then be applied to ensure the motor home is safely parked.



## CAUTION

*If PARK (P) is selected, and “P” does not display on the Monitor, the park brake must be set to prevent the vehicle from moving unexpectedly. The system should be checked and serviced.*

*If the ignition is turned OFF without shifting to PARK (P); a buzzer will sound and the display panel will illuminate and show the gear currently engaged. Shifting to “P” will engage the park pawl and turn off the display and buzzer.*

## NOTICE

*If the vehicle engine is off, the ignition on, and the park pawl is not engaged, the MONITOR will display “N” and a buzzer will sound regardless of the operator’s selection. Shifting to “P” will engage PARK and turn off the system.*

(D) REVERSE (R): Use this gear to back up. Pressing the “R” button shifts the transmission into REVERSE (R).

## NOTICE

*Shifting to REVERSE (R) while your vehicle is moving forward could damage your transmission. Shift to REVERSE (R) only after your vehicle is stopped.*

By following the correct procedure you can rock your vehicle back and forth to get out of snow, ice or sand without damaging your transmission. (See “Stuck in Sand, Mud, Ice or Snow” in the Index.)

(E) NEUTRAL (N): In this position, your engine is not connected with the wheels. To restart the engine when you are already moving, use NEUTRAL (N). Also use NEUTRAL (N) when your vehicle is being towed. (See “Towing Your Vehicle” in the Index.)



## CAUTION

*If the transmission is in “N” and the operator leaves the driver’s station, the vehicle park brake must be set to prevent the vehicle from rolling.*

(F) DRIVE (D) AUTOMATIC OVERDRIVE: This position is for normal driving. If you need more power for passing, and you are:

- Going less than about 35 mph (55 km/h), push your accelerator pedal about halfway down.
- Going more than 35 mph (55 km/h), push the accelerator pedal all the way down.

The transmission will downshift into the next lower gear range and provide more power.

The W22, W24, and W25 Series motor home fitted with ECS has a six-speed Allison™ transmission. All forward ranges can be selected with the PBSS. These are drive (sixth), fifth, fourth, third, second, and first. DRIVE “D” corresponds with overdrive. Lower gear positions on the six-speed transmission can be selected by the Manual Down and Up Gear selector buttons on the PBSS.

The “D” button shifts the transmission into DRIVE and allows the transmission to automatically shift through the full range of first through sixth. When DRIVE is initially selected, the Select and Monitor displays read “D1” indicating that DRIVE has been selected and the transmission is in first gear. As the transmission automatically upshifts or downshifts, the Select/Monitor Display will show which gear the transmission is actually in – D1, D2, D3, D4, D5, or D6.



Fifth gear position on the six-speed transmission can be used for normal driving offering more power but lower fuel economy than AUTOMATIC DRIVE (D). Fifth gear should also be used when driving on rolling hills or when facing gusty strong head wind.

You should use fourth gear position on the six-speed transmission when driving on steep hills. Selecting lower gear positions increases power but lowers fuel economy and can be useful to control speed as you go down steep mountain roads, but you would also want to use your brakes off and on intermittently.

First gear position provides the most tractive effort but lowest fuel economy. You can use it on very steep hills or in mud or snow. If first gear is selected, the transmission will not shift until the vehicle is going slow enough.

(G) SERVICE: If the SERVICE display illuminates there is a fault in the ECS system. A qualified technician should inspect the system as soon as possible.

(H) MODE: Workhorse W Series chassis do not utilize the MODE button.

(I) Manual Gear Selector - UP: When the transmission is in D1, D2, D3, D4, or D5 depressing the up-arrow button manually upshifts the transmission one gear at a time until D is selected. The Selector Display shows what gear has been selected, the Monitor Display will show what gear the transmission is actually in.

*Note: The transmission will not upshift beyond the gear range selected. When DRIVE is selected the full range automatic shift capability is restored.*

*Note: Selecting DRIVE at any time during the upshift sequence cancels the manual shifting function and allows the transmission to shift automatically.*

(J) Manual Gear Selector - DOWN: When the transmission is in DRIVE, the down-arrow button allows the operator to manually downshift one gear at a time – sixth through first (W22/W24/W25 Series chassis). The Select Display will show what gear range has been selected; the Monitor Display will show the actual gear range the transmission is in.

*Note: The transmission will not upshift beyond the gear range selected. When DRIVE (D) is selected the full range automatic shift capability is restored.*

*Note: Selecting DRIVE (D) at any time during the downshift sequence cancels the manual-shifting function and allows the transmission to shift automatically.*



## CAUTION

*Operation with the SERVICE lamp illuminated may indicate a loss of safety back-up systems, and the operator should use extra caution when shifting to ensure that the transmission is performing properly.*

### Flashing DISPLAY (A)

This indicates that the transmission (rather than the ECS) has inhibited the selected transmission operation; this could occur for a variety of reasons. Refer to the Allison™ Transmission's Operator's Manual for more information.

### MONITOR (B) and Buzzer Sounding

This indicates that the engine was shut off without shifting the transmission to PARK (P). The display will stay illuminated and show the gear it is currently in. In addition, a warning buzzer will sound. Selecting PARK (P) will turn off the panel warning and engage PARK (P).

## Emergency Removal From PARK (P)

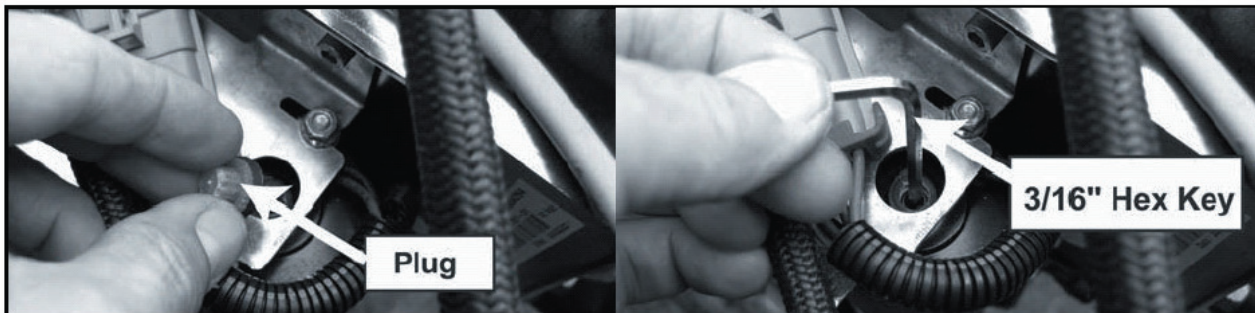
In the event that a vehicle must be towed, and the ECS system cannot be activated to move the vehicle's transmission out of PARK (P), the following must be done.

- Connect the tow vehicle to disabled vehicle in such a manner that the disabled vehicle cannot move in either direction when it is removed from PARK (P).
- Set the tow vehicle's brakes.
- Chock the tow vehicle's wheels.

- Set the disabled vehicle's brakes.
- Chock the disabled vehicle's wheels.
- Remove plug from rear of ECS actuator.
- Insert a 3/16" hex key into the rear of the ECS actuator and turn in a clockwise direction until the transmission comes out of PARK (P).
- Be sure to replace the moisture protection plug.

### NOTICE

*The vehicle can be returned to PARK (P) with this feature.*





## CAUTION

*When performing this operation all of the preceding steps must be done in the proper order to prevent possible injury from unexpected movement of the tow or disabled vehicles.*

### NOTICE

*See vehicle's operating guide and the Allison™ Transmission's Operator's Manual for instructions on preparing the vehicle for towing.*



## CAUTION

*If the rear wheels do not rotate, do not try to apply full power for more than 30 seconds in either direction. This can overheat the transmission. This could happen if the wheels are stuck or the vehicle is trying to pull a load that will not move. To cool an overheated transmission select "N" (NEUTRAL) and increase the idle to approximately 1,200 rpm for one to two minutes. This will increase transmission fluid flow through the transmission cooler and lower the fluid temperature.*

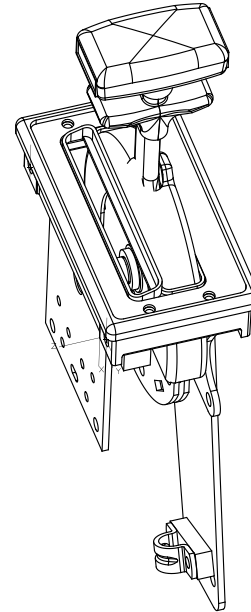
## **NOTICE**

*When stopped on an uphill grade, do not hold the vehicle in position with only the accelerator pedal for extended periods. This could overheat the transmission. Select PARK (P) and use the service or park brakes to hold the vehicle in position.*

## **Remote Shifter (W42/W62 Series Chassis)**

PARK (P): This position locks your rear wheels. It is the best position to use when you start your engine. Ensure the shift lever is fully in PARK (P) before starting the engine.

Fully depress the brake pedal before attempting to shift from PARK (P). (See “Shifting Out of PARK” in the Index).





## CAUTION

*Always apply the brakes before shifting the transmission out of PARK (P).*



## CAUTION

*It is dangerous to get out of your vehicle if the shift lever is not fully in PARK (P) with the park brake firmly set. Your vehicle can roll.*

*Do not leave your vehicle when the engine is running. If you leave the engine running, the vehicle can move suddenly. You or others could be injured. To be sure your vehicle will not move, even when you are on fairly level ground, always set your park brake and move the shift lever to PARK (P).*

*See “Shifting into PARK” in the Index.*

**REVERSE (R):** This position provides one range for backing the vehicle.

### NOTICE

*Shifting to REVERSE (R) while your vehicle is moving forward could damage your transmission. Shift to REVERSE (R) only after your vehicle is stopped.*

*To rock your vehicle back and forth to get out of snow, ice, or sand without damaging your transmission, see “If you are Stuck” in the Index.*

**NEUTRAL (N):** In this position, your engine is not connected with the wheels. To restart when you are already moving, use NEUTRAL (N) only. Also, use NEUTRAL (N) when your vehicle is being towed.



## CAUTION

*Shifting out of PARK (P) or NEUTRAL (N) while your engine is “racing” (running at high speed) is dangerous. Unless your foot is firmly on the brake pedal, your vehicle could move very rapidly. You could lose control and hit people or objects. Do not shift out of PARK (P) or NEUTRAL (N) while your engine is racing.*

## NOTICE

*Damage to your transmission caused by shifting out of PARK (P) or NEUTRAL (N) with the engine racing is not covered by your warranty.*

## DRIVE (D):

AUTOMATIC OVERDRIVE: This position is for normal driving. If you need more power for passing, and you are:

- Going less than about 35 mph (55 km/h), push your accelerator pedal about halfway down.
- Going more than 35 mph (55 km/h), push the accelerator pedal all the way down.

The transmission will downshift into the next lower gear range and provide more power.

The W42 Series commercial chassis equipped with a diesel engine and the W62 Series commercial chassis (gas and diesel) have a five-speed Allison™ transmission, four gears of which can be selected with the shift lever. These are overdrive (O/D), third (3), second (2), and first (1).

The W42 chassis equipped with a gasoline engine has a four-speed transmission. All four ranges, overdrive (O/D), drive (D), second (2), and first (1), can be selected using the shift lever.

Selecting lower gear positions increases power but lowers fuel economy and can be useful to control speed as you go down steep mountain roads, but you would also want to use your brakes off and on intermittently.

First gear position provides the most tractive effort but lowest fuel economy. You can use it on very steep hills or in mud or snow. If the selector lever is put in first, the transmission will not shift until the vehicle is going slow enough.

## Transmission Warning Lamps

### Check Transmission

The vehicle has a warning symbol lamp on the instrument cluster alerting of a possible transmission problem. (Refer to “Instrument Panel Display” in this section.)



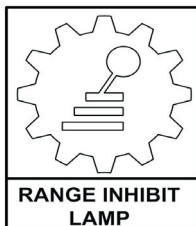
During normal operation the lamp illuminates only when the key is turned to the START position and for a few seconds after the key is released back to the RUN position. This is a check of the lamp and circuit.

If this symbol does not illuminate during the start cycle, or if it illuminates at any other time, there is a problem. Although the trouble may not be apparent, it should be inspected at a qualified repair facility. Depending on the nature of the problem it is possible the transmission may not allow range shifts.



## Range Inhibit Warning Lamp

This light comes on when the gear selected by the driver cannot be engaged (see the Allison™ transmission manual for more information).



*Example: You have selected “D” (6th range). However, during the upshift sequence, the transmission senses slippage while in 4th range. The transmission will reselect the last known favorable application.*

Depending on the cause or seriousness of the problem, the transmission warning lamp may be illuminated.

## Park Brake

The park brake should always be set when parking the vehicle. Always release the park brake before driving.

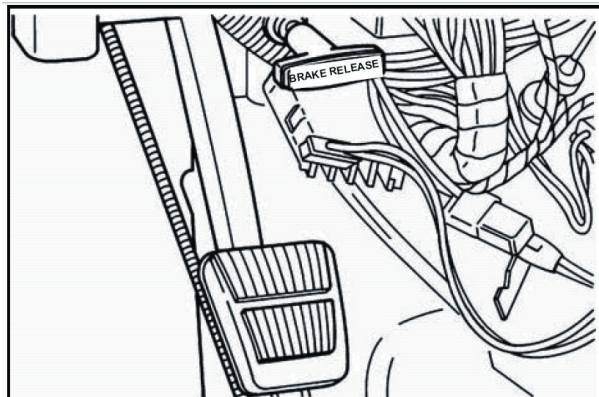
Applying the park brake will illuminate the instrument panel indicator symbol. Releasing the park brake will extinguish the indicator symbol.

### NOTICE

*Driving with the park brake “ON” can cause your park brake to overheat. You may have to replace it, and you could also damage other parts of your vehicle.*

## Pedal and Lever Park Brake

The park brake is applied by either a pedal, pull button, or lever assembly. Motor home and shuttle bus models use a pedal assembly or pull button and commercial models use a pedal or a lever assembly. The pedal assembly is foot-actuated and the lever assembly is hand-actuated.

**TYPICAL PARK BRAKE**

## Apply Park Brake

The park brake is applied by depressing the pedal assembly as far as possible.



## CAUTION

*Never apply the park brake while the vehicle is moving, except in an emergency.*

## Release Park Brake

To release the park brake:

- Apply the foot brake.
- Pull the “Brake Release” handle.
- Verify that the park brake pedal returns to its normal position.



## CAUTION

*If the pedal does not return to its normal position the brake may still be partially or fully applied. Driving the vehicle could damage the brake.*

## Pull-Button Park Brake

### NOTICE

*The W18 Series motor homes have the J72 auto-apply park brake option. Check the vehicle specification to confirm that you have a J72 park brake option.*



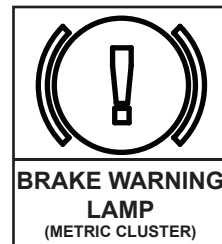
If you have a W18 Series motor home you have a pull-button park brake switch on the instrument panel to the left or right of the steering column.

The pull-button is used to apply the park brake in any gear other than PARK (P).

Pull the button to apply the park brake and the AUTO PARK warning light and the BRAKE warning light will both come on. Push the button back in to release the park brake.

When the vehicle is stationary and the button is pulled to apply the park brake, the BRAKE warning light will come on.

To release the park brake, push the button back in and the BRAKE warning indicator lamp will go off.



**NOTICE**

*Although the park brake can be applied using the pull-button during driving, it is strongly advised not to apply the park brake while driving. Application of the park brake while the vehicle is in motion may result in damage to the park brake or other components of the vehicle.*

*The park brake should be applied by using the pull-button whenever the transmission fault lamp is illuminated. This will ensure that your vehicle will not move in the event that the transmission does not shift to PARK (P) due to a transmission fault.*

**NOTICE**

*If the vehicle moves with park brake applied, brake adjustment or repairs are required. This vehicle should not move if the park brake is applied.*

**Auto-Apply Park Brake**

If you have a W18 Series motor home you have an auto-apply park brake. The auto-apply park brake will be activated when placing the transmission shifter into the PARK (P). This activates the autoapply park brake.

To activate the auto-apply park brake, press the regular brake pedal and shift the transmission shifter into PARK (P). Hold the regular brake pedal for about five seconds after shifting/switching into PARK (P) to allow the auto-apply park brake to fully apply, then release the regular brake.

This will cause the AUTO APPLY warning light to come on, but the BRAKE warning light will not come on, unless the pull-button is applied as well (pulled out position).

The auto-apply function is released when the transmission shifter is moved out of the PARK (P) position. Subsequently, the AUTO PARK warning light will go off.



## CAUTION

*If your vehicle is in motion, NEVER turn the ignition key to the OFF position. This will cause the park brake to apply rapidly and the damage to your vehicle can occur and/or loss of control. If the vehicle is moving and the engine stalls, immediately shift the transmission shifter into N (NEUTRAL) or select the N (NEUTRAL) button on the PBSS (if equipped) and use your regular brakes to stop the vehicle.*

## NOTICE

*In vehicles equipped with the automatically applied park brake, you may feel a slight jolt when you shift from PARK (P) into REVERSE (R) or DRIVE (D). This is a normal condition and is caused by the release of drive energy to the driveline due to the park brake releasing after the transmission engages the selected range*

## Shifting Into PARK (P).

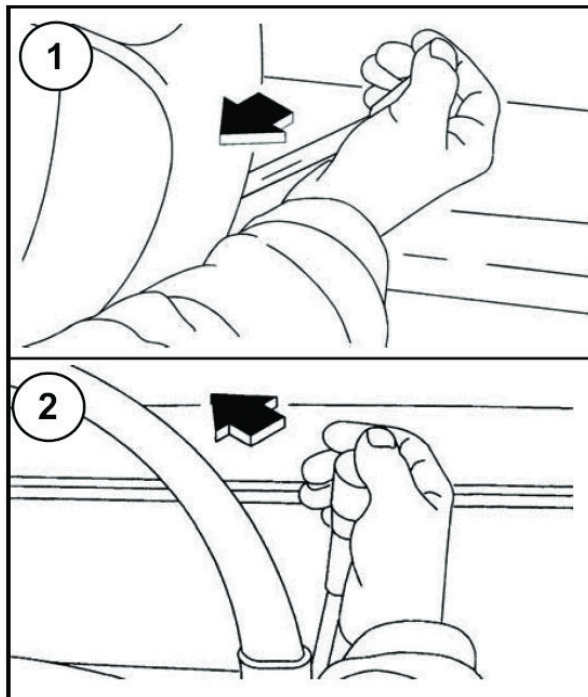


## CAUTION

*It can be dangerous to get out of your vehicle if the shift lever is not fully in PARK (P) with the park brake firmly set, or if the PBSS, (if equipped) is not set to PARK (P). Your vehicle can roll. If you leave the engine running, the vehicle can move suddenly. You or others could be injured. To be sure your vehicle will not move, even when you are on fairly level ground, use the steps that follow.*

## Column Shift

1. Shift into PARK (P) by holding the brake pedal down and setting the park brake. Then, move the shift lever into PARK (P) like this:
  - Pull the lever toward you.
  - Move the lever up as far as it will go.
2. Move the ignition key to LOCK, remove the key and take it with you.



### **Electronic Control — Transmission Shifter (ECS) System**

1. Shift into PARK (P) by selecting “P” on the PBSS.
2. Move the ignition key to LOCK, remove the key and take it with you.

### **Remote Shifter**

1. Hold the brake pedal down with your right foot and set the park brake.
2. Move the shift lever into PARK (P) like this:
  - Hold in on the button on the lever.
  - Push the lever all the way toward the front of your vehicle.
3. Turn the ignition key to OFF.
4. Remove the key and take it with you.

## Shifting Out of PARK (P)



### CAUTION

*Always make sure you have fully applied your regular brake before you select any gear. Not doing this could result in vehicle roll or others could be injured.*

### Column Shift

Your vehicle has a Brake-Transmission Shift Interlock (BTSI) system. You have to fully apply your regular brake before you can shift from PARK (P) when the ignition is in the RUN position.

If you cannot shift out of PARK (P), ease pressure on the shift lever and push the shift lever all the way into PARK (P) as you maintain brake application. Then move the shift lever into the gear you want. If you still cannot shift out of PARK, your vehicle will require service. Contact your nearest Workhorse dealer or Workhorse Customer Assistance at: **1-877-946-7731**.

## Electronic Control — Transmission Shifter (ECS)

Your vehicle has a Brake-Transmission Shift Interlock. You have to fully apply your regular brake before you can shift from PARK (P) when the ignition is in the RUN position. If you cannot shift out of PARK (P) the following can be done:

1. The brake switch could be faulty. As an emergency procedure, unplug the brake switch on top of the brake pedal. Make sure to unplug the switch with the dark green and white wires. This procedure will break the circuit and you should be able to select the gears. Have the vehicle serviced as soon as possible.
2. Emergency removal from PARK (P), if ECS is faulty.
  - Follow the procedure detailed in this section.

*Note: Vehicle can be returned to PARK (P) with this feature.*



## CAUTION

*When performing this operation all of the steps must be done in the proper order to prevent possible injury from unexpected movement of the tow or disabled vehicles.*

### Remote Shift

You must fully apply your regular brake before you shift from PARK (P) when the ignition is in the RUN position.

If you cannot shift out of PARK (P), ease pressure on the shift lever and push the shift lever all the way into PARK (P) as you maintain brake application. Then move the shift lever into the gear you want.

If you still cannot shift out of PARK, your vehicle will require service. Contact your nearest Workhorse dealer or Workhorse Customer Assistance at: **1-877-946-7731**.

### Leaving Vehicle While Engine Is Running



## CAUTION

*It can be dangerous to leave your vehicle with the engine running. Your vehicle could move suddenly if the shift lever is not fully in PARK (P) with the park brake firmly set. And, if you leave the vehicle with the engine running, it could overheat and even catch fire. You or others could be injured.*

If you have to leave your vehicle with the engine running, be sure your vehicle is in PARK (P) and your park brake is firmly set before you leave it. After you have moved the shift lever into PARK (P), or selected the PARK (P) on the PBSS, (if equipped), hold the regular brake pedal down.



Then, see if you can move the shift lever away from PARK (P) without first pulling it toward you or, if you have the remote shift lever, without first pushing the button. If you can, it means that the shift lever was not fully locked into PARK (P). If your vehicle is equipped with Electronic Control - Transmission Shifter, ensure that the PBSS display shows the letter "P".

### **Torque Lock (Vehicles with Automatic Transmission and Without Auto-Apply Park Brake) (J72)**

If you are parking on a hill and you do not shift your transmission into PARK (P) properly, the weight of the vehicle may put too much force on the park pawl in the transmission. You may find it difficult to pull the shift lever out of PARK (P). This is called "Torque Lock." To prevent torque lock, set the park brake and then shift into PARK (P) properly before you leave the driver's seat. To find out how, see "Shifting into PARK" in the Index.

When you are ready to drive, move the shift lever out of PARK (P) before you release the park brake.

If torque lock does occur, you may need to have another vehicle push yours a little uphill to take some of the pressure from the park pawl in the transmission, so you can pull the shift lever out of PARK (P).

## Parking Locations



### CAUTION

*Things that can burn could touch hot exhaust parts under your vehicle and ignite. Do not park over papers, leaves, dry grass or other matters that can burn.*



## Parking And Engine Exhaust



### CAUTION

*Engine exhaust can kill. It contains the gas Carbon Monoxide (CO), which you can not see or smell. It can cause unconsciousness and death. You might have exhaust coming in if:*

- *Your exhaust system sounds strange or different.*
- *Your vehicle gets rusty underneath.*
- *Your vehicle was damaged in a collision.*
- *Your vehicle was damaged when driving over road damage or over road debris.*
- *Repairs were not done correctly.*
- *Your vehicle or exhaust system had been modified improperly.*

*If you ever suspect exhaust is coming into your vehicle:*

- *Drive it only with all the windows down to blow out any CO gas; and*
- *Have your vehicle serviced immediately.*

## Running Engine While Parked

It is best not to park with the engine running. If unavoidable, the following should be considered.



### CAUTION

*Idling the engine with the climate control system off could allow dangerous exhaust into the vehicle, (see the earlier Caution under “Engine Exhaust”).*

*Idling in a closed-in place can let deadly Carbon Monoxide (CO) gas into your vehicle even if the fan switch is at the highest setting. One place this can happen is a garage. Exhaust - with CO gas - can come in easily. NEVER park in a garage with the engine running.*

*Another closed-in place can be a blizzard. Snow or debris may interfere with proper evacuation of exhaust, causing gasses to possibly enter the vehicle.*



### CAUTION

*It can be dangerous to get out of your vehicle if the shift lever is not fully in PARK (P) with the parking brake firmly set. Your vehicle can roll. Do not leave your vehicle when the engine is running. If you leave the engine running, the vehicle can move suddenly. You or others could be injured. To be sure your vehicle will not move, even when you are on fairly level ground, always set your parking brake and move the shift lever to PARK (P).*

Follow the proper steps to be sure your vehicle will not move. (See “Shifting into PARK” in the Index.)

## CONTROLS AND INDICATORS

### Horn

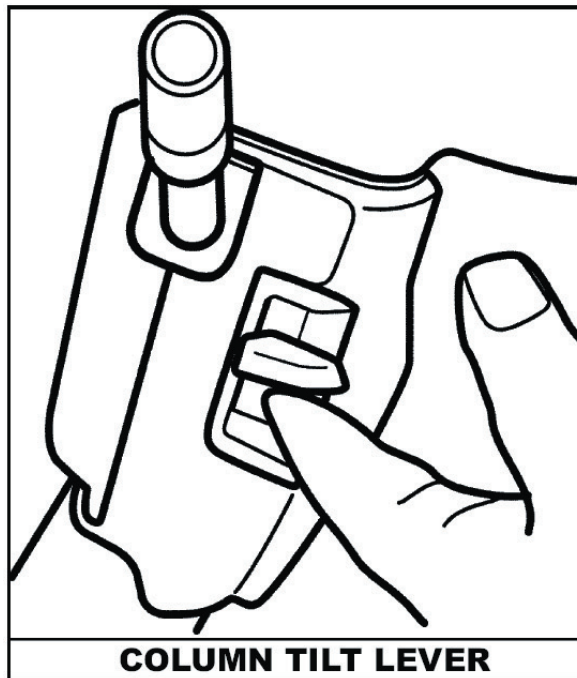
Press the pad in the center of the steering wheel to sound the horn.

### Steering Wheel/Column Adjustments

#### *Tilting*

The steering wheel allows raising and lowering angle adjustments to benefit the driver's long-term comfort. The tilt column can also be raised to the highest position to allow more room when entering or exiting the driver's station.

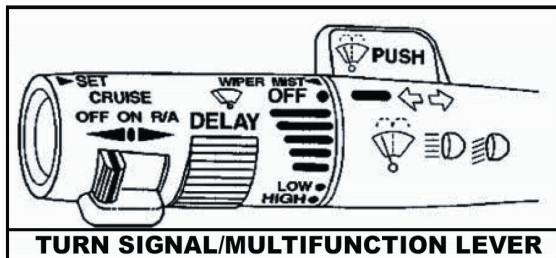
To tilt the wheel, hold the wheel with the right hand and pull the lever (left side below the turn signal lever) up toward the driver. Position the steering wheel as desired and release the lever to re-lock the column assembly.



## Turn Signal/Multifunction Lever

The lever on the left side of the steering column includes your:

- Turn Signal and Lane Change Switch
- Headlamp Dimmer Switch
- Windshield Wipers
- Windshield Washer
- Cruise Control (if equipped)



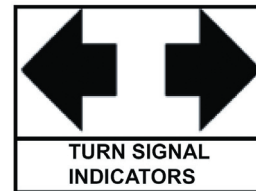
## Turn Signal Operation

The key must be in the RUN position to operate the turn signals. The turn signal lever has four off-center positions, two positions upward (for right) and two downward (for left). These positions allow signal lamps to indicate the driver's intention to turn or change lanes.

To signal a turn, move the lever all the way up or down. These are latching positions. The lever will stay in one of these positions until the steering wheel return movement forces them back to the center (OFF) position as the turn is completed, automatically cancelling the turn signals.

## Turn Signal And Lane Change Indicator

An arrow on the instrument panel will flash in the direction of the turn or lane change.



To signal a lane change, raise or lower the lever to the first resistance point. The signal arrow will start to flash. This is not a latching position. If released, the lever will quickly return to the center (OFF) position.

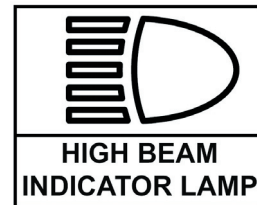
*Note: If the signal to turn or to change lanes fails to flash but just stays illuminated, a signal lamp may be burned out.*

If a lamp is burned out, have it replaced. If the indicator arrows do not illuminate at all while signaling to turn, check the fuses and lamps. (Refer to Section 4, "Fuses.")

## Headlamp Dimmer Switch

The headlamps must be illuminated for this operation to function. To change the headlamps from low beams to high beams, pull the same lever used for turn signal operation up toward the driver and release the lever. The high beams will illuminate and the low beams will go off. This is a self-returning action. Repeating this toggle action will return to the low beams.

With high beams selected, this indicator lamp on the instrument cluster will illuminate a blue symbol. With low beams, the symbol will not be illuminated.



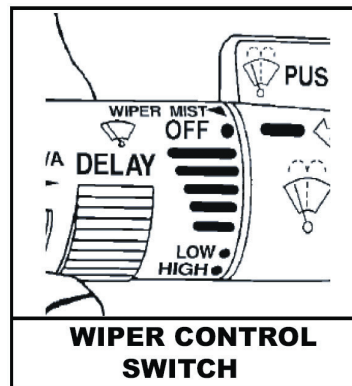
## Windshield Wiper System

The windshield wipers are controlled by turning the band with the wiper symbol on it. For a single wiping cycle, turn the band to MIST. Hold it there until the wipers start, then let go. The wipers will stop after one cycle. If you want more cycles, hold the band on MIST longer.

For steady wiping at low speed, turn the band away from you to LO/LOW. For high-speed wiping, turn the band further, to HI/HIGH. To stop the wipers, move the band to OFF.

Remember that damaged wiper blades may prevent you from seeing well enough to drive safely. To avoid damage, be sure to clear ice and snow from the wiper blades before using them. If they are frozen to the windshield, carefully loosen or thaw them. If your blades do become damaged, replace them as soon as possible.

Heavy snow or ice can overload your wiper system. Clear away snow or ice to prevent an overload.



### NOTICE

*Damaged or worn wiper blades may not clear the windshield properly resulting in poor visibility. To avoid damage, clear ice and snow from the blades before using them. If they are frozen to the windshield, carefully loosen or thaw them. If blades are damaged, get new blades or blade inserts.*

## Low-Speed Delay Wipers

You can set the wiper speed for a long or short delay between wipes. This can be very useful in light rain or snow. Turn the band to choose the delay time. The closer to LO/LOW, the shorter the delay.

## Windshield Washer

At the top of the multifunction lever there is a paddle with the word PUSH on it. To spray washer fluid on the windshield, push the paddle.

If the wipers were already operating before starting a wash cycle they will return to the settings chosen before the wash paddle was pressed.

If you have the standard wipers, the wipers will keep going in LO/LOW until you turn the wiper control to OFF. If you have the low-speed delay option, the wipers will clear the window and then either stop or return to your preset speed.



## CAUTION

*In extreme freezing weather, do not use washers until the windshield is warmed. Washer fluid can form ice on the windshield, blocking visibility.*

## Cruise Control

### Cruise Control Operation

With cruise control, you can maintain a speed of about 30 mph (64 km/h) or more without keeping your foot on the accelerator. Cruise control does not work at speeds below about 30 mph (64 km/h), or above the set vehicle speed limit. The cruise control switches are located on the Turn Signal/Multifunction Lever. An indicator light on the instrument cluster will light up when the cruise control is controlling the vehicle speed. When you apply your brakes, the cruise control shuts off.





## CAUTION

*Cruise control can be dangerous where you can not drive safely at a steady speed. Do not use your cruise control on winding roads or in heavy traffic.*



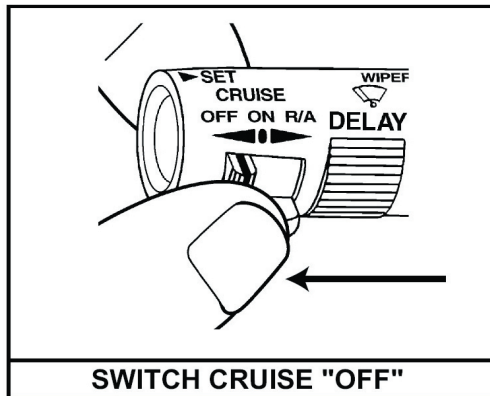
## CAUTION

*Cruise control can be dangerous on slippery roads. On such roads, fast changes in tire traction can cause needless wheel spinning, and you could lose control. Do not use cruise control on slippery roads.*

*If you leave your cruise control switch "ON" when you are not using cruise, you might hit a button and go into cruise when you do not want to. You could be startled and even lose control. Keep the cruise control switch "OFF" until you want to use it.*

Before activating cruise control, it is important to know how to deactivate it. There are two methods for canceling or interrupting cruise control.

- Press the brake pedal.
- Move the cruise control slide switch to the OFF position.



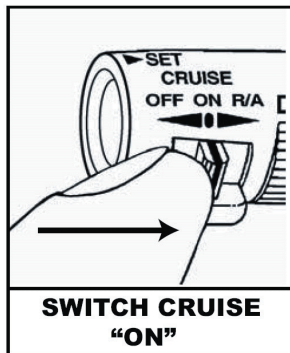
## Canceling Cruise Control

## Setting Cruise Control

The key must be in the RUN position. The engine must be running. The vehicle will need to reach the minimum speed before a cruise control signal will set. The cruise control is a function commanded by the engine controller.

When activated, an instrument cluster cruise lamp will illuminate.

1. Move the cruise control switch to ON.
2. Accelerate to the desired speed.
3. Press and release the SET button at the end of the lever.
4. Remove your foot from the accelerator pedal.

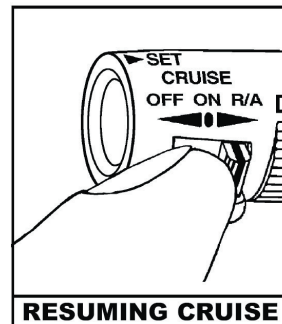


### Resuming A Set Speed

When driving with the cruise control set at a desired speed and you apply the brake the cruise control shuts off.

To resume cruise operation, once you are moving about 30 mph (64 km/h) or more, you can move the cruise control slide switch from ON to R/A for less than half a second. Your vehicle will return to your set speed and stay there.

If you hold the switch at R/A longer than a second the vehicle will accelerate above the set speed until you release the switch or apply the brake.



## **Increasing Speed With Cruise Control**

There are two ways to go to a higher speed:

- Use the accelerator pedal to get to the higher speed. Push the “SET” button at the end of the lever, then release the button and the accelerator pedal. You will now cruise at the higher speed.
- Move the switch from ON to R/A. Hold it there until you get up to the speed you want, and then release the switch. To increase your speed in very small amounts, move the switch to R/A for less than a second and then release it. Each time you do this, your vehicle will go about 1 mph (1.6 km/h) faster.

## **Reducing Speed With Cruise Control**

Depress the SET button on the end of the lever until you reach the lower speed you want, then release it. To slow down in very small amounts, push the button for less than half a second. Each time you do this, vehicle speed will be reduced by approximately 1 mph (1.6 km/h).

## **Passing With Cruise Control**

Use the accelerator pedal to increase speed. Releasing the accelerator pedal, will allow the vehicle speed to slow to the previous set speed.

## **Using Cruise Control On Hills**

How well the cruise control will work on hills depends upon speed, load, and the steepness of the hills.

### **NOTICE**

*Extreme downgrades will require service brake applications to control vehicle speed.*

Remember, applying the brakes cancels cruise control operation.

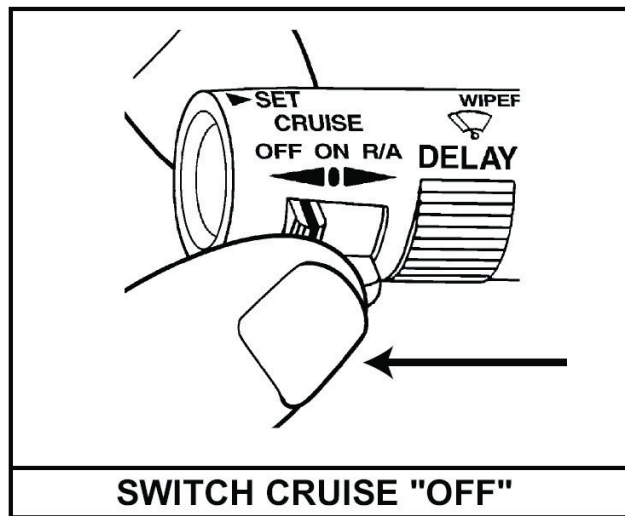
### Ending Cruise Control

There are two ways to turn off the cruise control:

- Slide the cruise control switch to the OFF position.
- Turn the ignition key to the OFF position.

### Erasing Speed Memory

When you turn off the cruise control or the ignition, your cruise control set speed memory is erased.



## Vehicle Operational Lamps

The following information may vary depending on coach manufacturer's design choices.

Lamp control switches will be on or near the instrument panel. These controls are usually accessible by the driver's left hand.

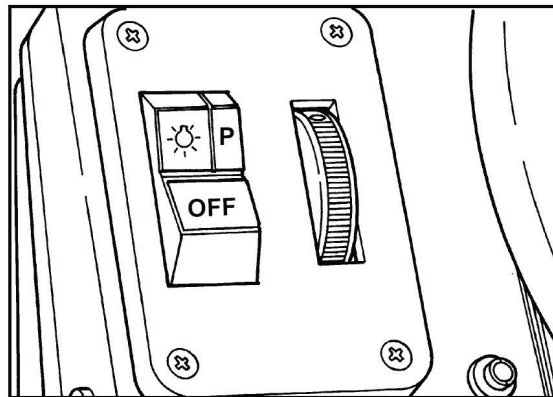
Press the switch marked "P" to turn on:

- Parking Lamps
- Side Marker Lamps
- Tail Lamps
- Instrument Panel Lamps

### NOTICE

*Press the switch with the master lamp symbol to turn on all the lamps listed as well as the headlamps. The lamp switch may also control any other lamps or lights provided by the body manufacturer.*

Press the bottom switch marked OFF to turn off all your lamps.



### Instrument Cluster Illumination

Backlighting can not be adjusted if the lamp switch is in the OFF position. Move the thumbwheel, located next to the main lamp switch, up to brighten your instrument panel lights. If you move the switch all the way up until it clicks, your interior lamps will come on if the body manufacturer wired your switch to these lamps. Move the thumbwheel down to dim your instrument panel lights.

If the thumbwheel is on the brightest setting but the instrument panel still appears dim, adjust the thumbwheel to the dimmest position and slowly readjust to the desired brightness.

### **Daytime Running Lamps (DRL) (If Equipped)**

Daytime Running Lamps (DRL) can make it easier for others to see the front of your vehicle during the day (taillamps and marker lamps remain off). DRL can be helpful in many different driving conditions, but they can be especially helpful in the short periods after dawn and before sunset.

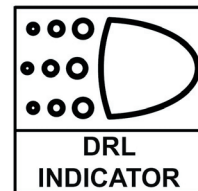
Your headlamps will come on at reduced brightness in daylight when:

- The ignition is on.
- The headlamp switch is off.
- The park brake is released.

When you turn on your headlamps, the DRL will switch off and the exterior lamps will come on. When you turn off the headlamps, the exterior lamps will go out and the headlamps will switch to the reduced brightness of DRL again.

To idle your vehicle with the DRL off, apply the park brake. The DRL will stay off until you release the park brake.

On W18, W24, and W25 Series motor homes (vehicles equipped with auto-apply park brake) the DRL will also turn off when you shift the transmission into PARK (P), which applies the park brake. The DRL will remain off until the transmission is shifted out of PARK (P), the manual park brake is fully released, and the park brake warning light goes out.



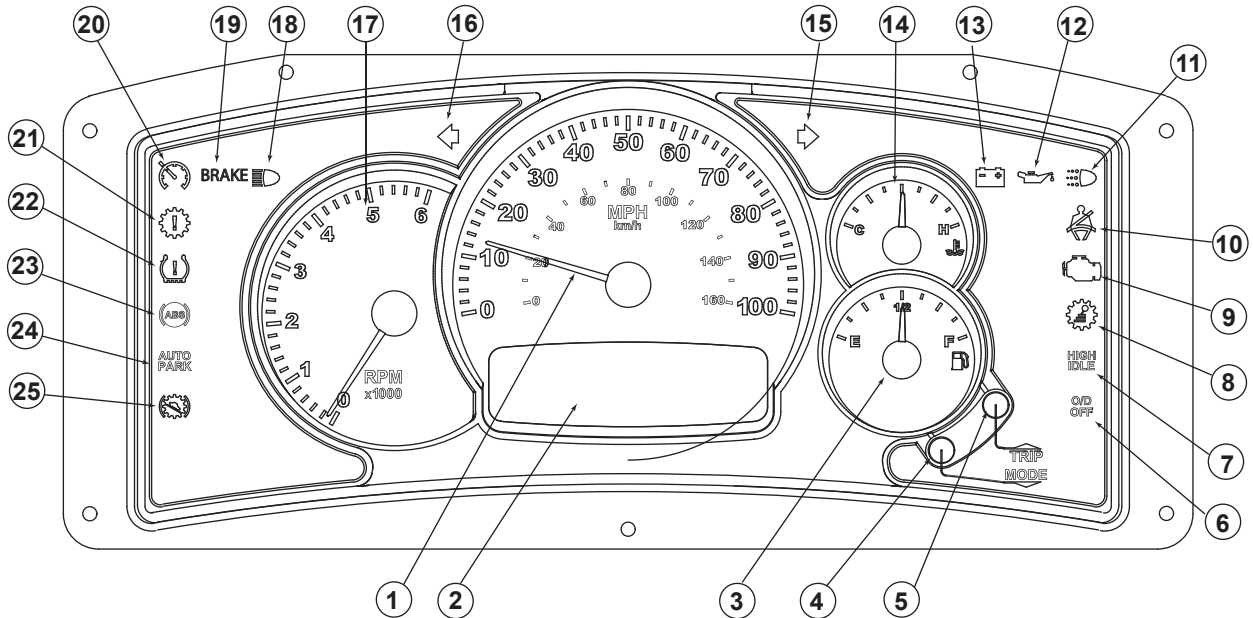
As with any vehicle, you should turn on the regular headlamp system when you need it.

### **NOTICE**

*Rear tail lamps and marker lamps are not illuminated when DRL are on.*

### ***Lamp Circuits Protection***

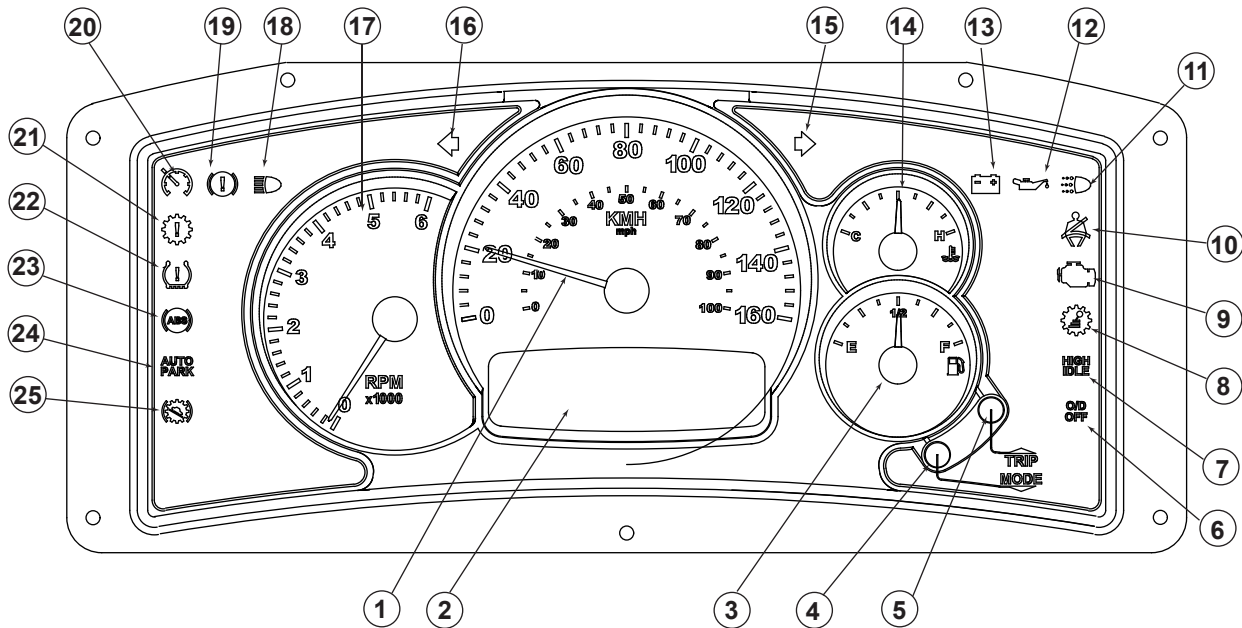
A circuit breaker protects your headlamps. If you have an electrical overload, your headlamps will flicker on and off. Have your headlamp wiring checked right away if this happens. (Refer to Section 4, for circuit breaker information.)



**GASOLINE ENGINE - ENGLISH CLUSTER**

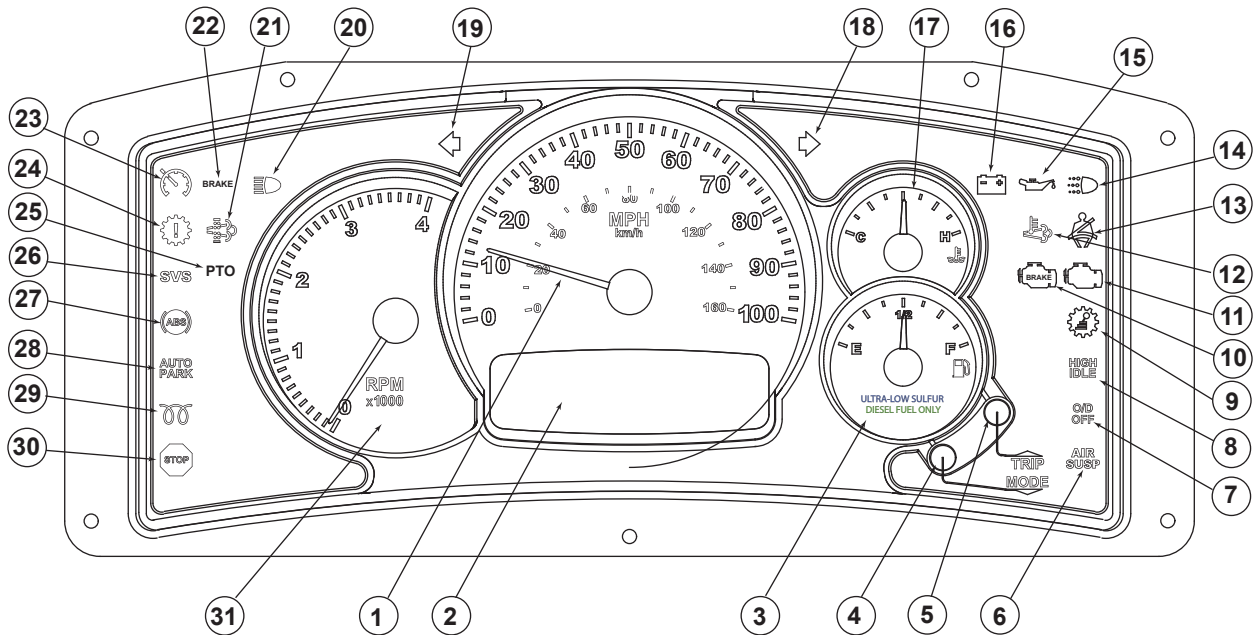


| <b>GASOLINE ENGINE — ENGLISH CLUSTER</b> |   |               |   |
|--|---|---------------|---|
| <b>Item #</b>                            | <b>Description</b>                      | <b>Item #</b> | <b>Description</b>                                  |
| 1  | Speedometer                             | 14            | Engine Coolant Temperature Gauge                    |
| 2  | LCD Screen                              | 15            | Right Turn Signal Indicator (Green)                 |
| 3  | Fuel Gauge                              | 16            | Left Turn Signal Indicator (Green)                  |
| 4  | Mode Button                             | 17            | Tachometer  |
| 5  | Trip Button                             | 18            | High Beam Indicator (Blue)                          |
| 6  | Overdrive (O/D) OFF Lamp (Amber)        | 19            | Brake Failure Warning/Park Brake Applied Lamp (Red) |
| 7  | High Idle Lamp (Amber)                  | 20            | Cruise Control Engaged Lamp (Green)                 |
| 8  | Range Inhibit Lamp (Red)                | 21            | Transmission Failure Warning Lamp (Red)             |
| 9  | Check Engine Lamp (Amber)               | 22            | Tire Pressure Monitor (Amber)                       |
| 10                                       | Seat Belt Reminder Lamp (Red)           | 23            | Antilock Brake System (ABS) Warning Lamp (Amber)    |
| 11                                       | Daytime Running Lamp (DRL) Lamp (Green) | 24            | Auto Park Lamp (Red)                                |
| 12                                       | Engine Oil Pressure Warning Lamp (Red)  | 25            | Grade Brake ON Lamp (Amber)                         |
| 13                                       | Battery Charge Warning Lamp (Red)       |               |   |



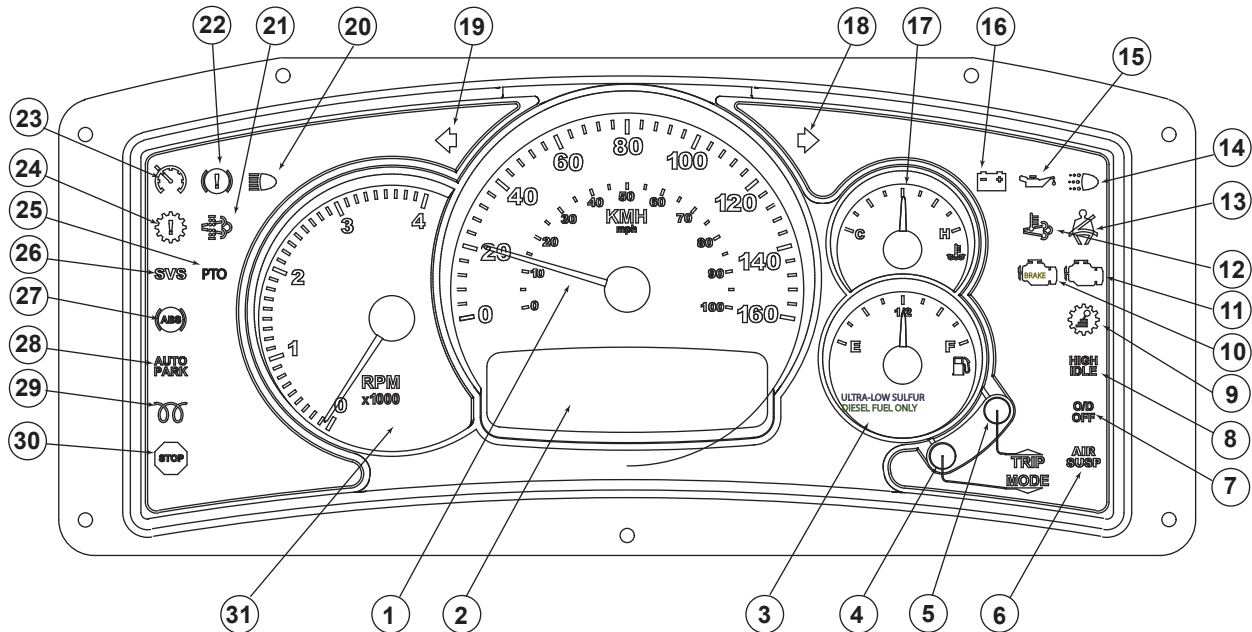
**GASOLINE ENGINE - METRIC CLUSTER**

| <b>GASOLINE ENGINE — METRIC CLUSTER</b> |   |               |   |
|---|---|---------------|---|
| <b>Item #</b>                           | <b>Description</b>                      | <b>Item #</b> | <b>Description</b>                                  |
| 1                                       | Speedometer                             | 14            | Engine Coolant Temperature Gauge                    |
| 2                                       | LCD Screen                              | 15            | Right Turn Signal Indicator (Green)                 |
| 3                                       | Fuel Gauge                              | 16            | Left Turn Signal Indicator (Green)                  |
| 4                                       | Mode Button                             | 17            | Tachometer  |
| 5                                       | Trip Button                             | 18            | High Beam Indicator (Blue)                          |
| 6                                       | Overdrive (O/D) OFF Lamp (Amber)        | 19            | Brake Failure Warning/Park Brake Applied Lamp (Red) |
| 7                                       | High Idle Lamp (Amber)                  | 20            | Cruise Control Engaged Lamp (Green)                 |
| 8                                       | Range Inhibit Lamp (Red)                | 21            | Transmission Failure Warning Lamp (Red)             |
| 9                                       | Check Engine Lamp (Amber)               | 22            | Tire Pressure Monitor (Amber)                       |
| 10                                      | Seat Belt Reminder Lamp (Red)           | 23            | Antilock Brake System (ABS) Warning Lamp (Amber)    |
| 11                                      | Daytime Running Lamp (DRL) Lamp (Green) | 24            | Auto Park Lamp (Red)                                |
| 12                                      | Engine Oil Pressure Warning Lamp (Red)  | 25            | Grade Brake ON Lamp (Amber)                         |
| 13                                      | Battery Charge Warning Lamp (Red)       |               |   |



**DIESEL ENGINE - ENGLISH CLUSTER**

| DIESEL ENGINE — ENGLISH CLUSTER |   |        |   |
|---------------------------------|---|--------|---|
| Item #                          | Description                                   | Item # | Description   |
| 1                               | Speedometer                                   | 17     | Engine Coolant Temperature Gauge                      |
| 2                               | LCD Screen                                    | 18     | Right Turn Signal Indicator (Green)                   |
| 3                               | Fuel Gauge                                    | 19     | Left Turn Signal Indicator (Green)                    |
| 4                               | Mode Button                                   | 21     | High Beam Indicator (Blue)                            |
| 5                               | Trip Button                                   | 21     | Diesel Particulate Filter Regeneration Needed (Amber) |
| 6                               | Air Suspension Lamp (Amber)                   | 22     | Brake Failure Warning/Park Brake Applied Lamp (Red)   |
| 7                               | Overdrive (O/D) OFF Lamp (Amber)              | 23     | Cruise Control Engaged Lamp (Green)                   |
| 8                               | High Idle Lamp (Amber)                        | 24     | Transmission Failure Warning Lamp (Red)               |
| 9                               | Range Inhibit Lamp (Red)                      | 25     | Power Take Off Engaged (PTO)                          |
| 10                              | Engine Brake Active (Amber)                   | 26     | Service Vehicle Soon (SVS) Lamp (Amber)               |
| 11                              | Check Engine Lamp (Amber)                     | 27     | Antilock Brake System (ABS) Warning Lamp (Amber)      |
| 12                              | High Exhaust Temperature Warning Lamp (Amber) | 28     | Auto Park Lamp (Red)                                  |
| 13                              | Seat Belt Reminder Lamp (Red)                 | 29     | Wait to Start Indicator Lamp (Amber)                  |
| 14                              | Daytime Running Lamp (DRL) Lamp (Green)       | 30     | Stop Engine Warning Lamp (Red)                        |
| 15                              | Engine Oil Pressure Warning Lamp (Red)        | 31     | Tachometer  |
| 16                              | Battery Charge Warning Lamp (Red)             |        |   |



**DIESEL ENGINE - METRIC CLUSTER**

| <b>DIESEL ENGINE — METRIC CLUSTER</b> |   |               |   |
|---------------------------------------|---|---------------|---|
| <b>Item #</b>                         | <b>Description</b>                            | <b>Item #</b> | <b>Description</b>                                    |
| 1                                     | Speedometer                                   | 17            | Engine Coolant Temperature Gauge                      |
| 2                                     | LCD Screen                                    | 18            | Right Turn Signal Indicator (Green)                   |
| 3                                     | Fuel Gauge                                    | 19            | Left Turn Signal Indicator (Green)                    |
| 4                                     | Mode Button                                   | 21            | High Beam Indicator (Blue)                            |
| 5                                     | Trip Button                                   | 21            | Diesel Particulate Filter Regeneration Needed (Amber) |
| 6                                     | Air Suspension Lamp (Amber)                   | 22            | Brake Failure Warning/Park Brake Applied Lamp (Red)   |
| 7                                     | Overdrive (O/D) OFF Lamp (Amber)              | 23            | Cruise Control Engaged Lamp (Green)                   |
| 8                                     | High Idle Lamp (Amber)                        | 24            | Transmission Failure Warning Lamp (Red)               |
| 9                                     | Range Inhibit Lamp (Red)                      | 25            | Power Take Off Engaged (PTO)                          |
| 10                                    | Engine Brake Active (Amber)                   | 26            | Service Vehicle Soon (SVS) Lamp (Amber)               |
| 11                                    | Check Engine Lamp (Amber)                     | 27            | Antilock Brake System (ABS) Warning Lamp (Amber)      |
| 12                                    | High Exhaust Temperature Warning Lamp (Amber) | 28            | Auto Park Lamp (Red)                                  |
| 13                                    | Seat Belt Reminder Lamp (Red)                 | 29            | Wait to Start Indicator Lamp (Amber)                  |
| 14                                    | Daytime Running Lamp (DRL) Lamp (Green)       | 30            | Stop Engine Warning Lamp (Red)                        |
| 15                                    | Engine Oil Pressure Warning Lamp (Red)        | 31            | Tachometer  |
| 16                                    | Battery Charge Warning Lamp (Red)             |               |   |

## INSTRUMENT PANEL DISPLAY

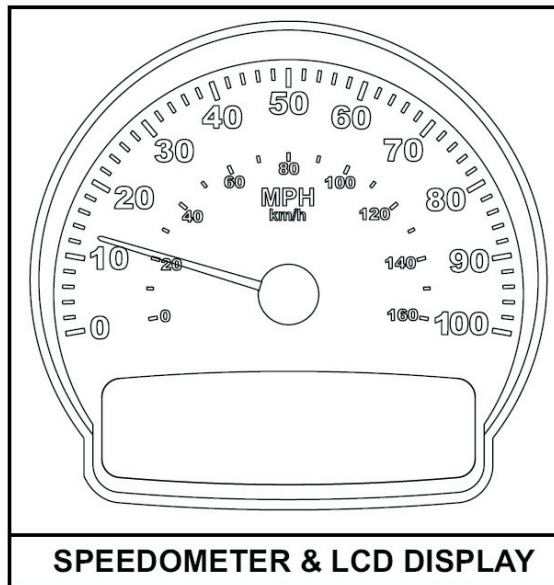
Your instrument cluster is designed to let you know at a glance how your vehicle is running. You will know how fast you are going, how much fuel you are using, and many other things you will need to know to drive safely and economically.

