

HOLIDAY RAMBLER® MOTORHOME 2006 LIMITED WARRANTY

What the Period of Coverage Is

If you use your Holiday Rambler® motorhome only for recreational travel and family camping purposes, the Limited Warranty provided by Holiday Rambler (“Warrantor”) covers your new motorhome when sold by an authorized dealer, for twelve (12) months from the original retail purchase date or the first 24,000 miles of use, whichever occurs first. However, the Limited Warranty provided by Warrantor covers the steel or aluminum frame structure of the sidewalls (excluding slide outs), roof, and rear and front walls for sixty (60) months from the original retail purchase date or the first 50,000 miles of use, whichever occurs first.

If you use your motorhome for any rental, commercial or business purposes whatsoever, the Limited Warranty provided by Warrantor covers your new motorhome when sold by an authorized dealer for ninety (90) days from the original retail purchase date or the first 24,000 miles of use, whichever occurs first. In addition, the Limited Warranty provided by Warrantor covers the steel or aluminum frame structure of the sidewalls (excluding slide outs), roof, and rear and front walls for twelve (12) months from the original retail purchase date or the first 24,000 miles of use, whichever occurs first. A conclusive presumption that your motorhome has been used for commercial and/or business purposes arises if you have filed a federal or state tax form claiming any business tax benefit related to your ownership of the motorhome.

The above Limited Warranty coverage applies to all owners, including subsequent owners, of the motorhome. However, a subsequent owner must submit a warranty transfer form by filing the form through an authorized Holiday Rambler dealer. A subsequent owner’s warranty coverage period is the remaining balance of the warranty coverage period the prior owner was entitled to under this Limited Warranty. Warranty transfer forms can be obtained by contacting the Customer Relations Department. There is no charge for the transfer.

Limitations of Implied Warranties

IMPLIED WARRANTIES, IF ANY, ARISING BY WAY OF STATE LAW, INCLUDING ANY IMPLIED WARRANTY OF MERCHANTABILITY AND ANY IMPLIED WARRANTY OF FITNESS FOR A PARTICULAR PURPOSE, ARE LIMITED IN DURATION TO THE TERM OF THIS LIMITED WARRANTY AND ARE LIMITED IN SCOPE OF COVERAGE TO THOSE PORTIONS OF THE MOTORHOME COVERED BY THIS LIMITED WARRANTY. Warrantor disclaims all implied and express warranties, including the implied warranty of merchantability and the implied warranty of fitness for a particular purpose, on components and appliances excluded from coverage as set forth below. There is no warranty of any nature made by Warrantor beyond that contained in this Limited Warranty. No person has authority to enlarge, amend or modify this Limited Warranty. The dealer is not the Warrantor’s agent but is an independent entity. Warrantor is not responsible for any undertaking, representation or warranty made by any dealer or other person beyond those expressly set forth in this Limited Warranty. Some states do not allow limitations on how long an Implied Warranty lasts, so the above limitation may not apply to you.

What the Warranty Covers

Warrantor’s Limited Warranty covers defects in the manufacture of your motorhome and defects in materials used to manufacture your motorhome. “Defect” means the failure of the motorhome and/or the materials used to assemble the motorhome to conform to Warrantor’s design and manufacturing specification and tolerances. Also see the section “What the Warranty Does Not Cover” set out as follows.

What We Will Do To Correct Problems

Warrantor will repair and/or replace, at its option, any covered defect if: **(1)** you notify Warrantor or one of its authorized servicing dealers of the defect within the warranty coverage period and within five (5) days of discovering the defect; and **(2)** you deliver your Motorhome to Warrantor or Warrantor's authorized servicing dealer at your cost and expense. It is reasonable to expect some service items to occur during the warranty period. The performance of warranty repairs shall not extend the original warranty coverage period. Further, any performance of repairs after the warranty coverage period has expired or any performance of repairs to component parts and appliances excluded from coverage shall be considered "good will" repairs, which shall not alter the express terms of this Limited Warranty.

Warrantor may use new and/or remanufactured parts and/or components of substantially equal quality to complete any repair.

Defects and/or damage to interior and exterior surfaces, trim, upholstery and other appearance items may occur at the factory during manufacture, during delivery of the motorhome to the selling dealer or on the selling dealer's lot. Normally, any such defect or damage is detected and corrected at the factory or by the selling dealer during the inspection process performed by the Warrantor and the selling dealer. If, however, you discover any such defect or damage when you take delivery of the motorhome, you must notify your dealer or Warrantor within five days of the date of purchase to have repairs performed to the defect at no cost to you as provided by this Limited Warranty.

If either three or more unsuccessful repair attempts have been made to correct any covered defect that you believe substantially impairs the value, use or safety of your motorhome or repairs to any covered defect(s), which you believe substantially impairs the value, use or safety of your motorhome, have taken 30 or more days to complete, you must, to the extent permitted by law, notify Warrantor directly in writing of the failure to successfully repair the defect(s) so that warrantor can become directly involved in exercising a final repair attempt for the purpose of performing a successful repair to the identified defect(s).

How To Get Service

The "Acknowledgement of Receipt of Warranty/Production Information" form must be returned to Warrantor promptly upon purchase to assure proper part replacement and repair of your motorhome. Failure to return the "Acknowledgement of Receipt of Warranty/Production Information" form will not affect your rights under the Limited Warranty so long as you can furnish proof of purchase. For warranty service simply contact one of Warrantor's authorized service centers for an appointment, then deliver your motorhome (at your expense) to the service center. If you need assistance in locating an authorized warranty service facility, contact Warrantor's **Warranty Department (1-877-466-6226)**. The mailing address is:

**Warranty Department
91320 Coburg Industrial Way
Coburg, Oregon 97408**

In the event the motorhome is inoperative due to malfunction of a warranted part, Warrantor will pay the cost of having the motorhome towed to the nearest authorized repair facility provided you notify Warrantor prior to incurring the towing charges to receive directions to the nearest repair facility.

Because Warrantor does not control the scheduling of service work by its authorized servicing dealers, you may encounter some delay in scheduling and/or in the completion of the repairs.

What the Warranty Does Not Cover

This Limited Warranty does not cover: any motorhome sold or registered outside of the United States or Canada; items which are added or changed after the motorhome leaves Warrantor's possession; items that are working as designed but which you are unhappy with because of the design; normal wear and usage, such as fading or discoloration of fabrics, or the effects of condensation inside the motorhome; defacing, scratching, dents and chips on any surface or fabric of the motorhome, not caused by Warrantor; routine maintenance, including by way of example wheel alignments; the automotive chassis and power train, including, by way of example the engine, drivetrain, steering and handling, braking, wheel balance, muffler, tires, tubes, batteries and gauges; appliances and components covered by their own manufacturer's warranty including, by way of example the microwave, refrigerator, ice maker, stove, oven, generator, roof air conditioners, hydraulic jacks, VCR, television(s), water heater, furnace, stereo, radio, compact disc player, washer, dryer, inverter and cellular phone; or flaking, peeling and chips or other defects or damage in or to the exterior or finish caused by rocks or other road hazards, the environment including airborne pollutants, salt, tree sap and hail. Component part and appliance manufacturers issue limited warranties covering those portions of the motorhome not covered by the Limited Warranty issued by Warrantor. To learn more on what specific component parts and appliances are excluded from the Limited Warranty issued by Warrantor please contact your selling dealership or Warrantor directly or review the warranty packet inside the motorhome.

Events Discharging Warrantor From Obligation Under Warranty

Misuse or neglect, accidents, unauthorized alteration, failure to provide reasonable and necessary maintenance (see Owner's Manual), damage caused by off road use, collision, fire, theft, vandalism, explosions, overloading in excess of rated capacities, and odometer tampering shall discharge Warrantor from any express or implied warranty obligation to repair any resulting defect.

Disclaimer of Consequential & Incidental Damages

THE ORIGINAL PURCHASER OF THE MOTORHOME AND ANY PERSON TO WHOM THE MOTORHOME IS TRANSFERRED, AND ANY PERSON WHO IS AN INTENDED OR UNINTENDED USER OR BENEFICIARY OF THE MOTORHOME, SHALL NOT BE ENTITLED TO RECOVER FROM WARRANTOR ANY CONSEQUENTIAL OR INCIDENTAL DAMAGES RESULTING FROM ANY DEFECT IN THE MOTORHOME. THE EXCLUSION OF CONSEQUENTIAL AND INCIDENTAL DAMAGES SHALL BE DEEMED INDEPENDENT OF, AND SHALL SURVIVE, ANY FAILURE OF THE ESSENTIAL PURPOSE OF ANY LIMITED REMEDY. Some states do not allow the exclusion or limitation of consequential or incidental damages, so the above exclusions may not apply to you.

Legal Remedies

THESE WARRANTIES ARE NOT INTENDED TO “EXTEND TO FUTURE PERFORMANCE.” ANY ACTION TO ENFORCE THESE EXPRESS OR ANY IMPLIED WARRANTIES SHALL NOT BE COMMENCED MORE THAN NINETY (90) DAYS AFTER THE EXPIRATION OF THE ONE YEAR WARRANTY COVERAGE PERIOD DESIGNATED ABOVE. IF YOU USE YOUR MOTORHOME FOR COMMERCIAL OR BUSINESS PURPOSES, ANY ACTION TO ENFORCE THESE EXPRESS OR ANY IMPLIED WARRANTIES SHALL NOT BE COMMENCED MORE THAN ONE YEAR AFTER THE EXPIRATION OF THE NINETY (90) DAY WARRANTY COVERAGE PERIOD DESIGNATED ABOVE. Some states do not allow the reduction in the statute of limitations, so the above reduction in the statute of limitations may not apply to you.

THIS WARRANTY GIVES YOU SPECIFIC LEGAL RIGHTS. YOU MAY ALSO HAVE OTHER RIGHTS, WHICH VARY FROM STATE TO STATE.

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ROADMASTER CHASSIS 2006 LIMITED WARRANTY

What the Period of Coverage Is

If you use the Roadmaster Chassis that your motorhome is mounted upon for only recreational travel and family camping purposes, the Limited Warranty provided by Roadmaster (“Warrantor”) covers your Roadmaster Chassis for thirty-six (36) months from the original retail purchase date or the first 36,000 miles of use, whichever occurs first.

If you use the Roadmaster Chassis that your motorhome is mounted upon for any rental, commercial or business purposes whatsoever, the Limited Warranty provided by Warrantor covers your new Roadmaster Chassis for Ninety (90) days from the original retail purchase date of the motorhome or the first 24,000 miles of use, whichever occurs first. A conclusive presumption that the Roadmaster Chassis has been used for commercial and/or business purposes arises if you have filed a federal or state tax form claiming any business tax benefit related to your ownership of the motorhome.

Limitation of Implied Warranties

IMPLIED WARRANTIES, IF ANY, ARISING BY WAY OF STATE LAW, INCLUDING ANY IMPLIED WARRANTY OF MERCHANTABILITY AND ANY IMPLIED WARRANTY OF FITNESS FOR A PARTICULAR PURPOSE, ARE LIMITED IN DURATION TO THE TERM OF THIS LIMITED WARRANTY AND ARE LIMITED IN SCOPE OF COVERAGE TO THOSE PORTIONS OF THE ROADMASTER CHASSIS COVERED BY THIS LIMITED WARRANTY. Warrantor disclaims all implied and express warranties, including the implied warranty of merchantability and the implied warranty of fitness for a particular purpose, on components and appliances excluded from coverage as set forth below. There is no warranty of any nature made by Warrantor beyond that contained in this Limited Warranty.

No person has authority to enlarge, amend or modify this Limited Warranty. Any dealer selling a motorhome assembled upon a Roadmaster Chassis is not the Warrantor’s agent but is an independent entity. Warrantor is not responsible for any undertaking, representation or warranty made by any dealer or other person beyond those expressly set forth in this Limited Warranty. Some states do not allow limitations on how long an implied warranty lasts, so the above limitation may not apply to you.

What the Warranty Covers

Warrantor’s Limited Warranty covers defects in the manufacture of the Roadmaster Chassis and defects in materials used to manufacture the Roadmaster Chassis. “Defect” means the failure of the Roadmaster Chassis and/or the materials used to assemble the Roadmaster Chassis to conform to Warrantor’s design and manufacturing specification and tolerances.

What We Will Do To Correct Problems

Warrantor will repair and/or replace, at its option, any covered defect if: **(1)** you notify Warrantor or one of its authorized servicing dealers of the defect within the warranty coverage period and within five (5) days of discovering any such defect; and **(2)** you deliver the Roadmaster Chassis to Warrantor or Warrantor's authorized servicing dealer at your cost and expense. It is reasonable to expect some service items to occur during the warranty period. The performance of warranty repairs shall not extend the original warranty coverage period. Further, any performance of repairs after the warranty coverage period has expired or any performance of repairs to component parts and appliances excluded from coverage shall be considered "good will" repairs, which shall not alter the express terms of this limited warranty.

Warrantor may use new and/or remanufactured parts and/or components of substantially equal quality to complete any repairs.

Defect and/or damage to the Roadmaster Chassis may occur during manufacture at the factory, during delivery of the motorhome to the selling dealer or on the selling dealer's lot. Normally, any factory defect or damage is detected and corrected at the factory or by the selling dealer during the inspection process performed by the Warrantor and the selling dealer. If, however, you discover any such defect or damage when you take delivery of the Roadmaster Chassis, you must notify your dealer or Warrantor within five days of the date of purchase to have repairs performed to any such defect at no cost to you as provided by this Limited Warranty.

If either three or more unsuccessful repair attempts have been made to correct any covered defect that you believe substantially impairs the value, use or safety of your motorhome or repairs to any covered defect(s), which you believe substantially impairs the value, use or safety of your motorhome, have taken 30 or more days to complete, you must, to the extent permitted by law, notify Warrantor directly in writing of the failure to successfully repair the defect(s) so that Warrantor can become directly involved in exercising a final repair attempt for the purpose of performing a successful repair to the identified defect(s).

How To Get Service

For warranty service simply contact one of Warrantor's authorized service centers for an appointment, then deliver your Roadmaster Chassis (at your expense) to the service center.

If you need assistance in locating an authorized warranty service facility, contact Warrantor's Warranty Department (1-877-466-6226). The mailing address is:

**Warranty Department
91320 Coburg Industrial Way
Coburg, Oregon 97408**

In the event the Roadmaster Chassis is inoperative due to malfunction of a warranted part, Warrantor shall pay the cost of having the Roadmaster Chassis that the motorhome is mounted upon towed to the nearest authorized repair facility provided you notify Warrantor prior to incurring the towing charges to receive directions to the nearest repair facility.

Because Warrantor does not control the scheduling of service work by its authorized servicing dealers, you may encounter some delay in scheduling and/or in the completion of the repairs.

What the Warranty Does Not Cover

This Limited Warranty does not cover: modifications and alterations to the Roadmaster Chassis by others; the motorhome that is mounted upon the Roadmaster Chassis, including by way of example the motorhome manufacturer's design, manufacture, assembly and/or installation of the side walls, roof, windows, flooring, electrical system, plumbing system, LP-Gas system, appliances and slide outs; items that are working as designed but which you are unhappy with because of the design; normal wear and usage; routine maintenance including by way of example wheel alignments; component parts covered by their own manufacturer's warranty, including by way of example the engine, transmission, tires, tubes, batteries, exhaust system and the emission control systems; and, flaking, peeling rusting and chips or other defects or damage in or to the frame and frame cross members caused by rocks or other road hazards and the environment including airborne pollutants and salt. Component part manufacturers issue limited warranties covering those portions of the Roadmaster Chassis not covered by the Limited Warranty issued by Warrantor. To learn more on what specific component parts are excluded from the Limited Warranty issued by Warrantor please contact your selling dealership or Warrantor directly or review the warranty packet inside the Motorhome.

Events Discharging Warrantor From Obligation Under Warranty

Misuse or neglect, accidents, unauthorized alteration, failure to provide reasonable and necessary maintenance (see Owner's Manual), damage caused by off road use, collision, fire, theft, vandalism, explosions, overloading in excess of rated capacities, and odometer tampering shall discharge Warrantor from any express or implied warranty obligation to repair any resulting defect.

Disclaimer of Consequential & Incidental Damages

THE ORIGINAL RETAIL PURCHASER OF THE ROADMASTER CHASSIS AND ANY PERSON TO WHOM THE ROADMASTER CHASSIS IS TRANSFERRED, AND ANY PERSON WHO IS AN INTENDED OR UNINTENDED USER OR BENEFICIARY OF THE ROADMASTER CHASSIS, SHALL NOT BE ENTITLED TO RECOVER FROM WARRANTOR ANY CONSEQUENTIAL OR INCIDENTAL DAMAGES RESULTING FROM ANY DEFECT IN THE MOTORHOME. THE EXCLUSION OF CONSEQUENTIAL AND INCIDENTAL DAMAGES SHALL BE DEEMED INDEPENDENT OF, AND SHALL SURVIVE, ANY FAILURE OF THE ESSENTIAL PURPOSE OF ANY LIMITED REMEDY. Some states do not allow the exclusion or limitation of consequential or incidental damages, so the above exclusions may not apply to you.

Legal Remedies

THESE WARRANTIES ARE NOT INTENDED TO “EXTEND TO FUTURE PERFORMANCE.” ANY ACTION TO ENFORCE THESE EXPRESS OR ANY IMPLIED WARRANTIES SHALL NOT BE COMMENCED MORE THAN NINETY (90) DAYS AFTER THE EXPIRATION OF THE ONE YEAR WARRANTY COVERAGE PERIOD DESIGNATED ABOVE. IF YOU USE YOUR ROADMASTER CHASSIS FOR COMMERCIAL OR BUSINESS PURPOSES, ANY ACTION TO ENFORCE THESE EXPRESS OR ANY IMPLIED WARRANTIES SHALL NOT BE COMMENCED MORE THAN ONE YEAR AFTER THE EXPIRATION OF THE NINETY (90) WARRANTY COVERAGE PERIOD DESIGNATED ABOVE. Some states do not allow the reduction in the statute of limitations, so the above reduction in the statute of limitations may not apply to you.

THIS WARRANTY GIVES YOU SPECIFIC LEGAL RIGHTS. YOU MAY ALSO HAVE OTHER RIGHTS, WHICH VARY FROM STATE TO STATE.

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The information contained in this document is intended to reflect standard and optional equipment included in a typically equipped model at the time of delivery to the initial retail owner. Your actual unit may vary from this document as a result of optional equipment that is not generally offered on this model. In the case that you are not the initial retail owner of the unit, this document will not reflect modifications that may have been performed by previous owners.

Product information and specifications are shown herein as of the time of printing. The motorhome manufacturer reserves the right to change product specifications, designs and standard equipment without notice and without incurring obligation.

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WARRANTY INFORMATION FILE

In addition to this Owner's Manual you will find a Warranty Information File in your unit. This file contains valuable documents about your motorhome's systems and equipment. Many of the component manufacturer's warranty registration cards can be found in the box. They will need to be filled out and mailed. Be sure you read and understand all the information in this file to help you safely operate, maintain and troubleshoot those items.

Additional Information:

Changes, additions and supplemental information in the form of Manual Addendums and "Tech Tips" can be obtained by visiting our Web Site at www.monaco-online.com. Select one of the products from the product lineup. Go to the Service menu. A submenu will appear.

It may also be helpful to browse the "Tech Tips" menu for the other product lines. The tips may not completely apply to your particular model but information contained therein can be useful.

MANUAL ADDENDUMS & TECH TIPS

www.monaco-online.com

Click on the **Holiday Rambler** logo, Place cursor on **SERVICE** link and choose either **MANUAL ADDENDUMS** or **TECH TIPS** from the drop down menu.

Wood Finish

Because no two trees look alike, authentic woods vary in color and character markings such as streaks, knots and grain patterns. Since the stains may attach differently to these grain patterns, some natural light and dark areas may result. The beauty lies in these natural variations of color and grain that give each cabinet its own individual charm.

The beauty of these products is protected with a furniture-quality exterior finish. After a period of time, there may be minimal changes in the finish color as it ages in its surrounding conditions. This is an inherent characteristic of this particular finish, and the natural aging process adds to the unique appearance of the cabinetry. Due to the minor differences in tone, it may not be possible to match the finish color of existing cabinets exactly when replacing doors or adding additional cabinets at a later date.

The foregoing is not a warning. See the Limited Warranty or call (877) 466-6226 for warranty information and limitations.

SAFETY TERMS

Many of the safety terms are personal safety instructions. Definitions for the terms are listed below. It is important to thoroughly read and understand the safety instructions displayed throughout the manual. Failure to comply with specific instructions may result in personal injury or death. Many instructions are required by National Safety Associations.

WARNING:

Warnings contain information regarding personal safety and/or pertaining to potential extensive or permanent damage to the motorhome or its components by means of hazards or improper use.

CAUTION:

Cautions pertain to potential damage to the motorhome and/or its components.

POISON:

A warning or caution pertaining to safety and/or use of a poisonous substance or harmful chemical.

NOTE:

Information and reminders concerning proper operation of the motorhome and/or its components.

INSPECTION:

Inspection of the motorhome and/or its components is required. Additional instruction may follow.

LUBE:

Lubrication, or addition of a lubricant product, to the motorhome and/or a specified component or part is required. Additional instruction may follow.

ASSEMBLE or REPAIR:

Assembly, disassembly or installation of a component or part, and/or repair to the motorhome may be required. Assistance of Technical Support or Technician may be necessary.

INFORMATION:

References to additional information regarding operation of the motorhome and/or its components found in additional sources, other than the Owner's Manual. Also refers to the WARRANTY INFORMATION FILE, found within the Warranty Information Box in the motorhome.

TIP:

Tips contain information, helpful hints and/or suggestion for ease of operation of the motorhome or its components.

GLOSSARY OF TERMS

AC Electricity - Alternating current also known as household power.

Air Compressor - Pumps air to and builds air pressure in an air system.

Air Dryer - Cools, filters and dries the air delivered by an air compressor.

Air Governor - Controls the operation of the air compressor by constantly monitoring air pressure in the supply tank of the air system. The air governor initiates the unload cycle when the cut-out pressure is reached.

Alternating Current (AC) - A current that varies periodically in magnitude and direction. A battery does not deliver alternating current. Also referred to as shore power, utility power, inverter power, generator power, etc.

Ampere (Amp) - The unit of measure of electron flow rate of current through a circuit.

Ampere-hour (Amp-hr. AH) - A unit of measure for a battery electrical storage capacity, obtained by multiplying the current in amperes by the time in hours of discharge. *Example:* A battery which delivers 5 amperes for 20 hours, delivers 5 amperes times 20 hours, or 100 Amp-Hr. of capacity.

ANSI - American National Standards Institute.

ASTM - American Society for Testing and Materials.

Black Water - Term associated with the sewage holding tank. The toilet drains directly into this tank.

CCA - Cold Cranking Amperage is the amount of current a battery can deliver for 30 seconds at 0° F without dropping below a specified voltage, usually 10.5 Volts DC.

Chassis Battery - Powers chassis 12 Volt accessories and starts engine.

Circuit - An electric circuit is the path of an electric current. A closed circuit has a complete path. An open circuit has a broken or disconnected path.

City Water - A term associated with the water supply that you hook-up to at campgrounds. It is called city water because water is pulled from a central source (like in a city) and not the fresh water tank.

Compressor Load Cycle - The time during which the compressor is building pressure in the air system.

Compressor Unload Cycle - The time during which the compressor is idling and not building pressure in the air system.

Curbside - This refers to the side of the motorhome which faces the curb when it is parked. Often called the door side or the passenger side.

Current - The rate of flow of electricity or the movement rate of electrons along a conductor. It is comparable to the flow of a stream of water. The unit of measure for current is the ampere.

Cut-In Pressure - The pressure level in the air system supply tank which triggers the compressor load cycle. May apply to some water systems, such as water pump, accumulator tank, etc.

Cut-Out Pressure - The pressure level in the air system supply tank which triggers the compressor unload cycle. May apply to some water systems, such as water pump, accumulator tank, etc.

Cycle - In a battery, one discharge plus one recharge equals one cycle.

Desiccant - A granular substance that has a high affinity for water and is used to retain moisture from the air stream flowing through the air dryer cartridge.

Direct Current (DC) - Power that is stored in a battery bank or supplied by photovoltaics, alternator, chargers and DC generators. Direct current is also known as battery power.

Drain Trap - This is a curve that is in all drains. Water is trapped in the curve and this creates a barrier so tank odors cannot escape through the drain.

Dry Camping - Camping in the motorhome when there is no city water hook-up or shore power. In other words, using only the water and power that is in the motorhome and not from another source.

Drying Cycle - The time during which the air dryer cools, filters and removes moisture from the air delivered by the air compressor. The drying cycle begins and ends the same as the compressor load cycle.

Dump Station - A site where the waste (grey) and sewage (black) tanks can be drained. In most states it is illegal to drain waste tanks anywhere other than at a dump station.

Dump Valve - Another name for the T-handle valve used to drain the sewage (black) and waste (grey) tanks.

Escape (Egress) Window - The formal name for the emergency window located in the rear of the motorhome. Egress windows can be easily identified by their red handles.

Full Hook-Up Site - A campground that has city water, shore power and sewer hook-ups or connections available.

Grey Water - Term associated with the waste water holding tank. Water from the sink drains, the shower and the washer-dryer (if equipped) go into this tank.

House Battery - Powers 12 Volt lights and accessories inside the motorhome.

LED (Light Emitting Diode) - Indicator light.

Low Point Drain - The lowest point in the plumbing. Drains are placed here so that water will drain out of the lower end of the motorhome. These drains must be closed when you fill the water tank.

OEM - Term for Original Equipment Manufacturer.

Ohm - A unit for measuring electrical resistances.

Ohm's Law - Express the relationship between Volt (E), amperes (I) in an electrical circuit with resistance (R). It can be expressed as follows: $E = IR$. If any two of the three values are known, the third value can be calculated by using the above formula.

Potentiometer - A device for measuring an unknown potential difference or electromotive force.

Pounds Per Square Inch Gauge (psig) - Pressure measured with respect to that of the atmosphere. This is a pressure gauge reading in which the gauge is adjusted to read zero at the surrounding atmospheric pressure. It is commonly called gauge pressure.

Purge - The initial blast of air (decompression) from the air dryer purge valve at the beginning of the air compressor.

Purge Cycle - The time during which the air dryer is undergoing purge and regeneration. This cycle starts at the beginning of the compressor unload cycle and normally ends well before the beginning of the compressor load cycle.

Regeneration - The mild backflow of air through the air dryer and out the purge valve that begins immediately after the purge and lasts normally 10 to 15 seconds. This backflow of air, from the air system and through the air dryer, removes moisture from the desiccant cartridge and prepares the air dryer for the next compressor load cycle.

Roadside - This refers to the side of the motorhome which faces the road when it is parked. Often called the off-door side or the driver side.

SCA - Term for Supplemental Coolant Additive. Chemical added to coolant for diesel engines to help prevent cylinder liner pitting and internal corrosion.

Shore Line - This is the electrical cord which runs from the motorhome to the campground 120 Volt electrical supply.

Shore Line Plug - The 120/240 Volt AC outlet allows the motorhome to be hooked up to a campground facility.

Stinger - An arm attachment on a tow truck that is used to lift the motorhome slightly so that it can be towed.

Volt - The unit of measure for electric potential.

Watt - The unit for measuring electrical power, i.e. the rate of doing work, in moving electrons by or against an electric potential.

Wet Cell Battery - A type of battery that uses liquid as an electrolyte. This type of battery requires periodic maintenance such as cleaning the connections and checking the electrolyte level.

Owner's Manual Survey Neptune 2006

Your suggestions are very important to us and we are continually striving to improve the quality of our manuals. After becoming familiar with your new recreational vehicle and the accompanying manual, please take the time to answer the following questions. When you are finished please return the survey via mail to our Technical Publications Department, or you may fax the survey to: **(541) 681-8031 Attention: Technical Publications Department**. Feel free to attach an additional page if you desire.

1. Is this your first recreational vehicle? YES / NO (circle one)

2. If no, what was your previous recreational vehicle brand/model? _____

3. Was the overall appearance and layout of this manual what you expected to see in your new recreational vehicle?

4. Was the information within this manual helpful in acquainting you with your new recreational vehicle? If not please address any area(s) we need to expand or improve on.

5. Were the operating instructions clearly written, and were you able to follow the steps without any difficulty?

6. Is there any additional information you would like to see incorporated within the owner's manual?

NAME: _____ PHONE: (____) _____

ADDRESS: _____

SERIAL # _____

Cut Along
Dotted Line
to Mail



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Place
Postage
Here

**TECHNICAL PUBLICATIONS PLT. 17
MONACO COACH CORPORATION
91320 COBURG INDUSTRIAL WAY
COBURG, OR 97408**

FOLD



Cut Along
Dotted Line
to Mail

**LIMITED WARRANTY TRANSFER
APPLICATION/CHANGE OF OWNER INFORMATION**

Mail to:
**Monaco Coach Corporation
Warranty Transfer
91320 Coburg Industrial Way
Coburg, OR 97408**
Please read terms and representations below before signing.

Submitted By:
Name: _____
Address: _____
City: _____ State: _____ Zip: _____
Phone: (_____) _____

Limited Warranty Transfer

Address Change

A. Current Owner Information:

First Name Initial Last Name

Vehicle Identification Number Unit # (15 digits) (6 digits) Model/Year

B. New Owner Information, Transfer Coverage To:

First Name Initial Last Name

(_____)
Phone Number Street Address City State Zip

Date of Transfer (If Applicable) Odometer Reading at Transfer (If Applicable)

C. Signatures:

(New) Owner's Signature Date Selling Dealer's Signature (If Applicable) Date

Terms & Representations

By your signature(s) on face side of this form, and in order to induce Monaco Coach Corporation to transfer its Limited Warranty, you represent the following:

1. That you have received and read a copy of the Limited Warranty.
2. You understand that the unit is to be used only for family camping and cross country travel on improved roads.
3. All information provided by you on face side of this form is true and correct.
4. You understand that you are purchasing a pre-owned recreational vehicle and Monaco Coach Corporation does not make any representation as to its present condition.



NEPTUNE 2006

Section 2 ~ Driving & Safety

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DRIVING & SAFETY

This section contains information on driving tips, emergency situations, towing, safety devices, weighing the motorhome and tires.

NOTE:

The motorhome has an electronic data recording device that may record information regarding direction, road speed, engine speed, brake application, steering attitude or other vehicle operating data. Data recording devices can be present in engines, transmissions, ABS (Antilock Brake Systems) or other systems affiliated with operation of the vehicle. Information from data recording devices can be examined in case of an accident. Contact the component manufacturer to learn more about these devices.

Inspections

There are significant differences between a passenger automobile and a motorhome. Always be aware of these differences when traveling. The key to safely operating a motorhome is **inspection**. Undetected problems could cause problems on the road and may result in lost time and increased repair costs. Several states require a special license endorsement and that the motorhome be **inspected** prior to registration. Know and observe the laws of the states in which you will be traveling. Laws may vary from state to state. A systematic **inspection** conducted prior to moving the motorhome can help ensure nothing is overlooked and will assist in familiarizing the owner with the motorhome. Prior to moving the motorhome perform a general **inspection**, which includes examining the condition of the vehicle and the surrounding area of the motorhome. Look high and low when walking around the motorhome.

Familiarize Yourself

Because the location of the driver's seat in the motorhome is higher and farther to the left than most vehicles, a different perspective of the roadway is created. Rely on the outside mirrors to line up with the center of the road and to check conditions behind the motorhome. The dashboard may include more gauges and controls than are normally found in passenger automobiles. Become familiar with these gauges and their indications before starting out.

Mirror Adjust (Manual)

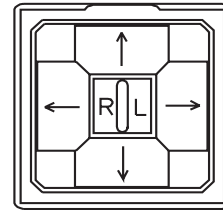
Adjust mirrors prior to starting out. It is recommended have an assistant help with the adjustments to prevent damage to the mirror or the motorhome.

Mirror Adjusting:

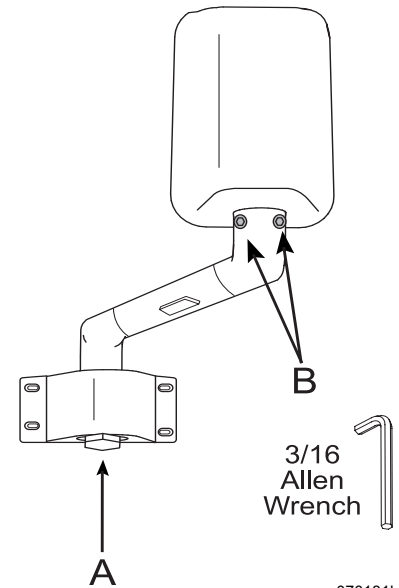
- Adjust the driver seat to travel position.
- Using a 9/16" socket, have the assistant loosen the bolt located at the base of the mirror (see **A** on illustration).
- Adjust the mirror for a clear side view of the motorhome.
- Tighten the base bolt once proper adjustment is made.
- To adjust the head of the mirror, loosen the 3/16" Allen screw located at point **B**. Adjust to the left or the right.
- Ensure Allen set screws and bolt are tight.

NOTE:

Use the mirror select and adjust switch located on the roadside console to fine tune the view.



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Safety Seat Belts

All occupants must be furnished with and use seat belts while the motorhome is moving. The driver's seat, and all other seats designed to carry passengers while the motorhome is in motion, are equipped with safety seat belts. **DO NOT** occupy beds or seats that are not equipped with a safety belt while the motorhome is in motion. The driver's seat must be locked in the forward facing position while motorhome is in motion. **DO NOT** use a seat belt on more than one person.

To fasten the seat belt, pull the belt out of the retractors and insert the tab into the buckle; you will hear a click when the tab locks into the buckle. Seat belt lengths automatically adjust to your size and sitting position. **DO NOT** route belts over armrest.

WARNING:

Safety belts are supplied at affixed seating positions. DO NOT occupy seats not equipped with safety belts while the motorhome is in motion. Seat belts must only be used on permanently mounted seats. DO NOT use a single seat belt on more than one person. Pilot and Co-pilot seats must be locked in a forward facing position with seat belts fastened while the motorhome is in motion. Avoid seat rotation while in transit.

Child Safety Seat:

Children that fit into *Example 1* and *Example 2* (on following pages) require the use of a child safety seat. In the motorhome, the child safety seat can be positioned in two places: the front passenger (co-pilot) seat and the forward facing permanently mounted booth dinette seat.

WARNING:

Only forward facing booth dinette seats equipped with seat belts, are designed for occupancy while the motorhome is in motion.

WARNING:

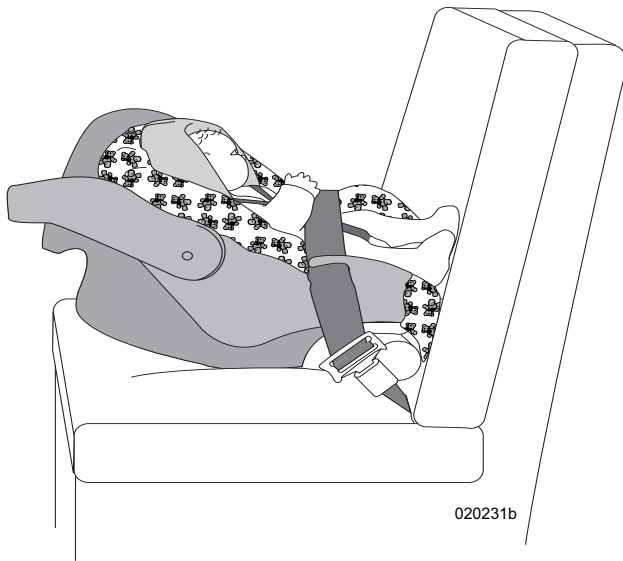
Children must not be transported unrestrained. Infants must be placed in approved safety seats. Small children must be restrained in child safety seats. DO NOT use a single seat belt on more than one child. Failure to comply with these rules can lead to injury or death.

NOTE:

Individual states and Canadian provinces may have laws that can exceed the requirements described above. It is your obligation to know and comply with the laws in the state or province in which you travel.

A child safety seat is required for any child:

- **Infants** - from birth to one year, or up to 21 pounds, the child is considered an infant. A (convertible) safety seat for an infant must be secured facing when facing to the rear. The top of the head must be below the top of the safety seat. Secure safety seat harness straps at or below the shoulders. *(See Example 1).*
- **Toddlers** - Children over 1 year and over 20 to 40 pounds are considered toddlers. A (convertible) safety seat for a child must be secured facing forward. The top of the head must be below the top of the safety seat. Secure safety seat harness straps should be at or above the shoulders. *(See Example 2).* Most seats require a top slot for facing forward.
- **Young Children** - Children (ages 4 to 8) over 40 pounds, unless over 4' 9", require a booster seat. The booster seat places the child's waist and shoulders at the proper height for the supplied safety belt to be effective. The top of the head must be below the top of the safety seat. *(See Example 2).*



Example 1: Convertible Seat Facing to the Rear.



Example 2: High back booster seat facing forward.

WARNING:

Installation illustrations are for reference only, and are not to be used as a guide. Because there are many styles of safety and booster seats, refer to the safety seat manufacturer's manual for proper installation and how to properly install and secure the safety or booster seat.