### Speedometer

Your speedometer lets you see your speed in both miles per hour (mph) - United States and in kilometers per hour (km/h) - Canada.

### Road-Speed Limiter

The top speed is limited by the Electronic Throttle Control (ETC), via the engine control unit, on the gasoline engines. The ETC controls the throttle valve to maintain the vehicle at the preset speed limit. The fuel will be cut off at a slightly higher speed if the vehicle manages to exceed the ETC controlled limiter on a steep downhill. The engine display a warning in the message center on the instrument panel cluster when the preset road speed limit has been reached.





**NOTICE**

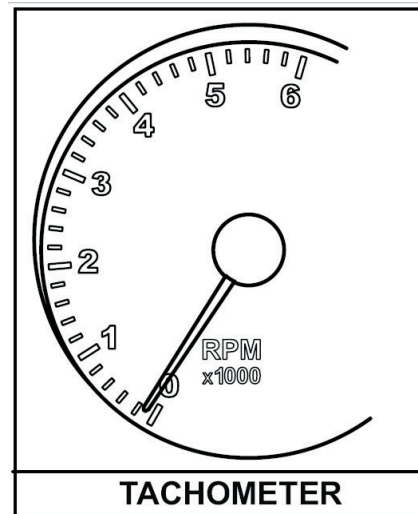
*Certain vehicles may have limited speeds during highway cruising. This is related to the rear axle ratio, tire speed limitations, and powertrain calibration.*

**NOTICE**

*Exceeding the posted speed limit is highly discouraged.*

**Tachometer**

The tachometer displays engine speed in revolutions per minute (rpm). The engine normally idles at 700- 800 rpm



Raising the engine idle can charge the battery faster, if needed. There is no advantage in idling above 1,400 rpm.

Looking at the tachometer before starting the engine is a good way to determine if the engine is already running.

## Warning Lights, Gauges, and Indicators Descriptions

This section describes the warning lights and gauges that may be on your vehicle. The pictures on the following pages will help you locate them.

Warning lights and gauges can signal that something is wrong before it becomes serious enough to cause an expensive repair or replacement. Paying attention to your warning lights and gauges could also save you or others from injury.

Warning lights come on when there may be or is a problem with one of your vehicle's functions. As you will see in the details on the next few pages, some warning lights come on briefly when you start the engine just to let you know they are working.

Gauges can indicate when there may be or is a problem with one of your vehicle's functions. Often gauges and warning lights work together to let you know when there is a problem with your vehicle.

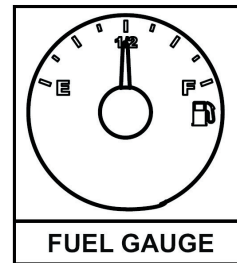
When one of the warning lights comes on and stays on when you are driving, or when one of the gauges shows there may be a problem, check the section that tells you what to do about it. Please follow this manual's advice. Waiting to do repairs can be costly - and even dangerous. So please get to know your warning lights and gauges. They are a big help.

### Fuel Gauge

The fuel gauge tells you about how much fuel you have left, when the ignition is on. When the gauge first indicates empty, there is some fuel remaining, however, it is imperative that you refuel your vehicle immediately.

If your fuel gauge indicates full at all times (gasoline engines only), the fuel gauge reading may be suspect. Have your vehicle serviced immediately.

Here are four things some owners ask about. None of these show a problem with your fuel gauge.

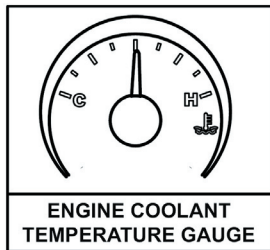


- At the gas station, the gas pump shuts off before the gauge reads full.
- The fuel tank will take either a little more or less fuel to fill up than the fuel gauge shows.
- The gauge moves a little when you turn a corner or speed up.
- The gauge does not go back to empty when you turn off the ignition.

For your fuel tank capacity, see “Fuel Tank Capacity” in the Index.

## Engine Coolant Temperature Gauge

These gauges show the engine coolant temperature. If the gauge pointer moves into the amber area near the “HOT” (H) mark, it means that your engine coolant has overheated.



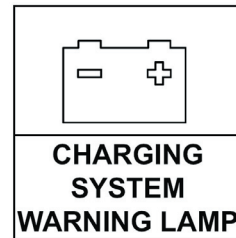
If you have been operating your vehicle under normal driving conditions, you should pull off the road, stop your vehicle, and turn off the engine as soon as possible.

The “Problems on the Road,” section of this manual shows what to do. (See “Engine Overheating” in the Index.)

## Battery Charging System Warning Lamp

This light is used by the charging system to warn that the system is not charging or is overcharging the battery. It will be on when the ignition is “ON” and the engine is not running. If this light comes on when driving, turn off as

many electrical loads as possible, specifically the air conditioning system. If the battery was fully charged when the light came on and the air conditioning system, radio, fan motors, etc., are turned off immediately, the vehicle might be capable of being driven for up to another hour, at highway speeds, before the engine will cut out due to a lack of electrical power.



Drive to the nearest Workhorse service center to have the charging system serviced, or if the distance to the nearest Workhorse service center is too great, contact Workhorse Roadside Assistance at 1-877-946-7731.



## CAUTION

*If you continue to drive after the light comes on, keep a close eye on the engine coolant temperature gauge. The belt which drives the generator also drives the engine water pump. If the temperature starts to rise after the light comes on, pull off of the road immediately. Continued driving with the light on and the temperature rising, will cause the engine to overheat. This can cause serious damage to the engine. The high temperature in the engine compartment might cause a fire.*

On some vehicles an optional warning buzzer may also sound to indicate that the charging system voltage is too high, too low, or that the charging system has failed. The buzzer will sound for three seconds or until the trip reset button is pressed, depending on the severity of the fault.

### Auto Park Brake Light

If you have W18 Series motor home, you will have this light on your instrument cluster.



### NOTICE

*The W18 Series motor home have the J72 autoapply park brake option. Check the vehicle specification to confirm that you have a J72 park brake option.*

It should come on as you start the vehicle and stay on when your transmission is in PARK (P). The light will also stay on while the system is building pressure to release the park brake. If it does not come on then, have it serviced so it will be ready to warn you if there is a problem.

If the light comes on frequently (less than 15 minute intervals) while driving, see your dealer for service on your auto-apply park brake system.

This applies only to the W18 Series motor homes equipped with J72 park brake system. If this light starts flashing simultaneously with the BRAKE warning light and the audible tone alarm sounds when the vehicle is in motion, it may indicate the malfunction of the park brake system. It is strongly recommended to abort driving and pull over to the side of the road. If the warning lights change from flashing to continuous and the audible alarm is off do not continue driving, call Workhorse Roadside Assistance.



### CAUTION

*This applies only to the W18 Series motor homes with J72 parking brake system. If the parking brake is set to apply by using the pull button while the vehicle is in motion and the speed is greater than 0.5 mph (.8km/h), then this light will flash simultaneously with the BRAKE warning light to warn you that the speed of the vehicle is too high for the safe application of the parking brake. If the pull button is not reset to its original position within approximately four seconds, the brake will apply.*



## CAUTION

*If your vehicle is in motion, NEVER turn the ignition key to the OFF position. This will cause the parking brake to apply rapidly and the damage to your vehicle can occur and/or loss of control. If the vehicle is moving and the engine stalls, immediately shift the transmission shifter into N (NEUTRAL) or select the N (NEUTRAL) button on the PBSS (if equipped) and use your regular brakes to stop the vehicle.*

### Brake Failure Warning Light

Your vehicle's hydraulic brake system is divided into two parts. If one part is not working, the other part can still work and stop you. For quality braking, you need both parts working well. This light should come on briefly when you turn the ignition key to RUN. If it does not come on then, have it serviced so it will be ready to warn you if there is a problem.



If this warning light stays on after you start the engine there could be a brake problem. Have your brake system inspected right away.

If the light comes on while you are driving, pull off the road and stop carefully. You may notice that the pedal is harder to push. Or, the pedal may go closer to the floor. It may take longer to stop.

On all W Series chassis the light will come on when the brake fluid level in the master cylinder is low and if there is no flow of hydraulic fluid in the brake boost system.

If the light is still on after you stop, have the vehicle towed for service. (See "Towing Your Vehicle" in the Index.)



## CAUTION

*Your brake system may not be working properly if the brake warning light is on. Driving with the brake warning light on can lead to an accident. If the light is still on after you have pulled off the road and stopped carefully, have the vehicle towed for service.*

### NOTICE

*If the ABS light is "ON" and the regular brake light is "OFF", the vehicle can be driven but you must adjust your driving accordingly.*



## Park Brake Indicator Light

When the ignition is "ON", this light will come on when you set your parking brake. The light will stay on if your parking brake does not release fully.

This light should also come on when you turn the ignition key to CRANK. If it does not come on then, have it serviced so it will be ready to remind you if the parking brake is applied or has not released fully.

### NOTICE

*The W18 Series motor homes have the J72 autoapply park brake option. Check the vehicle specification to confirm that you have a J72 park brake option.*

**BRAKE**

**BRAKE WARNING LAMP**  
(ENGLISH CLUSTER)



**BRAKE WARNING LAMP**  
(METRIC CLUSTER)

On the W18 Series motor homes equipped with the J72 parking brake system, this light will come on and stay on when you set the parking brake with the pullbutton pulled out. The light should go off when the pull-button is pushed in. This light will come on and a tone alarm will sound if the parking brake system requires service.

On the W18 Series motor homes with the J72 parking brake system, if the parking brake is set to apply by using the pull-button while the vehicle is in motion and the speed is greater than 0.5 mph (0.8 Km/h), then this light will flash simultaneously with AUTO PARK to warn you that the speed of the vehicle is too high for the safe application of the parking brake. If the pull-button is not reset to its original position within approximately 4 seconds, the brake will apply. This can result in damage to the vehicle.



## NOTICE

*Application of the parking brake while the vehicle is in motion may result in damage to the parking brake or other systems of the vehicle*



## CAUTION

*This applies only to the W18 Series motor homes with J72 parking brake system. If the parking brake indicator light starts flashing simultaneously with the AUTO PARK warning light and the audible tone alarm sounds when the vehicle is in motion, it may indicate the malfunction of the parking brake system. It is strongly recommended to abort driving and pull over to the side of the road. If the warning lights change from flashing to continuous and the audible alarm is off, do not continue driving, call for Roadside Assistance*



### **Anti-Lock Brake System (ABS) Warning Light**

With the anti-lock brake system (ABS), this light will come on when you start your engine and may stay on for several seconds. That is a normal function for this light.

If the light stays on, or comes on when you are driving, your vehicle needs service. If the regular brake system warning light is not on, you still have brakes, but you do not have anti-lock brakes. If the regular brake system warning light is also on, you do not have anti-lock brakes and there is a problem with your regular brakes. (See “Brake System Warning Light” earlier in this section.)

The anti-lock brake system warning light should come on briefly when you turn the ignition key to RUN. If the light does not come on then, have it serviced so it will be ready to warn you if there is a problem.



### **Transmission Light (Allison™ Transmissions Only)**

When this light comes on it indicates a problem with your transmission you should take your vehicle to the nearest dealer and have it serviced immediately.



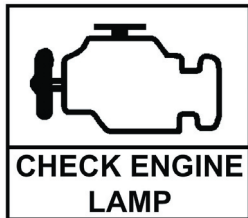
## **Malfunction Indicator Lamp (MIL) or Service Engine Soon Light (SES)**

Your vehicle is equipped with a computer which monitors operation of the fuel, ignition, and emission control systems.

This system is called On Board Diagnostics and is intended to assure that emissions are at acceptable levels for the life of the vehicle, helping to produce a cleaner environment. The SERVICE ENGINE SOON light comes on to indicate that there is a problem and service is required.

Malfunctions often will be indicated by the system before any problem is apparent. This may prevent more serious damage to your vehicle. This system is also designed to assist your service technician in correctly diagnosing any malfunction.

If this light comes on or flashes while you are driving, two things may happen. First, you will not notice any difference in engine performance, but your tail pipe emissions may increase.



Second, your engine may not run properly or may stall without warning. If either of these things happen, drive or tow your vehicle to your dealer for service.

### **NOTICE**

*Continuing to drive the vehicle with this light on, emission controls may not work properly, fuel economy may be reduced and your engine may not run as smoothly.*

### **NOTICE**

*Modifications made to the engine, transmission, exhaust, or fuel system of your vehicle or the replacement of the original tires with other than those of the same Tire Performance Criteria (TPC) can affect your vehicle's emission controls and may cause the SERVICE ENGINE SOON light to come on. Modifications to these systems could lead to costly repairs not covered by your warranty. This may also result in a failure to pass a required Emission Inspection/Maintenance test.*

This light should come on, as a check to show you it is working, when the ignition is on and the engine is not running. If the light does not come on, have it repaired. This light will also come on during a malfunction in one of two ways:

- **Light Flashing** — A misfire condition has been detected. A misfire increases vehicle emissions and may damage the emission control system on your vehicle. Dealer or qualified service center diagnosis and service may be required.
- **Light On Steady** — An emission control system malfunction has been detected on your vehicle. Dealer or qualified service center diagnosis and service may be required.

### ***If the Light Is Flashing***

The following may prevent more serious damage to your vehicle:

- Reducing vehicle speed.
- Avoiding hard accelerations.
- Avoiding steep uphill grades.
- If you are towing a trailer, reduce the amount of cargo being hauled as soon as it is possible.

If the light stops flashing and remains on steady, see “If the Light Is On Steady” next in this section. If the light continues to flash, when it is safe to do so, stop the vehicle. Find a safe place to park your vehicle. Turn the key “OFF”, wait at least 10 seconds and restart the engine. If the light remains on steady, see “If the Light Is On Steady”.

If the light is still flashing, follow the previous steps, and drive the vehicle to your dealer or qualified service center for service.

**NOTICE**

*If the engine light continues to flash, do not continue to drive your vehicle. Have your vehicle serviced immediately.*

***If the Light Is On Steady***

You may be able to correct the emission system malfunction by considering the following:

***Did you recently put fuel into your vehicle?***

If so, reinstall the fuel cap, making sure to fully install the cap. (See “Filling Your Tank” in the Index). The diagnostic system can determine if the fuel cap has been left off or improperly installed. A loose or missing fuel cap will allow fuel to evaporate into the atmosphere. A few driving trips with the cap properly installed should turn the light off.

***Did you just drive through a deep puddle of water?***

If so, your electrical system may be wet. The condition will usually be corrected when the electrical system dries out. A few driving trips should turn the light off.

***Are you low on fuel?***

As your engine starts to run out of fuel, your engine may not run as efficiently as designed since small amounts of air are sucked into the fuel line causing a misfire. The system can detect this. Adding fuel should correct this condition. Make sure to install the fuel cap properly. (See “Filling Your Tank” in the Index). It will take a few driving trips to turn the light off.

***Have you recently changed brands of fuel?***

If so, be sure to fuel your vehicle with quality fuel (see “Fuel” in the Index). Poor fuel quality will cause your engine not to run as efficiently as designed. You may notice this as stalling after start-up, stalling when you put the vehicle into gear, misfiring, hesitation on acceleration or stumbling on acceleration. (These conditions may go away once the engine is warmed up.) This will be detected by the system and cause the light to turn on.

If you experience one or more of these conditions, change the fuel brand you use. It will require at least one full tank of the proper fuel to turn the light off.

If none of the above steps have made the light turn off, have your dealer or qualified service center check the vehicle. Your dealer has the proper test equipment and diagnostic tools to fix any mechanical or electrical problems that may have developed.

### **Wait to Start Light (Diesel Engines)**

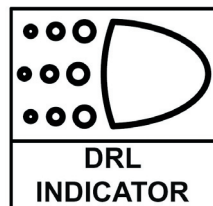
Your diesel engine has a special starting system. When the WAIT to START indicator lamp goes off, your engine is ready to be started.

For more details, see “Starting Your Diesel Engine” in the Index.



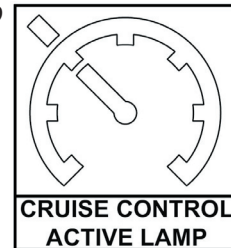
### **Daytime Running Lamp (DRL) Indicator Light**

The DRL indicator is on whenever the ignition is on and the headlamp switch and parking brake are off. This light tells you that your Daytime Running Lamps are on.



### **Cruise Control Active Lamp**

This light comes on when the vehicle speed is actively controlled by the Cruise Control system.



### **High Idle**

This light comes on when the High Idle is activated by “press-and-release” of the “HIGH IDLE” dash mount switch on gasoline engine vehicles or pressing the cruise “SET” switch on diesel engine vehicles, while the vehicle is in PARK (P) or NEUTRAL (N).



The light will turn off when the High Idle switch is deactivated by “press-and-release” of the High Idle switch.

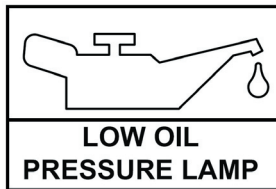
**NOTICE**

*Gasoline engine powered vehicles may not be fitted with a High Idle switch, which is installed by the body builder.*

**Low Engine Oil Pressure**

This light will come on when the Engine Oil Pressure is too low. There is also an audible alarm to assist this lamp at getting the driver's attention.

Oil pressure will vary with engine speed, engine and outside temperature, and oil viscosity. However, readings above the low pressure zone (no lamp) indicates the normal operating range.



An indication in the low pressure zone may be caused by a low oil level or other problems causing low oil pressure. At engine idling, lower pressure is normal.

**CAUTION**

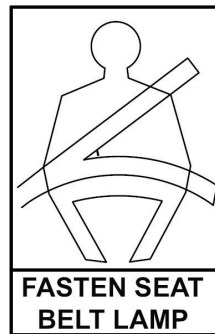
*Do not keep driving if the oil pressure is low. If you do, your engine may become so hot that it catches fire. You or others could be burned. Check your oil as soon as possible and have your vehicle serviced.*

**NOTICE**

*Damage to the engine due to lube oil neglect can be costly and is not covered by warranty.*

**Seat Belt Reminder Lamp**

This light comes on when the ignition is turned "ON" and will stay on until the seat belt is fastened, or for 60 seconds after the vehicle is started. The functionality depends on if the body builder installed a seat belt switch.



 **CAUTION**  
*It is important to wear seat belts whenever the vehicle is moving.*

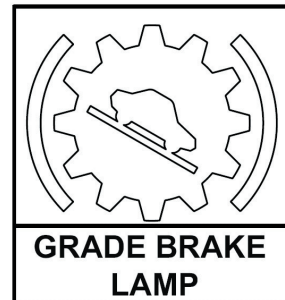
**Overdrive Off Lamp (Allison™ Transmission Only)**

This light comes on when the overdrive gear is disabled. The dash mount switch is used to select fourth or fifth gear when the range selector is in overdrive by disabling sixth gear or fifth gear.



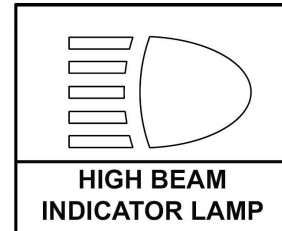
**Grade Braking Lamp**

You can enable this feature by switching the GRADE BRAKE switch (located on the dash panel) to the “ON” position. When the Grade Brake switch is on, the instrument panel will display this icon in green.



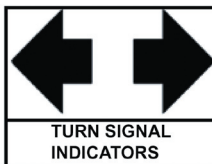
**High Beams Lamp**

When the High Beams are on, the blue indicator lamp on the instrument panel will be illuminated.



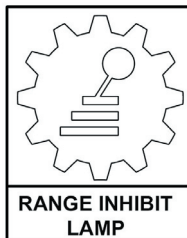
### Turn Signal Lamps

An arrow on the instrument panel will flash in the direction of the turn or lane change.



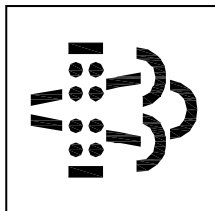
### Range Inhibit Lamp

This light comes on when the transmission controller does not allow a gear range to engage.



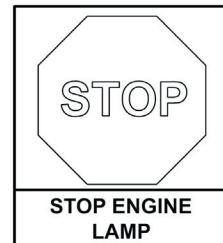
### Exhaust Filter Regeneration Needed Lamp (Diesel Engine Only)

The "Exhaust Filter Regeneration Needed" lamp will illuminate solid when exhaust filter regeneration is required. The lamp will flash when the exhaust filter is full. Refer to Section 7 of this publication for detailed information on the regeneration system.



### Engine Stop (Diesel Engine Only)

The "Engine Stop" lamp will be illuminated to warn the operator that a potential engine failure exists and that the vehicle should be immediately parked in a safe location and the engine shut off.



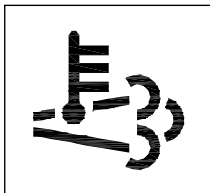
### NOTICE

*It is important to find a place to stop safely. Pull off the traveled portion of the roadway and stop as soon as possible.*



### **Exhaust Temperature High (Diesel Engine Only)**

The “Exhaust Temperature High” lamp will illuminate when exhaust temperature exceeds the normal operating range. When stationary, keep away from people and flammable materials, vapors or structures, or **STOP ENGINE**.



Refer to Section 7 of this publication for detailed information on the regeneration system.

### **PTO Lamp (Diesel Engine Only)**

The PTO Lamp will illuminate if the PTO is enabled.



### **NOTICE**

*This is for PTO equipped diesel chassis only.*

### **NOTICE**

*Workhorse provides PTO ready chassis (only) and any further detailed functionality documentation will be supplied by the PTO outfitter.*

## **INSTRUMENT PANEL CLUSTER MODEL OPTIONS**

The instrument cluster is available in three models:

- Base Instrument Cluster (W42 Gas/W62)
- Base Instrument Cluster with Trip Computer (CTC) (W16/W18/W20/W21/W22/W24/W25/W42 Diesel)
- Base Instrument Cluster with Trip Computer and Powertrain Data (CTP) (W20/W/21/W22/W24/W25 with SSC option)

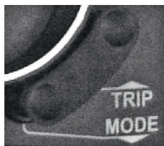
The hardware features of both the instrument cluster options are the same, and for this reason the Base Instrument Cluster function is described in detail. Additional features and functions of the Trip Computer option are described in that section.

## **Base Instrument Cluster Features**

The instrument cluster is equipped with the following listed features.

### **Trip Button:**

- Selects and resets the Trip 1 and 2 odometers.
- Scrolls upward in the menu display.
- Is used with the Mode button to select menu choices and toggle between Metric and US units.
- Displays the odometer reading when ignition is “OFF”.
- Acknowledges the sounding of the buzzer and chimes.



- Displays the odometer reading when ignition is “OFF”.
- Is used to enter the cluster diagnostic mode.

### **Liquid Crystal Display (LCD) Screen:**

- Indicates transmission gear selection.
- Odometer with maximum mileage accumulated to 999999.9 miles / km.
- Trip odometer 1 and 2 (independent functions).
- Battery voltage.
- Oil Pressure or PRND321 (depends on the user selection).
- Warning messages to provide more detail if the vehicle condition monitoring system detects a fault (this will interrupt monitoring data displayed).

### **Mode Button:**

- Selects inquiry mode.
- Scrolls downward in the menu display.
- Is used with the Trip Button to select menu choices and toggle between Metric and US units.

## Odometer display with the ignition “OFF”:

- Switch vehicle headlamps to “ON”. The odometer can be read until the lights are switched “OFF”

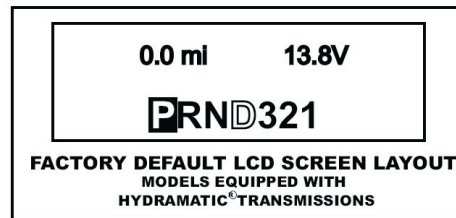
-or-

- Press the Trip or Mode button to view the odometer.

## Self-testing Feature:

- Insert key into the ignition and switch to “ON”. The instrument cluster will automatically perform a self-test and display any errors found on the LCD screen.

## Default LCD Screen Layout



| Left Half of Screen         | Right Half of Screen                          |
|-----------------------------|---|
| ODOMETER /<br>TRIP ODOMETER | PRND321 /<br>BATTERY VOLTAGE /<br>ACTUAL GEAR |
| OIL PRESSURE /<br>PRND321   |   |

The default settings of the LCD Screen layouts for the Base Instrument Cluster are described next. (The tables are a representation of the LCD Screen divided into three separate sections).

Base cluster with transmission gear selection displayed on instrument cluster LCD screen.

### **Large Font Option Messages**

After selecting the large font option from the main menu, the following messages can be scrolled through using the trip button.

### **Large Font PRND321**

When cluster display will show a large (20 bit) “PRND321” on bottom line, with a small (10 bit) Odometer in the upper left side of the display.

### **Large Font Odometer**

Large font (20 bit) odometer will display on lower line with small (10 bit) PRNDL in upper right corner.

### **Large Font Trip Meters**

Trip 1 and Trip 2 are available by toggling using the “trip” button.

After the trip meters, the PRNDL will be displayed again. To get back to the menu, press the mode button.

### **Menu Access/Changing Default LCD Display**

The default screen display can be changed as follows:

- Step 1 - Press the Mode button to enter the Inquiry Menu.
- Step 2 - Highlight choice by scrolling up or down with the Trip or Mode button.
- Step 3 - Make selections automatically by waiting three seconds or press and release both the Trip and Mode buttons simultaneously.

- The selection is highlighted.
- The Trip button scrolls up and the Mode button scrolls down.
- Pressing the Trip and Mode button and releasing them at the same time selects the item, or selection can be made automatically by waiting three seconds.

## Changing Units

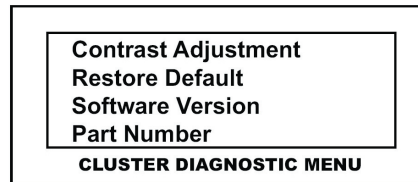
Press and release both the Trip and Mode buttons simultaneously to toggle between Metric and US units while in the default LCD screen.

## Cluster Diagnostics

### Diagnostic Menus

On-board diagnostic functions are displayed in the message center. They can be accessed if the vehicle transmission is in PARK (P) or NEUTRAL (N) or if the vehicle PARK BRAKE is set and the MODE (m) button is pressed and held for at least eight seconds. To exit diagnostics, select "EXIT MENU" or turn the vehicle ignition OFF then back ON.

### Diagnostic Mode



The cluster enters the Diagnostic Mode when a start diagnostic request is made.

The start diagnostic request is sent either by a diagnostic tool through the CAN data link or by selecting the Diagnostic option on the message display menu.

### Turn On Test

When the ignition voltage is first applied to the cluster, all the tell-tales (except turn signals) will turn ON for two seconds, and then turn OFF. Simultaneously, all of the gauges reference themselves and then go to the position corresponding to their current reading.

## **Ignition Mode**

The Ignition Mode is active when the ignition switch is ON. The Ignition Mode is the normal operation mode of the cluster. When the ignition switch is turned OFF, the following current settings of the cluster will be stored in non-volatile memory:

- Accumulated odometer, Trip 1 and Trip 2 values.
- The user selection of US or Metric Units on the message display.
- The last message selection being displayed on the second line of the message display. After storing these settings, the cluster goes into Sleep Mode after a delay of three seconds.

## **Key in Ignition Reminder Mode (If Equipped)**

When the ignition goes from ON to OFF and the key is left in the ignition, for a 60 second period, the chime will sound if the Door Ajar input is low (door open). The chime will continue to sound until either the driver's door is closed or the key is removed from the ignition or the 60-second period has elapsed (during the 60-second period the odometer is visible).

## **NOTICE**

*The body builder may not have implemented the Door Ajar feature on your vehicle. Please contact your body builder if you have any other questions.*

## **Menu Operation**

Menus have four lines. To make a selection, a line must first be highlighted. To highlight a line, the TRIP (t) button is used to scroll up and the MODE (m) button is used to scroll down (the highlighted line is shown in reverse video). Once highlighted, the line can be selected in either of two ways. Depressing and then releasing both the TRIP and MODE buttons at the same time chooses the line. Or, after three seconds of inactivity, the line shown in reverse video is automatically chosen. The display exits from the menu to the previous display or screen.

This is a summary of all menu lines available in self-diagnostic mode.

- Contrast Adjustment
- Part Number
- Software Version
- Restore Default
- Engine Hours
- Max Vehicle Speed
- Engine Oil Life (If Equipped)
- Cluster Testing
  - Gauge test
  - Warning Light Test
  - LCD Test
  - Backlighting Test
  - Speaker Test
  - Switch Inputs
  - Analog Inputs
  - Frequency Inputs
- Exit Menu

On-board diagnostic functions can be initiated and executed with the TRIP and MODE buttons.

### **Contrast Adjustment Feature**

Enter the Cluster Diagnostic menu by pressing the MODE button and holding for eight seconds. The cluster will enter the Diagnostic menu with Contrast Adjustment as the first item. The Diagnostic menu will time-out after three seconds and enter the Contrast menu. (Both the MODE and TRIP buttons can also be used to enter the Contrast menu). Use the TRIP button to increase the contrast and the MODE button to decrease the contrast.

After the Contrast Adjustment is made, the menu will time-out after three seconds. Scroll to the Exit menu and leave to time-out again to the default LCD screen.

### **NOTICE**

*Your vehicle should be in PARK or the park brake must be set to enter the Diagnostic Mode.*

*Note: If the LCD screen is blank, the contrast setting may be too low. Press the MODE button for eight seconds, with the park brake set or the transmission in the PARK (P) position, release the MODE button and wait three seconds. Press the TRIP button repeatedly until the contrast is set to your preference. If the LCD screen does not change, turn off the ignition, wait 10 seconds and retry from the start.*

*Note: If the LCD screen appears black, the contrast setting may be too high. Use the same sequence of steps as for a too low contrast, but use the MODE button instead of the TRIP button to adjust the contrast setting. Contrast cannot be adjusted outside the range of visibility.*

## **Part Number**

Displays the Part Number programmed into the micro controller. Pressing the MODE (m) button exits to the diagnostic menu. (The message “m to exit” appears on the screen.)

## **Software Version**

Displays the Software part number and Version programmed into the micro controller. Pressing the MODE (m) button exits to the diagnostic menu. (The message “m to exit” appears on the screen.)

## **Restore Default**

This routine allows the user to restore the settings of the dimmer and the contrast to the original factory settings.

## **Engine Hours**

Displays the calculated total Engine Hours based on when the engine is running. Pressing the MODE (m) button exits to the diagnostic menu. (The message “m to exit” appears on the screen.)

## **Max Engine RPM**

Displays the Maximum Engine RPM that was sustained for at least three seconds. Pressing the MODE (m) button exits to the diagnostic menu. (The message “m to exit” appears on the screen.)



## **Max Vehicle Speed**

Displays the Maximum Vehicle Speed that was sustained for at least five seconds. Pressing the MODE (m) button exits to the diagnostic menu. (The message “m to exit” appears on the screen.)

## **Engine Oil Life (If Equipped)**

If equipped, Engine Oil Life will display this value in percentage from 0 to 100%. Pressing the MODE (m) button exits to the diagnostic menu. (The message “m to exit” appears on the screen.)

## **Cluster Testing**

### **Gauge Test**

This routine takes each Gauge pointer through three points. This display indicates the position of the gauge pointer during the test. Each gauge pointer will be checked. The test can be stopped, at any time, by pressing the MODE (m) button.

## **Warning Lamp Test**

This routine tests each Warning Lamp by turning it ON then OFF. The display indicates the lamp being tested and its status during the test. The test can be stopped, at any time, by pressing the MODE (m) button.

## **LCD Test**

This routine tests the LCD screen using test patterns. The test automatically stops after three cycles or if the MODE (m) button is pressed.

## **Backlighting Test**

This routine sets the Backlighting through three points. The display indicates the percentage of backlighting during the test. The test automatically stops after three cycles or if the MODE (m) button is pressed.

### **Speaker Test**

This routine tests the Speakers using two tones. The test automatically stops after three cycles or if the MODE (m) button is pressed.

### **Switch Inputs**

This routine tells the operator the status of each Switch Input. The display indicates the Switch Input by descriptive name and the status level (ON/OFF) at the pin. Four inputs are shown per screen. The level status reflects the active state of the input. For example, if an input is active to ground, and the input level is zero volts, then the status will be ON.

#### **Gasoline Vehicle Switch Input List**

|             |                 |
|-------------|-----------------|
| Day Light   | Antenna / Jacks |
| Buzzer Call | Door Ajar       |
| Check Tires | Overdrive Off   |
| Auto Park   | Key In Ignition |
| High Idle   | High Beam       |
| Service     | Headlamp        |
| Right Turn  | Left Turn       |
| Seat Belt   | Grade Braking   |

### **Analog Inputs**

The Analog Inputs are displayed in the function of the engine type. This routine tells the operator the status of each Analog Input. The display indicates the Analog Input by descriptive name and the voltage at the pin. Four inputs are shown per screen.

#### **Gasoline Vehicle Analog Input List**

|               |                      |
|---------------|----------------------|
| Fuel Level    | Ignition             |
| Dimmer        | ABS                  |
| Brake Failure | External Temperature |

### **Frequency Inputs (Speedometer & Tachometer)**

This routine tells the operator the status of each Frequency Input. The display indicates the Frequency Input by the descriptive name and the frequency at the pin.

#### **Trip Odometer Resets**

- Select the Trip Odometer you want to reset by pressing the TRIP button.
- Press and hold the TRIP button for at least two seconds to reset it.

## Warning Message Feature

- If the vehicle condition monitoring system detects a fault, a message will be displayed on the LCD screen. A warning light may come on accompanied by a buzzer or chime.
- The fault message will take priority and interrupt the bottom line of the LCD display screen, accompanied by a buzzer or chime. The transmission gear selection indicator (PRND321) will move to the upper right hand (RH) corner of the LCD display screen, where applicable.
- If more than one fault is detected, each message will be displayed for three seconds, one after the other.
- A message is displayed until the fault is corrected or the user acknowledges the fault by pressing the TRIP button.

*Note: If the ignition is switched “OFF” with an active fault, the message will be displayed again once the ignition is switched “ON.”*

## Message Meanings

- Door Ajar — This message will be displayed when a door is not in the fully closed position.

### NOTICE

*The body builder may not have implemented the Door Ajar feature on your vehicle.*

- Vehicle Speed Limit — This message will be displayed if the pre-set maximum speed of the vehicle is reached.
- Fuel Level Low — This message is displayed when the fuel level in the tank reaches 20% remaining.

### NOTICE

*Full engine performance cannot be guaranteed below the warning level under prolonged wide open throttle (WOT) maneuvers.*

- Oil Pressure Low — This message will be displayed if the engine oil pressure drops too low.
- Check Engine Oil Level — This message will be displayed if the engine oil level drops below the minimum level.

- Check Engine Temperature — This message will be displayed if the engine temperature is too high.
- Check Transmission Temperature — This message will be displayed if the transmission temperature is too high.
- Check Coolant Temperature — This message will be displayed if the engine coolant temperature is too high.
- Reduced Engine Power — This message will be displayed if the engine controller detects a fault condition in the electronic throttle. If this happens, stop the vehicle, turn off the ignition, wait approximately 20 seconds, and restart the engine. If the message and warning light stay on after the restart, have the vehicle serviced.
- Check Battery — This message will be displayed if the battery voltage drops below or exceeds the safe margin set.

The instrument cluster is equipped with a tone generator to draw the users attention to specific warning conditions. These conditions will be displayed on the LCD screen as messages, or on the warning lamps. The tone generator will either sound the buzzer for serious conditions or the chime as a reminder.

### **Buzzer Warning Conditions**

- High Engine Coolant Temperature — The buzzer sounds for three seconds or until the user acknowledges the warning by pressing the TRIP button accompanied with either a “Check Coolant Temperature” or “Check Engine Temperature” message.
- Low Oil Pressure — The buzzer sounds until the user acknowledges the warning by pressing the TRIP button accompanied with a “Low Oil Pressure” message.
- Low Fuel — The buzzer sounds for three seconds or until the user acknowledges the warning by pressing the TRIP button when the fuel tank is at or below 20% of usable capacity.

## NOTICE

*Full engine performance cannot be guaranteed below the warning level under prolonged wide open throttle (WOT) maneuvers.*

- Low Engine Coolant — The buzzer sounds until the user acknowledges the warning by pressing the TRIP button with engine running accompanied with a “Low Coolant” message.
- High Transmission Fluid Temperature — The buzzer sounds for three seconds or until the user acknowledges the warning by pressing the TRIP button.
- Low Voltage — The buzzer sounds until the user acknowledges the warning by pressing the TRIP button with engine running and the battery voltage dropping below 10.5 V for a continuous period of 30 seconds.
- High Voltage — The buzzer sounds until the user acknowledges the warning by pressing the TRIP button with engine running and the battery voltage exceeding 16 V for a continuous period of five seconds.

- Charging Problem — The buzzer sounds for three seconds or until the user acknowledges the warning by pressing the TRIP button with the “Battery Charge” warning light illuminated.
- Brake System Failure — The buzzer sounds until the user acknowledges the warning by pressing the TRIP button with the “Brake System Failure” warning light illuminated.

## Chime Reminder Conditions

- Park Brake Reminder — The chime will sound when the park brake is applied and vehicle speed is above 3 mph (4.8 km/h). In the case of an automatic transmission, with the engine running, the park brake applied for longer than three seconds and the transmission out of PARK (P), the chime sounds until it is acknowledged by pressing the TRIP button or the park brake is released or the transmission range selector is moved to PARK (P) or the engine stops running.
- Seat Belt Reminder — When the driver’s seat belt is not fastened, the chime will sound. If the seat belt is buckled during this eight second period, the audible warning turns off. (If the body builder implemented a seat belt switch).

- Turn Signal Reminder — The chime will sound at the turn signal flasher rate, if the vehicle is in motion with the hazard switch off, and the left or right turn signal switch is activated and remains activated for more than a 3/4 mile (1.21 Km).
- Headlamps On Reminder — If the ignition is switched “OFF” and the headlamps are left on, the chime will sound until the headlamp switch is turned off, or the dimmer control is turned to the dome lamp position, or the TRIP button is pressed.
- Key In Ignition Reminder — The chime will sound when the key is left in the ignition with the ignition “OFF” and the driver’s door is opened. The chime will continue to sound for 60 seconds or until the driver’s door is closed. The availability of this feature is dependent on the body builder wiring. Also see “Door Ajar” message.

### **Engine Oil Change Reminder Message Reset**

#### **Method 1**

- Perform oil change as normal. — Turn the ignition switch to the “ON” position, but do not start engine.
- Fully press and release the accelerator pedal three times within five seconds, and turn ignition “OFF” for at least 10 seconds.
- The oil life counter on the engine controller will be reset to start a new cycle.

#### **Method 2**

- Perform oil change as normal at a certified Workhorse Service Center (Service Center will reset the message).

**NOTICE****Condition / Concern**

The “CHECK OIL LEVEL” message may display after a repair, if the key is left on when doing an oil change, or after topping off the engine oil due to a low oil condition. This could be caused because the engine coolant temperature criteria, to reset the “Check Oil Level”, has not been met. The system must see a 50°F (10°C) drop in engine coolant temperature to recheck the engine oil level and if the level is okay then the cluster LCD Display message will turn off.

**Recommendation / Instructions**

To correct this concern, allow the engine to run until operating temperature is reached and then shut the engine off and allow the engine to cool down for about 1 to 2 hours with the key in the off position. Upon the next key cycle, if the engine oil level is okay, the LCD Display message will be off.

**Base Instrument Cluster Trip Computer (CTC - Optional)**

In addition to all the features as described for the Instrument Cluster, this feature of the instrument cluster has additional functionality added in the form of a Trip Computer (CTC). The user can select one of the following to be displayed on the LCD screen (lower line) from the list below:

- Instantaneous Fuel Consumption (Gallons per hour or liters per hour) — Selecting this menu option will display the instantaneous fuel consumption, but will read “---” when the vehicle is stationary.
- Average Fuel Consumption — Selecting this menu option will display the average fuel consumption, based on the instantaneous fuel consumption over the last 50 miles (80 km).
- Fuel Range — Selecting this menu option will display the available fuel range, based on the remaining fuel capacity and the average fuel consumption over the last 50 miles (80 km). The display will read “---” below 5% of usable fuel capacity.

- Average Vehicle Speed — Selecting this menu option will display the average vehicle speed based on the time and distance traveled since the last reset.
- Outside Temperature — Selecting this menu option will display the outside temperature, if a sensor is fitted. (Subject to body manufacturer installation specifications.)

### **Base Instrument Cluster with Trip Computer and Powertrain Data (CTP - Optional)**

In addition to all of the features as described for the Base Instrument Cluster with Trip Computer, this option of the instrument cluster has additional functionality added in the form of Powertrain Data Messages (CTP).

The user can select one of the following to be displayed on the LCD screen (lower line) from the list below:

- Battery Voltage - Selecting this option will display battery voltage.
- Engine Coolant Temperature - Selecting this option will display the engine coolant temperature.

- Engine RPM - Selecting this option will display the engine RPM.
- Transmission Fluid Temperature - Selecting this option will display the transmission fluid temperature.
- Vehicle Speed - Selecting this option will display the vehicle speed.
- Manifold Intake Pressure - Selecting this option will display the pressure in the engine's intake manifold.
- Manifold Boost Pressure - Selecting this option will display the pressure in the engine's intake manifold.
- Intake Air Temperature - Selecting this option will display the temperature of the outside air entering the engine.
- Current Transmission Gear - Selecting this option will display the gear range in which the transmission is currently operating.
- Selected or Maximum Attainable Gear (Allison™ only) - This selection displays the highest gear the transmission will shift into based on the position of the shift lever/PBSS selection and the position of the O/D OFF switch.



## Selection of the LCD Lower Line Display

The Trip Computer allows the user to select the function to be displayed from the menu by the following method:

- Step 1 — Press the MODE button to enter Inquiry Menu.
- Step 2 — Highlight Trip Computer by scrolling up or down with the TRIP or MODE buttons.
- Step 3 — Make selection automatically by waiting three seconds or pressing and releasing both TRIP and MODE buttons simultaneously.

The LCD screen layouts are described with the different options of the Instrument Cluster with Trip Computer (CTC) as follows.

Cluster with CTC and transmission gear selection displayed in instrument cluster LCD screen.

| Left Half of Screen  | Right Half of Screen                                   |
|--|--|
| <b>ODOMETER /<br/>TRIP ODOMETER</b>                            | <b>PRND321 /<br/>BATTERY VOLTAGE /<br/>ACTUAL GEAR</b> |
| <b>OIL PRESSURE/Trip Computer option selected/<br/>PRND321</b> |  |

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In this section you will find information about the care of your vehicle. This section begins with service and fuel information, and then it shows how to check important fluid and lubricant levels. There is also technical information about your vehicle.

|                              |     |  |     |
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## CAUTION

*Drinking and then driving is very dangerous. Your reflexes, perceptions, attentiveness, and judgment can be affected by even a small amount of alcohol. You can have a serious — or even fatal collision if you drive after drinking. Please do not drink and drive or ride with a driver who has been drinking. Ride home in a cab; or if you are with a group, designate a driver who will not drink.*



## CAUTION

*For high GVWR vehicles, operating above 12,000 lbs. (5 400 kg), your vehicle may handle differently than a typical passenger car or light truck. That is because of the increased forces created by high weight and a higher center of gravity. This requires driver sensitivity while using the brakes for stopping distances, slowing of the vehicle on down grades, and cornering.*

## CONTROL OF A VEHICLE

You have three systems that make your vehicle go where you want it to go. They are the brakes, the steering, and the accelerator. All three systems have to do their work at the places where the tires meet the road.

Sometimes, as when you are driving on snow or ice, it is easy to ask more of those control systems than the tires and road can provide. That means you can lose control of your vehicle.

## BRAKING

Braking action involves **perception** time and **reaction** time.

First, you have to decide to push on the brake pedal. That is perception time. Then you have to bring up your foot and do it. That is **reaction time**.

Average reaction time is about 3/4 of a second. But that is only an average. It might be less with one driver and as long as two or three seconds or more with another. Age, physical condition, alertness, coordination, and eyesight all play a part. So do alcohol, drugs, and frustration. But even in 3/4 of a second, a vehicle moving at 60 mph (100 km/h) travels 66 feet (20 m). That could be a lot of distance in an emergency, so keeping enough space between your vehicle and others is important.

1. And, of course, actual stopping distances vary greatly with the surface of the road (whether it is pavement or gravel); the condition of the road (wet, dry, icy); tire tread; the condition of your brakes; the weight of the vehicle and the amount of brake force applied.
2. Avoid needless heavy braking. Some people drive in spurts of heavy acceleration followed by heavy braking rather than keeping pace with traffic. This is a mistake. Your brakes may not have time to cool between hard stops. Your brakes will wear out much faster if you do a lot of heavy braking. If you keep pace with the traffic and allow realistic following distances, you will eliminate a lot of unnecessary braking. That means better braking and longer brake life.



### CAUTION

*Overheated brakes may cause brake fade therefore limiting your vehicle's ability to stop in a safe distance.*

3. If your engine stops while driving a W42 series commercial vehicle, brake normally but do not pump your brakes. If you do, the pedal may get harder to push down. If your engine stops, you will still have some power brake assist. But you will use it when you brake. Once the power assist is used up, it may take longer to stop and the brake pedal will be harder to push.
4. If your engine stops while driving a W16/W18/W20/W22/W24/W25 Series motor home or a W62 Series commercial chassis, the brake system will continue to perform normally.

## ANTI-LOCK BRAKES (ABS)

Your vehicle has anti-lock brakes (ABS). ABS is an advanced electronic braking system that will help prevent a braking skid.

When you start your engine and begin to drive away, your anti-lock brake system will check itself. You may hear a momentary motor or clicking noise while this test is proceeding. This is normal system operation.

If there is a problem with the antilock brake system, this warning light will stay on. See “Anti-Lock Brake System Warning Light” in the Index.



Here is how anti-lock works. For instance, the road is wet and you are driving safely. Suddenly an animal jumps out in front of you.

- You slam on the brakes. Here is what happens with the ABS.
- The ABS control module senses that wheels are slowing down.

- If one of the wheels is about to stop rolling the computer will separately work the brakes at each wheel.
- The anti-lock system can change the brake pressure faster than any driver could. The computer is programmed to make the most of available tire and road conditions.
- You can steer around the obstacle while braking hard.
- As you brake, your computer keeps receiving updates on wheel speed and controls braking pressure accordingly.

**Remember:** Anti-lock does not change the time you need to get your foot up to the brake pedal or always decrease stopping distance. If you get too close to the vehicle in front of you, you will not have time to apply your brakes if that vehicle suddenly slows or stops. Always leave enough room up ahead to stop, even though you have anti-lock brakes.

## Using Anti-Lock

Do not pump the brakes. Just hold the brake pedal down firmly and let anti-lock work for you. You may feel the brake pedal vibrate, or you may notice some noise, this is normal.

## Braking In Emergencies

With anti-lock, you can steer and brake at the same time. In many emergencies, steering can help you more than even the very best braking.

## STEERING

### Power Steering

If you lose power steering assist because the engine stops or the system is not functioning, you can steer but it will take much more effort.

It is more difficult to steer the vehicle when it is stopped. To make it easier to steer, release the brakes slightly and allow the vehicle to move slowly.



## CAUTION

*Wet brakes can cause accidents. They will not work as well in a quick stop and may cause pulling to one side. You could lose control of the vehicle.*

*After driving through a large puddle of water or a vehicle wash, apply your brake pedal lightly for 15-30 seconds, or until your brakes work normally.*

## HILL AND MOUNTAIN ROADS

Know how to go down hills. The most important thing to know is this: let your engine do some of the slowing down. Shifting out of overdrive to lower gear(s) when you go down a steep or long hill, allows the engine to be part of the braking process. This is known as engine braking.

### **NOTICE**

*When in mountain/high altitude conditions, Workhorse recommends down-shifting to utilize engine braking. This will enhance brake pad life and will minimize wear and rotor damage.*



## **CAUTION**

*You must downshift when descending down a grade! Failure to do so can result in excessive brake heat which can result in inadequate brake performance. This could create a poor braking condition or complete loss of brakes resulting in a vehicle accident and or injury. When proceeding down a hill, down shift to a lower gear to allow your engine to assist your brakes on a steep downhill slope/grade.*

## MOUNTAIN BRAKING

Drivers often overheat and damage their vehicle braking systems by improper braking in mountain areas or by “riding” the brakes on flat ground. The brake pedal should never be used as a foot rest. The pedal should be contacted only when braking is necessary.



Following is braking recommendations as outlined in the DOT (Department of Transportation) commercial drivers license manual. Brake damage can be avoided by following these recommendations.

### **NOTICE**

*Brake damage from improper use is not covered by Workhorse Custom Chassis warranty.*

## **Mountain Driving**

### **Overview**

In mountain driving, gravity plays a major role. On any upgrade, gravity slows you down. The steeper the grade, the longer the grade, and/or the heavier the load —the more you will have to use lower gears to climb hills or mountains. In coming down long, steep downgrades, gravity causes the speed of your vehicle to increase. You must select an appropriate safe speed, then use a low gear, and proper braking techniques.

You should plan ahead and obtain information about any long, steep grades along your planned route of travel. If possible, talk to other motor home or truck drivers who are familiar with the grades to find out what speeds are safe. You must go slowly enough so your brakes can hold you back without getting too hot. If the brakes become too hot, they may start to “fade.” This means you have to apply them harder and harder to get the same stopping power. If you continue to use the brakes hard, they can keep fading until you cannot slow down or stop at all. Signs like this one warn that you are approaching a steep downgrade.

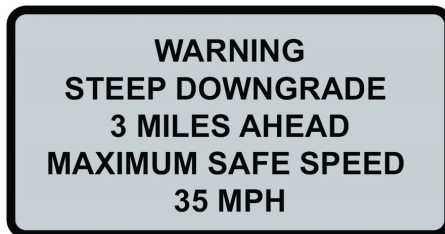


## Select a “Safe” Speed

Your most important consideration is to select a speed that is not too fast for the:

- Total weight of the vehicle and cargo
- Length of the grade
- Steepness of the grade
- Road conditions
- Weather

If a speed limit is posted, or there is a sign indicating “Maximum Safe Speed,” never exceed the speed shown. Also, look for and heed warning signs indicating the length and steepness of the grade



You must use the braking effect of the engine as the principal way of controlling your speed. The braking effect of the engine is greatest when it is near the governed RPMs and the transmission is in the lower gears. Save your brakes so you will be able to slow or stop as required by road and traffic conditions.

## Select the Right Gear Before Starting Down the Grade

Shift the transmission to a low gear before starting down the grade. Do not try to downshift after your speed has already built up. You will not be able to shift into a lower gear. You may not even be able to get back into any gear and all engine braking effect will be lost. Trying to force your automatic transmission into a lower gear at high speed could damage the transmission and also lead to loss of all engine braking effect.

With older motor homes, a rule for choosing gears is to use the same gear going down a hill that you would need to climb the hill. However, new motor homes have low friction parts and streamlined shapes for fuel economy. They may also have more powerful engines. This means they can go up hills in higher gears and have less friction

and air drag to hold them back going down hills. For that reason, drivers of modern motor homes such as yours may have to use lower gears going down a hill than would be required to go up the hill. You should know what is right for your vehicle.

### **Brake Fade or Failure**

Your brakes are designed so brake pads rub against the brake disks to slow the vehicle.

Braking creates heat, but brakes are designed to take a lot of heat. However, brakes can fade or fail from excessive heat caused by using them too much and not relying on the engine braking effect. To safely control a vehicle, every brake must do its share of the work. Brakes with excessively worn pads or rotors will not provide the same degree of braking power. If you are not sure about the condition of your braking system, have it inspected by an authorized Workhorse service center.

### **Proper Braking Technique**

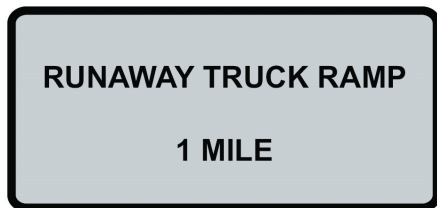
Remember. The use of brakes on a long and/or steep downgrade is only a supplement to the braking effect of the engine. Once the vehicle is in the proper low gear, the following is the proper braking technique:

- Apply the brakes just hard enough to feel a definite slowdown.
- When your speed has been reduced to approximately five mph below your “safe” speed, release the brakes. (This brake application should last for about three seconds.)
- When your speed has increased to your “safe” speed, repeat steps 1 and 2.

For example, if your “safe” speed is 40 mph, you would not apply the brakes until your speed reaches 40 mph. You now apply the brakes hard enough to gradually reduce your speed to 35 mph and then release the brakes. Repeat this as often as necessary until you have reached the end of the downgrade.

## Escape Ramps or Runaway Truck Ramps

Escape ramps, also known as Runaway Truck Ramps, have been built on many steep mountain downgrades. Escape ramps are made to stop runaway vehicles safely without injuring drivers and passengers. Signs show drivers where ramp are located.



Escape ramps use a long bed of loose, soft material to slow a runaway vehicle, sometimes in combination with an upgrade. Know escape ramp locations on your route. Escape ramps save lives.

## EMERGENCY ROAD CONDITIONS

If you should become stranded due to poor road conditions in cold weather consider the following tips to help conserve fuel and stay warm.



### CAUTION

*Snow can trap exhaust gases under your vehicle. This can cause deadly CO (Carbon Monoxide) gas to get inside. CO could overcome you and kill you. You cannot see it or smell it, so you might not know it is in your vehicle. Clear away snow from around the base of your vehicle, especially any that is blocking your exhaust pipe. Periodically check around your exhaust pipe to be sure snow is not collecting there. Open the window a small amount on the side of the vehicle that is away from the wind. This will help keep CO out.*

Run your engine only as long as you must. This saves fuel. When you run the engine, increase the engine RPMs to just above idle speed by pressing the accelerator pedal down slightly. This uses less fuel for the heat that you will get and it keeps the battery (or batteries) charged. You will need a well-charged battery (or batteries) to restart the vehicle, and possibly for signaling with your headlamps for help. Let the heater run for a while.

If you have a diesel engine, you may have to run it at a higher speed/RPM to get enough heat. Then, shut the engine off and close the window almost all the way to preserve the heat. Start the engine again and repeat this only when you become uncomfortable from the cold. Do this as little as possible to preserve fuel as long as you can. To help keep warm, you can get out of the vehicle and do some fairly vigorous exercises every half hour or so until help comes.

## RECREATIONAL VEHICLE TOWING

Gross Combination Weight Rating (GCWR - vehicle GVWR plus the weight of the towed unit) is always greater than the Gross Vehicle Weight Rating (GVWR). Towing capability will be determined by considering the following five factors:

1. The weight imposed on the towing vehicle's rear axle (combination weight on rear axle from towing vehicle and tongue load from towed load) shall not exceed the Gross Rear Axle Weight Rating as specified by the final stage manufacturer.
2. When the towed weight exceeds 1,000 pounds, the towing system must be equipped with a separate brake system for the towed load and be activated by the braking application of the towing vehicle.
3. The towing device is used in accordance with the manufacturer recommendations and capacity limits and is approved by the final stage vehicle manufacturer for use with your vehicle.

4. The total towed weight when added to the operating weight of the towing vehicle cannot exceed the Gross Combination Weight Rating of the towing vehicle as identified by the final stage manufacturer.
5. All state and federal requirements are adhered to.

### **IMPORTANT**

**Make sure that all five of the previous criteria are met if the vehicle is to be used for towing. Failure to adhere to these criteria will affect safe vehicle operation and could void manufacturer validations and warranties.**

## **LOADING YOUR VEHICLE**

The Certification/Tire Label in your vehicle will look similar to the example on the next page. Because the label is furnished by the final body manufacturer, there may be some differences between the example and the actual label on your vehicle.

The Certification/Tire Label location is also determined by the body manufacturer. See that company's manual to find out where it is on your vehicle or contact them directly.

The label shows the size of your original tires and the inflation pressures required if you are operating your vehicle at its maximum gross weight capacity.

This is called the Gross Vehicle Weight Rating (GVWR). The GVWR includes the weight of the vehicle, all occupants, fuel, and cargo. This information is also located on the Incomplete Vehicle Document.

The Certification/Tire Label also tells you the maximum weight for the front and rear axles, called the Gross Axle Weight Rating (GAWR). To find out the actual loads on your front and rear axles, you need to go to a weigh station and weigh your vehicle. Your dealer can help you with this. Be sure to spread out your load equally on both sides of the centerline.

GVWR GAWR FRT GAWR RR LBS/KG

PAYLOAD =

TIRE SIZE TIRE LOAD CAP RIM PSI/KPA (COLD)

SEE OWNER'S MANUAL FOR ADDITIONAL INFORMATION

Never exceed the GVWR for your vehicle, or the GAWR for either the front or rear axle.

And, if you do have a heavy load, you should spread the weight out.



## CAUTION

*Do not load your vehicle any heavier than the GVWR, or either the maximum front or rear GAWR. Also, do not load your vehicle unevenly from side to side. If you do, parts on your vehicle can break, and it can change the way your vehicle handles. These could cause you to lose control and crash. Also, overloading can shorten the life of your vehicle.*

Using heavier suspension components to get added durability might not change your weight ratings. Ask your dealer to help you load your vehicle the right way.

## NOTICE

*Your warranty does not cover parts or components that fail because of overloading.*



## CAUTION

*Things you put inside your vehicle can strike and injure people in a sudden stop or turn, or in a crash.*

- *Put things in the cargo area of your vehicle. Try to spread the weight evenly.*
- *Never stack heavier things, like suitcases, inside the vehicle so that some of them are above the tops of the seats.*
- *Do not leave an unsecured child restraint in your vehicle.*
- *When you carry something inside the vehicle, secure it whenever you can.*



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**NOTES:**

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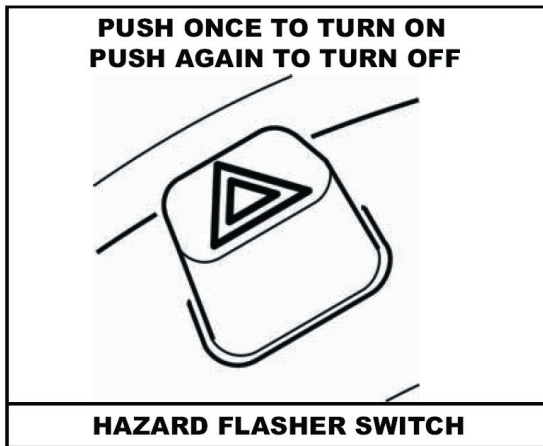
In this section you will find helpful information on what to do about some of the problems that can occur on the road.

|  |     |  |     |
|--|-----|--|-----|
| Hazard Warning Flashers .....  | 128 | Cooling System (Gasoline Engines) .....                                | 139 |
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| Jump Starting .....  | 129 | How to Add Coolant to the Coolant Surge Tank<br>(Diesel Engines) ..... | 147 |
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## HAZARD WARNING FLASHERS

Your hazard warning flashers let you warn others. They also let police know you have a problem. Your front and rear turn signal lamps will flash on and off.

Your hazard warning flashers work no matter what position your key is in, and even if the key is not in the ignition.



The hazard warning flashers may not flash if you are braking. Also, when the hazard warning flashers are on, your turn signals will not work.

Your hazard warning flashers button is located on top of the steering column.

Press the button in to turn on your flashers.

To turn them off press the button again.

To turn off the flashers, pull out on the collar.

## OTHER WARNING DEVICES

If you carry reflective triangles, you can set one up at the side of the road about 300 feet (100 m) behind your vehicle.

## JUMP STARTING

If your battery (or batteries) has run down, you may want to use another vehicle and some jumper cables to start your vehicle. But use the following steps listed to do it safely.



### CAUTION

**Batteries can hurt you. They can be dangerous because:**

- They contain acid that can burn you.
- They contain gas that can explode or ignite.
- They contain enough electricity to burn you.

**If you do not follow these steps exactly, some or all of these things there is a risk of injury.**

### NOTICE

*Ignoring these steps could result in costly damage to your vehicle that would not be covered by your warranty.*

Some batteries have a built-in hydrometer. Do not charge, test, or jump start the battery if the hydrometer looks clear or light yellow. Replace the battery when there is a clear or light yellow hydrometer and a cranking complaint.

Trying to start your vehicle by pushing or pulling it will not work, and it could damage your vehicle.

1. Before you start, check the other vehicle. It must have a 12-volt battery with a negative ground system.

### NOTICE

*If the other system is not a 12-volt system with a negative ground, both vehicles can be damaged.*

**NOTICE**

*With a diesel engine, do not apply more than the nominal 12 volts to the electrical system during charging or jump starting. Glow plug system failure may result.*

- If you have a diesel engine with two or more batteries, you should know before you begin that, especially in cold weather, you may not be able to get enough power from a single battery in another vehicle to start your diesel engine.*
  - If your vehicle has more than one battery, use the battery that is closest to the starter — this will reduce electrical resistance.*
2. Get the vehicles close enough so the jumper cables can reach, but be sure the vehicles are not touching each other. If they are, it could cause a ground connection you do not want.

**CAUTION**

*If your vehicle has air conditioning, the auxiliary electric fan under the hood can start up even when the engine is not running and can injure you. Keep hands, clothing, and tools away from any underhood electric fan.*

3. Set the park brake firmly on each vehicle. Put an automatic transmission in PARK (P) or a manual transmission in NEUTRAL (N).
4. Turn off the ignition on both vehicles. Turn off all lamps that are not needed and both radios. This will avoid sparks and help save both batteries. It could also save your radio.
5. Open the hoods or battery compartment doors and locate the batteries. Find the positive (+) and negative (-) terminals on each battery.



## CAUTION

*Using a match near a battery can cause battery gas to explode. People have been hurt doing this, and some have been blinded. Use a flashlight if you need more light.*

*Be sure the batteries have enough water. You do not need to add water to the battery (or batteries) installed in every new vehicle. But if a battery has filler caps, be sure the right amount of fluid is there. If it is low, add water to take care of that first. If you do not, explosive gas could be present.*

*Battery fluid (electrolyte) contains acid that can burn you. Do not get it on you. If you accidentally get it in your eyes or on your skin, flush the area with water and seek medical attention immediately.*

6. Check that the jumper cables do not have loose or missing insulation. If they do, you could get a shock. The vehicles involved could be damaged, too.

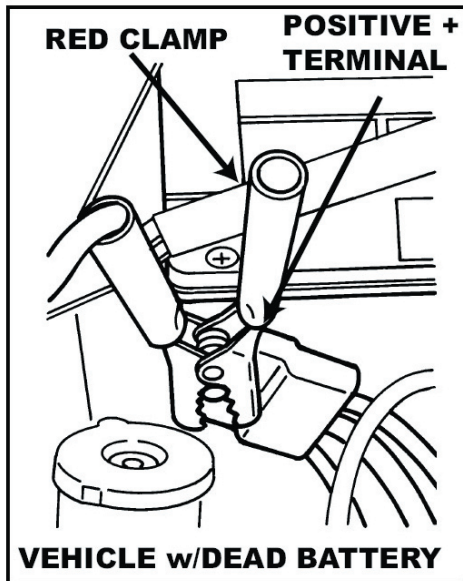
Before you connect the cables, here are some basic things you should know. Positive (+) will go to positive (+) and negative (-) will go to a metal engine part or some other well-grounded part. Do not connect positive (+) to negative (-) or you will get a short that would damage the battery and maybe other parts as well.



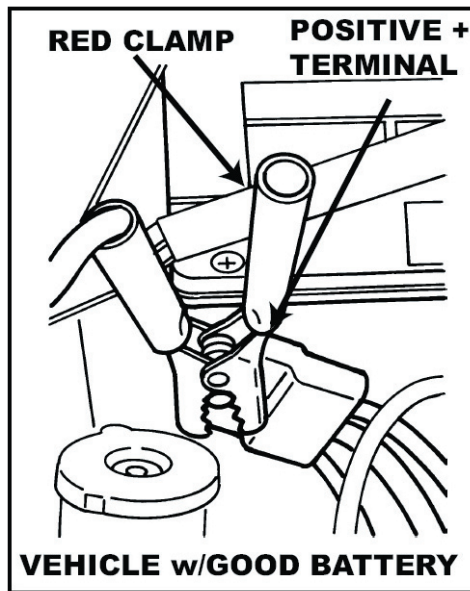
## CAUTION

*Fans or other moving engine parts can injure you badly. Keep your hands away from moving parts once the engine is running.*

7. Connect the red positive (+) cable to the positive (+) terminal of the vehicle with the dead battery. Use a remote positive (+) terminal if the vehicle has one.

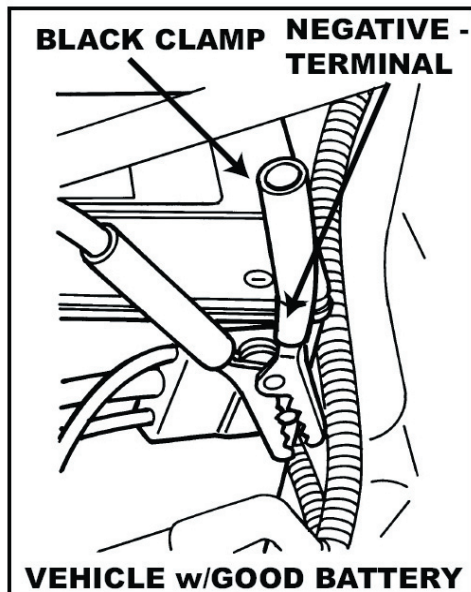


8. Do not let the other end touch metal. Connect it to the positive (+) terminal of the good battery. Use a remote positive (+) terminal if the vehicle has one.



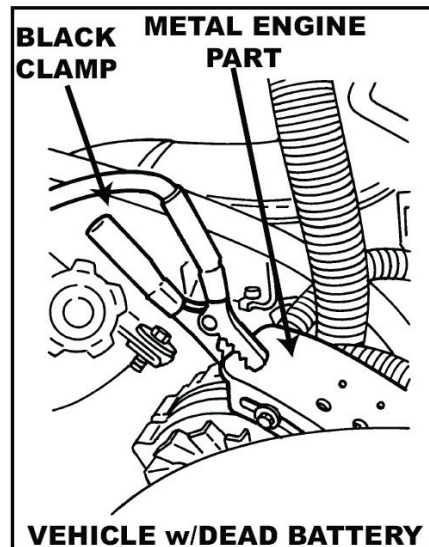


9. Now connect the black negative (-) cable to the good battery's negative (-) terminal. Do not let the other end touch anything until the next step.



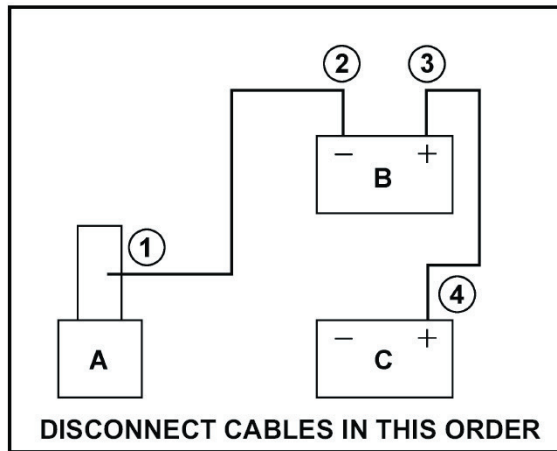
The other end of the negative (-) cable does not go to the dead battery. It goes to a heavy, unpainted metal part of the vehicle with the dead battery.

10. Attach the cable at least 18 inches (45 cm) away from the dead battery.



This will allow for a good electrical connection and lessen the chance of sparks near the battery.

11. Now start the vehicle with the good battery and run the engine for one to two minutes.
12. Try to start the vehicle with the dead battery. If it will not start after a few tries, it probably will need service.
13. Shut the engine off in the vehicle with the good battery then remove the cables in reverse order to prevent electrical shorting, reference the following illustration. Take care that the cable clamps do not touch each other or any other metal.



- A - Heavy Metal Engine Part
- B - Good Battery
- C - Dead Battery

## EMERGENCY RELEASE OF PARK BRAKE — W18 SERIES MOTOR HOME CHASSIS

If your transmission is in PARK (P) and the vehicle will not start, and you need to release the Auto-Apply park brake, do the following:

1. Push and hold the regular brake pedal down to prevent any movement of the vehicle during this procedure.
2. Pull the park brake control button out to apply the park brake and turn the ignition to RUN.
3. Shift the transmission to NEUTRAL (N).
4. Push the park brake control button in to release the park brake. The AUTO PARK warning light will go out at this time.



### CAUTION

*If you are not holding the regular brake pedal down and the park brake releases, the vehicle could roll. You or others could be injured.*

*When the AUTO PARK brake warning light goes out, the electric Auto-Apply park brake is released. The key must be left in RUN to keep the Auto-Apply park brake released.*

### NOTICE

*If the battery is dead the Auto-Apply park brake will not release, you will need to charge the battery or jump start your vehicle (see “Jump Starting” earlier in this section).*

### NOTICE

*The W18 Series motor homes have the J72 auto-apply park brake option. Check the vehicle specification to confirm that you have a J72 park brake option.*

The J72 park brake is a spring applied-hydraulic release type of brake. There is no mechanical connection (cable) between the actuator and the brake. Therefore, it is not possible to mechanically deactivate the park brake when the ignition is switched off. If the vehicle needs to be moved for service and/or towing, when the ignition is off, it is recommended to disconnect the rear propeller shaft.



## CAUTION

*Always block the wheels to prevent movement of your vehicle before removing the propeller shaft. Failure to do so could allow the vehicle to move and injure you or others.*



## CAUTION

*The Auto-Apply park brake system is a complex system containing mechanical, electrical, and hydraulic components. Only trained and authorized professionals must service this system. Any repairs or alterations to the Auto-Apply park brake system can result in bodily injury or vehicle damage.*



## CAUTION

*To help avoid serious personal injury to you or others:*

- *Never let passengers ride in a vehicle that is being towed.*
- *Never tow faster than safe or posted speeds.*
- *Never tow with damaged parts not fully secured.*
- *Never get under your vehicle after it has been lifted by the tow truck.*
- *Always secure the vehicle on each side with separate safety chains when towing it.*
- *Use only the correct hooks.*

## TOWING YOUR VEHICLE

### NOTICE

*Rear-wheel drive vehicles should not be towed on the drive wheels, if possible. If this is unavoidable, the vehicle can be towed forward for a maximum of 50 miles (80.47 km) at a maximum speed of 35 mph (56.33 km/h).*

### NOTICE

*Use the proper towing equipment to avoid damage to the bumper, fascia, or fog lamp areas of the vehicle.*

### NOTICE

*It is essential that the correct towing equipment is used to tow your vehicle. If you are not sure what equipment is correct, contact your nearest Workhorse dealer or the Workhorse Customer Assistance Toll-Free at: 1-877-946-7731.*

## ENGINE OVERHEATING

You will find a coolant temperature gauge on your vehicle's instrument panel.

### If Steam Is Coming From Your Engine



## CAUTION

*Steam from an overheated engine can burn you badly, even if you just open the hood. Stay away from the engine if you see or hear steam coming from it. Just turn it off and get everyone away from the vehicle until it cools down. Wait until there is no sign of steam or coolant before you open the hood.*

*If you keep driving when your engine is overheated, the liquids in it can catch fire. You or others could be badly burned. Stop your engine if it overheats, and get out of the vehicle until the engine is cool.*

## NOTICE

*If your engine catches fire because you keep driving with no coolant, your vehicle can be badly damaged. The costly repairs would not be covered by your warranty.*

### If No Steam Is Coming From Your Engine

If you get an engine overheat warning but do not see or hear steam, the problem may not be too serious. Sometimes the engine may increase in temperature when you:

- Climb a long hill on a hot day.
- Stop after high-speed driving.
- Idle for long periods in traffic.

If you get the overheat warning with no sign of steam, try this for a minute or so:

1. If you have an air conditioner and it is on, turn it off.
2. Turn on your heater to full hot at the highest fan speed and open the window as necessary.

3. If you are stopped in a traffic jam, shift to PARK (P) or NEUTRAL (N); otherwise, shift to the highest gear while driving AUTOMATIC OVERDRIVE (O/D) or DRIVE (D) for automatic transmissions.

If you no longer have the overheat warning, you can drive. Just to be safe, drive slower for about 10 minutes. If the warning does not come back on, you can drive normally.

If the warning continues, pull over, stop, and park your vehicle right away.

If there is still no sign of steam, push down the accelerator until the engine speed is about twice as fast as normal idle speed for at least three minutes while you are parked. If you still have the warning, turn off the engine and get everyone out of the vehicle until it cools down.

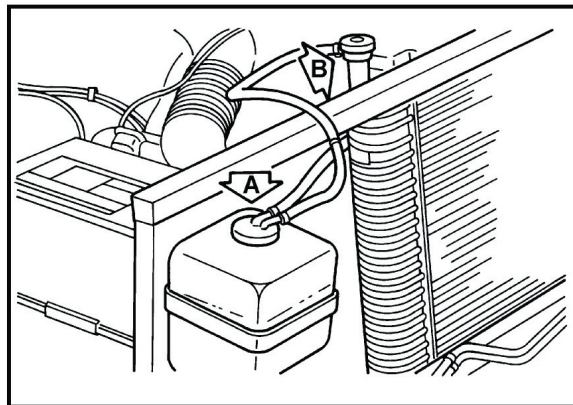
You may decide not to lift the hood/dog house, but to get service help right away.

## COOLING SYSTEM

### (Gasoline Engines)

When you decide it is safe to lift the hood, here is what you will see:

- A. Coolant Recovery Tank (mounted by the body manufacturer)
- B. Radiator Pressure Cap





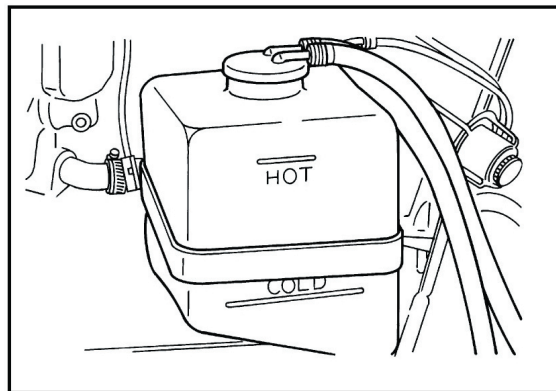
## CAUTION

*If your vehicle has air conditioning, the auxiliary electric cooling fan under the hood can start up even when the engine is not running and can injure you. Keep hands, clothing, and tools away from any underhood electric fan.*

## NOTICE

*The addition of bug screens/shields in the area of the vehicles radiator inlet or front grill can greatly reduce air flow and cause potential engine overheating and raise underhood temperatures. Failure to adhere to this notice can cause serious engine or underhood component damage.*

If the coolant inside the coolant recovery tank is boiling, do not do anything else until it cools down.



The coolant level should be at or above the HOT mark. If it is not, you may have a leak in the radiator hoses, heater hoses, radiator, water pump or somewhere else in the cooling system.





## CAUTION

*Heater and radiator hoses, and other engine parts, can be very hot. Do not touch them. If you do, you can be burned.*

*Do not run the engine if there is a leak. If you run the engine, it could lose all coolant. That could cause an engine fire, and you could be burned. Get any leak fixed before you drive the vehicle.*

## NOTICE

*When adding coolant, it is important that you use only DEX-COOL® (silicate-free) coolant. If coolant other than DEX-COOL is added to the system, premature engine, heater core, or radiator corrosion may result. In addition, the engine coolant will require change sooner — at 30,000 miles (50 000 km) or 24 months, whichever occurs first. Damage caused by the use of coolant other than DEX-COOL® is not covered by your new vehicle warranty.*

## NOTICE

*Engine damage from running your engine without coolant is not covered by your warranty.*

If there seems to be no leak, start the engine again. See if the engine cooling fan speed increases when idle speed is doubled by pushing the accelerator pedal down. If it does not, your vehicle needs service. Turn off the engine.

### **How to Add Coolant to the Coolant Recovery Tank (Gasoline Engines) NOTICE**

If you have not found a problem yet, but the coolant level is not at the HOT mark, add a 50/50 mixture of clean, drinkable water and DEX-COOL® engine coolant at the coolant recovery tank. (See “Engine Coolant” in the Index for more information.)

*In cold weather, water can freeze and crack the engine, radiator, heater core, and other parts. Use the recommended coolant and the proper coolant mixture.*



## **CAUTION**

*Adding only plain water to your cooling system can be dangerous. Plain water, or some other liquid like alcohol, can boil before the proper coolant mixture will. Your vehicle's coolant warning system is set for the proper coolant mixture. With plain water or the wrong mixture your engine could get too hot but you would not get the overheat warning. Your engine could catch fire and you or others could be burned. Use a 50/50 mixture of clean, drinkable water and approved coolant.*



## **CAUTION**

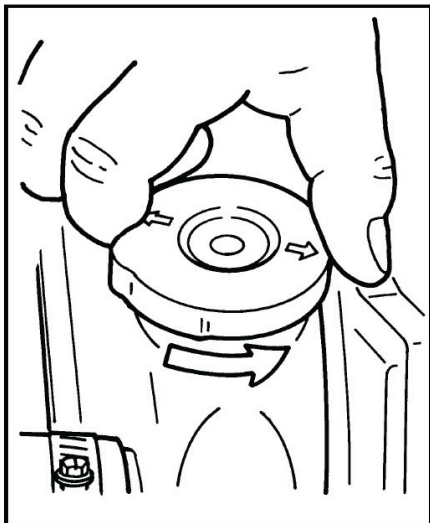
*You can be burned if you spill coolant on hot engine parts. Coolant contains ethylene glycol and it may burn if the engine parts are hot enough. Do not spill coolant on a hot engine.*

When the coolant in the coolant recovery tank is at the HOT mark, start your vehicle.

If the overheat warning continues, there is one more thing you can try. You can add the proper coolant mixture directly to the radiator, but be sure the cooling system is cool before you do it.

### How to Add Coolant to the Radiator (Gasoline Engines)

1. You can remove the radiator pressure cap when the cooling system, including the radiator pressure cap and upper radiator hose, is no longer hot.

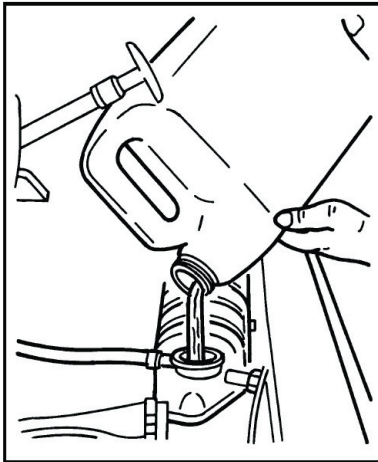


- Using a rag, turn the pressure cap slowly counterclockwise until it first stops. (Do not press down while turning the pressure cap.)
- If you hear a hiss, wait for that to stop. A hiss means there is still some pressure left.

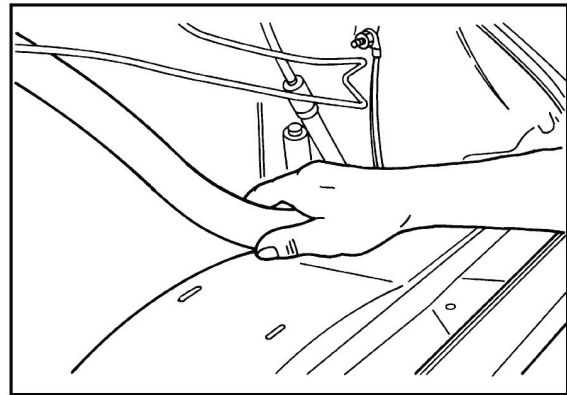
2. Then keep turning the pressure cap, but now push down as you turn it. Remove the pressure cap.



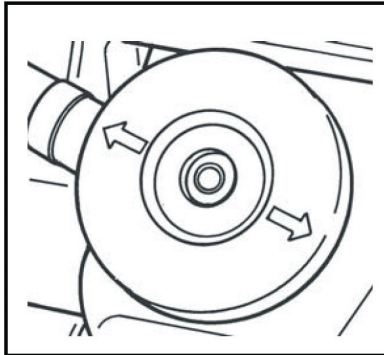
3. Fill the radiator with the proper coolant mixture, up to the base of the filler neck. (See "Engine Coolant" in the Index for more information about the proper coolant mixture.) Avoid fluid spills into engine air intakes.



4. Then fill the coolant recovery tank to the COLD mark.
5. Put the cap back on the coolant recovery tank, but leave the radiator pressure cap off.
6. Start the engine and let it run until you can feel the upper radiator hose getting hot. Stay clear of the engine cooling fan.



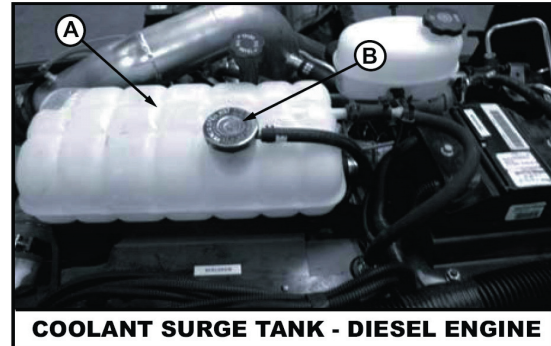
7. As the engine thermostat opens, the coolant level inside the radiator filler neck may be lower. If the level is lower, add more of the proper coolant mixture through the filler neck until the level reaches the base of the filler neck.
8. Then replace the pressure cap. At any time during this procedure if coolant begins to flow out of the filler neck, reinstall the pressure cap. If your cap has arrows as shown in the next picture, make sure they line up as shown.



## COOLING SYSTEM (DIESEL ENGINES)

When you decide it is safe to lift the hood, here is what you will see:

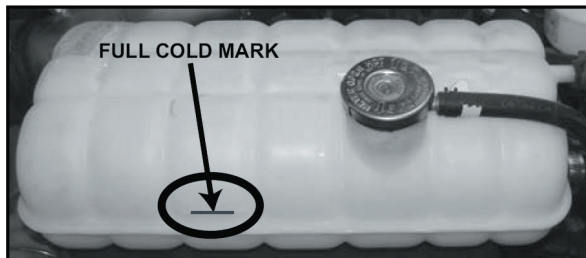
- A. Coolant Surge Tank
- B. Coolant Surge Tank Pressure Cap



You will also find the engine cooling fan at the front of the engine, behind the radiator.

If the coolant inside the coolant surge tank is boiling, do not do anything else until it cools down.

The coolant level should be at or above the FULL COLD mark. If it is not, you may have a leak in the radiator hoses, heater hoses, radiator, water pump, or somewhere else in the cooling system.



## CAUTION

*Heater and radiator hoses, and other engine parts, can be very hot. Do not touch them. If you do, you may be burned.*

*Do not run the engine if there is a leak. If you run the engine, it could lose all coolant. That could cause an engine fire, and you could be burned. Get any leak fixed before you drive the vehicle.*

### NOTICE

*Engine damage from running your engine without coolant is not covered by your warranty.*

### NOTICE

*If your vehicle's engine is overheated and the coolant level is low, allow the engine and cooling system to cool before adding coolant. Extreme engine damage may occur if not followed.*

If there seems to be no leak, start the engine again. See if the fan speed increases when idle speed is doubled by pushing the accelerator pedal down. If it does not, your vehicle needs service. Turn off the engine.

## **How to Add Coolant to the Coolant Surge Tank (Diesel Engines)**

If you have not found a problem yet, but the coolant level is not at FULL COLD, add a 50/50 mixture of clean, drinkable water and coolant at the coolant surge tank, but be sure the cooling system, including the coolant surge tank pressure cap, is cool before you do it. (See “Engine Coolant” in the Index for more information.)



## **CAUTION**

*Steam and scalding liquids from a hot cooling system can blow out and burn you badly. They are under pressure, and if you turn the coolant surge tank pressure cap — even a little — they can come out at high speed. Never turn the cap when the cooling system, including the coolant surge tank pressure cap, is hot. Wait for the cooling system and coolant surge tank pressure cap to cool if you ever have to turn the pressure cap.*

**NOTICE**

*Adding coolant that is less than the operating temperature of the engine may cause engine damage. Never add coolant to an overheated engine. Always allow an overheated engine ample time to cool before adding coolant.*

**CAUTION**

*Adding only plain water to your cooling system can be dangerous. Plain water, or some other liquid like alcohol, can boil before the proper coolant mixture will. Your vehicle's coolant warning system is set for the proper coolant mixture. With plain water or the wrong mixture, your engine could get too hot but you would not get the overheat warning. Your engine could catch fire and you or others could be burned. Use a 50/50 mixture of clean, drinkable water and coolant.*

**NOTICE**

*In cold weather, water can freeze and crack the engine, radiator, heater core, and other parts. So use the recommended coolant.*





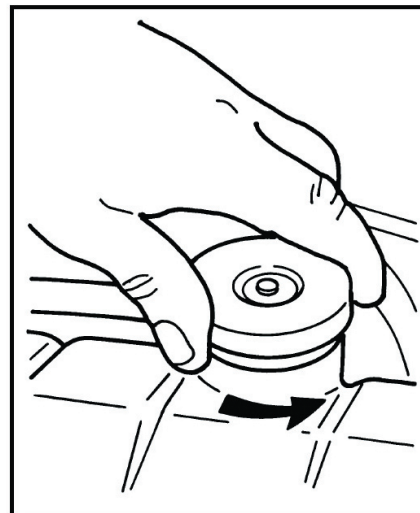
## CAUTION

*You can be burned if you spill coolant on hot engine parts. Coolant contains ethylene glycol and it will burn if the engine parts are hot enough. Do not spill coolant on a hot engine.*

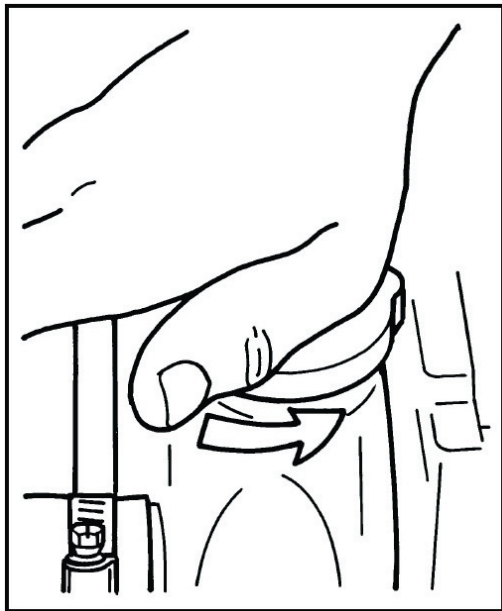
1. You can remove the coolant surge tank pressure cap when the cooling system, including the coolant surge tank pressure cap and upper radiator hose, is no longer hot.

Turn the pressure cap slowly counterclockwise (left) until it first stops. (Do not press down while turning the pressure cap.)

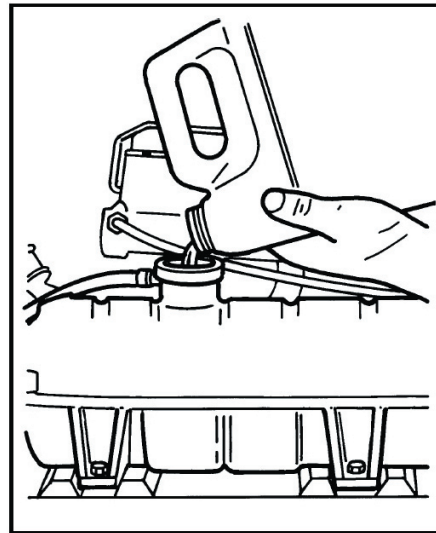
If you hear a hiss, wait for that to stop. A hiss means there is still some pressure left.



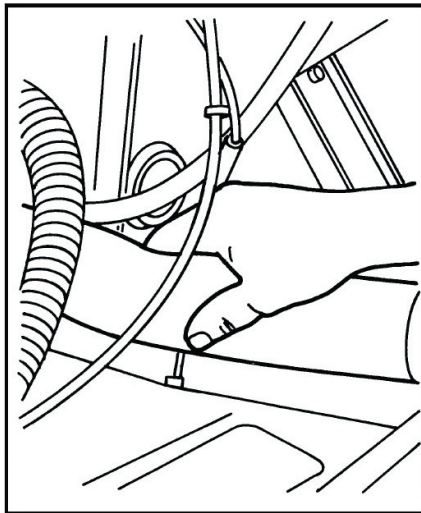
2. Then keep turning the cap, but now push down as you turn it. Remove the pressure cap.



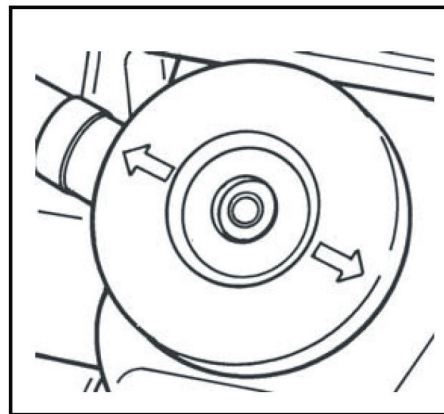
3. Then fill the coolant surge tank with the proper mixture, to the FULL COLD mark.



4. With the coolant surge tank pressure cap off, start the engine and let it run until you can feel the upper radiator hose getting hot. Watch out for the engine cooling fan(s).



5. By this time, the coolant level inside the coolant surge tank may be lower. If the level is lower, add more of the proper mixture to the coolant surge tank until the level reaches the FULL COLD mark.
6. Then replace the pressure cap. If your cap has arrows as shown in the next picture, make sure they line up as shown.



## ENGINE FAN NOISE

Your vehicle has a clutched engine cooling fan. When the clutch is engaged, the fan spins faster to provide more air to cool the engine. In most every day driving conditions, the clutch is not fully engaged. This improves fuel economy and reduces fan noise. Under heavy vehicle loading, trailer towing and/or high outside temperatures, the fan speed increases as the clutch more fully engages, so you may hear an increase in fan noise.

This is normal and should not be mistaken as the transmission slipping or making extra shifts. It is merely the cooling system functioning properly. The fan will slow down when additional cooling is not required and the clutch disengages.

You may also hear this fan noise when you start the engine. It will go away as the fan clutch disengages.

## IF A TIRE GOES FLAT

It is unusual for a tire to “blow out” while you are driving, especially if you maintain your tires properly. If air goes out of a tire, it is much more likely to leak out slowly. But if you should ever have a “blowout,” here are a few tips about what to expect and what to do:

If a front tire fails, the flat tire will create a drag that pulls the vehicle toward that side. Take your foot off the accelerator pedal and grip the steering wheel firmly. Steer to maintain lane position, and then gently brake to a stop well out of the traffic lane.

A rear blowout, particularly on a curve, acts much like a skid and may require the same correction you'd use in a skid. In any rear blowout, remove your foot from the accelerator pedal. Get the vehicle under control by steering the way you want the vehicle to go. It may be very bumpy and noisy, but you can still steer. Gently brake to a stop — well off the road if possible.

If a tire goes flat, refer to the following information for service procedures.

If a jack and jacking tools were supplied with your vehicle, refer to the body manufacturer's information for jacking instructions.

### Changing a Flat Tire

A flat or damaged tire can be a major roadside concern. You are very likely to have to seek assistance. Few drivers of these vehicles have the necessary equipment aboard to be able to change a flat tire safely. For example, you have to have a truck jack that can lift several thousand pounds and a torque wrench that can generate several hundred foot-pounds (newton-meters) of twisting force.

So if you are stopped somewhere by a flat or damaged tire or wheel, you should seek expert help.

If the correct equipment is available, though, here is the procedure to follow.

1. Does the tire still seem to have air under pressure in it? If so, stand to the side. Look at the wheel to see if it looks like another wheel on the vehicle. If so, go on to the next step. If it does not, or even if you cannot be sure, stop and seek expert help.



### CAUTION

***Serious injury or death may result from an explosion of tire/rim assembly due to the use of excessive pressure during mounting.***

- ***Never exceed 40 PSI (275 kPA) to seat beads. After beads are seated, adjust inflation to pressure recommended by vehicle manufacturer.***
- ***During tire inflation, always have assembly secured, stand clear and use remote controlled clip on air hose.***
- ***Only specially trained persons should mount tires.***

2. Does the wheel look normal? If you cannot be sure, stop and get expert help.
3. Let the air out of the tire. You can do this by taking out the valve core.
4. If you have the correct equipment, put on the spare wheel and tire assembly.



## CAUTION

*Rust or dirt on the wheel, or on the parts to which it is fastened, can make the wheel nuts become loose after a time. The wheel could come off and cause an accident. When you change a wheel, remove any rust or dirt from the places where the wheel attaches to the vehicle. In an emergency, you can use a cloth or a paper towel to do this; but be sure to use a scraper or wire brush later, if you need to, to get all the rust or dirt off.*

Use a clip-on chuck and hose extension when you add air to your tires. You will need an accurate truck tire pressure gage. Stand to one side and add the air. Use inflation pressure as shown on the Certification/Tire Label.



## CAUTION

*There are many ways you can be seriously injured or be killed, while you are trying to change a truck tire and rim. Follow all of the safety precautions on the truck jack and other equipment.*

*If you try to put air back into a tire that has run flat, or even a tire that was quite low on air, without first finding out why it was low or flat, the tire can have a sudden air-out. This could cause you to lose control of the vehicle and have a serious crash. Do not refill a flat or very low tire with air without first having the tire taken off the wheel and checked for damage.*

All wheel nuts and other tire and wheel fasteners must be properly tightened. See “Tightening the Wheel Nuts” in the Index.



## CAUTION

*Never use oil or grease on studs or nuts. If you do, the nuts might come loose. Your wheel could fall off, causing a serious accident.*



## CAUTION

*Incorrect wheel nuts or improperly tightened wheel nuts can cause the wheel to become loose and even come off. This could lead to an accident. Be sure to use the correct wheel nuts. If you have to replace them, be sure to get new original equipment wheel nuts.*

*Stop somewhere as soon as you can and have the nuts tightened with a torque wrench. See “Tightening the Wheel Nuts” in the Index for the proper torque for your particular wheel.*

## NOTICE

*Improperly tightened wheel nuts can lead to brake pulsation and rotor damage. To avoid expensive brake repairs, evenly tighten the wheel nuts in the proper sequence and to the proper torque specification.*

## IF YOU ARE STUCK

In order to free your vehicle when it is stuck, you will need to spin the wheels, but you do not want to spin your wheels too fast. The method known as “rocking” can help you get out when you are stuck, but you must use caution.



## CAUTION

*If you let your tires spin at high speed, they can explode, and you or others could be injured. And the transmission or other parts of the vehicle can overheat. That could cause an engine compartment fire or other damage. When you are stuck, spin the wheels as little as possible. Do not spin the wheels above 35 mph (55 km/h) as shown on the speedometer.*

## NOTICE

*Spinning your wheels can destroy parts of your vehicle as well as the tires. If you spin the wheels too fast while shifting your transmission back and forth, you can overheat and destroy your transmission. Bring the wheels to a complete stop before changing gears.*

*For information about using tire chains on your vehicle, see "Tire Chains," in the Index.*

## Rocking Your Vehicle To Get It Out

First, turn your steering wheel left and right. That will clear the area around your front wheels. Then shift back and forth between REVERSE (R) and a forward gear, spinning the wheels as little as possible. Release the accelerator pedal while you shift, and press lightly on the accelerator pedal when the transmission is in gear. By slowly spinning your wheels in the forward and reverse directions, you will cause a rocking motion that may free your vehicle. If that does not get you out after a few tries, you may need to be towed out. If you do need to be towed out, see "Towing Your Vehicle" in the Index.



In this section you will find information about the care of your vehicle. This section begins with service and fuel information, and then it shows how to check important fluid and lubricant levels. There is also technical information about your vehicle.

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## SERVICING YOUR VEHICLE

Your dealer knows your vehicle best and wants you to be happy with it. We hope you will go to your dealer for all your service needs.

### Performing Your Own Service Work

If you want to perform some of your own service work, you will want to use the proper Service Manual. It tells you much more about how to service your vehicle than this manual can. To order the proper Service Manual, see “Ordering Service Publications” in the Index.

You should keep a record with all parts receipts and list the mileage and the date of any service work you perform. See “Maintenance Records” in the Index.



## CAUTION

*You may be injured and your vehicle could be damaged if you try to perform service work on a vehicle without having the proper training/knowledge.*

- *Be sure you have sufficient knowledge, experience, the proper replacement parts and tools before you attempt any vehicle maintenance task.*
- *Be sure to use the proper nuts, bolts and other fasteners. “English” and “Metric” fasteners can be easily confused. If you use the wrong fasteners, parts can later break or fall off. You could be injured.*

## FUEL (GASOLINE ENGINE)

If your vehicle is equipped with a diesel engine, see “Diesel Fuel Requirements and Fuel System” in this Section. For vehicles with gasoline engines, please read the following.

Be sure the posted octane of the fuel you are using is at least 87. If the octane is less than 87, you may get a heavy knocking noise when you drive. If it is bad enough, it can damage your engine.

If you are using fuel rated at 87 octane or higher and you hear heavy knocking, your engine needs service. However, a small degree of engine ping or detonation may occur with some fuels under a heavy load. Your engine’s electronic controls are designed to make the correct adjustment to eliminate any pinging that would harm your engine. It is the heavy, constant knock that means you may have a problem.

If your vehicle is certified to meet California Emission Standards (indicated on the underhood emission control label), it is designed to operate on fuels that meet California specifications. If such fuels are not available in states adopting California emissions standards, your

vehicle will operate satisfactorily on fuels meeting federal specifications, but emission control system performance may be affected. The malfunction indicator lamp on your instrument panel may turn on and/or your vehicle may fail a smog check test. (See “Malfunction Indicator Lamp” in the Index.) If this occurs, return to your authorized dealer for diagnosis to determine the cause of failure. In the event it is determined that the cause of the condition is the type of fuels used, repairs may not be covered by your warranty.

Some gasolines that are not reformulated for low emissions may contain an octane-enhancing additive called methylcyclopentadienyl manganese tricarbonyl (MMT); ask your service station operator whether or not the fuel contains MMT. Workhorse does not recommend the use of such gasolines. If fuels containing MMT are used, spark plug life may be reduced and your emission control system performance may be affected. The malfunction indicator lamp on your instrument panel may turn on. If this occurs, return to your authorized dealer for service.

To provide cleaner air, all gasolines in the United States are now required to contain additives that will help prevent deposits from forming in your engine and fuel system, allowing your emission control system to function properly. Therefore, you should not have to add anything to the fuel. In addition, gasolines containing oxygenates, such as ethers and ethanol, and reformulated gasolines may be available in your area to contribute to clean air.

**NOTICE**

*Your vehicle was not designed for fuel that contains methanol. Do not use it. It can corrode metal parts in your fuel system and also damage plastic and rubber parts. That damage would not be covered under your warranty.*

**NOTICE:**

*Your vehicle is not designed to run on E-85 Ethanol Fuel. Use of fuel containing greater than 10% ethanol in non-E85 designated vehicles can cause drivability issues, service engine soon indicators as well as increased fuel system corrosion.*

**NOTICE**

*The presence of dirt and/or debris in the fuel will restrict the flow of fuel through the filter and may eventually affect the performance of the fuel system. Only clean fuel should be used and avoid contamination of the fuel tank by any reasonable means.*

**DIESEL FUEL REQUIREMENTS AND FUEL SYSTEM**

Some states and provinces have restrictions on the purchase of diesel fuel for light-duty vehicles and require you to buy permits or pay special taxes. Some of these restrictions apply only to residents, and others apply to both residents and visitors. These restrictions can change. To learn the current restrictions in any state or province, contact your auto club, the police, or other officials.

## What Fuel to Use



### CAUTION

*Diesel engine equipped chassis REQUIRE the use of ULSD (Ultra Low Sulfur Diesel) fuel. Failure to use ULSD will result in severe damage to engine fuel systems and excessive repair costs that will not be covered under warranty.*

***Use ULSD-15 PPM Diesel Fuel Only!***

Diesel fuel may foam when you fill your tank. This can cause the automatic pump nozzle to shut off, even though your tank is not full. If this happens, just wait for the foaming to stop and then continue to fill your tank.



### CAUTION

*Heat coming from the engine may cause the fuel to expand and force the fuel out of your tank. If something ignites the fuel, a fire could start and people could be burned. To help avoid this, fill your fuel tank only until the automatic nozzle shuts off. Do not try to “top it off.”*

### NOTICE

*The presence of dirt and/or debris in the fuel will restrict the flow of fuel through the filter and may eventually affect the performance of the fuel system. Only clean fuel should be used and avoid contamination of the fuel tank by any reasonable means.*



## CAUTION

*Diesel fuel containing water is still flammable. You could be burned. If you ever try to drain water from your fuel, keep sparks, flames, and smoking materials away from the mixture.*

### NOTICE

*If there is water in your diesel fuel and the weather is warm or humid, fungus and bacteria may grow in the fuel. This may damage your fuel system. You will need a diesel fuel biocide to sterilize your fuel system. Your dealer can advise you if you ever need this.*

*If your fuel tank needs to be purged to remove water, see your dealer or a qualified service technician. Improper purging may damage your fuel system.*

Sometimes, water can be pumped into your fuel tank along with your diesel fuel. This can happen if a service station does not regularly inspect and clean its fuel tanks, or if it gets contaminated fuel from its suppliers.

If this happens, a WATER IN FUEL message will appear on the LCD screen. If it does, the water must be drained. Your dealer can show you how to perform this procedure.

### NOTICE

*If you drive when this warning message is displayed, you can damage your fuel injection system and your engine. If the message is displayed right after you refuel, it means water was pumped into your fuel tank. Turn off your engine immediately.*

If the WATER IN FUEL message is displayed again after driving a short distance or the engine runs rough or stalls — a large amount of water has probably been pumped into the fuel tank. The fuel tank should be purged.

Hard starting, hesitation or “flat” performance at high speed or hard acceleration may be an indication of premature fuel filter plugging due to dirty or contaminated fuel. The filter element may need to be changed if this happens. See “Fuel Filter Replacement,” in the Index.

### ***Running Out of Fuel (Diesel Engines)***

Refer to the Section 7 in this manual to find out how to start the engine after running out of fuel.



## **CAUTION**

*Diesel fuel is flammable. It could start a fire if it comes in contact with hot engine parts. You could be burned. Wipe up any spilled fuel with a cloth.*

### ***To Drain Water (Diesel Engines)***

Refer to the Section 7 in this manual for instructions on draining water from the fuel system.

### ***Fuel Filter Replacement (Diesel Engines)***

Refer to the Section 7 in this manual for instructions on changing the fuel filter.

## **FUELS IN FOREIGN COUNTRIES (GASOLINE ENGINES)**

If you plan on driving in another country outside the United States or Canada, the proper fuel may be hard to find. Never use leaded gasoline or any other fuel not recommended in the previous text on fuel.

Costly repairs caused by the use of improper fuel will not be covered by your warranty.

To check on fuel availability, ask an auto club, or contact a major oil company that does business in the country where you will be driving.



## Filling Your Tank



### CAUTION

*Gasoline vapor is highly flammable. It burns violently, and can cause very serious injuries. Do not smoke if you are near gasoline or refueling your vehicle. Keep sparks, flames, and smoking materials away from gasoline.*

To remove the cap, turn it slowly to the left (counterclockwise).

### NOTICE

*The location of your fuel filler cap is determined by the upfitter (body builder or coach company). The piping from the filler cap to the tank is also the responsibility of the upfitter.*



### CAUTION

*If you get gasoline on yourself and then something it ignites, you could be badly burned. Gasoline may spray out on you if you open the fuel filler cap too quickly. This spray can happen if your tank is nearly full, and is more likely in hot weather. Open the fuel filler cap slowly and wait for any “hiss” noise to stop. Then unscrew the cap all the way.*

When you put the cap back on, turn it to the right (clockwise) until you hear a clicking sound. Make sure you fully install the cap. The diagnostic system can determine if the fuel cap has been left off or improperly installed. This would allow fuel to evaporate into the atmosphere. See “Malfunction Indicator Lamp” in the Index.

**NOTICE**

*If you need a new cap, be sure to get the right type. Your dealer can get one for you. If you get the wrong type, it may not fit properly. This may cause your malfunction indicator lamp to light and your fuel tank and emissions system may be damaged. See “Malfunction Indicator Lamp” in the Index.*

**Filling a Portable Fuel Container****CAUTION**

***Never fill a portable fuel container while it is in your vehicle. Static electricity discharge from the container may ignite the gasoline vapor. You can be badly burned and your vehicle damaged if this occurs. To help avoid injury to you and others:***

- ***Dispense gasoline only into approved containers.***
- ***Do not fill a container while it is inside a vehicle, in a vehicle's trunk, pickup bed, or on any surface other than the ground.***
- ***Bring the fill nozzle in contact with the inside of the fill opening before operating the nozzle. Contact should be maintained until the filling is complete.***
- ***Do not smoke while pumping gasoline.***

## CHECKING THINGS UNDER THE ENGINE COMPARTMENT COVER

To open the hood, see the body manufacturer's information.



### CAUTION

*If your vehicle has air conditioning, the auxiliary engine fan under the hood can start up and injure you even when the engine is not running. Keep hands, clothing, and tools away from any underhood electric fan.*



### CAUTION

*Liquids like gasoline or diesel fuel, oil, coolant, brake fluid, windshield washer solvent, and other fluids along with plastic or rubber that burn can get on hot engine parts and start a fire. You or others could be burned. Be careful, do not drop or spill things that will burn onto a hot engine.*

Before closing the hood, be sure all the filler caps are on properly.

## CLEANING YOUR DIESEL ENGINE

### NOTICE

*If you spray or pour water or any other liquid on your engine when it is warm or hot, or when it is running, you could cause serious damage to it. Clean your engine only when it is cold.*

## NOISE CONTROL SYSTEM

The following information relates to compliance with Federal noise emission standards for vehicles with a Gross Vehicle Weight Rating (GVWR) of more than 10,000 lbs. (4 536 kg). The Maintenance Schedule provides information on maintaining the noise control system to minimize degradation of the noise emission control system during the life of your vehicle. The noise control system warranty is given in Section 6 of this manual.

These standards apply only to vehicles sold in the United States.

## Tampering With Noise Control System Prohibited

Federal law prohibits the following acts or the causing thereof:

1. The removal or rendering inoperative by any person, other than for purposes of maintenance, repair or replacement, of any device or element of design incorporated into any new vehicle for the purpose of noise control, prior to its sale or delivery to the ultimate purchaser or while it is in use;

-or-

2. The use of the vehicle after such device or element of design has been removed or rendered inoperative by any person.

Among those acts presumed to constitute tampering are the following acts listed.

### **Insulation**

- Removal of the noise shields or any underhood insulation.

### **Engine**

- Removal or rendering engine speed limiter (if equipped) inoperative so as to allow engine speed to exceed manufacturer specifications.

### **Fan and Drive**

- Removal of fan clutch (if equipped) or rendering clutch inoperative.
- Removal of the fan shroud (if equipped).

### **Air Intake**

- Removal of the air cleaner silencer.
- Reversing the air cleaner cover.

### **Exhaust**

- Removal of the muffler and/or resonator.
- Removal of the exhaust pipes and exhaust pipe clamps.

## ENGINE OIL (GASOLINE ENGINE)

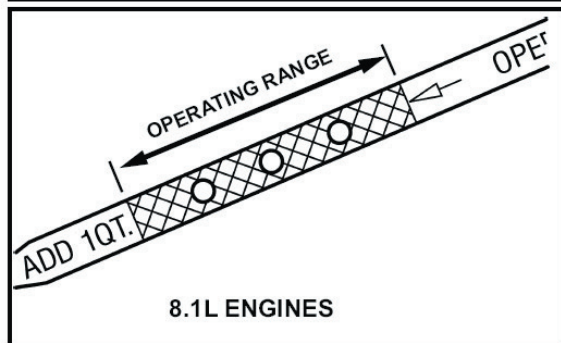
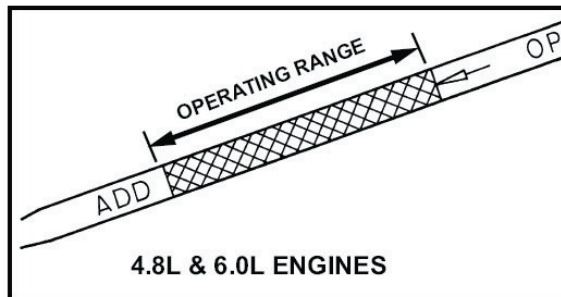
If your vehicle has a diesel engine, see “Engine Oil (Diesel Engine)” in this section.

It is a good idea to check your engine oil every time you get fuel. In order to get an accurate reading, the oil must be warm and the vehicle must be on level ground.

Turn off the engine and give the oil several minutes to drain back into the oil pan. If you do not, the oil dipstick might not show the actual level.

### Checking Engine Oil

Pull out the dipstick and clean it with a paper towel or cloth, then push it back in all the way. Remove it again, keeping the tip down, and check the level.



## When to Add Engine Oil

If the oil is at or below the ADD line, you will need to add at least one quart of oil. But you must use the right type. This section explains what type of oil to use. For crankcase capacity, see “Capacities and Specifications” in the Index.

### NOTICE

*Do not overfill oil level. If your engine has too much oil that the oil level gets above the crosshatched area showing the proper operating range, your engine could be damaged.*

Be sure to fill it enough to put the level somewhere in the proper operating range. Push the dipstick all the way back in when you are through. Avoid fluids spills into engine air intakes.

## What Type of Engine Oil to Use

Oils recommended for your vehicle can be identified by looking for the “Starburst” symbol. This symbol indicates that the oil has been certified by the American Petroleum Institute (API). Do not use any oil which does not carry this Starburst symbol.

If you change your own oil, be sure you use oil that has the Starburst symbol on the front of the oil container. If you have your oil changed for you, be sure the oil put into your engine is American Petroleum Institute certified for gasoline engines.

You should also use the proper viscosity oil for your vehicle, as shown in the following chart:

As shown in the chart, SAE 5W-30 is best for your vehicle. However, you can use SAE 10W-30 if it is going to be 0°F (-18°C) or above. These numbers on an oil container show its viscosity, or thickness. Do not use other viscosity oils, such as SAE 20W-50.

### NOTICE

*Use only engine oil with the American Petroleum Institute Certified for Gasoline Engines “Starburst” symbol. Failure to use the recommended oil can result in engine damage not covered by your warranty*



If you are in an area where the temperature falls below -20°F (-29°C), consider using either an SAE 5W-30 synthetic oil or an SAE 5W-30 oil. Both will provide easier cold starting and better protection for your engine at extremely low temperatures.

### NOTICE

*For maximum performance and engine protection use only genuine Workhorse approved oil filters and service parts.*

## Engine Oil Additives

Do not add anything to your oil. Your dealer is ready to advise if you think something should be added.

**RECOMMENDED SAE VISCOSITY GRADE ENGINE OILS**

**FOR BEST FUEL ECONOMY AND COLD STARTING, SELECT THE LOWEST SAE VISCOSITY GRADE OIL FOR THE EXPECTED TEMPERATURE RANGE.**

**HOT WEATHER**

**COLD WEATHER**

**LOOK FOR THIS SYMBOL**

IF NEITHER SAE 5W-30 NOR SAE 10W-30 GRADE OILS ARE AVAILABLE, SAE 30 GRADE MAY BE USED AT TEMPERATURES ABOVE 40 DEGREES F (4 DEGREES C).

DO NOT USE SAE 10W-40, SAE 20W-50 OR ANY OTHER GRADE OIL NOT RECOMMENDED

## When to Change Engine Oil

If any one of these is true for you, use the short trip/city maintenance schedule:

- Most trips are less than 5 to 10 miles (8 to 16 km). This is particularly important when outside temperatures are below freezing.
- Most trips include extensive idling (such as frequent driving in stop-and-go traffic).
- Most trips are through dusty areas.
- The vehicle is used for motor home, delivery service, or other commercial application.

Driving under these conditions causes engine oil to break down sooner. If any one of these is true for your vehicle, then you need to change your oil and filter every 3,000 miles (5 000 km) or 3 months — whichever occurs first.

Driving a vehicle with a fully warmed engine under highway conditions causes engine oil to break down slower.

## OIL CONSUMPTION

All engines require oil to lubricate and protect the load bearing and internal moving parts from wear including cylinder walls, pistons, and piston rings.