NOTE:

Individual states and Canadian provinces may prohibit use of a safety or booster seat in the front seat.

Seat Belt Care:

Keep the belt clean and dry. To clean, use mild soap and lukewarm water. **DO NOT** clean seat belts with bleach, dye or abrasive cleansers that may weaken the belt material. Periodically **inspect** belts for cuts, frays or loose parts, and replace damaged parts. **DO NOT** disassemble or modify the system. Replace the seat belt assembly after a severe impact, even when damage is not obvious.

Driving Tips

The motorhome is a complex vehicle that requires increased driving awareness because of its size and various components. Due to the motorhome length the turning radius will be much wider than that of a standard automobile. Always pay close attention to the perimeter of the motorhome: front, sides, rear, roof and undercarriage. Ensure the surrounding area is clear of obstacles. Utilize the driving mirrors to observe traffic conditions as well as the motorhome exterior: tires, bay doors, blind spots, etc. Use a push-pull method of steering with both hands parallel on the steering wheel. The motorhome is also heavier than an automobile with a higher center of gravity. These factors affect the reaction time of the motorhome. Swerves and sharp turns, especially performed at high speeds, could result in loss of control of the motorhome. Keep the size of the motorhome in mind and drive with extra caution to avoid situations which might require quick momentum changes. Increase reaction time by paying attention to traffic and road conditions 12 to 15 seconds ahead of the motorhome's position.

The motorhome will travel safely and comfortably at highway speed limits; however, it takes more time to reach highway speed. Allow extra time and space when passing another vehicle to complete the pass due to the added length of the motorhome.

Manually shift the transmission to a lower gear to descend a long hill, and begin the decent at a slow speed. **DO NOT** allow the motorhome to gain momentum before trying to slow down. Use the exhaust or engine brake in conjunction with the service brakes to help maintain a safe slow speed of decent. The transmission and engine will help control downhill speed and can extend the service life of the brake lining. The distance required to stop the motorhome is greater than an automobile. The brakes are designed for the **(GVWR) Gross Vehicle Weight Rating**. Practice stopping away from traffic to get the feel of distance required to stop the motorhome.



When backing up, have the co-pilot stand at the roadside rear corner so the co-pilot remains visible in the roadside mirror. The co-pilot can watch for obstacles and give hand signals during the backing up process.

Make sure bridges being crossed can support the weight of the motorhome. Check the tonnage limit of the bridges before crossing. Signs should be posted at bridge entrances. Check the posted height of all overpasses or situations where overhead clearance is limited. Keep in mind that road surfaces may be repaved or packed with snow; therefore, the actual posted clearance height would not apply in such conditions.

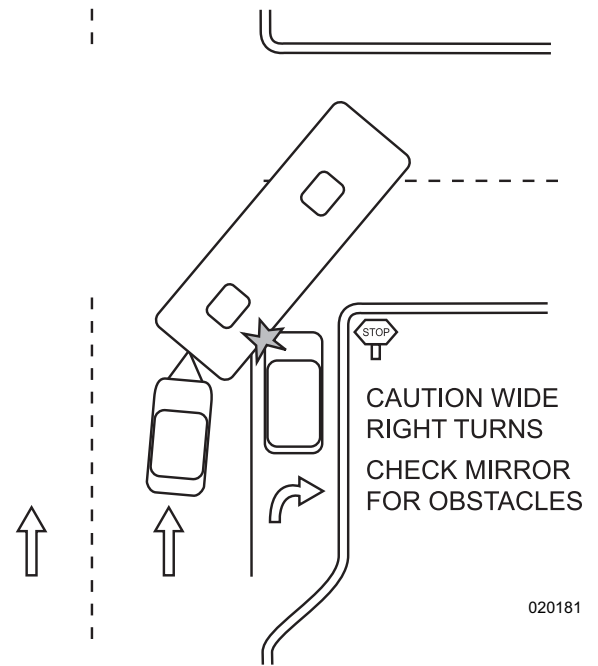
Driving Cautions:

- Avoid getting too close to the edge of the road. A soft shoulder may not support the weight of the motorhome.
- Side spacing is best maintained by keeping the motorhome centered in the driving lane.
- Driving lanes in work zones can be uneven, congested and narrower than usual.
- Be cautious of road debris which can damage the undercarriage of the motorhome or become lodged in the dual tires causing damage to the tires, wheel rims or tow car.
- Keep in consideration that posted speed signs are passenger automobile rated. Therefore, an extra awareness of the driving conditions and appropriate speed for a motorhome are necessary, especially on corners and mountain roads.
- Downgrade speed should be at least 5 mph less than upgrade speed, or downgrade speed should be attainable within three seconds of a brake application.
- Use a four second rule when following other vehicles at speeds under 40 mph, and a five second rule when following at speeds over 40 mph.

Right Turns:

Negotiating a right hand turn in a motorhome can be difficult. Many drivers fear they cannot make the turn without entering into the other lane or jumping the curb. Here are a few tips to make a right hand turn easier:

- As the turn approaches, look into the mirror to ensure the lane to the left is clear, then move wide over to the left.
- When making the right turn, the left rear wheel should touch the center line of the road and your hips should be parallel to the roadside curb of the corner being turned. This will aid in avoiding a premature turn.
- Make the turn slowly.
- Check mirrors frequently. Stay aware of necessary clearance and space management of the motorhome while negotiating the turn.



Left Turns:

- **DO NOT** start the turn until the center of the intersection is reached with your hips. If there are two lanes available, take the right hand lane. A car or driver on the left hand side is easier seen.

Ascending a Grade:

When approaching an uphill grade, assess the grade and length before beginning the climb. Prepare early for long climbs. Unlike gasoline engines, diesels do not necessarily produce more power by pressing further on the accelerator. A gasoline engine will happily work at full throttle (at least for a short period of time), but a diesel usually just wastes fuel at full throttle. The power output from a diesel engine is dependent upon the following:

- **RPM** - Every engine has a range of RPM that produces power most efficiently.
- **Fuel/Air mixture** - At a given RPM, the engine, even with the help of a turbo-charger, can only pump a given volume of air into the combustion chamber. This volume of air can efficiently combine with only so much fuel, so feeding more fuel to the fire will simply waste fuel.

Determine ranges where the motorhome works best by driving long grades when temperatures remain stable for the duration of the climb.

SAFETY TIP:

If the road speed degrades to the point where the motorhome is moving significantly below the posted speed, turn ON the four way flashers. Take advantage of pullouts if traffic is building. Once in the pullout, if there is sufficient clearance for safety, take a break. Idle the engine to allow the exhaust and the turbo to cool. While these are cooling, the transmission also cools. Monitor the gauges and enjoy the view while you wait.

Descending a Grade:

Prepare to descend a grade at the crest of the hill. Observe signs indicating grade angle and duration. The sign may suggest maximum downhill speed according to Gross Combined Weight (the combined weight of the motorhome and a trailer/tow car). At the crest of the hill, manually shift the transmission into a lower gear. **DO NOT** allow the motorhome to gain momentum before slowing down. Use the exhaust brake to help maintain a slow, safe downhill speed. Located on the driver side console is the exhaust brake switch. When the engine brake switch is **ON**, the exhaust brake will activate when the throttle is released.



With the exhaust brake applied, road speed may increase until the transmission automatically shifts to the next higher gear. Apply the service brakes using moderately heavy pressure on the brake pedal to reduce speed and manually downshift to maintain a safe, slow speed. **DO NOT** pump the brakes as this can result in a loss of air pressure. Avoid riding the brakes as this can cause the brakes to overheat. Either method can result in loss of brake effectiveness or brake failure.

Night Driving:

- As always be well rested and alert when driving. If necessary, find a safe stopping place to rest until ready to continue.
- Avoid using interior lights that can create a glare on the windshield and decrease visibility.
- Dim dash lights to a comfortable level to reduce the level of glare.

Extreme Heat and Hot Weather Conditions:

- Frequently observe all gauges. Variations from normal conditions should be promptly evaluated.
- Check tire pressure before traveling in hot conditions. Tire air pressure increases with heat. **DO NOT** let air out of a hot tire. When the tires cool down they will return to the correct/previous tire pressure.
- Pay extra attention to hoses and belts that are more susceptible to fatigue in extreme heat.

Winter and Cold Climate Conditions:

- The motorhome should be prepared for cold weather use.
- Keep speeds slow and steady. Make moves gradually and increase visual distance for a gain in reaction time.
- If road or weather conditions are treacherous find a safe stopping place and wait for conditions to improve.
- Avoid using an engine braking device on wet or slippery surfaces as this can cause the drive wheels to skid.
- Wiper blades should be in good condition. Fill the washer reservoir with antifreeze formula window washer fluid.
- Use mirror heat to keep mirrors clear.
- Remove any ice build-up from the entry step to avoid accidental slipping.

Wet Conditions:

- Worn or improperly inflated tires can increase the risk of hydroplaning.
- Heavy rain or deep standing water can cause brakes to apply unevenly or grab.

Fuel Economy:

- Driving style, wind resistance, terrain, vehicle weight, and engine-driven accessories are some of the factors that affect fuel economy.

Guidelines to Help Increase Fuel Efficiency:

- When starting out, apply the throttle lightly and accelerate gradually. Avoid using excessive throttle and accelerating quickly.
- Check the tire pressure. A low tire is not only a safety hazard, but also increases rolling resistance to increase fuel consumption.
- While operating the motorhome, keep the engine at a low to mid operating range of 1100 to 1500 RPM. This will use less fuel than operating at higher RPM.
- Avoid using full throttle when ascending a long hill. This wastes fuel and increases engine operating temperature from incomplete combustion. Manually shift to a lower gear and use less throttle to burn fuel more efficiently.
- Operate the transmission with the **MODE** function set to Economy whenever possible; this allows for earlier shifts and enhanced fuel economy.

- Avoid extended idling to warm-up the engine. Excessive idling (more than 10 or 15 minutes) can clog fuel injectors, and eventually cause piston rings and valves to stick. Start the engine and wait for normal oil pressure to register. Engage the high idle feature until the engine coolant temperature gauge raises. The engine is now ready for travel. Whenever coolant temperature is below 160° F (idling engine) incomplete combustion occurs, causing carbon build-up and raw fuel to wash lubricating oil from the cylinder walls and dilute the crankcase oil.
- Follow the maintenance schedule for the engine.

Refueling:

- Truck stops are good refueling points for motorhomes.
- Check overhead clearance height before pulling through the fuel island.
- Be aware of concrete/steel posts installed around fuel islands.
- Avoid running over the fuel hose as it can get hung up on the motorhome and cause body damage.
- Use of gloves is recommended for refueling. Store gloves in the outside compartment.
- To prevent grease and fuel deposits from being tracked into the motorhome when refueling, change shoes before entering. Store the extra pair of shoes near the entry door.

WARNING:

Avoid the risk of fire or explosion. Turn OFF all pilot lights and appliances before entering a refueling station.

PRE-TRIP PREPARATIONS CHECKLIST

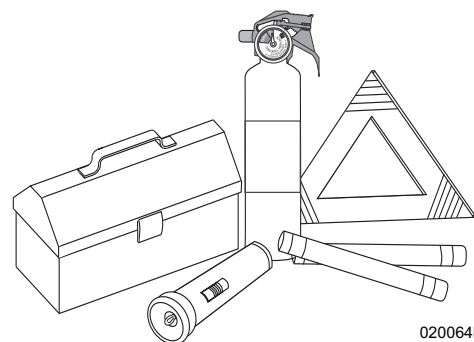
Prior to departure on a trip, several items will need to be prepared. Suggestions are listed below to use as a general guideline when preparing to depart.

INFORMATION:

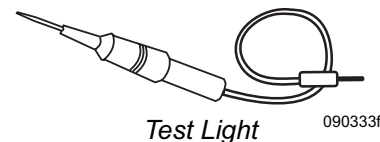
Refer to the chassis section for chassis maintenance details.

Items To Carry:

- Local, State and National Maps. A “Motor Carrier” road atlas can be useful for showing maps, refueling stations and truck repair facilities.
- Emergency road kit containing a flashlight, road flares, warning signs and a fire extinguisher.
- Potable/non-potable water hoses and a water pressure regulator.
- Assortment of termination connectors for sewage.
- Hand tools.
- 12 Volt DC test light and a 120 AC polarity tester. (These may be helpful when on the phone with a technician.)
- Battery hydrometer.
- Spare 12 Volt DC continuous duty solenoid (if applicable).
- An assortment of spare fuses.
- One link kit for ride height control assembly (for air suspension only).
- Spare alternator belt.
- Charge air cooler T-bolt clamp.



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Tool Box/Road Emergency Supplies



090333f
Test Light



020062
Polarity Tester

Interior Items:

- Start refrigerator operation the night before departure to start the cooling process. Pre-cool items prior to loading them in the refrigerator.
- Load pots, pans, utensils, soap, linens, etc.
- Secure and fasten bi-fold and pocket doors. Lock the shower door.
- Close roof vents and windows.
- Secure loose, heavy or sharp objects in case of a sudden stop.
- Close all cabinet doors and drawers.
- Walk the interior and check for items not secured.
- Test appliances before leaving home.
- Turn interior lighting **OFF**.

Exterior Items:

- Check operation of all exterior lights, headlamps, taillights, brake and clearance lights.
- Check the battery fluid level of Liquid Lead Acid batteries.
- Check all fluid levels on the chassis and generator. (See Chassis Information section and the OEM generator manual for details.)
- Check the fuel/water separator behind the inverter compartment. Clean and drain if needed.
- Adjust mirrors.
- Test the windshield wipers.
- Fill the LP-Gas tank.
- Test the generator.
- Make sure the following items are in the motorhome: sewer connection hose, water fill hose, awning rod and electrical adapters.

Engine Checklist:

- **Inspect** the engine, transmission and engine compartment for fluid leaks.
- **Inspect** the area under the motorhome for fluid leaks or puddles.
- Check all fluid levels, oil, antifreeze, transmission, hydraulic fluid and washer fluid.
- **Inspect** belts and hoses for wear.
- **Inspect** wiring for loose, frayed or corroded connections.
- Start engine and listen for unusual noises.

Driving Preparations:

- **Inspect** oil level of oil bath hubs if applicable.
- Fill the water tank and confirm waste tanks are empty. Test the water pump.
- Disconnect and store the fresh water hose.
- Check all tires for accurate pressure. **Inspect** tires for cuts, punctures, weather damage or cracks in the sidewalls and tread areas. Check for foreign objects lodged between dual tires.
- Make sure all lug nuts are tight. This should be done by an approved repair facility.
- Secure all awning locks.
- Secure items in storage bays to prevent shifting or damage to items.
- Outside compartment doors should be closed and locked.
- Look around, above and under the motorhome for obstruction.
- Check fuel level gauge. Fill the fuel tank if necessary.
- Check all other dash gauges for operation and correct level indications.
- Secure and lock the entry door for travel.
- Lower the antenna.

Storing Cargo:

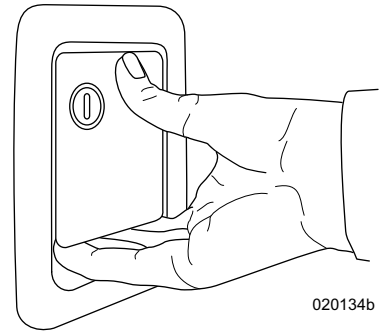
Exercise caution when opening storage bays as cargo may shift during travel. When closing the bay doors, keep fingers clear of openings.

CAUTION:

Open the cargo door slowly as cargo may shift forward during travel.

WARNING:

To avoid injury, never place hands or fingers near the edges of the bay door when opening or closing. Always use the latch handle. Apply pressure with the other hand just above the latch handle.



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Remember that regardless of how large the motorhome, there is a limit to storage capacity. Pack as lightly as possible to allow for additional storage during the trip. It is often easier to purchase needed items at the final destination rather than discarding items to make room for additional cargo.

When packing the motorhome keep two things in mind: turning and braking. For the motorhome to handle well, the load will need to be evenly distributed side-to-side and front-to-back. Additionally, heavy items should be stored as low as possible to keep the motorhome from becoming top heavy. Make sure that everything is secure and safe from quick turns, bumps and sudden stops.

Guidelines for Loading the Motorhome:

- Distribute the cargo weight evenly from side-to-side and front-to-back. This practice will prevent both handling problems and uneven stress on the components throughout the life of the motorhome.
- Heavy items should be stored near the rear axle; lighter items stored toward the front.
- To maintain a low center of gravity and reduce sway, store light items in the overhead cabinets and heavier items near the floor.
- Secure loose items to prevent weight shifts that could affect the balance of the motorhome.

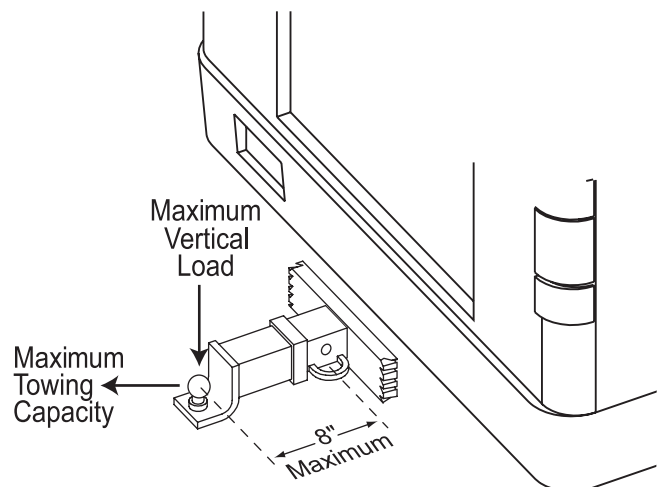
TIPS:

Multi-purpose items, versatile clothing and periodic removal of unused cargo will streamline cargo storage.

HITCH

Using the Rear Receiver

When using the rear hitch receiver, remember that the motorhome is intended for towing light loads and is primarily designed as a recreational vehicle. Safety and durability of the hitch receiver requires proper receiver use. Avoid excessive towing loads or other misuse of the receiver. Towing will affect fuel economy. Weight pushing down on the rear hitch must not exceed 10% of the hitch capacity.



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It is recommended to weigh the motorhome when fully loaded to ensure proper weight distribution of the GCVW (Gross Combined Vehicle Weight). When weighing the motorhome add all passenger weight to the GCVW total. The motorhome fully loaded, including fresh water, LP-Gas and any vehicle or trailer towed, must not exceed the GCWR (Gross Combined Weight Rating).

WARNING:

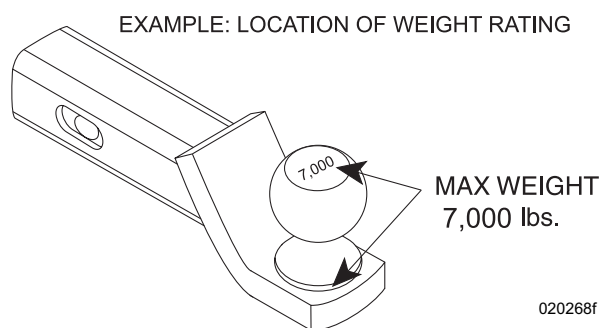
Most states and Canadian provinces require trailers and/or towed vehicles to have adequate auxiliary brakes. Failure to comply with these State and Canadian province requirements may result in fines and/or pose a safety hazard, which may result in an accident.

WARNING:

DO NOT tow a trailer or vehicle that exceeds the rated capacity of the hitch receiver. Overloading the hitch receiver can cause unusual handling characteristics and overstress the hitch receiver and chassis. It could also void the warranty. If there are any questions, call Technical Support.

 MONACO COACH CORPORATION Coburg, Oregon Springfield, Oregon Wakarusa, Indiana Elkhart, Indiana Nappanee, Indiana	Do Not Cut, Weld or Modify	03213019
	Do Not Exceed Vehicle Ratings	
	Maximum Towing Capacity 7,000Lbs. (3,175Kg.)	
	Maximum Vertical Load 700 Lbs. (317Kg.)	
	Any Towed Vehicle or Trailer Over 1000 lbs (454 kg) Should Have Separate Functioning Brake System.	
	Refer To Owner's Manual For Additional Towing Guidelines	

100200b



CAUTION:

If the motorhome is loaded to the maximum GVWR, gross weight tow capacity is reduced to 6,500 lbs.

Tow Car or Trailer:

1. Connect a tow car or trailer to the motorhome with safety chains rated for the weight of load.
2. Make the electrical connection and perform a light check before starting a trip and at each rest stop.
3. Check the tires frequently. Flat tires on a towed vehicle cannot be detected from the motorhome while driving. A flat tire is a safety hazard and may cause extensive damage.

WARNING:

Be sure the weight ratings of the ball mount, tow ball and safety chains are equal to or greater than the load. The use of an extension to the receiver or extended ball mount will significantly reduce hitch receiver weight ratings. Modifications to the hitch receiver, or use of the hitch receiver other than intended, can void the warranty of the hitch receiver, chassis or both.

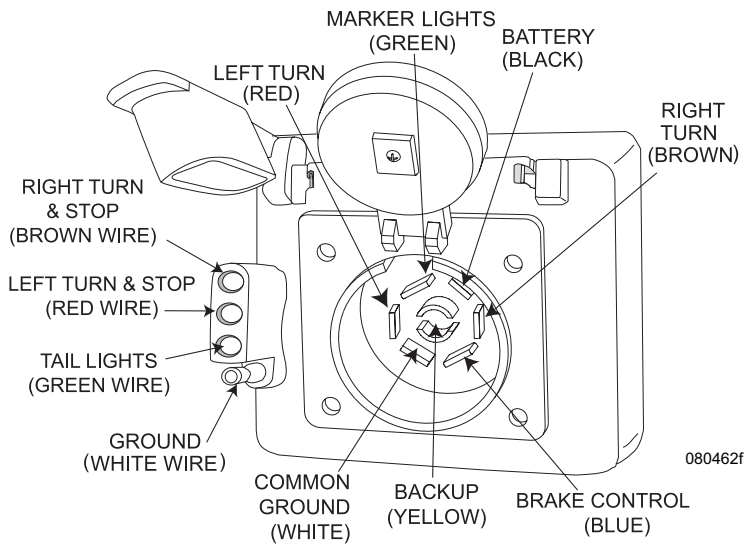
Tow Plug Connection

The motorhome is pre-wired from the factory with an electrical connection for towing, located on or near the hitch receiver. Convoluted tubing protects the tow harness wires. Current draw should not exceed ten amps for each designated light circuit. Within the electrical connection is a positive terminal for use when towing a trailer equipped with a battery. The positive terminal maintains the charge of the trailer battery.

When preparing a tow plug connection strip the wires 3/8". Twist the wire strands and place under the clip and secure the screw. Make sure there are no loose strands of wire that could short against the case or other terminals. **DO NOT** accidentally mirror image the trailer connection.

CAUTION:

Positive terminal connection of the tow plug remains live at all times. When towing a trailer equipped with a battery, unplug the electrical tow connection when parked. Failure to unplug the tow connection may result in discharged chassis batteries.

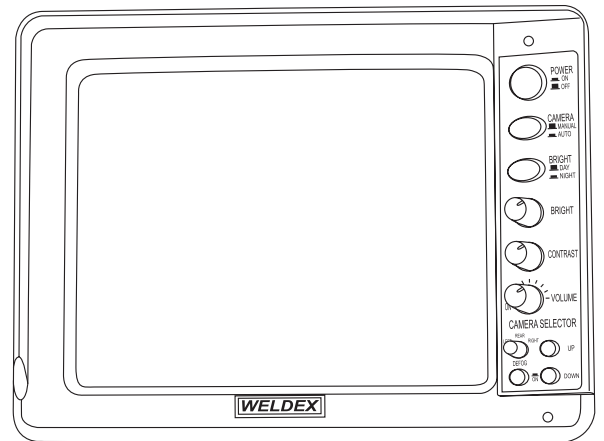


REAR VIEW SYSTEM

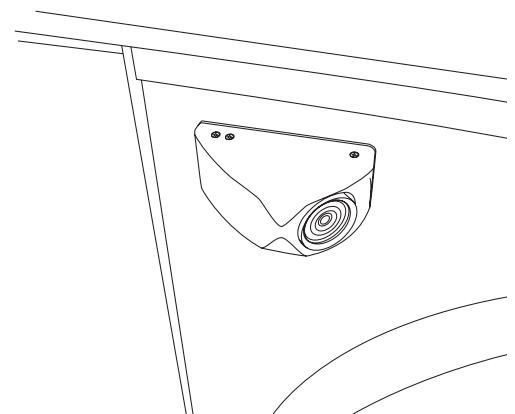
The rear vision system consists of an adjustable camera with a microphone and a dash mounted monitor. This allows the driver to see what is behind the motorhome and listen to verbal guidance.

Monitor Features:

- **Power ON/OFF** button. Turning the main power switch **ON** will allow continuous operation of the rear vision system while the ignition key is **ON**.
- **Camera Manual/Auto** button. This is for use with the optional three camera system only. With the button in the Manual (out) position, any one of the three cameras can be selected with the red toggle switch at the bottom of the monitor. With the button in the Auto (in) position, the camera will automatically change views with blinker activation.
- **Day/Night** button. Set camera for better picture in varying light conditions.
- **Contrast** and **Brightness** knobs.
- **Volume** control knob.
- **Camera Select** switch. Keep switch in the “rear” position to adjust camera angle.
- **Up** and **Down** buttons are for adjustment of rear camera angle. Optional Side cameras are not adjustable.
- **Defog** button. Defog option works for rear camera only. Defog automatically turns off after a preset temperature is reached.



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Side View Camera

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INFORMATION:

For more detailed instructions see the manufacturer’s manual.

BACKING UP A MOTORHOME

Whether you are a long time owner of recreational vehicles, or just starting out, backing up can be a challenge. Following some simple guidelines may help to reduce that challenge. When backing up, the driver (pilot) should be comfortable using the mirrors, the back-up camera and the co-pilot's directions (ground guide) for assistance. Practice backing up with the co-pilot's guidance in a large, unobstructed parking lot. Backing up is a team effort.

The backing process should begin while the motorhome is in forward motion. Maneuver the motorhome to align with the chosen site. Aligning the motorhome with the site, after the backing process begins, may require more than one attempt. When the motorhome is properly aligned with the site, the parking area will be visible in both mirrors. Use road markings as reference points when possible.

When pull-through sites are not available, pick a solid, level site on the left side for a better field of vision using the roadside mirror. If the site is on the right, use the curbside mirror for backing up. Stay aware of blind spots. Get out and walk the area prior to backing in a site. Look for potential hazards or obstacles that may damage the motorhome. If the site is satisfactory, prepare to back in carefully. Have the co-pilot provide guidance using the five hand signals.

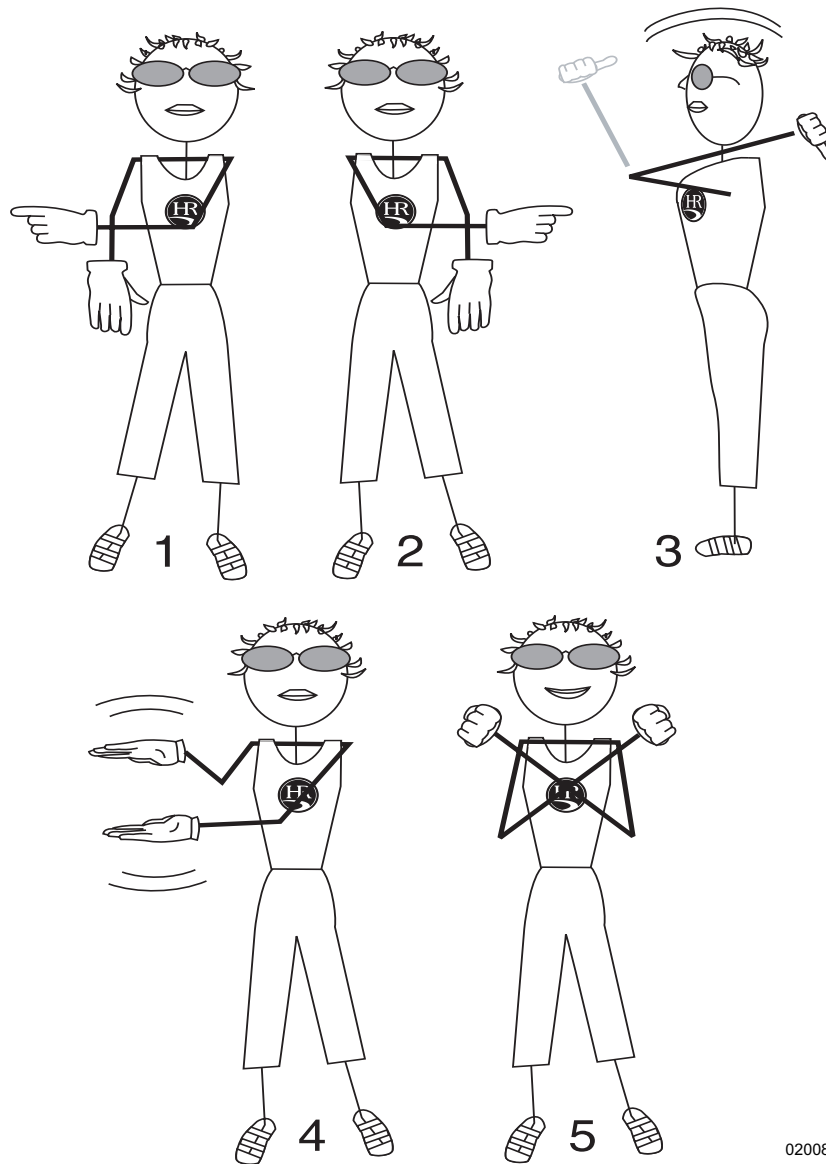
The co-pilot will perform just as important a job as the driver. When guiding the driver, the co-pilot should be located safely at the left rear corner of the motorhome, facing forward, while remaining visible in the roadside mirror at all times. The co-pilot should make a conscious effort to maintain sight of the driver through the roadside mirror as the motorhome maneuvers. If the driver loses sight of the co-pilot, stop the backing up process until the co-pilot returns to view. To avoid mishaps, the co-pilot should be focused only on what the driver is doing, with brief observation moments. If necessary, stop the backing up process to have co-pilot **inspect** other areas or angles of concern.

The driver should receive directions only from the co-pilot. When guiding the driver the co-pilot should use only the five clearly defined directional signals, one at a time. Flailing arms with indecisive signals only confuse the driver. Signals should be given with purpose and confidence. Directional signals are directing travel of the rear of the motorhome.

If the desired direction is left, the co-pilot points left. For example: The co-pilot will use his/her right arm and forefinger pointing distinctly left with arm and finger held on a horizontal plane, indicating desired direction of travel of the rear of the motorhome. A directional signal should remain steady until the desired movement is complete.

The five directional signals are as follows:

1. Left hand and arm held horizontal, with forefinger pointing right, to direct rear of motorhome to the right.
2. Right hand and arm held horizontal, with forefinger pointing left, to direct rear of motorhome to the left.
3. Both arms and hands parallel with thumbs pointing up and to rear in a waving vertical motion. This signals driver to maintain a straight back direction.
4. Arms held horizontally with hands open and palms facing one another. Start with a wide separation, then gradually close distance between hands in a rate appropriate to vehicle speed to indicate the distance to stopping point.
5. Closed fists and crossed arms indicate **STOP**.



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Backing Up Trailers:

Towed vehicles using a tow bar or tow dolly have more than one pivot point and are not suitable for backing. Attempting to back up the motorhome while connected to a tow bar or tow dolly can jack-knife the tow device and cause the wheels of the towed vehicle to move in a forward ‘sideways’ motion that will cause irreparable and expensive damage. If necessary, disconnect the tow vehicle to avoid a backing up situation.

Trailers have one pivot point and may be backed up. The same rules for backing a motorhome can be applied to backing a trailer. When preparing to back the trailer into a space, maneuver the motorhome sweeping wide. Turn back to the opposite direction to maneuver the trailer into the space. Keep the bottom of the steering wheel in the desired direction of travel for the trailer. For example: If the desired direction of the trailer is left, rotate the bottom of the steering wheel left. If the trailer moves in an undesired direction, use a short pull-up method, pulling forward just far enough to align the trailer with the space. The co-pilot should stand safely at the left rear corner of the trailer within view of the driver in the roadside mirror, using the five hand signals for guidance.

CAUTION:

Tow bars or car dollies are generally made to travel in a forward direction only. Most towing equipment of this type is not designed for backing. Never attempt short back up distances with a tow bar or tow dolly. Damage to the motorhome, vehicle or towing device will result.

SET-UP PROCEDURE CHECKLIST

If the site for the motorhome provides full hook-ups, use this quick reference checklist as a guide only. The checklist contains information on hooking up the utilities and preparing appliances for use. Specific information on slide room, awning and leveling system operations is discussed in detail in other sections.

- If applicable, unlock any travel locks which may be securing the slide room.

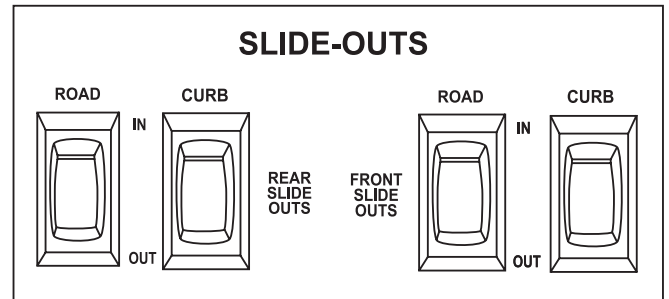
CAUTION:

Check for lateral clearance before extending the slide room.

NOTE:

Turn the ignition switch to OFF and set the park brake to operate any slide room. Extend slide rooms prior to leveling.

- Follow the procedures and guidelines for “Leveling the Motorhome” in Section 10. If the motorhome is equipped with hydraulic jacks, confirm that the parking surface will accommodate the weight placed on the jacks.



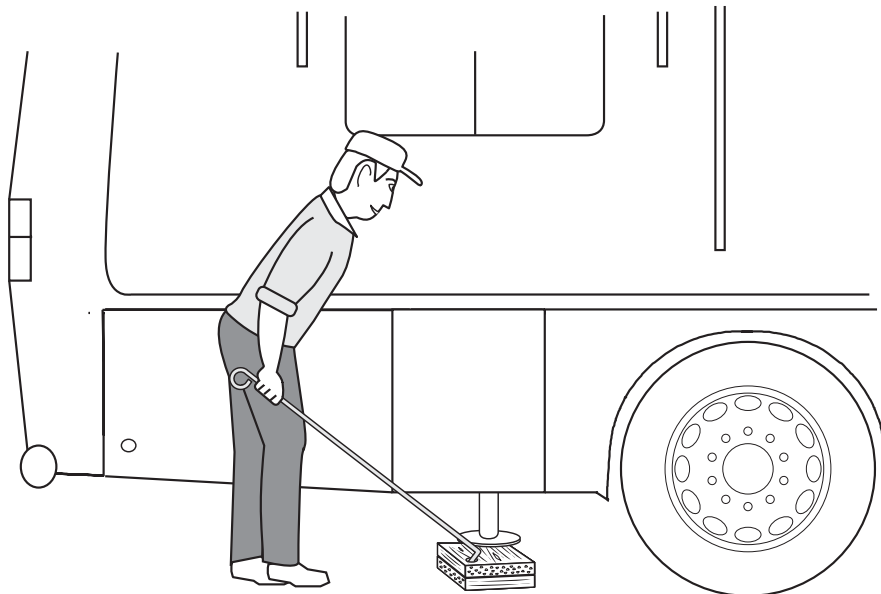
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CAUTION:

Before leveling the motorhome survey the area around and under the motorhome for obstructions which can damage the motorhome or undercarriage components when the air bags are deflated.

CAUTION:

Hot asphalt, gravel or dirt may not support the weight that is placed on the hydraulic jack pads. Place thick plywood under the jack pads to help disperse the weight. If blocking up a rear jack pad to gain added clearance when the motorhome is on a slope, place a wheel chock at the opposite set of rear wheels to prevent the motorhome from rolling.



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- Open the LP-Gas tank primary valve and turn on the remote switch.
- Prepare the shore cord for connection. Uncoil and **inspect** the cord, and perform necessary cord maintenance. Install proper electrical adapters if anything other than 50 Amp service is provided. Operate electrical appliances in sequence when hooked to limited shore power service. Turn shore power circuit breaker **OFF** prior to plugging in the shore cord.
- If possible, begin appliance operation on LP-Gas for the first 60 minutes. Switch the refrigerator operation to gas and start the water heater and furnace, if needed. This allows time for the inverter to stabilize battery charging.

NOTE:

Motorhomes equipped with a converter require no wait time to operate appliances.

When Hooked to 50 Amp:

After verifying proper voltage, wait approximately one minute for the optional inverter to stabilize charging of the batteries before starting air conditioners or other large AC loads.

When Hooked to 30 Amp:

Wait approximately one hour before operating electrical appliances. This will allow time for the optional inverter to stabilize charging the batteries. Use caution when operating appliances to avoid overloading the supplied shore service breaker. Operate appliances and outlets in sequence rather than all at the same time.

CAUTION:

If shore power service is limited to 15 or 20 Amps, use of light duty extension cords and electrical adapters will create a voltage loss through the cord and at each electrical connection. Line voltage loss and the resistance at each electrical connection can be a hazardous combination. Damage to sensitive electronic equipment may result!

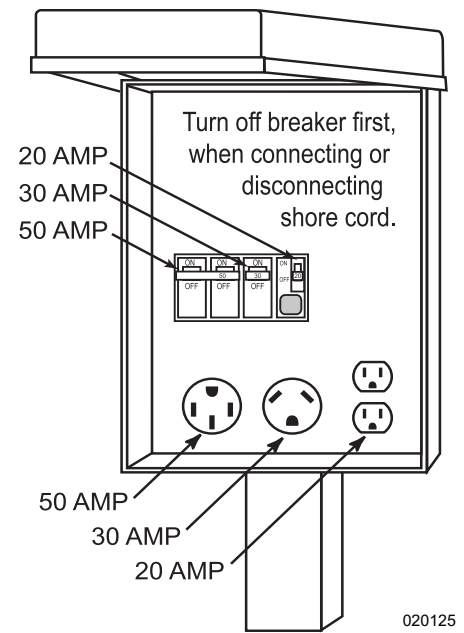
NOTE:

To avoid shore power overload when hooked to 30 Amp service, determine appliances current load prior to turning on appliances or using interior outlets.

CAUTION:

DO NOT remove cover from shore power supply to troubleshoot electricity to the motorhome. Serious personal injury or death may occur. If there is no power to the motorhome, inform the park manager. It is park management responsibility to fix any problems with the shore hook-up at the site.

- If cable service is provided, hook-up a 75 Ohm RG59 or RG6 cable to the cable connection in the service center. If the motorhome has a video selector box press the appropriate viewing button for the item desired.
- A phone connection port is provided in the service center. Phone utility outlets are placed throughout the motorhome, including a phone line attached to the satellite receiver for Pay-Per-View movies and events.



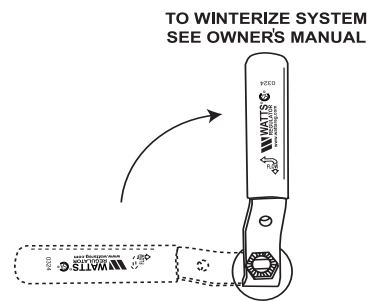
Typical Power Pedestal

- Hook the potable water hose to the city water connection in the service center. Install a water pressure regulator to protect the water hose from excess pressure. Turn the hand valve to the City Water position.

NOTE:

A water pressure regulator attached between the city water faucet and the potable fresh water hose will protect the hose from swelling or bursting under high city water pressure. Securing the pressure regulator to the hose with pliers will prevent the regulator from being misplaced.

- Hook up the sewer hose. Sewer drain pipe diameters are generally either three or four inches. Proper sewer hose adapters will ensure against leaks or spillage. With the sewer hose properly connected open the grey water valve (small valve). The black water valve (large valve) remains closed until the tank is full or until time of departure.



WARNING: POTABLE WATER ONLY
SANITIZE, FLUSH AND DRAIN
BEFORE USING
(SEE OWNER'S MANUAL)

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DRY CAMPING

By planning ahead and using a little imagination there are endless ways to conserve resources, and still enjoy the comforts of the motorhome, while dry camping.

Starting Out:

- Fill the hot water tank before topping off the fresh water supply. Confirm waste holding tanks are empty. When the fresh water supply is low, drain waste holding tanks prior to refilling the fresh water tank.
- Confirm the destination can accommodate the size and length of the motorhome. Drive-through sites are preferred for easier access.
- When navigating campgrounds, watch for low hanging limbs, tree trunks and barriers lining the roadway. Have the co-pilot or campground host provide guidance when negotiating tight curves. Position the motorhome to extend slide rooms and awnings. Before leveling the motorhome, check underneath for obstacles that may damage undercarriage components.
- Dry camping requires fully charged and properly maintained batteries. Fill batteries to proper level with distilled water only. Conserve battery power whenever possible.

Tips for Conserving Resources when Dry Camping:

- Switch refrigerator operation from Auto to LP-Gas.
- Plan what is needed from the refrigerator prior to opening.
- Turn off interior 12 Volt DC power whenever possible. The refrigerator is designed to operate with the power off.
- Conserve propane and electricity by cooking dinner over a campfire. Try to operate the microwave with the generator.
- Keep a working flashlights handy for night trips through the campsite and inside motorhome. When interior lighting is desired, use one light in a central location such as the vanity. Unscrew all but one or two bulbs.

- If weather does not permit or no outdoor table is available, eat at the dinette table by candlelight.
- Turn off small items that use battery power, such as porch lights, bay lights, engine compartment lights, etc. Turn off the 12 Volt antenna boost when not viewing the television.

ITEM	AMP DRAW
Interior House Power	1.5
13" TV	1.7
Rope Lights (10 ft.)	1.3
Porch Light	2.0
Fluorescent Dual Bulb	2.1

Typical Current Draw

- Monitor battery voltage. **DO NOT** allow batteries to fully discharge (lights dim) before starting the generator. If possible, run the generator twice a day, morning and afternoon, to charge the batteries.
- Turn off the inverter when not in use.
- Turn on the water heater about twenty minutes before hot water is needed. Once heated, turn it off. Water will remain hot for several hours.
- Turn on the water pump only when using water.
- Frequently monitor holding tank levels. Careful management of water is critical when dry camping. Conserve water when showering. Turn water off when soaping then back on to rinse. Take a sponge bath when water conservation is critical. **DO NOT** fill the sink full of water to wash only a few dishes. Use disposable dishes when possible. Chances are a campground without hookups will also lack showers or bathrooms and may only be equipped with primitive facilities. However, if it helps to conserve water and holding tank capacity, use them.
- Leave shoes outdoors or at the entry step to avoid tracking in dirt and using valuable resources for clean up.

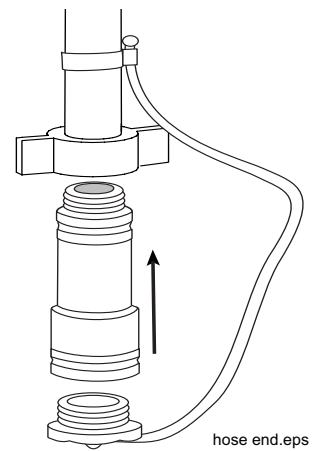
BREAKING CAMP

Preparing the motorhome for travel will require several small tasks. Properly securing and storing items will help to prevent them from getting lost or damaged. Below is a checklist guide to reference when preparing to break camp.

Outside Checklist:

- Disconnect the cable TV and lower the satellite dish and/or antenna.
- Disconnect and stow the telephone line.
- Retract awnings and secure them for travel.
- Close the primary LP-Gas tank valve and turn off remote LP-Gas switch.
- Connect the sewer hose.
- Drain and flush holding tanks. Start by closing the grey water valve. Run enough cold water down the sink and shower drains to fill the grey tank at least 50%. Use caution to avoid overflowing or flooding the grey tank. Connect a non-potable water hose to the "No-Fuss" hose bib, open the black tank valve, and allow adequate time for the black tank to drain. Close the black tank valve and open the grey water valve. Water from the grey tank will help to flush the drain hose. Once evacuated, close the grey water valve. Disconnect the sewer hose and flush that hose with clean water from a non-potable hose. Store the hose. Replace the sewer cap.

- Disconnect fresh water hose from the source and store with end cap in place. If applicable, remove the hose protection water pressure regulator from the city water faucet.
- Turn the shore power breaker off and disconnect the shore line. Wind up and store the shore cord and secure the door.
- **Inspect** fluid level in oil bath hubs (if applicable) and check all tire pressures.
- Secure all compartment doors.
- **Inspect** tires and wheels.
- Check for fluid leaks under and around the motorhome.



Cap the end of the hose before storage to prevent leakage and to prevent dust and insects from entering hose.

Engine Checklist:

- **Inspect** the engine, transmission and the engine compartment for fluid leaks.
- **Inspect** the area under the motorhome for fluid leaks or puddles.
- Check all fluid levels: oil, antifreeze, transmission, hydraulic fluid and washer fluid.
- **Inspect** belts and hoses for wear.
- **Inspect** wiring for loose, frayed or corroded connections.
- Start engine and listen for unusual noises.
- **Inspect** gauges and controls for proper operation.

Interior Checklist:

- Clear the slide room path, clean the floor and move the driver seat forward. Retract the slide room, after confirming the bay doors are closed, and secure all slide room awning locks.

NOTE:

To operate the kitchen slide the ignition must be OFF and the park brake must be set.

- Secure and fasten all interior doors. Lock the shower door.
- Close roof vents and windows.
- Secure all loose, heavy or sharp objects in case of a sudden stop.
- Close all cabinet doors and drawers.
- Turn **OFF** interior lights.
- Disengage the water pump.
- Check the fuel level gauge and all other dash gauges for operation and correct level indications.

Departure Checklist:

- Check items in storage bays to make sure shifting or damage of items will not occur.
- Look around, above and under the motorhome for obstructions. Check for debris stuck between the rear dual tires.
- Walk around the motorhome and camp area checking for forgotten items.
- Outside compartment doors should be closed and locked.
- Check operation of all exterior lights, headlamp, taillamp, brake and clearance lights.
- Carefully pull forward out of the campsite. If necessary, clean the site and check for forgotten items.
- Secure and lock the entry door for travel.

EMERGENCY ROADSIDE PROCEDURES

Road flares or reflective warning signs should be displayed if the motorhome is alongside of the road for any length of time. Guidelines for placing the warning triangles depend upon the road characteristics and visibility. For example: The standard placement is 10 feet, 100 feet and 200 feet from the rear of the motorhome when on a divided highway or one-way road. On a two-way road, with traffic traveling both directions, the same placement would also be required at the front of the motorhome. Roads with curves and hills may require the placement of the last/furthest triangle to be 500 feet behind the motorhome in order to safely warn approaching traffic.

EMERGENCY SERVICE PROVIDER		
Equipment	Provider	Emergency Number
Motorhome: Holiday Rambler	Monaco Customer Support	1-877-466-6226
Chassis: Roadmaster	Roadmaster	1-877-466-6226
Engine: Cummins	Cummins Customer Call	1-800-343-7357
Transmission	Allison Transmission	1-800-524-2303
Towing	Coach Net	1-928-855-2403
Tire: Goodyear	Goodyear	1-877-484-7376

In Case of Flat Tire

In the event of a flat tire, it is recommended to call for roadside assistance. The size and weight of the motorhome and its tires require proper equipment to change the tire. A professional service technician will have the equipment and training needed to repair or replace the tire. In the case of sudden tire failure, avoid heavy braking. Hold the steering wheel firmly and gradually decrease speed. Slowly move to a safe off-road place, which should be a firm level spot. Turn the ignition **OFF** and turn the hazard flasher system **ON**. Save the old tire for possible warranty coverage.

Running Out of Fuel

When the motorhome runs out of fuel, air will enter the fuel lines and fuel system components of the engine. Diesel engines are sensitive to air in the fuel system. If the engine has stalled due to low fuel, it will be necessary to prime the fuel system to restart the engine. Several gallons of fuel will be necessary in the tank before attempting to prime the fuel system.

CAUTION:

The engine will sputter for a short period before it stops running due to a low fuel condition. Pull off the road on a firm level surface a safe distance away from traffic. Steering may become stiff if the engine stops running.

To Prime the Fuel System:

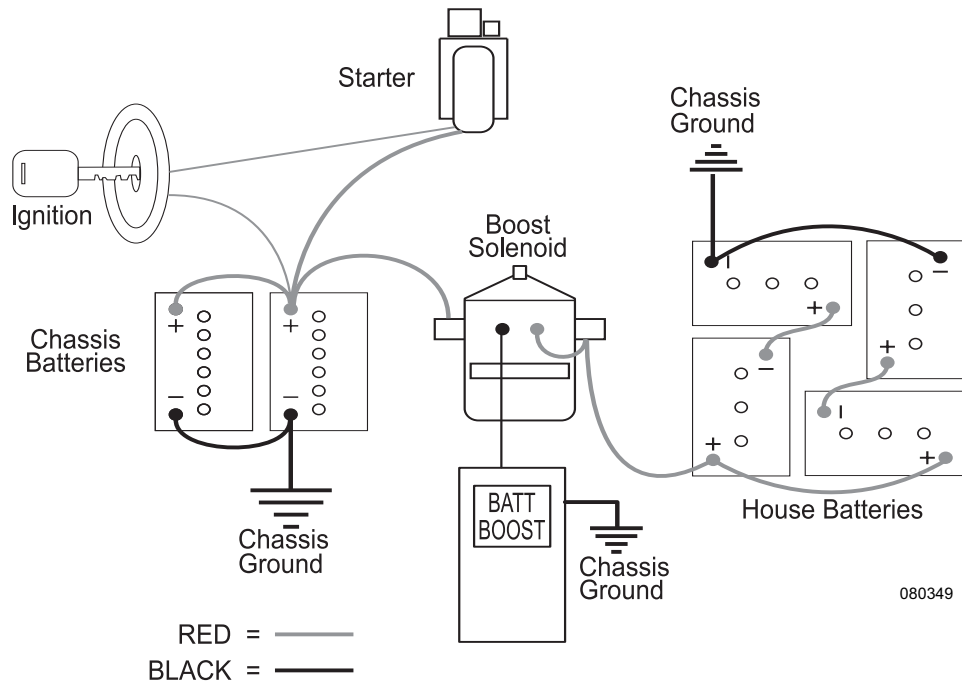
1. Add 20 gallons of fuel to the empty tank, possibly more if the motorhome is parked on an angle.
2. Follow instructions in *To Prime the Fuel System* located under **Fuel System/Fuel Filters - Section 10**.

Dead Chassis Battery

A weak or discharged battery will not supply the amount of **CCA** (Cold Cranking Amps) necessary to initiate the required voltage to start the engine. If the engine fails to crank, or cranks slowly due to a weak chassis battery, use the battery boost switch to increase battery power.

Using the Battery Boost Switch:

The battery boost switch, located on the dash, engages a heavy-duty solenoid to electrically connect the house batteries to the chassis battery in the event the engine will not crank or cranks slowly.



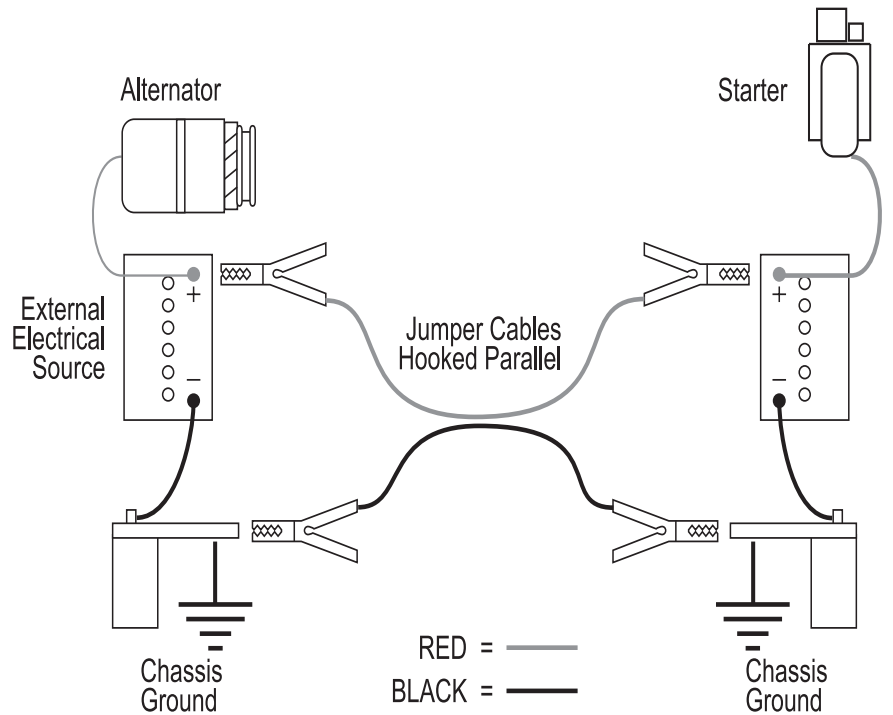
- With the ignition key **OFF**, press and hold the battery boost switch for ten seconds. After ten seconds, continue to hold the switch down and turn **ON** the ignition. Observe the battery voltage gauge on the dash - it should read at least 12 Volts. If voltage is sufficient, try to start the engine.
- If the engine fails to crank, or does not crank fast enough, discontinue the attempt. Continued attempts will only diminish any remaining surface charge in the chassis battery and end future alternative attempts.
- Next, start the generator. This may require using the Battery Boost switch for the generator to start from the chassis battery. Once the generator is operating, the electrical combination of the generator and inverter will charge the house batteries. This will allow a more significant boost to be applied to the chassis batteries.
- Allow the generator to run approximately $\frac{1}{2}$ hour before attempting to use the boost switch.
- After $\frac{1}{2}$ hour of generator operation, leave the generator on and hold down the battery boost switch for two minutes. Release the switch for one minute, then press the switch again for two minutes. Alternate this cycle three times.
- Next, hold the switch down and turn the ignition on. The battery voltage gauge on the dash should indicate at least 12 Volts. If voltage is sufficient with the Boost switch held down, try to start the engine.
- If the engine fails to crank, or fails to crank quickly, the chassis battery may be depleted and the motorhome will require jump-starting or an external charger hooked to the chassis battery. When using jumper cables to start the engine, the cables must connect in a parallel configuration. That is positive (+) to positive (+) and negative battery (-) to negative chassis (-). Always connect the positive (+) before connecting the negative (-). To prevent arcing when disconnecting the cables, disconnect the negative (-) before disconnecting the positive (+).

WARNING:

Batteries can emit explosive gas. Always ventilate the battery compartment prior to any work or service to the batteries. Extinguish all smoking material and keep all open flame and spark producing devices away from battery area.

Jump Starting using an external source:

1. When using an external electrical source to connect to the chassis battery, turn the main battery disconnect switches **OFF** prior to hooking up the jumper cables.
2. Hook up the cables then wait several minutes to allow a surface charge to build in the chassis battery before attempting to start the engine.
3. Turn **ON** the battery disconnect switches and attempt to start the engine. **DO NOT** crank the engine more than a few seconds.
4. After the engine has started disconnect the cables. Disconnect the negative (-) cables before disconnecting the positive (+) cables to prevent arcing.
5. If the engine does not crank, or cranks slowly, **DO NOT CONTINUE**. Extensive damage, fire or injury can occur. Obtain help from a qualified technician.



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WARNING:

The gas around the battery can explode if exposed to flames, sparks or other sources of ignition, resulting in injury or vehicle damage. Batteries contain sulfuric acid that can burn skin, eyes and clothing. DO NOT connect the end of the second cable to the negative (-) terminal of the battery to be jumped. A spark may cause an explosion of the gases that surround the battery. Connect only to the chassis away from the battery.

CAUTION:

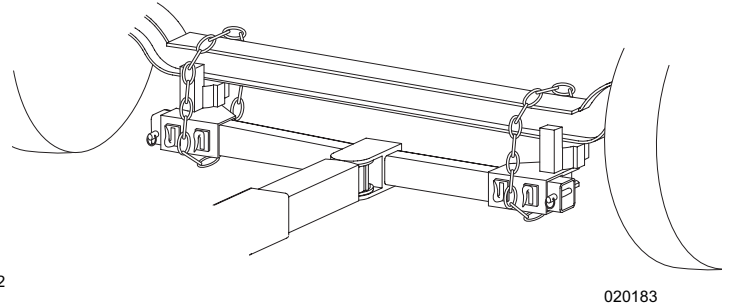
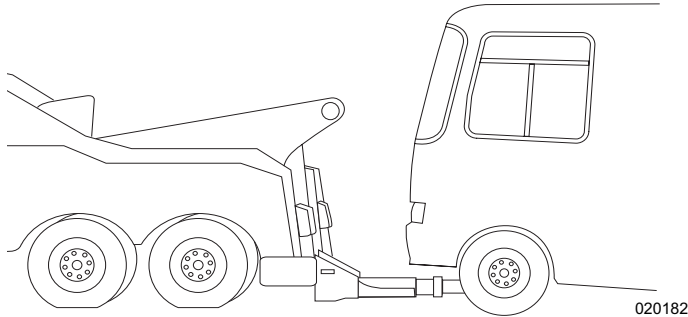
The charging system on the towed vehicle does not supply the amperage necessary to jump-start the motorhome. Voltage sensitive equipment on the towed vehicle can be damaged, leaving the towed vehicle disabled. If a jump-start is necessary, it is recommended to call Roadside Assistance. They will have the equipment necessary to jump-start the motorhome.

CAUTION:

A large amount of electrical current is required to jump-start an engine. The sizes of the battery, alternator and jumper cables supplying the jump are current limiting factors. Voltage fluctuations that occur during a jump-start procedure can damage sensitive electronic equipment and charging systems. Wait a sufficient amount of time for a surface charge to build before attempting to crank an engine when using a jump-start procedure. If uncertain about performing a jump-start procedure, contact a professional. Damage and personal injury can occur if this procedure is not performed correctly.

TOWING PROCEDURES

If calling a towing company for service, it is recommended to use a lowboy/landall type of trailer. If a tow truck is used it needs to have a support arm that goes under the motorhome and secures to the front axle. Inform the tow company of the axle weights and total weight of the motorhome. Other important information is the length of the motorhome, number of passengers and milepost location. Two tow trucks may be necessary if the tow vehicle is not operational.

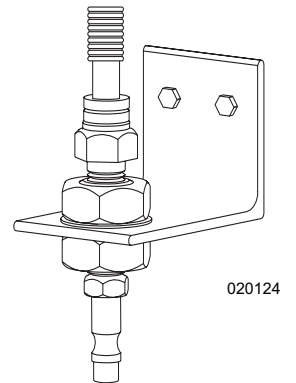


- Secure any loose or protruding parts if the motorhome is damaged.
- **Inspect** the points of attachment on a disabled motorhome. If attachment points are damaged, select other attachment points at a substantial frame structural member.
- Never allow anyone to go under a motorhome while it is being lifted by towing equipment unless the disabled motorhome is adequately supported by safety stands.
- **DO NOT** tow the motorhome from the rear. Towing from the rear will severely overload the front tires and suspension possibly resulting in tire and/or front suspension failure. Rear frame extensions are not designed to support weight loads imposed by lifting the motorhome from the rear.

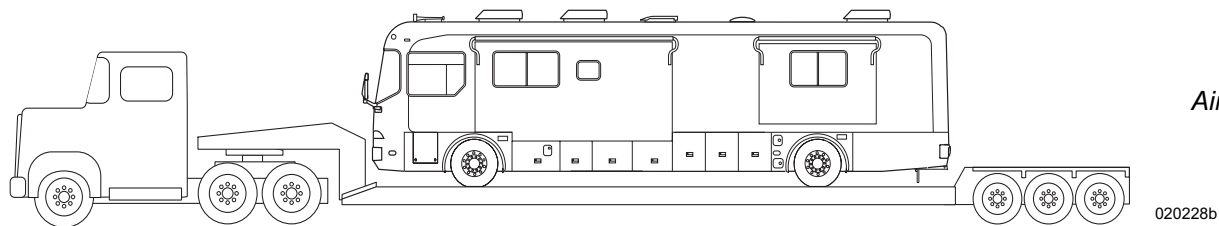
NOTE:

The towing company may need to access the air nipple, located in the generator compartment, to release the air brakes. Only towing personnel should perform this procedure.

- If the rear wheels are disabled, place the motorhome on a flat bed trailer, or use a heavy duty dolly under the rear wheels and tow the motorhome from the front.



Air Nipple



- The drive shaft must be removed to prevent damage to the transmission. Secure end caps to prevent losing or contaminating the needle bearings.
- The mud flap may need to be removed to prevent damage due to limited ground clearance.

WARNING:

In case the motorhome requires towing, ensure all precautions are followed. The drive shaft must be disconnected and the mud flap may need to be removed. The manufacturer WILL NOT cover damage to the motorhome caused by towing.

Brake - Disabling Parking Brake

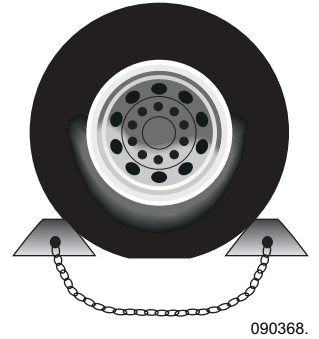
The park/emergency brakes apply to the drive axle only. The brakes can be manually released if the air system will not build sufficient air pressure to release them. This emergency procedure is to be used by trained technicians or towing personnel to move the motorhome to a safe location or repair facility.

WARNING:

Only trained personnel should perform this procedure.

Drum Brakes:

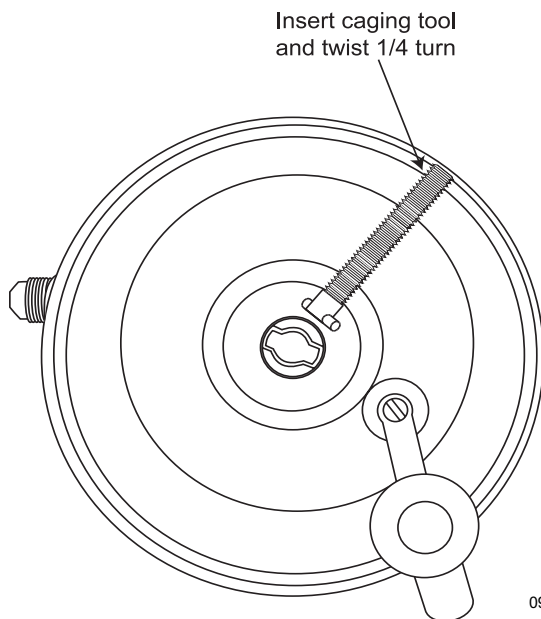
- Place wheel chocks firmly against the wheel before performing this procedure.
- Remove the plug from the center of rear brake chamber on the drive axle.
- Remove the caging tool from its holder on the brake chamber and insert the tool into hole. Turn clockwise to engage.
- Screw nut and washer onto caging tool. Use a wrench to tighten the nut, compressing the internal spring to release the brake.
- Repeat procedure for the other side.
- After towing, or when air pressure is again available, loosen the nut and remove the tool. Return the caging tool to its original location and replace the plug.
- Repeat for the other side.



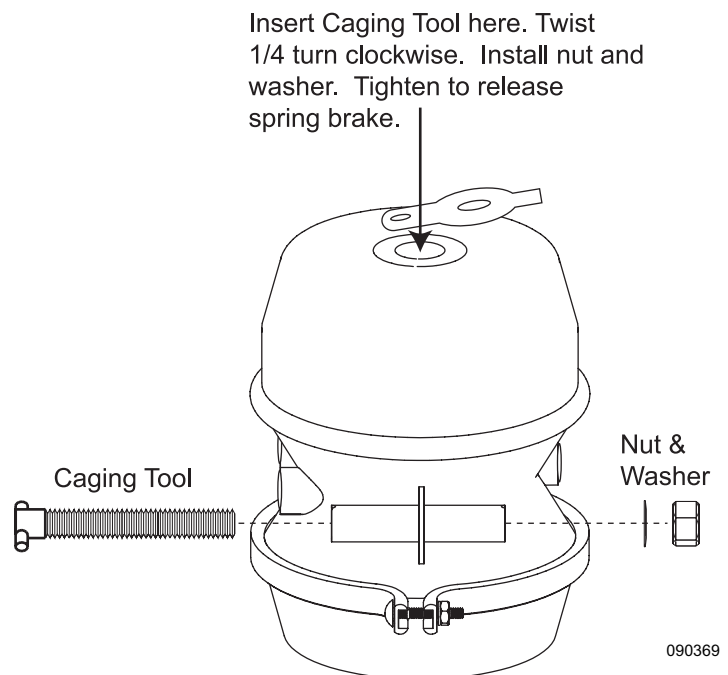
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WARNING:

Failure to securely chock the wheels can result in the motorhome rolling when the spring brakes are released. Severe injury or death can occur.



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TIRES

Tires designed for the motorhome are a very technical and engineered product. Since the tire is the only contact the motorhome has with road surface, it is critical that proper tire pressures be maintained. Improper tire pressure will lead to abnormal wear or sudden tire failure. The motorhome must be weighed fully loaded before proper tire inflation pressures can be determined. The following information concerning tires and weighing the motorhome are set in the order in which the process is performed or experienced.

The tire performs additional functions of traction for moving stopping and steering, as well as providing a cushion for the motorhome. Modern tire technology blends a unique mix of chemistry, physics and engineering to provide a high degree of comfort, performance, efficiency, reliability and safety. To obtain the maximum wear and best service from tires, it is helpful to understand the components and functions of the tire.

Tire Components:

Tread: Provides traction and cornering grip.

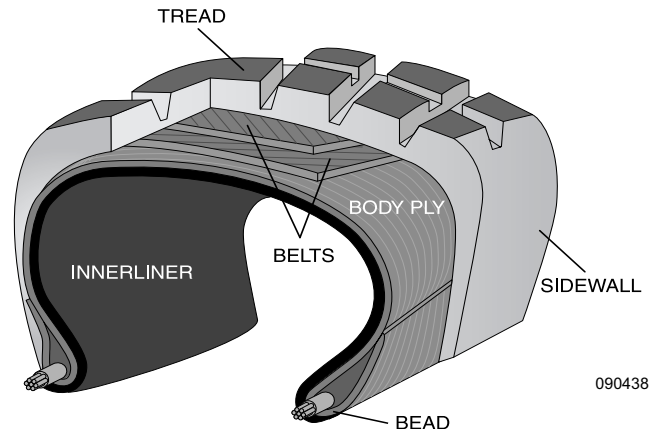
Belts: Stabilize and strengthen the tread.

Sidewall: Protects the side of the tire from road and curb damage.

Body Ply: Gives the tire strength and flexibility.

Bead: Assures an air-tight fit with the wheel.

Inner Liner: Keeps air inside the tire.



Importance of Air Pressure

The most important factor in maximizing the life of the tires is maintaining proper inflation. Driving on any tire that does not have the correct inflation pressure for the load of the motorhome is dangerous and may cause premature wear, tire damage and/or loss of control of the motorhome.

An under-inflated tire will build up excessive heat that may go beyond the design limits of the rubber and radial cords and could result in sudden failure. An under-inflated tire will also cause poor motorhome handling, rapid and/or irregular tire wear and an increase in rolling resistance that results in a decreased fuel economy.

An over-inflated tire will reduce the tire's footprint/contact patch with the road, thus reducing traction, braking capacity and handling of the motorhome. Over-inflation of a tire for the load will result in a harsh ride, uneven tire wear and a susceptibility to impact damage.

Maintaining correct tire inflation pressure for each loaded wheel position on the motorhome is of the utmost importance and must be a part of regular motorhome maintenance.

WARNING:

Driving on a tire that is under-inflated can exceed the design limits of the tire and may damage the sidewall. A damaged sidewall can burst upon inflation resulting in serious damage, injury or death. Aged tires are also susceptible to sidewall damage.

Tire Pressure Inflation Guideline

Federal law requires that the specifications for the tire's maximum load rating be molded into the sidewall of the tire. The amount of air pressure to use is dependent on the weight of the motorhome when fully loaded. The tire chart indicates the weights that can be properly supported by varying air pressures. Decreasing air pressure decreases load carrying capacity.

Always comply with the tire manufacturer's recommended pressure inflation guideline. The actual weight of the motorhome can vary significantly depending on how it is loaded. For optimum tire wear, ride and handling always comply with the manufacturer guideline. A tire inflation chart listing proper inflation pressure for different loads can be found in this section.

The tires of the motorhome are inflated to pressure(s) appropriate for the actual weight on each axle in the unloaded, shipped condition. When the motorhome is loaded, check and adjust the inflation pressure on each tire as needed.

Always inflate tires to the pressure indicated in the tire chart for the load carried by the tire. **DO NOT OVERINFLATE OR UNDERINFLATE THE TIRES.**

The Gross Axle Weight Rating (**GAWR**) of the axles listed on the federal certification label attached to the motorhome is the maximum allowable loaded weight on an axle.

When the actual loaded weight of the motorhome and the weight on each axle is unknown, follow the recommended tire inflation pressure(s) listed on the federal certification label. When loading a motorhome never exceed the motorhome's **Gross Vehicle Weight Rating (GVWR)** or the **GAWR** for each axle.

Contact the tire manufacturer for further information concerning proper tire pressure inflation and other tire issues.

Tire Chart - Goodyear

Understanding the Inflation Table:

The tire size is on the left margin of the table. Determine the **Single** inflation reading or **Dual** inflation reading, denoted with a **D** or **S** on the Table. **Single** is for the front axle, and **Dual** is for the drive axle. Find the corresponding PSI at the top columns to see the corresponding maximum weight capacity for that PSI.

NOTE:

Every load range has a maximum rating as well as a minimum rating. DO NOT exceed those ratings.

Rated load capacities are listed for individual tires in a Dual or Single position.

INFLATION PRESSURE PSI

Tire Size	Max Speed Rating (MPH)	Single (S) Dual (D)	INFLATION PRESSURE PSI												
			65	70	75	80	85	90	95	100	105	110	115	120	125
8R19.5	75	S	2410	2540	2680	2835	2955	3075	3195	3305	3415	3525(F)			
		D	2350	2460	2610	2755	2865	2975	3085	3195	3305	3415(F)			
225/70R19.5	75	S		2895	3040	3195	3315	3450	3640(F)	3715	3845	3970(G)			
		D		2720	2860	3000	3115	3245	3415(F)	3490	3615	3750(G)			
245/70R19.5	75	S		3640	3740	3890	4080(F)	4190	4335	4540(G)					
		D		3415	3515	3655	3970(F)	4115	4265	4410(G)					
265/70R19.5	75	S				3970	4180	4355	4540	4685	4850	5070	5170	5355(G)	
		D				3750	3930	4095	4300	4405	4560	4805	4860	5070(G)	
9R22.5	75	S		3370	3560	3730	3890	4080	4235	4390	4540(F)				
		D		3270	3410	3550	3690	3860	4005	4150	4300(F)				
10R22.5	65	S		4080	4280	4480	4675	4850	5025	5205(F)	5360	5515	5675(G)		
		D		3860	4045	4230	4410	4585	4760	4940(F)	5075	5210	5355(G)		
11R22.5	75	S		4530	4770	4990	5220	5510	5730	5950	6175(G)	6320	6465	6610(H)	
		D		4380	4580	4760	4950	5205	5415	5625	5840(G)	5895	5950	6005(H)	
12R22.5	75	S		4940	5200	5450	5690	6005	6205	6405	6610	6870	7130	7390(H)	
		D		4780	4990	5190	5390	5675	5785	5895	6005	6265	6525	6780(H)	
245/75R22.5	75	S		3470	3645	3860	3980	4140	4300	4455	4610	4675(G)			
		D		3260	3425	3640	3740	3890	4080	4190	4335	4410(G)			
255/70R22.5	75	S				4190	4370	4550	4675	4895	5065	5205	5400	5510(H)	
		D				3970	4110	4275	4410	4455	4610	4675	4915	5070(H)	
265/75R22.5	75	S		3875	4070	4255	4440	4620	4800	4975	5150	5205(G)			
		D		3870	4040	4205	4370	4525	4685	4805(G)					
275/70R22.5	75	S					5170	5400	5630	5850	6070	6290	6510	6730	6940(H)
		D					4770	4980	5180	5390	5590	5800	6000	6200	6395(H)
275/80R22.5	75	S						5500	5745	5985	6225	6460	6700	6930	7160(H)
		D						5080	5305	5530	5750	5965	6185	6400	6610(H)
295/75R22.5	75	S						4725	5510	5780	5980	6175(G)	6370	6610(H)	
		D						4690	5440	5675(G)	5800	6005(H)			
295/80R22.5	75	S					5480	5750	6285	6550	6810	7070	7320	7580	7830(H)
		D					4855	5100	5570	5805	6035	6265	6490	6720	6490(H)
315/80R22.5	75	S						6415	6940	7190	7440	7610	7920	8270(J)	
		D						5840	6395	6540	6770	6940	7210	7610(J)	
11R24.5	75	S				5310	5550	5840	6095	6350	6610(G)	6790	6970	7160(H)	
		D				5070	5260	5510	5675	5840	6005(G)	6205	6405	6610(H)	
285/75R24.5	75	S				4990	5210	5420	5675	5835	6040	6175(G)			
		D				4930	5205	5310	5495	5675(G)					

The motorhome manufacturer is not the author of this chart and makes no representation or warranty concerning the accuracy of the information disclosed by the chart. Monaco Coach Corporation is not responsible for the accuracy of the information disclosed or for any errors within the Tire Inflation Chart.