When a piston moves down its cylinder, a thin film of oil is left on the cylinder wall. During the combustion process, part of this oil layer is consumed. As a result, varying rates of oil consumption are accepted as normal in all engines.

Oil usage has a direct relationship with the amount of fuel used. The harder an engine works, the more fuel and oil it will use. Therefore, oil usage as a factor of fuel usage is a more accurate indicator of acceptable oil consumption levels than vehicle mileage for vehicles at or above 8,600 GVW.

Many factors can affect an owner's concern with oil consumption. Driving habits and vehicle maintenance vary from owner to owner.



**NOTICE**

*Oil level should not be over the full mark or more than one quart low. Oil can become aerated when overfilled or when more than one quart low.*

*Aeration of the oil can cause valve lifters to collapse causing major damage to the engine.*

**Improper Reading of the Oil Level**

The vehicle must be parked on a level surface to obtain accurate oil level readings. Verify that the dipstick tube is fully seated in the block. When checking the oil level, make sure the dipstick is wiped clean before taking an oil level reading and fully depress the dipstick until the shoulder bottoms out on the dipstick tube. The dipstick should be the proper part number for the engine/vehicle that is being checked.

**Not Waiting Long Enough After Running Engine to Check Oil Level**

The vehicle should be allowed to sit for at least 15 minutes, after the engine has been shut off, before taking an oil level reading to assure the oil has had enough time to drain back into the crankcase/oil pan. In order to ensure accurate results, the temperature of the oil should be close to the same temperature as the last time the oil level was checked.

**Improper Oil Fill After an Oil Change**

Following an oil change, verify that the proper amount and type of oil was put in the engine and that the oil level on the dipstick is not above the full mark or below the add marks.

**High Speed or High RPM Operation**

Continuous driving at high speeds/high RPMs may increase oil consumption. Because this may not always be an everyday occurrence, it is hard to determine exactly how much the oil economy will be affected.

## Towing or Heavy Usage

Towing a trailer or hauling additional weight may increase oil consumption. Large frontal area trailers will further increase the work required from the engine, especially at highway speeds, and thus increases the rate of oil consumption.



### **CAUTION**

*When towing heavy loads, reduce your speed and increase the distance between you and other vehicles.*

## Crankcase Ventilation System

Verify that the positive crankcase ventilation (PCV) system is operating properly. Blockages, restrictions, or damage to the PCV system can result in increased oil use.

## Oil Dilution from Condensation

On vehicles that are usually driven short distances, less than 5 mi (8 km), especially in colder weather, condensation generated from cold engine operation may not get hot enough to evaporate out of the oil. When this occurs, the dipstick may indicate that the oil level is over-full. Subsequent driving on a trip of sufficient length to enable normal engine operating temperature for 30 minutes or more, in order to vaporize excess moisture, may give you the impression of excessive oil consumption.

## Engine Temperature

If an engine is run at overheated temperatures (see “Engine Overheating” in the Index) for more than brief periods, oil may oxidize at a faster than normal rate. In addition, gaskets may distort, piston rings may stick, and excessive wear may result. Verify that all cooling system components are in proper working order.

## Measurement of Oil Consumption

Engines require a period of time to **BREAK IN** so that moving parts are properly seated. Therefore, oil economy should not be tested until the vehicle has accumulated at least 5,000 mi (8 000 km) and the oil has been changed for the first time.

## ENGINE OIL (DIESEL ENGINES)

It is a good idea to check your engine oil level every time you get fuel. In order to get an accurate reading, the oil must be warm and the vehicle must be on level ground.

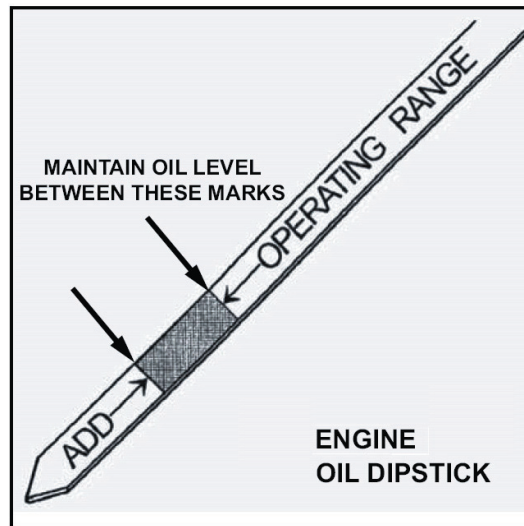
Turn off the engine and give the oil a few minutes to drain back into the oil pan. If you do not, the oil dipstick might not show the actual level.

## Checking Engine Oil

Pull out the dipstick and clean it with a paper towel or a cloth, then push it back in all the way. Remove it again, keeping the tip down.

## When to Add Engine Oil

If the oil is at or below the **ADD** line, then you will need to add at least one quart of oil. But you must use the right type. For diesel engine crankcase capacity specifications, refer to Section 7 in this manual.



**NOTICE**

*Do not overfill oil level. If your engine has too much oil that the oil level gets above the crosshatched area showing the proper operating range, your engine could be damaged.*

Be sure to add enough oil to bring the level up to the proper operating range. Push the dipstick all the way back in when you are through.

**What Type of Engine Oil to Use**

Refer to the Section 7 in this manual for instructions on the proper oil to use in your diesel engine.

If you use oils that do not have one of these designations, you can cause engine damage which is not covered by your warranty.

**Engine Oil Additives**

Do not add anything to your oil. Your dealer is ready to advise if you think something should be added.

**When to Change Engine Oil**

Refer to the Section 7 in this manual for instructions on the proper maintenance schedule for your diesel engine.

**What To Do With Used Oil & Oil Filters****CAUTION**

*Did you know that used engine oil contains certain elements that may be unhealthy for your skin and could even cause cancer? Do not let used oil stay on your skin for very long. Clean your skin and nails with soap and water, or a good hand cleaner. Wash or properly throw away clothing or rags containing used engine oil. (See the manufacturer's warnings about the use and disposal of oil products.)*

Used oil can be a real threat to the environment. If you change your own oil, be sure to drain all freeflowing oil from the filter before recycling. Do not ever dispose of oil or oil filters by putting them in the trash, pouring it on the ground, into sewers, or into streams or bodies of water. Instead, recycle it by taking it to a place that collects used oil and filters. If you have a problem properly disposing of your used oil and filters, ask your dealer, a service station, auto parts store, or a local recycling center for help.

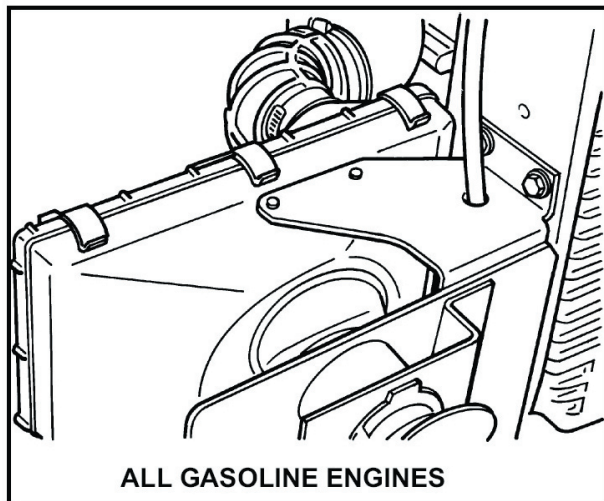
## ENGINE AIR CLEANER/FILTER

### Gasoline Engines

To remove the air cleaner cover, remove the metal clips that hold the cover on. Remove the cover and lift out the air filter.

Insert a new air filter, then replace the air cleaner cover. Move the metal clips to hold the cover seated.

To avoid the possibility of unfiltered air being drawn into the engine, make sure the air cleaner cover is on straight and the metal clips are properly in place. Ensure that the evacuator valve located in the bottom of the air inlet tube is checked frequently for debris blockage on all vehicles with the 8.1L engine.



ALL GASOLINE ENGINES

**NOTICE**

*Make sure air intake screen is securely in place.*

**Diesel Engines**

To remove the air cleaner cover on the diesel engine, remove the wing nuts that hold the cover on. Remove the cover and lift out the air filter. Insert new air filter, then replace the air cleaner cover.

Refasten the cover with the wing nuts.

If the vehicle is fitted with an optional air restriction indicator, change the air filter only when indicated.

**CAUTION**

*Gasoline Engines Only: Operating the engine with the air cleaner/filter off can cause you or others to be burned. The air cleaner not only cleans the air, it stops flame if the engine backfires. If it is not in place, and the engine backfires, you could be burned. Do not drive with it off, and be careful working on the engine with the air cleaner/filter off.*

**NOTICE**

*Gasoline Engines Only: If the air cleaner/filter is removed, a backfire may cause a damaging engine fire. Dirt/debris can easily get into your engine, which will damage it. Always have the air cleaner/filter in place when you are driving.*

**AUTOMATIC TRANSMISSION FLUID****Allison™ 1000 / 2000 Series**

**(W20/W21/W22/W24/W25/W42-Diesel/W62)**

See your Allison™ Automatic Transmission Operator's Manual to find out when to change your transmission fluid and filters.

**Hydramatic® Transmissions**

**(W16/W18/W42 Series Gasoline Engines)**

**When to Check and Change**

A good time to check your automatic transmission fluid level is when the engine oil is changed.

Change both the fluid and filter every 50,000 miles (83 000 km). See “Maintenance - Part A - Scheduled Maintenance Services” in the Index.

## How to Check

Because this operation can be a little difficult, you may choose to have this done at the dealership service department.

If you perform this service yourself, be sure to follow all the instructions here, or you could get a false reading on the dipstick.

### NOTICE

*Too much or too little fluid can damage your transmission. Too much fluid can mean that some of the fluid could discharge out of the transmission vent onto hot engine or exhaust parts and potentially start a fire. Be sure to get an accurate reading when checking your transmission fluid.*

Wait at least 30 minutes before checking the transmission fluid level if you have been driving:

- When outside temperatures are above 90°F (32°C).
- At high speed for quite a while.
- In heavy traffic — especially in hot weather.
- While pulling a trailer.

To get the right reading, the fluid should be at normal operating temperature, which is 180°F to 200°F (82°C to 93°C).

Get the vehicle warmed up by driving about 15 miles (24 km) when outside temperatures are above 50°F (10°C). If it's colder than 50°F (10°C), drive the vehicle in DRIVE (D) until the engine temperature gauge moves and then remains steady for 10 minutes. Then follow the hot check procedures.

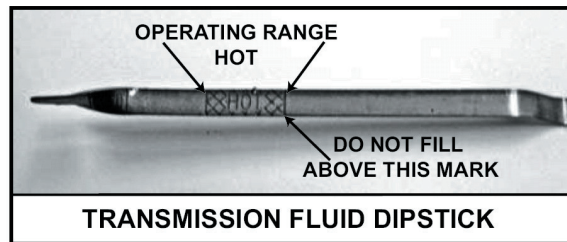
## Checking Transmission Fluid Level

### Checking Transmission Fluid Cold

A cold check is made after the vehicle has been sitting for eight hours or more with the engine off and is used only as a reference. Let the engine run at idle for five minutes if outside temperatures are 50°F (10°C) or more. If it's colder than 50°F (10°C), you may have to idle the engine longer. Should the fluid level be low during a cold check, you must perform a hot check before adding fluid. This will give you a more accurate reading of the fluid level.

### Checking the Fluid Level

- Park your vehicle on a level place. Keep the engine running.
- With the parking brake applied, place the shift lever in PARK (P).
- With your foot on the brake pedal, move the shift lever through each gear range, pausing for about three seconds in each range. Then, position the shift lever in PARK (P).
- Let the engine run at idle for three minutes or more.



Then, without shutting off the engine, follow these steps:

1. Pull out the dipstick and wipe it with a clean rag or paper towel.
2. Push it back in all the way, wait three seconds and then pull it back out again.
3. Check both sides of the dipstick, and read the lower level. The fluid level must be in the COLD area for a cold check or in the HOT area or crosshatched area for a hot check.
4. If the fluid level is in the acceptable range, push the dipstick back in all the way.



## How to Add Fluid

Refer to the Maintenance Schedule to determine what type of transmission fluid to use. See “Maintenance - Part D: Recommended Fluids and Lubricants” in the Index.

Add fluid only after checking the transmission fluid while it is hot. (A cold check is used only as a reference.) If the fluid level is low, add only enough of the proper fluid to bring the level up to the HOT area for a hot check. It does not take much fluid, generally less than one pint (0.5 L). Do not overfill. Avoid fluid spills into engine air intakes.

### NOTICE

*We recommend you use only fluid labeled DEXRON®-VI in Hydramatic® transmissions, because fluid with that label is made especially for your automatic transmission. Damage caused by fluid other than DEXRON®-VI is not covered by your new vehicle warranty.*

### NOTICE

*We recommend you use only fluid labeled Transynd™ in Allison™ transmissions, because fluid with that label is made especially for your automatic transmission. Damage caused by fluid other than Transynd™ may void your Allison™ transmission warranty.*

- *After adding fluid, recheck the fluid level as described under “How to Check.”*
- *When the correct fluid level is obtained, push the dipstick back in all the way.*

### NOTICE

*If the fluid is found discolored or has a pungent odor, have your vehicle inspected by an authorized Workhorse service center right away.*

## REAR AXLE

### When to Check and Change Lubricant

Refer to the Maintenance Schedule to determine how often to check the lubricant and when to change it. See “Maintenance - Part A: Scheduled Maintenance Services” in the Index.

#### **NOTICE**

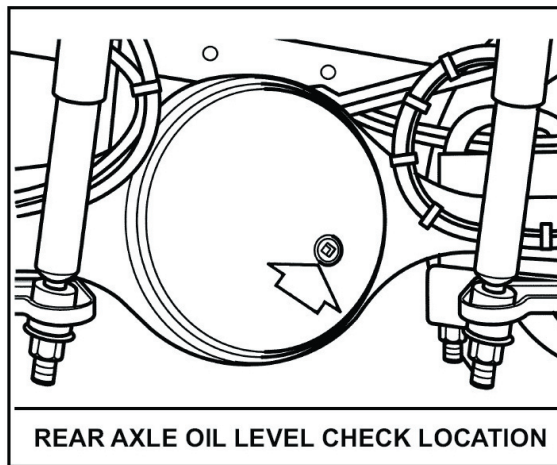
*The rear axle of your vehicle has several large turning gears that can emit resonating noises which may be a normal operating characteristic, depending on vehicle load or vehicle speed.*

### How to Check Rear Axle Lubricant

If the level is below the bottom of the filler plug hole, you will need to add some lubricant. Add enough lubricant to raise the level to the bottom of the filler plug hole.

### What to Use

Refer to the Maintenance Schedule to determine what type of lubricant to use. See “Maintenance - Part D: Recommended Fluids and Lubricants” in the Index.



## RADIATOR PRESSURE CAP

### *(Gasoline Engines)*

The radiator pressure cap must be tightly installed. If your cap has alignment arrows, make sure they line up with the overflow tube on the radiator filler neck.

### **NOTICE**

*Your radiator pressure cap is a 15 psi (105 kPa) pressure-type cap and must be tightly installed to prevent coolant loss and possible engine damage from overheating. If alignment arrows are present, make sure you line them up with the overflow tube on the radiator filler neck.*

Always use a Workhorse approved radiator cap if replacement is necessary.

## SURGE TANK PRESSURE CAP

### *(Diesel Engines)*

The surge tank pressure cap must be tightly installed on the coolant surge tank.

### **NOTICE**

*Your surge tank pressure cap is a unique 15 psi (105 kPa) pressure-type cap for use with surge tank cooling systems only. It must be tightly installed to prevent coolant loss and possible engine damage from overheating. If alignment arrows are present, make sure you line them up with the overflow tube on the coolant surge tank.*

## THERMOSTAT

Engine coolant temperature is controlled by a thermostat in the engine coolant system. The thermostat stops the flow of coolant through the radiator until the coolant reaches a preset temperature.

Always use a Workhorse approved engine thermostat if replacement is necessary.

## ENGINE COOLING SYSTEM

### Gasoline Engine Coolant

The cooling system in your vehicle is filled with DEXCOOL® engine coolant. This coolant is designed to remain in your vehicle for five years or 150,000 miles (240 000 km) whichever occurs first, if you add only DEX-COOL® extended life coolant.

The following explains your cooling system and how to add coolant when it is low. If you have a problem with engine overheating, see “Engine Overheating” in the Index.

A 50/50 mixture of clean, drinkable water and DEXCOOL® coolant will:

- Give freezing protection down to -34°F (-37°C).
- Give boiling protection up to 265°F (129°C).
- Protect against rust and corrosion.
- Help keep the proper engine temperature.
- Let the warning lights and gauges work as they should.

### NOTICE

*When adding coolant, it is important that you use only DEX-COOL® (silicate-free) coolant. If coolant other than DEX-COOL® is added to the system, premature engine, heater core, or radiator corrosion may result. In addition, the engine coolant will require change sooner — at 30,000 miles (50 000 km) or 24 months, whichever occurs first. Damage caused by the use of coolant other than DEX-COOL® is not covered by your new vehicle warranty.*

### What to Use

Use a mixture of one-half clean, drinkable water and one-half DEX-COOL® coolant which will not damage aluminum parts. If you use this coolant mixture, you do not need to add anything else.



## CAUTION

### GASOLINE ENGINE COOLING SYSTEMS

*Adding only plain water to your cooling system can be dangerous. Plain water, or some other liquid like alcohol, can boil before the proper coolant mixture will. Your vehicle's coolant warning system is set for the proper coolant mixture. With plain water or the wrong mixture, your engine could get too hot but you would not get the overheat warning. Your engine could catch fire and you or others could be burned. Use a 50/50 mixture of clean, drinkable water and DEXCOOL® coolant.*

### NOTICE

*Coolant level movement (within the coolant recovery tank) between cold and hot indicates the cooling system is operating correctly. If there is no movement between hot and cold the radiator may be low. If this is the case, have your authorized Workhorse service dealer inspect the cooling system.*

### NOTICE

*If you use an improper coolant mixture, your engine could overheat and be badly damaged. The repair cost would not be covered by your warranty. Too much water in the mixture can freeze and crack the engine, radiator, heater core, and other parts.*

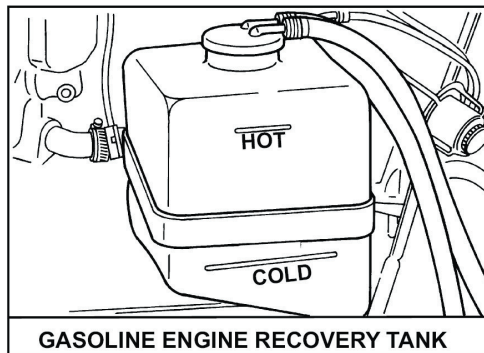
If you have to add coolant more than four times a year, have your dealer check your cooling system.

### NOTICE

*If you use the proper coolant, you do not have to add extra inhibitors or additives, which claim to improve the system. These can be harmful.*

### Checking Coolant — Gasoline Engines

If your vehicle has a gasoline engine, it has a see through coolant recovery tank, mounted by the body manufacturer.



The vehicle must be on a level surface. When your engine is cold, the coolant level should be at FULL COLD, or a little higher. When your engine is warm, the level should be up to FULL HOT, or a little higher.

### ***Adding Coolant — Gasoline Engines***

If you need more coolant, add the proper DEXCOOL<sup>®</sup> coolant mixture at the coolant recovery tank.



## **CAUTION**

*Turning the radiator pressure cap when the engine and radiator are hot can allow steam and scalding liquids to blow out and burn you. With the coolant recovery tank, you will almost never have to add coolant at the radiator. Never turn the radiator pressure cap — even a little — when the engine and radiator*

Add coolant mixture at the recovery tank, but be careful not to spill it.



## **CAUTION**

*You can be burned if you spill coolant on hot engine parts. Coolant contains ethylene glycol, and it will burn if the engine parts are hot enough. Do not spill coolant on a hot engine.*

## Diesel Engine Coolant

The cooling system in your diesel engine is filled with extended life coolant which is red in color.

*Note: Not all extended life coolant is red in color. Always refer to the specifications when choosing a replacement coolant for your diesel engine.*

This coolant is designed to remain in your vehicle for five years or 300,000 miles (480 000 km), whichever occurs first, provided you adhere to the requirements stated in Section 7 in this manual.

For additional information on your cooling system and how to add coolant when it is low, refer to the aforementioned section in this manual.



## CAUTION

### DIESEL COOLING SYSTEMS

*Adding only plain water to your cooling system can be dangerous. Plain water, or some other liquid like alcohol, can boil before the proper coolant mixture will. Your vehicle's coolant warning system set for the proper coolant mixture. With plain water or the wrong mixture, your engine could get too hot but you would not get the overheat warning. Your engine could catch fire and you or others could be burned. Use a 50/50 mixture of clean, drinkable water and extended life (red) coolant.*

## NOTICE

*Coolant level movement (within the coolant surge/recovery tank) between cold and hot indicates the cooling system is operating correctly. If there is no movement between hot and cold the radiator may be low. If this is the case, have your authorized Workhorse service dealer inspect the cooling system.*

## Checking Coolant — Diesel Engines

If your vehicle has a diesel engine, it has a see through surge/recovery tank mounted on top of the radiator.

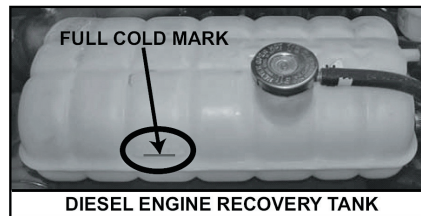


### CAUTION

*Turning the surge/recovery tank pressure cap when the engine and radiator are hot may allow steam and scalding liquids to blow out and burn you. Never turn the surge tank pressure cap — even a little — when the engine and radiator are hot.*

The vehicle must be on a level surface. When your engine is cold, the coolant level should be at the FULL COLD mark.

If the LOW COOLANT message is displayed on the LCD screen, accompanied by an audible beep it means you are low on engine coolant.



## Adding Coolant — Diesel Engines

If you need more coolant, add the proper extended life (red) coolant mixture at the surge/recovery tank, but only when the engine is cool.



### CAUTION

*You can be burned if you spill coolant on hot engine parts. Coolant contains ethylene glycol, and it may burn if the engine parts are hot enough. Do not spill coolant on a hot engine.*

When replacing the pressure cap, make sure it is hand-tight.



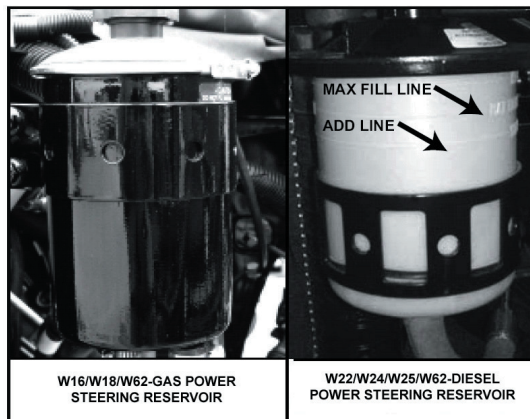
## POWER STEERING FLUID

### NOTICE

*Always turn the engine off before checking or adding power steering fluid. The power steering cap is close to the fan and other moving parts. Be careful when working in this area.*

### When to Check Power Steering Fluid

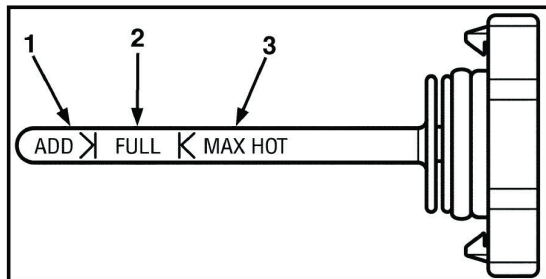
It is not necessary to regularly check power steering fluid unless you suspect there is a leak in the system or you hear an unusual noise. A fluid loss in this system could indicate a problem. Have the system inspected and repaired.



### How to Check Power Steering Fluid

#### *W16/W18/W62-Gas Chassis*

When the engine compartment is cool, wipe the cap and the top of the reservoir clean, then unscrew the cap and wipe the dipstick with a clean rag. Replace the cap and completely tighten it. Then remove the cap again and look at the fluid level on the dipstick.



1. Add fluid mark.
2. Acceptable operating range between marks.
3. Maximum level when hot.

### **W22/W24/W25/W62 Diesel Series Chassis**

The W22/W24/W25/W62-Diesel Series chassis utilize a see through reservoir housing. It is not necessary to remove the filler cap to check the fluid level. Wipe the reservoir surface with a clean rag or shop towel and view the fluid level through the reservoir wall. The level should be between the Maximum Full and Add Fluid lines.

### **NOTICE**

*Do not overfill the power steering system.*

The level should be within the FULL range mark. If necessary, add only enough fluid to bring the level within the range.

### **What to Use**

To determine what type of fluid to use, see “Maintenance - Part D: Recommended Fluids and Lubricants” in the Index. Always use the proper fluid. Failure to use the proper fluid can cause leaks and damage hoses and pump seals.

## **WINDSHIELD WASHER FLUID**

### **What to Use**

When you need windshield washer fluid, be sure to read the manufacturer’s instructions before use. If you will be operating your vehicle in an area where the temperature may fall below freezing, use a fluid that has sufficient protection against freezing.

## Adding Washer Fluid

The windshield washer fluid bottle is mounted by the body manufacturer. Avoid fluid spills into engine air intakes.

Open the cap labeled WASHER FLUID ONLY. Add washer fluid until the tank is full.

### NOTICE

- *When using concentrated washer fluid, follow the manufacturer's instructions for adding water.*
- *Do not mix water with ready-to-use washer fluid. Water can cause the solution to freeze and damage your washer fluid tank and other parts of the washer system. Also, water does not clean as well as washer fluid.*
- *Fill your washer fluid tank only three-quarters full when it's very cold. This allows for expansion if freezing occurs, which could damage the tank if it is completely full.*
- *Do not use engine coolant (antifreeze) in your windshield washer. It can damage your washer system and paint.*

## BRAKES

### Brake Fluid

Your brake master cylinder reservoir is located under the hood, above the radiator. It is filled with DOT-3 brake fluid.

There are only two reasons why the brake fluid level in the reservoir might go down. First is that the brake fluid will go down to an acceptable level during normal brake lining wear. When new linings are put in, the fluid level will go back up. Second is that fluid is leaking out of the brake system. If that occurs, you should have your brake system inspected/repaired, since a leak means that sooner or later your brakes will not work well, or not at all.

It is not a good idea to "top off" your brake fluid. Adding brake fluid will not correct a leak. If you add fluid when your linings are worn, then you will have too much fluid when you get new brake linings. You should add (or remove) brake fluid, as necessary, only when work is done on the brake hydraulic system. Avoid fluid spills into engine air intakes.



## CAUTION

*If you have too much brake fluid in the reservoir, it can spill on the engine. The fluid may burn if the engine is hot enough. You or others could be burned, and your vehicle could be damaged. Add brake fluid only when work is done on the brake hydraulic system.*

Refer to the “Maintenance - Part A: Scheduled Maintenance Services” in the Index to determine the correct interval when to check your brake fluid. The brake system warning light will come on when the fluid level becomes too low.

### Checking Brake Fluid

You have the see-through reservoir with outside markings, so you can check the brake fluid without removing the cap.

Just look at the brake fluid reservoir. The fluid level should be above MIN. If it is not, have your brake system checked to see if there is a leak.

After work is done on the brake hydraulic system, make sure the level is above the MIN but not over the MAX mark.

### What to Add

When you do need brake fluid, use only DOT-3 brake fluid. Refer to “Maintenance - Part D: Recommended Fluids and Lubricants” in the Index. Use new brake fluid from a sealed container only.

Always clean the brake fluid reservoir cap and the area around the cap before removing it. This will help keep dirt from entering the reservoir.



## CAUTION

*With the wrong type of fluid in your brake system, your brakes may not work well, or they may not even work at all. This may cause an accident. Always use the proper brake fluid.*



## CAUTION

*Never add DOT 5 brake fluid to your vehicle. DOT 5 brake fluid will damage components in your brake system and may cause a loss of braking ability.*

### NOTICE

*Using the wrong brake fluid can badly damage brake system components. For example, just a few drops of mineral-based oil, such as engine oil, in your brake system can damage brake system parts so severely that they will have to be replaced. Do not let someone add the wrong type of fluid.*

### NOTICE

*If you spill brake fluid on your vehicle's painted surfaces, the paint finish may be damaged. Be careful not to spill brake fluid on your vehicle. If you do, wash it off immediately. Do not rub the surface while cleaning.*

## Brake Wear

Disc brake pads have built-in wear indicators that make a high-pitched warning sound when the brake pads are worn and new pads are needed. The sound may come and go or be heard all the time your vehicle is moving (except when you are pushing on the brake pedal firmly).



## CAUTION

*The brake wear warning sound means that your brake linings may be worn and may not work well. That could lead to an accident. When you hear the brake wear warning sound, have your vehicle serviced.*

### NOTICE

*Continuing to drive with worn-out brake pads could result in costly brake repairs.*

**NOTICE**

*Lubricate the brake caliper slides if your vehicle is in storage for periods of six months or longer.*

Some driving conditions or climates may cause a brake squeal when the brakes are first applied or lightly applied. This does not necessarily mean there is an issue with your brakes.

Properly torqued wheel nuts are necessary to help prevent brake pulsation. When tires are rotated, inspect brake pad lining for wear and evenly torque wheel nuts in the proper sequence to Workhorse specifications.

When you have the front brake pads replaced, have the rear brakes inspected, too. Brake linings should always be replaced as complete axle sets.

See “Brake System Inspection” in Section 5 of this manual under Maintenance - Part C: “Periodic Maintenance Inspections.”

**Brake Pedal Travel**

See your dealer if the brake pedal does not return to normal height, or if there is a rapid increase in pedal travel. This could be a sign of brake trouble.

**Brake Adjustment**

Every time you make a brake stop, your disc brakes adjust for wear.

**Replacing Brake System Parts**

The braking system on a vehicle is complex. Its many working parts have to be of top quality and work well together if the vehicle is to have top quality braking. Your vehicle was designed and tested with top-quality brake parts. When you replace parts of your braking system — for example, when your brake linings wear down and you have new linings installed, be sure you get new factory approved replacement parts. If you do not, your brakes may no longer work as designed.

For example, if someone installs brake linings that are incorrect for your vehicle, the balance between your front and rear brakes can change, altering brake performance. The braking performance you have come to expect can change in many other ways if someone installs the wrong replacement brake parts.

## Auto Park Brake System (Electric Pump)

The W18 Series motor homes are equipped with an electric auto-applied parking brake, the fluid reservoir is located in front and to the left of the radiator.

This system uses Automatic Transmission Fluid (DEXRON®-VI). Use the same specification fluid as used in the Hydramatic® automatic transmission. Fluid should be checked with the vehicle in PARK (P) and should have a reading between the MIN and MAX markings. Clean the cap prior to adding fluid. Do not overfill.



## BATTERY

### Vehicle Storage

If you are not going to drive your vehicle for 25 days or more, remove the black, negative (-) cable from the battery. This will help keep your battery from running down.



## CAUTION

*Batteries have acid that may burn you and gas that may explode. You may be badly hurt if you are not careful. See “Jump Starting” in the Index for tips on working around a battery without getting hurt.*

If the vehicle is to be stored for extended periods of 60 days or more, it is recommended to keep the battery charged by connecting it to a trickle charger, in a safe place — because of emitted hydrogen during battery charging. This will extend the life of the battery.

### NOTICE

*Use an automatic trickle charger or a battery tender that will keep the batteries at a full rate of charge. Never use a manual battery charger as the battery can become overcharged and sulfate.*

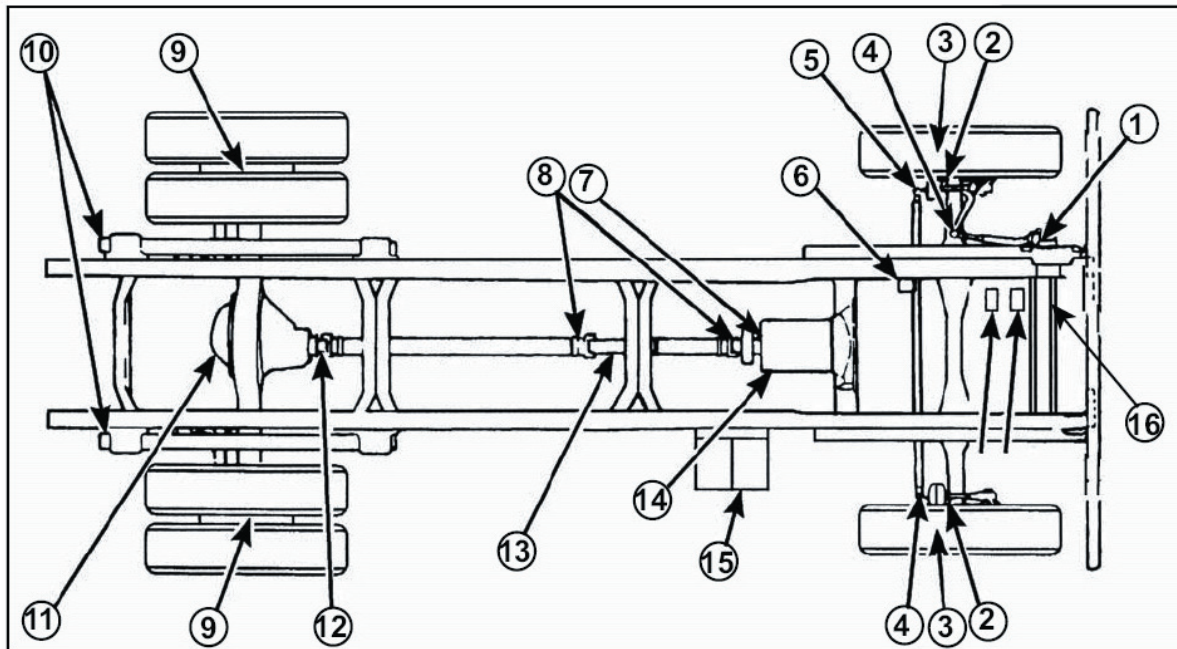
The idle control learned variables might need to be re-learned by the engine controller after the battery is reconnected. Consult your local dealer or service manual for the “Idle Learn” procedure. It is a procedure, which does not require any tools and can be easily performed by yourself. This procedure is not absolutely necessary, since the engine controller will learn new values every time your engine returns back to idle speed.

### NOTICE

*The engine may not idle smoothly until the idle control variables are relearned.*

Contact your dealer to learn how to prepare your vehicle for longer storage periods.



**CHASSIS LUBRICATION CHART — TYPICAL W SERIES CHASSIS**

| ITEM | COMPONENT                | REMARKS  |
|------|--------------------------|--|
| 1    | Steering Drag Links      | One fitting each end.  |
| 2    | Front Steering Knuckles  | One fitting each side. (Hand operated grease gun only.)  |
| 3    | Front Wheel Bearings     | SAE 90W GL-5 Gear oil or optionally Chevron Delo Gear ESI SAE -80W-90 gear oil. Sealed hubs do not require periodic maintenance. |
| 4    | Steering Drag Links      | One fitting each end.  |
| 5    | Steering Tie Rods        | One fitting each end.  |
| 6    | Spring Slip Pads         | Apply chassis lube. (W42 only)   |
| 7    | Parking Brake Clevis Pin | Apply chassis lube.  |
| 8    | Prop Shaft U-Joints      | One fitting each joint; lube with Grade 1 Wheel Bearing Lubricant.   |
| 9    | Rear Wheel Bearings      | Lubricated by rear axle lubricant.   |
| 10   | Spring Slip Pads         | Apply chassis lube. (W42 only)   |
| 11   | Rear Axle                | Fill to level of filler plug.  |
| 12   | Prop Shaft U-Joints      | One fitting each joint; lube with Grade 1 Wheel Bearing Lubricant.   |
| 13   | Prop Shaft Slip Joint    | One fitting each joint; lube with Grade 1 Wheel Bearing Lubricant.   |
| 14   | Transmission             | Refer to "Automatic Transmission Fluid" earlier in this section.   |
| 15   | Battery Terminals        | Keep coated with petroleum jelly.  |
| 16   | Brake Bell Crank         | One fitting; apply chassis lube.   |

## GASOLINE VEHICLE STORAGE

Extended periods of vehicle storage (over 60 days) can result in deterioration of gasoline fuel due to oxidation. A commercially available fuel stabilizer (“STA-BIL®” or equivalent) should be added prior to gasoline fill whenever the anticipated storage period is over 60 days. The manufacturer’s instructions included with the product should be followed.

Operate the vehicle for 10 minutes at idle speed to distribute the stabilizer throughout the fuel system. Moisture condensation will be minimized by filling the fuel tank to the full level.

### NOTICE

*If your coach is stored for a long duration of time (six months or longer) there are areas of your vehicle that may be susceptible to corrosion due to moisture. Moisture corrosion can magnify if the coach is stored outside on grass, dirt, and/or concrete. It is very important to have your coach inspected at your authorized Workhorse dealer when it is recommissioned for service/usage. This will help verify if there are any component(s) that have been effected by moisture.*

## Front Wheel Bearings with Oil-Filled Hubs (If Equipped)

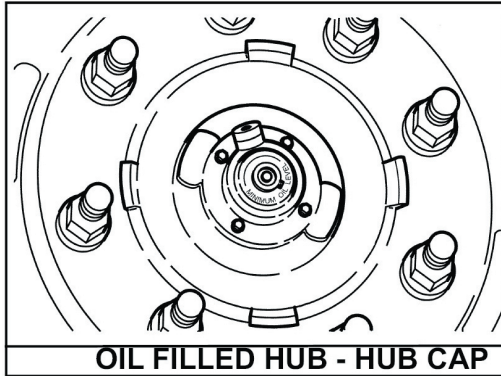
Some vehicles have oil-lubricated front hubs.

If your vehicle is so equipped, check to see if they have enough oil. You can tell by simply looking into the sight glass on the front wheel hubs to see if the oil is at the correct level.

If the oil is low, remove the fill cap, and be careful not to allow any dirt or water into the oil. Add enough oil to bring it up to the proper level mark on the sight glass.

Your Maintenance Schedule will tell you what type of oil to use. See “Maintenance - Part D: Recommended Fluids and Lubricants” in the Index.

When you fill the hub, check the sight glass again after driving a short distance. It may take a while for the oil to flow through the system, and you may need to add additional oil to fill it to the proper level.



## TIRES

Your new vehicle comes with high-quality tires made by a leading tire manufacturer. If you ever have questions about your tire warranty and where to obtain service, see your tire warranty booklet for details.

### NOTICE

*To reduce the potential of flat spots in your tires during storage, park the coach with each tire on a 1/2 inch (12.7 mm) piece of plywood. This will help evenly disperse the load on the tires during storage.*



## CAUTION

*Poorly maintained and improperly used tires are dangerous.*

- *Overloading your tires can cause overheating as a result of too much friction. You could have an air-out and a serious accident. See “Loading Your Vehicle” in the Index.*
- *Underinflated tires pose the same danger as overloaded tires. The resulting accident could cause serious injury. Check all tires frequently to maintain the recommended pressure. Tire pressure should be checked when your tires are cold.*
- *Overinflated tires are more likely to be cut, punctured or broken by a sudden impact — such as when you hit a pothole. Keep tires at the recommended pressure.*
- *Worn, old tires can cause accidents. If your tread is badly worn, or if your tires have been damaged, replace them.*

## Inflation — Tire Pressure

The Certification/Tire Label, which is located on your vehicle (check with your body manufacturer or on the incomplete vehicle document for the correct location), shows the correct inflation pressures for your tires when cold. “Cold” means your vehicle has been sitting for at least three hours or driven no more than one mile (1.6 km).

### NOTICE

*Be aware that underinflation or overinflation is not recommended. If your tires do not have enough air (underinflation), you can get the following:*

- *Too much flexing*
- *Too much heat*
- *Tire overloading*
- *Poor wear*
- *Poor handling*
- *Poor fuel economy*

*If your tires have too much air (overinflation), you can get the following:*

- *Unusual wear*
- *Poor handling*
- *Rough ride*
- *Needless damage from road hazards.*

## When to Check

Check your tires once a month or more.

## How to Check

Use a good quality pocket-type gauge to check tire pressure. You cannot tell if your tires are properly inflated simply by looking at them. Radial tires may look properly inflated even when underinflated.

### **NOTICE**

*If the reading you receive with the gauge seems questionable, use another gauge to verify the reading.*

Be sure to put the valve caps back on the valve stems. They help prevent leaks by keeping out dirt and moisture.

## Tire Inspection and Rotation

Tires should be rotated every 6,000 to 8,000 miles (10 000 to 13 000 km). Any time you notice unusual wear, rotate your tires as soon as possible and verify correct air pressure, wheel balance, and wheel alignment. Also check for damaged tires or wheels. See “When It’s Time for New Tires” and “Wheel Replacement” later in this section for more information. If your vehicle has dual rear wheels, also see “Dual Tire Operation” later in this section.

The purpose of regular rotation is to achieve more uniform wear for all tires on the vehicle. The first rotation is the most important. See “Maintenance - Part A: Scheduled Maintenance Services” in the Index for scheduled rotation intervals.

If your vehicle has single rear wheels, always use one of the correct rotation patterns shown on the next page when rotating your tires.

## Same Load Range and Tread Pattern

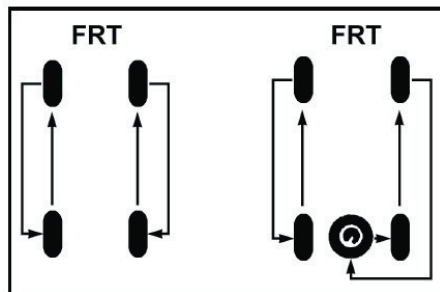
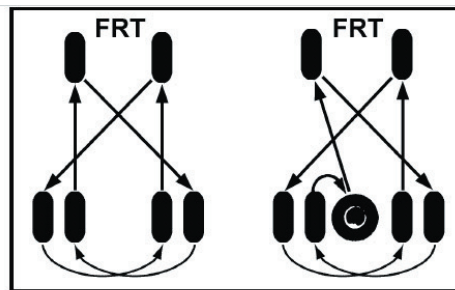
### Front and Rear

If your vehicle is equipped with dual rear wheels, always use one of the correct rotation patterns shown here when rotating your tires.

When you install dual wheels, be sure the vent holes in the inner and outer wheels on each side are lined up.

*Note: If your vehicle has aluminum wheels you cannot follow the “crossing -pattern” of tire rotation. Seek the advice of your authorized Workhorse dealer on the proper care of your tires.*

After the tires have been rotated, adjust the front and rear inflation pressures as shown on the Certification/ Tire Label. Make certain that all wheel nuts are properly tightened using the correct sequence. See “Wheel Nut Torque” in the Index.





## CAUTION

*Rust or dirt on wheels, or on the parts to which they are fastened, can make wheel nuts become loose after time. The wheel could come off and cause an accident. When you change a wheel, remove any rust or dirt from places where the wheel attaches to the vehicle. In an emergency, you can use a cloth or a paper towel to do this; but be sure to use a scraper or wire brush later, if you need to, to get all the rust or dirt off. (See “Changing a Flat Tire” in the Index.)*

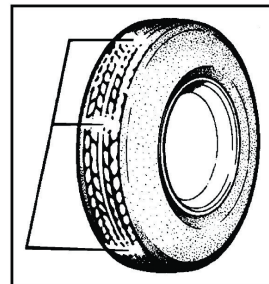
## When It Is Time For New Tires

One way to tell when it is time for new tires is to check the tread wear indicators, which will appear when your tires have only 1/16 inch (1.6 mm) or less of tread remaining.

Some commercial truck tires may not have tread wear indicators. Some larger tires, such as 19.5 or 22.5 inch tires, do not have tread wear indicators.

You need a new tire if any of the following statements are true:

- You can see the indicators at three or more places around the tire.
- You can see cord or fabric showing through the tire's rubber.
- The tread or sidewall is cracked, cut or snagged deep enough to show cord or fabric.
- The tire has a bump, bulge or split.
- The tire has a puncture, cut or other damage that cannot be repaired well because of the size or location of the damage.





## Dual Tire Operation

When the vehicle is new, or whenever a wheel, wheel bolt or wheel nut is replaced, check the wheel nut torque after 100, 1,000 and 6,000 miles (160, 1 600 and 10 000 km) of driving. For proper torque, see “Wheel Nut Torque” in the Index.

The outer and inner tire on a dual wheel set up will wear differently. Your tires will wear more evenly and last longer if you rotate the tires periodically. If you’re going to be doing a lot of driving on high-crown roads, you can reduce tire wear by adding 5 psi (35 kPa) to the tire pressure in the outer tires. Be sure to return to the recommended pressures when no longer driving under those conditions. See “Changing a Flat Tire” in the Index for more information.



## CAUTION

*If you operate your vehicle with a tire that is badly underinflated, the tire can overheat. An overheated tire may lose air suddenly or catch fire. You or others may be injured. Be sure all tires (including the spare, if any) are properly inflated.*

## Buying New Tires

To find out what kind and size of tires you need, look at the Certification/Tire Label.

The tires installed on your vehicle when it was new may have had a Tire Performance Criteria Specification (TPC Spec) number on each tire’s sidewall. When you get new tires, get ones with that same TPC Spec number. That way your vehicle will continue to have tires that are designed to give proper endurance, handling, speed rating, traction, ride, and other things during normal service on your vehicle. If your tires have an all-season tread design, the TPC number will be followed by an “MS” (for mud and snow).

If you ever replace your tires with those not having a TPC Spec number, make sure they are the same size, load range, speed rating, and construction type (bias, bias-belted, or radial) as your original tires.



## CAUTION

*Mixing tires may cause you to lose control while driving. If you mix tires of different sizes or types (bias, bias-belted, or radial), the vehicle may not handle properly, and you may have a crash. Using tires of different sizes may also cause damage to your vehicle. Be sure to use the same size and type tires on all wheels.*



## CAUTION

*If you use bias-ply tires on your vehicle, the wheel rim flanges could develop cracks after many miles of driving. A tire and/or wheel could fail suddenly, causing a crash. Use only radial-ply tires with the wheels on your vehicle.*

## Wheel Alignment and Tire Balance

The wheels/tires on your vehicle were aligned and balanced carefully at the factory to give you the longest possible tire life and best overall performance.

Scheduled wheel alignment and wheel balancing are not needed. However, if you notice unusual tire wear or your vehicle pulling one way or the other, the alignment may need to be reset. If you notice your vehicle vibrating when driving on a smooth road, your wheels may need to be rebalanced.

## Wheel Replacement

Replace any wheel that is bent, cracked, or badly rusted or corroded. If wheel nuts keep coming loose, the wheel, wheel bolts, and wheel nuts should be replaced. If the wheel leaks air, replace it (except some aluminum wheels, which can sometimes be repaired). See your dealer if any of these conditions exist.

Your dealer will know the type of wheel you need.

Each new wheel should have the same load-carrying capacity, diameter, width, offset and must be mounted the same way as the one it replaces.

If you need to replace any of your wheels, wheel bolts, or wheel nuts, replace them only with new original equipment parts. This way, you will be sure to have the right wheel, wheel bolts and wheel nuts for your vehicle.



## CAUTION

*Using the wrong replacement wheels, wheel bolts, or wheel nuts on your vehicle can be dangerous. It could affect the braking and handling of your vehicle, make your tires lose air and make you lose control. You could have a collision in which you or others could be injured. Always use the correct wheel, wheel bolts, and wheel nuts for replacement.*

## NOTICE

*Using the wrong wheel can also cause problems with bearing life, brake cooling, speedometer or odometer calibration, headlamp aim, bumper height, vehicle ground clearance, and tire or tire chain clearance to the body and chassis.*

Whenever a wheel, wheel bolt, or wheel nut is replaced on a dual wheel setup, check the wheel nut torque after 100, 1,000 and 6,000 miles (160, 1 600 and 10 000 km) of driving. For proper torque, see "Wheel Nut Torque" in the Index.

See “Changing a Flat Tire” in the Index for more information.

## Used Replacement Wheels



### CAUTION

*Putting a used wheel on your vehicle is dangerous. You may not know how it has been used or how far it has been driven. It could fail suddenly and cause an accident. If you have to replace a wheel, use a new original equipment wheel.*

## Tire Chains

### NOTICE

*Use tire chains only where legal and only when you must. Use chains that are the proper size for your tires. Install them on the tires of the rear axle. Tighten them as tightly as possible with the ends securely fastened.*

*Drive slowly and follow the chain manufacturer's instructions. If you can hear the chains contacting your vehicle, stop and retighten them. If the contact continues, slow down until it stops. Driving too fast or spinning the wheels with chains on will damage your vehicle.*

Before using any tire chains, check with your body manufacturer to be sure there is enough clearance between the tires and the wheel well.

## Cleaning Tires

To clean your tires, use a stiff brush with a tire cleaner.

### NOTICE

*When applying a tire dressing always take care to wipe off any overspray or splash from all painted surfaces on the body or wheels of the vehicle. Petroleum-based products may damage the paint finish and tires.*

## UNDERBODY MAINTENANCE

Chemicals used for ice and snow removal and dust control can collect on the underbody. If these are not removed, accelerated corrosion (rust) can occur on the underbody parts such as fuel lines, frame, floor pan, and exhaust system even though they have corrosion protection.

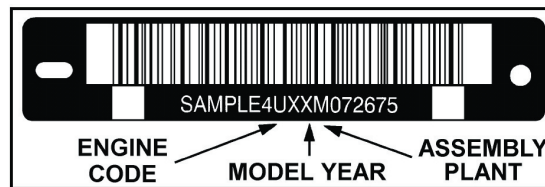
At least every spring, flush these materials from the underbody with plain water. Clean any areas where mud and other debris can collect. Dirt packed in closed areas of the frame should be loosened before being flushed. Your Workhorse dealer or an underbody vehicle washing system can do this for you.

### NOTICE

*Allow the vehicle to properly air dry after the flushing procedure has been completed. This is particularly important before storage.*

## VEHICLE IDENTIFICATION NUMBER (VIN)

This is the legal identifier for your vehicle. It appears on the radiator support panel. The VIN also appears on the Vehicle Certification and Service Parts Labels and the certificates of title and registration.



## ENGINE IDENTIFICATION

The 8th character in your VIN is the engine code. This code will help you identify your engine, specifications and replacement parts.

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## SERVICE PARTS IDENTIFICATION LABEL

You will find this label somewhere on your vehicle — final label location is determined by the body manufacturer. However, a good place to look for the label is on the right front inside hood or engine access panel. It is very helpful if you ever need to order parts. On this label is:

- Your VIN
- The model designation
- A list of all production options and special equipment

### **NOTICE**

*Be sure that this label is not removed from the vehicle.*

## ELECTRICAL SYSTEM

### Add-On Electrical Equipment

### **NOTICE**

*Do not add anything electrical to your vehicle unless you check with your dealer first. Some electrical equipment can damage your vehicle and the damage may not be covered by your warranty. Some add-on electrical equipment may keep other components from working as they were designed.*

## Fuses and Circuit Breakers

The wiring circuits in your vehicle are protected from short circuits by a combination of fuses, circuit breakers and fusible thermal links in the wiring itself. This greatly reduces the chance of fires caused by electrical problems.

### Fuse Block

The fuse block is mounted by the body manufacturer.

You can remove fuses with a fuse extractor.

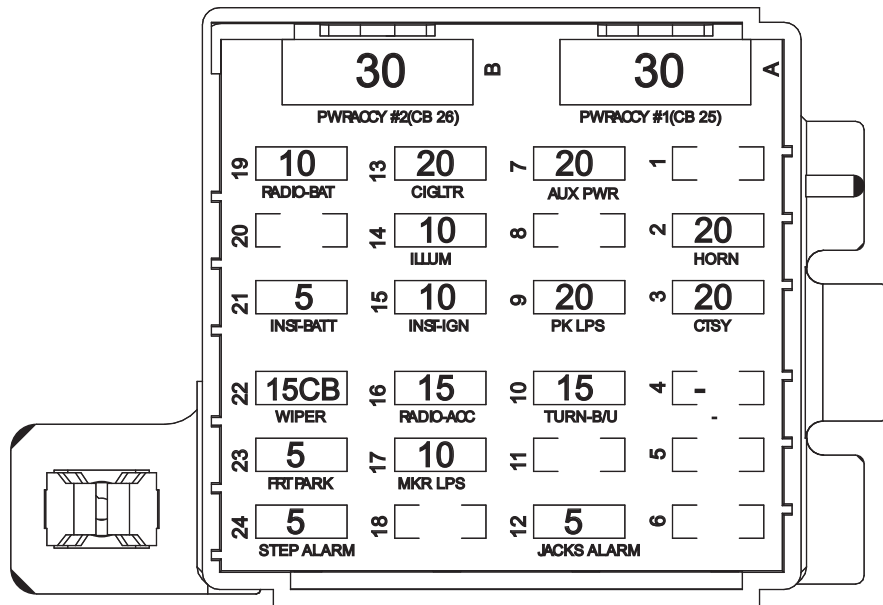
Be sure to use the correct fuse. If you ever have a problem on the road and do not have a spare fuse, you can borrow one of the correct value. Just pick a feature of your vehicle that you can get along without using and borrow its fuse. Replace it as soon as you can. See “Fuses and Circuit Breakers” in this section.