Inspecting & Pressure

The Load and Inflation Table will help determine correct tire inflation pressure after properly weighing the motorhome. All pressures are rated at a cold psi. Cold psi is defined as early in the morning before the day's ambient temperature, sun's radiant heat or the heat generated while driving have caused the tire pressure to temporarily increase. Tire pressure should be checked in the morning before the motorhome has been driven more than one mile. Check tire inflation regularly. Use a quality truck tire gauge with an angle airhead to access the dual wheel positions of the drive axle. Ensure the valve cap is replaced on the stem after the inflation pressure is checked. Use valve stem caps with a positive seal to prevent air escaping from the valve stem. If there are extension hoses on the valve stem, make sure they are quality reinforced stainless steel braid. Attach hoses securely to the outer wheel. The valve stem cap guarantees the valve core will remain free of dirt and foreign material. Material lodged between the valve core and internal stem can cause slow leaks resulting in tire failure.

Optimum tire performance is achieved at proper inflation pressure for the load carried. **DO NOT** mix tires of different tread patterns, size or construction on the same axle. The difference in traction could cause rear end gear fight and mechanical damage to the drive train.

CAUTION:

Never let air out of a hot tire.

WARNING:

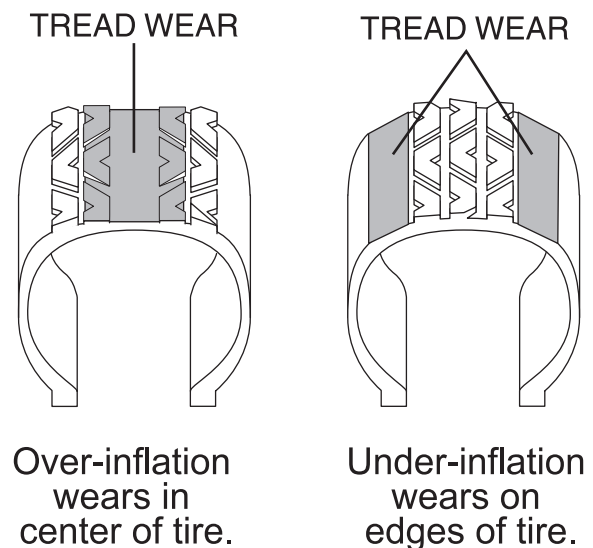
Improperly inflated tires can effect handling or cause sudden tire failure possibly resulting in loss of vehicle control of the motorhome. Always use an accurate tire pressure gauge when checking tire pressure.

Higher than recommended pressure can cause:

- Hard ride.
- Tire bruising or carcass damage.
- Rapid tread wear in the center of the tire.

Lower than recommended pressure can cause:

- Tire squeal on turns.
- Separations.
- Rapid and uneven wear on the edges of the tread.
- Circumferential breaks.
- Tire container may bruise or rupture.
- Higher risk of road hazard.
- Tire cord breakage.
- Loss of casing durability.
- Excessive tire temperature.
- High fuel consumption.
- Reduced handling quality.



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WARNING:

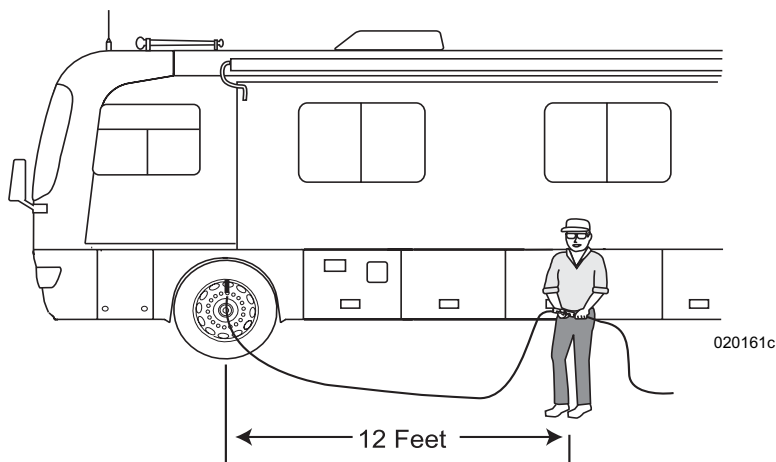
A slow leak may go unnoticed on one of the dual tires. This can cause the good tire paired with it to fail due to exceeding the load limits it is designed to carry. Tires with damaged sidewalls can burst upon inflation. A flat or nearly flat tire can also generate enough heat from friction to ignite.

Unequal tire pressures on same axle can cause:

- Uneven braking, swerve upon acceleration.
- Steering lead, torque steer.
- Reduced handling quality.

WARNING:

For safety purposes clear the area of people and pets during tire inflation. Inflate tires using a remote inflation device.



Air Pressure Checklist

1. When **inspecting** the tires, confirm the tires are cool before increasing or reducing air pressure. Even driving a short distance can heat up tires.

NOTE:

If the motorhome must be driven a distance to get air, check and record the tire pressure first and add the recorded calculation when reaching the pump. It is normal for tires to heat up and the air pressure inside to go up as driven. Never reduce air pressure when tires are hot.

2. Remove the cap from the valve on one tire.
3. Firmly press a tire gauge onto the valve and record reading.
4. Add air to achieve recommended air pressure.
5. If the tire is over filled, release air by pushing on the metal stem in the center of the valve. Then recheck the pressure with the tire gauge.
6. Replace the valve cap.
7. Repeat with each tire.
8. Visually **inspect** the tires to make sure there are no nails, or other objects embedded that could poke a hole in the tire and cause an air leak.
9. Check the sidewalls to make sure there are no gouges, cuts, bulges, or other irregularities.

NOTE:

Air pressure in a tire goes up (in warm weather) or down (in cold weather) one to two pounds for every 10° of temperature change.

Supporting When Leveling

Extreme caution must be taken to ensure that the tires are fully supported when placing blocks under the tires. The load on the tire should be evenly distributed on the support block. In the case of dual tires, distribute the load evenly on blocks for both tires. If not properly supported, the steel cables in the sidewall of the tires may be damaged and could lead to premature fatigue of the sidewall.

CAUTION:

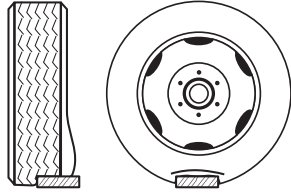
Supporting tires prevents damage to the sidewall of the tires and does not prevent tire roll.

Tire "Support" Methods

INCORRECT

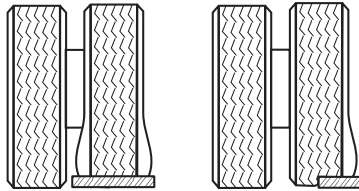
Singles

Only a portion of the tire is supporting the full load.

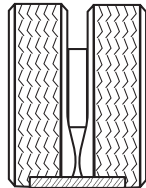


Duals

One tire or a portion of one tire is supporting the full load.

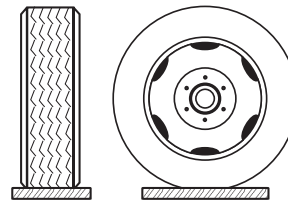


One tire or a portion of the two tires supporting the full load.



CORRECT

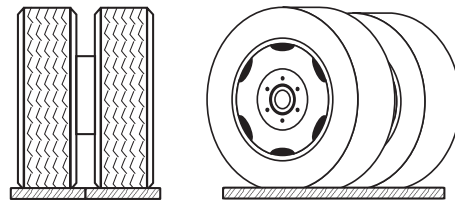
Singles



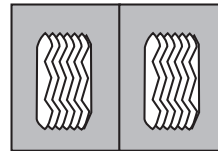
Tire Footprints



Duals



Dual Tire Footprints



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Tire Vibration

Sudden tire failure is often preceded by tire vibration. Symptoms that can cause tire failure are a bulge in the sidewall or swelling in the tire carcass. Striking an object or large hole in the road surface can damage a tire. **Inspect** the tires periodically thereafter as rotational forces can continue to stress damaged areas and later manifest in tire failure. If an unusual vibration begins, or a bulge is noticed in the sidewall, have the tires evaluated by a qualified professional as soon as possible.

Tire Rotation

Tire rotation can increase the useful life of the tires by achieving uniform wear on all of the tires. Have the tire manufacturer determine the rotation pattern. The first tire rotation is the most important in determining which rotation pattern to use. Any unusual or unique wear patterns, or indications of uneven wear that may have developed, should be evaluated for possible tire rotation. Misalignment, imbalance or other mechanical problems may exist and will need to be corrected prior to rotation.

Tread

To prevent skidding and hydroplaning, replace tires when the tread is worn down to 4/32" on the front, and 2/32" on the rear. Questions regarding tread wear should be directed to the tire manufacturer.

Built in tread wear indicators, or "wear bars" which look like narrow strips of smooth rubber across the tread, will appear on the tire when the tread is worn down to 1/16". The tire should be replaced when wear bars are noticed.

Visually check the tires for signs of uneven wear. Signs of irregular tread wear are usually exhibited by low or unusually smooth areas on the tire surface. Consult the tire manufacturer as soon as possible.

WARNING:

In many instances the life of the tires on the motorhome is not determined by mileage but by age. Tires are subject to weathering. Weathering cracks run in circumference with the tire. Though the sidewall of the tire may look fine and be structurally sound, weathering can occur inside the well of the tread, therefore replacement may be determined not by mileage but age. Have the tire manufacturer inspect the tires for age weathering.

Storage of Tires - Long Term

A cool, dry, garage with a sealed cement floor is the preferred method of storage. Tires stored outside may prematurely age.

Prior to Storage:

- Thoroughly clean the tires.
- Unload the motorhome to reduce weight on the tires.
- Ensure the surface is reasonably level, firm, clean and has good drainage.
- Inflate the tires to the maximum inflation pressure as indicated on the Federal Identification Tag.

During Storage:

- Cover the tires to block direct sunlight.
- Periodically ensure tires are at proper pressure.
- Move the motorhome every three months to prevent cracking in bulge areas, as well as flat spotting from prolonged sidewall strain and tread deflection.

Removal from Storage:

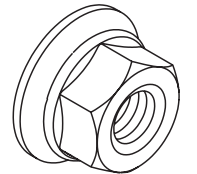
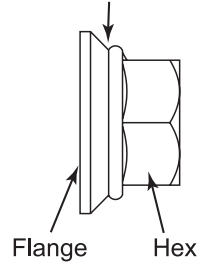
- Before removing the motorhome from long-term storage thoroughly **inspect** each tire's tread area and air pressure. If the tires have lost air during storage, inflate them to the correct pressure.

WHEEL MOUNTING

Hub Piloted Mounting:

- Before using flange nuts that have already been used in service, apply two drops of oil at one point between the flange and hex. This will allow parts to rotate freely and provide the proper clamping force when tightened. Use any common lubricant typically used for fasteners. Examples are motor oil and general purpose lubricating oils. Excessive lubricant is not desirable, and will not improve nut torquing performance. Excessive lubricant makes the nuts hard to handle, attracts dirt, and may cause unsightly appearance to the wheel. Only used nuts require lubrication.
- Flange nuts generate higher clamping force. Always use grade eight studs with hub mount wheels.
- Before installing the wheels, lubricate the hub pilot pads with a drop of oil to prevent galling. **DO NOT** lubricate any other wheel or hub surface.
- For a hub with intermittent pilot pads, position a pad at the twelve o'clock position to center the wheel and reduce runout.

For Used Nuts
Add 2 drops of Oil
Between Flange
and Hex



Flange Nut:
Front and Side view

NOTE:

Loosen and tighten lug nuts in a star pattern sequence. Sequence tighten to 50 ft. lbs. first, then sequence tighten to 450 lbs. Over-tightening can cause distortion.

WARNING:

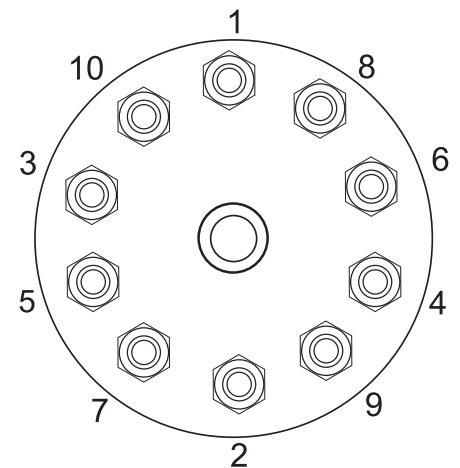
Never use wheels or lug nuts different than the original equipment as this could damage the wheel or the mounting system. Damage to the wheel or mounting system could cause a wheel to come off while the motorhome is in motion.

Front Wheels:

- Slide the front wheel over the studs. Use caution to avoid damaging stud threads. Snug the nuts in sequence.
- When all nuts have been seated, tighten the nuts to 450 ft. lbs. in the proper sequence (as shown in illustration).

Dual Rear Wheels:

- Slide the inner dual wheel over the studs. Use caution to avoid damaging threads. Align the handholds for valve access and slide the outer dual wheel over the studs, again using caution to avoid damaging the stud threads.
- When all nuts are seated, tighten the nuts to 450 ft. lbs. in sequence (as shown in the illustration below).
- The hub mount wheels use two-piece flange cap nuts for both front and rear applications. No inner cap nuts are required.



Nut Tightening Sequence

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Torque the Nuts Properly:

- Tighten the wheel nuts to the recommended lug nut torque. **DO NOT** over tighten.
- Maintain the nut torque at the recommended level through planned periodic checks or at 10,000 miles intervals, whichever comes first.
- If air wrenches are used they must be periodically calibrated for the proper torque output. Use a torque wrench to check the air wrench output and adjust the line pressure for the correct torque.

WEIGHING THE MOTORHOME

Proper weight distribution, load management and operating within established limitations will aid in safe and enjoyable travel. The information contained in this publication outlines guidelines and provides worksheets for weighing procedures.

Proper weight distribution and load management is an individual responsibility. In order to correctly manage load and weight distribution, more than one weight measurement will be required. Each wheel position must be weighed to accurately determine the weight placed on each wheel position for proper weight computations. The entire process of weight management begins with the **Gross Vehicle Weight Rating** as listed on the Federal Certification Label. This weight cannot be exceeded.

CAUTION:

Most States limit the amount of weight carried by any single axle position. It is the responsibility of the operator to know the legal weight limit of the State in which they travel.

Weight Terms

Numerous Federal, State and local governments mandate weight limits. Understanding the terminology and performing proper weighing procedure will help eliminate confusion. It is important to understand there are two reasons to weigh the motorhome. One to find out the **Cargo Carrying Capacity (CCC)** and the other to ensure no axle is overloaded.

The **Gross Axle Weight Rating (GAWR)** of the axles is listed on the federal certification label attached to the motorhome. This is the maximum allowable loaded weight on a particular axle. This label is generally located to the rear of the driver's seat, on the wall.

When the actual loaded weight of the motorhome, and the weight on each axle is unknown, follow the recommended tire inflation pressure(s) listed on the federal certification label. When loading a motorhome never exceed the motorhome's **Gross Vehicle Weight Rating (GVWR)** or the **GAWR** for each axle.

NOTE:

Contact the tire manufacturer for further information concerning proper tire pressure inflation and other tire issues.

The **Gross Vehicle Weight Rating (GVWR)** and **Gross Axle Weight Rating (GAWR)** Listed on the Federal Certification Label attached to the motorhome details the chassis manufacturer's and/or the RV manufacturer's total vehicle maximum weight rating and per axle weight rating.

The **GVWR** is the maximum total weight for which the motorhome is rated - including passengers, fluids and cargo. The **GAWR** is the maximum weight for which a single axle is designed. The tires, wheels, axle, motorhome frame and/or other components of the motorhome may limit these per axle and total maximum weight ratings.

The Federal Certification Label is a guide in knowing the maximum loaded axle weight rating **GAWR**, and subsequently the correct tire inflation pressure for that weight. Every recreational vehicle, even of the same make and model, will vary in actual loaded axle weights because of different options and personal loads.

While the actual loaded axle weight should be below the **GAWR**, the motorhome must be weighed in a loaded condition to determine actual weight. Separately weigh the front and, rear axle. It is possible for a motorhome to be within the **GVWR** yet overloaded on one axle. It is even possible for one wheel position to be overloaded, even though the **GAWR** has not been exceeded. For this reason it will be necessary to weigh each wheel position of the motorhome to give a clear indication of exactly how the weight of the motorhome is distributed.

Instructions and diagrams are presented on the following pages. When the total weight and the weight on each axle is known, the tire load data chart in this manual will show the correct cold inflation pressure per tire for each axle.

There are two important factors to consider when loading the motorhome: **total weight** and **balance**. When loading heavy objects keep them as low as possible, preferably on the floor or below in storage compartments. Load weight must be distributed as evenly as possible.

The following is an explanation of commonly used weight abbreviations:

- **Gross Vehicle Weight Rating (GVWR):** Maximum permissible weight of this motorhome. **GVWR** is equal to or greater than the sum of **UVW** plus **CCC**.
- **Unloaded Vehicle Weight (UVW):** Weight of this motorhome as built at factory with full fuel, engine oil and coolants. **UVW** does not include cargo, fresh water, LP-Gas, occupants or dealer installed accessories.
- **Cargo Carrying Capacity (CCC):** Equal to **GVWR** minus each of the following: **UVW**, full fresh potable water weight (including water heater), full LP-Gas weight, and **SCWR**. Tongue weight of towed vehicle and dealer installed equipment will reduce **CCC**.
- **Gross Combination Weight Rating (GCWR):** The maximum allowable loaded weight of this motorhome and any towed trailer or towed vehicle.
- **Gross Axle Weight Rating (GAWR):** Load-carrying capacity specified by manufacturer of a single axle system, as measured at tire ground interfaces.
- **Sleeping Capacity Weight Rating (SCWR):** The manufacturer's designated number of sleeping positions multiplied by 154 lbs.

Tire Pressure:

A motorhome may weigh slightly heavier on one side. Tire inflation pressure of the heavier side tires determine the inflation pressure for all tire(s) on that axle due to the weight transfer that occurs when cornering.

Improperly inflated tires, or an incorrectly loaded suspension, can result in poor fuel economy, poor handling and over-stressed chassis components. How the motorhome is loaded will influence tire inflation pressure and the load carried by each axle. This is why each wheel position must be weighed. Motorhome axle configuration and floor plan styles will require different weighing procedures.

NOTE:

When weighing a motorhome, each tire on any axle must be inflated to the same pressure. The wheel position carrying the most weight will determine the tire inflation pressure for each tire of that particular axle.

Scales:

Certified public scales are located in moving and storage lots, farm supplies with grain elevators, gravel pits, recycling companies and large commercial truck stops. To locate a nearby public scale access, check the local area telephone book yellow pages under Scales-Public or Weighers. A nominal fee may be charged, but this is money wisely spent.

Weight scale types and weighing methods determine the procedure used to calculate proper tire inflation pressure and axle loading. Several types of scales are in use today. A platform scale will allow the entire motorhome to fit on the scale to read the **GVW** in one scale recording. A segmented platform scale is designed to weight one axle at a time. A single axle scale weighs one axle at a time. Some scales read only one wheel position at a time due to physical size. Several scale readings may be required to determine the **GAW** or **GVW** total. Each wheel position requires weighing, referred to as a four-point weigh, to accurately determine the correct tire inflation pressure.

NOTE:

Four-point weighing is the most accurate method to determine proper tire pressure. Each wheel position must be weighed independently. Weighing the entire axle will not accurately determine the total weight carried by that wheel position. When calculating the drive axle dual tire pressure using a independent corner weigh method, divide the total weight by two to determine the weight carried by each tire. Each wheel position must be weighed and recorded.

When weighing, the scales and the motorhome must be level to obtain an accurate scale reading. Even when an axle is not physically on the scale, a definite lean in the motorhome will produce inaccurate scale readings.

Weight Label

MODEL YEAR: _____ MAKE: _____ MODEL: _____

UNIT NO. _____ CHASSIS VIN: _____

LBS. KGS.

GVWR (Gross Vehicle Weight Rating) is the maximum permissible weight of this fully loaded motorhome _____

UVW (Unloaded Vehicle Weight) is the weight of this motorhome as manufactured at the factory with full fuel, engine oil and coolants..... _____

SCWR (Sleeping Capacity Weight Rating) is the manufacturer's designated number of sleeping positions multiplied by 154 pounds (70 kilograms) _____

CCC (Cargo Carrying Capacity) is the GVWR minus each of the following: UVW, full fresh (potable) water weight (including water heater), full LP-Gas weight and SCWR (*1)..... _____

GCWR (Gross Combination Weight Rating) is the maximum allowable combined weight of this motorhome and the towable product. (*1)..... _____

FACTORY INSTALLED OPTIONS are options installed at the factory but do not include dealer installed after market equipment... _____

CARGO CARRYING CAPACITY (CCC) COMPUTATION

GVWR	_____	_____
minus UVW	_____	_____
minus fresh water (*2) weight of ___ gallons @ 8.3 lbs./gal	_____	_____
minus LP-Gas weight of ___ gallons @ 4.2 lbs./gal	_____	_____
minus SCWR of ___ persons @ 154 lbs./person.....	_____	_____
CCC for this motorhome (*3)	_____	_____

WARNING: CONSULT OWNER MANUAL(S) FOR SPECIFIC WEIGHING INSTRUCTIONS AND TOWING GUIDELINES INCLUDING AUXILIARY BRAKE REQUIREMENTS FOR ANY TOWED TRAILER OR TOWED VEHICLE.

Factory installed options do not include dealer installed after market equipment.

WARNING: DO NOT EXCEED THE GVWR, GCWR AND/OR GAWR AFTER LOADING YOUR MOTORHOME WITH WATER, FUEL, PASSENGERS AND CARGO. GAWR (Gross Axle Weight Rating) means the maximum permissible load weight a specific axle is designed to carry. See Federal Certification Label for disclosure of The GAWR for each axle.

(*1) Towing capacity is limited by GCWR; your vehicle's towing capacity is the difference between the GCWR and the actual vehicle weight; including all water, fuel, passengers, and cargo. Consult you Owner's Manual for further towing information.

(*2) Your motorhome's fresh water tank and water heater taken together determine the gross fresh water capacity. Your usable fresh water capacity, however, may be less.

(*3) Dealer installed equipment and towed vehicle tongue weight will reduce CCC.

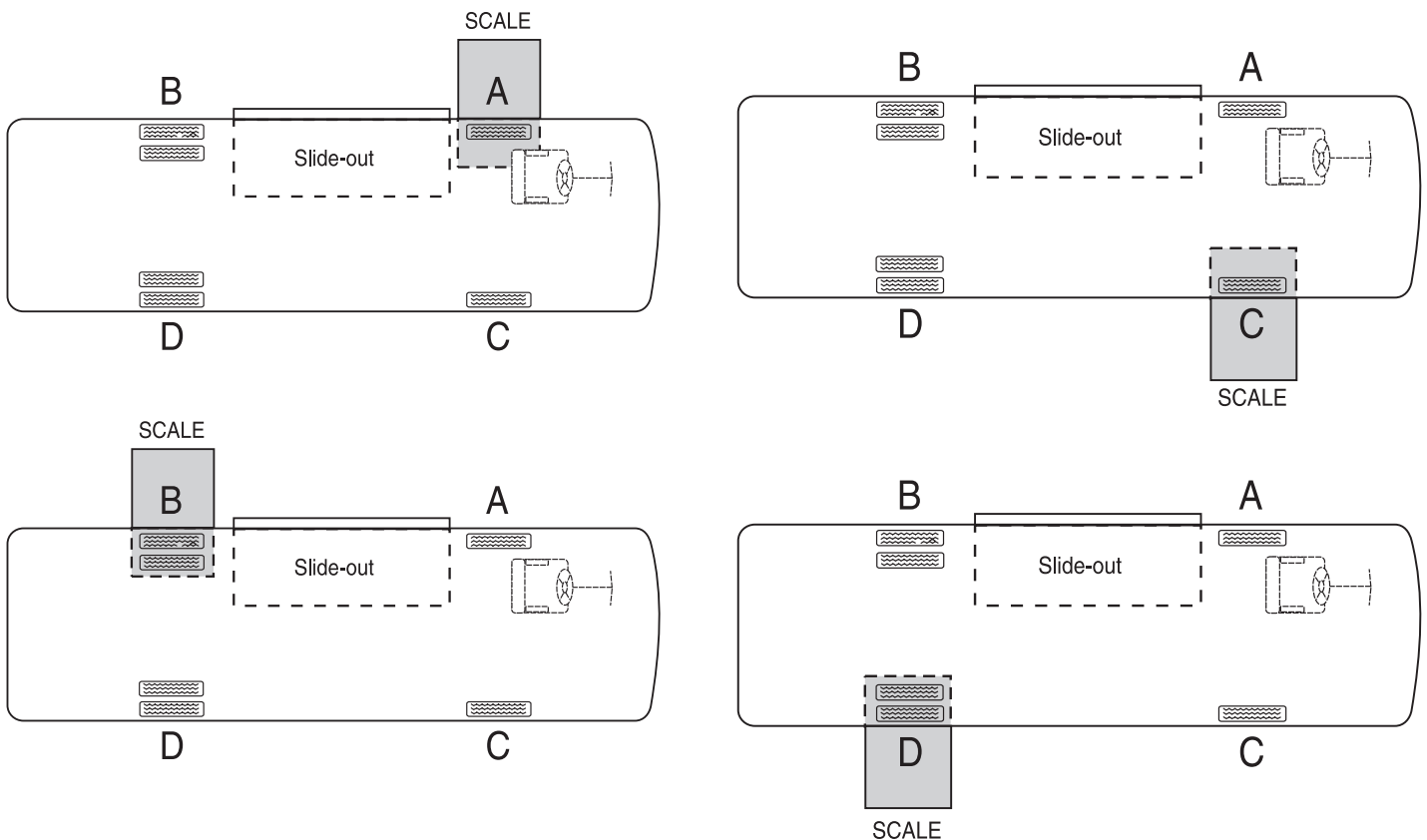
Four Point Weighing (Example)

NOTE:

Following scale readings and Gross Axle Weight Ratings are fictitious. Actual scale readings and Gross Axle Weight Ratings will vary with model and options.

The motorhome must be weighed fully loaded to obtain accurate scale readings and to determine the proper tire pressure. All slide rooms, must be in retracted position.

1. Take the **FRONT** axle Gross Axle Weight Rating (**GAWR**) and divide it by two. Example: **FRONT** axle **GAWR** taken from the motorhome Vehicle Certification Label is 13,000 lbs. Divide the figure by two, using chart, record 6,500 lbs. on line 1.
2. Weigh the driver side **FRONT** corner (Scale A) and record weight on chart Scale A, line 2.
Example: 5,000 lbs.
3. Weigh the passengers side **FRONT** corner (Scale C) and record weight on chart Scale C, line 2.
Example: 4,000 lbs.
4. Add Roadside and Console side from line 1, for Gross Axle Weight Rating (**GAWR**) and record on chart under Totals. Example: 13,000 lbs.
5. Add chart scale A and C, line 2 for actual Gross Axle Weight (**GAW**) and record on chart under Totals.
Example: 9,000 lbs.
6. Actual Gross Axle Weight (**GAW**). Example: 9,000 lbs. is not to exceed Gross Axle Weight Rating (**GAWR**). Example: 13,000 lbs.



Four Point Weighing Example Chart

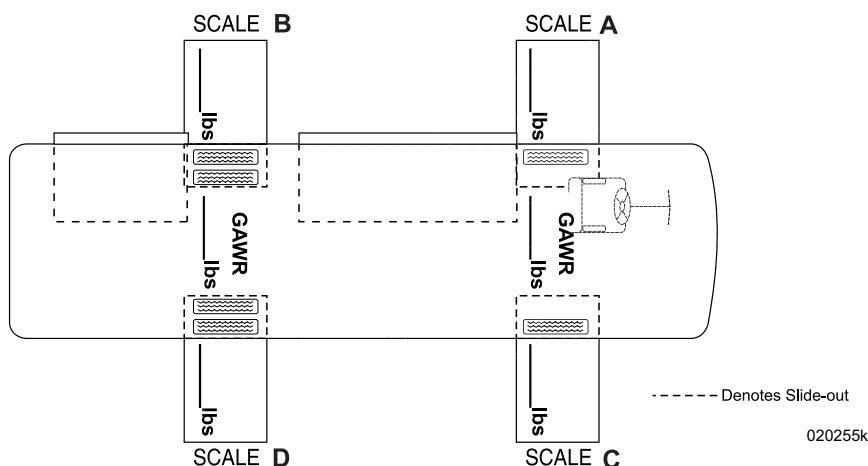
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- Refer to the Tire Chart (**Tire size 295/80R22.5**) Use the highest actual weight, Scale **A** or **C**, line 2. Example 5,000 lbs. Determine the proper tire pressure for each tire using the Load Inflation chart. Example: 80 psi or stamped on the sidewall of the tire.
- Repeat above procedures to determine **REAR** axle Scale **B** and **D**, tire pressures.

	ROADSIDE		CURBSIDE		TOTAL AXLE WEIGHT	GROSS AXLE WEIGHT RATING GAWR	GAWR Minus Total Axle Weight
FRONT AXLE	1. 6,500	+	6,500	=	13,000	13,000	4,000
	2.(A) 5,000		(C) 4,000		9,000		
DRIVE AXLE	1. 10,000	+	10,000	=	20,000	+ 20,000	6,000
	2.(B) 7,100		(D) 6,900		+ 14,000		
			Total Axle Weight		= 23,000 UVW	= 33,000 GVWR	= 10,000 CCC

NOTE:

These measurements are with a full fuel tank and nobody in the motorhome.



WARNING:

Improperly inflated or overloaded tires can cause a blowout. An overloaded axle can cause a component failure of the suspension system. Tire blowout or broken suspension components can lead to loss of vehicle control resulting in property damage, personal injury or death.

CAUTION:

If actual weight carried by any tire is below the tire chart weight specification minimum tire pressure the minimum inflation pressure must be maintained. Tire pressure below the minimum inflation pressure can overheat and damage the tire casing leading to premature tire failure or blowout.

Load and Inflation Tables:

The Load and Inflation Table will help determine correct inflation for the motorhome tires after properly weighing the motorhome. All pressures are rated at a cold psi. Cold conditions are defined as early in the morning before the day's ambient temperature, sun's radiant heat or the heat generated while driving have caused the tire pressure to temporarily increase. This means that the pressure should be checked early and when the motorhome has not been driven more than one mile. The check interval should be in the morning, before the "drive" trip and every morning on extended trips. A quality truck tire gauge with a multiple angle airhead is needed to ensure access to both dual wheel positions of the drive axle. Ensure the valve cap is replaced on the stem after the inflation is checked. This guarantees the valve core will remain free of dirt and foreign material. Material lodged between the valve core and internal stem can cause slow leaks resulting in tire failure.

Cargo Carrying Capacity:

When weighing the motorhome it is important to understand that each motorhome, even of the same model year, floorplan and length will weigh different due to options and accessories. The **Gross Vehicle Weight Rating (GVWR)**, **Gross Combination Weight Rating (GCWR)** and/or **Gross Axle Weight Rating (GAWR)** must not be exceeded.

GVWR of the vehicle limits the weight of the entire load combination, regardless of the water, LP-Gas, passengers and cargo weight.

It is important to understand that the weighing process is performed in two phases. First, by determining the **Cargo Carrying Capacity (CCC)**; and second, to ensure the **GVWR** is not exceeded when adjusting tire pressures. The weighing process should start by recording the **GVWR** from the Federal Weight Label, then weighing the motorhome unloaded, without passengers and with a full fuel tank. Engine and transmission fluid levels must be full. This is known as the **Unloaded Vehicle Weight (UVW)**. Once this weight has been recorded it can be subtracted from the **GVWR**.

$$\text{GVWR } \underline{35,000} - \text{UVW } \underline{20,000} = \text{A } \underline{15,000}$$

Next, begin to calculate the **Cargo Carrying Capacity (CCC)**.

Fresh water weight and LP-Gas weight can now be subtracted from the remaining total line A.

- Water weight is the number of gallons multiplied by 8.3.
- LP-Gas weight is the number of gallons multiplied by 4.2.

A 10-gallon water heater with a 40-gallon fresh tank would total 50 gallons times 8.3, or 415 lbs.

A 30-gallon LP-Gas tank will have 24 gallons of LP-Gas due to the 80% valve. This would mean 24 gallons multiplied by 4.2, or 100.8 lbs.

$$\text{A } \underline{15,000} - 415 = \text{B } \underline{14,585}$$

$$\text{B } \underline{14,585} - 100.8 = \text{C } \underline{14,482.2}$$

Next, calculate the **Sleep Capacity Weight Rating (SCWR)** the manufacturer's designated number of sleeping positions for the motorhome multiplied by 154 lbs.

The 154 lbs. (70 kg.) is the average weight established by the US Federal Government and Transport Canada, and is used to arrive at **Cargo Carrying Capacity (CCC)**. However, actual sleep capacity weight may be greater. The **SCWR** is not intended to limit the sleeping capacity to a specified weight.

Example: If the manufacturer has designated the motorhome sleeping position at 4 (616 lbs.) and there are four people who weight 200, 200, 178 and 138 lbs., totaling 716 lbs., that does not mean the sleeping capacity is reduced to three individuals, but rather the **CCC** is reduced by 100 lbs. due to the actual passenger weight.

$$\text{C } \underline{14,482.2} - \text{SCWR } 716 = \text{CCC } \underline{13,768.2}$$

Cargo Carrying Capacity (CCC) is how much cargo the motorhome can carry. However, tongue weight of a towed vehicle will further reduce this amount.

Now the motorhome can be fully loaded and weighed to ensure **GVWR** is not exceeded. Once the motorhome is fully loaded it is ready to be weighed to obtain an accurate scale reading and determine the proper tire pressure. All slide rooms must be in the retracted position when weighing the motorhome. The motorhome must remain as level as possible on the scale, even when an axle or side is not physically on the scale.

- Each wheel position must be weighed to accurately determine the weight carried at each wheel position.
- Refer to the previous examples on how to weigh each wheel position. Each wheel position weight must be weighed and recorded to determine proper tire inflation.
- Wheel position weights are not to exceed **Gross Axle Weight Rating (GAWR)** and **Gross Vehicle Weight Rating (GVWR)** as printed on the Motorhome Vehicle Certification Label.
- Compare wheel position weights with weight ratings on the label. If wheel position weights exceed maximum specifications, items will need to be removed until rating weight is within specification.

Cargo Carrying Capacity Flowchart

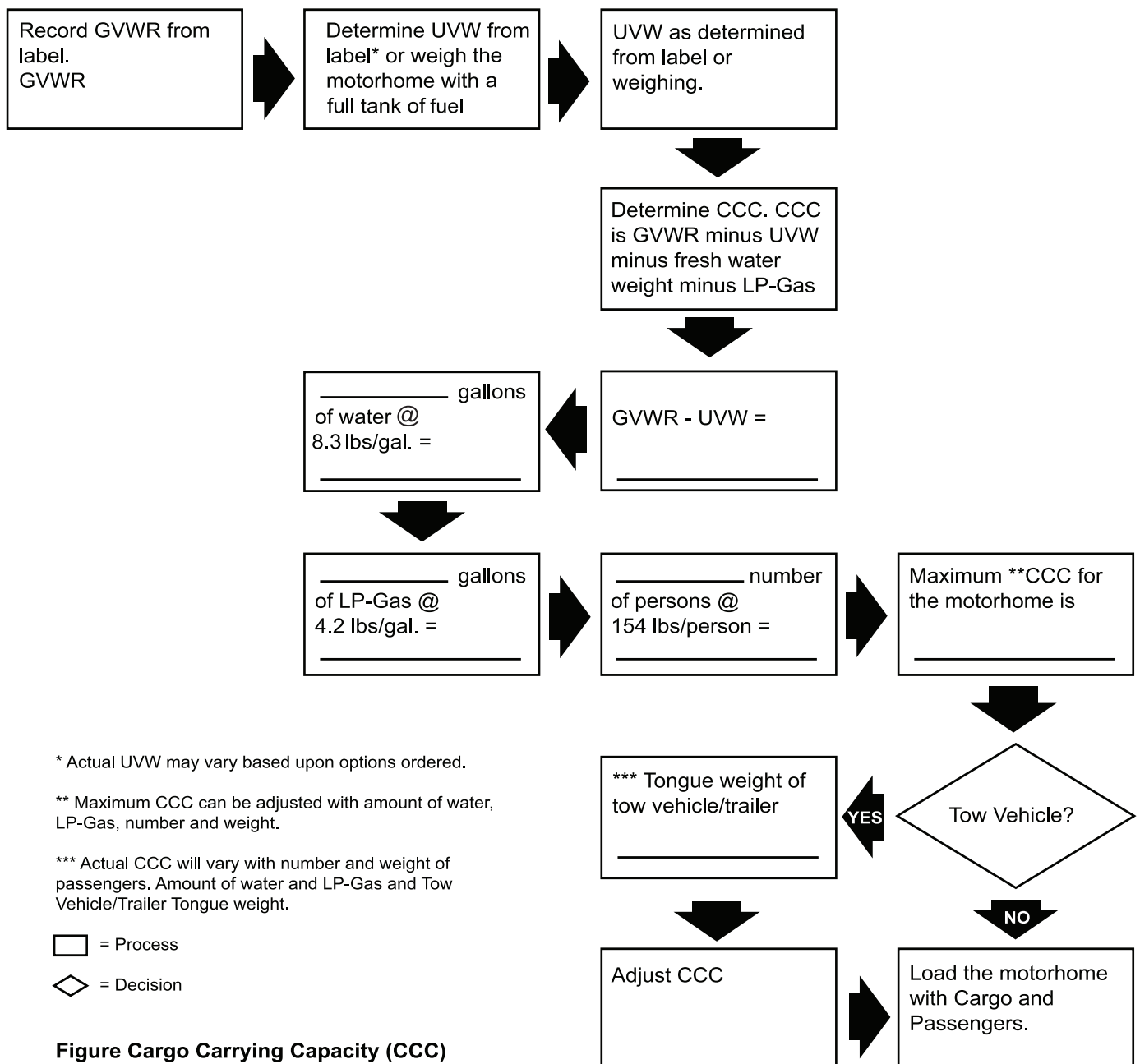


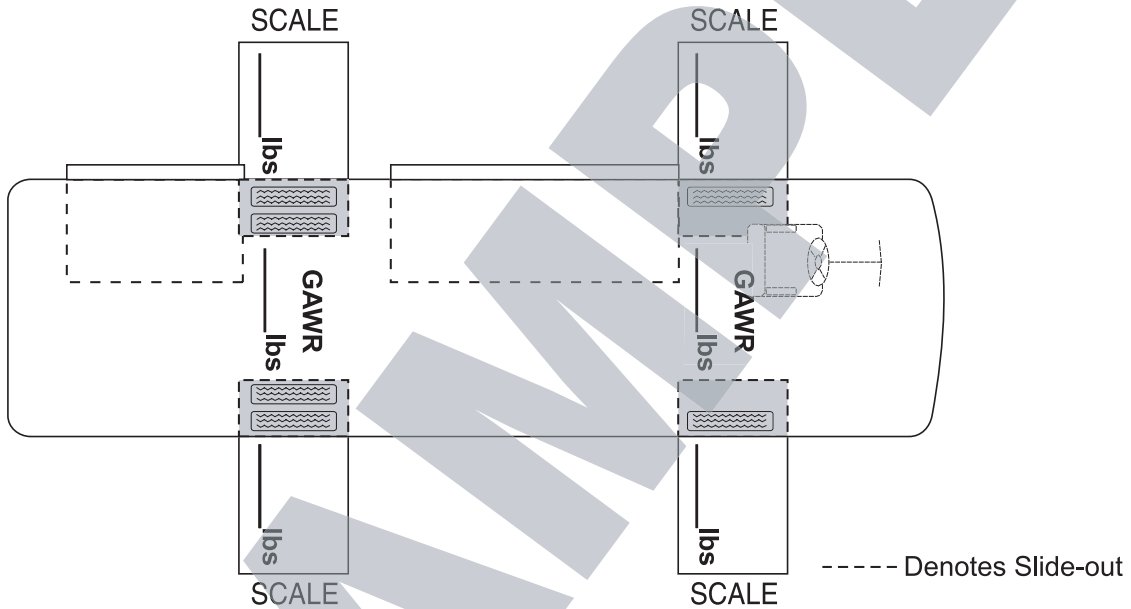
Figure Cargo Carrying Capacity (CCC)

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Example Worksheet

	ROADSIDE		CURBSIDE		TOTAL AXLE WEIGHT	GROSS AXLE WEIGHT RATING GAWR	GAWR Minus Total Axle Weight
FRONT AXLE	1. 6,500	+	6,500	=	13,000	13,000	4,000
	2.(A) 5,000		(C) 4,000		9,000		
DRIVE AXLE	1. 10,000	+	10,000	=	20,000	+ 20,000	6,000
	2.(B) 7,100		(D) 6,900		+ 14,000		
			Total Axle Weight		= 23,000 UVW	= 33,000 GVWR	= 10,000 CCC

NOTE: These measurements are with a full fuel tank and nobody in the motorhome.



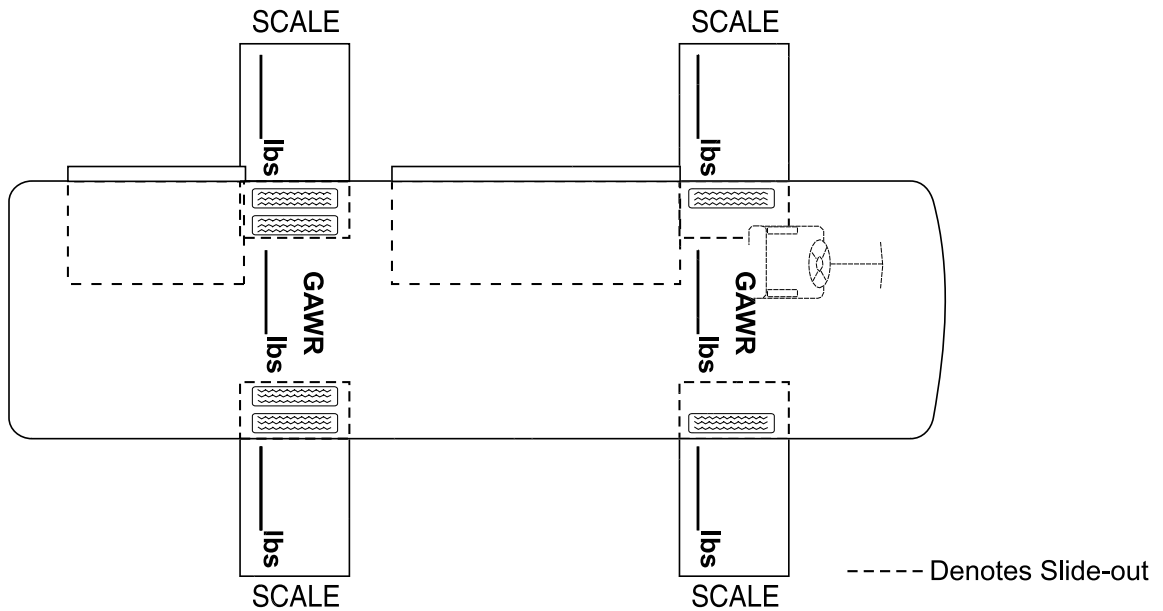
FORMULA		UVW	CAPACITY	
FRESH WATER	Subtract Gallon @ 8.3 lbs/gal	100 x 8.3 = 830	-	10,000
WATER HEATER	Subtract Gallon @ 8.3 lbs/gal	10 x 8.3 = 83	-	9,170
LP-GAS	Subtract Gallon @ 4.2 lbs/gal	40 x 4.2 = 168	-	9,087
SLEEP CAPACITY WEIGHT RATING	Subtract Persons @ 154 lbs/person	5 x 154 = 770	-	8,149
		Maximum Cargo Carrying Capacity CCC		8,149

Maximum Cargo Carrying Capacity will change by varying any of the capacities. Tongue Weight of a towed vehicle will reduce the Cargo Carrying Capacity (CCC).

Actual Worksheet

	ROADSIDE	CURBSIDE	TOTAL AXLE WEIGHT	GROSS AXLE WEIGHT RATING GAWR	GAWR Minus Total Axle Weight
FRONT AXLE	1.	+	=		
	2.(A)	(C)	=		
DRIVE AXLE	1.	+	=		
	2.(B)	(D)	+	+	
		Total Axle Weight	= UVW	= GVWR	= CCC

NOTE: These measurements are with a full tank and nobody in the motorhome.



		UVW	CCC
FORMULA		CAPACITY	
FRESH WATER	Subtract Gallon @ 8.3 lbs/gal	X 8.3 =	-
WATER HEATER	Subtract Gallon @ 8.3 lbs/gal	X 8.3 =	-
LP-GAS	Subtract Gallon @ 4.2 lbs/gal	X 4.2 =	-
SLEEP CAPACITY WEIGHT RATING	Subtract Persons @ 154 lbs/person	X 154 =	-
		Maximum Cargo Carrying Capacity CCC	

Maximum Cargo Carrying Capacity will change by varying any of the capacities. Tongue Weight of a towed vehicle will reduce the Cargo Carrying Capacity (CCC).

020255b

Weight Record Sheet

DATE: _____

PLACE: _____

FRONT: _____ + _____ = _____
 LEFT RIGHT TOTAL

REAR: _____ + _____ = _____
 LEFT RIGHT TOTAL

= _____
 TOTAL GROSS
 VEHICLE WEIGHT

DATE: _____

PLACE: _____

FRONT: _____ + _____ = _____
 LEFT RIGHT TOTAL

REAR: _____ + _____ = _____
 LEFT RIGHT TOTAL

= _____
 TOTAL GROSS
 VEHICLE WEIGHT

DATE: _____

PLACE: _____

FRONT: _____ + _____ = _____
 LEFT RIGHT TOTAL

REAR: _____ + _____ = _____
 LEFT RIGHT TOTAL

= _____
 TOTAL GROSS
 VEHICLE WEIGHT

DATE: _____

PLACE: _____

FRONT: _____ + _____ = _____
 LEFT RIGHT TOTAL

REAR: _____ + _____ = _____
 LEFT RIGHT TOTAL

= _____
 TOTAL GROSS
 VEHICLE WEIGHT

DATE: _____

PLACE: _____

FRONT: _____ + _____ = _____
 LEFT RIGHT TOTAL

REAR: _____ + _____ = _____
 LEFT RIGHT TOTAL

= _____
 TOTAL GROSS
 VEHICLE WEIGHT

DATE: _____

PLACE: _____

FRONT: _____ + _____ = _____
 LEFT RIGHT TOTAL

REAR: _____ + _____ = _____
 LEFT RIGHT TOTAL

= _____
 TOTAL GROSS
 VEHICLE WEIGHT

DATE: _____

PLACE: _____

FRONT: _____ + _____ = _____
 LEFT RIGHT TOTAL

REAR: _____ + _____ = _____
 LEFT RIGHT TOTAL

= _____
 TOTAL GROSS
 VEHICLE WEIGHT

DATE: _____

PLACE: _____

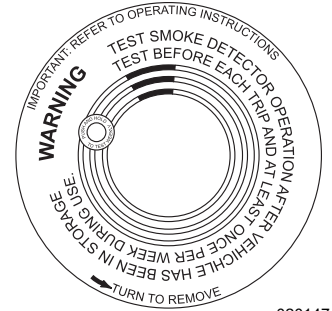
FRONT: _____ + _____ = _____
 LEFT RIGHT TOTAL

REAR: _____ + _____ = _____
 LEFT RIGHT TOTAL

= _____
 TOTAL GROSS
 VEHICLE WEIGHT

SMOKE DETECTOR

Statistics show that most fire casualties are not caused by direct flame, but by less visible smoke (products of combustion). The smoke detector responds to both visible and invisible products of combustion. The smoke detector will automatically return from alarm to normal state when the presence of smoke is completely removed. Fires are commonly caused by smoking in bed, leaving children unattended or using flammable cleaning fluids. Please be safety conscious and avoid unnecessary risk.



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WARNING:

There is no way to insure against injury or loss of life in a fire; however, the smoke detector is intended to help reduce the risk of tragedy. Additional smoke detectors may help to reduce the risk. Proper use and care of the smoke detector could save lives.

Operation

When a 9 Volt DC battery is correctly connected, the smoke alarm is operating. The LED will flash every minute showing the battery is supplying power. A loud alarm will sound when a product of combustion is sensed.

NOTE:

The unit will not operate without a battery. A battery flag will pop up preventing the unit from being installed to the mounting bracket without a battery. Carbon zinc batteries average a service life of one year. Alkaline batteries average a service life of one to two years.

Testing

Simply press the test button on the smoke alarm cover for approximately three seconds. The alarm will sound if all electronic circuitry, horn and battery are working properly. The smoke alarm should be tested at least once a week when the motorhome is in use, prior to each trip and when the motorhome has been in storage. When testing the smoke alarm it is advised to stand at arm's length.

CAUTION:

Never use an open flame to test the smoke alarm. You may ignite and set fire to the alarm and to the motorhome.

Maintenance

There are some simple steps to perform in order to keep the smoke alarm working properly:

- Test the smoke alarm once a week.
- Keep a supply of 9 Volt DC batteries on hand.
- Vacuum the slots in the cover and sides with a soft brush attachment every month. Test the smoke alarm once the unit has been vacuumed.
- The smoke alarm will beep once a minute when a low battery condition exists to signify battery must be immediately replaced.

Troubleshooting

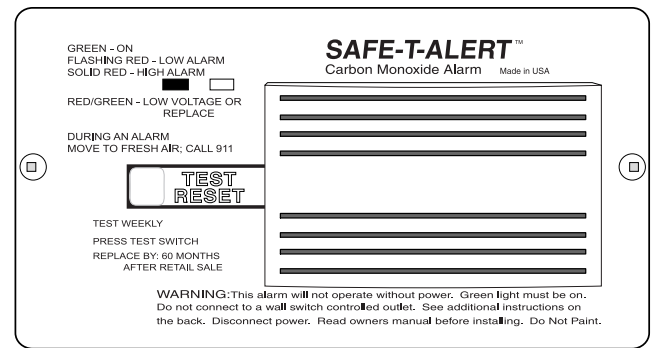
If the alarm does not sound when the test button is pushed, or with a smoke test, try the following:

- **Inspect** for obvious damage.
- **Check** for the recommended battery type.
- **Check** the battery for proper connection or replace the battery if needed.
- Gently vacuum as recommended.

If these procedures do not correct the problem, do not attempt repairs. If the smoke alarm is within the warranty period and the terms indicate the nature of the problem, return the unit to your dealer. Smoke detectors beyond the warranty period cannot be economically repaired.

CARBON MONOXIDE DETECTOR

American National Standards Institute (ANSI) **A119.2 - Fire & Life Safety 3-4.6 Carbon Monoxide Detectors** states *“All RVs equipped with an internal combustion engine or designed with features to accommodate future installation of an internal combustion engine and truck campers shall be equipped with a listed CO detector installed in accordance with its listing.”*



The motorhome is equipped with such a Carbon Monoxide detector. Everyone is at risk with Carbon Monoxide poisoning. Carbon Monoxide (CO) is a colorless, odorless and tasteless gas that binds with hemoglobin reducing the body's ability to absorb and carry oxygen to vital organs. Even low levels of CO have been known to cause brain and other vital organ damage in unborn infants, with no effect on the mother.

When removed from exposure, the symptoms dissipate as CO is expelled through the lungs. Contamination levels in the body reduce in half-life increments at approximately four-hour intervals. Treatment with Oxygen will quicken recovery time.

In cases of mild exposure, the symptoms may include: a slight headache, nausea, vomiting and fatigue. Some consider this a "flu-like symptom." Symptoms for medium exposure may include a severe throbbing headache, drowsiness, confusion and fast heart rate. Extreme exposure can result in unconsciousness, convulsions, cardio-respiratory failure and death. Young children and household pets may be the first affected. Other highly sensitive people would include the elderly and people with lung or heart disease or anemia.

The CO detector is designed to detect the toxic CO Gas resulting from incomplete combustion of any fuel. This can be gasoline, propane, natural gas, oil, charcoal or wood. Anything that burns fuel such as engines, generators, furnaces, gas stoves or water heaters produces CO gas. Consequently, it is uncommon for household smoke from cigarettes or normal cooking to cause the alarm to sound.

The CO detector is wired to both the house and chassis batteries to allow reliable and continuous protection by alerting the build up of potentially dangerous levels of CO. Once the unit is powered, it will run through a brief warm-up and self check prior to monitoring for CO gas. There are no switches that can accidentally be turned off.

WARNING:

If there is constant beeping and the red light is flashing, CO gas has been detected. Shut off appliances, coach engine, and water heater. Evacuate the motorhome and call the fire department. DO NOT restart any appliances or the motorhome until the problem is corrected.

Operation

The detector is equipped with a self-cleaning CO sensor and requires a ten minute initial warm-up period to clean the sensor element and achieve stabilization. During the warm-up period, the green power light will flash **ON** and **OFF**. The green power light should be lit when the power is on. If the light is not lit, turn **OFF** the power and check all wire connections. If the power is on and the connections are correct, but the indicator still does not light, the detector should be returned for service. **DO NOT attempt to fix the detector.**

The indicator light displays a specific color to monitor along with a matching sound pattern:

Indicator Lights and Sound Patterns:

- **ON** or normal condition is indicated by green. The CO detector has power and is sensing air for the presence of CO gas. The alarm horn will not sound.
- Flashing red indicates low **CO ALARM** condition along with four beeps then **OFF** for five seconds. The alarm horn will sound and can be reset by the **TEST/RESET** button. The **CO** detector has detected the presence of 70 ppm.
- Steady red indicates a **CO ALARM** condition. The detector has sensed the presence of levels over 100 ppm of Carbon Monoxide. The alarm horn will sound continuously until the **RESET** switch is reset.
- Alternating red and green indicates a malfunction alarm.

Alarm

When the alarm sounds have the detector and the motorhome checked by an authorized service technician as soon as possible. Never disconnect a CO detector to silence an annoying alarm. Evacuate the motorhome immediately when the red light is lit and the alarm sounds. Do a head count to check that all persons are accounted for. Call the nearest fire department and ask them to determine the source of the Carbon Monoxide. **DO NOT** re-enter the motorhome until it has been aired out and the problem corrected.

Potential Sources of CO when operating the motorhome:

- Engine Exhaust
- Portable Space Heaters
- Gas Stoves and Ovens
- Defective Engine Exhaust System
- Nearby Motorhomes
- Portable Grills
- Camp Fires
- Generator Exhaust
- Portable Generators

Testing

Test Procedures:

Test the Carbon Monoxide detector operation after the motorhome has been in storage, before each trip and at least once a week during use. Test the alarm by holding the **TEST/RESET** button in until the alarm sounds. The alarm will sound four beeps and the indicator lamp goes steady **RED**. Six seconds later the alarm will again beep four times and the indicator light goes steady **GREEN**.

Peak Level Memory:

The CO detector has the capability to remember the level of Carbon Monoxide that activated the alarm. Press the **TEST/RESET** button for less than one second and observe the visual and audible signals.

- One beep and a **green** flash indicate memory is clear.
- Two beeps and two **red** flashes indicate less than 100 ppm.
- Three beeps and three **red** flashes indicate less than 200 ppm.
- Four beeps and four **red** flashes indicate greater than 200 ppm.

NOTE:

Memory is erased when power is disconnected for 15 seconds.

Cleaning & Maintenance

Use a vacuum cleaner to remove dust or any other buildup on the detector. **DO NOT** wash. Wipe the detector with a damp cloth and dry with a towel. **DO NOT** open the detector for cleaning. **DO NOT** paint the detector. It is recommended that the Carbon Monoxide detector be replaced every 10 years.

The CO detector has **NO** user service parts. If there is a problem with the detector refer to an authorized service center. **DO NOT REMOVE POWER.**

INSPECT:

Check the CO detector weekly and at the beginning and end of each trip.

FIRE EXTINGUISHER

The fire extinguisher in the motorhome is located near the main entrance door. Please read the operating instructions that are printed on the fire extinguisher. If there is any doubt on how to operate the fire extinguisher practice using it. Be sure to replace or recharge the extinguisher immediately after use.

INSPECT the fire extinguisher at least once a month. Do so more frequently if the extinguisher is exposed to weather or possible tampering. **DO NOT** test the extinguisher by partially discharging. Internal pressure will escape and the fire extinguisher will need to be replaced.

Use the PASS word!

Pull the pin to unlock the extinguisher.

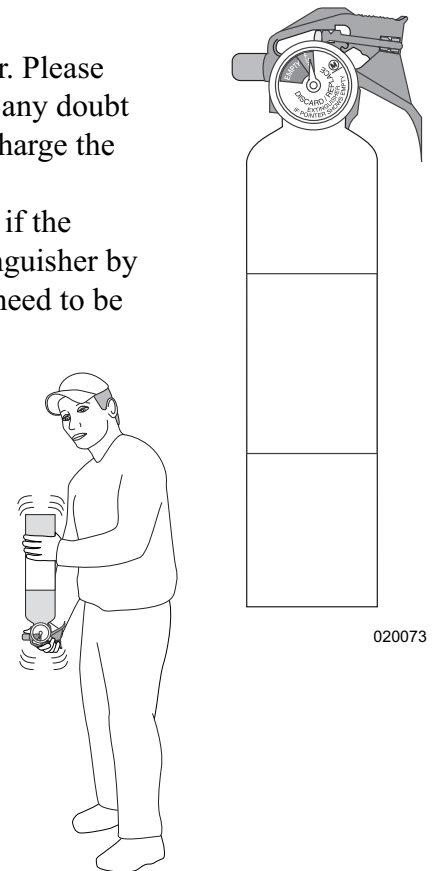
Aim at the base (bottom) of the fire and stand 6 to 10 feet away.

Squeeze the lever to discharge the agent.

Sweep the spray from left to right until totally extinguished.

WARNING:

Road vibration will cause extinguisher powder to compact and may cause extinguisher malfunction. Invert and shake extinguisher monthly.



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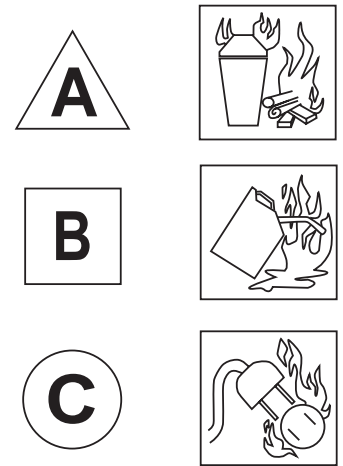
There are three classes of fire to be concerned with in a motorhome. Any fire can fall into more than one class; a fire that involves both burning paper and kitchen grease is classified as Class AB fire.

Classes of Fire:

A - Fire that are fueled by materials that leave a residue when they burn: paper, wood, cloth, rubber, and certain plastics.

B - Fire that involve flammable liquids and gases: gasoline, paint thinner, kitchen grease, propane and acetylene.

C - Fires that involve energized electrical wiring or equipment. If electricity to the equipment is turned off, a class C fire becomes one of the other two class fires.



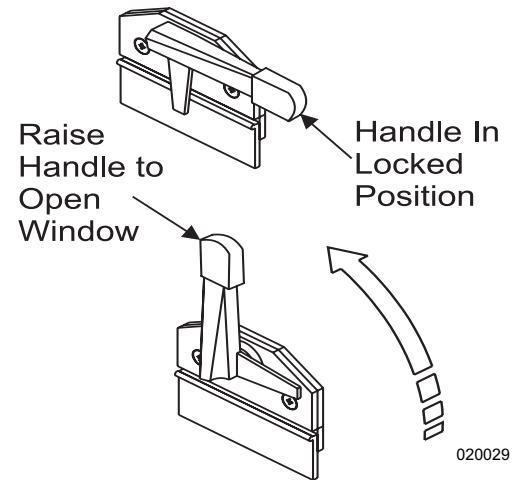
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ESCAPE (EGRESS) WINDOW

The egress window, designated for use as an emergency exit, is identified inside of the motorhome by a red locking handle and **Exit** label. To open, lift the red handle and push outward. Pull closed and lower handles to lock the egress window.

Hinges along the outside window top identify the egress window on the motorhome exterior.

The glass slider in the egress window operates the same as all other windows in the motorhome. Occasionally open and close the egress window to prevent the rubber seal from sticking.



020029

Egress Window Handle

NEPTUNE 2006

Exterior & Interior Care • Section 3

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EXTERIOR CARE

Corrosion

The most common cause of corrosion to the motorhome exterior is accumulation of road salts, grime and dirt. These elements, combined with moisture, may possibly cause early component failure. The undercarriage, around wheel openings and the radiator charge air cooler package require periodic cleaning to prevent component failure caused by corrosive materials collected from roadways. If the motorhome is driven in areas where road salts are used it should be washed at least once a week. Otherwise, it is recommended to hose off the undercarriage area at least once a month to help minimize the corrosion process. High-pressure washers or steam cleaners are the most effective way of cleaning off the underside and inside wheel openings. **Avoid directly spraying the painted surface with a high-pressure washer.**

CAUTION:

Exercise caution when cleaning the radiator charge air cooler package. Damage to the fins can result when using a high-pressure washer or steam cleaner. Nozzle discharge pressure can exceed 1800 psi. Avoid using high-pressure steam cleaners on the exterior paint surfaces. Remove all spattered washing debris from the exterior paint surfaces as soon as possible.

Washing

Periodic cleaning will help to preserve the paint finish. The motorhome is painted with a “base coat, clear coat system.” Clear coat is a polyurethane-based material which brings out the shine and luster to the base coat paint. Care should be used when washing the motorhome. Use only mild detergents or specifically designed automotive detergents. Avoid using abrasive cleansers or laundry detergents that will scratch the clear coat and leave a soap film. Use a soft cloth to wash the paint finish. Avoid using brushes as they can scratch the surface and damage the paint. Before washing the motorhome, remove most of the accumulated dirt from behind wheel openings, below the windshield and on the rear of the motorhome. If build-up is excessive, run water over a soft cotton cloth while gently wiping the surface in one direction. This will help float away the build-up from the clear coat. Avoid back and forth or circular motions as this may act like sandpaper, scratching the clear coat and leaving a haze or swirl marks. After removing the heavy build-up, use the mixed detergent solution to wash the motorhome. Start washing at the top of the motorhome and work towards the bottom. If possible, wash the motorhome in a shaded area when the exterior is not hot to the touch. If necessary, turn the motorhome around to keep the area being washed in the shade. Try not to allow the detergent to dry onto the clear coat surface. Use plenty of water when rinsing the surface to remove all detergent residue.

Drying

Chamois cloths come in natural and synthetic materials. Either type is acceptable as long as the surface is clean. Soak the chamois in clean water, then wring it dry. Remove the water from the surface by starting at the top and working towards the bottom, using a downward “S” pattern. Wring out the chamois as needed. Using a chamois cloth to remove the rinse water is not necessary, but the effort can be worthwhile.

Waxing

Whether or not to wax the motorhome is often debated. Two most common thoughts on this issue are:

1. The clear coat needs to “breathe.” A layer of wax will seal the clear coat and not allow it to breathe, possibly leading to failure of the clear coat.
2. If the surface is not waxed, what is protecting the surface from the environment (road salts, rain, road tar, ultraviolet light)?

It is recommended to wax the motorhome twice a year: spring and fall. Many types of protective barriers are available today that may be applied to the clear coat: glazes, waxes, polishes, rubbing compounds or combinations of these products.

NOTE:

Use a grease and wax remover before applying another coat of wax. Chemicals can become trapped between layers of wax, possibly damaging the paint finish.

INFORMATION:

When selecting a product for use, follow the product manufacturer’s recommended application instructions.

Types of Products:

Glazes - Glazes are generally used to fill very fine scratches in the clear coat, being applied either by hand or by using a polisher with a special pad.

Waxes - Waxes come in many types of chemical make-up. The popular Carnauba wax is a naturally occurring wax from the leaves or fronds of the Carnauba palm tree. Mineral waxes have a paraffin base. Other waxes that contain silicone are also available.

Polishes - Polishes combine wax based substances with an abrasive to clean and polish at the same time. These products can be too abrasive for clear coats and are not recommended.

Rubbing Compounds - These types of products are generally applied by using a buffer. The use of rubbing compounds should be left to professionals as undesired results can quickly occur. These products are generally used to correct or flatten a surface by removing high spots or small amounts of material.

When selecting a product the container should be marked “safe for clear coats” or “clear coat safe.” Carefully follow the application instructions when using a product. Upon first use of a product, try it on a small test spot in an inconspicuous area in case an undesired reaction occurs.

Observe the test area from different angles checking for hazing or swirl marks. If an abnormal reaction to the finish occurs, discontinue product use and consult the product manufacturer. If the product is a paste, do not allow dried paste to be baked on by the sun. Remove paste shortly after drying. Clean, dry, 100% cotton cloths are best suited for the removal of dried paste. Turn the cloth often. Use a separate clean cloth to buff. The surface should feel slick when rubbing the cloth lightly over it. Avoid repeated wax applications which can cause wax to build up. Some very fine scratches or swirl marks may be removed by an application of a glaze. These types of glazes fill the scratches or swirl marks.

The motorhome has a large surface area. Washing and waxing may not be completed in one afternoon. Select sections to wax until the motorhome is complete. If the task seems overwhelming, have an automotive detailer perform the task.

Paint Codes

The motorhome paint scheme is comprised of specific colors. Each of these colors has been assigned a paint code. The paint code is a formula used to mix different colors to achieve a desired color of paint. It may be necessary to obtain “Touch-Up” paint to repair a small imperfection in the paint surface. However, if it is necessary to paint a larger area, obtain the paint code to get the correct color.

To Obtain the Paint Code:

1. Contact **National Parts** at **1-877-466-6226**.
2. Specify the year, model, serial number and exterior color scheme name (if known).
3. Once the paint code has been obtained for the desired color, contact **Industrial Finishes** at **1-800-531-1305**. They will use the paint code to get the mixing formula.
4. This formula can be mixed at a local BASF paint store.

NOTE:

All special paint schemes require contacting Monaco Coach Corporation directly for the paint codes.

Tire Care

Use proper care and cleaning methods to obtain maximum service years out of the tires. Road oil will cause deterioration of the rubber. Dirt build-up can trap chemicals, causing deterioration. Use a soft brush and a mild detergent to clean the tires. If a dressing product is used to protect the tires from aging, use extra care and caution. Tire dressings that contain petroleum products or alcohol may cause deterioration or cracking.

In many cases it is not the dressing that causes a problem but the chemical reaction that subsequently occurs. When these same dressing products are used on a passenger car tire that is replaced every three to four years, it is rare to see a major problem. However, in most cases recreational vehicle tires may last longer due to limited annual mileage and exposure.

Bright Metal

All chrome and stainless steel should be washed and cleaned each time the motorhome is washed. Use only automotive approved non-abrasive cleaners and polishes on exterior bright work. **DO NOT** use rubbing compounds. **DO NOT** use abrasive cleaners or compounds to clean the mirrors.

NOTE:

When using chemicals to remove road tars, use only automotive type products that are recommended for use on painted surfaces and fiberglass. Observe the warning recommendations and directions printed on the container of any agent being used.

EXTERIOR MAINTENANCE

The motorhome is subject to a great deal of outside conditions. When parked, the motorhome is exposed to extreme temperatures, humidity, ultraviolet rays, rain and other organic environmental conditions. While in operation the motorhome is subject to twisting and flexing caused by rough roads, potholes and winding mountain roads. Maintenance is necessary to keep the exterior looking nice and to keep in proper working order.

Fiberglass

Inspect the fiberglass exterior. Periodic **inspection** may reveal that flexing of the fiberglass exterior has created imperfections in the surface commonly known as spider or hairline cracks. A crack that has opened up to reveal the weave of the cloth threatens the integrity of the fiberglass. Prevent moisture penetration if the exterior exhibits signs of damage, particularly in freezing climates. Cover the area using plastic sheeting or tape, and have the damaged fiberglass repaired as soon as possible.

Roof Care & Seal Inspections

Periodic resealing of the joints and seams is necessary to prevent the entrance of moisture into the motorhome. Enough emphasis cannot be placed on this issue. Extreme damage from a water leak can rapidly occur. Never leave the motorhome unattended with the slide room extended. If the motorhome is to be stored outside throughout the winter months, a full interior **inspection** for water leaks should be made twice monthly.

Extensive sealing has been done at the factory; however, the normal twisting and flexing that occurs while traveling may have compromised a seal or seam.

CAUTION:

The roof surface is slick in all conditions. Exercise extreme caution when accessing the roof.

INSPECT:

All joints and seams should be inspected at least twice a year and recalked as necessary.

Special attention should be directed toward the roof air conditioning seals, ceiling and plumbing vents, skylights, roof mounted antennas, windows, door molding, clearance lights and the beltline molding.

Specific sealant products should be used in the areas for which they were designed. These items can be obtained from recreational vehicle parts suppliers. Listed below are some of the more common sealants and the areas in which they are used. Approved sealants are available at service centers and authorized dealers.

WARNING:

Some products may contain hazardous materials which require special handling. Read labels carefully. Follow all of the product manufacturer's safety requirements.

Sealant Types

Butyl Rubber Tape:

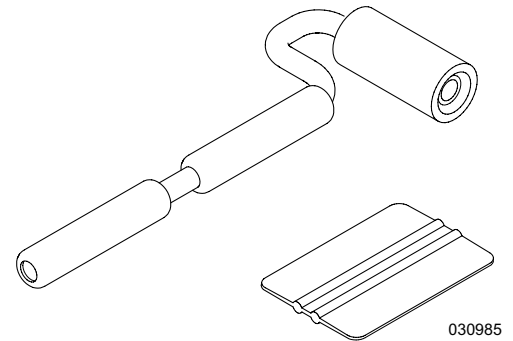
This tape is used on aluminum roofs seal seams at the front, rear and down the center. The sealant is available as a peel and stick waterproof membrane that contains UV inhibitors and is temperature resistant providing superior seal protection in all types of weather. Store sealant out of direct sunlight between 50° F and 90° F.

To Apply:

1. Clean the aluminum surface with denatured alcohol.
2. Set the tape upon desired area, heat to a warm temperature allowing tape to form into place.
3. Use a squeegee to mold sealant into cracks and seams, followed by a roller to roll out tape to get a good uniform seal.

NOTE:

Check the tape at least twice a year for cracks. Use a plastic putty stick to remove tape. Thoroughly clean the surface using 3M adhesive cleaner before applying new tape.



Squeegee and roller used to apply rubber sealant tape.

Acrylic Foam Tape:

Read the following instructions to properly install the 3M acrylic foam tape.

- **Clean Surface** - Use *Pro-Clean* to clean the surface of dirt, wax, and any other foreign substances for the best results.
- **Surface Temperature** - The surface where the product is desired should be 75 °F/24°C for proper adhesion.
- **Adhesion Promoter** - Just prior to installation, apply a light coat of *Pro-Bond* adhesion. The *Pro-Bond* will make for a better bond for the acrylic tape.

NOTE:

Use a heat gun to warm the product. When storing the motorhome, store in a warm area if possible. To install acrylic foam tape, cut the liner for the proper length and then peel back the poly liner from the tape. Apply the tape on the desired line. Continue this process until the project is complete.

Dolphin Sealants (7549):

Used where items are sealed under a painted surface such as the metal corners of the slide-out room. The material is specially formulated to allow paint adhesion.

Black Urethane:

Used for sealing the windshields, not to fill holes or other imperfections. Black urethane comes in a tube and it applies much the same way as silicone. Clean up using solvents such as paint thinner. Gloves are required as this material is hazardous.

Silicone Sealant:

Primarily used on the sidewalls where a hole has been made and an item installed. This includes windows, doors, handles, beltline molding, latches and around bases of items surface mounted such as clearance lights. Old peeling sealant should be removed. Avoid using metal utensils which can scratch the painted surface. Use nylon sticks or equivalent. Avoid using lacquer thinners or ketone based solvents as these chemicals can damage the painted surfaces. Be sure the surface is clean and dry before application. Cut the tube at an angle with smallest usable opening. Avoid a heavy bead as a little goes a long way. Use finger at a 45° angle on beaded surface to smooth out product. **DO NOT** moisten finger, use a disposable latex glove. Keep rags or paper towels handy for clean up. Use care when applying silicone. Plan ahead before starting a bead. Look for obstacles that may impede application.

Spray Foam:

Used as a sealant where a hole has been made for items such as water lines or wires that are coming through a floor opening.

INTERIOR CARE***Cockpit***

The cockpit area dashboard is a molded fiberglass vinyl wrapped pod. The instrument panel is comprised of various gauges and switches. The dashboard and instrument panel each have different cleaning requirements. Clean the vinyl wrapped dash pod following the instructions under Vinyl Care in this section. In the event a blemish or small cut occurs in the vinyl, contact a professional upholstery repair service.

Clean the plastic or Plexiglas instrument panels using a cloth dampened in a mild soap and water solution. Dry using a separate cotton cloth. Plastic polish products such as *Novus Plastic Care*® (a three-part system), *Meguires*® and *Johnson Paste Wax*® (requires extensive buffing and rubbing) help brighten the appearance of plastic or Plexiglas instrument panels.

Glass lens gauges can be cleaned using glass cleaner. Spray cleaning on the cloth, not directly onto the lens, to prevent over spray or runoff.

CAUTION:

Most glass cleaning products are volatile to plastics; extreme care must be used to prevent the glass cleaners from contacting the plastic, making the plastic brittle and dulling the finish.

TIP:

Tap the lens with a fingernail to determine if it is glass or plastic. A plastic lens will have a dull hollow sound, whereas glass will have a clear ping.

FABRICS

If a fabric is abused, it can be damaged. Special care needs to be taken when the motorhome is exposed to a very humid climate for an extended period of time. Cover all upholstery and make sure window coverings are down to protect fabrics from sun damage.

Protect the fabric from any unnecessary exposure to moisture. Frequently used items require more attention than those items not regularly used.

Guidelines for Cleaning Upholstery Fabrics:

- Water-based cleaners are not recommended.
- If a spill does occur, blot the soiled area. **DO NOT** rub it.
- Some solvents may have an adverse reaction on a specific backing of the upholstery fabric and are not recommended.
- To prevent overall soiling, frequent vacuuming or light brushing are recommended to remove dust and grime.
- Clean spots using a mild water-free solvent or dry cleaning product.
- Clean only in a well ventilated area and avoid any product containing carbon tetrachloride or other toxic materials.
- Use a professional furniture cleaning service for overall cleaning.