## CAUTION

*Manually apply parking brake and turn off your ignition before removing any fuses or relays from your vehicle.*

## W16/W18 Series Chassis Internal Fuse Block

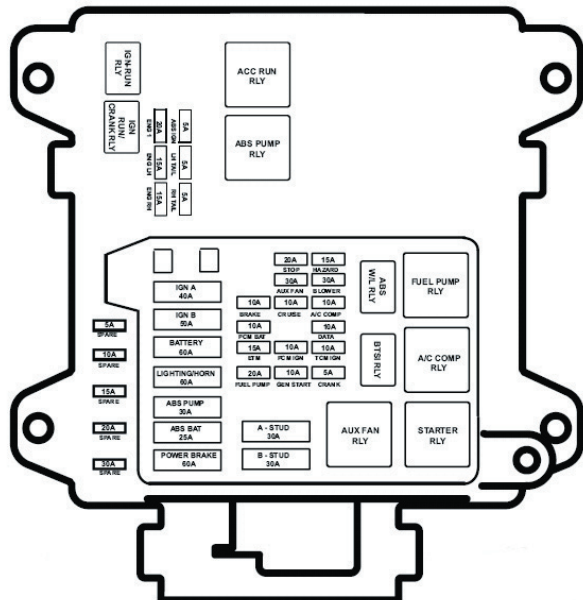




| W16/W18 Series Chassis Internal Fuse Block |             |      |  |
|--|-------------|------|--|
| POS  | Name        | AMP  | Circuits Protected   |
| 1  | OPEN        | —    | —  |
| 2  | HORN        | 20 A | Horn Relay   |
| 3  | CTSY        | 20 A | Dome & Courtesy Lamps<br>(Body Builder)                            |
| 4  | OPEN        | —    | —  |
| 5  | OPEN        | —    | —  |
| 6  | OPEN        | —    | —  |
| 7  | AUX PWR     | 20 A | Body Builder   |
| 8  | OPEN        | —    | —  |
| 9  | PK LPS      | 20 A | Headlamp Switch (Park,<br>Marker, & Tail Lamps)                    |
| 10   | TURN-B/U    | 15 A | Turn Signal Switch, Park/<br>Neutral Position & B/U<br>Lamp Switch |
| 11   | OPEN        | —    | —  |
| 12   | JACKS ALARM | 5 A  | Body Builder Jacks Alarm   |
| 13   | CIG LTR     | 20 A | Body Builder Cigarette<br>Lighter                                  |

| POS | Name        | AMP          | Circuits Protected                                     |
|-----|-------------|--------------|--|
| 14  | ILLUM       | 10 A         | Instrument Panel Cluster,<br>Audio Alarm, Body Builder |
| 15  | INST-IGN    | 10 A         | DRL Relay, DRL Control<br>Module, Cluster              |
| 16  | RADIO ACC   | 15 A         | Body Builder Radio                                     |
| 17  | MKR LPS     | 10 A         | Body Builder Marker<br>Lamps                           |
| 18  | OPEN        | —            | —  |
| 19  | RADIO BAT   | 10 A         | Body Builder Radio                                     |
| 20  | OPEN        | —            | —  |
| 21  | INST BAT    | 5 A          | Cluster & Tire Pressure<br>Monitor                     |
| 22  | WIPER       | 15 A<br>BRKR | Body Builder Wiper                                     |
| 23  | FRT PARK    | 5 A          | Front Park Lamps                                       |
| 24  | STEP ALARM  | 5 A          | Body Builder Step Alarm                                |
| 25  | PWR ACCY #1 | 30 A<br>BRKR | Body Builder   |
| 26  | PWR ACCY #2 | 30 A<br>BRKR | Body Builder   |

### W16/W18 Series Chassis Underhood Fuse Block (Without Auto-Apply Park Brake)

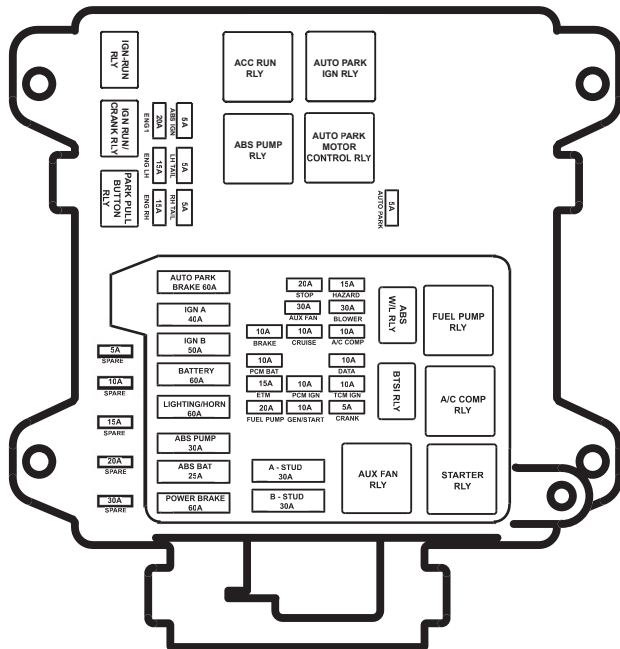


| W16/W18 Series Chassis Underhood Fuse Block (Without Auto-Apply Park Brake) |      |   |
|---|------|---|
| Name  | AMP  | Circuits Protected  |
| LIGHTING \<br>HORN  | 60 A | IP Extension Fuse Block, Headlamp Switch                    |
| IGN A   | 40 A | Ignition Switch, Starter Relay, Ignition Run/Crank Relay    |
| IGN B   | 50 A | Ignition Switch, Ignition Run/ACC Relay, Ignition Run Relay |
| ABS BAT   | 25 A | ABS Module  |
| POWER<br>BRAKE  | 60 A | Power Brake Relay   |
| ABS PUMP  | 30 A | ABS Pump Relay  |
| BATTERY   | 60 A | Stop & Hazard Fuses   |
| BLOWER  | 30 A | HVAC Blower (Body Builder)                                  |
| ABS IGN   | 5 A  | ABS Module  |
| PCM BAT   | 10 A | Powertrain Control Module                                   |
| AUX FAN   | 30 A | HVAC Auxiliary Fan Relay                                    |
| STOP  | 20 A | Brake Lamp Switch   |
| HAZARD  | 15 A | Hazard Flasher Relay  |

| <b>W16/W18 Series Chassis Underhood Fuse Block<br/>(Without Auto-Apply Park Brake)</b> |            |  |
|--|------------|--|
| <b>Name</b>  | <b>AMP</b> | <b>Circuits Protected</b>                        |
| ENG RH   | 15 A       | Cylinder 2,4,6,8 Injectors and Coils             |
| ENG LH   | 15 A       | Cylinder 1,3,5,7 Injectors and Coils             |
| PCM IGN  | 10 A       | Powertrain Control Module                        |
| TCM IGN  | 10 A       | Transmission Ignition Supply                     |
| ENG-1  | 20 A       | Purge Valve Solenoids, Oxygen Sensors            |
| ALT/START  | 10 A       | Generator, ABS Relay, A/C Comp Relay             |
| A/C CMPR   | 10 A       | A/C Compressor Relay                             |
| BRAKE  | 10 A       | Brake Lamp Switch                                |
| CRUISE   | 10 A       | Cruise Control Switch                            |
| FUEL PUMP  | 20 A       | Fuel Pump Relay                                  |
| ETM  | 15 A       | Electronic Throttle Module, Mass Air Flow Sensor |
| CRANK  | 5 A        | Starter Relay Coil                               |
| LH TAIL  | 5 A        | LH Tail Lamps                                    |

| <b>W16/W18 Series Chassis Underhood Fuse Block<br/>(Without Auto-Apply Park Brake)</b> |            |                                    |
|--|------------|------------------------------------|
| <b>Name</b>  | <b>AMP</b> | <b>Circuits Protected</b>          |
| RH Tail  | 5 A        | RH Tail Lamps                      |
| DATA   | 10 A       | Diagnostic Connectors Power Supply |
| B STUD   | 30 A       | Body Builder                       |
| A STUD   | 30 A       | Body Builder                       |

### W18 Series Chassis Underhood Fuse Block (With Auto-Apply Park Brake)

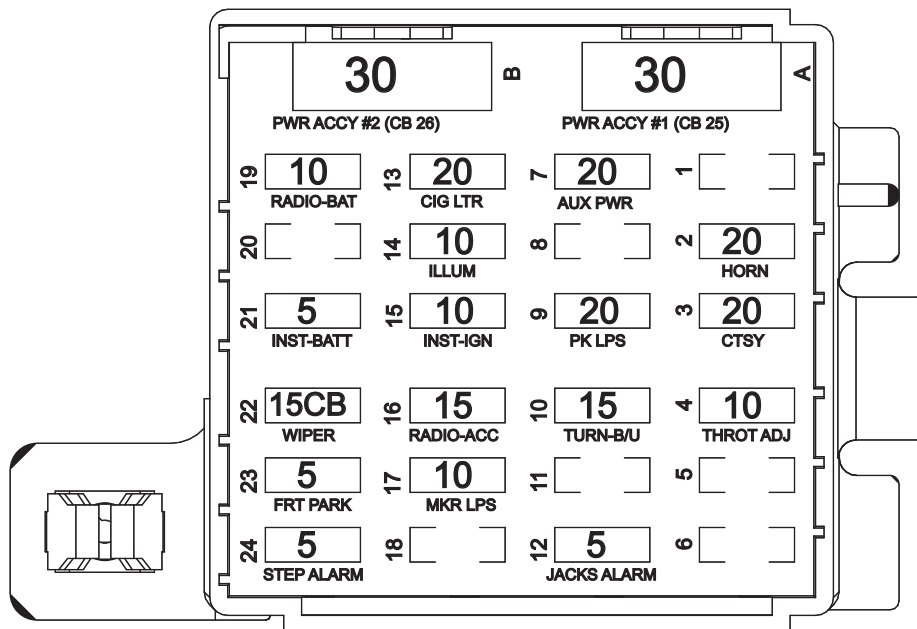


| W18 Series Chassis Underhood Fuse Block (With Auto-Apply Park Brake) |      |   |
|--|------|---|
| Name   | AMP  | Circuits Protected  |
| AUTO PARK  | 5 A  | Auto Apply Control Module                                   |
| LIGHTING \ HORN  | 60 A | IP Extension Fuse Block, Headlamp Switch                    |
| IGN A  | 40 A | Ignition Switch, Starter Relay, Ignition Run/Crank Relay    |
| IGN B  | 50 A | Ignition Switch, Ignition Run/ACC Relay, Ignition Run Relay |
| ABS BAT  | 25 A | ABS Module  |
| POWER BRAKE  | 60 A | Power Brake Relay   |
| ABS PUMP   | 30 A | ABS Pump Relay  |
| AUTO PARK BRK  | 60 A | Auto Apply Relays (Auto Apply Motor)                        |
| BATTERY  | 60 A | Stop & Hazard Fuses   |
| BLOWER   | 30 A | HVAC Blower (Body Builder)                                  |
| ABS IGN  | 5 A  | ABS Module  |
| PCM BAT  | 10 A | Powertrain Control Module                                   |
| AUX FAN  | 30 A | HVAC Auxiliary Fan Relay                                    |

| <b>W18 Series Chassis Underhood Fuse Block<br/>(With Auto-Apply Park Brake)</b> |            |   |
|---|------------|---|
| <b>Name</b>   | <b>AMP</b> | <b>Circuits Protected</b>                               |
| STOP  | 20 A       | Brake Lamp Switch                                       |
| HAZARD  | 15 A       | Hazard Flasher Relay                                    |
| ENG RH  | 15 A       | Cylinder 2,4,6,8 Injectors and Coils                    |
| ENG LH  | 15 A       | Cylinder 1,3,5,7 Injectors and Coils                    |
| PCM IGN   | 10 A       | Powertrain Control Module                               |
| TCM IGN   | 10 A       | Transmission Ignition Supply                            |
| ENG-1   | 20 A       | Purge Valve Solenoids, Oxygen Sensors                   |
| ALT/START   | 10 A       | Generator, ABS Relay, A/C Comp Relay, Auto-Apply Relays |
| A/C CMPR  | 10 A       | A/C Compressor Relay                                    |
| BRAKE   | 10 A       | Brake Lamp Switch                                       |
| CRUISE  | 10 A       | Cruise Control Switch                                   |
| FUEL PMP  | 20 A       | Fuel Pump Relay   |
| ETM   | 15 A       | Electronic Throttle Module, Mass Air Flow Sensor        |

| <b>W18 Series Chassis Underhood Fuse Block<br/>(With Auto-Apply Park Brake)</b> |            |                                    |
|---|------------|------------------------------------|
| <b>Name</b>   | <b>AMP</b> | <b>Circuits Protected</b>          |
| CRANK   | 5 A        | Starter Relay Coil                 |
| LH TAIL   | 5 A        | LH Tail Lamps                      |
| RH TAIL   | 5 A        | RH Tail Lamps                      |
| DATA  | 10 A       | Diagnostic Connectors Power Supply |
| B STUD  | 30 A       | Body Builder                       |
| A STUD  | 30 A       | Body Builder                       |

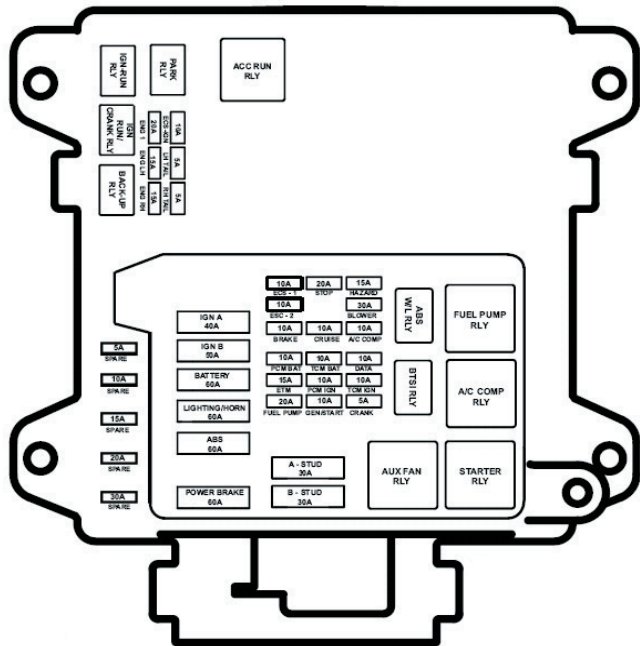
## W20/W21/W22 Series Chassis Internal Fuse Block



| W20/W21/W21 Series Chassis Internal Fuse Block |              |      |  |
|--|--------------|------|--|
| POS  | Name         | AMP  | Circuits Protected   |
| 1  | OPEN         | —    | —  |
| 2  | HORN         | 20 A | Horn Relay   |
| 3  | CTSY         | 20 A | Dome & Courtesy Lamps  |
| 4  | THROTTLE ADJ | 10 A | Adjustable Throttle Motor  |
| 5  | OPEN         | —    | —  |
| 6  | OPEN         | —    | —  |
| 7  | AUX PWR      | 20 A | Body Builder   |
| 8  | OPEN         | —    | —  |
| 9  | PK LPS       | 20 A | Headlamp Switch (Park, Marker, and Tail Lamps)                     |
| 10   | TURN-B/U     | 15 A | Turn Signal Switch, Park and Reverse Relays                        |
| 11   | OPEN         | —    | —  |
| 12   | JACKS ALARM  | 5 A  | Body Builder Jacks Alarm   |
| 13   | CIG LTR      | 20 A | Cigarette Lighter  |
| 14   | ILLUM        | 10 A | Instrument Panel Cluster, Body Builder Feed, Backlighting Switches |

| POS | Name        | AMP          | Circuits Protected   |
|-----|-------------|--------------|--|
| 15  | INST-IGN    | 10 A         | DRL Relay, DRL Control Module, Cluster, Grade Brake Switch |
| 16  | RADIO-ACC   | 15 A         | Body Builder Radio   |
| 17  | MKR LPS     | 10 A         | License Lamps, Body Builder Marker Lamps                   |
| 18  | OPEN        | —            | —  |
| 19  | RADIO-BATT  | 10 A         | Body Builder Radio   |
| 20  | OPEN        | —            | —  |
| 21  | INST-BATT   | 5 A          | Cluster, Check Tire  |
| 22  | WIPER       | 15 A<br>BRKR | Body Builder Wipers  |
| 23  | FRT PARK    | 5 A          | Front Park Lamps   |
| 24  | STEP ALARM  | 5 A          | Body Builder Step Alarm                                    |
| 25  | PWR ACCY #1 | 30 A<br>BRKR | Body Builder   |
| 26  | PWR ACCY #2 | 30 A<br>BRKR | Body Builder   |

## W20/W21/W22 Series Chassis Underhood Fuse Block



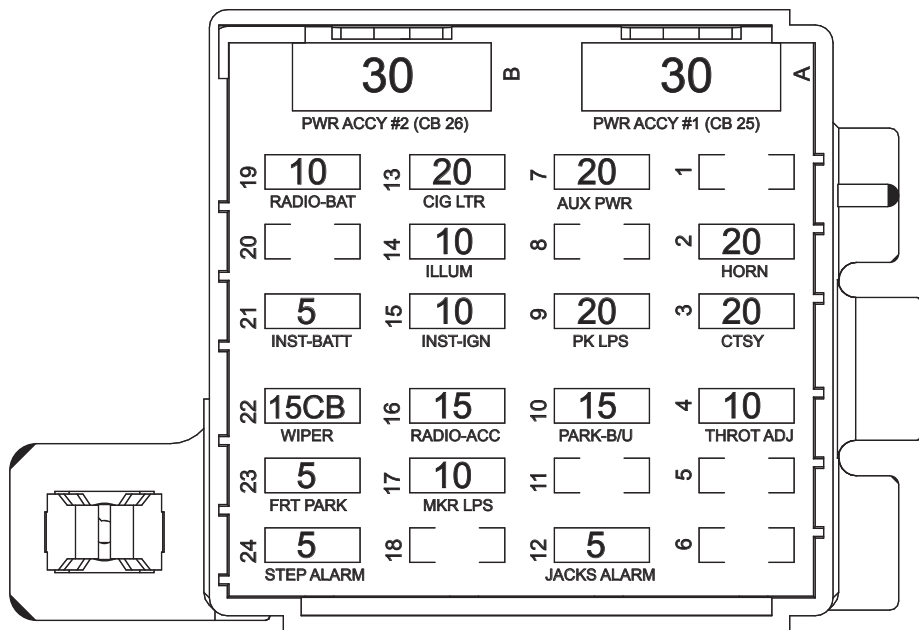
| W20/W21/W22 Series Chassis<br>Underhood Fuse Block |      |  |
|--|------|--|
| Name   | AMP  | Circuits Protected                         |
| PCM BAT  | 10 A | Powertrain Control Module                  |
| TCM BAT  | 10 A | Transmission Control Module                |
| STOP   | 20 A | Brake Switch                               |
| HAZARD   | 15 A | Turn Signal Switch                         |
| ENG RH   | 15 A | Cylinder 2,4,6,8 Injectors and Coils       |
| ENG LH   | 15 A | Cylinder 1,3,5,7 Injectors and Coils       |
| PCM IGN  | 10 A | Powertrain Control Module                  |
| TCM IGN  | 10 A | Transmission Control Module                |
| ENG-1  | 20 A | EVAP Canister Solenoid, Oxygen Sensors     |
| ALT/START  | 10 A | Generator, ABS Relay, A/C Compressor Relay |
| ECS-1  | 10 A | Electronic Shifter Keypad                  |
| ECS-2  | 10 A | Electronic Shifter Keypad                  |
| ECS - IGN  | 10 A | Electronic Shifter Keypad                  |



| <b>W20/W21/W22 Series Chassis<br/>Underhood Fuse Block</b> |            |  |
|--|------------|--|
| <b>Name</b>  | <b>AMP</b> | <b>Circuits Protected</b>                                |
| ETM  | 15 A       | Electronic Throttle Module, Mass Air Flow Sensor         |
| FUEL PUMP  | 20 A       | Fuel Pump Relay  |
| CRUISE   | 10 A       | Cruise Control Switch                                    |
| BLOWER   | 30 A       | HVAC Blower (Body Builder)                               |
| A/C COMP   | 10 A       | A/C Compressor Relay                                     |
| DATA   | 10 A       | Data Link  |
| CRANK  | 5 A        | Starter Relay Coil                                       |
| BRAKE  | 10 A       | ABS Module, Brake Switch                                 |
| LH TAIL  | 5 A        | LH Tail Lamps  |
| RH TAIL  | 5 A        | RH Tail Lamps  |
| IGN A  | 40 A       | Ignition Switch, Starter Relay, Ignition Run/Crank Relay |
| IGN B  | 50 A       | Ign Switch, Ignition Run/ACC Relay, Ignition Run Relay   |
| BATTERY  | 60 A       | IP extension Fuse Block Fuses                            |

| <b>W20/W21/W22 Series Chassis<br/>Underhood Fuse Block</b> |            |  |
|--|------------|--|
| <b>Name</b>  | <b>AMP</b> | <b>Circuits Protected</b>                          |
| LIGHTING/<br>HORN  | 60 A       | Horn, CTSY Fuse, Park Lamps Fuse, Head Lamp Switch |
| ABS  | 60 A       | ABS Module   |
| PWR BRAKE  | 60 A       | Power Brake  |
| A STUD   | 30 A       | Body Builder                                       |
| B STUD   | 30 A       | Body Builder                                       |

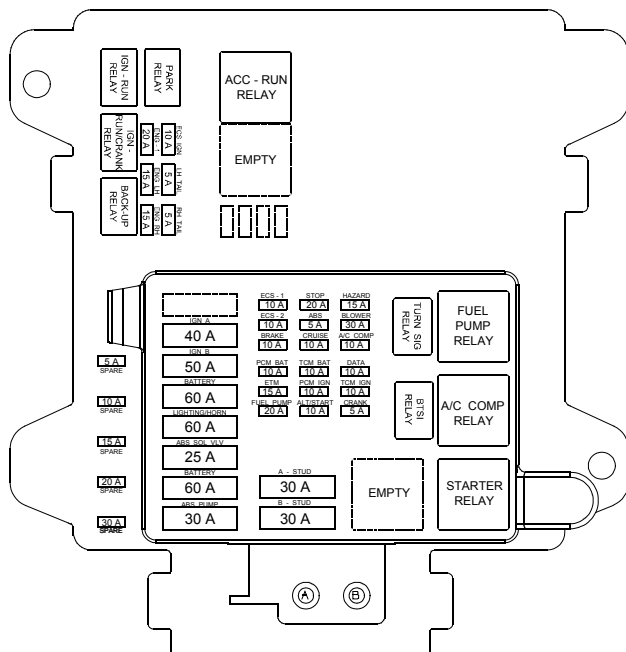
## W24/W25 Series Chassis Interior Fuse Block



| W24/W25 Series Chassis Internal Fuse Block |             |      |  |
|--|-------------|------|--|
| POS  | Name        | AMP  | Circuits Protected                             |
| 1  | OPEN        | —    | —  |
| 2  | HORN        | 20 A | Horn Relay                                     |
| 3  | CTSY        | 20 A | Dome & Courtesy Lamps (Body Builder)           |
| 4  | THROT-ADJ   | 10 A | Adjustable Pedals                              |
| 5  | OPEN        | —    | —  |
| 6  | OPEN        | —    | —  |
| 7  | AUX PWR     | 20 A | Body Builder                                   |
| 8  | OPEN        | —    | —  |
| 9  | PK LPS      | 20 A | Headlamp Switch (Park, Marker, and Tail Lamps) |
| 10   | PARK-B/U    | 15 A | Park/Neutral Position & Back-Up Lamp Relay     |
| 11   | OPEN        | —    | —  |
| 12   | JACKS ALARM | 5 A  | Body Builder Jacks Alarm                       |
| 13   | CIG LTR     | 20 A | Cigarette Lighter (Body Builder)               |

| POS | Name        | AMP          | Circuits Protected   |
|-----|-------------|--------------|--|
| 14  | ILLUM       | 10 A         | Instrument Panel Cluster, Body Builder Feed, Backlighting Switches |
| 15  | INST-IGN    | 10 A         | DRL Relay, DRL Control Module, Cluster, Grade Brake Switch         |
| 16  | RADIO-ACC   | 15 A         | Body Builder Radio   |
| 17  | MKR LPS     | 10 A         | License Lamps, Body Builder Marker Lamps                           |
| 18  | OPEN        | —            | —  |
| 19  | RADIO-BAT   | 10 A         | Body Builder Radio   |
| 20  | OPEN        | —            | —  |
| 21  | INST-BAT    | 5 A          | Cluster, Check Tire  |
| 22  | WIPER       | 15 A<br>BRKR | Body Builder Wiper   |
| 23  | FRT PARK    | 5 A          | Front Park Lamps   |
| 24  | STEP ALARM  | 5 A          | Body Builder Step Alarm  |
| 25  | PWR ACCY #1 | 30 A<br>BRKR | Body Builder   |
| 26  | PWR ACCY #2 | 30 A<br>BRKR | Body Builder   |

## W24/W25 Series Chassis Underhood Fuse Block



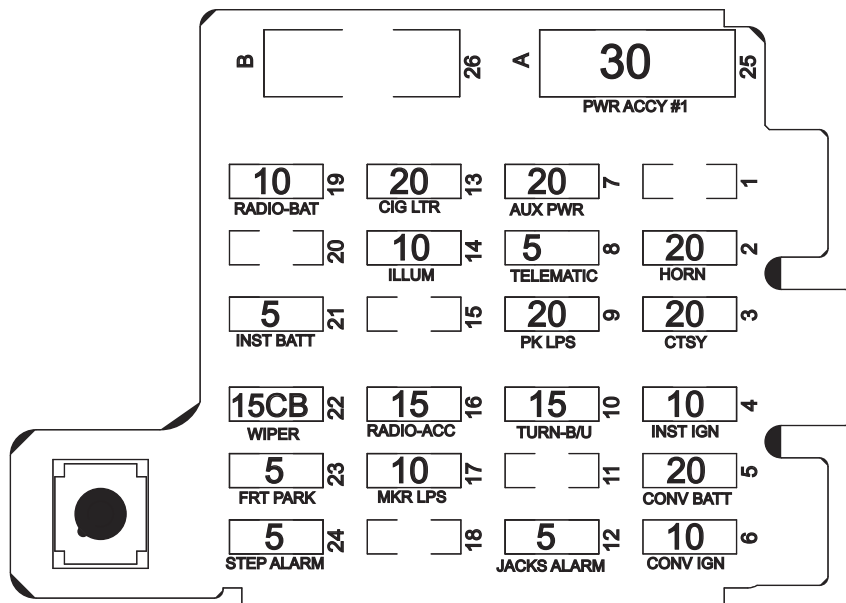
W24/W25 Series Chassis Underhood Fuse Block

| Name      | AMP  | Circuits Protected                     |
|-----------|------|--|
| PCM BAT   | 10 A | Powertrain Control Module              |
| TCM BAT   | 10 A | Transmission Control Module            |
| STOP      | 20 A | Brake Switch                           |
| HAZARD    | 15 A | Turn Signal Switch                     |
| ENG RH    | 15 A | Cylinder 2,4,6,8 Injectors and Coils   |
| ENG LH    | 15 A | Cylinder 1,3,5,7 Injectors and Coils   |
| PCM IGN   | 10 A | Powertrain Control Module              |
| TCM IGN   | 10 A | Transmission Control Module            |
| ENG-1     | 20 A | EVAP Canister Solenoid, Oxygen Sensors |
| ALT/START | 10 A | Generator, ABS Relay, A/C Comp Relay   |
| A/C CMPR  | 10 A | A/C Compressor Relay                   |
| BRAKE     | 10 A | ABS Module, Brake Switch               |
| CRUISE    | 10 A | Cruise Control Switch                  |

| <b>W24/W25 Series Chassis<br/>Underhood Fuse Block</b> |            |  |
|--|------------|--|
| <b>Name</b>  | <b>AMP</b> | <b>Circuits Protected</b>                                      |
| FUEL PMP   | 20 A       | Fuel Pump Relay  |
| ETM  | 15 A       | Electronic Throttle Module, Mass Air Flow Sensor               |
| CRANK  | 5 A        | Starter Relay Coil   |
| LH TAIL  | 5 A        | LH Tail Lamps  |
| RH TAIL  | 5 A        | RH Tail Lamps  |
| DATA   | 10 A       | Data Link  |
| B STUD   | 30 A       | Body Builder   |
| A STUD   | 30 A       | Body Builder   |
| ECS-IGN  | 5 A        | Electronic Shifter Key Pad                                     |
| LIGHTING/<br>HORN                                      | 60 A       | Horn, CTSY Fuse, Park Lamps Fuse, Headlamp Switch              |
| IGN A  | 40 A       | Ignition Switch, Starter Relay, Run/<br>Crank Relay            |
| IGN B  | 50 A       | Ignition Switch, Ignition Run/ACC<br>Relay, Ignition Run Relay |
| ABS PUMP   | 30 A       | ABS Pump Relay, ABS Module                                     |

| <b>W24/W25 Series Chassis<br/>Underhood Fuse Block</b> |            |   |
|--|------------|---|
| <b>Name</b>  | <b>AMP</b> | <b>Circuits Protected</b>                                   |
| ECS 1  | 10 A       | Electronic Shifter Keypad                                   |
| ECS 2  | 10 A       | Electronic Shifter Keypad                                   |
| BATTERY  | 60 A       | IP Extension Fuse Block Fuses,<br>Stop, Hazard, & ECS Fuses |
| BLOWER   | 30 A       | HVAC Blower (Body Builder)                                  |
| ABS  | 5 A        | ABS Module  |
| ABS SOL VLV  | 25 A       | ABS Module  |

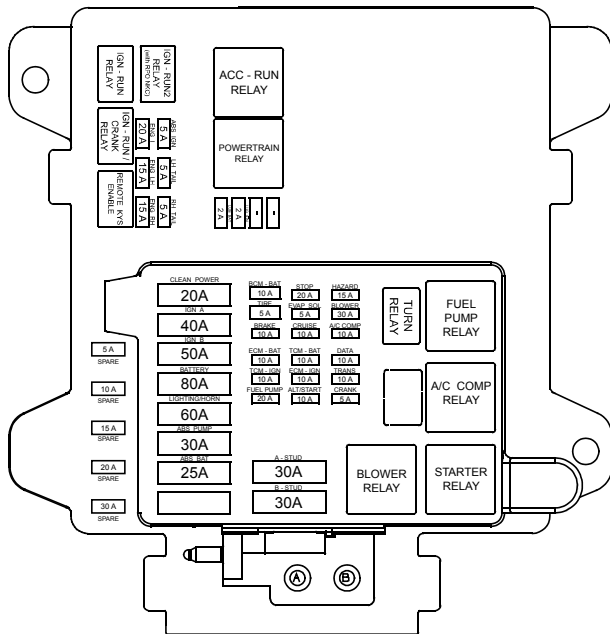
## W42 Series Chassis Internal Fuse Block (L6I Diesel and LY2/LY6 Gas)



| W42 Series Chassis - L6I Diesel and LY2/LY6 Gas |               |      |   |
|---|---------------|------|---|
| POS   | Name          | AMP  | Circuits Protected  |
| 1   | OPEN          | —    | —   |
| 2   | HORN          | 20 A | Horn Relay  |
| 3   | CTSY          | 20 A | Dome & Courtesy Lamps                                       |
| 4   | INST IGN      | 10 A | DRL Relay, DRL Control Module, Cluster, Audio Alarm         |
| 5   | CONV BATT     | 20 A | CONV BATT Body Builder                                      |
| 6   | CONV IGN      | 10 A | CONV IGN Body Builder                                       |
| 7   | AUX PWR       | 20 A | Body Builder  |
| 8   | TELEMATIC SYS | 5 A  | Body Builder  |
| 9   | PK LAMPS      | 20 A | Headlamp Switch (Park, Marker & Tail Lamps)                 |
| 10  | TURN-B/U      | 15 A | Turn Signal Switch, Park/Neutral Posn & Back Up Lamp Switch |
| 11  | OPEN          | —    | —   |
| 12  | JACKS ALARM   | 5 A  | Jacks Alarm   |
| 13  | CIG LTR       | 20 A | Cigarette Lighter   |

| POS | Name        | AMP          | Circuits Protected                     |
|-----|-------------|--------------|--|
| 14  | ILLUM       | 10 A         | I/P Cluster, Audio Alarm               |
| 15  | OPEN        | —            | —                                      |
| 16  | RADIO - ACC | 15 A         | Body Builder – Radio                   |
| 17  | MKR LPS     | 10 A         | License Lamps, Marker Lamps            |
| 18  | OPEN        | —            | —                                      |
| 19  | RADIO BAT   | 5 A          | Body Builder Radio                     |
| 20  | OPEN        | —            | —                                      |
| 21  | INST BAT    | 5 A          | Cluster & Tire Pressure Monitor Supply |
| 22  | WIPER       | 15 A<br>BRKR | Body Builder Wiper                     |
| 23  | FRT PARK    | 5 A          | Front Park Lamps                       |
| 24  | STEP ALARM  | 5 A          | Step Alarm                             |
| 25  | PWR ACCY #1 | 30 A         | Body Builder                           |
| 26  | OPEN        | —            | —                                      |

## W42 Series Chassis Underhood Fuse Block (LY2/LY6 Engines)



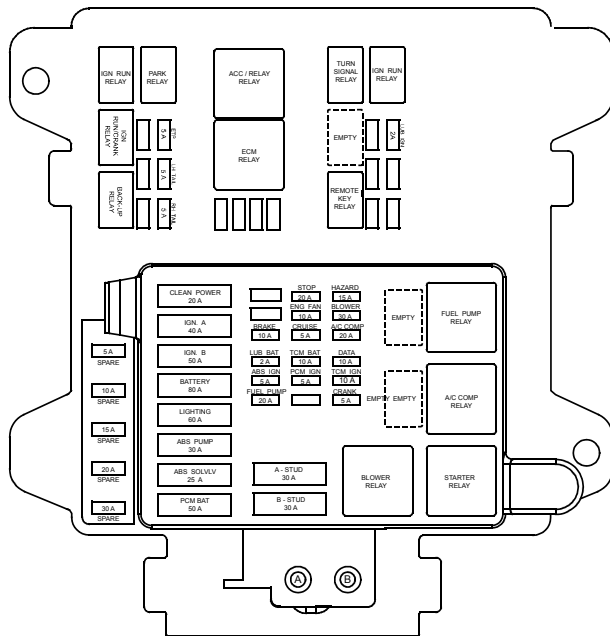
| W42 Series Chassis Underhood Fuse Block (LY2/LY6 Engine) |      |                                       |
|--|------|---------------------------------------|
| Name   | AMP  | Circuits Protected                    |
| PCM BAT  | 10 A | Powertrain Control Module             |
| BLOWER   | 30 A | HVAC Auxiliary Fan Relay              |
| STOP   | 20 A | Brake Lamp Switch                     |
| HAZARD   | 15 A | Hazard Flasher Relay                  |
| ENG RH   | 15 A | Cylinder 2,4,6,8 Injectors and Coils  |
| ENG LH   | 15 A | Cylinder 1,3,5,7 Injectors and Coils  |
| PCM IGN  | 10 A | Powertrain Control Module             |
| TCM IGN  | 10 A | Transmission Ignition Supply          |
| ENG-1  | 20 A | Purge Valve Solenoids, Oxygen Sensors |
| ALT/START  | 10 A | Generator, ABS Relay, A/C Comp Relay  |
| A/C CMPR   | 20 A | A/C Compressor Relay                  |
| BRAKE  | 10 A | Brake Lamp Switch                     |
| CRUISE   | 10 A | Cruise Control Switch                 |



| <b>W42 Series Chassis<br/>Underhood Fuse Block (LY2/LY6 Engine)</b> |            |  |
|---|------------|--|
| <b>Name</b>   | <b>AMP</b> | <b>Circuits Protected</b>                                      |
| FUEL PMP  | 20 A       | Fuel Pump Relay  |
| CRANK   | 5 A        | Starter Relay Coil   |
| LH TAIL   | 5 A        | LH Tail Lamps  |
| RH TAIL   | 5 A        | RH Tail Lamps  |
| DATA  | 10 A       | Diagnostic Connectors Power Supply                             |
| B STUD  | 30 A       | Body Builder   |
| A STUD  | 30 A       | Body Builder   |
| LIGHTING/<br>HORN   | 60 A       | IP Extension Fuse Block,<br>Headlamp Switch                    |
| IGN A   | 40 A       | Ignition Switch, Starter Relay                                 |
| IGN B   | 50 A       | Ignition Switch, Ignition Run/ACC<br>Relay, Ignition Run Relay |
| ABS BAT   | 25 A       | ABS Module   |
| CLEAN POWER   | 20 A       | Body Builder   |
| ABS PUMP  | 30 A       | ABS Pump Relay   |
| BATTERY   | 80 A       | Stop & Hazard Fuses  |

| <b>W42 Series Chassis<br/>Underhood Fuse Block (LY2/LY6 Engine)</b> |            |                           |
|---|------------|---------------------------|
| <b>Name</b>   | <b>AMP</b> | <b>Circuits Protected</b> |
| ABS IGN   | 5 A        | ABS Module                |
| EVAP SOL  | 5 A        | EVAP System Solenoid      |
| TRANS   | 10 A       | Transmission              |
| BCM-BAT   | 10 A       | Body Control Module       |
| TIRE  | 5 A        | Tire Monitoring System    |
| LUB BAT   | 2 A        | Lubrication System        |
| LUB IGN   | 2 A        | Lubrication System        |

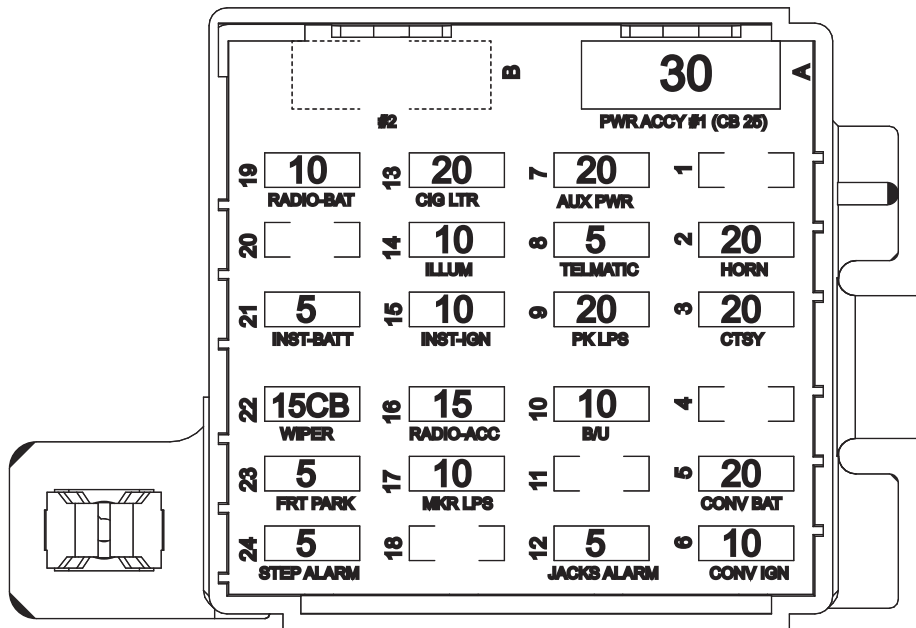
## W42 Series Chassis Underhood Fuse Block (L6I Diesel Engine)



| W42 Series Chassis Underhood Fuse Block (L6I Diesel Engine) |      |                              |
|---|------|------------------------------|
| Name  | AMP  | Circuits Protected           |
| PCM BAT   | 50 A | Powertrain Control Module    |
| ENG FAN   | 10 A | Engine Fan Clutch            |
| STOP  | 20 A | Brake Lamp Switch            |
| HAZARD  | 15 A | Hazard Flasher Relay         |
| PCM IGN   | 5 A  | Powertrain Control Module    |
| TCM IGN   | 10 A | Transmission Ignition Supply |
| A/C CMPR  | 10 A | A/C Compressor Relay         |
| BRAKE   | 10 A | Brake Lamp Switch            |
| CRUISE  | 5 A  | Cruise Control Switch        |
| FUEL PUMP   | 20 A | Fuel Pump Relay              |
| CLEAN POWER   | 20 A | Body Builder                 |
| TCM BAT   | 10 A | Transmission Control Module  |
| ETP   | 5 A  | ETP Circuit                  |
| CRANK   | 5 A  | Starter Relay Coil           |
| LH TAIL   | 5 A  | LH Tail Lamps                |
| RH TAIL   | 5 A  | RH Tail Lamps                |

| <b>W42 Series Chassis<br/>Underhood Fuse Block (L6I Diesel Engine)</b> |            |   |
|--|------------|---|
| <b>Name</b>  | <b>AMP</b> | <b>Circuits Protected</b>                                   |
| DATA   | 10 A       | Diagnostic Connectors Power Supply                          |
| A STUD   | 30 A       | Body Builder  |
| B STUD   | 30 A       | Body Builder  |
| LIGHTING   | 60 A       | IP Extension Fuse Block, Headlamp Switch                    |
| IGN A  | 40 A       | Ignition Switch, Starter Relay                              |
| IGN B  | 50 A       | Ignition Switch, Ignition Run/ACC Relay, Ignition Run Relay |
| ABS PUMP   | 30 A       | ABS Pump Relay  |
| BATTERY  | 80 A       | Stop & Hazard Fuses   |
| BLOWER   | 30 A       | HVAC Blower (Body Builder)                                  |
| ABS IGN  | 5 A        | ABS Module  |
| LUB BAT  | 2 A        | Lubrication System  |
| ABS SOL VLV  | 25 A       | ABS Module  |

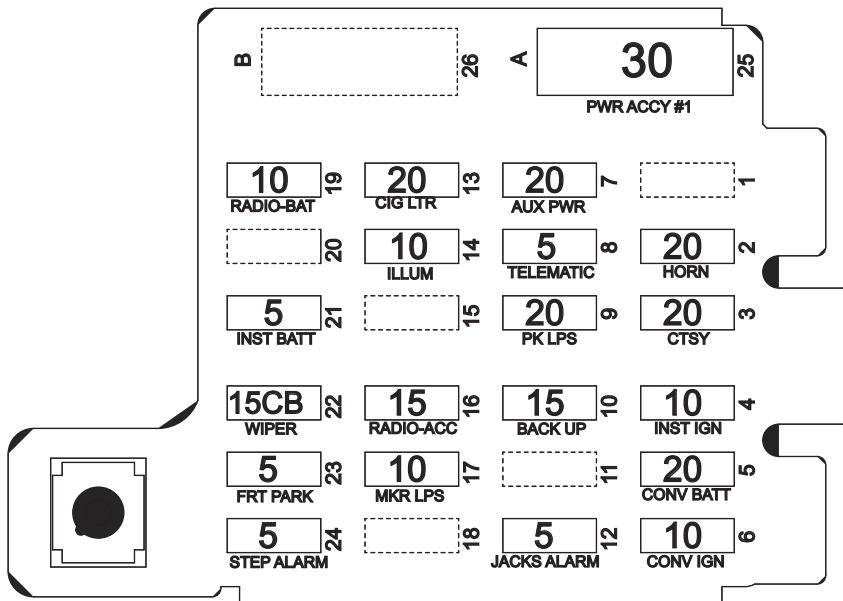
## W62 Series Chassis Interior Fuse Block (L18 Engine)



| W62 Internal Fuse Block - L18 Gas Engine |             |      |  |
|--|-------------|------|--|
| POS                                      | Name        | AMP  | Circuits Protected                           |
| 1  | OPEN        | —    | —  |
| 2  | HORN        | 20 A | Horn Relay                                   |
| 3  | CTSY        | 20 A | Body Builder – Dome & Courtesy Lamps         |
| 4  | OPEN        | —    | —  |
| 5  | CONV BATT   | 20 A | Body Builder – Conv. Battery Supply          |
| 6  | CONV IGN    | 10 A | Body Builder – Conv. Ignition Supply         |
| 7  | AUX PWR     | 20 A | Body Builder                                 |
| 8  | TELEMATIC   | 5 A  | Body Builder Telematic Sys                   |
| 9  | PK LAMPS    | 20 A | Headlamp Switch (Park, Marker, & Tail Lamps) |
| 10                                       | B/U         | 10 A | Park/Neutral Position & Back Up Lamps Switch |
| 11                                       | OPEN        | —    | —  |
| 12                                       | JACKS ALARM | 5 A  | Jack Alarm                                   |

| POS | Name        | AMP          | Circuits Protected                                |
|-----|-------------|--------------|---|
| 13  | CIG LTR     | 20 A         | Cigarette Lighter                                 |
| 14  | ILLUM       | 10 A         | I/P Cluster, Audio Alarm, Body Builder Feed       |
| 15  | INST IGN    | 10 A         | DRL Relay, DRL Control Module, Instrument Cluster |
| 16  | RADIO ACC   | 15 A         | Body Builder – Radio                              |
| 17  | MKR LPS     | 10 A         | Body Builder - License Lamps, Marker Lamps        |
| 18  | OPEN        | —            | —   |
| 19  | RADIO BATT  | 10 A         | Body Builder Radio                                |
| 20  | OPEN        | —            | —   |
| 21  | INST BATT   | 5 A          | Cluster, Check Tire                               |
| 22  | WIPER       | 15 A<br>BRKR | Body Builder Wiper                                |
| 23  | FRT PARK    | 5 A          | Front Park Lamps                                  |
| 24  | STEP ALARM  | 5 A          | Step Alarm  |
| 25  | PWR ACCY #1 | 30 A<br>BRKR | Body Builder                                      |
| 26  | OPEN        | —            | —   |

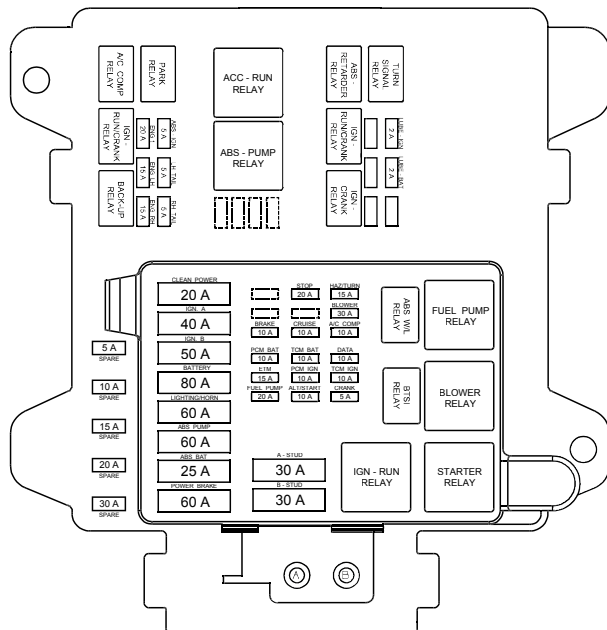
## W62 Series Chassis Interior Fuse Block (L6I Engine)



| <b>W62 Series Chassis Interior Fuse Block - L6I Diesel Engine</b> |             |            |   |
|---|-------------|------------|---|
| <b>POS</b>  | <b>Name</b> | <b>AMP</b> | <b>Circuits Protected</b>                                       |
| 1   | OPEN        | —          | —   |
| 2   | HORN        | 20 A       | Horn Relay  |
| 3   | CTSY        | 20 A       | Body Builder - Dome & Courtesy Lamps                            |
| 4   | INST IGN    | 10 A       | DRL Relay, DRL Control Module, Cluster, Audio Alarm             |
| 5   | CONV BATT   | 20 A       | Body Builder - Conv Batt  |
| 6   | CONV IGN    | 10 A       | Body Builder - Conv Ign   |
| 7   | AUX PWR     | 20 A       | Body Builder  |
| 8   | TELEMATIC   | 5 A        | Telematic System  |
| 9   | PK LPS      | 20 A       | Headlamp Switch (Park, Marker, and Tail Lamps)                  |
| 10  | BACK UP     | 15 A       | Turn Signal Switch, Park/Neutral Position & Back-Up Lamp Switch |
| 11  | OPEN        | —          | —   |
| 12  | JACKS ALARM | 5 A        | Jacks Alarm   |

| <b>POS</b> | <b>Name</b> | <b>AMP</b> | <b>Circuits Protected</b>                      |
|------------|-------------|------------|--|
| 13         | CIG LTR     | 20 A       | Body Builder - Cigarette Lighter               |
| 14         | ILLUM       | 10 A       | I/P Cluster, Audio Alarm, Body Builder Feed    |
| 15         | OPEN        | —          | —  |
| 16         | RADIO ACC   | 15 A       | Body Builder - Radio                           |
| 17         | MKR LPS     | 10 A       | Body Builder - License Lamps, Marker Lamps     |
| 18         | OPEN        | —          | —  |
| 19         | RADIO BAT   | 10 A       | Body Builder - Radio                           |
| 20         | OPEN        | —          | —  |
| 21         | INST BATT   | 5 A        | Cluster & Tire Pressure Monitor Battery Supply |
| 22         | WIPER       | 15 A BRKR  | Body Builder - Wipers                          |
| 23         | FRT PARK    | 5 A        | Front Park Lamps                               |
| 24         | STEP ALARM  | 5 A        | Step Alarm                                     |
| 25         | PWR ACCY #1 | 30 A       | Body Builder                                   |
| 26         | OPEN        | —          | —  |

## W62 Series Chassis Underhood Fuse Block (L18 Engine)



**W62 Series Chassis (L18)  
Underhood Fuse Block**

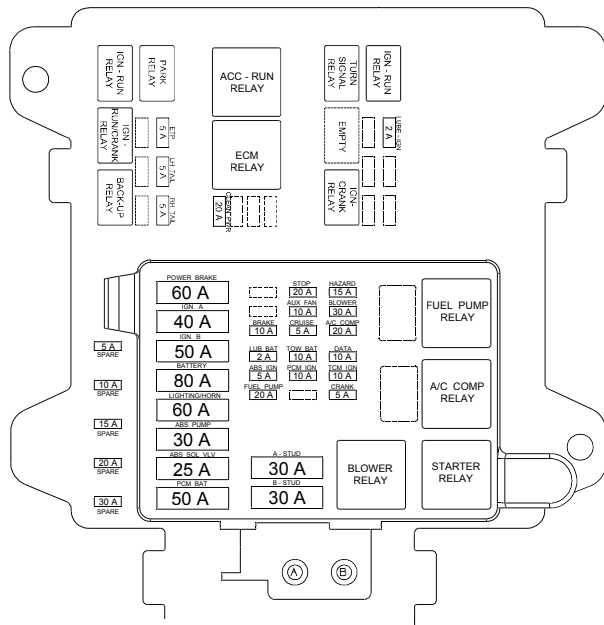
| Name      | AMP  | Circuits Protected                               |
|-----------|------|--|
| PCM BAT   | 10 A | Powertrain Control Module                        |
| TCM BAT   | 10 A | Transmission Control Module                      |
| STOP      | 20 A | Brake Switch                                     |
| HAZ/TURN  | 15 A | Turn Signal Switch                               |
| ENG RH    | 15 A | Cylinder 2,4,6,8 Injectors and Coils             |
| ENG LH    | 15 A | Cylinder 1,3,5,7 Injectors and Coils             |
| PCM IGN   | 10 A | Powertrain Control Module                        |
| TCM IGN   | 10 A | Transmission Control Module                      |
| ENG-1     | 20 A | EVAP Canister Solenoid, Oxygen Sensors           |
| GEN/START | 10 A | Generator, ABS Relay, A/C Comp Relay             |
| BRAKE     | 10 A | ABS Module, Brake Switch                         |
| FUEL PMP  | 20 A | Fuel Pump Relay                                  |
| ETM       | 15 A | Electronic Throttle Module, Mass Air Flow Sensor |



| <b>W62 Series Chassis (L18)<br/>Underhood Fuse Block</b> |            |  |
|--|------------|--|
| <b>Name</b>  | <b>AMP</b> | <b>Circuits Protected</b>                                      |
| CRANK  | 5 A        | Starter Relay Coil   |
| CLEAN POWER  | 20 A       | Body Builder   |
| BLOWER   | 30 A       | Body Builder   |
| LH TAIL  | 5 A        | LH Tail Lamps  |
| RH TAIL  | 5 A        | RH Tail Lamps  |
| DATA   | 10 A       | Data Link  |
| B STUD   | 30 A       | Body Builder   |
| A STUD   | 30 A       | Body Builder   |
| LIGHTING/<br>HORN  | 60 A       | Horn, CTSY Fuse, Park Lamps<br>Fuse, Headlamp Switch           |
| IGN A  | 40 A       | Ignition Switch, Starter Relay, Run/<br>Crank Relay            |
| IGN B  | 50 A       | Ignition Switch, Ignition Run/ACC<br>Relay, Ignition Run Relay |
| ABS BAT  | 25 A       | ABS Module   |
| POWER<br>BRAKE   | 60 A       | Power Brake Relay  |

| <b>W62 Series Chassis (L18)<br/>Underhood Fuse Block</b> |            |   |
|--|------------|---|
| <b>Name</b>  | <b>AMP</b> | <b>Circuits Protected</b>                                   |
| ABS PUMP   | 60 A       | ABS Pump Relay, ABS Module                                  |
| LUBE-BAT   | 2 A        | Lubrication System  |
| LUBE-IGN   | 2 A        | Lubrication System  |
| BATTERY  | 80 A       | IP Extension Fuse Block Fuses,<br>Stop, Hazard, & ECS Fuses |
| ABS IGN  | 5 A        | ABS Module  |
| CRUISE   | 15 A       | Cruise Control  |
| A/C COMP   | 15 A       | A/C Compressor Relay  |

## W62 Series Chassis Underhood Fuse Block (L6I Engine)



| W62 Series Chassis (L6I)<br>Underhood Fuse Block |      |                             |
|--|------|-----------------------------|
| Name   | AMP  | Circuits Protected          |
| PCM BAT  | 50 A | Powertrain Control Module   |
| TCM BAT  | 10 A | Transmission Control Module |
| STOP   | 20 A | Brake Switch                |
| HAZ/TURN   | 15 A | Turn Signal Switch          |
| PCM IGN  | 10 A | Powertrain Control Module   |
| TCM IGN  | 10 A | Transmission Control Module |
| BRAKE  | 10 A | ABS Module, Brake Switch    |
| FUEL PMP   | 20 A | Fuel Pump Relay             |
| ETP  | 5 A  | Throttle Control Module     |
| CRANK  | 5 A  | Starter Relay Coil          |
| CLEAN POWER                                      | 20 A | Body Builder                |
| BLOWER   | 30 A | Body Builder                |
| LH TAIL  | 5 A  | LH Tail Lamps               |
| RH TAIL  | 5 A  | RH Tail Lamps               |
| DATA   | 10 A | Data Link                   |
| B STUD   | 30 A | Body Builder                |

| <b>W62 Series Chassis (L6I)<br/>Underhood Fuse Block</b> |            |  |
|--|------------|--|
| <b>Name</b>  | <b>AMP</b> | <b>Circuits Protected</b>                                      |
| A STUD   | 30 A       | Body Builder   |
| LIGHTING/<br>HORN  | 60 A       | Horn, CTSY Fuse, Park Lamps<br>Fuse, Headlamp Switch           |
| IGN A  | 40 A       | Ignition Switch, Starter Relay, Run/<br>Crank Relay            |
| IGN B  | 50 A       | Ignition Switch, Ignition Run/ACC<br>Relay, Ignition Run Relay |
| POWER<br>BRAKE   | 60 A       | Power Brake Relay  |
| ABS PUMP   | 30 A       | ABS Pump Relay, ABS Module                                     |
| LUBE-BAT   | 2 A        | Lubrication System   |
| LUBE-IGN   | 2 A        | Lubrication System   |
| BATTERY  | 80 A       | IP Extension Fuse Block Fuses,<br>Stop, Hazard, & ECS Fuses    |
| ABS IGN  | 5 A        | ABS Module   |
| AUX FAN  | 10 A       | Cooling Fan  |
| CRUISE   | 5 A        | Cruise Control Switch  |
| A/C COMP   | 20 A       | A/C Compressor Relay   |

| <b>W62 Series Chassis (L6I)<br/>Underhood Fuse Block</b> |            |                           |
|--|------------|---------------------------|
| <b>Name</b>  | <b>AMP</b> | <b>Circuits Protected</b> |
| ABS SOL VLV  | 25 A       | ABS Control Module        |

## CAPACITIES AND SPECIFICATIONS

These specifications are for informational purposes only. If you have any questions, see the Service Manual for more detailed chassis information or refer to the body manufacturer's publications for body specific information.

### Engine Identification - Gasoline Engines

| Engine Type                     | 4.8L  | 6.0L  | 8.1L  |
|---------------------------------|-------|-------|-------|
| VIN Code                        | 8     | 7     | G     |
| Fuel System                     | SPFI* | SPFI* | SPFI* |
| *Sequential Port Fuel injection |       |       |       |

### Engine Identification - Diesel Engines

|             |   |
|-------------|---|
| Engine Type | 4.5L V6 MaxxForce™ 5                          |
| VIN Code    | 5   |
| Fuel System | Electro-Hydraulic Fuel Injection Turbocharged |

## Crankcase Capacity

| Engine                          | Quarts (Liters) |
|---------------------------------|-----------------|
| 4.5L                            | 15.0 (14.0)     |
| 4.8L                            | 5.0 (4.7)       |
| 6.0L                            | 5.0 (4.7)       |
| 8.1L                            | 6.4 (6.0)       |
| All quantities are approximate. |                 |

### NOTICE

*After refill, the level MUST be checked. (See "Checking Engine Oil" in the Index.)*

## Fuel Tank Capacity

| Series                                   | Gallons (Liters) |
|--|------------------|
| <b>Commercial</b>                        |                  |
| • Standard W42 Series                    | 40 (151)         |
| • Standard W62 Series                    | 40 (151)         |
| <b>W16/18 Series Motor Home</b>          |                  |
| • 158" Wheel Base                        | 60 (227)         |
| • 178", 190", 208", 228" Wheel Base      | 75 (284)         |
| <b>W20/W22/W24/W25 Series Motor Home</b> |                  |
| • Standard                               | 75 (284)         |
| All above quantities are approximate.    |                  |

## Cooling System Capacity

| Engine | Quarts (Liters) |
|--------|-----------------|
| 4.5L   | 20.0 (18.9)     |
| 4.8L   | 24.7 (23.4)     |
| 6.0L   | 24.7 (23.4)     |
| 8.1L   | 23.5 (22.2)     |

### NOTICE

*All quantities are approximate. After refill, the level MUST be checked. (See "Engine Cooling System" in the Index.)*

## Allison™ Transmission Fluid Capacity

|                  | Quarts (Liters) |
|------------------|-----------------|
| Standard Oil Pan | 15.0 (14.0)     |
| Dry              | 19.0 (18.0)     |

**NOTICE**

Full system capacity (dry) includes the capacity of the torque converter, transmission cooler lines, and transmission oil cooler. Transmission oil pan/filter service (fluid only) quantity is 9.0 quarts (8.5-9.0 liters).

All quantities are approximate.

**NOTICE**

After refill, the level **MUST** be checked. (See “Automatic Transmission Fluid” in the Index.)

After a transmission fluid service, the fluid level must be checked several times on a flat level surface to ensure the proper level.

Make sure the transmission is shifted through all of the gear ranges before checking the fluid level.

**Hydramatic® 4L80E/4L85E Fluid Capacity**

|                  | Quarts (Liters)                   |
|------------------|-----------------------------------|
| Standard Oil Pan | 7.7 (7.3)<br>(Oil pan removal)    |
| Dry              | 13.5 (12.8)<br>(Dry transmission) |

**NOTICE**

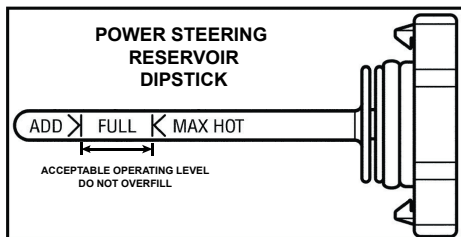
After refill, the fluid level **MUST** be checked. (See “Automatic Transmission Fluid” in the Index.)

After a transmission fluid service, the fluid level must be checked several times on a flat level surface to ensure the proper level.

## Power Steering System Capacity

### Power Steering Reservoir

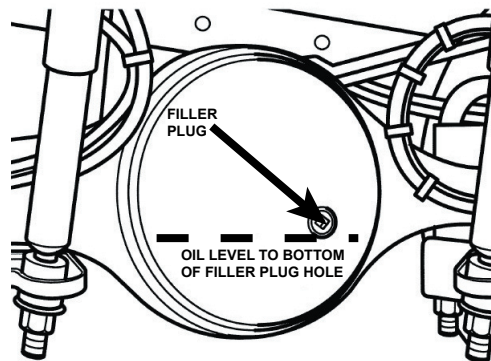
Fill to the "FULL" mark on the dipstick with the fluid at operating temperature. (Refer to "How to Check Power Steering Fluid" in this section for more information.)



## Rear Axle Capacity

### Rear Axle

Fill to the bottom edge of the filler plug hole.



## Brake Fluid Capacity

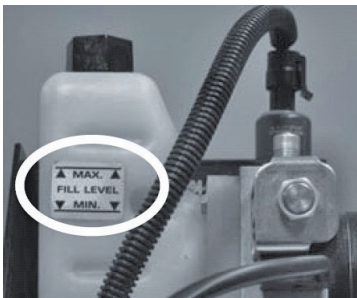
### Brake Master Cylinder Reservoir

Fill to the "FULL" mark with DOT 3 brake fluid.

## Park Brake Reservoir Fluid Capacity (W18 Only)

### Park Brake Reservoir

Fill the park brake reservoir to the "MAX" line with Dexron® VI automatic transmission fluid.



## Service Replacement Parts Recommendations

Replacement part numbers, listed in this section, are based on the latest information available at the time of printing and are subject to change. If a part listed in this manual is not the same as the part used in your vehicle when it was built, or if you have any questions, please contact your nearest Workhorse dealer for more information.



| Engine  | Displacement      |                     | Displacement      |                     | Displacement      |                     | Displacement     |
|---|-------------------|---------------------|-------------------|---------------------|-------------------|---------------------|------------------|
| Part  | 4.8 Liters (LY2)  |                     | 6.0 Liters (LY6)  |                     | 8.1 Liters (L18)  |                     | 4.5 Liters (L6I) |
|   | Workhorse Part #  | Manufacturer Part # | Workhorse Part #  | Manufacturer Part # | Workhorse Part #  | Manufacturer Part # | Workhorse Part # |
| Spark Plug                                      | W8800472          | 41-985              | W8800472          | 41-985              | W8000518          | 41-983              | N/A              |
| Gap   | .060"<br>(1.52mm) | —                   | .060"<br>(1.52mm) | —                   | .060"<br>(1.52mm) | —                   | N/A              |
| Oil Filter                                      | 89017524          | PF48                | 89017524          | PF48                | 25324052          | PF454               | W8003078         |
| Air Cleaner Filter                              | W8800481          | A1236C              | W8800481          | A1236C              | W8800481          | A1236C              | W8003079         |
| Fuel Filter                                     | W0010883          | N/A                 | W0010883          | N/A                 | W0010883          | N/A                 | W8003080         |
| Radiator Cap                                    | W8003081          | RC33                | W8003081          | RC33                | W8003081          | RC33                | W8003081         |
| Drive Belt                                      | W0002987          | K060935             | W0002987          | K060935             | W0000581          | 25-061080           | W0009741         |
| Allison™ Transmission Spin-on Filter — 29537268 |                   |                     |                   |                     |                   |                     |                  |

## WHEEL NUT TORQUE

Following the proper wheel torque and tightening sequence procedure is very important. Your wheels should be tightened using the sequence shown to the value shown on the following page.



### CAUTION

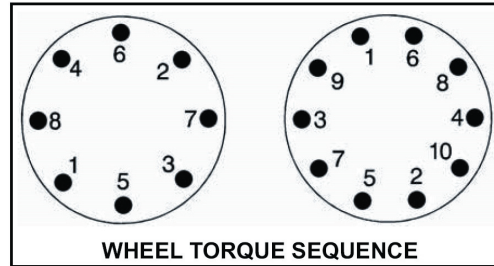
*Rust or dirt on the wheel, or on the parts to which it is fastened, can make the wheel nuts become loose after a time. The wheel could come off and cause an accident. When you change a wheel, remove any rust or dirt from the places where the wheel attaches to the vehicle. In an emergency, you can use a cloth or a paper towel to do this; but be sure to use a scraper or wire brush later, if you need to, to get all the rust or dirt off.*



### CAUTION

*Never use oil or grease on studs or nuts. If you do, the nuts might come loose. Your wheel could fall off, causing a serious accident.*

## Wheel Torque Values



| Series         | GVW Range<br>Lbs (kg)        | Number of Wheel<br>Bolts | Torque<br>lb ft (N•m) |
|----------------|------------------------------|--------------------------|-----------------------|
| W16 Motor Home | 16,000 (7,258)               | 10                       | 147 (200)             |
| W18 Motor Home | 18,000 (8,165)               | 10                       | 147 (200)             |
| W20 Motor Home | 20,700 (9,389)               | 8                        | 475 (644)             |
| W22 Motor Home | 22,000 (9,979)               | 8                        | 475 (644)             |
| W24 Motor Home | 24,000 (10,886)              | 8                        | 475 (644)             |
| W25 Motor Home | 25,500                       | 8                        | 475 (644)             |
| W42 Commercial | 9,400-14,500 (4,264-6,577)   | 10                       | 147 (200)             |
| W62 Commercial | 19,500-23,500 (8,845-10,659) | 8                        | 475 (644)             |

## Lamp and Bulb Data

Before replacing any bulbs, be sure that all lamps are off and the engine is not running.

We recommend that you use a Workhorse approved parts whenever you need to replace a bulb.

The exterior lamps are supplied by the body manufacturer. Consult the body manufacturer's information for the correct replacement lamp part number.

## AIR CONDITIONING REFRIGERANTS

If the air conditioning system in your vehicle needs refrigerant, be sure the proper refrigerant is used. The proper refrigerant for your vehicle is type R134a refrigerant.



### CAUTION

*Never use refrigerants other than type R134a in your air conditioning system.*

This section covers the maintenance required for your vehicle. Your vehicle needs these services to retain its safety, dependability, and emission control performance.

|   |     |  |     |
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## INTRODUCTION

### Your Vehicle and the Environment

Proper vehicle maintenance not only helps to keep your vehicle in good working order, but also helps the environment. All recommended maintenance procedures are important. Improper vehicle maintenance can even affect the quality of the air we breath. Improper fluid levels or the wrong tire inflation can increase the level of emissions from your vehicle. To help protect our environment, and to keep your vehicle in good condition, please maintain your vehicle properly.

#### **NOTICE**

*To help protect the environment, never dump or discard in the trash used engine oil or oil filters. Please return all used engine oil and oil filters to an approved collection center, gas station, or auto parts store.*



### HOW THIS SECTION IS ORGANIZED

This maintenance schedule is divided into five parts:

**Part A: Scheduled Maintenance Services** shows what to has to be done and how often. Some of these services can be complex, so unless you are technically qualified and have the necessary equipment, you should let your dealer's service department or another qualified service center perform these procedures.



## CAUTION

*Performing maintenance work on a vehicle can be dangerous. In attempting to perform these procedures, you could be seriously injured. Perform your own maintenance work only if you have the required knowhow, proper tools, and the equipment for the job. If you have any doubt, seek to have a qualified technician do the work.*

If you are skilled enough to perform work on your vehicle, you will need to obtain genuine Workhorse service information. (See “Ordering Service Publications” in the Index).

**Part B: Owner Checks and Services** tells you what should be checked and when. It also explains what you can easily do to help keep your vehicle in top operating condition.

**Part C: Periodic Maintenance Inspections** explains important inspections that your dealer’s service department or another qualified service center should perform.

**Part D: Recommended Fluids and Lubricants** lists some recommended products to help keep your vehicle properly maintained. These products, or their equivalents, should be used whether you perform the work yourself or have it done.

**Part E: Maintenance Record** provides a place for you to record the maintenance performed on your vehicle. Whenever any maintenance procedure is performed, be sure to write it down in this part. This will help you determine when your next maintenance procedure should be performed. In addition, it is a good idea to keep your maintenance receipts. They may be needed to qualify your vehicle for warranty repairs.

## **PART A: SCHEDULED MAINTENANCE SERVICES**

### **Using Your Maintenance Schedule**

We at Workhorse want to help you keep your vehicle in top operating condition. But, we cannot anticipate all of your driving habits. You may drive very short distances, long distances, in very hot, dusty weather, or in cold climates. Or, you may use your vehicle in making deliveries.

Because of the different ways people utilize their vehicles, maintenance requirements also vary. You may need more frequent inspections and service performed.

Please read the following and note your style of driving. If you have any questions on how to keep your vehicle in top condition, see your Workhorse dealer.

This section tells you the maintenance services you should have performed and when you should schedule them. If you utilize your dealer for your service needs, you will know that trained service people will perform the work using genuine Workhorse replacement parts.

The proper fluids and lubricants to use are listed in Part D, of this section. Make sure whoever services your vehicle uses the recommended fluids and lubricants.

All parts should be replaced and all necessary repairs performed before you or anyone else drives the vehicle.

These schedules are for vehicles which:

- Carry passengers and cargo within recommended limits. You will find these limits on your vehicle's Certification/Tire Label. (See "Loading Your Vehicle" in the Index).
- Are driven on reasonable road surfaces within legal driving limits.
- Use the recommended fuel.



## Selecting the Right Schedule

Gasoline engine vehicles and diesel engine vehicles have different maintenance requirements. If you have a diesel engine, follow the maintenance schedule in Section 7 of this manual.

### Gasoline Engines

Every 3,000 Miles (5 000 km): Engine Oil and Filter Change (or 3 months, whichever occurs first). Chassis Lubrication (or 3 months, whichever occurs first). Drive Axle Service (or 3 months, whichever occurs first).

After the First 5,000 Miles (8 000 km): Change the Allison™ transmission filter and top-off the fluid as required.

Every 6,000 Miles (10 000 km): Tire Rotation.

Every 15,000 Miles (25 000 km): Air Cleaner Filter Inspection, if driving in dusty conditions. Shields and Underhood Insulation Inspection.

Every 25,000 Miles (40 000 km): Change rear axle lubricant and fill to correct level.

Every 30,000 Miles (50 000 km): Air Cleaner Filter Replacement. Fuel Filter Replacement. Every 50,000 Miles (83 000 km): Automatic Transmission Service.

Every 60,000 Miles (100 000 km): Engine Accessory Drive Belt Inspection. Fuel Tank, Cap and Lines Inspection. Exhaust Gas Recirculation System Inspection. Evaporative Control System Inspection.

Every 100,000 Miles (166 000 km): Spark Plug Wire Inspection. Spark Plug Replacement.

Every 150,000 Miles (240 000 km): Cooling System Service (or every 60 months, whichever occurs first).

### NOTICE

*These intervals are only a summary of maintenance services. Be sure to follow the complete scheduled maintenance on the following pages.*

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## Footnotes

† The U.S. Environmental Protection Agency or the California Air Resources Board (CARB) has determined that the failure to perform this maintenance item will not nullify the emission warranty or limit recall liability prior to the completion of the vehicle's useful life. We, however, urge that all recommended maintenance services be performed at the indicated intervals and the maintenance be recorded.

# Lubricate the front suspension, kingpin bushings, steering linkage, automatic transmission shift linkage, parking brake cable guides, propshaft splines, universal joints, brake pedal springs, and front wheel bearings.

\* When the vehicle is operated in extreme dust and dirt conditions (off-road), the air cleaner filter may need to be checked as often as every 300 miles (500 km) and replaced as necessary.

+ A good time to check your brakes is during tire rotation. See "Brake System Inspection" under "Periodic Maintenance Inspections" in Part C of this schedule.

\*\* Drive axle service (see "Recommended Fluids and Lubricants" in the Index for proper the lubricant to use):

- More frequent lubrication may be required for heavy-duty use.
- Dana 70/80/S135 Series Axles— Check fluid level and add fluid as needed at every oil change. If driving in dusty, sandy, wet conditions, towing a trailer, storing the vehicle for periods of extended time (6 mos or greater) or using the vehicle for heavy vocational/commercial/RV purposes, change lubricant every 25,000 miles (40,000 km) or 6 months, (whichever occurs first).

## GASOLINE ENGINES

### 3,000 Miles (5 000 km)

- Change engine oil and filter (or every 3 months, whichever occurs first).
- An Emission Control Service.
- Lubricate chassis components (or every 3 months, whichever occurs first). (See footnote #.)
- Check axle fluid level and add fluid as needed. (See footnote \*\*)

| DATE           |              |
|----------------|--------------|
| ACTUAL MILEAGE | SERVICED BY: |
|                |              |

### 5,000 Miles (8 000 km)

- Change Allison™ transmission filter and top-off fluid.

| DATE           |              |
|----------------|--------------|
| ACTUAL MILEAGE | SERVICED BY: |
|                |              |

### 6,000 Miles (10 000 km)

- Change engine oil and filter (or every 3 months, whichever occurs first). An Emission Control Service.
- Lubricate chassis components (or every 3 months, whichever occurs first). (See footnote #.)
- Check axle fluid level and add fluid as needed. (See footnote \*\*.)
- Rotate tires. See “Tire Inspection and Rotation” in the Index for proper rotation pattern and additional information. (See footnote +.)

| DATE           |              |
|----------------|--------------|
| ACTUAL MILEAGE | SERVICED BY: |
|                |              |

**9,000 Miles (15 000 km)**

- Change engine oil and filter (or every 3 months, whichever occurs first). An Emission Control Service.
- Lubricate chassis components (or every 3 months, whichever occurs first). (See footnote #.)
- Check axle fluid level and add fluid as needed, (See footnote \*\*.)

| DATE           |              |
|----------------|--------------|
| ACTUAL MILEAGE | SERVICED BY: |
|                |              |

**12,000 Miles (20 000 km)**

- Change engine oil and filter (or every 3 months, whichever occurs first). An Emission Control Service.
- Lubricate chassis components (or every 3 months, whichever occurs first). (See footnote #.)
- Check axle fluid level and add fluid as needed. (See footnote \*\*.)
- Rotate tires. See "Tire Inspection and Rotation" in the Index for proper rotation pattern and additional information. (See footnote +.)

| DATE           |              |
|----------------|--------------|
| ACTUAL MILEAGE | SERVICED BY: |
|                |              |

### 15,000 Miles (25 000 km)

- Change engine oil and filter (or every 3 months, whichever occurs first). An Emission Control Service.
- Lubricate chassis components (or every 3 months, whichever occurs first). (See footnote #.)
- Inspect air cleaner filter if you are driving in dusty conditions. Replace filter if necessary. An Emission Control Service.
- Check axle fluid level and add fluid as needed. (See footnote \*\*.)
- Clean and repack the front wheel bearings (or at each brake relining, whichever occurs first).
- Inspect shields and underhood insulation for damage or looseness. Adjust or replace as required. This is a Noise Emission Control Service. Applicable only to vehicles sold in the United States.

| DATE           |              |
|----------------|--------------|
| ACTUAL MILEAGE | SERVICED BY: |
|                |              |

### 18,000 Miles (30 000 km)

- Change engine oil and filter (or every 3 months, whichever occurs first). An Emission Control Service.
- Lubricate chassis components (or every 3 months, whichever occurs first). (See footnote #.)
- Check axle fluid level and add fluid as needed. (See footnote \*\*.)
- Rotate tires. See "Tire Inspection and Rotation" in the Index for proper rotation pattern and additional information. (See footnote +.)

| DATE           |              |
|----------------|--------------|
| ACTUAL MILEAGE | SERVICED BY: |
|                |              |

**21,000 Miles (35 000 km)**

- Change engine oil and filter (or every 3 months, whichever occurs first). An Emission Control Service.
- Lubricate chassis components (or every 3 months, whichever occurs first). (See footnote #.)
- Check axle fluid level and add fluid as needed. (See footnote \*\*.)

| DATE           |              |
|----------------|--------------|
| ACTUAL MILEAGE | SERVICED BY: |
|                |              |

**24,000 Miles (40 000 km)**

- Change engine oil and filter (or every 3 months, whichever occurs first). An Emission Control Service.
- Lubricate chassis components (or every 3 months, whichever occurs first). (See footnote #.)
- Check axle fluid level and add fluid as needed. (See footnote \*\*.)
- Rotate tires. See "Tire Inspection and Rotation" in the Index for proper rotation pattern and additional information. (See footnote +.)

| DATE           |              |
|----------------|--------------|
| ACTUAL MILEAGE | SERVICED BY: |
|                |              |

**25,000 Miles (40 000 km)**

Change rear axle lubricant and fill to correct level (See footnote \*\*.)

| DATE           |              |
|----------------|--------------|
| ACTUAL MILEAGE | SERVICED BY: |
|                |              |

### 27,000 Miles (45 000 km)

- Change engine oil and filter (or every 3 months, whichever occurs first). An Emission Control Service.
- Lubricate chassis components (or every 3 months, whichever occurs first). (See footnote #.)
- Check axle fluid level and add fluid as needed. (See footnote \*\*.)

| DATE           |              |
|----------------|--------------|
| ACTUAL MILEAGE | SERVICED BY: |
|                |              |

### 30,000 Miles (50 000 km)

- Change engine oil and filter (or every 3 months, whichever occurs first). An Emission Control Service.
- Lubricate chassis components (or every 3 months, whichever occurs first). (See footnote #.)
- Check axle fluid level and add fluid as needed. (See footnote \*\*.)
- Clean and repack the front wheel bearings (or at each brake relining, whichever occurs first).
- Replace fuel filter. An Emission Control Service.
- Replace air cleaner filter. An Emission Control Service.
- Inspect shields and underhood insulation for damage or looseness. Adjust or replace as required. This is a Noise Emission Control Service. Applicable only to vehicles sold in the United States.
- Rotate tires. See "Tire Inspection and Rotation" in the Index for proper rotation pattern and additional information. (See footnote +.)

| DATE           |              |
|----------------|--------------|
| ACTUAL MILEAGE | SERVICED BY: |
|                |              |

**33,000 Miles (55 000 km)**

- Change engine oil and filter (or every 3 months, whichever occurs first). An Emission Control Service.
- Lubricate chassis components (or every 3 months, whichever occurs first). (See footnote #.)
- Check axle fluid level and add fluid as needed. (See footnote \*\*.)

| DATE           |              |
|----------------|--------------|
| ACTUAL MILEAGE | SERVICED BY: |
|                |              |

**36,000 Miles (60 000 km)**

- Change engine oil and filter (or every 3 months, whichever occurs first). An Emission Control Service.
- Lubricate chassis components (or every 3 months, whichever occurs first). (See footnote #.)
- Rotate tires. See "Tire Inspection and Rotation" in the Index for proper rotation pattern and additional information. (See footnote +.)
- Check axle fluid level and add fluid as needed. (See footnote \*\*.)

| DATE           |              |
|----------------|--------------|
| ACTUAL MILEAGE | SERVICED BY: |
|                |              |



### 39,000 Miles (65 000 km)

- Change engine oil and filter (or every 3 months, whichever occurs first). An Emission Control Service.
- Lubricate chassis components (or every 3 months, whichever occurs first). (See footnote #.)
- Check axle fluid level and add fluid as needed. (See footnote \*\*.)

| DATE           |              |
|----------------|--------------|
| ACTUAL MILEAGE | SERVICED BY: |
|                |              |

### 42,000 Miles (70 000 km)

- Change engine oil and filter (or every 3 months, whichever occurs first). An Emission Control Service.
- Lubricate chassis components (or every 3 months, whichever occurs first). (See footnote #.)
- Check axle fluid level and add fluid as needed. (See footnote \*\*.)
- Rotate tires. See "Tire Inspection and Rotation" in the Index for proper rotation pattern and additional information. (See footnote +.)

| DATE           |              |
|----------------|--------------|
| ACTUAL MILEAGE | SERVICED BY: |
|                |              |

**45,000 Miles (75 000 km)**

- Change engine oil and filter (or every 3 months, whichever occurs first). An Emission Control Service.
- Lubricate chassis components (or every 3 months, whichever occurs first). (See footnote #.)
- Check axle fluid level and add fluid as needed. (See footnote \*\*.)
- Clean and repack the front wheel bearings (or at each brake relining, whichever occurs first).
- Inspect air cleaner filter if you are driving in dusty conditions. Replace filter if necessary. An Emission Control Service.
- Inspect shields and underhood insulation for damage or looseness. Adjust or replace as required. This is a Noise Emission Control Service. Applicable only to vehicles sold in the United States.

| DATE           |              |
|----------------|--------------|
| ACTUAL MILEAGE | SERVICED BY: |
|                |              |

**48,000 Miles (80 000 km)**

- Change engine oil and filter (or every 3 months, whichever occurs first). An Emission Control Service.
- Lubricate chassis components (or every 3 months, whichever occurs first). (See footnote #.)
- Check axle fluid level and add fluid as needed. (See footnote \*\*.)
- Rotate tires. See "Tire Inspection and Rotation" in the Index for proper rotation pattern and additional information. (See footnote +.)

| DATE           |              |
|----------------|--------------|
| ACTUAL MILEAGE | SERVICED BY: |
|                |              |

**50,000 Miles (83 000 km)**

- Change automatic transmission fluid and filter.
- Change rear axle lubricant and fill to correct level (See footnote \*\*.)

| DATE           |              |
|----------------|--------------|
| ACTUAL MILEAGE | SERVICED BY: |
|                |              |

**51,000 Miles (85 000 km)**

- Change engine oil and filter (or every 3 months, whichever occurs first). An Emission Control Service.
- Lubricate chassis components (or every 3 months, whichever occurs first). (See footnote #.)

| DATE           |              |
|----------------|--------------|
| ACTUAL MILEAGE | SERVICED BY: |
|                |              |

**54,000 Miles (90 000 km)**

- Change engine oil and filter (or every 3 months, whichever occurs first). An Emission Control Service.
- Lubricate chassis components (or every 3 months, whichever occurs first). (See footnote #.)
- Check axle fluid level and add fluid as needed. (See footnote \*\*.)
- Rotate tires. See "Tire Inspection and Rotation" in the Index for proper rotation pattern and additional information. (See footnote +.)

| DATE           |              |
|----------------|--------------|
| ACTUAL MILEAGE | SERVICED BY: |
|                |              |

**57,000 Miles (95 000 km)**

- Change engine oil and filter (or every 3 months, whichever occurs first). An Emission Control Service.
- Lubricate chassis components (or every 3 months, whichever occurs first). (See footnote #.)
- Check axle fluid level and add fluid as needed. (See footnote \*\*.)

| DATE           |              |
|----------------|--------------|
| ACTUAL MILEAGE | SERVICED BY: |
|                |              |

**60,000 Miles (100 000 km)**

- Change engine oil and filter (or every 3 months, whichever occurs first). An Emission Control Service.
- Lubricate chassis components (or every 3 months, whichever occurs first). (See footnote #.)
- Check axle fluid level and add fluid as needed. (See footnote \*\*.)
- Clean and repack the front wheel bearings (or at each brake relining, whichever occurs first).
- Inspect shields and underhood insulation for damage or looseness. Adjust or replace as required. This is a Noise Emission Control Service. Applicable only to vehicles sold in the United States.
- Inspect engine accessory drive belt. An Emission Control Service.
- Replace fuel filter. An Emission Control Service.
- Conduct evaporative control system inspection. Check all fuel and vapor lines and hoses for proper hook-up, routing and condition. Check that the purge valve works properly (if equipped). Replace as needed. An Emission Control Service. (See footnote †.)
- Replace air cleaner filter. An Emission Control Service.
- Inspect fuel tank, cap and lines for damage or leaks. Inspect fuel cap gasket for any damage. Replace parts as needed. An Emission Control Service. (See footnote †.)
- Rotate tires. See "Tire Inspection and Rotation" in the Index for proper rotation pattern and additional information. (See footnote +.)

| DATE           |              |
|----------------|--------------|
| ACTUAL MILEAGE | SERVICED BY: |
|                |              |

**63,000 Miles (105 000 km)**

- Change engine oil and filter (or every 3 months, whichever occurs first). An Emission Control Service.
- Lubricate chassis components (or every 3 months, whichever occurs first). (See footnote #.)
- Check axle fluid level and add fluid as needed. (See footnote \*\*.)

| DATE           |              |
|----------------|--------------|
| ACTUAL MILEAGE | SERVICED BY: |
|                |              |

**66,000 Miles (110 000 km)**

- Change engine oil and filter (or every 3 months, whichever occurs first). An Emission Control Service.
- Lubricate chassis components (or every 3 months, whichever occurs first). (See footnote #.)
- Check axle fluid level and add fluid as needed. (See footnote \*\*.)
- Rotate tires. See "Tire Inspection and Rotation" in the Index for proper rotation pattern and additional information. (See footnote +.)

| DATE           |              |
|----------------|--------------|
| ACTUAL MILEAGE | SERVICED BY: |
|                |              |

**69,000 Miles (115 000 km)**

- Change engine oil and filter (or every 3 months, whichever occurs first). An Emission Control Service.
- Lubricate chassis components (or every 3 months, whichever occurs first). (See footnote #.)
- Check axle fluid level and add fluid as needed. (See footnote \*\*.)

| DATE           |              |
|----------------|--------------|
| ACTUAL MILEAGE | SERVICED BY: |
|                |              |

**72,000 Miles (120 000 km)**

- Change engine oil and filter (or every 3 months, whichever occurs first). An Emission Control Service.
- Lubricate chassis components (or every 3 months, whichever occurs first). (See footnote #.)
- Check axle fluid level and add fluid as needed. (See footnote \*\*.)
- Rotate tires. See "Tire Inspection and Rotation" in the Index for proper rotation pattern and additional information. (See footnote +.)

| DATE           |              |
|----------------|--------------|
| ACTUAL MILEAGE | SERVICED BY: |
|                |              |

**75,000 Miles (125 000 km)**

- Change engine oil and filter (or every 3 months, whichever occurs first).  
An Emission Control Service.
- Lubricate chassis components (or every 3 months, whichever occurs first).  
(See footnote #.)
- Clean and repack the front wheel bearings (or at each brake relining, whichever occurs first).
- Inspect air cleaner filter if you are driving in dusty conditions. Replace filter if necessary. An Emission Control Service.
- Change rear axle lubricant and fill to correct level (See footnote \*\*.)
- Inspect shields and underhood insulation for damage or looseness. Adjust or replace as required. This is a Noise Emission Control Service. Applicable only to vehicles sold in the United States.

| DATE           |              |
|----------------|--------------|
| ACTUAL MILEAGE | SERVICED BY: |
|                |              |



### 78,000 Miles (130 000 km)

- Change engine oil and filter (or every 3 months, whichever occurs first). An Emission Control Service.
- Lubricate chassis components (or every 3 months, whichever occurs first). (See footnote #.)
- Check axle fluid level and add fluid as needed. (See footnote \*\*.)
- Rotate tires. See "Tire Inspection and Rotation" in the Index for proper rotation pattern and additional information. (See footnote +.)

| DATE           |              |
|----------------|--------------|
| ACTUAL MILEAGE | SERVICED BY: |
|                |              |

### 81,000 Miles (135 000 km)

- Change engine oil and filter (or every 3 months, whichever occurs first). An Emission Control Service.
- Lubricate chassis components (or every 3 months, whichever occurs first). (See footnote #.)
- Check axle fluid level and add fluid as needed. (See footnote \*\*.)

| DATE           |              |
|----------------|--------------|
| ACTUAL MILEAGE | SERVICED BY: |
|                |              |

**84,000 Miles (140 000 km)**

- Change engine oil and filter (or every 3 months, whichever occurs first). An Emission Control Service.
- Lubricate chassis components (or every 3 months, whichever occurs first). (See footnote #.)
- Check axle fluid level and add fluid as needed. (See footnote \*\*.)
- Rotate tires. See "Tire Inspection and Rotation" in the Index for proper rotation pattern and additional information. (See footnote +.)

| DATE           |              |
|----------------|--------------|
| ACTUAL MILEAGE | SERVICED BY: |
|                |              |

**87,000 Miles (145 000 km)**

- Change engine oil and filter (or every 3 months, whichever occurs first). An Emission Control Service.
- Lubricate chassis components (or every 3 months, whichever occurs first). (See footnote #.)
- Check axle fluid level and add fluid as needed. (See footnote \*\*.)

| DATE           |              |
|----------------|--------------|
| ACTUAL MILEAGE | SERVICED BY: |
|                |              |

**90,000 Miles (150 000 km)**

- Change engine oil and filter (or every 3 months, whichever occurs first). An Emission Control Service.
- Lubricate chassis components (or every 3 months, whichever occurs first). (See footnote #.)
- Check axle fluid level and add fluid as needed. (See footnote \*\*.)
- Clean and repack the front wheel bearings (or at each brake relining, whichever occurs first).
- Replace fuel filter. An Emission Control Service.
- Replace air cleaner filter. An Emission Control Service.
- Rotate tires. See "Tire Inspection and Rotation" in the Index for proper rotation pattern and additional information. (See footnote +.)
- Inspect shields and underhood insulation for damage or looseness. Adjust or replace as required. This is a Noise Emission Control Service. Applicable only to vehicles sold in the United States.

| DATE           |              |
|----------------|--------------|
| ACTUAL MILEAGE | SERVICED BY: |
|                |              |

**93,000 Miles (155 000 km)**

- Change engine oil and filter (or every 3 months, whichever occurs first). An Emission Control Service.
- Lubricate chassis components (or every 3 months, whichever occurs first). (See footnote #.)
- Check axle fluid level and add fluid as needed. (See footnote \*\*.)

| DATE           |              |
|----------------|--------------|
| ACTUAL MILEAGE | SERVICED BY: |
|                |              |

**96,000 Miles (160 000 km)**

- Change engine oil and filter (or every 3 months, whichever occurs first). An Emission Control Service.
- Lubricate chassis components (or every 3 months, whichever occurs first). (See footnote #.)
- Check axle fluid level and add fluid as needed. (See footnote \*\*.)
- Rotate tires. See "Tire Inspection and Rotation" in the Index for proper rotation pattern and additional information. (See footnote +.)

| DATE           |              |
|----------------|--------------|
| ACTUAL MILEAGE | SERVICED BY: |
|                |              |

**99,000 Miles (165 000 km)**

- Change engine oil and filter (or every 3 months, whichever occurs first). An Emission Control Service.
- Lubricate chassis components (or every 3 months, whichever occurs first). (See footnote #.)
- Check axle fluid level and add fluid as needed. (See footnote \*\*.)

| DATE           |              |
|----------------|--------------|
| ACTUAL MILEAGE | SERVICED BY: |
|                |              |

**100,000 Miles (166 000 km)**

- Inspect spark plug wires. An Emission Control Service.
- Replace spark plugs. An Emission Control Service.
- Change automatic transmission fluid and filter.
- Change rear axle lubricant and fill to correct level. (See footnote \*\*.)

| DATE           |              |
|----------------|--------------|
| ACTUAL MILEAGE | SERVICED BY: |
|                |              |

**125, 000 Miles (200 000 km)**

- Change rear axle lubricant and fill to correct level. (See footnote \*\*.)

| DATE           |              |
|----------------|--------------|
| ACTUAL MILEAGE | SERVICED BY: |
|                |              |

**150, 000 Miles (240 000 km)**

- Drain, flush and refill cooling system (or every 60 months since last service, whichever occurs first). See “Engine Coolant” in the Index for what to use. Inspect hoses. Clean radiator, condenser, pressure cap and neck. Pressure test cooling system and pressure cap. An Emission Control Service.
- Change rear axle lubricant and fill to correct level. (See footnote \*\*.)

| DATE           |              |
|----------------|--------------|
| ACTUAL MILEAGE | SERVICED BY: |
|                |              |

## **PART B: OWNER CHECKS AND SERVICES**

Listed here in this part are owner checks and services which should be performed at the intervals specified to help ensure the safety, dependability, and optimum emission control performance of your vehicle.

Be sure any necessary repairs are completed at once. Whenever fluids or lubricants are added to your vehicle, make sure they are the proper type, as shown in Part D.

### **At the First 100, 1,000 and 6,000 Miles (160, 1 600 and 10 000 km)**

For vehicles equipped with dual wheels, check the dual wheel nut torque. For proper torque specifications, see “Wheel Nut Torque” in the Index.

### **At Each Fuel Fill**

It is important for you or a service station attendant to perform these checks at each fuel fill.

#### ***Engine Oil Level Check***

Check the engine oil level and add the proper oil if necessary. See “Engine Oil” in the Index for further details.

#### ***Engine Coolant Level Check***

Check the engine coolant level and add the proper coolant mixture if necessary. See “Engine Coolant” in the Index for further details.

#### ***Tire Inflation Check***

Check tire inflation cold. Make sure tires are inflated to the pressures specified on the Certification/Tire Label. See “Tires” in the Index for further details. Note: Use an accurate gauge to verify pressures.

## At Least Twice a Year

### Park Brake Check

1. Check your vehicle and confirm that your auto-apply parking brake is working properly. If you suspect that your system needs work, please contact your Workhorse dealer for service. Workhorse recommends that you check the operation of your auto-park brake at least twice yearly and after long periods of storage.



## CAUTION

*When you are performing this check, your vehicle could begin to move. You or others could be injured and property could be damaged. Make sure that there is room in front of your vehicle in case it begins to roll. Be ready to apply the regular brake at once should the vehicle begin to move.*

- Park on a fairly steep hill, with the vehicle facing downhill. Keeping your foot on the regular brake, set the parking brake.
- To check the parking brake's holding ability: With the engine running and the transmission in NEUTRAL (N), slowly remove foot force from the regular brake pedal. Do this until the vehicle is held by the parking brake only.



## CAUTION

*If the vehicle does not hold under the above circumstances, see your dealer immediately for parking brake repair.*

2. As an added precaution to prevent your vehicle from rolling away, Workhorse recommends:
  - Avoid parking on steep grades whenever possible.
  - Park with front wheels turned into a curb or berm when possible.
  - Check to make sure vehicle is held before shutting off engine.
  - Block front and rear wheels if parking on a very steep grade.

3. The park brake system should never be used to stop the vehicle when in motion. Doing so can damage the park brake system.
4. Never turn the ignition key off when vehicle is in motion. This will apply the auto-park brake causing damage to the system.
5. Never connect added electrical items to any of the auto-park brake control electrical circuits. The added electrical load can cause the auto-park brake to apply.
6. Check auto-park fluid reservoir for proper level at every oil change.
7. The auto-park brake is “fail safe” to meet Department Of Transportation requirements. This means that the brake will apply if any brake related failure occurs. There is no easy way to unlock the brake if it will not disengage.

### **Automatic Transmission Check**

Check the transmission fluid level; add if needed. See “Automatic Transmission Fluid” in the Index. A fluid loss may indicate a problem. Check the system and repair if necessary.

## **At Least Once a Year**

### **Starter Switch Check**



## **CAUTION**

*When you are performing this check, the vehicle may move suddenly. If it does, you or others may be injured. Carefully follow the steps below.*

1. Before you start, be sure you have enough room around the vehicle.
2. Firmly apply both the parking brake (see “Parking Brake” in the Index if necessary) and the regular brake.

### **NOTICE**

*Do not use the accelerator pedal, and be ready to turn off the engine immediately if it starts.*



3. On automatic transmission equipped vehicles, try to start the engine in each gear. The starter should work only in PARK (P) or NEUTRAL (N). If the starter works in any other position, your vehicle needs service immediately.

### **Brake-Transmission Shift Interlock (BTSI) Check (Automatic Transmission)**



## **CAUTION**

*When you are performing this check, the vehicle may move suddenly. If it does, you or others may be injured. Carefully follow the steps that follow.*

1. Before you start, be sure you have enough room around the vehicle. It should be parked on a level surface.
2. Firmly apply the parking brake (see “Parking Brake” in the Index if necessary).

## **NOTICE**

*Be ready to apply the regular brake immediately if the vehicle begins to move.*

3. With the engine off, turn the key to the RUN position, but do not start the engine. Without applying the regular brake, try to move the shift lever out of PARK (P) with normal effort. If the shift lever moves out of PARK (P), your vehicle’s BTSI system needs service.

### **Ignition Transmission Lock Check (Column Shift Only)**

While parked, and with the parking brake set, try to turn the ignition key to LOCK in each shift lever position.

- With an automatic transmission, the key should turn to LOCK only when the shift lever is in the PARK (P).

## **Parking Brake and Automatic Transmission PARK (P) Mechanism Check Procedure**



### **CAUTION**

*When you are performing this check, your vehicle could begin to move. You or others may be injured and property may be damaged. Make sure there is room in front of your vehicle in case it begins to roll. Be ready to apply the regular brake at once should the vehicle begin to move.*

Park on a fairly steep hill, with the vehicle facing downhill. Keeping your foot on the regular brake, set the parking brake.

- To check the parking brake's holding ability: With the engine running and transmission in NEUTRAL (N), slowly remove foot pressure from the regular brake pedal. Do this until the vehicle is held by the parking brake only.

- To check the PARK (P) mechanism's holding ability: With the engine running, shift to PARK (P). Then release all brakes.

## **Underbody Flushing Service**

At least every spring/fall, use plain water to flush any corrosive materials from the underbody. Take care to clean thoroughly any areas where mud and other debris can collect. Dirt/debris hold moisture which can accelerate the corrosion process.

*Note: Allow your vehicle to dry in an open area, letting air circulate underneath the body before storage.*

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## **PART C: PERIODIC MAINTENANCE INSPECTIONS NOTICE:**

Listed in this section are inspections and services which should be performed at least twice a year (for instance each spring and fall). You should let your dealer's service department or other qualified service center perform these services. Make sure any necessary repairs are completed at once.

Proper procedures to perform these services can be found in the Workhorse Chassis Service Manual. See "Ordering Service Publications" in the Index.

### **Steering and Suspension Inspection**

Inspect the front and rear suspension and steering system for damaged, loose, or missing parts, look for signs of wear or lack of lubrication. Inspect the power steering lines and hoses for proper hook-up, binding, leaks, softness, cracks, chafing, etc.

*Grease purge from a sealed package bearing of this type is expected and is a normal condition. When pressure builds within the bearing, the seal will burp, which allows for the pressure to be relieved. This action also causes some grease to escape (a small bead of grease will form around the seal lip). This grease acts as a secondary barrier to contaminants and should not be removed.*

*Note: If the amount of grease purge becomes excessive, there will be signs of grease being splattered/sprayed on surrounding components. If this condition is present the vehicle should be taken to an authorized Workhorse service center for further evaluation.*

## Exhaust System Inspection

Inspect the complete vehicle exhaust system. Inspect the body near the exhaust system. Look for broken, damaged, missing, or out-of-position parts. Look for open seams, holes, loose connections, or other conditions which could cause a heat build-up in the floor pan or could let exhaust fumes into the vehicle.

## Engine Cooling System Inspection

Inspect all cooling system hoses and have them replaced if they are cracked, swollen, or deteriorated. Inspect all pipes, fittings, and clamps; replace as necessary. Clean the outside of the radiator and air conditioning condenser. To help ensure proper operation, a pressure test of the cooling system and pressure cap is recommended at least once a year.

## Throttle System Inspection

Inspect the throttle system for interference or binding, and for damaged or missing parts. Replace parts as needed. Replace any components which have a high effort or excessive wear.

## Rear Axle Service

Check the gear lubricant level in the rear axle and add if needed. See “Rear Axle” in the Index. A fluid loss may indicate a problem. Check the axle and repair it if necessary.

## Brake System Inspection

Inspect the complete brake system. Inspect brake lines and hoses for proper hook-up, binding, leaks, cracks, chafing, etc. Inspect disc brake pads for wear and rotors for surface condition. Inspect other brake parts, including calipers, parking brake, etc. Check the parking brake adjustment. You may need to have your brakes inspected more often if your driving habits or conditions result in frequent braking (stop and go traffic or trailer towing).

### **NOTICE:**

*Brake Inspections need to be completed a minimum of twice a year. This inspection should always be performed after periods of extended storage (3 months or longer.) Brake components wear at different levels which can depend on driver habits, road terrain, location of usage and temperature.*

Check caliper slides (pins) for proper lubrication and free of corrosion. Check linkage for proper free play and lubrication at all moving joints. Check brake light switch for proper adjustment and operation.

## PART D: RECOMMENDED FLUIDS AND LUBRICANTS

### NOTICE

*Fluids and lubricants shown on the following pages by name, part number, or specification may be obtained from your Workhorse dealer.*

## PART E: MAINTENANCE RECORD

After the scheduled services are performed, record the date, odometer reading, and who performed the service in the boxes provided after the maintenance interval. Any additional information from “Owner Checks and Services” or “Periodic Maintenance” can be added on the following record pages. Also, you should retain all maintenance receipts. Your owner information portfolio is a convenient place to store them.

| USAGE                        | FLUID/LUBRICANT   |
|------------------------------|---|
| Engine Oil (Gasoline Engine) | Engine oil with the American Petroleum Institute Certified for Gasoline Engines “Starburst” symbol of the proper viscosity. To determine to preferred viscosity for your vehicle’s engine, see “Engine Oil” in the Index.   |
| Engine Oil (Diesel Engine)   | Engine oil with the letters “CJ-4” is required for your 2007 and later emissions compliant diesel engine. The CJ-4 designation may appear alone or in combination with other API designations such as SPI CJ-4/SL. These additional letters show API levels of quality. To determine to preferred viscosity for your vehicle’s engine, see “Engine Oil” in the Index. |

### NOTICE:

*Do not use DOT 5 brake fluid in your brake system or damage may occur.*

| USAGE                            | FLUID/LUBRICANT  |
|----------------------------------|--|
| Engine Coolant (Gasoline Engine) | 50/50 mixture of clean, drinkable water and use DEX-COOL®. See "Engine Coolant" in the Index.                              |
| Engine Coolant (Diesel Engine)   | 50/50 mixture of clean, drinkable water and use extended life red coolant. Refer to Section 7, "Diesel Engine Supplement." |
| Hydraulic Brake System           | Delco Supreme 11® Brake Fluid or equivalent DOT-3 Brake Fluid  |
| Brake Bell Crank                 | Chassis Lubricant meeting requirements of NLGI #2, Category LB or GC-LB  |

**NOTICE:**

*To help minimize the potential of brake fluid in your system becoming contaminated with water and causing brake system damage, it is a good practice to change/flush your brake fluid every 2 years/24,000 miles. As water becomes absorbed, brake fluid will become very dark in color. This is very common whenever the vehicle is in storage.*

| USAGE                                | FLUID/LUBRICANT   |
|--------------------------------------|---|
| Auto-Apply Parking Brake System      | Dexron® VI Automatic Transmission Fluid                                 |
| Parking Brake Cable Guides           | Chassis Lubricant meeting requirements of NLGI #2, Category LB or GC-LB |
| Park Brake Cam Switch and Linkage    | Chassis Lubricant meeting requirements of NLGI #2, Category LB or GC-LB |
| Power Steering System                | Power Steering Fluid  |
| Automatic Transmission – Hydramatic® | Dexron® VI Automatic Transmission Fluid                                 |
| Automatic Transmission – Allison™    | Transynd® Automatic Transmission Fluid                                  |
| Chassis Lubrication                  | Chassis Lubricant meeting requirements of NLGI #2, Category LB or GC-LB |

| <b>USAGE</b>                              | <b>FLUID/LUBRICANT</b>  |
|---|---|
| Front Wheel Bearings with Oil-Filled Hubs | SAE 90W GL-5 Gear oil or optionally Chevron Delo Gear ESI SAE 80W-90 gear oil |
| Differential, Rear Axle                   | Chevron Delo Gear ESI SAE 80W-90 gear oil                                     |
| Propshaft Splines and Universal Joints    | Chassis Lubricant meeting requirements of NLGI #2, Category LB or GC-LB       |

| <b>MAINTENANCE RECORD</b> |                             |                    |                              |
|---------------------------|-----------------------------|--------------------|------------------------------|
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| <b>MAINTENANCE RECORD</b> |                         |                    |                              |
|---------------------------|-------------------------|--------------------|------------------------------|
| <b>DATE</b>               | <b>ODOMETER READING</b> | <b>SERVICED BY</b> | <b>MAINTENANCE PERFORMED</b> |
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| <b>MAINTENANCE RECORD</b> |                         |                    |                              |
|---------------------------|-------------------------|--------------------|------------------------------|
| <b>DATE</b>               | <b>ODOMETER READING</b> | <b>SERVICED BY</b> | <b>MAINTENANCE PERFORMED</b> |
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This section tells you how to contact Workhorse if you need assistance with your Workhorse chassis. In this section you will also find information about your Workhorse limited warranty, including information about coverage for your Workhorse chassis' emissions control systems.

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**PART A - OWNER INFORMATION**

Owner's Name: \_\_\_\_\_

Street Address: \_\_\_\_\_

City &amp; State: \_\_\_\_\_ ZIP: \_\_\_\_\_

Vehicle Identification Number (VIN): \_\_\_\_\_

Warranty Date &amp; Start Mileage\*: \_\_\_\_\_

Date of Purchase/Delivery: \_\_\_\_\_

Coach/Body Manufacturer: \_\_\_\_\_

Selling Dealer: \_\_\_\_\_

Note: Ask the selling dealer if you are eligible for a Delayed Warranty Start (see Part G of this Section). Your warranty start date will be the date Workhorse shipped your Workhorse chassis from the factory, unless a Delayed Warranty Start form is completed and submitted by your selling dealer and approved by Workhorse. This is necessary for first and subsequent owners.

## **PART B - CUSTOMER ASSISTANCE AND ROADSIDE ASSISTANCE**

### **I. Customer Assistance**

Your complete satisfaction with your Workhorse chassis is our goal. If you have any questions or concerns with your Workhorse chassis, please take the following steps:

1. Contact your sales representative or service department at the dealership where you purchased your Workhorse chassis.
2. If your inquiry is not resolved to your satisfaction, contact the sales manager or service manager at the dealership.
3. If your inquiry is not resolved with the sales manager or service manager at the dealership, please contact Workhorse Customer Relations at **1-877-946-7731**.

Please have the following information available:

- Vehicle Identification Number (VIN). This is a 17-digit number starting with a 5 and can be found on your vehicle registration or title or the plate above the left top of the instrument panel
- Dealer name and location
- Vehicle delivery date and present mileage

**You can also write to us at the following address:**

**Workhorse Custom Chassis, LLC  
Customer Relations  
850 Stephenson Highway, Suite #510  
Troy, MI 48083-1174**

4. Both Workhorse and your Workhorse dealer are committed to ensuring that you are completely satisfied with your Workhorse chassis. However, if you remain unsatisfied after following the procedure above, you may file a complaint with the BBB Autoline Program as set forth at the end of this Section.

## II. Roadside Assistance

**Workhorse provides at no charge to you, roadside assistance for three years or 36,000 miles (57 600 kilometers), whichever occurs first, for those repairs covered under the Workhorse Limited Warranty. If you ever experience a concern with your Workhorse chassis while you are on the road, you may contact roadside assistance 24 hours a day, 365 days a year, by calling 1-877 -946-7731.**

### **NOTICE**

*The Workhorse provided roadside assistance towing coverage is only during the 3 year/36,000 mile, whichever occurs first, chassis warranty for both RV and commercial chassis. There will be an expense limitation to Roadside Assistance coverages such as: lockout, flat tire and towing expenses. Incidental expenses ARE NOT covered.*

By calling this toll-free number, you can obtain over-the-phone assistance with any minor problems you may experience with your Workhorse chassis. If your problems cannot be resolved by telephone, our representatives can guide you to a nationwide network of service providers.

The following services are available through roadside assistance:

- Towing for warranty repairs
- Basic over-the-phone technical advice
- References to dealer services (for example: locksmith, glass repair, etc.)

For prompt, efficient assistance when calling, please have the following information available

- Vehicle Identification Number (VIN)
- License plate number
- Vehicle type (recreational vehicle, step van, etc.)
- Vehicle location
- Telephone number where you can be reached
- Vehicle mileage
- Description of the problem

Workhorse roadside assistance uses a network of high quality independent service providers that will provide you with priority service. Any payment obligations you may incur for non-warranty repairs from these service providers should be explained to you by the roadside assistance advisors.

After the expiration of the Workhorse limited warranty(ies), you may continue to contact Workhorse roadside assistance at the toll-free number if you require assistance with your Workhorse chassis while on the road; however, all repair and related services will be at your expense.

## **PART C - INTRODUCTION TO YOUR WORKHORSE LIMITED WARRANTY**

### **I. Workhorse's Commitment to You**

Thank you for your purchase of your Workhorse chassis. Workhorse stands committed, along with your Workhorse dealer, to assuring your complete satisfaction with your Workhorse chassis.

Your selling dealer would like to complete the repairs, but you may also take your vehicle to any other authorized Workhorse service facility. Please note that certain warranty repairs require special training, so not all dealers are authorized to perform all warranty repairs. If your selling dealer is unable to complete your warranty repairs, contact Workhorse Customer Relations at 1-877-946-7731.

### **II. Purpose of Section**

This Section explains in detail the limited warranty coverage that applies to your Workhorse chassis (Workhorse Limited Warranty), as well as coverage that applies to your Workhorse chassis' emissions control systems warranties (Emissions Warranties).

### **III. Warranty Repairs**

All warranty repairs that may be required on your Workhorse chassis must be performed by an authorized Workhorse service facility (except as set forth under "Emergency Repairs" below in this section.)

Your selling dealer would like to complete the repairs, but you may also take your vehicle to any other Workhorse authorized service center. Please note that certain warranty repairs require some special training, so not all dealers are authorized to perform all warranty repairs. If your selling dealer is unable to complete your warranty repairs, contact Workhorse Customer Relations at 1-877-946-7731.

#### **IV. Who Pays for Warranty Repairs**

You will not be charged for any warranty repairs on your Workhorse chassis if the repairs are covered under your Workhorse limited warranty and if the repairs are performed at an authorized Workhorse servicing dealer.

##### **NOTICE:**

*All warranty repairs must be performed during the applicable warranty period.*

Some states and/or local governments may assess a tax on some warranty repairs performed on your Workhorse chassis. Where applicable law provides, the tax must be paid by you, the owner of the vehicle.

#### **V. Where Your Workhorse Limited Warranty Applies**

Your Workhorse limited warranty and the emissions warranties apply to any covered warranty repair on your Workhorse chassis while operated within the United States and Canada.

##### **NOTICE**

*Your Workhorse limited warranty is invalid if the vehicle is operated outside the United States or Canada.*

#### **VI. Emergency Repairs**

If your vehicle requires an emergency repair, and an authorized Workhorse service facility is not reasonably available, you may have warranty repairs performed on your Workhorse chassis by any available vehicle service or repair establishment.



Workhorse may reimburse you for emergency repairs to your Workhorse chassis that are covered under your Workhorse limited warranty in an amount not to exceed the manufacturer's suggested retail price for all warranted parts and components replaced and for labor charges based on Workhorse's recommended time allowance and rates for warranty repairs. To obtain reimbursement, contact Workhorse Customer Relations at 1-877- 946-7731. You will be required to submit all receipts that were incurred in connection with your repair.

### **VII. Your Recreational Vehicle or Commercial Vehicle**

Your recreational or commercial vehicle is composed of two major components supplied by two different manufacturers: your Workhorse chassis and your coach/body. When you chose your Workhorse chassis, Workhorse supplied the chassis to your coach/body manufacturer, and your coach/body manufacturer completed the vehicle by installing the coach/body onto your Workhorse chassis. Having two major manufacturers of your vehicle, you have two separate warranties: Workhorse provides a warranty for your Workhorse chassis, and your coach/body manufacturer provides a warranty for the completed vehicle and the coach/body. If you have any questions regarding the warranty coverage for your vehicle, con tact your selling dealer or authorized Workhorse service facility. You may also contact Workhorse Customer Relations at 1-877-946-7731.

## **PART D - CHASSIS OPERATION AND CARE**

### **I. Maintenance**

Proper maintenance of your Workhorse chassis is vital to its continued operation. Proper maintenance guards against major repair expenses and may help increase the resale value of your vehicle.

It is your responsibility to make sure that all scheduled maintenance is performed on your Workhorse chassis and that the parts and components used during maintenance are genuine Workhorse parts.

Failure to perform scheduled maintenance on your Workhorse chassis as specified in your Owner's Manual will invalidate your Workhorse limited warranty.

Should you have any questions on how to keep your Workhorse chassis in good working condition, ask your Workhorse dealer.

### **II. Maintenance Records**

You should retain all receipts for regular maintenance performed on your Workhorse chassis. These receipts can be very important if a question arises as to whether a malfunction in your Workhorse chassis is caused by lack of maintenance or a defect in materials and/or workmanship. Workhorse has provided a Maintenance Record form in the Maintenance Schedule section of your Owner's Manual, for recording services performed.

### **III. Owner Assistance**

Your authorized Workhorse service facility is best equipped to provide all of your regular maintenance needs.

## PART E - YOUR WORKHORSE LIMITED WARRANTY

### I. What is Covered

#### ***Motor Home Chassis Powertrain***

Your Workhorse Limited Powertrain Warranty begins on the date that your Workhorse chassis is first delivered from Workhorse and continues for five years or 60,000 miles (96 500 kilometers), whichever occurs first. During this coverage period, authorized Workhorse service facilities will repair, replace, or adjust the following powertrain components:

#### **NOTICE**

*The 5yr/60,000 mile, whichever occurs first, powertrain warranty is in effect for all gasoline powered chassis produced after 1-1-08.*

**Engine Assembly:** Including block, crankshaft, connecting rods, pistons, wrist pins, camshaft/lifters, cylinder heads, valves, valves springs, valve retainers, rocker arms, oil pump oil pan, intake manifold, valve covers, seals/gaskets, flywheel/flexplate (complete mechanical rotating mass).

**Battery:** The battery and or batteries supplied by Workhorse with your chassis are warranted for 12 months or 12,000 miles, whichever occurs first, from the date of retail purchase.

#### **NOTE:**

*Any item(s) not listed here are part of the standard three year/36,000 mile, whichever occurs first, warranty and/or emissions warranty (where applicable). Needed repairs may be performed by using new or remanufactured parts.*

**Transmission:** Includes the transmission case and all internal parts, including electronic components for the W16 and W18 Series motor home chassis equipped with a Hydramatic® 4L80-E or 4L85-E transmission.

**NOTE:**

The Allison™ warranty of five years/200,000 miles (320 000 km), whichever occurs first, for motor home chassis and three years/unlimited mileage for commercial chassis remains unchanged. (Refer to your Allison™ Owner's Manual for more information.) All Allison™ warranty work must be completed by an authorized Allison™ distributor or dealer.

**Rear Axle Assembly:** All rear axle assemblies, housings, and internal components are covered (includes bearings and seals for rear axle only).

**NOTICE**

Your five year/60,000 mile, whichever occurs first, warranty covers the preceding powertrain components **ONLY** and does **NOT** include the following:

- Frame
- Steering & Suspension System
- Wheels/Tires
- Propeller Shaft, U-Joints, and Center Bearings
- Brake System (all components including booster)

- Air Conditioning System
- Cooling System
- Fuel Delivery System
- Electrical System (all)

**NOTICE**

The 5yr/60,000 mile, whichever occurs first, powertrain warranty is in effect for all gasoline powered chassis produced after 1-1-08.

**Motor Home Chassis Non-Powertrain**

Your Workhorse limited warranty begins on the date that your Workhorse chassis is first delivered from Workhorse and continues for three years or 36,000 miles (57 600 kilometers), whichever occurs first. During this coverage period, authorized Workhorse service facilities will repair, replace, or adjust all Workhorse supplied parts and components installed by Workhorse on your Workhorse chassis that are defective in materials and/or workmanship.

Your Workhorse limited non-powertrain warranty (three years or 36,000 miles / 57 600 kilometers, whichever occurs first) covers your Workhorse chassis frame, brakes, propeller shaft, universal joints, center bearings, steering, suspension, air conditioning system, and chassis electrical components, unless those components are warranted by their own manufacturer (for example, an International® engine or an Allison™ transmission, which have their own warranties).

Your Workhorse limited warranty includes costs coverage (up to \$450) that you may incur to tow your vehicle to your nearest authorized Workhorse service facility.

### **Commercial Chassis**

Your Workhorse limited warranty begins on the date that your Workhorse chassis is first delivered from Workhorse and continues for three years or 36,000 miles (57 600 kilometers), whichever occurs first. During this coverage period, authorized Workhorse service facilities will repair, replace, or adjust all Workhorse supplied parts and components installed by Workhorse on your Workhorse chassis that are defective in materials and/or workmanship. Your Workhorse limited warranty covers your Workhorse chassis frame, axle, engine, transmission, brakes, steering, suspension, and chassis electrical components, unless those components are warranted by their own manufacturer (for example, an International® engine or an Allison™ transmission, which have their own warranties).

Your Workhorse limited warranty includes costs (up to \$450) that you may incur to tow your vehicle to your nearest authorized Workhorse service facility.

**A. 4.5L MaxxForce™ 5 Diesel Engine Coverage**

You are provided extended warranty coverage on the parts and components of the 4.5L MaxxForce™ 5 Diesel Engine listed below. The extended warranty coverage on these parts and components begins on the date that your Workhorse chassis is first delivered from Workhorse and continues for three years or 150,000 miles (240 000 kilometers), whichever occurs first. During this period, authorized Workhorse service facilities will repair, replace, or adjust any of these parts and components that are defective in materials and/or workmanship. A \$100 deductible per repair visit will apply to repairs to these parts and components after your Workhorse chassis has been in use for three years or 36,000 miles (57 600 kilometers), whichever occurs first.