Vinyl

Several areas of the motorhome, such as the dash, ceiling and items of furniture, may be covered in vinyl. The care and cleaning of these areas are as follows:

Normal Cleaning:

Most common stains can be cleaned using warm soapy water and a clear water rinse. Moderate scrubbing with a medium bristle brush will help to loosen soil from the depression of embossed surfaces. For stubborn stains use the following commercially available mild detergents in accordance with the manufacturer's instructions: *Mr. Clean*[®] or *Fantastik*[®].

Full strength rubbing alcohol or mineral spirits may be tried cautiously as a last resort on very stubborn stains if the above suggestions do not work.

Indiscriminate use of any solvent, or solvent containing cleaner, can severely damage or discolor the vinyl. Stains may become permanent if they are not immediately removed.

NOTE:

Detergents should never be used on a regular or repeated basis for normal cleaning.

CAUTION:

Powdered cleaners containing abrasives, steel wool and industrial strength cleaners are not recommended for vinyl.

Bird Excreta & Vomit Stains:

Sponge the area with soapy water containing a diluted bleach until the stain is removed. Rinse thoroughly with clean water.

Urine Stains:

Sponge with soapy water containing a small amount of household ammonia. Rinse thoroughly with clean water.

Surface Mildew:

Wash with diluted bleach and use a soft brush for stubborn growth. Rinse repeatedly with clear, cold water.

Ballpoint Ink:

Wipe the stain immediately with rubbing alcohol in a well ventilated area.

Oil-Base Paint:

Use turpentine in a well ventilated area to remove any fresh paint. Dried paint must be moistened using a semi-solid, gel-type stripper. The softened paint can be gently scraped away. Rinse with soap and water.

CAUTION:

Lacquer solvent will cause immediate irreparable damage to the vinyl. DO NOT use wax on vinyl upholstery as it will cause premature embrittlement and cracking. Dilute chlorine bleach before using. Never use full strength bleach.

CAUTION:

Paint strippers will remove the print pattern and damage the vinyl if it comes in direct contact.

WARNING:

If flammable solvents such as alcohol, turpentine or varsol are used for cleaning, use only small quantities while in a well-ventilated area. Exercise proper caution by notifying any persons in the area. Keep away from any ignition source. Always wear protective gloves.

Latex Paint:

Fresh paint can be wiped off with a damp cloth. Hot soapy water will normally remove dried latex.

Tar or Asphalt:

Remove immediately. Prolonged contact will result in a permanent stain. Use a cloth lightly dampened with mineral spirits and rub the stain gently, working from the outer edge of the stain toward the center to prevent spreading. Rinse with soap and water.

Crayon, Mustard or Ketchup:

Sponge with mild soap and water. For stubborn stains that have set, use a cloth soaked in diluted mild detergent with gentle rubbing. Any remaining stain should be washed with diluted bleach. Rinse repeatedly with cold water.

Chewing Gum:

Scrape off as much gum as possible using a dull knife. Rub the gum with an ice cube to harden and for easier removal. In a well ventilated area, use a cloth saturated with mineral spirits and gently rub the remaining gum. Rinse thoroughly with clean water.

Lipstick, Grease, Oil, Make-Up or Shoe Polish:

Apply a small amount of mineral spirits with a cloth. Rub gently. Be careful not to spread the stain by smearing beyond the original source. Remove shoe polish immediately as it contains a dye which will cause permanent staining. Rinse thoroughly with clean water.

Candy, Ice Cream, Coffee, Tea, Fruit Stains, Liquor, Wine, Tanning Lotion or Soft Drinks:

Loose material should be gently scraped with a dull knife. Use lukewarm water and sponge repeatedly. Any soiled area that remains after drying should be gently rubbed with a cloth, dampened with a mild detergent solution. Rinse thoroughly with clean water.

Blood or Plant Residue:

Rub out any spots using a clean cloth, soaked in cool water. If stubborn spots remain, use household ammonia and rinse repeatedly with a clean, wet cloth. **DO NOT** use hot water or soap suds as this will set the stain.

TIP:

Vinyl requires periodic cleaning to maintain its appearance and to prevent the buildup of dirt and contaminant that may permanently stain or reduce the life of the vinyl if left untreated. Frequency of cleaning and procedures used depend upon the amount of use and the environmental conditions in which the vinyl is subjected. Tears or holes in the vinyl can be temporarily covered with clear packing tape to prevent further damage. Repairs should be made by a professional upholstery shop. Commercial repair products may contain lacquers and cause the vinyl to become brittle and more difficult to repair.

Optima Leather & “O” Vinyl**Optima Leather and “O” Vinyl Cleaning Suggestions:**

The following steps are to be performed in sequence for recommended cleaning methods for the “O” Vinyl and Optima Leather material. Each subsequent step is to be used if the previous step was not successful.

For General Cleaning:

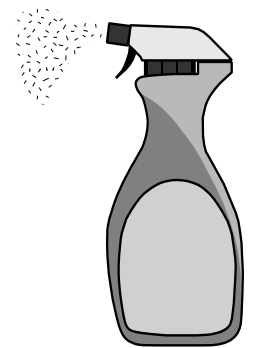
Wipe the soiled area with warm water, a mild detergent soap and a soft cotton cloth.

For Oil-based Stains:

Spray soiled area with household cleaner, such as 409® or Fantastik®, and wipe with warm water using a soft cotton cloth.

For Marker-type Stains:

Dab stained area with solution of 50% Isopropyl Alcohol and 50% warm water using a soft cotton cloth.



070200

Clean the area with warm water after each process.

WARNING:

When using an alcohol solution, avoid open flames or hot lighting.

CAUTION:

It is not recommended to use any abrasive cleaner with this material.

NOTE:

When disinfecting is necessary, a 5:1 bleach and water solution is recommended.

Fabric Cleaning Codes

The codes listed below detail the cleaning instructions recommended by the fabric manufacturing industry. Refer to the fabric specification charts (located on the following pages) for particular fabrics. Follow the recommended cleaning code for each particular fabric.

If a spill occurs, blot the moisture as quickly as possible. **DO NOT** use soap and hot water as this may set a stain. Clean the spot as soon as possible.

“W” - Clean this fabric with the foam only of a water-based cleaning agent to remove the overall soil. Many household cleaning solvents are harmful to the color and life of a fabric. Cleaning only by a professional furniture cleaning service is recommended. To prevent overall soil, frequent vacuuming or light brushing to remove dust and grime is recommended.

“S” - Clean this fabric with pure solvents (petroleum distillate-based products such as Energine, Carbona, Renuzit, or similar products may be used) in a well ventilated room. Cleaning only by a professional furniture cleaning service is recommended.

CAUTION:

Use of water-based or detergent-based solvent cleaners may cause excessive shrinking. Water stains may become permanent and unable to be removed with solvent cleaning agents. Avoid products containing Carbon Tetrachloride as it is highly toxic. To help prevent overall soiling, frequent vacuuming or light brushing to remove dust and grime is recommended.

“S/W” - Clean this fabric with the foam only of a water-based cleaning agent or with a pure solvent in a well ventilated room (petroleum distillate-based products such as Energine, Carbona, Renuzit, or similar products may be used). Cleaning only by a professional furniture cleaning service is recommended. To help prevent overall soiling, frequent vacuuming or light brushing to remove dust and grime is suggested.

“P” - The article is resistant against perchlorethene, cleaning benzine (spirit), white spirit, R-11 and R-13.

“Dry Clean Only” - Cleaning only by a professional dry cleaner or furniture cleaning service is recommended for this fabric.

“X” - Vacuum only. A non-metallic brush may be used.

***Machine Washing for 100% Polyester:**

“Wash Cycle” - Use synthetic setting and high water level with mild agitation. A mild soap or detergent in water not to exceed 160° F. No bleach or fabric softener.

“Drying” - Use low temperatures, a synthetic setting of 85° F to 90° F maximum should be used. **DO NOT** exceed three to five minutes time on the synthetic cycle. If washed at 160° F, the maximum temperature which can be used to dry is 140° F. Hang or fold immediately after drying.

“Finishing” - If necessary, press as following:

- Iron on low setting (275° F) with damp cloth or steam iron using a dry press cloth.
- Grid Head press for short intervals with minimum steam. **DO NOT** lock the head.
- Flat bed press dampened drapery using cloth covering.
- Avoid prolonged contact with heat.

Fabric Specification Charts

COLOR/PATTERN	APPLICATION	CONTENT	CODE
Moroccan Sunset			
O Vinyl Palomino	Leather/Vinyl for Furniture	100% Vinyl facing, 100% Polyester backing	"O" Vinyl
Optima Leather Palomino	Euro Recliner	100% Polyurethane facing, Rayon backing	Optima Leather
Palomino	Main Dash (vacuumed)	Vinyl	Vinyl
Palomino	Dash Accents (wrapped)	Vinyl	Vinyl
Johnson Cream	Windshield	100% Polyester	Dry Clean
Cressida Curry 18995-C5-LU	Sofa, LR Val, Dinette Surround	13% Cotton, 58% Rayon, 1% Nylon, 28% Polyester	Dry Clean
Gambas Adobe	LR Lounge Chair, Recliner, LR Val	67% Rayon, 33% Polyester	S
Halsted Flat Adobe	LR Pillow, FSD, Dinette Cushions	67% Rayon, 33% Polyester	S
LaMarche Plum	Bedsread, BR Val	57% Cotton, 43% Polyester	Dry Clean
Silk Scarlet	Headboard, BR Val, BR Pillow, Bedsread Accent	100% Cotton	Dry Clean
FRB 754 B Oak Hill Gold	Decorative Pillow Trim	80% Acrylic, 15% Rayon, 5% Polyester	S
O Vinyl Merlot Embossed 172	Vinyl Insert for Slide Fascia	100% Vinyl facing, 100% Polyester backing	"O" Vinyl

Saville Row			
O Vinyl Palomino	Leather/Vinyl for Furniture	100% Vinyl facing, 100% Polyester backing	"O" Vinyl
Optima Leather Palomino	Euro Recliner	100% Polyurethane facing, Rayon backing	Optima Leather
Palomino	Main Dash (vacuumed)	Vinyl	Vinyl
Palomino	Dash Accents (wrapped)	Vinyl	Vinyl
Johnson Cream	Windshield	100% Polyester	Dry Clean
M-6210 Sandstone	Sofa, LR Val, Dinette Cushion	73% Rayon, 27% Polyester	S
M-6285 Cocoa	LR lounge chair, Recliner, LR Val, LR Pillow	46% Rayon, 37% Polyester, 17% Cotton	S
Diego BK-Moss	LR Pillow, FSD, Dinette Surround	37% Polyester, 34% Acrylic, 29% Olefin	S/W
Passionata Natural	Bedsread, BR Val	100% Cotton	S
Claiborne Antique	Beadboard, BR Val, BR Pillow, Bedsread Accent	100% Polyester	Dry Clean
#20062 Coff/DIJ/Moss Fringe	Decorative Pillow Trim	96% Chenille, 4% Polyester	Vacuum Only
O Vinyl Merlot Embossed 172	Vinyl Insert for Slide Fascia	100% Vinyl facing, 100% Polyester backing	"O" Vinyl

Bronzeville			
O Vinyl Milkweed	Leather/Vinyl for Furniture	100% Vinyl facing, 100% Polyester backing	"O" Vinyl
Optima Leather Milkweed	Euro Recliner	100% Polyurethane facing, Rayon backing	Optima Leather
Milkweed	Main Dash (vacuumed)	Vinyl	Vinyl
Milkweed	Dash Accents (wrapped)	Vinyl	Vinyl
Johnson Cream	Windshield	100% Polyester	Dry Clean
Waterton 1045-31277	Sofa, Dinette Surround	60% Acrylic, 25% Polyester, 15% Polypropylene	S
Calderone Walnut	LR Val, LR Pillow, FSD, Dinette Cushions	79% Polyester, 21% Acrylic	W
Calderone Walnut	LR Lounge Chair, Recliner, LR Val	79% Polyester, 21% Acrylic	W
Alta Vista Chocolate	Bedsread, BR Val	100% Cotton	Dry Clean
Silk Chocolate	Headboard, BR Val, BR Pillow, Bedsread Accent	100% Cotton	Dry Clean
FRB 1220 Pyramid	Decorative Pillow Trim	67% Acrylic, 21% Polyester, 6% Rayon, 6% Cotton	S
O Vinyl Merlot Embossed 172	Vinyl Insert for Slide Fascia	100% Vinyl facing, 100% Polyester backing	"O" Vinyl

COLOR/PATTERN	APPLICATION	CONTENT	CODE
Jadestone			
O Vinyl Milkweed	Leather/Vinyl for Furniture	100% Vinyl facing, 100% Polyester backing	"O" Vinyl
Optima Leather Milkweed	Euro Recliner	100% Polyurethane facing, Rayon backing	Optima Leather
Milkweed	Main Dash (vacuumed)	Vinyl	Vinyl
Milkweed	Dash Accents (wrapped)	Vinyl	Vinyl
Johnson Cream	Windshield	100% Polyester	Dry Clean
Ayers Old Gold	Sofa, LR Val, Dinette Surround	23% Acrylic, 34% Cotton, 21% Polyester, 22% UB Acrylic	Dry Clean
Frito Sage	LR Lounge Chair, Recliner, LR Val	46% Rayon Chenille, 24% Polyester, 28% Rayon	Dry Clean
Flagship Sage	LR Pillow, FSD, Dinette Cushions	46% Rayon Chenille, 24% Polyester, 28% Rayon	Dry Clean
Ashland Amber	Bedspread, BR Val	100% Cotton	Dry Clean
Belize Verde	Headboard, BR Val, BR Pillow, Bedspread Accent	50% Polyester, 50% Cotton	Dry Clean
20058 Aria	Decorative Pillow Trim	51% Polyester, 49% Acetate	N/A
O Vinyl Merlot Embossed 172	Vinyl Insert for Slide Fascia	100% Vinyl facing, 100% Polyester backing	"O" Vinyl

Ebony Vine II			
O Vinyl Palomino	Leather/Vinyl for Furniture	100% Vinyl facing, 100% Polyester backing	"O" Vinyl
Optima Leather Milkweed	Euro Recliner	100% Polyurethane facing, Rayon backing	Optima Leather
Palomino	Main Dash (vacuumed)	Vinyl	Vinyl
Palomino	Dash Accents (wrapped)	Vinyl	Vinyl
Johnson Cream	Windshield	100% Polyester	Dry Clean
Breathtaking Taupe 39172-E3-GU	Sofa, LR Lounge, Recliner, LR Val, Dinette Surround	17% Cotton, 46% Acrylic, 37% Polyester	W
Fairlawn MO-38464-001	LR Val, LR Pillow, FSD, Dinette Surround	76% Cotton, 24% Polyester	S
Affection Khaki	Bedspread	100% Polyester	Dry Clean
Hayfield Flint	Bedspread	65% Polyester, 35% Cotton	S
Shantung SH-66 Black	Headboard, BR Val, Bedspread Accent	57% Cotton, 43% Rayon	Dry Clean
Prince Black	BR Val, BR BR Pillow	75% Acrylic, 25% Polyester	Dry Clean
FRB 754-B Oak Hill Mocha	Decorative Pillow Trim	80% Acrylic, 15% Rayon, 5% Polyester	S
O Vinyl Merlot Embossed 172	Vinyl Insert for Slide Fascia	100% Vinyl facing, 100% Polyester backing	"O" Vinyl
O Vinyl Merlot Embossed 172	Vinyl Insert for Slide Fascia	100% Vinyl facing, 100% Polyester backing	"O" Vinyl

COLOR/PATTERN	APPLICATION	CONTENT	CODE
“Blackwood Manor” featuring fabrics by Liz Claiborne			
O Vinyl Palomino	Leather/Vinyl for Furniture	100% Vinyl facing, 100% Polyester backing	“O” Vinyl
Optima Leather Palomino	Euro Recliner	100% Polyurethane facing, Rayon backing	Optima Leather
Palomino	Main Dash (vacuumed)	Vinyl	Vinyl
Palomino	Dash Accents (wrapped)	Vinyl	Vinyl
Johnson Cream	Windshield	100% Polyester	Dry Clean
Penn Amber	Sofa	100% Polyester	Dry Clean
Snapper Ebony	Sofa Accent	100% Polyurethane	S
Teacup Ebony	LR Lounge Chair, Recliner, LR Val, FSD, Dinette Cushions	57% Cotton, 43% Polyester	Dry Clean
Penn Ebony	LR Val, Dinette Surround, Bedspread Accent	100% Polyester	Dry Clean
Gazebo Ebony	LR/BR Pillow, Headboard, BR Val	100% Cotton	Dry Clean
FRB 1220 Pyramid	Decorative Fringe	67% Acrylic, 21% Polyester, 6% Rayon, 6% Cotton	S

FLOORS

Carpet Cleaning

Spot Removal Procedures:

- Act quickly when anything is dropped or spilled. Remove spots before they dry.
- Blot liquids with a clean, white absorbent cloth or paper towel.
- For semi-solids, scoop up with a rounded spoon.
- For solids, break up and vacuum out as much as possible.
- Pretest the spot removal agent in an inconspicuous area to make certain it will not damage the carpet dyes.
- Apply a small amount of the cleaning solution recommended for the particular spot. **DO NOT** scrub. Work from the edges of the spot to the center. Blot thoroughly. Repeat until spot is removed.
- Follow steps on the Carpet Spot Removal Guide.
- After each application, absorb as much as possible before proceeding to the next step.
- Absorb remaining moisture with layers of white paper towels, weighted down with a non-staining glass or ceramic object.
- When completely dry, vacuum or brush the pile to restore texture.
- If the spot is not completely removed, contact a professional carpet cleaner.

Cleaning Solutions:

A. Dry Cleaning Fluid: A nonflammable spot removal liquid, available in grocery and hardware stores.

B. Nail Polish Remover: Any acetate, which often has a banana fragrance. **DO NOT** use if it contains acetone.

C. Detergent Solution: Mix two cups of cold water and 1/8 teaspoon mild liquid detergent (no lanolin, non-bleach).

D. Warm Water: Lukewarm tap water.

E. Vinegar Solution: One cup white vinegar to one cup water.

F. Ammonia Solution: One tablespoon household ammonia to one cup water.

G. Stain Removal Kit: Available from retail carpet stores or professional cleaners.

H. Call Professional: Additional suggestions, special cleaning chemicals or the ability to patch the area may be available.

I. Permanent Change: Due to the nature of the stain, there may be color loss. The carpet has been permanently dyed or the carpet yarns have been permanently damaged.

NOTE:

While the recommended cleaning agents have proven to be effective, some stains may become permanent.

Carpet Spot Removal Guide

	A	B	C	D	E	F	G	H	I
	DRY CLEANING FLUID	NAIL POLISH REMOVER	DETERGENT SOLUTION	WARM WATER	VINEGAR SOLUTION	AMMONIA SOLUTION	STAIN REMOVAL KIT	CALL PROFESSIONAL	PERMANENT CHANGE
Use the solution specified in order from 1-8 until stain is removed.									
SPOTS									
Acid				2		1		3	*
Acne Medication		1		2	5	4	3	6	*
Alcoholic Beverage			1	4	3	2			*
Ammonia				2	1				*
Bleach		1	2					3	*
Blood		1	3		2	4			
Candle Wax	1					2			
Cement & Glue	2	1	3		5	4	6		*
Chalk		1	2						
Charcoal		1	2						
Chewing Gum	1								
Coffee			1	3	2		4	5	*
Cosmetics		2	1	3	6	5	4	7	*
Crayon	1		2	3					
Drain/Toilet Cleaner			2	1	3			4	*
Dye	1		2		4	3	5	6	*
Food			1	4	3	2	5	6	*
Fungicides, Insecticides, Pesticides	1		2	5	4	3	6	*	
Furniture Polish (Water Based)			1	4	3	2	5	6	*
Furniture Polish (Solvent Based)	2	1	3	6	5	4	7	8	*
Furniture Stain	2	1	3	6	5	4	7	8	*
Graphite		1	2						
Grease	1	2	3				4	5	*
Ink	2	1	3	6	5	4	7	8	*
Iodine	1		2	5	4	3	6	7	*
Lipstick	2	1	3	6	5	4	7	8	*
Medicine	2	1	3	6	5	4	7	8	*
Merthiolate			1	4	3	2	5	6	*
Nail Polish	2	1	3				4	5	*
Oil	1		2	4		3		5	*
Paint	2	1	3				4	5	*
Plant Food			1	4	3	2	5	6	*
Rust			2	3	1		4	5	*
Shoe Polish	2	1	3	5		4	6	7	*
Soft Drinks			1	4	3	2	5	6	*
Soot	1		2	3				4	*
Tar	1						2	3	*
Toothpaste			1						
Urine			1		2		3	4	*
Vomit			1	4	3	2	5	6	*

* While recommended cleaning agents are effective, some stains may become permanent.

Laminate Floors

Cleaning and Maintenance:

For everyday cleaning, vacuum the floor to remove dirt and debris. It is recommended to occasionally mop the floor using a cotton string mop and a minimal amount of water. Use a mixture of soap-free household cleaner (either vinegar or ammonia work well) and water for a more thorough cleaning. Wipe away stains with a damp cloth. Stains caused by inks or paints may require a cloth moistened with acetone (nail polish remover). Apply felt protectors on the bottom of furniture and floor mats to preserve the beauty and appearance of the floors.

NOTE:

For the removal of other stains, contact Armstrong Customer Response Center at (800) 233-3823.

CAUTION:

Abrasive cleaners and scouring pads can scratch and damage the flooring. Never wax, sand or apply lacquer to laminate flooring.

SHOWER

Showers are susceptible to soap build-up and should be cleaned weekly to ease the task. To control mildew growth, spray the shower with household chlorine bleach. Allow it to stand for five minutes, then rinse with clear water. Clean the glass shower doors with window cleaner on a weekly basis to maintain shine. If water spots cannot be removed from glass, rub lightly with the flat edge of a razor blade to remove deposits.

To prevent excessive moisture and a continual growth of mildew, use the shower only with adequate ventilation. The sealant in a regularly used shower should be replaced once a year. To replace sealant, remove the old sealant using a sharp non-metallic instrument. Apply a new sealant, which can be found at most recreational vehicle supply stores.

CEILING

Hardwood Vinyl and Decorated Paneling:

Certain cleaning agents will affect the surface on both printed and unprinted vinyl. Use only a mild, non-abrasive detergent and warm water with a soft cloth or sponge to clean. **DO NOT** use bleach, alcohol, oil-based spray cleaners or cleaning agents that contain solvents, citrus oil or harsh chemicals.

WALL COVERINGS

Immediately remove solvent-based or pigmented substances from wall coverings. **DO NOT** use abrasive cleaners containing chlorine bleach or solvents. Fidelity and Jolie brands are recommended. Always begin with a mild detergent or soap and warm water. To remove normal dirt, clean with a soft sponge. Rinse and wipe dry.

Care for the Tower Wall Covering:

Remove ordinary stains with mild soap and warm water. Sponge on. Rinse well and dry with a soft cloth. For special cleaning problems: To remove ball point pen, blood, lipstick, etc., use a sponge or soft bristle brush and *Formula 409*[®], *Fantastik*[®] or a similar product. Rinse well and dry. Finish cleaning by applying full strength isopropyl alcohol with a sponge or soft brush. Rinse well and dry.



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Care for the Satinesque Wall Covering:

Stains must be removed quickly to minimize the reaction on the wall covering, especially if the stain is solvent-based or pigmented. Examples: nail polish, oil, shampoo, lacquer, enamel, paint, ink and lipstick.

Begin cleaning the stain with a mild soap-based detergent; and if necessary, move to a stronger cleaner such as household bleach, liquid household cleaners or rubbing alcohol. Before applying a stronger cleaner, test the cleaning agent on a small inconspicuous portion of the wallcovering to ensure the cleaner does not affect the color or gloss of the wall covering.

Stain Removal Procedures for Specific Stain Types:

Normal Dirt - Remove normal dirt using a mild soap or detergent and warm water. Allow it to soak for a few minutes then rub briskly with a cloth or sponge.

Nail Polish, Shellac or Lacquer - Remove liquid using a dry cloth. Use care not to spread the stain. Quickly clean the remaining stain with rubbing alcohol. Rinse with clean water.

Ink - Remove immediately by wiping with a cloth dampened in rubbing alcohol. Rinse with clean water.

Chewing Gum- Rub with an ice cube to cool and harden. Gently pull off the bulk of the gum. Remove remaining gum with rubbing alcohol.

Pencil - Erase as much of the pencil mark as possible. Wipe remaining marks with rubbing alcohol.

Blood, Feces or Urine - Remove these staining substances as quickly as possible. Wash the stained area with a strong soap. If the stain does not disappear, rinse the soapy area thoroughly with clean water. Mix a solution of 50% water and 50% household bleach. Clean the stained area with the bleach solution. Rinse with clean water.

WOOD CARE

For general cleaning, regularly wipe wood surfaces using a soft cloth lightly dampened with clear warm water, and thoroughly dry to prevent streaking. For stubborn stains, use a clean cloth dampened with a solution of mild non-alkaline soap (dishwashing liquid) and water and rinse. Dry thoroughly, buffing in the direction of the wood grain. Never use abrasive cleaners, scouring pads or powdered cleansers. Polishing products used on the solid wood surface depends on individual preference. Always follow product instructions.

Excessive dampness, dryness, heat, or cold can damage solid wood finishes. Sunlight can change the color or age the wood. Never allow moisture or spills to stand, always blot dry immediately. Solvents, alcohol, nail polish and polish removers, as well as harsh cleaners, should not be used on finished wood surfaces.

Minor damage to solid wood surfaces can be repaired quickly and effectively with a bit of hard work, some careful attention to details, and most importantly, the right materials. However, any wood repair or finishing job is best left for a professionally trained individual.

NOTE:

It is important to inform the service technician of any products used for the care and cleaning in the event of wood repairs.

Sanding and Sandpaper:

The following table is a general guide, but this may vary from wood type to type. The key to sanding is using the right sandpaper for the repair that is needed. Always sand with the grain.

GRIT	GRADE	USE
80-120	Medium	Smoothing the surface, removing small marks.
150-180	Fine	Final sanding prior to finishing.
220-240	Very Fine	Sanding between coats of sealing.
280-320	Extra Fine	Removing dust spots or mark between finish coats.
360-600	Super Fine	Removing luster or surface blemishes.

Steel Wool:

Abrasive material composed of long steel fibers of varying degrees of fineness that are matted together. Coarser grades are used to remove paint and other finishes; the finer grades for polishing or smoothing a finished surface.

Nail Holes and Small Cracks:

Fill nail holes and small cracks with wood putty or dough for unstained woods prior to any sanding. Stained finishes require filling holes and cracks after the stain has been applied. Putty should match the stain closely in color.

TIP:

A little sawdust and wood glue can be used to make putty for end grains.

Fixing scratches in stained woodwork:

“Quick and simple” rarely describes repairs to stained wood finishes. However, a few tricks can be tried. When scratches appear lighter than the surrounding dark-stained woodwork, it usually means either that the scratch goes through the stain into the wood or that the varnish is flaking off.

Dents:

Small dents may be repaired by using steam. To raise a small dent, place a damp cloth over the area and hold a medium-hot iron on it. The steam causes the wood fibers to swell back into place. It may be necessary to repeat this process until the dented area is level with the surface. Allow the area to dry.

Restoring the clear finish:

Check the scratches carefully. If flaking varnish is visible with dark-stained wood underneath, only the clear finish may need to be restored. Rub the loose varnish with fine steel wool or fine synthetic steel wool until you have removed the flaking varnish and slightly roughened a small area of the finish surrounding the scratch. With the tip of a rag, a small brush, or even a cotton swab, apply a thin coat of wipe-on finish. Apply finish to the damaged area only. Several coats may be needed to hide the scratch.

Re-staining the wood:

The wood will need to be re-stained if bare wood is exposed at the bottom of the scratch. To remove damaged varnish, lightly roughen a small area around the scratch with sandpaper, steel wool or synthetic steel wool. Find a stain that is a shade lighter than the wood finish. Stain the bare wood with a very small amount of stain on a rag, brush or cotton swab. If the color is too light, apply several coats. Rub away excess stain with a dry rag. If the wood becomes too dark, use a rag moistened in mineral spirits to lighten the wood. Select a lighter color stain and continue.

Several companies have simplified this repair process by designing oil-based wood stain into marker-like containers to rub on to the scratch. Start with a stain color that is lighter than the original finish because torn and scratched wood fibers will absorb stain and darken quickly. A second coat can always be applied if the color of the first coat is too light. Once the color is blended, patch the clear finish as described above and apply a wipe-on finish.

Scratches and Nicks:

Professional woodworkers use certain procedures on scratches and nicks for easy repair. Light scratches will often disappear when carefully rubbed with furniture polish or paste wax. Deeper scratches can be hidden by carefully rubbing with a piece of oily nutmeat such as Brazil nut, black walnut or pecan. Be careful to rub the nutmeat directly into the scratch to avoid darkening of the surrounding wood. Color the scratch with brown coloring crayon or liquid shoe dye (especially good on walnut). Always test a procedure on an inconspicuous area on the wood to ensure no damages to the finish occurs.

Staining the scratch with iodine:

Mahogany - Use new iodine.

Brown or Cherry Mahogany - Use iodine that has turned dark brown.

Maple - Dilute one part iodine with one part denatured alcohol.

Commercial scratch removers, or stick wax to match the wood finish, can also be used. After the scratch has been hidden, polish or wax the entire area. Deep scratches should be repaired and finished by a professional.

COUNTERTOPS

Solid Surface

Guidelines to maintain the countertop surface:

Routine Care:

The motorhome solid surface countertops and sinks have a matte/satin finish. Soapy water or ammonia-based cleaners will remove most dirt and stains from all tops and bowls. Individual techniques may be used to remove different stains. Follow the recommendations below.

Cleaning the Countertops:

- **Most dirt and stains** - Use soapy water or ammonia-based cleaner.
- **Water marks** - Wipe with damp cloth and towel dry.
- **Difficult stains** - Use *Soft Scrub*® Liquid Cleanser and a gray *Scotchbrite*® pad.
- **Disinfecting** - Occasionally wipe surface with diluted household bleach (one part water and one part bleach).

Cleaning the Solid Surfaces Sink:

Occasionally clean by using *Soft Scrub*® and a gray *Scotchbrite*® pad. Scrub the sink, rinse and towel dry.

Removing Cuts and Scratches:

Solid Surface countertops are renewable. Use the following instructions to remove minor cuts and scratches.

- Sand with 180 grit sandpaper, followed by 320 grit, until the scratch is gone.
- Restore the finish using a gray *Scotchbrite*® pad. Never sand hard in one small area. Feather out lightly to blend restoration.

Preventing Heat Damage:

Hot pans and heat-generating appliances, such as frying pans or crockpots, can damage the surface. To prevent heat damage, always use a hot pad or a trivet with rubber feet to protect the surface.

Other Important Tips:

Avoid using strong chemicals on the Solid Surface such as paint removers or oven cleaners. If these chemicals come in contact with the Solid Surface, quickly wash with water. Avoid contact with nail polish or nail polish remover. If contact is made, quickly wash with water.

NOTE:

DO NOT cut directly on the solid surface. When pouring boiling water into the Solid Surface sink, run cold water to prevent damage.

Laminate

Clean laminate countertops with a damp cloth or sponge. Use a spray cleaner to remove stubborn stains. Do not use harsh abrasives, scouring powders, peroxides or bleaches as these products may dull or damage the surface. Avoid contact with dyes, bleaches, and indelible inks on food packages. Do not use laminated countertops as a cutting board. Laminated countertops are resistant to minor heat; however, hot pans, irons, and lit cigarettes will damage the surface. Use hot pads under pans taken directly from the stovetop.

STAINLESS STEEL SURFACE

Clean stainless steel once a week. Always apply stainless steel cleaner/polish with a non-abrasive cloth or sponge - working with, not across, the grain. **DO NOT** use steel wool, wire brushes or abrasive sponge pads. Cleaners containing chloride are not recommended. If used, rinse surface immediately to prevent corrosion.

Allowing water to evaporate will form water deposits. To avoid this, it is important to use a dabbing action to dry, not an abrasive or rubbing action. Cleaning with a damp sponge and drying should keep surface looking beautiful.

WINDOWS

Water Spots:

Glass will develop water spots if not properly cleaned. Water spots are magnified when the glass has a reflective finish. Use a squeegee immediately after washing to reduce water spotting. To remove stubborn water stains from reflective glass we recommend *Cerium Oxide Polishing Compound*, made by C.R. Lawrence, available at most glass shops.

Condensation

Condensation occurs from water vapor present in the air. More vapor is added by breathing, bathing, cooking, etc. and collects wherever there is available air space. When the temperature reaches the dew point, the water vapor in the air condenses and changes to liquid form.

Controlling Moisture Condensation:

Reduce or eliminate interior moisture condensation during cold weather by using the following steps:

- Partially open the roof vents and windows so that outside air can circulate into the interior. Increase the ventilation when large numbers of people are in the motorhome. Even in raining or snowing conditions the air outside will be far drier than the interior air.
- Install a dehumidifier. Continuous use of a dehumidifier is effective in removing excess moisture from interior air. Using a dehumidifier is not a cure-all, however, it will reduce the amount of outside air needed for ventilation.
- Run the range vent fan when cooking and the bath vent fan (or open the bath vent) when bathing, to reduce water vapor. Avoid excessive boiling or use of steam producing hot water.
- **DO NOT** heat the motorhome interior with the range or oven. Heating with the range or oven increases the risk of toxic fumes and depletes oxygen. Open flames also add moisture to the interior air and increase condensation.
- In very cold weather, leave cabinet and closet doors partially open. Air flow will warm and ventilate the interior storage compartments and exterior walls to reduce or eliminate condensation and prevent the possibility of ice formations.

WINDOW TREATMENTS

Mini-blinds

Dusting:

Regular dusting will maintain the appearance of the mini-blinds. Keep aluminum blinds looking their best by periodically wiping them with a soft cloth or a dusting mitt. By tilting the slats down, not quite closed, most of the top surface of each slat can be cleaned. Blinds may be cleaned while hanging in place using this method.

Vacuuming:

For deeper cleaning, vacuum gently with a soft brush attachment of a vacuum cleaner.

Compressed Air or Hair Dryer (non-heat setting):

Blow dust off each slat. Dust will be air-borne using this method so ventilate the motorhome.

Spot-Cleaning:

Spot-clean shades and blinds using a soft cloth or a moistened sponge with lukewarm water. Add mild detergent, if needed. Blot gently to avoid creasing. In a dusty environment, the blinds may need to be cleaned regularly using a sponge or dampened soft cloth. Use warm (not hot) water and a mild detergent. The mild detergent cannot contain abrasives. Rinse the blinds using a clean cloth and water to prevent water spots. Place a towel directly under the blinds to absorb water that might drip down.

Ultrasonic cleaning:

Professional ultrasonic cleaning may be preferred.

Day/Night Shades

Guidelines for care and maintenance of polyester blended day/night shades:

- Leave Day-Night shades in the UP position when not in use to help the shades hold their shape.
- String tension for the shades should be equal. The tension can be adjusted if the shades will not remain up.

Dusting:

Vacuum with a brush attachment, or use a dusting tool, on a regular basis.

Cleaning:

A dry foam cleaner may be used for soil and dirt removal. Follow all directions on the container or a cleaning solution of ¼ ounce clear liquid soap to 8 ounces water.

NOTE:

DO NOT use colored liquid soap as a stain may appear when fabric dries.

MOLD & MILDEW

What is Mold?

Mold is a type of fungus that occurs naturally in the environment. Mold spreads by means of microscopic spores borne on the wind and is found everywhere life can be supported. Motorhome construction is not, and cannot be, designed to exclude mold spores. If the conditions are right, mold can grow in the motorhome. Most people are familiar with mold growth in the form of bread mold and mildew that may grow on bathroom tile. Mold spores, as they grow, can leave a musty odor, discolor fabrics, stain surfaces, and cause considerable damage.

What Does Mold Need to Grow?

Mold requires a food source to grow. Grease films contain nutrients to cultivate mold spores. Soil on items such as fabrics and furniture may also supply nutrients for mold growth. Synthetic fabrics such as acetate, polyester, acrylic and nylon are mildew resistant, but soil on the surface of these fabrics is susceptible to mold.

Temperate climate and moisture help to cultivate mold growth. Moisture in the motorhome can result from unattended spills, leaks, overflows and condensation. Moisture allowed to remain on a growth medium can develop mold within 24 to 48 hours. Minimizing moisture inside of the motorhome can reduce or eliminate favorable mold growth conditions. Good housekeeping and regular maintenance are essential in the effort to prevent or eliminate mold growth.