- Cylinder block and heads and all internal parts, intake and exhaust manifolds, timing gears and cover, flywheel, harmonic balancer, valve covers, oil pan, oil pump, water pump, seals and gaskets
- Diesel fuel metering system (injection pump, nozzles, high pressure lines and high pressure sealing devices)
- Glow plug control system (control/glow plug assembly, glow plugs, and ECM)

**B. Emissions Control Systems Warranties****1. Emissions Control Systems Design and Defect Warranty Coverage**

Workhorse provides warranty coverage for your Workhorse chassis' Federal emissions control systems in accordance with the United States Federal Clean Air Act. Your heavy duty emissions control system warranty begins on the date your Workhorse chassis is delivered to you and continues for a period of either (i) 5 years or 50,000 miles, whichever occurs first (for all heavy duty gasoline chassis greater than 8,500 pounds GVWR and on diesel chassis up to 19,500 pounds GVWR) or (ii) 5 years or 100,000 miles, whichever occurs first (for all diesel chassis over 19,500 lbs. GVWR).

During this coverage period, Workhorse warrants that your Workhorse chassis (i) is designed, equipped, and built to meet the emissions regulations of the United States Environmental Protection Agency (EPA) in effect at the time you purchased your Workhorse chassis; and (ii) is free from defects in Workhorse supplied materials and/or workmanship that could prevent it from conforming with the applicable EPA regulations.

## 2. Emissions Control Systems Performance Warranty Coverage

The performance warranty covers repairs which are required during the first 2 years or 24,000 miles, whichever occurs first, of use because the vehicle failed an emissions test. If you are a resident of an area with an inspection and maintenance (I/M) program that meets federal guidelines, you are eligible for this warranty protection, provided that you meet all of the following conditions:

- A. Your vehicle fails an approved emissions test;
- B. Your vehicle is less than 2 years old and has less than 24,000 miles;
- C. Your state or local government requires that you repair the vehicle;
- D. The test failure does not result from misuse of your vehicle or a failure to follow written maintenance instructions for your vehicle; and
- E. You present your vehicle to an authorized Workhorse service facility, along with evidence of the emissions test failure, during the warranty period.

If all these conditions exist, Workhorse will perform any repair or adjustment which is necessary to make your Workhorse chassis pass an approved, locally-required emissions test.

## C. Emissions Warranties Parts List

The following parts and components are covered under the emissions warranties:

### Powertrain Control System

- Barometric Pressure Sensor
- Brake Switch
- Camshaft Position Sensor
- Coolant Fan Control Relay
- Coolant Level Sensor
- Crankshaft Position Sensor
- Data Link Connector
- Electric Throttle Control (ETC) Motor
- Engine Control Module (ECM)
- Engine Coolant Temperature Sensor
- Fast Idle Solenoid
- Intake Air Temperature Sensor
- Malfunction Indicator Lamp
- Manifold Absolute Pressure Sensor
- Mass Air Flow Sensor

- Oxygen Sensors
- Park/Neutral Position Switch
- Powertrain Control Module (PCM)
- Programmable Read Only Memory (PROM)
- Throttle Position Sensor
- Throttle Position Switch
- Torque Converter Clutch Solenoid Valve
- Transmission Speed Sensors
- Vehicle Control Module (VCM)
- Vehicle Speed Sensor

### **Fuel Management System**

- Altitude Fuel Limiter (diesels)
- Diesel Fuel Injection Pump
- Diesel Fuel Injection Pump Timing Adjuster
- Fuel Injectors
- Fuel Pressure Regulator
- Fuel Rail Assembly
- Diesel Glow Plugs

### **Air Management System**

- Air Cleaner (except for filter element)
- Air Cleaner Diaphragm Motor
- Air Cleaner Resonator
- Air Cleaner Temperature Compensator Valve
- Air Flow Meter
- Air Intake Ducts
- Charge Air Control Actuator
- Charge Air Control Solenoid Valve
- Charge Air Control Valve
- Charge Air Cooler
- Charge Air Cooler Fan
- Charge Air System
- Idle Air Control Valve
- Idle Speed Control Motor
- Intake Manifold
- Throttle Body Assembly
- Throttle Body Heater
- Throttle Closing Dashpot
- Turbocharger
- Turbocharger Oil Separator
- Turbocharger Thermo Purge Switch



**Ignition System**

- Ignition Coil
- Ignition Control Module
- Ignition Timing Adjustment
- Knock Sensor System
- Spark Plug Wires
- Spark Plugs

**Catalytic Converter System**

- Catalytic Converter
- Exhaust Manifold
- Exhaust Pipes and/or Mufflers (when located between converter and exhaust manifold)
- Positive Crankcase Ventilation System
- Diesel Crankcase Depression Regulator Valve
- Oil Filler Cap
- PCV Filter
- PCV Oil Separator

**Exhaust Gas Recirculation System**

- EGR Control Valves
- EGR Passages
- EGR Temperature Sensor
- EGR Thermal Vacuum Valve
- EGR Vacuum Pump (diesels)
- EGR Valve

- EGR Valve and Exhaust Pressure Regulator
- Solenoid Valve (diesels)
- EGR Valve Relay
- Exhaust Backpressure Transducer
- Exhaust Pressure Regulator Valve and Actuator (Diesel engine)
- Evaporative Emissions Control System (Gasoline Engines) Canister
- Canister Vent Solenoid
- Canister Purge Solenoid Valve
- Fuel Feed and Return Pipes and Hoses
- Fuel Filler Cap
- Fuel Tank Filler Pipe (with restrictor)
- Fuel Tank Pressure Control Valve
- Fuel Tank(s)
- Fuel Tank Vacuum Sensor or Pressure Sensor
- Purge Line
- Fuel Limiter Vent Valve

**Miscellaneous Items Used in Preceding Systems**

- |                       |          |
|-----------------------|----------|
| Actuators Hoses       | Pulleys  |
| Sealing Devices Belts | Gaskets  |
| Housings Sensors      | Wiring   |
| Clamps Mounting       | Fittings |

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|                    |          |
|--------------------|----------|
| Springs Connectors | Valves   |
| Hardware Switches  | Relays   |
| Ducts Pipes        | Grommets |
| Tubes              |          |

### **D. California Emissions Control Systems Warranty**

The California Air Resources Board (CARB) and Workhorse are pleased to explain the emissions control systems warranties on your Workhorse chassis. This additional warranty is available only if your vehicle is registered and certified for sale in California or in another state which has adopted California's emissions and warranty regulations. (As of January 1, 2006, states which have adopted California's emissions and warranty regulations are California, Maine, Massachusetts, Pennsylvania, and Vermont) for chassis with heavy-duty diesel engines only. In California, new chassis must be designed, equipped, and built to meet the state's stringent anti-smog standards. Workhorse will warrant your Workhorse chassis' emissions control systems as set forth below, provided there has been no abuse, neglect, or improper maintenance of your Workhorse chassis. Your Workhorse chassis' emissions control systems may

include parts and components such as the fuel injection system, ignition system, catalytic converter, and engine computer. Also included are hoses, belts, connectors, and other emissions-related assemblies. Your applicable warranty period shall begin on the date your vehicle is delivered to you. Workhorse will repair your Workhorse chassis at no cost to you, including diagnosis, parts, and components, and labor as follows:

#### **Emissions Control Systems Warranty Coverage for California Medium Duty Vehicles - 8,500-14,000 pounds (3,855 6,350 kilograms) GVWR**

1. For 3 years or 50,000 miles, whichever occurs first:
  - If your Workhorse chassis fails a smog check inspection, Workhorse will make all necessary repairs and adjustments to ensure that your Workhorse chassis passes the inspection. This is your chassis emissions control system performance warranty.
  - If any emissions-related part or component on your Workhorse chassis is defective, Workhorse will repair or replace it. This is your short-term emissions control systems defects warranty.

2. For 7 years or 70,000 miles, whichever occurs first, if any of the following parts or components are defective, Workhorse will repair or replace it: Engine Control Module (ECM), Mass Air Flow Sensor, Powertrain Control Module (PCM), Vehicle Control Module (VCM), Intake Manifold, Throttle Body Assembly, Turbocharger, Ignition Control Module, Catalytic Converter, Exhaust Manifold, Fuel Tanks, Fuel Limiter Vent Valve. This is your long-term emissions control systems defects warranty.

### **Emissions Control Systems Warranty Coverage for California Heavy Duty Vehicles - Over 14,000 pounds (6,350 kilograms) GVWR**

1. For heavy duty gasoline engine chassis, your emissions control systems warranty period is 5 years or 50,000 miles, whichever comes first.
2. For heavy duty diesel engine chassis, your emissions control systems warranty period is 5 years or 100,000 miles, or 3,000 hours of operation, whichever comes first.

3. If any emissions-related part or component on your Workhorse chassis is defective, Workhorse will repair or replace it. This is your emissions control systems defects warranty.

You are responsible for the performance of the required maintenance in your Owner's Manuals. Workhorse recommends that you retain all receipts for maintenance on your vehicle, but Workhorse cannot deny warranty coverage solely for the lack of receipts or for your failure to ensure the performance of all scheduled maintenance.

You are responsible for presenting your vehicle to an authorized Workhorse repair facility as soon as a problem exists. The warranty repairs should be completed in a reasonable amount of time, not to exceed 30 days.

You should be aware that Workhorse may deny you warranty coverage if the vehicle or a part or component has failed due to abuse, neglect, improper maintenance, or unapproved modifications.

If you have any questions regarding your warranty rights and responsibilities, or if you want to report what you believe to be violations of the terms of your California warranty, you may contact Workhorse Customer Relations at 1-877-946-7731 or the California Air Resources Board (CARB) at:

State of California Air Resources Board  
Mobile Source Operations Division  
PO. Box 8001  
El Monte, California 91731-2990

### ***E. Noise Emissions Warranty***

Workhorse warrants to the first person who purchases your Workhorse chassis for purposes other than resale and to each subsequent purchaser that your Workhorse chassis as manufactured by Workhorse was designed, built, and equipped to conform at the time it left Workhorse's control with all applicable U.S. EPA Noise Control Regulations.

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

WORKHORSE IS NOT RESPONSIBLE FOR ANY INCIDENTAL OR CONSEQUENTIAL DAMAGES OR EXPENSES YOU MAY CLAIM AS A RESULT OF YOUR USE OF YOUR WORKHORSE CHASSIS, INCLUDING BUT NOT LIMITED TO THE COST OF ALTERNATIVE TRANSPORTATION OR LODGING, INCONVENIENCE OR LOSS OF USE.

The noise emissions warranty does not apply to any vehicle which is not covered by the United States EPA Medium and Heavy Trucks Noise Emission Standards (40 C.F.R. Part 205, Subpart B).

## II. What is Not Covered

### A. Quick Reference

The following is a list of what is not covered under your Workhorse limited warranty:

1. Any part or component that is warranted by its own manufacturer, including but not limited to the engine, transmission, tires, and any non-Workhorse parts or components
  2. Damage to your Workhorse chassis caused by accident, misuse, or alteration of you Workhorse chassis including:
    - Installation of non-Workhorse parts or components on your Workhorse chassis
    - Addition of aftermarket suspension, engine, or transmission equipment or modifications to your Workhorse chassis
    - Tampering with your Workhorse chassis' emissions control systems
    - Driving your Workhorse chassis through deep water
- Overloading or uneven weight distribution of your Workhorse chassis
  - Accidents, collisions, fires, thefts, freezing, vandalism, riots, explosions, or objects striking your Workhorse chassis
  - Misuse or inappropriate operation of your Workhorse chassis
  - Improper or extended storage
  - Insufficient or improper maintenance
  - Environment, chemical treatments, or aftermarket products that may contribute to corrosion
  - Contaminated fuel
  - Failure to follow the recommended Maintenance Schedule on your Workhorse chassis or failure to use or maintain fluids, fuel, lubricants, or refrigerant in your Workhorse chassis as recommended in your Owner's Manual.
  - Airborne fallout (chemicals, tree sap, salt spray, etc.), stones, hail, earthquake, water, flood, windstorm, lightning, or the application of chemicals or sealants.

- Contaminated fuel provided to your vehicle, included but not limited to injector plugging, fuel filters clogging, fuel pump damage, tank cleaning, and towing.
- 3. Odometer alteration
- 4. Vehicles titled as salvaged, scrapped, junked, or totaled
- 5. Front suspension alignment
- 6. Periodic maintenance
- 7. Economic loss or other expenses
- 8. Damage to or loss of personal property contained in vehicle

### ***B. Detailed Information About What is Not Covered by Your Workhorse Limited Warranty***

1. Any Part or Component that is Warranted by its Own Manufacturer, including but not Limited to the Engine, Transmission, Tires, and any Non-Workhorse Parts or Components.

Your Workhorse limited warranty does not cover parts and components of your Workhorse chassis that are manufactured and warranted by other manufacturers, including but not limited to nonchassis electrical components, the coach, or other body installed on your Workhorse chassis, the engine, the transmission, the tires, and non-Workhorse parts or components. Please review the separate part or component manufacturers' owner's manuals and warranties or consult their distributors for any warranty coverage of those parts or components. You can also contact Workhorse Customer Relations at 1- 877-946-7731 for assistance.

2. Damage Caused by Accident, Misuse, or Alteration  
Your Workhorse limited warranty does not cover damage to your Workhorse chassis that is caused by any of the following:
  - Cutting, welding, stretching, disconnecting, shrinking, or otherwise altering your Workhorse chassis' wheelbase, suspension, frame rails, driveline or axle, as well as any alteration or modification performed upon your Workhorse chassis or its original components after your Workhorse chassis left Workhorse's control.

IF THE COACH OR BODY MANUFACTURER THAT ASSEMBLED YOUR VEHICLE ALTERED YOUR WORKHORSE CHASSIS IN ANY WAY, THEN THIS WARRANTY NO LONGER COVERS ANY PORTION OF YOUR WORKHORSE CHASSIS THAT HAS BEEN SO ALTERED, AND WORK HORSE WILL NOT COVER ANY REPAIRS THAT MAY BE REQUIRED ON THIS ALTERED PORTION OF YOUR WORKHORSE CHASSIS OR ON ANY PORTION OF THE CHASSIS AFFECTED BY THE ALTERATIONS.

- Installation of any non-Workhorse parts, components, accessories, or other materials.
- Addition of aftermarket suspension equipment on your Workhorse chassis, including but not limited to tag axles, springs or spring helpers, spacer blocks, or air springs.
- Addition of aftermarket engine and transmission modifications on your Workhorse chassis, including but not limited to superchargers, turbo chargers, exhaust brakes, exhaust systems, air induction systems, computers, software or hardware modifications, governors, gear splitters, or electric braking devices.

- Tampering with your Workhorse chassis or your Workhorse chassis' emissions control systems or with parts or components that affect your Workhorse chassis or emissions control systems.
  - Your Workhorse chassis being driven through water deep enough to be ingested into your vehicle's engine.
  - Chassis overloading or uneven weight distribution.
  - Accidents, collisions, fires, thefts, freezing, vandalism, riots, explosions, or objects striking your Workhorse chassis.
  - Misuse of your Workhorse chassis such as driving over curbs, overloading, or racing or other competition.
  - Improper or extended storage, including but not limited to corrosion and battery damage due to inadequately maintained charge.
3. Odometer Alteration  
Your Workhorse limited warranty will be void if your odometer has been dis connected, its reading has been altered or if mileage cannot be determined.
  4. Vehicles Titled as Salvaged, Scrapped, Junked, or Totaled

Your Workhorse limited warranty does not cover your Workhorse chassis if it is currently or was previously titled as salvaged, scrapped, junked, flooded, or totaled.

5. Front Suspension Alignment

Your Workhorse limited warranty does not cover your Workhorse chassis' front suspension alignment.

6. Periodic Maintenance

Your Workhorse limited warranty does not cover periodic maintenance on your Workhorse chassis, including but not limited to lubrication, cleaning, and replacement of items due to use, wear, and tear or exposure.

7. Economic Loss or Other Expenses

Your Workhorse limited warranty does not cover any economic loss or expenses suffered by you as a result of your Workhorse chassis requiring warranty or other repairs, including but not limited to loss of use, inconvenience, storage, lost time or pay, rental expense, lodging, meals, or other travel costs.

8. Damage to or Loss of Personal Property Contained in Vehicle

Your Workhorse limited warranty does not cover damage to or loss of any personal property that is contained in your vehicle, including but not limited to perishables contained in refrigerators, freezers, or cupboards, at any time, including but not limited to when your vehicle is located at an authorized Workhorse service facility.

## **PART F - DISCLAIMER OF ALL OTHER WARRANTIES**

YOUR WORKHORSE LIMITED WARRANTY IS THE ONLY EXPRESS WARRANTY PROVIDED BY WORKHORSE FOR YOUR WORKHORSE CHASSIS. WORKHORSE ASSUMES NO OTHER OBLIGATION OR LIABILITY IN CONNECTION WITH YOUR WORKHORSE CHASSIS OR YOUR VEHICLE. WORKHORSE DOES NOT AUTHORIZE YOUR SELLING DEALER, YOUR COACH OR BODY MANUFACTURER OR ANY OTHER PERSON OR ENTITY TO ALTER, AMEND, OR OTHERWISE CHANGE YOUR WORKHORSE LIMITED WARRANTY IN ANY MANNER.



WORKHORSE IS NOT RESPONSIBLE FOR ANY INCIDENTAL OR CONSEQUENTIAL DAMAGES OR EXPENSES YOU MAY CLAIM AS A RESULT OF YOUR USE OF YOUR WORKHORSE CHASSIS, INCLUDING BUT NOT LIMITED TO THE COST OF ALTERNATIVE TRANSPORTATION OR LODGING, INCONVENIENCE OR LOSS OF USE.

YOU MAY HAVE SOME IMPLIED WARRANTIES ON YOUR WORKHORSE CHASSIS, SUCH AS AN IMPLIED WARRANTY OF MERCHANTABILITY OR AN IMPLIED WARRANTY OF FITNESS FOR A PARTICULAR PURPOSE. THESE IMPLIED WARRANTIES ARE LIMITED, TO THE EXTENT ALLOWED BY LAW, TO THE TIME PERIOD COVERED BY YOUR WORKHORSE LIMITED WARRANTY.

Some States do not allow limitations on how long an implied warranty lasts, so the above limitation may not apply to you.

Some States do not allow the exclusion or limitation of incidental or consequential damages, so the above limitation or exclusion may not apply to you.

Your Workhorse limited warranty gives you specific legal rights, and you may also have other rights which vary from State to State.

## **PART G - THINGS YOU SHOULD KNOW ABOUT YOUR WORKHORSE LIMITED WARRANTY**

### **I. Component Exchanges**

Workhorse may offer exchange service on some of your chassis components. This service is intended to reduce the amount of time your vehicle is unavailable for use due to repairs. Components used in exchange may be new, remanufactured, reconditioned, or repaired, depending on the component involved.

All exchange components meet Workhorse quality standards and are warranted the same as new components. Examples of the types of components that might be exchanged include engine and transmission assemblies, instrument cluster assemblies, and powertrain control modules.

Your Workhorse limited warranty covers Workhorse installed air conditioning system parts and components such as the compressor and condenser. Your coach or body manufacturer supplies and installs most other parts and components of your air conditioning systems, including but not limited to the evaporator, controls, ductwork, and blower fan. Final assembly and functional testing is completed by the coach or body manufacturer.

## II. Recycled Materials

EPA guidelines require the capture, purification, and reuse of automotive air conditioning refrigerant gases and engine coolant. As a result, any repairs that your authorized Workhorse service facility may make to your Workhorse chassis may involve the installation of purified reclaimed refrigerant or coolant.

## III. Air Conditioning Systems Coverage

Workhorse does not design, test, certify, assemble, or install dash or roof-mounted air conditioning systems.

Your Workhorse limited warranty does not cover any of these systems.

### ***Parts/Components/Repairs Covered by Workhorse Limited Warranty:***

- Compressor mounting
- Compressor drive belt
- Compressor clutch installation including electrical
- Compressor failure not resulting from system malfunction
- Condenser mounting
- Condenser leaks not caused by damage
- Condenser fan failure not caused by damage nor resulting from system malfunction
- Dryer leaks not caused by damage
- Dryer failure not resulting from system malfunction
- Hose or compressor-outlet-to-condenser inlet leaks not caused by damage or faulty installation by coach or body manufacturer
- Hose or compressor-outlet-to-condenser inlet failure not caused by system malfunction
- System leaks caused by defective Workhorse parts or components

Your Workhorse limited warranty covers Workhorse installed air conditioning system parts and components such as the compressor and condenser. Your coach or body manufacturer supplies and installs most other parts and components of your air conditioning systems, including but not limited to the evaporator, controls, ductwork, and blower fan. Final assembly and functional testing is completed by the coach or body manufacturer.

## **Parts/Components/Repairs NOT Covered by Workhorse Limited Warranty:**

- Testing of air conditioning systems
- Damaged parts or components
- Added performance kits
- Air conditioning systems performance
- Leaks at Schrader valves
- System leaks not caused by defective Workhorse parts or components
- Leaks at any hose connections
- Damage due to low or overfilled refrigerant
- Controls inside vehicle
- Ductwork

- Blower fan
- All electrical except compressor clutch
- Clutch failure caused by excessive head pressure
- Evaporator

## **IV Extensions**

### **A. Time Extensions**

Your Workhorse limited warranty may be extended one day for each day beyond the first 24-hour period your vehicle is at an authorized Workhorse service facility for warranty service under your Workhorse limited warranty. Workhorse reserves the right to require you to show the repair orders performed on your Workhorse chassis to verify the period of time your warranty is to be extended. Your extension rights may also vary depending on state law.

### **B. Mileage Extensions**

Prior to delivery, your Workhorse chassis may be driven during testing at Workhorse's assembly plant, during shipping, and while at the coach or body manufacturer's

or dealer's facility. Your dealer records this mileage at the beginning of this Section. This mileage, up to a maximum of 1,000 miles, will be added to the mileage limits of your Workhorse limited warranty. You will not receive a mileage extension if you purchased a used chassis, dealer-owned used chassis or dealer demonstrator chassis.

### ***V. Delayed Warranty Start***

If your Workhorse chassis was originally sold by Workhorse to a coach or body manufacturer prior to your purchase of the vehicle, you may be eligible for a "delayed warranty start." Contact Workhorse Customer Relations at 1-877-946-7731 if you have any questions as to whether you are eligible for a delayed warranty start.

If you are eligible for a delayed warranty start, subject to the limitations set forth below, your Workhorse limited warranty will commence on the earlier of the date and mileage that your chassis was sold by the coach or body manufacturer's dealer to you or the first retail purchaser of your vehicle.

Your Workhorse limited warranty may only be delayed as follows:

- A. Chassis originally sold for commercial use may be delayed for a maximum extension of 4,000 miles, whichever comes first.
- B. Chassis originally sold for recreational use may be delayed for a maximum extension of 6,000 miles, whichever comes first.

Workhorse chassis used in a demonstrator vehicle are not eligible for a delayed warranty start. All delayed warranty starts must be approved by Workhorse.

*Note: Your warranty start date will be the date Workhorse shipped your Workhorse chassis from the factory, unless a Delayed Warranty Start form is completed and submitted by your selling dealer and approved by Workhorse. This is necessary for first and subsequent owners.*

## VI. Production Changes

Workhorse reserves the right to make changes in chassis built and/or sold by Workhorse at any time without incurring any obligation to make the same or similar changes on your Workhorse chassis.

## VII. Things You Should Know About Your Emissions Warranties

### A. Replacement Parts and Components

The emissions control systems of your Workhorse chassis were designed, built, and tested with Workhorse parts and components. Workhorse recommends that any replacement parts or components used for maintenance or repair of emissions control systems be genuine Workhorse parts or components; however, your emissions warranties' coverage is not dependent upon the use of any particular brand of replacement parts or components. You may elect to use non-Workhorse parts; however, the use of non-Workhorse parts may impair the effectiveness of emissions control systems.

### B. Claims Procedure

Take your vehicle to any authorized Workhorse repair facility to obtain service under your Workhorse chassis' emissions warranties. This should be done as soon as possible after failing an EPA approved I/M test or a California Smog Check test, or at any time you suspect a defect in a part or component.

For further information or to report violations of the emissions warranties, you may contact the following:

Field Operations and Support Division  
Environmental Protection Agency  
401 "M" Street S.W.  
Washington, DC 20460  
-or-

State of California Air Resources Board  
Mobile Source Operations Division  
R O. Box 8001  
El Monte, CA 91731-2990

## **PART H - WORKHORSE PARTICIPATION IN THE BBB AUTOLINE PROGRAM**

The BBB Autoline Program is an out-of-court program administered by the Council of Better Business Bureaus to settle consumer disputes regarding warranty coverage and repairs to automotive and related products, such as your Workhorse chassis. This informal dispute resolution program is free to you. If you do not agree with the decision of the BBB in your case, you may reject it and seek any other relief available to you.

Workhorse currently participates in the BBB program in 28 states. Your eligibility to participate in the BBB program is limited by your vehicle's age, mileage and other factors. Workhorse reserves the right to change eligibility requirements or to discontinue its participation in the BBB program.

You may be required to resort to the BBB Autoline Program before exercising rights or seeking remedies created by the Magnuson-Moss Warranty Act (the "Act"). If you choose to seek redress by pursuing rights and remedies not created by the Act, resort to the BBB Autoline Program would not be required by the Act.

### **Name and Address of BBB Autoline Program You may contact the BBB as follows:**

BBB Autoline Program  
Council of Better Business Bureaus, Inc.  
4200 Wilson Boulevard, Suite 800  
Arlington, VA 22203-1804  
1-800-955-5100

### **Brief Description of BBB Autoline Program Procedures, Time Limits and Information Required**

Your case is officially filed with BBB Autoline once you provide them with the following required information:

- Your name and address
- The Vehicle Identification Number (VIN) of your vehicle
- The make, model and year of your vehicle
- A description of the problem with your vehicle

Upon receipt of the information about your case, a representative from Workhorse may contact you to discuss settlement options. In some cases, a prehearing settlement conference may be held by telephone. If the case is not settled, it proceeds to arbitration, an informal process in which the parties present their views of the dispute to an impartial third party, an arbitrator, who will decide how the dispute will be resolved. Your case will generally be heard within 40 days.

### **PART I - STATE WARRANTY LAWS**

Laws in some states permit you under certain circumstances to obtain (i) a replacement of your Workhorse chassis or (ii) a refund of your purchase price for your Workhorse chassis. These laws vary from state to state. Some state laws require that you use the BBB Autoline Program prior to filing any claim in a state court. To the extent allowed by state law, Workhorse requires that you first provide workhorse with (a) written notice of your claim, and (b) an opportunity to make any needed repairs on your Workhorse chassis, before you are eligible for the remedies provided by these state laws. Your written notice should be sent to:

Workhorse Custom Chassis, LLC  
Customer Relations  
850 Stephenson Highway, Suite #510  
Troy, MI 48083-1174  
1-877-946-7731

## **PART J - WORKHORSE SERVICE PUBLICATIONS**

### **Service Manuals**

Service manuals have diagnosis and repair information on engines, transmissions, axles, suspensions, brakes, electrical systems, steering, etc. and can be order directly. (See the following ordering information.)

### **Owner's Information**

Your Owner's Manual is written specifically for owners and provides basic operation information about your Workhorse chassis. Your Owner's Manual includes the maintenance schedule for all models.

### **Ordering Service Publications**

Information on ordering all service publications, including pricing, shipping, and payment options, can be obtained by calling, 1-248-616-9085 (Monday-Friday, 9 AM-5 PM EST), or by email at: [orders@wccpublications.com](mailto:orders@wccpublications.com).

If you have any questions about your Workhorse chassis, Workhorse encourages you to call our toll free number or write:

Workhorse Custom Chassis, LLC  
Customer Relations  
850 Stephenson Highway, Suite #510  
Troy, MI 48083-1174  
1-877-946-7731



The information in this section will familiarize you with the International® MaxxForce™ 5 series on-highway diesel engine. Additionally, it will provide enough information to enable you to perform necessary services for efficient

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**NOTES:**

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## INTRODUCTION

This manual lists the schedule of maintenance operations required to assure optimum emission control and service from the engine. Refer to the exhaust emission label, affixed to the left hand valve cover for compliance information.

As the owner, it is your responsibility to be certain that maintenance operations are performed at specified intervals. In addition to controlling required emission levels, proper maintenance pays off in improved vehicle performance and more economical operations.

The maximum life and efficiency of equipment is assured when the correct precautions are taken to keep dirt and other foreign particles out of the units. Be sure that oil, coolant, and fuel are always kept clean and that combustion air is always filtered. Always follow specified maintenance schedule and maintenance procedures to reduce potential concerns.

When new engine parts are required, be sure to specify genuine International® service parts or ReNEWed® parts to assure the best results and high quality.

Throughout this manual use of terms left, right, front and rear must be understood to avoid confusion when following instructions. The left and right sides of the engine are described when facing the flywheel from flywheel (back) end of engine.

### **NOTICE**

*Your International® MaxxForce™ 5 engine warranty is covered at any authorized/equipped International Truck and Engine Corporation dealer ONLY. For Warranty information, please refer to Section 6 of this manual (Customer Assistance and Warranty Information).*

## SAFE PRACTICES FOR OPERATING AND SERVICING THE ENGINE



### CAUTION

*Do not use volatile starting aids in the air intake system such as the following:*

- Ether
- Propane
- Gasoline

Quick access to a first aid kit should be provided at all times to treat minor cuts and scratches.

It is recommended that an appropriate class fire extinguisher be provided at an accessible location.

Check the classification of each fire extinguisher to ensure that the following fire types can be extinguished:

- Type A - Wood, paper, textiles, and rubbish
- Type B - Flammable liquids
- Type C - Electrical equipment

Avoid running engines with unprotected air inlets or exhaust openings. When unavoidable for service reasons, place protective screens over all openings before servicing engine.

The engine should be operated or serviced only by those who are qualified, responsible, and trained to do so.

Always wear the correct safety equipment as required for the job. This may include: hard hat, safety shoes, ear protectors, reflective clothing, safety goggles, and heavy gloves.

Avoid personal injury, comply with the following warnings: Always wear safety glasses with side shields.

Do not wear rings, wrist watches, jewelry, loose or hanging apparel that can catch on moving parts or short across battery terminals causing serious injury.

Provide proper ventilation when operating an engine in a closed area to remove deadly exhaust gases, breathing of exhaust fumes may be fatal.

Keep engine exhaust system and exhaust manifolds clear of combustible material.

Be sure the driver's area is clean, organized, and free of obstructions, remove or secure all maintenance or personal items.

Be sure that everything is clear before starting the engine.

Do not use an open flame as a light source to look for leaks or for inspection anywhere on the vehicle.

Always shift transmission to PARK (P), stop the engine, apply the parking brake, and remove the key before permitting anyone to inspect, clean, lubricate, adjust, or repair any part of the engine or its attachments unless otherwise specifically recommended in this manual.

When required to make any checks with the engine running:

- Always apply the parking brake
- Always use two people, with one person at the operator's position and the other checking the engine

Be sure that the gear shift lever is in PARK (P) before starting the engine.

Always be sure that all shields, guards and access covers are in place when engine is in operation.

Do not operate the engine with an unsafe condition. If an unsafe condition is found, tag the engine and ignition key to alert others.

Do not place head, body, limbs, feet, fingers, or hands near a rotating fan, belt, or power driven part.

Do not adjust engine when the vehicle is in motion.

Electric storage batteries give off highly flammable hydrogen gases. To prevent possible explosion:

- Never allow lighted smoking material, an open flame, or electrical sparks near the battery
- Do not lay tools or other conductive materials on the battery where they may cause short circuits and sparks
- Never charge batteries in a closed unventilated area
- Leave battery box open to improve ventilation when charging batteries
- Provide proper ventilation to guard against an accidental explosion from an accumulation of gases given off in the charging process

Always disconnect batteries and tag all controls according to OSHA requirements before working on electrical system and to warn that work is in progress. Be sure to connect the battery cable clamps to proper terminals (+ to +) and (- to -) at both ends. Avoid shorting clamps.

Fluid (electrolyte) in electric storage batteries contain sulfuric acid which can cause severe burns.

- Avoid all contact of fluid with the eyes, skin, or clothing
- If contact does occur, flush immediately with large amounts of water
- Get prompt medical attention

Always permit parts that are hot or contain hot fluid to cool to a safe temperature before handling or disconnecting.

Shut engine off and be sure all pressure in the system has been relieved before removing panels, housing covers, and caps. Use extreme caution when removing the coolant fill cap.

The following safe practices are recommended:

- Allow engine to cool before removing cap
- Loosen the cap very slowly and avoid pressurized steam or water that might be in cooling system
- Add coolant only when engine is idling or stopped

Use care when dealing with fluids under pressure. Fluid escaping under pressure from a small hole can have sufficient force to penetrate the skin. The following safe practices are recommended:

- Never use hands, fingers, or other body parts to inspect for pressure leaks
- Use a piece of cardboard or wood to search for suspected pressure leaks
- If injured by escaping fluid, see a doctor at once. Serious infection can result if medical treatment is not given immediately

## NOTICE

*Engine fluids, oil, fuel, and coolant can be a threat to the environment. Never dispose of engine fluids or oil filters by putting them in the trash, pouring them on the ground, in the sewers, in streams or bodies of water. Collect and dispose of engine fluids according to local regulations.*



## CAUTION

*Do not allow used engine fluids to stay on your skin. Clean your skin and nails with soap and water, or a good hand cleaner. Wash or properly throw away clothing or rags containing used engine fluids. Used engine fluids contain certain elements that may be unhealthy for skin and could even cause cancer.*

Always stop engine before fueling. The following safe practices are recommended:

- Always place hose, nozzle, or funnel in contact with side of filler opening before fueling. This reduces the chance of a static electricity spark
- Keep contact until after fuel flow has stopped
- Do not over fill the fuel tank
- Do not smoke or have open flame in the fueling area
- Never fuel when the engine is hot or running

Never use gasoline, diesel fuel, or other flammable fluid for cleaning parts unless otherwise specified. Use authorized commercial, nonflammable, nontoxic solvents.

Handle all parts with extreme care. Keep hands and fingers from between parts. Wear authorized protective equipment such as safety glasses, heavy gloves, and safety shoes.

Always use safety stands in conjunction with hydraulic jacks or hoists. Do not rely on jack or hoist alone to carry the load.

Lift and handle all heavy parts with a lifting device of proper capacity. Be sure parts are supported by proper slings and hooks. Use lifting hooks with proper anti-slip closures. Use lifting eyes if provided. Watch out for people in the vicinity.

Never align holes with fingers or hands. Use the proper aligning tool.

Remove sharp edges and burrs from reworked parts.

Service platforms and ladders used to service engines should be constructed and maintained according to OSHA requirements.

Use safety glasses with side shields or goggles when using compressed air. Limit the pressure on approved air blow gun to 30 psi (207 kPa) according to OSHA requirements to avoid injury.



Do not use defective power tools. Check for frayed cords before using the tool. Be sure all electric tools are grounded.

Be sure all tools are in good condition. Do not use tools that require repair.

When servicing an engine with the air inlet piping disconnected, install turbocharger screen cover (Tool Number ZTSE 4239) on air inlet. Obtain cover from nearest International® dealer.



### CAUTION

*Avoid damage to the engine and the possibility of personal injury, the following procedures should be followed:*

*Turn ignition key to OFF before unplugging or plugging in a connector or relay for the Electronic Control Module (ECM) and Injector Drive Module (IDM). Failure to turn key to OFF will cause a voltage spike and damage to electrical components.*

*When welding is required on vehicle:*

- *Always disconnect engine and chassis harness connectors at the ECM and IDM*
- *Always wear welding goggles and gloves*
- *Acetylene and oxygen tanks must be separated by a metal shield and chained to a cart*
- *Always use shielding around hydraulic lines and components*
- *Do not weld or heat areas near fuel tanks or lines*

| <b>Serial or Part No.</b> | <b>Write No. In Blank Space</b> | <b>Description and Location</b>  |
|---------------------------|---------------------------------|--|
| Engine Serial No.         |                                 | Stamped on pad located on left rear of crankcase, just below parting line of cylinder head and crankcase.  |
| Engine Model              |                                 | Emission label, located on left valve cover  |
| Turbocharger Serial No.   |                                 | Turbocharger information plate   |
| Turbocharger Part No.     |                                 | Turbocharger information plate   |
| A/C Compressor            |                                 | Lower front right side of engine, and run by the fan belt  |
| Generator                 |                                 | Top front right side of engine, and run by the fan belt  |
| Cooling Fan Clutch        |                                 | Front of the water pump pulley   |
| Power Steering            |                                 | Lower right side of the power steering unit. Power steering pump is mounted on the lower front left side of the engine, and run by the fan belt. |
| Starter Motor             |                                 | Lower left side of the starter motor. Starter motor is mounted to the rear cover.  |

**Note: We suggest you write the engine model and serial number along with component identification numbers in the appropriate blank above.**

---

## **ENGINE SERIAL NUMBER**

The engine serial number is in two locations:

- Stamped on the crankcase pad, on the rear left side below the cylinder head.
- On the engine emission label on the crankcase breather located on the LH valve cover.

### **Engine Serial Number Example**

4.5HM2Y0101718

4.5 — Engine Displacement (liters)

H — Diesel, turbocharged, air intercooled, and electronically controlled

M2 — Motor truck

Y — United States, Huntsville

7 Digit Suffix — Sequence number

## **Emissions Labels**

An Environmental Protection Agency (EPA) Engine Emission Label is issued for the International® MaxxForce™ 5 diesel engine. Labels or identification plates include information and specifications helpful to vehicle operators and technicians. The label is on top of the crankcase breather, toward the front, on the left valve cover.

The label includes the following:

- Advertised brake horsepower ratings
- Engine model code
- Service applications
- Emission family and control systems
- Year the engine was certified to meet EPA emission standards

### Engine Accessories

The following engine accessories may have manufacturer's labels or identification plates:

- A/C compressor assembly
- Generator
- Cooling fan clutch
- Dual turbocharger assembly
- Power steering pump
- Starter motor

### Engine Description Standard Features

The International® MaxxForce™ 5 is a V6 engine. Engine displacement is 275 cubic inches (4.5 liters). The firing order is 1-2-5-6-3-4.

The cylinder head has four valves per cylinder for improved air flow. Each fuel injector is centrally located between the four valves and directs fuel over the piston bowl for improved performance and reduced emissions.

The overhead valve train includes self adjusting hydraulic roller cam followers, push rods, rocker arms, and dual valves that open using valve bridge.

A two piece crankcase withstands the loads of diesel operation. The lower crankcase has integral main bearing caps. Coolant and oil passages are cast and machined in the crankcase and front cover housing.

The crankshaft has four main bearings with fore and aft thrust controlled by a thrust bearing on main bearing number three. Two connecting rods are attached to each crankshaft rod journal. Piston pins are free floating and held in place with retaining rings.

The camshaft is supported by four insert bushings pressed into the crankcase. Two cam lobes, cam followers, push rods and valve bridges control four valves per cylinder. The crankshaft gear drives the camshaft.

Camshaft thrust is controlled with the rear surface of the cam journal and the cam gear.

The primary balancer shaft turns inside the camshaft. The balancer shaft is driven by the crankshaft gear on the rear of the engine. The primary balancer counterweight is on the front of the balance shaft held on with the thrust-primary plate. The thrust plate aligns and holds the front end of the balance shaft in the crankcase.

The Crankshaft Position (CKP) sensor and Camshaft Position (CMP) sensor are used by the Electronic Control Module (ECM) and Injector Drive Module (IDM) to calculate rpm, fuel timing, fuel quantity, and duration of fuel injection.

One piece aluminum alloy pistons are fitted with one keystone ring, one rectangular intermediate compression ring, and a two piece oil control ring.

The combustion bowl is located in the piston crown to reduce emissions. All pistons are mated to fractured cap joint connecting rods.

The engine lubrication system is pressure regulated, full flow cooled, and full flow filtered. The gerotor pump, driven by the crankshaft pressurizes the system. The oil pressure regulator, in the front cover, maintains system pressure. The oil cooler cover and oil filter base assemblies, in the top of the upper crankcase, direct the flow of coolant and oil.

The International® common rail high-pressure injection system includes a cast iron oil rail assembly, fuel injectors, and a high-pressure oil pump. The IDM electronically controls the injectors. The IDM sends high voltage pulses to the opening and closing coils of each injector to control fueling. The IDM receives input information from the ECM to determine timing, quantity, and duration of fuel for each injection event.

Boost pressure controls the dual stage turbocharger. A pneumatically actuated bypass valve controls boost pressure. A closed crankcase breather system recirculates crankcase vapors to the air inlet duct.

The Horizontal Fuel Conditioning Module (HFCM) is attached to a bracket mounted on the right (passenger) side of the transmission. The HFCM contains a fuel pump, filter, water separator with a drain plug, Water In Fuel (WIF) sensor, and Diesel Thermo Recirculation Module (DTRM).

The secondary fuel filter assembly has a fuel pressure regulator and an air bleed orifice.

The coolant supply housing includes an auxiliary water connection. The A/C compressor, mounted on a bracket on the lower, front, right side of engine is driven by the fan belt.

The generator is mounted on top of the front, right side of engine and is run by the fan belt.

Three electronic control modules monitor and control the engine:

- Diamond Logic™ engine controller - ECM
- Injector Drive Module (IDM)
- Exhaust Gas Recirculation (EGR) drive module

The inlet air heater (IAH) controls the inlet air heater which is mounted in the bottom of the intake manifold under the intake manifold elbow. The IAH warms the incoming air during cold start-up.

The glow plug relay controls the six glow plugs, one for each cylinder, to warm the cylinder walls and cylinders during start-up. The inlet air heater and glow plugs work together during start-up.

The power steering pump is mounted on the lower, front, left side of the engine, and is run by the fan belt.

The Charge Air Cooler (CAC) is an air-to-air heat exchanger which is designed to increase the density of the air charge.

### Optional Features

The coolant heater raises the temperature of coolant surrounding the cylinders for improved performance and fuel economy during start-up.

## **INSTRUMENT PANEL**

This manual does not describe internal cab mounted gauges and indicators, these are discussed in Section's "0" and "1" in this manual.

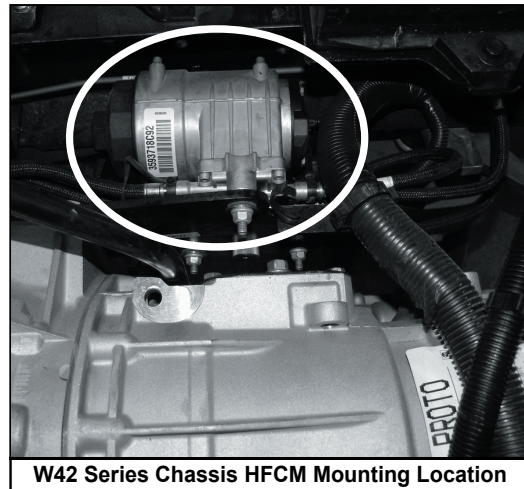
After the engine starts and at frequent intervals while the engine is operating, all gauges and indicators should be observed for correct readings.

### **Water in Fuel (WIF) Indicator**

The Horizontal Fuel Conditioning Module (HFCM), located on a bracket mounted to the transmission and is equipped with a fuel filter (primary) and water separator assembly.

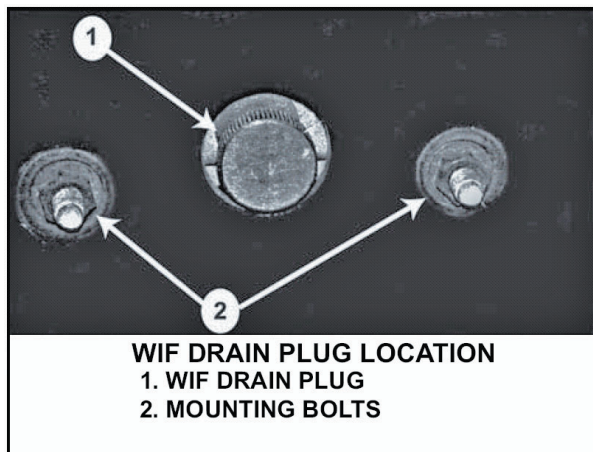
The water separator assembly sensor sends a signal to the ECM which sends a signal to the Water in Fuel (WIF) indicator located on the instrument panel.

When the indicator glows continuously while the engine is running, the engine should be shutdown as soon as possible to prevent damage to the fuel injection system. The water in the fuel filter and water separator should be drained as soon as possible after the engine is shutdown.



**W42 Series Chassis HFCM Mounting Location**

On the W42 Series chassis the WIF drain plug is accessible through the bracket mounted on the right (passenger) side of the transmission. On the W62 Series chassis the HFCM is mounted on the left frame rail. Service procedures are the same.



## Air Intake Restriction Indicator

Air cleaner restriction is detected by an air intake restriction indicator.

If the vehicle is equipped with an air cleaner mounted restriction indicator it is reset by pushing the button on the air intake restriction indicator. The air intake restriction indicator measures maximum restriction of the air cleaner element when the engine is operated at full load and locks at that point.

The indicator should be tested periodically to ensure proper indication. This can be accomplished with a master vacuum gauge.

### **NOTICE**

*It is not necessary that the engine be shut down when the yellow indicator in the gauge reaches the maximum restriction (red zone), rather it indicates that air intake service is required.*



## ENGINE START PROCEDURE

### Before Starting the Engine

This engine has been given pre-delivery service by Workhorse Custom Chassis and is ready for operation. You should fully understand the use and function of all controls, instruments and equipment.

Before starting the engine, go through the preoperation checklist.



### CAUTION

*Avoid serious personal injury or possible death, provide proper ventilation when operating an engine in a closed area, in order to remove deadly exhaust fumes. Inhalation of exhaust fumes may be fatal.*



### CAUTION

*Avoid serious personal injury or possible death, do not allow used engine fluids to stay on your skin. Clean your skin and nails with soap and water, or a good hand cleaner. Wash or properly throw away clothing or rags containing used engine fluids. Used engine fluids contain certain elements that may be unhealthy for skin and may even cause cancer.*

### Pre-Operation Checklist

*Note: Engine fluids, oil, fuel, and coolant, can be a threat to the environment. Never dispose of engine fluids or oil filters by putting them in the trash, pouring them on the ground, in the sewers, in streams or bodies of water. Collect and dispose of engine fluids according to local regulations.*

Before starting the engine perform the following:

1. Check the cooling system level.
  - Refer to “Maintenance Schedule - Check Coolant Level (Daily),” in this section.
  - If maintenance is necessary, refer to “Service Cooling System - Drain and Filling,” in this section.
2. Check that the engine crankcase is filled to the correct oil level.

## NOTICE

*Avoid damage to the engine, do not overfill with oil.*

- Refer to “Maintenance Schedule - Check Oil Level (Daily),” in this section.
  - Be sure to use the correct grade of oil.
3. Inspect for coolant, fuel or oil leaks. Refer to “Maintenance Schedule - Inspect for External Leakage (Daily),” in this section.
  4. Visually inspect air cleaner and piping for tightness and correct installation of filter element.

5. Visually inspect air intake restriction indicator. If yellow indicator is locked in the fully raised position, service the air cleaner.
6. Visually inspect for loose or hanging electrical connections.
7. Check belt for condition and alignment.
8. Fill the tank with the recommended fuel.
9. Visually inspect for exhaust system obstruction or damage.

## Starting Procedure



### CAUTION

*Avoid damage to the engine and the possibility of personal injury or death:*

*Do not use volatile starting aids in the air intake system such as:*

- Ether
- Propane
- Gasoline

*The glow plugs or inlet air heater could ignite the vapors.*

*Note: The various starting procedures may vary slightly depending upon accessory packages attached to or supplied with the engine (vehicle).*

1. Apply the parking brake and place the transmission control lever in the PARK (P) position.
2. Turn key switch to ON, this activates the glow plugs immediately, activates the intake air heater after a short time delay, and starts the HFCM.

*Note: The engine normally does not energize the glow plugs and the intake air heater during hot starts. However, it senses reduced atmospheric pressure at high altitude and could energize the glow plugs and intake air heater during hot starts.*

3. Watch for the WAIT TO START lamp on the dashboard to go off. DO NOT crank the engine until the lamp goes off.
4. When the WAIT TO START lamp goes off, turn the key switch to START.
5. When the engine starts, release the key switch. The key switch will return to ON and the engine will continue to run.

## **NOTICE**

*Avoid damage to the engine, do not depress the accelerator pedal.*

## **NOTICE**

*Avoid engine damage, if engine fails to start within 20 seconds:*

- Release key switch, turn the key switch to OFF, wait two to three minutes.
- Repeat steps 2 through 5.
- If after three attempts the engine does not start, determine the cause.
- Starter motor damage may result if starting attempts are continued. Allow ample time for the starter to cool between attempts.

## **NOTICE**

*Avoid damage to the engine:*

- Do not increase the engine speed until the oil pressure gauge indicates normal.
- Shutdown the engine if oil pressure does not meet minimum limit on the gauge within 20 to 30 seconds.

6. Low idle speed is 700 rpm (nonadjustable).  
Extended idling periods should be avoided, refer to “Extended Idling Periods,” in this section for further information. Check all gauges and indicators during warm-up.
7. Within seconds after starting, engine oil pressure should exceed 12 psi (83 kPa) minimum.
8. If oil pressure does not meet the minimum limit, stop the engine, locate and correct the problem.
9. After the engine has reached operating temperature, oil pressure should be 40 psi (276 kPa) minimum at rated speed. If oil pressure does not meet the minimum limit, stop the engine, locate and correct the problem.

*Note: If the engine starts and then stops, repeat the engine starting procedure, if more than three attempts are required, investigate for causes of no start.*



## CAUTION

**Avoid serious damage to the engine or the possibility of serious personal injury:**

- Always wear eye protection when working around batteries.
- Keep lighted tobacco, open flames, or sparks away from battery vent openings.
- Avoid inhaling hydrogen gas fumes normally produced by batteries.
- Always use a 12 volt system with a negative ground for jump starting.
- Always disconnect main negative battery cable first and connect main negative battery cable last.
- Never exceed 16.0 volts to the vehicle's electrical system.



## CAUTION

*Avoid the possibility of serious personal injury. Do not attempt to jump start a vehicle with a frozen battery. When a frozen battery is suspected perform the following:*

- *Examine all battery fill vents for ice.*
- *When ice is present do not jump start.*
- *Thaw out battery and test/recharge at a low rate.*

## EMERGENCY STARTING

If your battery (or batteries) has run down, you may want to use another vehicle and some jumper cables to start your vehicle. Follow the steps outlined in Section Three, “Jump Starting,” in this manual to do it safely.

## NOTICE

*Avoid damage to the engine, do not attach the other end of the negative cable to the negative (-) dead battery terminal, because a spark could occur. This can create an explosion of gases normally present around the battery.*

## STARTING AFTER RUNNING OUT OF FUEL

### NOTICE

*Avoid damage to the engine, avoid running out of fuel, air in the fuel system can cause damage to the fuel injectors.*

If the engine runs out of fuel:

1. Apply the parking brake and place the transmission control lever to PARK (P).
2. Add fuel to the tank. Refer to “Fuel Requirements,” in this section.
3. Turn the key switch to ON to start the fuel pump to fill the system.

*Note: The fuel pump will energize when the key is turned to ON. The fuel pump will stay on for several seconds. In order to prevent rough engine idle and smoking, cycle the key to ON and back to OFF several times to completely fill the fuel system and remove any air.*

4. Engage starter for 20 seconds and allow starter to cool for two to three minutes.

*Note: To decrease the load on the batteries, return the key switch to ON between starts. Do not return the key switch to OFF. This will prevent the glow plugs and the intake air heater from recycling.*

## **NOTICE**

*Avoid damage to your starter, if the engine fails to start within 20 seconds, release key switch and wait 2 to 3 minutes to allow starter motor to cool. Repeat the above procedure.*

5. Repeat step 4 until the engine starts and runs on its own.
6. Any remaining trapped air will self-purge from the fuel system once the engine starts running.

*Note: The engine may run rough and produce white smoke while air is in the fuel system. This is normal and should stop after a short time.*

## **SUGGESTED WARM-UP TIME**

*Note: It is very important that any engine be warmed up before applying a load.*

If the engine coolant temperature is below 158 °F (70 °C), the ECM adjusts the low idle speed from a maximum of 875 down to 700 rpm.

The warm-up period provides time for the lubricating oil to establish a film between moving parts. Before applying a load or speed above 1000 rpm to the engine, make sure to warm-up the engine for a minimum of five minutes at or below 1000 rpm.

**A Cold Ambient Protection (CAP)** system aids in engine warm-up and maintaining engine heat during extended idling periods. Refer to “Extended Idling Periods,” in this section for further information.

*Note: Cold ambient engine warm-up time can be reduced by operating the vehicle under load at reduced engine speed. Commence normal operation when engine systems reach operating temperature.*

## EXTENDED IDLING PERIODS

### NOTICE

*Prevent engine damage by avoiding extended low idle periods.*

Extended idling periods should be avoided. Diesel engine efficiency is improved when the cylinder temperature remains high. If cylinder temperatures are too low, the following may occur:

- Exhaust slobber is unburned fuel that may seep from the exhaust manifold and vehicle exhaust system connections. It has the dark colored appearance of lubricating oil.

- Fuel dilution, unburned fuel carried into the lubrication oil causing the viscosity of the oil to change. When cylinder temperatures are too low to allow complete combustion, the unburned fuel will wash lubricating oil from the cylinder walls.
- Fuel injector tips will form carbon deposits that cause plugging.
- Carbon deposits also form inside the turbocharger and EGR components causing reduced engine efficiency.
- Carbon deposits form restrictions in the converter causing reduced engine efficiency.

## CALIFORNIA ELECTRONIC SHUTDOWN SYSTEM

***(CALIFORNIA - STANDARD) Title 13 Section 1956.8(a)(6)***

**Government Regulation:** State and local regulations may limit engine idle time. The vehicle owner or operator is responsible for compliance with these regulations.

Your heavy duty diesel engine conforms to applicable California Air Resources Board (CARB) Engine Shutdown System (ESS) regulations. This vehicle is registered and certified for sale in California. This vehicle also meets regulations in all 50 States and may be sold in all 50 States.

The CARB Electronic Shutdown System (ESS) will limit engine idle time to comply with certain state and local regulations. When parking brake is set, the idle time will be limited to 5 minutes. When parking brake is released, the idle time will be limited to 15 minutes.

ESS will not be active under the following conditions:

- PTO Mode / Auxiliary Equipment Operation
- If the engine coolant is below 60 F°
- Diesel Particulate filter Stationary Regeneration
- Service or Maintenance

Thirty seconds before engine shutdown, the red engine lamp will flash, and an audible alarm will sound.

ESS will be reset when there is any movement on the accelerator or brake pedal.

### ENGINE IDLE SHUTDOWN TIMER - OPTIONAL

The Idle Shutdown Timer (IST) is an optional feature that allows the ECM to shutdown the engine when an extended idle condition occurs. The idle time can be programmed from 5 to 120 minutes.

Thirty seconds before engine shutdown, the red engine lamp will begin flashing and an audible alarm will sound. This continues until the engine shuts down or the low idle shutdown timer is reset. Idle time is measured from the last brake pedal transition. The transmission must be in PARK (P) for the IST to work.

The engine shutdown time will deactivate when one or more of the following occurs:

- Engine speed is not at idle speed (700 rpm).
- Vehicle movement is detected.
- Accelerator pedal movement or an Accelerator Pedal Position Sensor (APS) fault is detected.
- Engine coolant operating temperature is below 140 °F (approximately 60 °C ).



- Ambient temperature below 60 °F (16 °C) or above 110 °F (44 °C).
- Brake pedal movement is detected or a brake switch fault is detected
- Can be programmed to deactivate when the transmission Power Take Off (PTO) is active (optional).
- Shift selector is moved from PARK (P) If the IST is enabled, the Cold Ambient Protection (CAP) will not function.
- Check that all other electrical equipment is in good condition.
- Keep the cooling system filled with the proper mix of approved coolant to prevent damage by freezing.
- Check cooling system hoses for leaks.
- At the end of each daily operation, refer to “Engine Shutdown,” in this section.

At temperatures of -10 °F (-23 °C) and below, it is recommended that you use a crankcase mounted cup plug coolant heater (optional) to improve cold starting.

*Note: 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.*

## COLD WEATHER OPERATION

*Note: The various starting procedures may vary slightly depending upon accessory packages attached to or supplied with the engine (vehicle).*

When operating the engine near 32 °F (0 °C) and lower, perform the following:

- Make certain that the battery is the correct size and is fully charged.
- Make sure battery has correct amount of electrolyte, if it is NOT a maintenance-free battery.

## Cold Ambient Protection (CAP)

The CAP system aids in engine warm-up and maintaining engine heat during extended idling periods.

If after five minutes of idle time and the intake air temperature is below 54 °F (12 °C) and coolant is below 128 °F (70 °C), the CAP system will slowly ramp up the engine idle speed to 1400 rpm. The engine speed will continue to increase or decrease in rpm to maintain a coolant temperature of 176 °F (80 °C) until the following occurs:

- Engine load is greater than 35%.
- Brake pedal is applied or brake switch fault is detected.
- Transmission shift selector is moved from PARK (P), shift selector must be in PARK (P) for CAP to work.
- The switch, also used for electronic hand throttle, is turned on and actively controls engine speed.
- Accelerator pedal is depressed or accelerator pedal sensor fault is detected.
- The IST is enabled.

- Engine Coolant Temperature (ECT) sensor fault is detected.
- Intake Air Temperature (IAT) ambient temperature sensor fault is detected.

## HOT WEATHER OPERATION

When operating the engine in temperatures above 32°F (0 °C), do the following:

- Make certain that the battery is the correct size and is fully charged.
- Make sure battery has correct amount of electrolyte, if it is NOT a maintenance-free battery.
- Check that all other electrical equipment is in good condition.
- Keep the cooling system filled with clean coolant to prevent damage by overheating.
- Check cooling system hoses for leaks.
- At the end of each daily operation, refer to “Engine Shutdowns,” in this section.

## NORMAL ENGINE OPERATION

### Parking



## CAUTION

*Avoid serious personal injury or property damage when parking:*

- Place the transmission in PARK (P).
- Apply the parking brake.
- Block the wheels or turn the wheels toward curb when parking on a grade.

*Failure to follow these procedures could result in an unattended vehicle moving.*

### Road Usage

Correct road operation of your vehicle will provide the following:

- Satisfactory engine performance
- Maximum fuel economy
- Long service life

Here are some good general guidelines to follow for correct road usage.

1. Accelerate smoothly and evenly to engine rated speed. Rapid acceleration results in higher fuel consumption and no increase in performance.
2. Engine speed should not be permitted to drop below peak torque rpm when pulling at full throttle to avoid lugging conditions.
3. When approaching a hill, depress accelerator smoothly to start the upgrade at full power.

### Backing Up

Before backing up the vehicle, be sure it can be done safely. If anything behind the cab limits your view, do not rely on mirrors alone to ensure that the intended path is clear. If other people are in the vicinity, have someone standing well behind the vehicle and outside of the intended path (visible through an exterior mirror) guide the operator as the vehicle is backed up.

Although OSHA or some governmental regulations may require the use of an electrical or mechanical back-up alarm to warn bystanders, such an alarm does not ensure that the intended path is clear. When in doubt, get out of the vehicle and visually check the intended path and make sure it is clear. Back up slowly to allow others time to move, if necessary.



## CAUTION

*Avoid serious personal injury or property damage when backing the vehicle, always be sure the vehicle's path is clear.*

### Downhill Operation

Protect your engine when driving downhill as follows:

- Prevent over-speeding of the engine when going down long and steep grades.
- Operate the engine at a lower rpm to provide some engine braking.

### NOTICE

*When driving downhill, avoid engine damage by making sure the engine is NOT operated above the high idle speed.*

### Idle Speeds

Low idle speed for the International® MaxxForce™ 5 diesel engine is 700 rpm (non-adjustable).



## CAUTION

*Avoid serious personal injury or possible death, provide proper ventilation when operating engine in a closed area.*

---

## Driving While Towing

### **NOTICE**

*To avoid damage to the engine, transmission, or vehicle, do not exceed the Gross Combined Weight Rating (GCWR) rating.*

*To aid in engine/transmission cooling and air conditioning efficiency during hot weather while stopped in traffic, place the gearshift lever in PARK (P).*

### **When towing a trailer:**

- Turn off the speed control. The speed control may shut off automatically when towing on long, steep grades.
- Anticipate stops and brake gradually.

## ENGINE SHUTDOWN

### **Normal Engine Shutdown**

At the end of each day, prior to stopping the engine perform the following:

- Idle the engine for several minutes prior to shutdown.
- Idling the engine is recommended when an engine has been running at maximum horsepower.
- Idling allows heat to dissipate from the engine iron mass.

At the end of each daily operation, perform the following:

- Fill the fuel tank to prevent condensation with recommended fuel. Refer to “Fuel Requirements,” in this section.
- Using the correct lubricating oil, be sure the crankcase contains the correct amount of oil. Refer to “Lubrication Requirements,” in this section.

## ENGINE WARNING PROTECTION SYSTEM (EWPS)

The EWPS safeguards the engine from undesirable operating conditions, to prevent engine damage and prolong engine life.

Depending upon vehicle configuration, if any of the following conditions are detected, the on-board electronics will warn the operator:

- High Coolant Temperature (standard, 2-way or 3-way system)
- Low Engine Oil Pressure (2-way or 3-way system)
- Low Coolant Level (3-way system only)

The on-board computer will alert the operator with the following two alarm limits:

- Warning:
  - Red ENGINE lamp illuminates and the alarm sounds
  - This is a condition which meets or exceeds programmed warning limit

- Critical:
  - Red ENGINE lamp flashes and alarm sounds
  - This is a condition which has already exceeded a warning limit and meets or exceeds a critical limit

If the protection feature is enabled, the on-board electronics will shut the engine down when a critical engine condition is detected. Once the red engine lamp and alarm is activated, the operator has 30 seconds to safely pull the vehicle off the road. As long as the critical engine condition remains, the ECM allows the engine to be restarted and run for additional 30 second periods.

## ENGINE SPECIFICATIONS

| Engine Model   | MaxxForce™ 5                                 |
|--|--|
| Number of Cylinders  | 5  |
| Configuration  | V  |
| Bore   | 3.74 in (95 mm)                              |
| Stroke   | 4.134 in (105 mm)                            |
| Displacement   | 275 cu. in. (4.5 liter)                      |
| Compression Ratio  | 18.0:1                                       |
| Firing Order   | 1–2–5–6–3–4                                  |
| Engine Lube Oil Pressure (operating temperature w/ SAE 15W-40 oil) |  |
| Low Idle   | 12 psi (83 kPa) minimum                      |
| High Idle  | 40 psi (276 kPa) minimum                     |
| Brake Horsepower @ rpm   | See Exhaust Emission Label on LH valve cover |
| Peak Torque @ rpm  | See Exhaust Emission Label on LH valve cover |
| Idle Speed, No-Load  | 700 rpm +/- 50 rpm (nonadjustable)           |
| Rated Speed, Full-Load   | 3000 rpm (nonadjustable)                     |

| Engine Model                                       | MaxxForce™ 5  |
|--|---|
| Maximum Exhaust Restriction @ Muffler Inlet        | 68 in. of H <sub>2</sub> O (16.9 kPa) @ 3000 rpm, @ full load |
| Maximum Intake Restriction                         | 25 in. of H <sub>2</sub> O (6.2 kPa) @ 3000 rpm, @ full load  |
| Thermostat Opening Temperature                     | 192°F and 89°C  |
| Crankcase Oil Capacity – Lube Oil (without filter) | 14 quarts (13 liters)   |
| Crankcase Oil Capacity – Lube Oil (with filter)    | 15 quarts (14 liters)   |

## LUBRICATION REQUIREMENTS

### Oil Quality

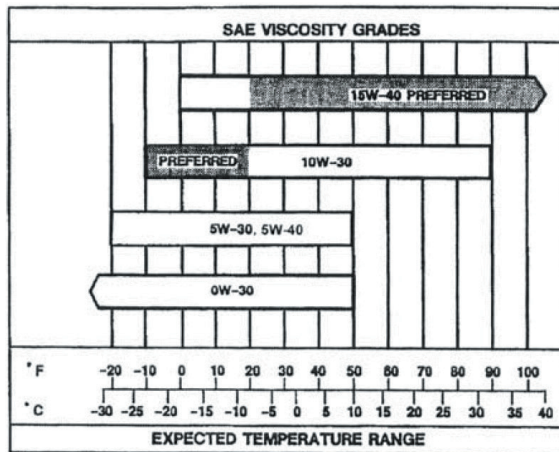
Oil quality is described by American Petroleum Institute (API) engine service categories. API categories are defined by oil performance (deposits and wear) measured in standardized engine tests. The API “S” category (SL) describe oils for spark ignition (gasoline) engines.

### NOTICE

*For 2007 and later emissions compliant diesel engines use ONLY API category CJ-4 engine oil.*

API licensed oils can be recognized by the Identification Symbol displayed on the container.

Refer to the shaded areas in SAE Viscosity Grades and Temperature Range Chart found in this section. It indicates the preferred oil for the expected temperature range. Low viscosity or winter grade oils are desirable for low temperature engine operation.



### NOTICE

*Refer to “Maintenance Schedule,” in this manual, for the recommended oil change interval for your engine.*



**NOTICE**

*Avoid damage to the engine:*

*Do not use oil grades outside the recommended ranges.*

*Do not use oil with a “Starburst” symbol and “For Gasoline Engines” notation.*

*Do not use oils marketed to specifically service other engine applications, including the following:*

- *Stationary diesel or natural gas engines*
- *Marine diesel engines*
- *Railroad diesel engines*

**Oil Viscosity**

Oil viscosity (thickness) is described as viscosity grade by the Society of Automotive Engineers (SAE). Colder temperatures require lower viscosity oils to ensure good flow during starting. Hotter temperatures require higher viscosity oils for satisfactory lubrication.

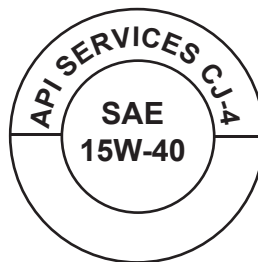
Based upon the temperature range you expect before your next oil change, use the chart and the recommended alternatives to choose the proper viscosity grade.

Increase in oil consumption may be experienced when SAE 0W-30, 5W-30, 10W, and 10W-30 oils are used. Check oil level more frequently.

**Identification Symbol**

An oil container symbol system has been developed to help you choose the correct oil as follows:

- The top portion of the symbol shows the oil quality, such as API Service CJ-4 in this example



- The center portion will show the SAE viscosity grade, such as SAE 15W-40 in the example

### **Crankcase Oil Specifications**

For specific information on most commercial oil brand names, write for the booklet entitled:

“Lubricating Oil Data Book For Heavy-Duty Automotive and Industrial Engines”

Engine Manufacturers Association

Two North LaSalle Street, Suite 2200

Chicago, Illinois 60602

Phone (312) 827-8700 Fax (312) 827-8737

E-mail: [ema@enginemanufacturers.org](mailto:ema@enginemanufacturers.org)

### **Check Engine Oil Level**

Keep oil level within the operating range on the oil level gauge. Never operate an engine with oil level outside the operating range. Do not overfill. Refer to “Maintenance Schedule,” in this section.

## FUEL REQUIREMENTS

### Recommended Fuel

The International® MaxxForce™ 5 diesel engine will yield maximum performance for minimal cost by adhering to the following fuel recommendations. The specifications are broad enough to permit the use of low cost fuels. Additionally, they are restrictive enough to prevent the use of poor quality fuels that may cause frequent overhauls.



## CAUTION

*Diesel engine equipped chassis REQUIRE the use of ULSD (Ultra Low Sulfur Diesel) fuel. Failure to use ULSD will result in severe damage to engine fuel systems and excessive repair costs that will not be covered under warranty.*

*Use ULSD-15 PPM Diesel Fuel Only!*

Do **NOT** use fuels sold as heating or furnace oil.

### NOTICE

*Federal law requires all 2007 and later emission compliant on-road certified diesel engines to use a non-dyed fuel containing a sulfur level of no more than 15 PPM (parts per million) It is a violation of Federal law to operate these engines on the former low sulfur fuel (500 PPM) or on red-dyed non-road high sulfur fuel.*

The Engine Manufacturers Association (EMA) is a member of the Worldwide Fuel Charter (WWFC). The WWFC has defined a diesel fuel that is superior in quality than the commercial fuel specification ASTM D975 Table 1. This fuel has increased the cetane number resulting in:

- Improved cold weather performance.
- Minimum level of fuel lubricity for improved fuel system durability.
- Distillation properties and cleanliness requirements that enhance fuel quality.

### **NOTICE**

*Avoid engine damage, do not use propane fuel by itself or in conjunction with any of the International® recommended fuels. International® Truck and Engine Corporation will not honor any and all warranty claims against engines that have been using propane fuel.*

When a superior quality diesel fuel is desired, ask your fuel supplier for a diesel fuel that meets the WWFC category 4 guideline for premium diesel fuel.

The guidelines are available at:

[www.enginemanufacturers.org/admin/library/upload/61.pdf](http://www.enginemanufacturers.org/admin/library/upload/61.pdf).

### **Biodiesel Fuel**

International® Truck and Engine Corporation allows the use of Biodiesel Blends at the maximum concentration of B5 - (5% biodiesel blended with 95% petroleum based ULSD diesel fuel). The biodiesel must meet either the ASTM D6751 or the European EN14214 Specifications.

## Advisory Against Diesel Fuel/Used Oil Blends

International® Truck and Engine Corporation does not recommend the following:

- Blending used engine oil with diesel fuel. This practice can increase vehicle emissions and the rate of internal engine wear.
- Blending gasoline, alcohol or gasohol with diesel fuel.

This practice can create fire or explosive hazards and is detrimental to engine performance.

## Advisory Against Diesel Fuel/Gasoline/Alcohol Blends

A minimum of two percent volume gasoline mixed with diesel fuel will create a flammable and explosive mixture in the fuel tank vapor space. This practice can create fire or explosive hazards and is detrimental to engine performance.



## CAUTION

*Avoid serious injury or possible death, do not mix gasoline, gasohol or alcohol with diesel fuel. This practice creates a fire hazard and is potentially explosive.*



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## Fuel Related Performance Issues

Lower fuel viscosity can reduce engine power, fuel economy, and increases the possibility of excessive fuel system wear or failure.

A lower cetane number could cause hard starting and slower warm-up. Additionally, an increase in engine noise and exhaust emissions can occur. Use diesel fuel with a minimum 42 cetane number.

If your engine suddenly becomes noisy after a fuel fill, you may have received substandard fuel with a low cetane rating. When possible, buy diesel fuel from a supplier who sells large quantities of commercial diesel fuel.

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## COOLING SYSTEM REQUIREMENTS

### Introduction

In order to comply with the Technology Maintenance Council (TMC) recently issued Recommended Practice RP 351 "Guidelines for Color Standardization of Engine Coolant/Antifreeze," dated September 2003, these guidelines for antifreeze/coolant color coding have been established.

All coolants must be low silicate (less than 0.10%) meeting ASTM D4985 specifications.

The standard cooling system factory fill is with extended life coolant (red color).

Should a maintenance technician choose to empty all extended life coolant from the engine, under this circumstance conventional coolant may be used as a replacement.

Engine coolant applications are comprised of water, glycol (either ethylene or propylene) and inhibitors. Conventional fully formulated and extended service products require regular testing of inhibitor levels in order to maintain safe

levels of protection. Testing of conventional or extended service coolants requires determining levels of nitrite and or nitrite/molybdate and freeze point and then refortifying with Supplemental Coolant Additives (SCA's) on a regular basis to replenish lost inhibitors.

Testing for nitrites or nitrite/molybdate levels is not required when using Rotella® Extended Life Coolant (RELC). RELC uses patented carboxylate inhibitors in an ethylene glycol base that allows the coolant to maintain correct coolant chemistry with just one addition of extender halfway through the operating life.

International® ethylene glycol coolant may be added in 45% to 55% concentration for protection below -20 °F (-29 °C). Concentrations above 60% and not over 67% are acceptable only for very cold climates where freeze protection of -55 °F (-48 °C) to -78 °F (-61 °C) respectively are required.

Blends of propylene glycol coolant and water containing 50 to 55% coolant concentrate are also acceptable for normal applications. These correspond to freeze points of -26 °F (-32 °C) and -40 °F (-40 °C) respectively. Concentrations above 60% and not over 67% are acceptable only for very cold climates where freeze protection of -55 °F (-48 °C) to -78 °F (-61 °C) respectively are required.

*Note: When refilling or adding coolant check the reservoir for coolant color.*

### Extended Life (Red) Coolant

International® factory fills all cooling systems with extended life (red) coolant. Conventional (green) coolant will be substituted upon customer request. See your International® dealer for details.

The use of ROTELLA® (extended life) pre-diluted 50/50 to make up for coolant loss will assure the glycol/water concentrations stay in balance.

**NOTICE**

To avoid engine damage:

- Do not use a coolant concentration greater than 67%. A coolant concentration greater than 67% has a higher freezing point than coolant with a 67% or lower mixture. This will adversely affect freeze protection and heat transfer rates which may result in restriction of engine coolant passages, causing overheating, and subsequent engine damage.
- All coolants must be low silicate (less than 0.10%) meeting ASTM D4985 specifications. Your diesel engine warranty could be adversely effected should automotive high silicate coolant be used.
- DO NOT mix ethylene glycol type coolant and propylene glycol type coolant.

**Coolant Extender (Red)**

The coolant inhibitors deplete more slowly, thereby extending service intervals to 5 years, 300,000 miles (483 000 kilometers) or 12,000 hours, with the addition of extender only at the half way point: 30 months, 150,000 miles (241 000 kilometers) or 6,000 hours.

**ROTELLA® Extender — Service Interval Quantity**

150,000 miles (241 000 km) 30 months, or 6,000 hours

Extended life (red) coolant does not require a coolant filter.

| GALLONS  | LITERS   | ROTELLA® EXTENDER QUANTITY |
|----------|----------|----------------------------|
| 6 to 8   | 22 to 30 | 0.5 quart (.2 L)           |
| 8 to 13  | 30 to 49 | 1.0 quart (0.5 L)          |
| 13 to 22 | 49 to 83 | 1.5 quart (0.7 L)          |

ROTELLA® Extender Mixing Quantities



**Conventional (Green) Coolant**

| International® Conventional Coolant Part Numbers |            |
|--|------------|
| Gallon   | 2JJ996723A |
| 55 Gallon Drum                                   | 2JJ996900C |

## Supplemental Coolant Additives (SCA) Coolant Conditioner

At the coolant change period if conventional coolant is installed, also add liquid International® cooling system conditioner.

All cooling system conditioners, including those in coolant solutions, become depleted through normal operation. If conditioners in coolant are allowed to become depleted, the coolant becomes corrosive.

The coolant solution then attacks the metal surface of the cooling system causing leaks and deposit build up, which reduces heat transfer. To maintain an acceptable conditioner concentration, additional chemicals must be supplied to the cooling system.

Cooling systems should be checked twice a year to assure proper water/glycol concentrations.

International® SCA is recommended for use in International® diesel engines. SCA is a complete conditioner system. It is a phosphate molybdate and nitrite based formulation which provides corrosion protection, reduced cylinder wall pitting, controls pH, neutralizes acids, and contains additives which prevent the formulation of mineral deposits.

Anytime makeup coolant is added to the cooling system, liquid International® cooling system conditioner should be added at a minimum rate of 227 ml (8 ounces) (2.5 units) per one gallon of makeup coolant. After adding conditioner, operate engine until it is warmed up enough to circulate the conditioner through the cooling system.

Engines in high-hour and low mileage applications, which operate frequently at low engine speeds and engine temperatures, are best maintained according to hour intervals rather than mileage intervals.

At the coolant change period if conventional (green) coolant is installed, also add liquid International® cooling system conditioner.

| Coolant Capacity and Coolant Conditioner Requirements |                                   |               |
|---|-----------------------------------|---------------|
| Cooling System Capacity                               | Additional DCA-4 Units per Gallon | Liquid Ounces |
| 28 to 32 quarts (7.0 to 8.0 gallon)                   | 0.4 to 0.5 =                      | 1.3 to 1.6    |
| 33 to 36 quarts (8.25 to 9.0 gallon)                  | 0.6 to 0.8 =                      | 1.9 to 2.5    |
| 37 to 40 quarts (9.25 to 10.0 gallons)                | 0.9 to 1.0 =                      | 2.3 to 3.2    |
| 41 to 44 quarts (10.25 to 11.0 gallons)               | 1.0 to 1.2 =                      | 3.2 to 3.8    |
| 45 to 48 quarts (11.25 to 12.0 gallons)               | 1.1 to 1.3 =                      | 3.5 to 4.1    |
| 49 to 52 quarts (12.25 to 13.0 gallons)               | 1.2 to 1.4 =                      | 3.8 to 4.5    |
| 53 to 56 quarts (13.25 to 14.0 gallons)               | 1.3 to 1.5 =                      | 4.2 to 4.8    |

## Contamination of Coolant

The maximum permissible contamination of Propylene Glycol coolant with Ethylene Glycol coolant is 10%. If the contamination level is exceeded, either consider the cooling system as filled with conventional coolant or drain coolant and thoroughly flush cooling system with an alkaline or acid type cooling system cleaner, refer to "Cleaning the System," in this section.

Refill the cooling system with clean water and the appropriate coolant.

### NOTICE

*Avoid engine damage, do not add ethylene glycol coolant to any International® diesel engine cooling system containing propylene glycol coolant or vice versa. Do not mix ethylene glycol coolant and propylene glycol coolant.*

## MAINTENANCE SCHEDULE

| Inspection Interval Service — whichever comes first: miles, hours, or years           |   |   |   |
|---|---|---|---|
| Daily   | Check Oil Level <sup>1</sup><br>Check Coolant Level <sup>1</sup><br>Inspect for External Leakage <sup>1</sup><br>Inspect Air Restriction Indicator <sup>2</sup> | Annually  | Inspect Electrical & Electronic Systems<br>Pressurize Induction System <sup>3</sup> |
| 4 months  | Coolant System Maintenance —<br>Conditioner Concentration Test<br>(green coolant only <sup>5</sup> )  | 72,000 miles (116 000 km),<br>24 months,<br>or 2,400 hours  | Drain & Refill Coolant System (green coolant only)                                  |
| 10,000 miles (16 000 km)<br>6 months, 350 engine hours,<br>or 1,000 gallons of fuel   | Service Water-in-Fuel Separator<br>Change Engine Oil & Filter<br>Inspect Belt, Idlers, & Tensioner  | 150,000 miles (241 000 km),<br>30 months,<br>or 6,000 hours | Add Coolant Extender (red coolant) <sup>4</sup>                                     |
| 20,000 miles (32 000 km),<br>12 months, 700 engine hours, or<br>2,000 gallons of fuel | Change Primary & Secondary Fuel Filters<br>Measure Air Intake Restriction 2,3   | 300,000 miles (483 000 km),<br>or 5 years                   | Drain & Refill Extended Life (red) Coolant  |

### Footnotes:

1. Correct if necessary.
2. Service air cleaner element as required.
3. Refer to MaxxForce™ 5 Diesel Engine Diagnostic Manual.
4. For extended life coolant only, refer to ROTELLA® Extender Service Interval Quantity in this section.
5. For conventional coolant only, refer to maintenance intervals specified in this section.

## Oil Change Interval

For International® diesel engines, the recommended oil change intervals are based on the U.S. EPA Emission Standards for On-Highway vehicles operating on ULSD diesel fuel with a maximum sulfur content of 15 PPM. Know your fuel sulfur content. When in doubt ask your supplier or have fuel analyzed. Fuel containing more than 15 PPM sulfur **CANNOT** be used in 2007 and later emission compliant diesel engines.

### **NOTICE**

*Use of oils exceeding the required quality level, synthetic oils or other oils claiming longer service intervals does not justify extending oil change intervals beyond those recommended.*

## GENERAL INFORMATION

*Note: Engine fluids, oil, fuel, and coolant, can be a threat to the environment. Never dispose of engine fluids or oil filters by putting them in the trash, pouring them on the ground, in the sewers, in streams, or bodies of water. Collect and dispose of engine fluids and oil filters according to local regulations.*

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

Service intervals are based on average operating conditions. Additional servicing will be required for:

- Dusty conditions
- Frequent starts and stops
- Heavily laden operations



## CAUTION

*Avoid serious personal injury or possible death, do not allow used engine fluids to stay on your skin. Clean your skin and nails with soap and water, or a good hand cleaner. Wash or properly throw away clothing or rags containing used engine fluids. Used engine fluids contain certain elements that may be unhealthy for skin and could even cause cancer.*

The owner is responsible for all scheduled maintenance. The required maintenance operations may be completed by the owner or a service establishment of the owner's choosing. Any replacement parts used for required maintenance services or repairs should be genuine International® parts or equivalent in quality and performance to genuine International® parts. Use of inferior/incorrect replacement parts hinder operations of the engine and emissions control system.

Receipts showing regular maintenance should be retained if questions arise concerning maintenance. The receipts should be transferred to each subsequent owner of the engine (vehicle).

Engines are more efficient when they are clean. Grease and dirt buildup keep the engine warmer than normal.

When washing:

- Take care when using a power washer to clean the engine. The high-pressure fluid could penetrate the sealed parts and cause damage.
- Spray cleaner/degreaser on all parts that require cleaning and rinse clean.

### NOTICE

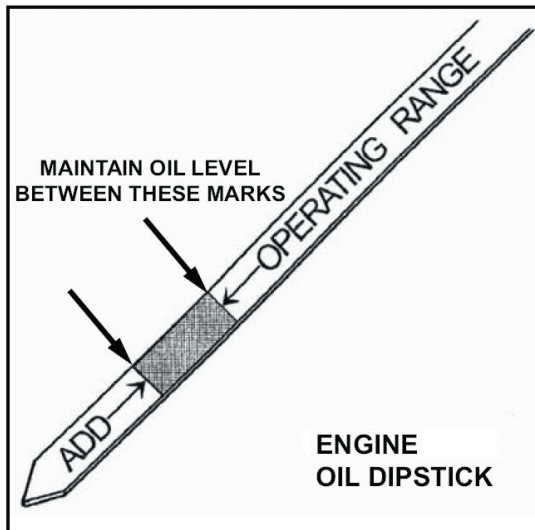
*Do not spray a hot engine with cold water to avoid cracking the engine block or other engine components.*

### NOTICE

*Never wash or rinse the engine while it is running; water in the running engine may cause internal damage.*

## Check Oil Level

Note: Never check oil level with the engine running or immediately after engine shutdown. Allow a 15 minute drain down time to avoid an inaccurate reading.



## NOTICE

*Avoid engine damage:*

- *Keep oil level within the cross-hatched operating range indicated on the oil level gauge*
- *DO NOT overfill the engine with oil*
- *Never operate engine with oil level above the full mark or operating range*

To accurately determine engine oil level:

1. Make sure vehicle is parked on level ground.
2. Remove oil level gauge from oil level gauge tube.
3. Correct oil level is indicated by cross-hatched operating range on gauge.
4. When oil level is below operating range, fill with proper oil recommended for operating climate. Refer to "Lubrication Requirements," in this section.
5. The add mark indicates 1 quart (0.95 liter) of oil should be added.
6. Refer to "Maintenance Schedule," in this section for service intervals.

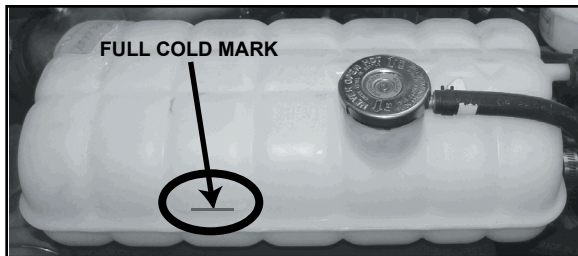
## Check Coolant Level

### CAUTION

*Avoid damage to the engine and the possibility of personal injury:*

- Always allow the engine to cool for 15 minutes.
- Wrap a thick cloth around the cap.
- Loosen cap slowly a quarter to half turn.
- Pause for a moment to avoid water or steam scalding, allow all water or steam pressure to be relieved.
- Continue to turn the cap and remove.
- Never add cold coolant to a hot engine, this can result in a cracked cylinder head or crankcase.
- Never use water as a coolant substitute.

1. Check the level of coolant in the de-aeration tank.
  - Coolant level should be above the FULL COLD mark.
  - When coolant level is below the FULL COLD mark when the engine is cold, refer to “Cooling System Requirements,” in this section for the correct procedure to add coolant.



*Note: When refilling or adding coolant, check the reservoir for coolant color. DO NOT exceed a maximum water/glycol concentration of 67%. Concentrations greater than 67% offer less freeze protection.*

2. Refer to “Service Cooling System,” in this section for the correct filling procedure.
3. Refer to “Maintenance Schedule,” in this section for service intervals.



## BELT & AIR INTAKE PIPING SERVICE

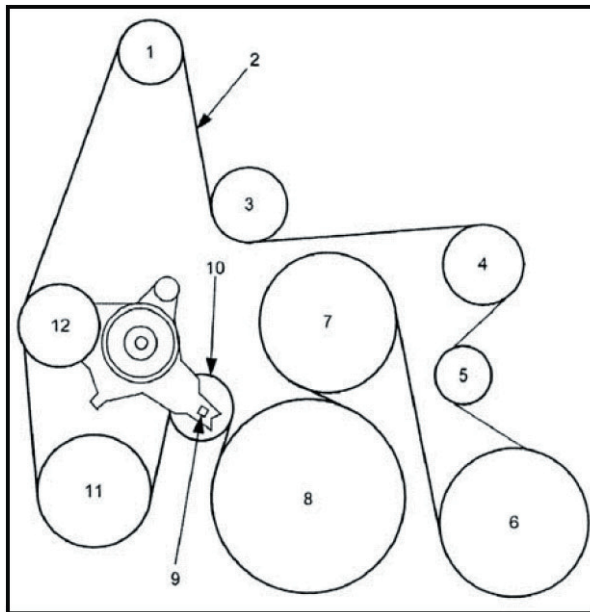
### Inspect the Belt

Inspect the ribbed surface of the belt for cracks or other damage. Replace the belt if excessive cracking is evident.

### Replace the Belt

Note: When installing belt always place the belt around the inside edge of auto tensioner assembly. Install the belt according to the belt routing diagram.

- 1 Generator
- 2 Belt
- 3 Idler
- 4 Idler
- 5 Idler
- 6 Power Steering Pump
- 7 Water Pump
- 8 Crankshaft Damper
- 9 Tensioner Square
- 10 Belt Tensioner
- 11 A/C Compressor
- 12 Belt Tensioner



Install new belt as follows:

1. Place the belt around the pulleys.
2. Insert the 1/2 inch square drive breaker bar in the square hole of the auto tensioner pulley.
3. Pull breaker bar down to release tension. Place belt around edge of belt tensioner, release and remove the breaker bar. The belt tensioner is automatically adjusted.

Refer to “Maintenance Schedule,” in this section for service intervals.

## Inspect for External Leakage



### CAUTION

*Before inspecting, shift the transmission to PARK (P), shut down the engine, apply the parking brake, and block the wheels.*

To identify possible leaks, inspect:

- Hoses for cracking or loose clamps
- Water stains
- Oil stains
- Wetness at water pump
- Fuel stains

Inspect Air Intake Restriction indicator when the filter element reaches maximum allowable restriction, the yellow indicator reaches the top of window and automatically locks in this position. The indicator remains fully exposed even after engine shutdown. The filter element must be properly serviced at this time to prevent low power complaints or engine damage.

### NOTICE

*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.*

The initial restriction with a new air cleaner 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 below the window so the air restriction gauge can be reused.

## Measure Air Filter Air Intake Restriction

Note: Often a low power and poor fuel economy complaint is simply due to a dirty air filter element. As the air filter accumulates dirt, restriction to air flow increases. If the service indicator is locked at maximum restriction, replace the air filter element or elements.

1. Refer to “Air intake Restriction Indicator,” in this section.
2. Inspect the element(s) for damaged gaskets or dents in the element(s). If they exhibit either they should be replaced.
3. If low power is still experienced after replacing the air filter element, see your Workhorse authorized service center.



*Note: The air cleaner must be serviced when the restriction reaches the maximum allowable limit. The restriction can be measured by the air intake restriction indicator.*

### Service Air Cleaner Element

Service the air cleaner filter element as follows:

1. Remove dirty air filter element and discard.
2. Clean any accumulation of dirt from the air cleaner housing using a damp rag. Do not use shop air for this cleaning.
3. Inspect air cleaner housing for damage or distortion which could allow unfiltered air to enter the engine.
4. Install a new air filter element.
5. Reset the indicator by pushing and releasing the reset button. The yellow indicator will drop below the window so the gauge can be reused.

Refer to “Maintenance Schedule,” in this section for service intervals.

### Change Engine Oil and Filter (Diesel Engine)

Note: Engine fluids, oil, fuel, and coolant, can be a threat to the environment. Never dispose of engine fluids or oil filters by putting them in the trash, pouring them on the ground, in the sewers, in streams, or bodies of water. Collect and dispose of engine fluids and oil filters according to local regulations.



## CAUTION

*Avoid serious personal injury or possible death, do not allow used engine fluids to stay on your skin. Clean your skin and nails with soap and water, or a good hand cleaner. Wash or properly throw away clothing or rags containing used engine fluids. Used engine fluids contain certain elements that may be unhealthy for skin and could even cause cancer.*



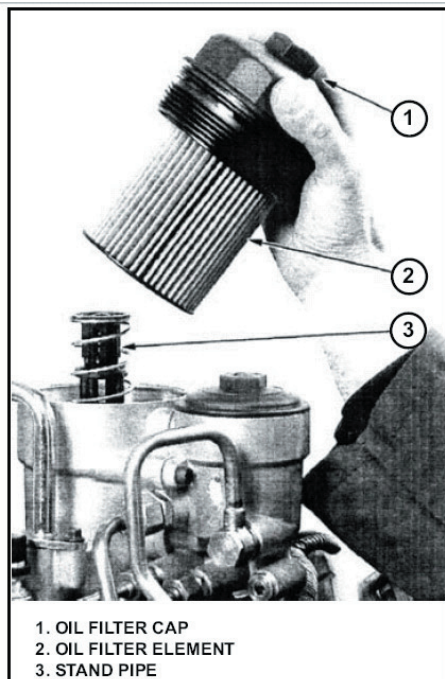
## CAUTION

*Avoid serious personal injury, wear protective clothing and use caution around hot engine oil.*

## NOTICE

*Avoid engine damage, remove the oil filter before draining the oil pan. When the oil filter is removed, the oil filter drain valve opens and allows unfiltered oil in the filter housing to drain back into the oil pan.*

1. Park vehicle on level ground. Apply the parking brake and place transmission control lever in PARK (P).
2. Run engine until operating temperature is achieved, then shut down.
3. Replace the oil filter element as follows:
  - Using a 1-7/16 inch wrench or a strap wrench, loosen the oil filter cap.
  - Lubricate and install a new o-ring on filter cap.
  - Install new oil filter element (dry) over stand pipe and into the oil filter housing.
  - Install oil filter cap and tighten until cap contacts filter housing.
  - Tighten to the specified torque value of 18 lb ft (25 N•m).



4. Drain oil pan as follows:
  - Place a suitable container according to local regulations, under the oil pan drain plug.
  - Remove oil pan drain plug and drain oil.
  - Remove and discard the oil pan drain plug gasket.
  - Install oil pan drain plug gasket, install and tighten the oil pan drain plug to 32 lb ft (44 N•m).
  - Dispose of oil according to local regulations.
5. Fill engine to specified capacity with the appropriate oil type as specified in “Lubrication Requirements,” in this section.
  - Lift cap and filter element do not remove from oil filter housing. Allow oil to drain for approximately one minute.
  - Remove oil filter element and o-ring from the filter cap and dispose of according to local regulations.

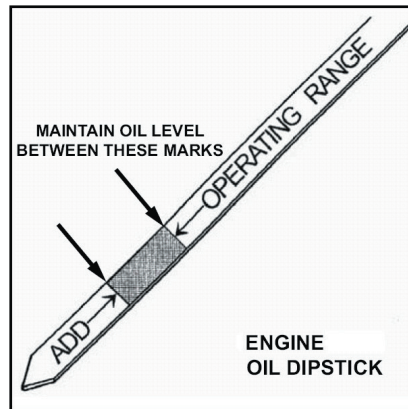
**NOTICE**

Avoid damage to the engine:

- Do not increase engine speed until the oil pressure gauge indicates normal.
  - Shut down engine if oil pressure is not registered on the gauge within 20-30 seconds.
6. Start engine and run at low idle rpm.
    - Check lube oil pressure gauge reading
    - If the gauge reading is at or below a minimum of 12 PSI (83 kPa) at 700 rpm, shut engine off immediately
    - Check for oil filter and oil pan drain plug leaks or other indications of low oil pressure readings
    - Let engine run until operating temperature is reached
    - Check for leaks and correct if found

7. Shut down engine and wait 15 minutes.

8. Recheck oil level and add oil (if needed) to bring oil level within the cross-hatched operating range on gauge.



9. Do not overfill, oil level should not go above top of cross-hatched operating range mark on the oil level gauge.

*Note: Engine fluids, oil, fuel, and coolant, can be a threat to the environment. Never dispose of engine fluids by putting them in the trash, pouring them on the ground, in the sewers, in streams or bodies of water. Collect and dispose of engine fluids according to local regulations.*

## DIESEL FUEL SYSTEM MAINTENANCE

### Fuel Filter Replacement

#### *Change Secondary Fuel Filter Element*



## CAUTION

*Avoid serious personal injury, possible death or damage to the engine or vehicle by:*

- *Disposing of fuel in the correct container clearly marked DIESEL FUEL according to local regulations.*
- *DO NOT smoke.*
- *Keep away from open flames and sparks.*

Fuel with more than average impurities (refer to “Fuel Requirements,” in this section) may require changing filter element at shorter intervals.

Change the fuel filter element as follows:

1. Park vehicle on level ground. Apply the parking brake and place transmission control lever in PARK (P).
2. Using a 1/2 inch square drive wrench, remove fuel filter cap.
3. Remove and replace fuel filter element assembly as follows:
  - a. Remove and discard the fuel filter element according to local regulations.
  - b. Remove and discard fuel filter gasket according to local regulations. Carefully clean mating surfaces.
  - c. Apply a coating of diesel fuel to new fuel filter gasket and install on fuel filter housing.
  - d. Install new fuel filter element in the fuel filter housing.
  - e. Place the cap in the fuel filter housing. Tighten the fuel filter cap on the fuel filter housing until the fuel filter cap contacts the aluminum housing. Tighten to the specified torque value of 18 lb ft (25 N•m).



4. Start the engine and check for leaks.

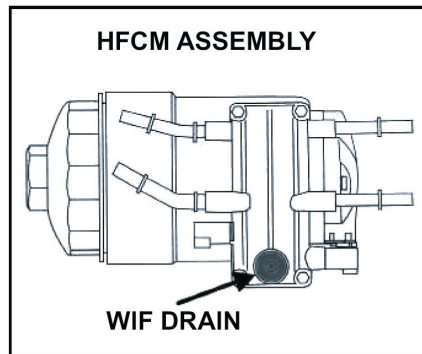
*Note: The engine may run rough and produce white smoke while air is in the fuel system. This is normal and should stop after a short period of time.*

Both the primary and secondary fuel filter elements should be replaced at the same time.

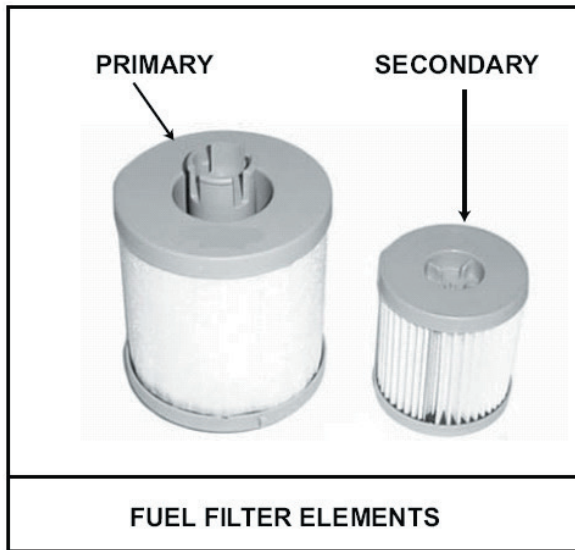
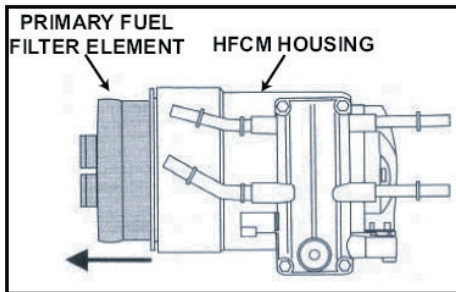
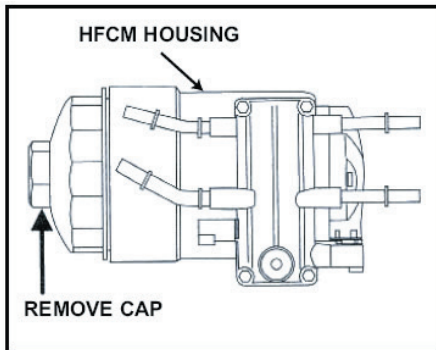
## Change HFCM (Primary) Fuel Filter Element

1. Stop the vehicle, set and lock the parking brake and place transmission control lever in the PARK (P) position, and shut off the engine.
2. Place a suitable container according to local regulations, under the fuel module filter cap and WIF drain.
3. Open WIF drain and drain fuel filter cavity.

4. Remove the fuel filter cap by turning counterclockwise and finish draining the HFCM housing.



5. Remove and discard cap O-ring according to local regulations. Carefully clean mating surfaces.
6. Remove and discard the fuel filter element according to local regulations. Carefully clean mating surfaces.
7. Lubricate and install a new O-ring on the end of the fuel filter and the fuel filter cap. Install new fuel filter into the fuel filter housing.



8. Tighten the cap until it contacts the housing.  
Tighten to the special torque value of 18 lb ft (25 N•m).
9. Shut the WIF drain.
10. Start the engine and check for leaks.  
*Note: The engine may run rough and produce white smoke while air is in the fuel system. This is normal and should stop after a short period of time.*

## Service Water in Fuel Separator

Water should be drained from the HFCM whenever the warning light comes on or every 10,000 miles (16,000 km). The Water In Fuel (WIF) light will come on when water accumulates in the module.

Service the WIF separator as follows:

1. Stop the vehicle, set and lock the parking brake and place transmission control lever in the PARK (P) position, and shut off the engine.
2. Place a suitable container according to local regulations, under the HFCM drain plug.

3. Open the drain plug (located through the bracket mounted on the right (passenger) side of the transmission) by turning it counterclockwise. Allow to drain for approximately 25 seconds or until clean fuel is observed.
4. Inspect the drain plug o-ring, replace as required.
5. Close the drain plug by turning it clockwise until it is firmly seated.
6. Verify that the drain plug is shut and sealed, then remove the container from under the vehicle.
7. Restart the engine, check for leaks and check WIF indicator light; it should not be illuminated. If it continues to illuminate, have the fuel system checked and repaired.
8. Dispose of fuel according to local regulations.

*Note: Engine fluids, oil, fuel, and coolant, can be a threat to the environment. Never dispose of engine fluids by putting them in the trash, pouring them on the ground, in the sewers, in streams or bodies of water. Collect and dispose of engine fluids according to local regulations.*

Damaged or clogged radiator fins prohibit the flow of outside air to the radiator and hamper efficient cooling system operation. Periodically check for:

- Bent or damaged radiator fins
- Bugs, leaves, or other debris blocking the radiator

The cooling system will be factory filled with extended life coolant. It is recommended that extended life coolant be added to the system when required.



## CAUTION

*Avoid serious personal injury or possible death, do not allow used engine fluids to stay on your skin. Clean your skin and nails with soap and water, or a good hand cleaner. Wash or properly throw away clothing or rags containing used engine fluids. Used engine fluids contain certain elements that may be unhealthy for skin and could even cause cancer.*

## Exhaust Filter Regeneration

This vehicle is equipped with a Diesel Particulate Filter (DPF) in the exhaust system to meet 2007 EPA mandated emissions requirements. This DPF traps particulate matter from the engine exhaust and is subject to “plugging” after a certain amount of time due to accumulation of soot particles. At some point, this plugging effect may reach a level where action must be taken. If the plugging effect becomes severe, engine performance will be automatically derated (power reduced) and may shut down completely. Electronic sensors in the engine exhaust system and on the DPF itself determine the level of plugging in the DPF and are used to provide an indication to the operator, through the instrument cluster, that the DPF needs to be cleaned.

The DPF may be cleaned by having an International dealer remove and clean it or through a process called regeneration. Auto regeneration process requires extended driving at highway speeds (to increase engine exhaust temperatures). If the DPF indicator in the instrument cluster does not turn off, a manual Parked Regeneration procedure must be performed. If regeneration is not performed soon enough, the DPF may get to a condition where removal and cleaning by an International dealer must be done (parked regeneration in this case must not be performed).

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



### **WARNING**


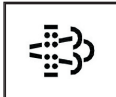
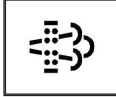


*Failure to perform a Regeneration (Parked or Auto) when exhaust filter Indicator is ON will cause the engine to lose power and eventually shutdown.*





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

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

There will be four 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 exhaust filter Indicator does not reduce in level or disappear, a Parked Regeneration must be performed.*

| Level | Indication  | Audible Alarm   | LCD Text Message<br>(Units Built After June 2007) | Vehicle<br>Conditions/Operation                                | Action Required  |
|-------|---|---|---|--|--|
| 1     | <br>Solid  | 5X beeps  | Regen Required                                    | Exhaust filter regeneration required.                          | Drive on highway at highway speeds <b>until the light turns off OR</b> start <b>Parked Regeneration</b> to prevent loss of power.  |
| 2     | <br>Flashing   | 5X beeps  | Regen Req Soon                                    | Exhaust filter is full.  | Pull vehicle safely off roadway and start <b>Parked Regeneration</b> to prevent loss of engine power.  |
| 3     | <br>Flashing<br><br><br>Solid | An alarm will beep 5 times every minute while ignition is on. | Regen Req Now<br>Check Engine                     | Exhaust filter is full. Engine performance is <b>LIMITED</b> . |  <b>WARNING</b><br><i>Pull vehicle safely off roadway and start Parked Regeneration to prevent engine stopping.</i> |

| Level   | Indication  | Audible Alarm   | LCD Text Message<br>(Units Built After June 2007) | Vehicle<br>Conditions/Operation   | Action Required   |
|---|---|---|---|---|---|
| 4   | <br>Flashing<br><br>Solid | An alarm will beep continuously while ignition is on. | Stop Engine                                       | A serious engine problem has occurred. Exhaust filter may be overfull. Engine may <b>SHUTDOWN</b> soon. |  <b>WARNING</b><br><i>Pull vehicle safely off roadway, turn on flashers, place warning devices, and STOP ENGINE. DO NOT USE Parked Regeneration. Call for service.</i> |
|  <p><b>Note:</b> If this dash indicator is present, the exhaust system is HOT and regeneration is in progress.</p> |   |   |   |   |   |

## 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 (pressing the REQUEST DPF REGEN switch), the following conditions must be in place:
  - a. Park brake must be set.
  - b. Transmission must be in Park (P) or Neutral (N).
  - c. Accelerator, foot brake and clutch (if present) pedals must not be depressed.

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

3. Press the REQUEST DPF REGEN switch to initiate the regeneration cycle.

The engine speed will automatically ramp up to a preset RPM and the “REGEN ACTIVE” message will appear in the cluster message center. If the “REGEN ACTIVE” message does not appear after a few seconds, check to be sure that all conditions in step 2 are met. Once started, the regeneration cycle will last approximately 30 minutes.

*Note: In the event of an emergency situation where the vehicle must be moved after beginning Parked Regeneration, press the CANCEL DPF REGEN to cancel Parked Regeneration.*

4. When the regeneration cycle is complete, “REGEN ACTIVE” message WILL NOT display on the cluster message center, the engine RPM will return to normal idle, and all exhaust filter indicators will be off. The vehicle may now be driven normally. The hot exhaust temperature lamp may still be illuminated, indicating that there are still high exhaust temperatures, even after the regeneration cycle is complete.



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## COOLING SYSTEM MAINTENANCE

### Inspection

Only coolants with an ethylene glycol or a propylene glycol low silicate base are recommended for use in the International® cooling systems (do not mix ethylene glycol and propylene glycol coolant). Other base coolants may damage rubber hoses, especially those made of silicone rubber. Type of rubber can usually be determined by color. Silicone rubber hoses are made in COLOR while other rubber hoses are BLACK.

Your engine is equipped with a high temperature thermostat. BE SURE to use glycol based coolant with this thermostat.

### Extender Concentration Testing - Red Coolant

Regular coolant testing of extender concentration for extended life coolants such as the ROTELLA® extended life brand is not necessary due to the slow depletion of carboxylate inhibitors. No test kit is required.

*Note: When the cooling system is maintained properly and ROTELLA® extended life coolant or equivalent is used for top off, there is no need to conduct routine testing for nitrite and or nitrite/molybdate levels.*

When freeze point testing is conducted, inspect the coolant. The coolant should be free of dirt, debris, rust, or other contaminants. If coolant contamination is suspected, the coolant should be tested. To verify coolant quality, contact an International® service parts dealer and request coolant test kit ZSH297400001 KIT. Additional extended life coolant questions can be answered by calling 1-800-782- 7852, option 3 or visit:

[www.rotella.com/products/relc/howtomaintain.html](http://www.rotella.com/products/relc/howtomaintain.html).

Conditioner Concentration Testing - Green Coolant When the cooling system is maintained as recommended, the conditioner concentration should be satisfactory. A Coolant Test Kit, P/N CC2602 is available to determine the chemical concentration level.

In general, a good reading indicates that the conditioner contained in the coolant is sufficient to insure cooling system protection. Test kit measurements are in units per gallon. Recommended level is 1.5 to 3.0 units per gallon. It is recommended that the conditioner concentration be checked with the test kit at a minimum of every four months or anytime there is a large loss of coolant.

*Note: The use of form EGED-140, Supplemental Coolant Level Reference Chart, is helpful in determining the amount of liquid DCA-4 that needs to be added, if required. The reverse side of form EGED-140 provides a simple three-step method to determine the total units per gallon at any level of protection desired. Refer to "Ordering Publications," in this section for instructions on procuring these forms.*

*Note: One unit of DCA-4 conditioner is equal to 3.2 liquid ounces.*

## **NOTICE**

*Avoid engine damage, it is vital that the above change intervals and conditioner be followed precisely. It is recommended that the coolant conditioner concentration level be maintained between 1.5 to 3.0 units per gallon of DCA-4. If not, the concentration of conditioners in the coolant may become depleted or over concentrated, both of which can be detrimental to the cooling system and engine. SCA levels should not exceed 3.0 units per gallon. Cooling system conditioners other than those recommended by International may not provide the proper concentration of conditioners and may not be compatible with the cooling system.*

**NOTICE**

*Avoid engine damage, do not follow the time intervals and quantities specified on the liquid conditioner bottles. Instead, follow the maintenance schedule specified.*

**CAUTION**

*Avoid serious personal injury or possible death, do not allow used engine fluids to stay on your skin. Clean your skin and nails with soap and water, or a good hand cleaner. Wash or properly throw away clothing or rags containing used engine fluids. Used engine fluids contain certain elements that may be unhealthy for skin and could even cause cancer.*

**CAUTION**

*Avoid damage to the engine and the possibility of personal injury:*

- *Always allow the engine to cool for 15 minutes.*
- *Wrap a thick cloth around the cap.*
- *Loosen cap slowly a quarter to half turn.*
- *Pause for a moment to avoid water or steam scalding. Allow all water or steam pressure to be relieved.*
- *Continue to turn the cap and remove.*
- *Never add cold coolant to a hot engine. This can result in a cracked cylinder head or crankcase.*

*Note: Engine fluids, oil, fuel, and coolant, can be a threat to the environment. Never dispose of engine fluids or oil filters by putting them in the trash, pouring them on the ground, in the sewers, in streams or bodies of water. Collect and dispose of engine fluids and oil filters according to local regulations.*

*Note: Refer to “Cleaning the System,” in this section.*

If changing to conventional (green) coolant, drain and flush the cooling system. Add as an initial charge, 15 units (48 liquid ounces) of DCA-4. Add additional units as required by the cooling system capacity. Refer to “Cooling System Requirements,” in this section.

If system is to be filled with extended life coolant, refer to “Cooling System Requirements,” in this section for ROTELLA® inhibitor quantity.

## **Cleaning the System**

Prevent corrosion by doing the following steps:

1. Use an Alkaline cooling system cleaner which will clean silicate gel from the cooling system as long as the silicate gel has not hardened.
2. An acid type cleaner will clean heavy rust and corrosion from the cooling system.
3. The cooling system must be flushed with clean water after using an alkaline or acid type cooling system cleaner.

### **NOTICE**

*Avoid damage to your engine, coolant conditioner only should NOT be added to the cooling system if the unit has been run for a long period of time without coolant conditioner. Coolant conditioner can loosen deposits which might cause radiator plugging. The cooling system should be drained and thoroughly flushed. Refer to “Maintenance Schedule,” in this section for service intervals*

Unless the cooling system is treated with a corrosion preventative, rust and scale will eventually clog up passages in the radiator and water jackets. This condition is aggravated in some localities by formation of insoluble salts from the water used.

Commercial cleaning solutions are available which have proven very successful in removing accumulation of rust, scale, sludge and grease. They should be used according to the recommendation on the container.

*Note: DO NOT use chemical mixtures to stop radiator leaks except in an emergency.*

### **Drain the Radiator**

Drain the vehicle radiator by doing the following steps:

1. Park the vehicle so the engine is level. This will permit all coolant to drain from the cooling system.
2. Apply the parking brake and place transmission control lever in the PARK (P) position.
3. Place a suitable container according to local regulations under the radiator.

4. Remove de-aeration tank pressure cap.
5. Open radiator drain valve if performing scheduled maintenance. This allows all the coolant to drain from the radiator.

### **Drain the Cooling System**

Drain the engine coolant:

1. Place a suitable container according to local regulations under the drain plugs.
2. Remove crankcase coolant drain plugs on left and right side of engine (located at rear of crankcase, below exhaust manifolds on each side).
3. After coolant has thoroughly drained, replace both crankcase coolant drain plugs and torque to 41 lb ft (31 N•m) and close radiator drain valve.
4. Dispose of used engine coolant according to local regulations.

## Fill the Cooling System

Once the cooling system has been drained, fill and check as follows:

1. Slowly fill the cooling system until coolant is at the mid point between the ADD and MAX level in the de-aeration tank. Install de-aeration tank cap.
2. Start the engine.
3. Allow the engine to operate at a fast idle until the engine reaches its normal operating temperature.
4. As the engine warms up, make sure coolant is flowing through de-aeration line which will feel warm to the touch.
5. After the engine has reached its normal operating temperature and the thermostat has opened, shut the engine off. If necessary, add coolant to the deaeration tank to bring the level up to the MAX mark.
6. Refer to "Maintenance Schedule," in this section for service intervals.

## INSPECT ELECTRICAL AND ELECTRONICS SYSTEM

Inspect electrical system as follows:

1. Check wiring harness for cracks, rubbing or chaffing marks and loose connections.
2. Check sensors for loose connections, corrosion or cracks.
3. Check battery cables for:
  - Broken insulation
  - Rubbing or chaffing
  - Corroded or loose connections

Periodically check that all fault codes are cleared out and do not reappear. For correct procedures, see MaxxF<sup>TM</sup> 5 Diesel Engine Diagnostic Manual or your International® dealer.

Refer to "Maintenance Schedule," in this section for service intervals.

## PRESSURE TEST AIR INDUCTION SYSTEM

Pressure test the air induction system as follows:

- Have your International® dealer pressure test the air induction system
- See MaxxForce™ 5 Diesel Engine Diagnostic Manual for the inspection procedures

*Note: Oil within air induction system is normal due to closed crankcase system.*

Refer to “Maintenance Schedule,” in this section for service intervals.



### CAUTION

***Avoid personal injury, possible death, or damage to the engine or vehicle, read all safety instructions in the Foreword of the MaxxForce™ 5 Diesel Engine Diagnostic Manual.***



### CAUTION

***Avoid personal injury, possible death, or damage to the engine or vehicle. Make sure the transmission is in PARK (P), parking brake is applied, and the wheels are blocked before doing diagnostic or service procedures on engine or vehicle.***

## EMISSION SERVICE MAINTENANCE RECORD

The “Emission Maintenance Service Record” form is provided to record dates and mileage for required emission control maintenance.

Scheduled maintenance work orders and receipts should be saved as proof of proper maintenance. Failure to maintain such records may affect your warranty coverage.

*Note: Following is a blank form of the “Emission Maintenance Service Record” chart. Use this blank form as an original. Make copies as needed for your maintenance records.*

Excessive use of crankcase lubricating oil, coolant, battery fluid or fuel. Inspect the air intake restriction indicator with engine running. Service air cleaner when yellow piston remains in up position or when vacuum gauge reaches allowable restriction.

Dirt should not be allowed to accumulate on the engine. A few minutes spent daily in keeping it clean are well repaid in improved appearance, and greater ease and safety in operation and maintenance.

A daily check of the engine should be made to prevent engine failure. Report all problems for immediate inspection and service. Check the following daily:

- Oil, air, water or fuel leaks.
- Cooling system, clean radiator core, add coolant or coolant as necessary. Make sure filler cap installed correctly.
- Unusual engine noise.

*Note: Following is a blank form of the "Daily Maintenance Report" form. Use this blank form as an original. Make copies needed for your maintenance records.*



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**EMISSION SERVICE MAINTENANCE FORM**

| DATE | SERVICE MONTH | SERVICE HOURS | MILES (km) | ITEM SERVICED |
|------|---------------|---------------|------------|---------------|
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## DAILY MAINTENANCE REPORT FORM

| DATE | MILES | FUEL |      | LUBE OIL | PARTS |      | LABOR |      | SERVICE PERFORMED |
|------|-------|------|------|----------|-------|------|-------|------|-------------------|
|      |       | Qty  | Cost |          | Parts | Cost | Time  | Cost |                   |
|      |       |      |      |          |       |      |       |      |                   |
|      |       |      |      |          |       |      |       |      |                   |
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# **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.

**NOTES:**

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