Consequences of Mold:

All mold is not necessarily harmful, but certain strains of mold have been shown to cause, in susceptible persons, allergic reactions that may include skin irritation, watery eyes, runny nose, coughing, sneezing, congestion, sore throat and headache. Individuals with suppressed immune systems may risk infections. Some experts contend that mold causes serious symptoms and disease which may even be life threatening. However, experts disagree about the level of mold exposure that may cause health problems, and about the exact nature and extent of the health problems that may be caused by mold. The Center for Disease Control (CDC) states that a casual link between the presence of toxic mold and serious health conditions has not been proven.

Standards or threshold limit values for concentration of mold or mold spores have not been set. No Environmental Protection Agency (EPA) regulations or standards currently exist for airborne mold contaminants. There is simply no practical way to eliminate all mold and mold spores in the indoor environment. For example, studies have shown that ozone cleaners are not effective at killing airborne mold or surface mold contamination.

Controlling Mold Growth:

The motorhome owner can use the following information to help reduce or eliminate mold growth in the motorhome.

- Check for signs of mold prior to bringing items in the motorhome. Potted plants (roots and soil), furnishings, or stored clothing and bedding material, as well as many other household goods, may already contain mold growth.
- Regular vacuuming and cleaning will help reduce mold levels. Mild bleach solutions and most tile cleaners are effective in eliminating or preventing mold growth.
- Indoor humidity can be reduced by 30 to 60% when venting clothes dryers to the outdoors. Ventilate the kitchen and bathroom by opening windows, using exhaust fans or a combination of both. Operating the air conditioning will remove excess moisture in the air and help facilitate evaporation of water from wet surfaces.
- Promptly clean up spills, condensation and other sources of moisture. Thoroughly dry any wet surfaces or material. **DO NOT** let water pool or stand in the motorhome. Promptly replace materials that cannot be thoroughly dried.

- **Inspect** for leaks on a regular basis. Look for discolorations or wet spots. Repair leaks promptly. **Inspect** condensation pans (refrigerators and air conditioners) for mold growth. Take notice of musty odors and any visible signs of mold.
- Should mold develop, thoroughly clean the affected area with a mild solution of bleach. First, test to see if the affected material or surface is color safe. Should mold growth be severe, call on the services of a qualified professional cleaner.
- If mold cannot be removed from an item, properly disposed of it.

Whether or not a motorhome owner experiences mold growth depends largely on how the motorhome is managed and maintained. As a manufacturer, our responsibility is limited to things that we can control. As explained in the written warranty, we will repair or replace defects in the construction (defects defined as a failure to comply with reasonable standards of motorhome construction) for the Limited Warranty coverage period provided. **THE MANUFACTURER WILL NOT BE RESPONSIBLE FOR ANY DAMAGES CAUSED BY MOLD THAT MAY BE THE CONSEQUENCE OF OR ASSOCIATED WITH DEFECTS IN THE CONSTRUCTION.**

PEST CONTROL

Regardless of the area one lives in or travels to, it is safe in stating there will be pests waiting. These pests are not only annoying; they can pose a health risk and create serious damage to the motorhome.

Common pests include insects such as ants, cockroaches, termites, flies, pantry pests and wasps as well as wildlife such as rodents, raccoons, bats, birds and snakes. It is important to remember that pests are searching for food, water and a place to live. Eliminating any one of those elements will help control the pest infestation. Take immediate steps to remove pests as soon as their presence is detected.

To help control pests:

- Reduce the clutter inside the motorhome and storage bays. All storage items, particularly food (including pet food), should be kept in tightly sealed containers. Seal all cracks and holes, and insure that window, door and vent screens are securely in place.
- Routinely clean the motorhome, including storage bays. Wipe down the water bay. Promptly remove all crumbs from areas where food is regularly prepared and eaten. Garbage should be placed in a sealed container and removed to an outside receptacle daily. Only put out pet food that will be immediately eaten.
- Keep foods such as flour, cereal, spaghetti and pet food in re-sealable containers with tight lids.
- Sweep and vacuum often (especially in eating areas) to help eliminate a food source for pests.
- Seal cracks, crevices, and gaps around doors and windows. Ensure all windows and doors are screened and that the screens fit snug in the frames.
- Many pests need moisture to successfully live and reproduce. Limit their access to water or moisture sources by sealing any cracks and leaks in pipes and faucets. Reduce moisture in the motorhome by controlling condensation, immediately wiping up spills and promptly repairing leaks. Be extra alert around areas that attract rodents and insects, including the sewer hose, fresh water hose, bay doors and items that may be leaning against the outside of the motorhome, such as fishing poles and golf clubs.
- When the motorhome is stored outdoors, clear the surrounding area of all rodent friendly hiding places - shrubs, trees and clutter. Completely seal the underside of the motorhome. Wire mesh will work well to prevent points of entry, but beware of blocking necessary air vents. Prior to operating the motorhome after storage, remove all insect and animal nests that may have developed around vents, engine compartments, the exhaust pipe and in the wheel wells.

Rodents:

Rodents may chew through wires or build nests in components of the motorhome. Signs of rodent infestation include droppings, shredded material or chewed furniture fabrics and vinyl. Rodents like to build nests with wire insulation, and are commonly attracted to the outside coating of 120 Volt AC wiring more than 12 Volt DC wiring.

NOTE:

Although the back cap of the motorhome is well sealed, rodents are capable of chewing through the foam insulation and that area should be routinely inspected.

If there are signs of rodent infestation around the motorhome, place traps or poisons in suspected areas. Keep the traps and poisons safely away from pets and children. Cheese is not the best bait for a rodent trap. Use peanut butter or chocolate in small amounts. Place the bait on the trigger of the trap to induce the rodent to climb onto the trigger to reach the bait. Rodents do not limit invasion to unused vehicles.

Insects:

Eliminate insects when signs of infestation appear. If you are unable to identify the type of insect, purchase sticky traps from the hardware store and place the tape where the insects have been seen. Once a sample is caught, seek assistance in identifying the insect to determine what will be required to remove the infestation.

Regularly **inspect** the exterior of the motorhome for signs of a budding wasp nest, and promptly destroy small nests before they become too large.

Spiders can be in any structure. Immediately remove spider webs. Some types of spiders like to nest on top of the diesel tank and around the diesel hoses. Dispense of spiders using a vacuum. Use care to capture the spider and egg sacs. Throw the vacuum bag away in a sealed bag.

Fruit flies invade the motorhome by attaching to fresh fruits and vegetables. Determine what food items are generating the flies and discard that item in an outdoor trash receptacle. Fruit flies can be eliminated with a homemade trap. Pour a few ounces of vinegar into a cup and cover the cup with plastic wrap. Secure the wrap with tape or a rubber band and poke a ¼" hole in the plastic. Place the trap in the area where fruit flies are present.

Ants live in colonies. Only a fraction of the ant colony will leave to seek food. Spraying pesticides will only kill the ants that are away from the colony. The colony must be destroyed to eliminate all ants. Keep ants away from the sewer hose by spraying the hose ends with a soap and water solution.

Fleas can be removed by properly treating pets with a veterinarian approved treatment and by thoroughly cleaning the motorhome. Vacuum vinyl areas and tile floors to remove dust, flea larva and flea eggs. Follow by thoroughly washing those areas with soap and water. Carpets must be vacuumed and treated with a residual flea control product labeled safe for indoor carpet and furniture use. Perform the cleaning treatment daily for three days to ensure that all fleas have encountered the treatment.

Flying outdoor insects are attracted to bright light. Yellow porch light covers on the motorhome work to discourage insect invasion. During nighttime hours insects will be attracted to docking lights, or other bright exterior lighting. If the presence of moths is detected inside of the motorhome, usually by holes appearing in material, clean the affected clothing and all other items stored in the same area. Follow by completely cleaning the closet, dresser or storage area. If cracks are detected, seal the cracks and treat the area with a properly labeled indoor pest control product.

Birds:

Even birds can be considered pests, particularly when the motorhome is parked in the flight path of a flock. Bird droppings are hard to remove and will leave stains. Prevent permanent staining to the motorhome roof by regularly cleaning the surface to remove all bird droppings.

Damage from Pests:

Lizards have been known to crawl into the inverter and short out the circuit board. Lizards can be captured using glue traps. To remove the lizard from the trap, dissolve the glue with vegetable oil and release it outside and well away from the motorhome. A scorpion will glow blue-green in UV light. If the presence of scorpions in the motorhome is suspected, investigate with an UV black light during the nighttime hours.

Best sources of information about common household pests:

The Internet is a great place to find information about common pests, however, the information is not always correct. The National Pest Management Association website can be useful resource about common pest. Another good source for information are colleges and universities with entomology departments (entomology is the study of insects).

Electronic pest control devices can be costly and most likely will not work on all types of rodents and insects. When calling on the services of a professional to combat pest infestation, call a reputable business that is licensed in handling pesticides. Check references. Explain that you are seeking assistance for a motorhome, as treatments may differ from standard household jobs.

If a pest problem is suspected in the motorhome, consider professional pest control help. The following guidelines can be used for selecting a pest control service.

- Seek referrals from those who have used pest control services. Inquire about the type of pest problem encountered and if they were satisfied with the service.
- Membership in the national, state or local pest control associations is a good indicator that the company has access to modern technical information and is committed to further education.
- Reach a complete understanding with the company before work starts; find out what the pest is, how the problem will be treated, how long the period of treatment will be, and what results can be expected.
- Be sure to understand what is guaranteed and what is not.

STORAGE
Short Term

Short term storage is defined as storing the motorhome for a period of thirty days or less. Properly preparing the motorhome during periods of short term storage will make bringing the motorhome out of storage a much easier process. Winterize the plumbing system if the motorhome is stored in winter months, or if stored when temperatures are below 32° F.

Checklist-Short Term Storage:

- Retract the slide rooms. **DO NOT** store the motorhome with slide rooms extended.
- Shut off all appliances. Close the primary LP-Gas valve.
- Remove all articles from refrigerator/freezer and clean thoroughly. Prop doors open to prevent mildew.
- Holding tanks should be drained and fresh water system winterized with potable antifreeze or winterize the plumbing system using air pressure.
- Retract and secure all awnings.
- Turn **OFF** the interior house power.
- Batteries should be stored fully charged. Batteries stored in a discharged state will readily freeze.
- If possible, park the motorhome so that the batteries are accessible for charging or changing without having to move the motorhome.
- If available, leave the motorhome hooked to shore power. Leave the main battery disconnect switches **ON**.
- Careful placement of a small heat source in the interior will help control moisture. Desiccate filter systems will help remove interior moisture.
- If AC power is not available, turn the chassis battery disconnect switch **OFF**.
- If possible, store the motorhome inside a storage building.
- If stored outside, **inspect** all seams and seals every two weeks for possible leakage.
- Store the motorhome with a full fuel tank to minimize moisture condensing at top of fuel tank.
- Vents and windows should be closed to prevent wind driven rain entrance.
- Tires should be stored at maximum inflation pressure.
- **Inspect** the interior twice a month for indication of water leaks. Be sure to check behind all cabinet doors and drawers.

Long Term

Long term storage of the motorhome can be defined as leaving a motorhome unattended for a period of thirty days or more. A motorhome requires protection from the elements just as a house or a car would. When left out in the environment without proper storage or maintenance, a motorhome, house or car is vulnerable to the moisture and oxidation processes inherent in the environment.

NOTE:

The natural process of moisture in the air condensing will occur with temperature changes of 30° F or more in one day. Humidity readings of 60% or greater will allow the accumulated moisture to remain for extended periods of time.

If the motorhome is stored in a location where AC power is not available:

- Turn **OFF** all the appliances.
- Turn **OFF** the battery cut-off switch.
- If possible, situate the motorhome so the batteries remain accessible. This allows a battery to be charged or replaced without moving the motorhome.
- Charge the batteries to a full state of charge.
- Turn the main battery disconnects **OFF**.
- When stored outside, make a quick reference check of the battery voltage on the monitor panel.
Preventative measures should be used if the voltage readings are low. Removing the motorhome from storage or moving the motorhome in case of an emergency will be a much easier process.

NOTE:

Batteries in a low state of charge will readily freeze. Freezing will damage the battery.

CAUTION:

A 20 Amp service using light duty extension cords and the required adapters create serious voltage losses. Line voltage loss and the resistance at each electrical connection is a hazardous combination and should be avoided. Damage to sensitive electronic equipment may result!

Type of surface to park and store the motorhome on:

- Parking the motorhome on a grass surface, with the tires supported by blocks, is a perfect situation for moisture to accumulate.
- A graveled parking area still allows moisture to evaporate from the ground, through the gravel and to the underside of the motorhome.
- Concrete pads seal the surface allowing better ventilation under the motorhome.
- Storage buildings with concrete floors, or heated storage facilities, greatly reduce the amount of moisture accumulation and protects the motorhome from moisture damage.

If the motorhome is stored outdoors:

- The interior should be heated to help prevent mold and mildew growth. Moisture removing desiccate filter systems are available from hardware and RV supply stores. Place the filter system inside the motorhome to reduce interior moisture condensation or humidity.
- Proper winterization of the fresh water system will prevent potential damage in extreme cold.
- Ultraviolet radiation affects soft goods and rubber products such as privacy curtains, window shades and tires. These items should be protected. Store Day/Night Shades in the UP position.
- Cardboard templates can be made for the windows to protect the interior from exposure to direct sunlight.
- Tire covers are available to protect the sidewall of the tires from cracking. Make sure tires in storage contain the correct air pressure to prevent damaged caused by underinflation.
- Regularly washing the exterior to help control moss accumulation. Waxing the motorhome twice a year will augment these substances.

Inspect the motorhome:

- Perform a full interior **inspection** for water leaks every two weeks while the motorhome is in storage. Check inside all cabinets for signs of dampness or leaks. **Inspect** the ceiling areas around roof vents or other roof openings.
- The roof and sidewall seams should be **inspected** every two weeks and cleaned at least twice a year. **Inspect** for exterior sealant gaps of all roof seams, vents, skylights, roof air conditioners and windows.

Fuel:

Storing the motorhome with a full tank of fuel will minimize moisture condensing at the top of the tank. Diesel fuel is an organic material which will develop a microbe growth (black slime). Fuel stabilizers may be added to control microbe growth and degrading of the fuel. Consult the engine manufacturer owner's manual or a distributor for further detailed information on fuel stabilizers and additives.

Brakes:

Brakes suffer from non-use during periods of storage. The bare metal machined surfaces of brake drums or rotors have only a light coating of dust from the brake lining friction material. The brake dust is the only thing protecting the bare metal surfaces from rusting. Only regular brake applications dry the moisture preventing rust on brake drum or rotor surfaces. During periods of non-use, oxygen and moisture oxidize the machined surfaces. Only occasional use keeps these surfaces from oxidizing. Rusty brake drum or rotor surfaces permeate the brake lining upon the first few applications, reducing the friction action of the linings.

Engine:

Internal combustion engines need to be exercised on a regular basis to ensure an adequate supply of lubricating oil coats the cylinder walls and piston rings. Valve and valve seat surfaces also suffer from non-use. Some valves will remain open depending at which part of the combustion cycle the engine has stopped. The heat and cold of the day allows moisture to accumulate through the exhaust system. Start the motorhome engine every two weeks and the generator at least once a month.

Electric Motors:

Electric motors in the motorhome should be occasionally operated to help lubricate and keep surfaces rotating freely. These items include the roof air conditioners, dash fans, dash blower motor, Aqua-Hot motors, heat exchangers and powered roof vents.

Winter Storage Checklist

- **Plumbing Lines** - Drain and protect. (See **Winterizing - Section 6**)
- **Fresh Water Tank** - Drain.
- **Body** - Clean and wax. Oil locks and hinges. Repair roof seams as needed.
- **Countertop and Cabinets** - Wash with mild soap and water.
- **Curtains** - Remove and clean according to care specifications.
- **Windows** - Cover windows by pulling blinds, closing shades or using a separate cover such as a sheet.
- **Holding Tank** - Drain and rinse. Close valves.

LUBRICATION:

Add a small amount of antifreeze to waste holding tanks to keep valves and gaskets lubricated.

- **Drain Traps** - Pour RV antifreeze down all drains.
- **Refrigerator** - Clean and leave both doors propped open. Cover the exterior panels and roof vents.
- **Batteries** - Add distilled water and recharge if needed. If necessary, disconnect the cables, remove the batteries and store them in a cool dry place. Check and recharge as needed.
- **Air Conditioner** - Remove the air filters. Clean or replace.
- **Roof** - Keep clear of snow accumulation or damage may occur.
- **Interior/Exterior** - Storing under cover or indoors helps extend interior and exterior life.
- **Fuel Tank** - Diesel fuel tank should be full of fuel.

Removal from Storage

If the motorhome was properly and carefully prepared for storage, removing from storage will not be difficult. The following checklist pertains to items or areas which should be checked before operating or moving the motorhome. If the motorhome was not properly winterized, extensive freeze damage or other serious deterioration may have occurred. Consult a dealer or an authorized service center for advice.

- Thoroughly **inspect** the outside of motorhome. Look for animal nests in the wheel wells or in other out of the way places.
- Remove all appliance flue vent covers, ceiling vent covers and air conditioning covers. Be sure the refrigerator openings are free of debris, insect nests, webs, etc.
- Open all doors and compartments. Check for animal or insect intrusion, water damage or other types of damage which may have occurred.
- Check the state of charge of the batteries. If necessary fill the cells with distilled water only and charge as necessary. **Inspect** the cable ends and terminals. They should be clean and free of corrosion.
- Check all the chassis fluid levels: engine oil, engine coolant, hydraulic fluid reservoir, transmission oil and rear axle oil.
- Start the engine, allowing it to reach operating temperature. Ensure the engine instruments are indicating proper readings.
- While the engine is running check the operation of headlights, taillights, turn signals, back-up lights, license plate light and emergency flasher. Operate the dash air conditioner. If the air conditioner does not work, or the compressor makes an unusual noise, have the system checked by a qualified air conditioner technician.
- Shut the engine down. Adjust or add fluids as necessary. **Inspect** the engine for fluid leaks. Look under the motorhome for fluid leaks.
- Drain, sanitize and flush the fresh water system as outlined in the **Water Systems - Section 6**. **Inspect** the sewer drain hose and connections for leaks. Replace if necessary.
- Operate all faucets and fixtures in the fresh water system. Run a sufficient amount of fresh water through all the water lines and faucets to thoroughly purge any potable antifreeze from the fresh water system.

NOTE:

Discard at least the first two trays of ice from the icemaker to ensure the ice does not contain traces of antifreeze or other contaminants.

- Open cabinet doors and drawers. **Inspect** for water leaks at joints or fittings. Repair as necessary.
- Operate all 12 Volt DC lights and accessories. If something does not work there may be a bad 12 Volt circuit breaker or blown fuse.
- Install new batteries in battery operated safety detectors or devices. Test the Carbon Monoxide, LP-Gas and smoke detectors for proper operation.
- Check that the monitor panel is properly functioning.
- **Inspect** the 120 Volt AC electrical system which includes the power cord, inverter/converter, all outlets and exposed wiring.

NOTE:

Prepare the generator for operation following the instructions in the Generator Manual.

- Start and run the generator.
- Confirm that the batteries are charging. Operate the 120 Volt AC appliances and air conditioners. If an electrical item or appliance is not properly functioning, contact the dealer or an authorized service center to have it evaluated.

- Have a qualified technician **inspect** the LP-Gas system and perform an LP-Gas leak test. The leak test should also include an LP-Gas regulator adjustment (if needed). The test can also verify if the regulator is faulty and should be replaced. Have the LP-Gas tank **inspected**.
- Operate each LP-Gas appliance. Observe all burner/pilot flames for proper color and size.
- **Inspect** and clean the interior.
- Check the sealant around all roof and body seams and windows. Reseal if necessary.
- Lubricate all the exterior locks, hinges and latches with a graphite lubricant.
- Check the windshield wiper blade condition. Check the wiper/washer operation.
- Wash and wax the exterior. Check the body for scratches or other damage; touch up or repair as necessary. Flush the underside thoroughly.
- Run through the operational checks for steering, brakes, engine and transmission. Operate the motorhome slowly during these checks to allow sufficient circulation of fluids and resetting of the components.
- If desired, have the dealer or repair center double-check preparation to make necessary adjustments and/or correct defects.

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APPLIANCES

Introduction

This section covers operation and care of appliances in the motorhome: a refrigerator, cooktop range, microwave, roof air conditioner and optional appliances. These appliances operate on AC or DC current, LP-Gas or a combination of the three.

INFORMATION:

Detailed information with CAUTION or WARNING instructions for the various appliances, other than what is found in this section, can be found in the manufacturer's manuals.

WARNING:

Turn OFF all LP-Gas operated appliances before entering any type of refueling station. Most LP-Gas appliances used in recreational vehicles are vented to the outside. It is possible for fuel vapors to enter this type of appliance (when parked close to a gasoline pump) and ignite, resulting in an explosion or fire.

WARNING:

Carbon Monoxide gas may cause nausea, fainting or death. Operating an LP-Gas appliance with inadequate ventilation or partial blockage of the flue can result in Carbon Monoxide poisoning. DO NOT store flammable liquids such as lighter fluid, gasoline or propane in the outside refrigerator compartment.

NOTE:

Features and options vary with floorplans.

REFRIGERATOR

The motorhome refrigerant is heated to circulate and vaporize using gravity. To ensure longevity and proper operation of the refrigerator, follow the specific guidelines in the refrigerator manual. With proper care and maintenance, the refrigerator should provide years of trouble-free service.

INFORMATION:

Refer to the refrigerator manual for detailed operating and maintenance instructions.

NOTE:

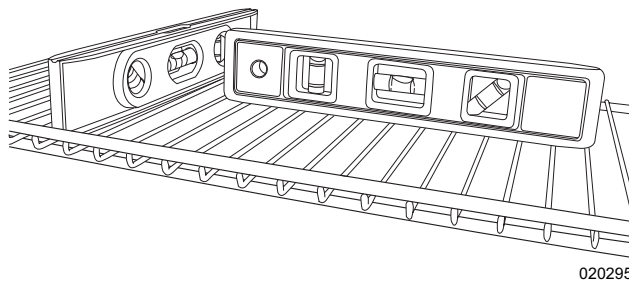
To reduce the possibility of food spoilage, keep the interior box temperature at or below 40° F. The refrigerator will consume more energy to maintain low temperature, especially in hot, humid climates. Lower temperature may also lead to quicker frost build-up.

Operation Specifics

- The refrigerator operates from LP-Gas or 120 Volts AC electric.
- DC Voltage must be no higher than 15.4 Volts DC or lower than 10.5 Volts DC.
- AC voltage must be no higher than 132 Volts AC or lower than 108 Volts AC.

CAUTION:

Operate refrigerator only when level. Level the refrigerator using a torpedo or bulls eye (fence post) level. Place the levels on the bottom shelf of the refrigerator. The level should be within the circle by a half of a bubble. Generally, this is within comfortable living conditions.



NOTE:

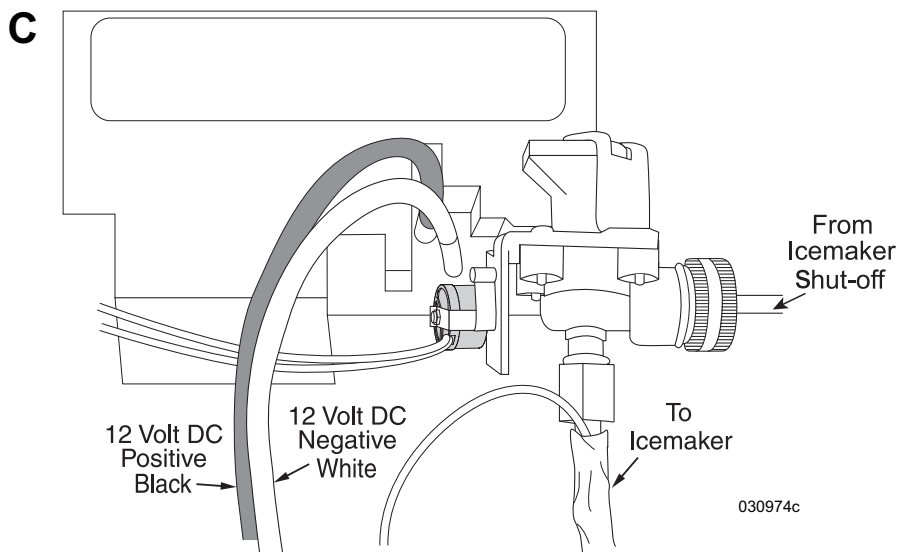
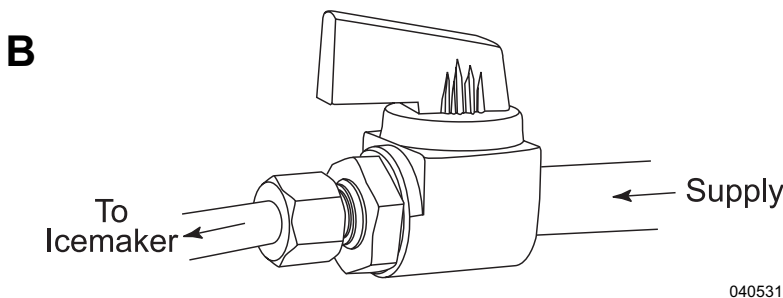
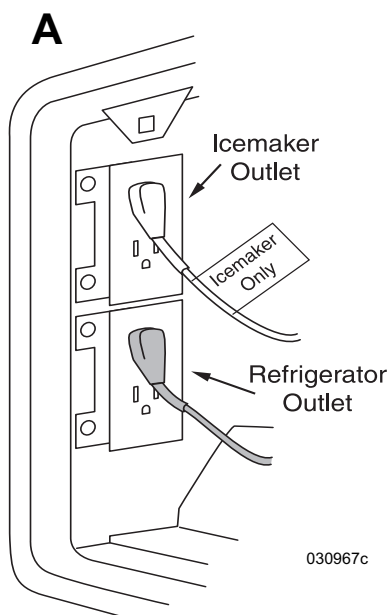
Operating the refrigerator “off level” separates chemicals, causing them to crystallize and block the circulation action of the cooling unit. Damage is cumulative and irreversible.

WARNING:

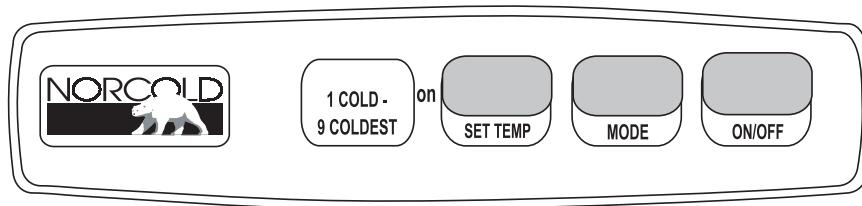
DO NOT use the refrigerator if there is an ammonia smell inside or outside of the refrigerator, or if a yellowish substance appears inside or at the outside access compartment. This can be an indication of a refrigerant leak. Contact an authorized repair facility.

For the refrigerator to operate:

- The house batteries must be fully charged.
- The primary LP-Gas valve and the electric LP-Gas valve must be on, or an AC source must be available.
- **Figure A:** The refrigerator 120 Volt AC cord(s) must be plugged in (located outside behind refrigerator access door).
- **Figure B:** The icemaker shut-off valve, located in the interior access below the refrigerator, must be opened if the system is equipped with an icemaker.
- **Figure C:** If the controls do not light up, check the house batteries charge status or see if the 12 Volt DC wires are plugged into the refrigerator’s circuit board (located outside behind refrigerator access door).



Control Panel



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- **ON/OFF Button** - Turns the refrigerator **ON** or **OFF**.
 - Push the **ON/OFF** button to start the refrigerator in Auto mode.
 - Push and hold the **ON/OFF** button for two seconds to shut it **OFF**.
- **LED Display** - This screen is used for mode, temperature and fault code display.
- **MODE Button** - Controls the operation mode of the refrigerator.
 - Push the **MODE** button to select between Automatic **AU**, **AC** or **LP** operation.
- **SET TEMP Button** - Adjusts the temperature.
 - To adjust push and hold the **SET TEMP** button.
 - Number **9** is the coldest setting.

Manual Mode:

When one of the two manual modes is selected:

1. **AC** = The refrigerator is operating on AC electric.
2. **LP** = The refrigerator is operating on LP-Gas.

Automatic Mode (AU):

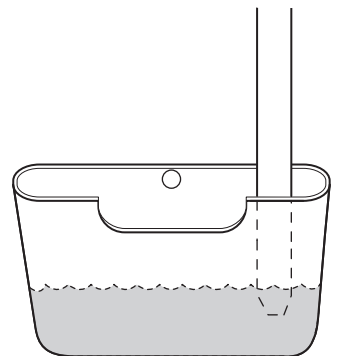
This feature selects AC over LP-Gas operation. If AC discontinues the alarm sounds and the refrigerator switches to LP-Gas operation. If the refrigerator fails to light, the alarm sounds and a code displays.

- Press and hold the **MODE** button until **AU** displays. Release the button.
- Press and hold the **TEMP SET** button until the desired temperature displays. Release the button.
- In **AUTO** mode, **AU/AC** or **AU/LP** will alternate three times when a mode has changed.

If the LP-Gas does not ignite within 30 seconds, the control changes to a different energy source or the gas safety valve closes and **NO FL** displays. Turn the refrigerator **OFF** then back on. If the gas does not ignite after several attempts consult a dealer or authorized Norcold service center.

Tips:

- Cool items first, if possible, before putting them into the refrigerator.
- Keep the doors shut. Know what you want before opening the doors.
- Allow the refrigerator 24 hours of operation before actual use to help get a head start with the refrigeration process.
- A box of open baking soda will help absorb food odors.
- Refrigerator icing can be slowed in high humidity if the end of the drain tube is submersed in drip pan. It may be necessary to add water to the drip pan to keep the drain tube submersed.



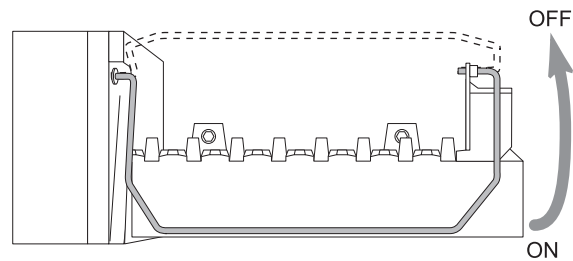
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Drip Pan: Located behind the outside access.

Icemaker (Optional)

The icemaker requires 120 Volts AC to operate. Only after the freezer reaches freezing temperature will the icemaker function. City water or the water pump must be on and the valve for the water supply line to the icemaker must be on.

- Pull the metal arm (bail) down to turn the icemaker **ON**.
- Push the arm up to turn the icemaker **OFF**.

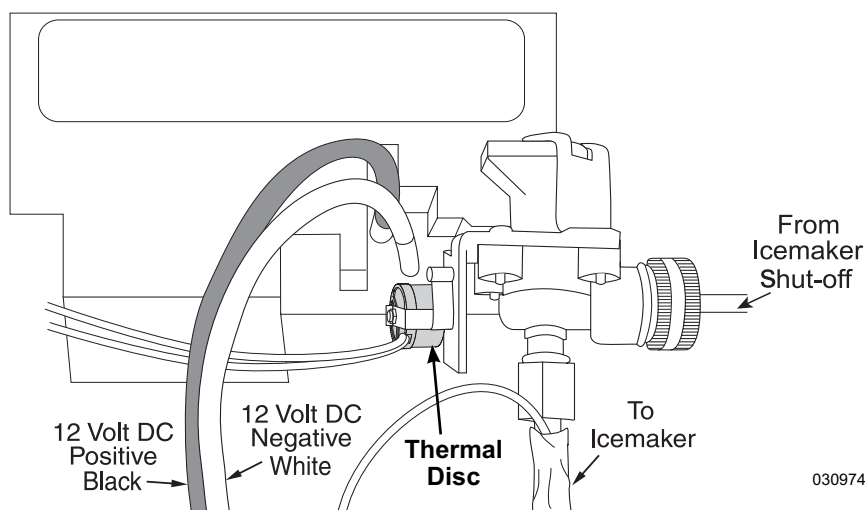


NOTE:

Water may spill out of the ice tray when the icemaker is in operation while the motorhome is in motion. Raise the icemaker arm to stop ice production while in transit. DO NOT use the first one or two trays of ice if the refrigerator has been in storage. Ice cubes may have contaminants. DO NOT operate the icemaker without water pressure supplied to the refrigerator as this can damage the icemaker assembly.

Water Line Heater:

A thermal disc supplies voltage to heater tape when ambient temperature is less than 38° F (+/- 4°) and shuts off at temperature greater than 48° F (+/- 5°). The water line heater is only for the line from the solenoid to the icemaker. The line from the icemaker shut-off valve to the water valve is not protected.



Refrigerator Alarm

The refrigerator uses an audible alarm that will sound for the following reasons:

1. DC or AC voltage is higher or lower than allowed.
2. Refrigerator is set to Auto, 120 Volts AC is discontinued and LP Gas fails to light.
3. The refrigerator fails to light on LP-Gas or fails to light after a period of operation.
4. Door is open longer than two minutes.
5. The circuit board detects a failure. The control panel will display a code.

NOTE:

If the alarm sounds, note the code in the LED display and turn the refrigerator off to silence the alarm.

INFORMATION:

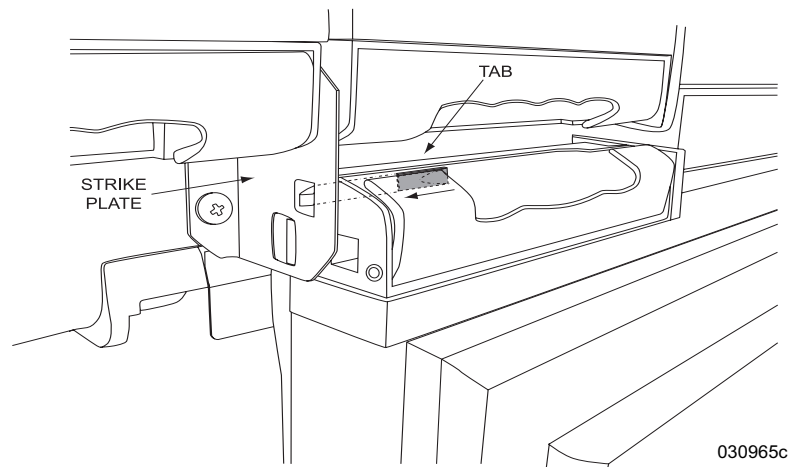
Refer to the manufacturer's manual for the list of codes and their meanings.

Cooling Unit Fans

The cooling unit is equipped with a pair of cooling fans that pass air across the cooling unit. These fans start automatically and are audible when in operation.

Doors

The refrigerator doors use a positive latch that secures the door with a “click” to prevent the door from opening during travel. The doors use a heating element located in the flapper on the left door. The heating element activates when operating the refrigerator in any mode to help prevent moisture accumulation in high humidity conditions.



In storage, a completely sealed refrigerator is a perfect environment for mold and bacteria to grow. When storing the motorhome, reduce odor from mold and bacteria in the refrigerator by using the door storage feature to lock the doors partially open. To use the storage feature, open doors enough to slide tab into the cut-out of the strike plate.

Storage Procedures

Storage Feature:

- Turn the refrigerator **OFF** and remove all items. Leave the drip tray under the cooling fins.
- Shorten defrost time by using trays of warm water. **DO NOT** use a heating gun, hair dryer or sharp objects to remove frost as these can damage the interior or cooling unit.
- Wash the interior using mild spray cleaners or a solution of liquid dish detergent and warm water. **DO NOT** use scouring pads or abrasive cleaners as these can damage the interior finish.
- Rinse with a solution of baking soda and water. Dry with a clean cloth.
- Lock the doors open.

CAUTION:

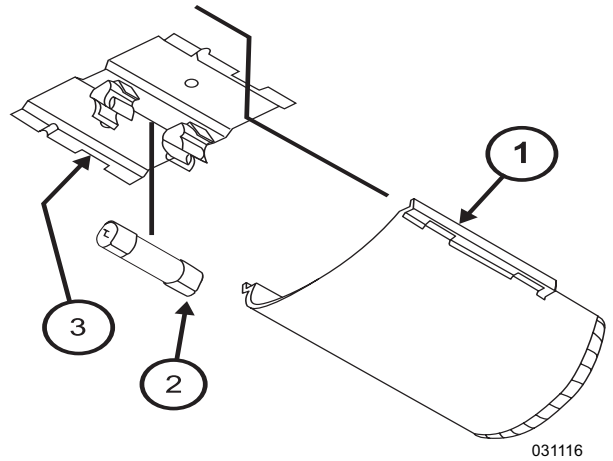
DO NOT use a hot air blower when defrosting. Permanent damage could result to plastic parts. **DO NOT** use a knife, ice pick or any other sharp instrument to remove ice from the freezer as they can puncture the system.

Interior Light

The interior light is located at the top of the fresh food compartment. When the door is open the light will illuminate.

Bulb Replacement:

1. Remove the light cover by pulling it toward the front of the refrigerator.
2. Remove the light bulb from the holder.
3. Install a GE#214-2 replacement bulb and install the cover.



Service

The LP-Gas function of the refrigerator and LP-Gas pressure will require annual service. Over time, the BTU rating of the flame can change, affecting the refrigerator's performance. Ambient temperature, high humidity and altitude above 5,500 feet can affect performance and function. If possible, switch mode operation to AC while at a higher altitude.

Air in LP-Gas Supply Lines

For safety reasons, the refrigerator will attempt to ignite on LP-Gas within a specified amount of time. When starting the refrigerator for the first time after storage, or after servicing the gas supply system, LP-Gas supply lines may contain air. Due to the air in the gas supply lines, the refrigerator may not ignite on LP-Gas within the specified amount of time. Follow the procedure on how to remove air from the LP-Gas supply lines.

To remove the air from the LP-Gas supply lines:

- Ensure the primary LP-Gas valve and the electric LP-Gas valves are open.
- Try lighting the cooktop burners first to quickly purge air from the main distribution line.
- Push the **ON/OFF** button to turn the refrigerator on.
- Press the **MODE** button until the refrigerator indicates LP. The refrigerator will start a 30 second trial for ignition during which the gas safety valve opens and the igniter sparks.
- If the refrigerator fails to light, indicated by **NO FL** (No Flame), turn the refrigerator off then back on and set to LP mode. If after the third attempt the refrigerator fails to light, stop and consult your local dealer or an authorized Norcold Service Center.

MICROWAVE/CONVECTION OVEN

The microwave/convection oven operates from 120 Volt AC supplied by shore power, the generator or the inverter.

Operation Tips:

- Check the type of cookware being used to see if it is microwave or oven safe depending on the type of cooking being done. Gold paint or glaze may contain a trace amount of gold which is electrically conductive and not compatible for microwave. Hand painted china commonly contains traces of metal.
- The glass tray and roller guide must always be in place during cooking.
- Ensure the door is firmly closed before use.
- If the control pad is not lit, plug another electrical appliance into the same outlet to verify 120 Volt AC power is present. If the test item works, contact an appliance repair facility to have the microwave/convection oven checked.
- Steam accumulating inside or around the outside of the oven door may occur when the microwave/convection oven is operated under high humidity conditions and in no way indicates a malfunction of the unit. Wipe away condensation using a soft cloth.

Microwave/Convection Oven Facts:

One of the most useful documents for the microwave/convection oven is the operator's manual, located in the owner's information file box. Read it carefully and keep it for reference.

A properly functioning microwave/convection oven presents no hazard with ordinary use. Safety features should be kept in good condition. Never attempt to bypass safety interlocks or allow debris or residue to accumulate on the door or oven face. If the oven is damaged, discontinue use.

Oven adjustments or repairs should be made by qualified service personnel. Check the microwave/convection oven owner's manual for maintenance tips and other information. Remember to register the microwave/convection oven with the manufacturer.

WARNING:

If a fire flares up when using the cooktop, turn OFF the ventilation fan. The fan may spread the flame. If the ventilation fan has started automatically from a heated cooktop, it can not be manually turned off. Turn OFF the microwave AC circuit breaker to prevent the flame from getting up into the microwave and spreading the fire.

NOTE:

Minimize inverter use to operate the microwave/convection oven when dry camping due to the high rate of battery consumption.

NOTE:

The microwave/convection oven is for food preparation only. DO NOT use the microwave/convection oven to dry clothes, newspapers, shoes or other items.

Setting the Clock

To Set Clock:

- Press the **STOP/CLEAR** pad.
- Press the **CLOCK** pad.
- Enter correct time in sequence using the number pads.
- Press the **CLOCK** pad to begin time.

NOTE:

The clock is a 12 hour clock only.

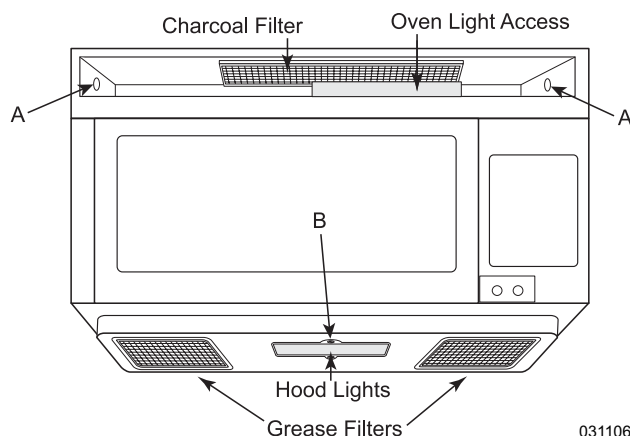
Cleaning the Microwave/Convection Oven

The exterior of the microwave/convection oven is plastic and metal. The interior is metal. **DO NOT** clean with scouring pads, harsh or abrasive cleaners, chemical cleaners or petroleum based thinners that can damage the finish. Use mild soap and water with a damp cloth or paper towel to remove stains or spills. When cleaning the touch pad, open the door to prevent accidental operation. Use mild soap and water with a soft cloth. Avoid using excess amounts of water on the touch pad. The turntable plate and oven racks are dishwasher safe.

Charcoal Filter:

Depending on use the charcoal filter should be replaced every 6 to 12 months. Use the following procedure to remove the louvers to replace the charcoal filter and oven light.

1. Remove power to the microwave/convection oven.
2. Remove the screws **(A)** securing the louver.
3. Insert a flat edge screwdriver over each tab pressing downward and move the louver away from the microwave.
4. Remove and replace the charcoal filter ensuring the filter is positioned on the supporting tabs.
5. Replace louver and mounting screws.



Oven Light:

1. Remove the louver as indicated above.
2. Slide the metal light cover forward and lift upwards.
3. Remove the light bulb and replace only with an equivalent watt bulb. **DO NOT EXCEED 30 WATTS.**
4. Replace light cover, louver and mounting screws.

Hood Light:

1. Remove power to the microwave/convection oven.
2. Remove the screw **(B)** securing the light cover.
3. Remove the light bulb and replace only with an equivalent watt bulb. **DO NOT EXCEED 30 WATTS.**
4. Close the cover and re-secure with screw.

CAUTION:

Light cover may be hot. DO NOT touch glass with lamp ON. Never use the light for prolonged periods, such as a night light.

Grease Filters:

Operating the microwave/convection oven without the grease filters in place can damage the unit. Grease filters should be cleaned at least one a month. To remove the filters, use the pull-tab to slide the filter to the end of the opening and tip down. Soak the filters in the sink or in a dishpan filled with hot water and detergent.

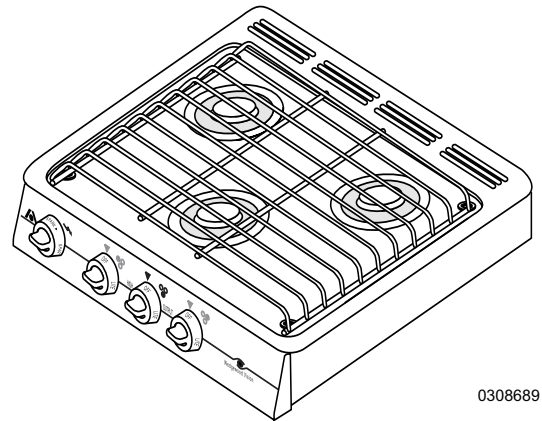
- **DO NOT** use ammonia or other alkali-based products that may darken the filter material.
- Agitate the filter. Use a scrub brush to remove caked on grease.
- Rinse the filter thoroughly and shake dry. Place the filter back into the opening, tip upward and slide filter to the end of the opening. Lock in place. Be careful not to kink or warp the filter upon installation.

Cleaning Tips:

- Turn the oven **OFF** before cleaning.
- Cover food while cooking to keep food spattering to a minimum.
- Clean up all spills or spatters before they dry. Wipe up food spatters or spilled liquids with a damp cloth. Mild detergent may be used for stubborn spills. **DO NOT** use harsh detergent or abrasive cleaner.
- It is occasionally necessary to remove the glass tray for cleaning. Wash the tray in warm, sudsy water or in a dishwasher.
- The roller guide and oven cavity floor should be cleaned regularly to avoid excessive noise. Wipe the bottom surface of the oven with mild detergent water or window cleaner and then dry. The roller guide may be washed in mild sudsy water.
- Food odors may linger inside oven. To help eliminate odors, combine the juice and the peel from one lemon, several whole cloves and 8 oz. of water into a two cup bowl. Place in oven on high power; bring to a boil for several minutes. Let cool in the oven for several minutes.
- Clean the outside oven surface with soap and water. Wipe away any residue using a damp cloth. Dry with a soft cloth. To prevent damage to the operating parts inside the oven, do not allow water to seep into the ventilation openings.
- If the control panel becomes wet, clean with a soft, dry cloth. **DO NOT** use harsh detergents or abrasives when cleaning the control panel.

COOKTOP

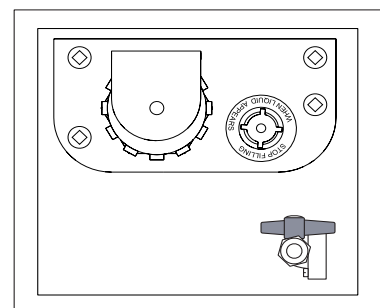
The cooktop uses LP-Gas only as a fuel source. The burners use a piezo type igniter. The cooktop should be used for cooking purposes only and not as a heating source. When the burner valve is opened the fuel source flows through the valve into the mixture tube. The fuel passes by a hole or venturi in the mixture tube, which draws air in with the fuel for a proper fuel/air ratio. The flame should have a blue appearance with a lighter blue defined flame at the burner head. A yellow flame or yellow tips indicate a rich fuel mixture, which can leave a black color or carbon on the bottom of a pot or pan.



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The cooktop will operate when the following conditions are met:

1. The primary LP-Gas valve on the LP-Gas tank is open.
2. The remote LP-Gas switch is on.
3. The battery cut-off switch is on.

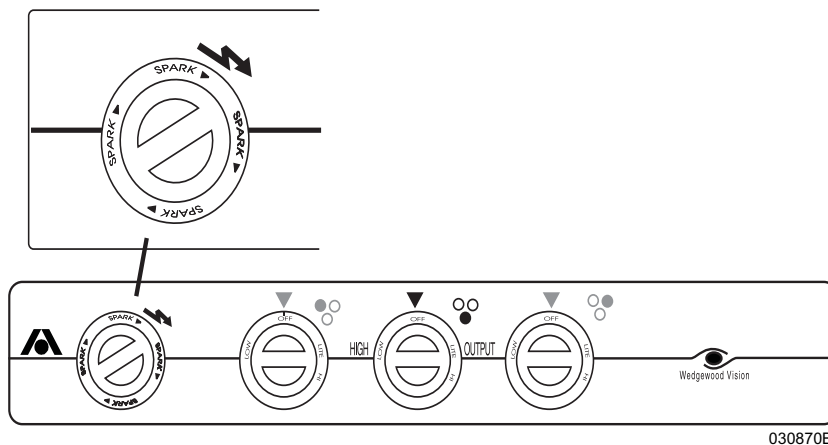


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Electric LP-Gas Switch

Lighting Cooktop Burners

- Turn the appropriate burner knob counterclockwise to **LITE**. **DO NOT** attempt to light more than one burner at a time.
- Turn the **SPARK** knob, located at the left hand side of the cooktop, clockwise one click. If the burner fails to light, continue turning the **SPARK** knob clockwise until the burner lights.
- To turn the burner off, turn the burner knob clockwise to the **OFF** position.
- Never close the cover while the burners are in use.



WARNING:

DO NOT heat the motorhome interior with the cooktop or optional oven. Gas combustion consumes oxygen inside the motorhome. Carbon Monoxide is an odorless, colorless and highly poisonous gas.

WARNING:

If you smell gas, extinguish all open flames and turn **OFF** the main gas supply. Liquid propane is highly volatile, highly explosive and extremely dangerous. Explosion, fire, property damage, injury or death can result. Propane is a heavy gas and will lay on the floor and hide in corners. Open all windows and doors. **DO NOT** touch any electrical switches. They may cause a spark which can ignite. Contact a qualified service center to have the problem correctly diagnosed and repaired before resuming operation.

Operation Tips:

1. A yellow flame is an indication of incorrect fuel/air ratio. Lowered BTU output and carbon build up can occur.
2. Flame appearance may change and BTU output will lower when operating the cooktop at an altitude above 5,000 feet. Allow extra cooking time.
3. **DO NOT** allow the tips of the flame to extend beyond pan or pot edge. When this occurs heat is wasted and possibility of injury increases.
4. Remove cooktop cover to help keep the underside of the cooktop clean. Place strips of aluminum foil on the cooktop floor pan and under burners. **DO NOT** restrict air flow of mixture tubes.
5. Pre-heat the oven for 10 minutes prior to use.

Burner Grate

Removing the burner grate and cooktop cover for cleaning:

- Place a towel on the counter next to the cooktop.
- Remove the burner grate by lifting out of rubber inserts of cooktop cover and place on towel.
- Remove the cooktop cover up by pushing cover toward rear of cooktop and lift cover at the front edge. Place cooktop on the towel.

Cleaning

- Clean all surfaces as soon as possible after boil overs or spillovers.
- Use warm, soapy water to clean the burner grates, cooktops, painted surfaces, porcelain surfaces, stainless steel surfaces and plastic items on the range or cooktop. Grit or acid-type cleaners may ruin the surface.
- Use only non-abrasive plastic scrubbing pads.
- **DO NOT** allow foods containing acids (such as lemon or tomato juice or vinegar) to remain on porcelain or painted surfaces. Acids may remove the glossy finish. Wipe up egg spills when cooktop is cool.
- Allow porcelain surfaces to cool before cleaning. Burns from the heated surface may occur or the cooktop porcelain can crack.

Regular cleaning with a soft cloth and a warm detergent solution is generally enough to keep the cooktop clean. Wash, rinse and dry with a soft cloth. Thoroughly clean the cooktop when it is cool. Use a dry cloth or paper towel while the surface is warm to the touch to clean splatters or spills. Cleaning will be more difficult if spills bake on to the surface. Glass cleaner sprayed on a paper towel should be used for the cooktop surface. **DO NOT** spray glass cleaner directly on the surface. **DO NOT** use abrasive cleaners or steel wool. Harsh cleansers like bleach, ammonia and oven cleaner should **NEVER** be used. The surface burner grate and caps should be cleaned using the same guidelines as the cooktop surface.

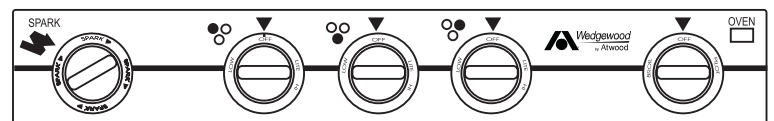
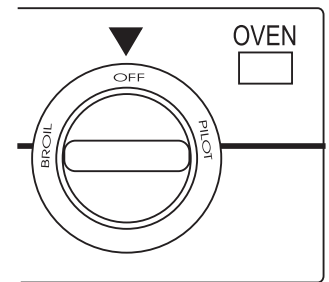
Porcelain Enamel:

Porcelain enamel, a type of glass fused on steel at a very high temperature, is not extremely delicate but must be treated as glass. Sharp blows, radical surface temperature changes, etc., will cause enamel to chip or crack. Some foods such as vinegar, lemon juice, tomatoes and milk contain acids which can dull the finish of the enamel. To avoid dulling the finish, wipe up the spill before it is baked on. **DO NOT** use steel wool or coarse, gritty cleanser as these will scratch or mar the surface. Gentle kitchen cleanser powder or grease cleaner are suitable. For further information on care of the porcelain, call “*Hopes Cultured Marble Polish*” at 800-325-4026.

COOKTOP WITH OVEN (Optional)

The cooktop range/oven is operated and maintained the same as the cooktop only with an oven. This option allows for a wider variety in floor plans and provides more storage space.

- The oven may be used with the cover on. **DO NOT** block vent openings on cover.
- Push in the oven control knob and rotate counterclockwise to **PILOT ON**.
- Manually light the oven pilot located near the back of the oven, under the broiler shelf and to the left of the oven burner.
- Set the oven control knob to **PILOT ON** to maintain pilot flame. The oven and broiler are now ready for operation. The oven pilot has been factory set and requires no further adjustment.
- To extinguish the oven pilot push in the oven control knob and rotate clockwise to **OFF**.



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WARNING:

Extinguish all pilots when refueling or traveling. DO NOT block vents in oven with cookware or other objects.

WALL THERMOSTAT

The wall thermostat operates the HVAC (Heating, Ventilating and Air Conditioning) system. The thermostat requires 12 Volts DC to operate.

Fan Operation:

- Move the **Fan** switch to the **ON** position.
- Set the thermostat to the desired temperature.
- Use the **HI/LOW** switch to select the fan speed.

Air Conditioner Operation:

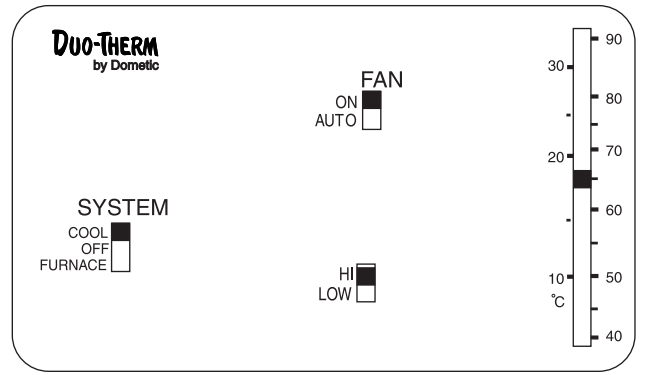
- Move the **System** switch to **Cool** and the Fan switch to **Auto**.
- Set the thermostat to the desired temperature.
- Use the **HI/LOW** switch to select the fan speed.

NOTE:

The thermostat in the bedroom performs the same function as the living room thermostat. The Furnace position on the bedroom thermostat is nonfunctional on all models except the 36' PDQ model.

Furnace Operation:

- Set the **Fan** switch to **Auto**.
- Set the thermostat to the desired temperature.
- Set the **System** switch to **Furnace**.



Standard Wall Thermostat

050235b

Comfort Control (Heat Pump Equipped Models Only)

The optional comfort control operates the HVAC (Heating, Ventilating and Air Conditioning) system. The comfort control is located in the hallway on the monitor panel. The comfort control uses a liquid crystal display to show the current mode status.

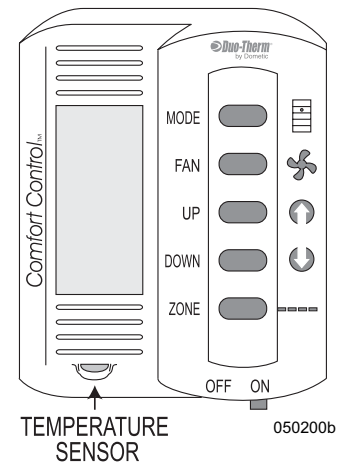
Five different modes of the Comfort Control system:

Off, Fan, Cool, Heat Pump (optional) and **Furnace**. These are selected by repeat pressing of the **Mode** button. The **Fan** button controls the fan speed of the roof air conditioner. Low and high fan speed control applies only to the blower speed of the roof air conditioner. Selecting the fan speed auto adjusts the fan speed automatically, depending on temperature set point and actual temperature in a selected zone.

The motorhome is divided into two operating zones. The living room is **Zone One**, and the bedroom is **Zone Two**. Press the **Zone** button to change zones. The selected zone will flash. The **up** and **down** buttons control the temperature in any mode.

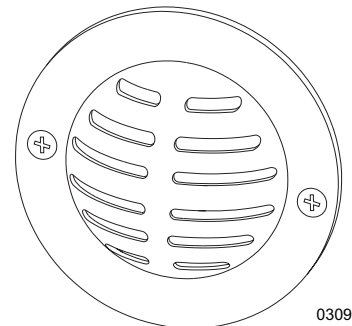
NOTE:

The Comfort Control must be on to operate any HVAC function.



TEMPERATURE SENSOR

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Remote Temperature Sensor

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NOTE:

The motorhome will not heat or cool faster by selecting a very high or very low temperature setting.

NOTE:

Conflicting modes cannot be selected. One zone cannot be set to heat mode while another zone is set to cool mode.

Fan Operation:

Interior air is circulated using the roof air conditioner blower. The fan speed controls the roof air conditioner blower speed in the following modes: **Fan**, **Cool** or **Heat Pump**.

- Slide the **On/Off** switch (on hallway thermostat) to the **On** position.
- Press the **Mode** button repeatedly until **Fan** is displayed.
- Press the **Fan** button to select fan speed.

Air Conditioner Operation:

- Slide the **On/Off** switch (on hallway thermostat) to the **On** position.
- Press the **Zone** button to select **Zone 1** (front roof A/C) or **Zone 2** (rear roof A/C).
- Press the **Mode** button repeatedly until **Cool** is displayed.
- Select fan speed by pressing the **Fan** button.
- Set desired cooling temperature in each Zone by pressing **Up** and **Down** buttons.

Furnace Operation:

- Slide the **On/Off** switch (on hallway thermostat) to the **On** position.
- Press the **Zone** button to select **Zone 1** (36" floorplan has a two Zone furnace).
- Select the **Furnace** mode on the Comfort Control using the **Mode** button.
- Select the desired temperature using the **Up** and **Down** arrow buttons.

Heat Pump Operation (not available with standard thermostat):

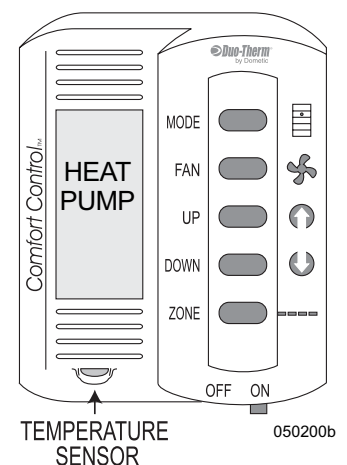
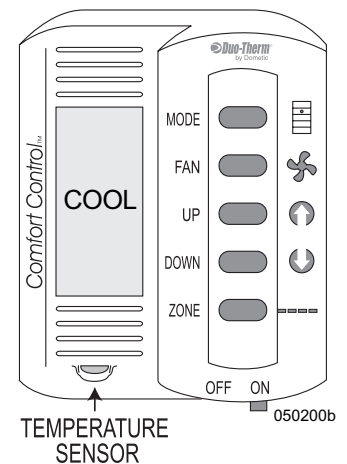
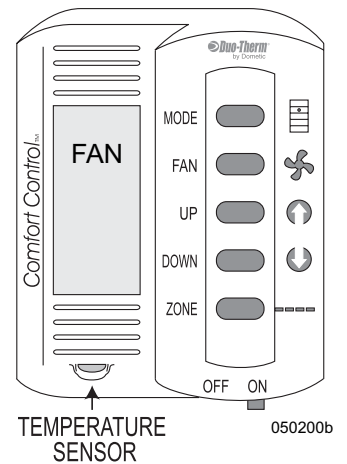
The **Heat Pump** mode supplies heat by using the air conditioner. The air conditioning principle is reversed, supplying heated air to the ceiling registers instead of refrigerated air.

NOTE:

The roof air conditioner will not operate in Heat Pump mode with ambient temperatures at or below 30° F. Aux Heat mode will automatically be selected.

When ambient temperature is between 30 to 42° F., a defrost cycle is initiated approximately every 40 minutes of compressor operation. The blower motor will stop for five minutes and **Defrost** will display. After the defrost cycle the Heat Pump operation will resume.

- Slide the **On/Off** switch on the thermostat to the **On** position.
- Press the **Zone** button to select **Zone 1** or **Zone 2**.
- Press the **Mode** button repeatedly until **Heat Pump** is displayed.
- Set desired fan speed by pressing the **Fan** button.
- Press the **Up** or **Down** buttons to set desired heating temperature.



Auxiliary Heat - If the Heat Pump mode is selected at or below 30° F, or if operating in Heat Pump mode and temperature drops to 30° F, the air conditioner will stop Heat Pump operation and **Aux Heat** will be displayed. The furnace will be selected as the auxiliary heat source and will begin operation. The furnace will remain the primary heat source until ambient temperature rises above 42° F.

AIR CONDITIONER - ROOF

The roof air conditioners operate from 120 Volts AC, supplied by shore power or the generator. 12 Volt DC is required to operate the wall thermostat.

NOTE:

The air conditioning system freezes moisture in the air. It is recommended to set the blower fan speed to high when operating in high humidity.

Operation

Roof Air Conditioner Operation Requirements:

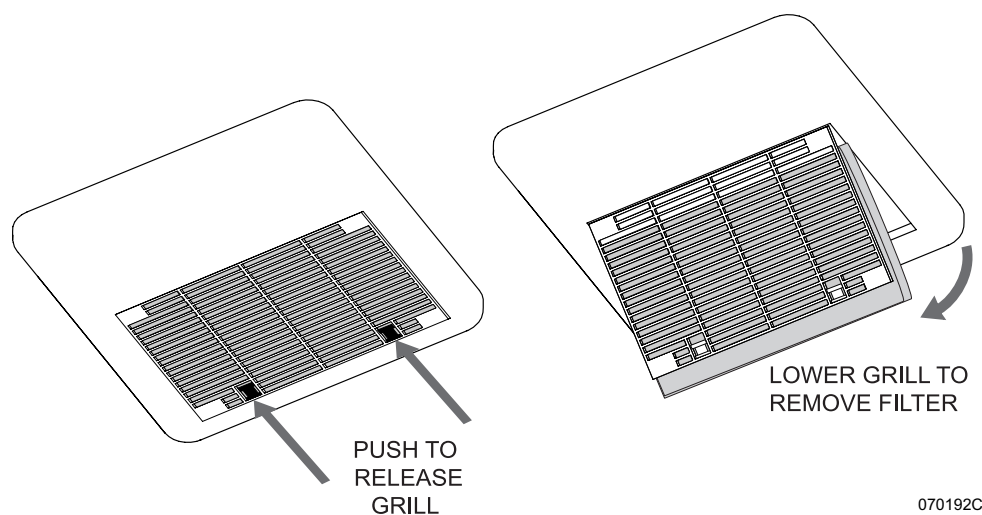
- 120 Volts AC from either shore power or the generator.
- The interior house power is on and house batteries are charged.

Return Air Filters

Frequently clean the return air filters, which are located inside the motorhome behind the intake vent covers. To access the filters, firmly grasp the leading edge and push back on both tabs. Never run the air conditioner without the return air filters in place. Dust and other particles will plug the evaporator core and substantially reduce the performance of the air conditioners.

To Clean:

- Wash filters in warm soapy water. Do not use solvents.
- Rinse filters thoroughly with fresh water. Allow them to dry.
- Install filters and secure the covers.



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FURNACE

The furnace and its related components are 12 Volt DC operated and use LP-Gas as the fuel source. Electronic circuitry (automatic ignition) is used to ignite the burner. The furnace uses outside air for the burner combustion, and exhaust is expelled through the outside vent. Inside air is drawn into the furnace and blown across the internal heat exchanger. Heated air is then discharged through ducted hoses which can be run throughout the motorhome.

CAUTION:

Do not store any items/materials in furnace area. Restricted air flow may hamper furnace operation leading to failure and/or fire hazard.

WARNING:

IF YOU SMELL GAS extinguish all open flames and turn off the main gas supply. Liquid propane is a highly volatile, extremely dangerous gas. It can explode or ignite, resulting in property damage, injury or death. Propane is heavy and can float on the floor or hide in corners. Open all windows and doors. Do not touch electrical switches, which can spark and ignite. Keep all open flames, spark producing devices and smoking material out of the area. Contact a qualified service center to have the problem correctly diagnosed and repaired before resuming operation.

Operating Instructions

When the furnace is selected there is a small time delay before the blower motor begins. After the temperature on the thermostat is reached the burner is extinguished. The blower motor stops approximately two to three minutes after cool down.

Furnace Operation Requirements:

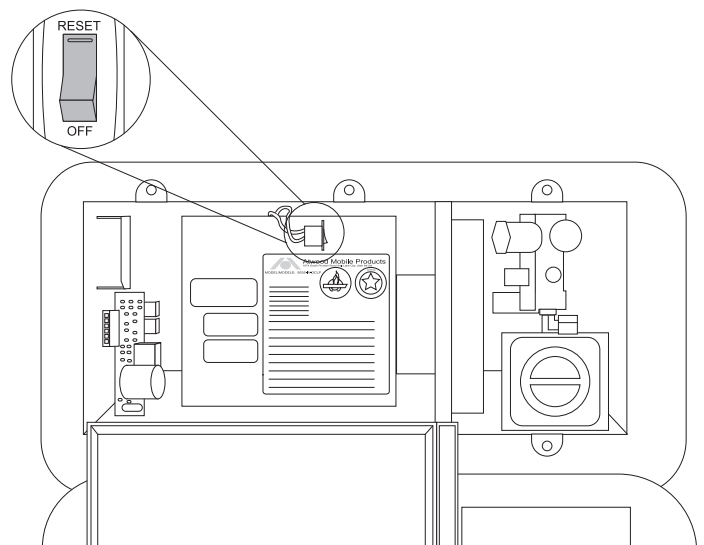
1. The LP-Gas primary valve on the LP tank and the electric LP-Gas valve at the remote fill are open.
2. The house batteries in the motorhome are fully charged and the interior house power is on.

NOTE:

The automatic ignition circuit board will attempt to light the burner three times before the ignition board will go into lock-out. If the burner does not light, the furnace blower motor will continue to run and the wall thermostat will have to be turned off.

Tips:

- After storage the furnace may produce a musty smell during the first couple of cycles.
- Operating the furnace at an altitude above 5,000 feet reduces the BTU output due to air/fuel ratio.
- The furnace will periodically need servicing by a qualified technician. If the furnace exhibits unusual symptoms or noises, or has an unusual odor when operating, have the furnace checked or serviced.
- If the blower fails to operate after verifying the batteries are charged and fuses are good, use a coin or screwdriver to open outside access door. Ensure the Reset switch is in the Reset position.



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CAUTION:

It is not advisable to use the furnace to heat the inside of the motorhome during transit.

NOTE:

When washing the exterior of the motorhome, avoid a direct stream of water into the outside furnace vents. This can cause damage to the furnace.

If the Furnace Fails to Light

Make sure the primary LP-Gas valve is open and the LP-Gas switch is turned on. The furnace will not light if the blower motor is not spinning to its specified speed. This may be due to a low house battery charge condition.

To Charge the House Batteries:

1. Hook-up to shore power.
2. Start the generator.
3. Start the main engine to charge the batteries.

WARNING:

If you smell gas and the blower motor is spinning, do not attempt additional furnace operation as this may result in an explosion, fire or personal injury. Contact a qualified technician.

WATER HEATER

The water heater uses two different methods to heat water: 120 Volt AC (supplied either by shore power or generator) or LP-Gas. The 120 Volt AC uses a heating element similar to the type used in a house water heater. The 120 Volt AC is efficient if shore power is available. An automatic ignition circuit board, operated by 12 Volt DC, controls the LP-Gas. Two thermostats control water temperature: One for the 120 Volt and the other for the LP-Gas. The thermostat temperatures are preset by the water heater manufacturer and are not adjustable.

Water is pumped into the bottom of the water heater tank where it is heated and discharged out of the top upon use. For ease of draining the tank during winterization, the water heater is equipped with a pressure-temperature valve, by-pass valve and drain plug.

NOTE:

DO NOT operate the water heater without water in the water heater tank. Damage to the thermostats and electric heating element can occur.

NOTE:

It is not fuel efficient to use the generator to operate the water heater on 120 Volt AC.

Before Using the Water Heater

Before using the water heater, purge all trapped air from the water system and water heater.

To Purge the Air and Pressurize the System:

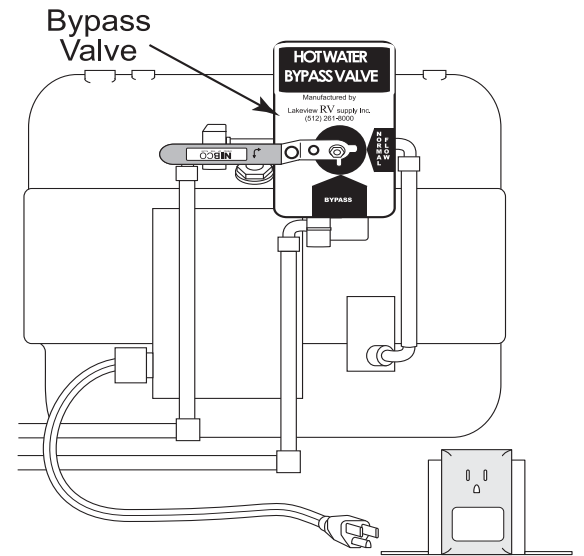
- Remove the access panel to the back of the water heater.
- Turn the water heater Bypass Valve (located at the back of the water heater) to Normal Flow. If necessary replace drain plug.
- Fill the fresh water tank or hook to city water.
- Turn on the water pump or city water.
- Turn on the hot and cold valves for each faucet, one at a time. Operate each faucet, inside and outside the motorhome, until a steady stream of water with no air bubbles or air pockets are present. **DO NOT** operate the water heater until the water system is purged of air.
- Inspect water heater and water system for leaks, after the system pressurizes.

CAUTION:

Air may remain in the line after purging the water lines and water heater. Use caution upon opening a hot water faucet after the first heat cycle of the water heater.

WARNING:

IF YOU SMELL GAS extinguish all open flames and turn OFF the primary LP-Gas valve. DO NOT touch any electrical switches. They may cause a spark that can ignite. Open all windows and doors. Evacuate the motorhome. Propane is a heavy gas and will lie on the floor and hide in corners. Liquid propane is highly volatile, explosive and extremely dangerous. Explosion, fire, property damage, injury or death can result. Contact a qualified service center to have the problem correctly diagnosed and repaired before resuming operation.



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Water Heater Bypass Valve in Normal Flow position.

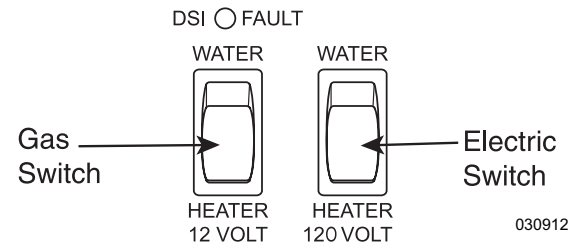
Operation

Heating Water with 120 Volt AC:

- Have either shore power or the generator supplying AC voltage.
- Turn on the water heater switch.

NOTE:

Both gas and electric functions may be on at the same time. This will speed up the process of heating water for large volume use.



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Heating Water with LP-Gas:

- Turn on interior house power.
- Make sure the LP-Gas is turned on.
- Turn the LP-Gas water heater switch on. The water heater burner will make an audible roar when ignited.
- When the water heater is lit the indicator light on the switch will illuminate briefly, then go out. The indicator light will glow steady when the ignition cycle has gone into “lock-out.”

CAUTION:

It is recommended not to operate the water heater on LP-Gas while the motorhome is in transit. Be sure the water heater is OFF before refueling.

NOTE:

The automatic ignition circuit board will make three attempts to light the burner. If the burner does not light the ignition circuit board will go into “lock-out.” Cycling the On/Off switch will reset the ignition board.

Ignition Module:

The LP-Gas ON/OFF switch controls the ignition circuit to the water heater.

The indicator lamp illuminates under the following conditions:

- Upon initial start-up the lamp illuminates briefly, ignition occurs, and the lamp goes out.
- If the burner does not light within six to nine seconds, the ignition board will lock out and the indicator lamp will glow steady.

Thermostats

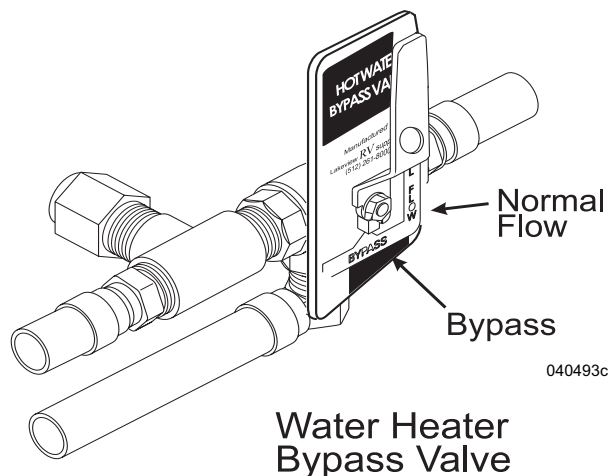
Separate thermostats are used for LP-Gas and AC electric. The thermostat controls the power to the module board. At 130° F, the thermostat will open, extinguishing the burner. If the thermostat fails, a high temperature safety limit switch will open. The safety switch will require manual reset.

CAUTION:

If the High Temperature safety limit should open, discontinue using the water heater. Have the water heater inspected by a qualified technician to determine the cause of the over temperature condition.

Water Heater Bypass

The bypass valve is located at the back of the water heater. Turning the valve to **BYPASS** stops water from entering the cold water inlet of the water heater. Turn the valve to **BYPASS** when winterizing. For normal operation, turn valve so that handle points to **NORMAL FLOW**.



Pressure-Temperature Relief Valve

The water heater is equipped with a Pressure-Temperature Relief Valve (P & T) that may discharge during the heating cycle, due to thermal expansion of water. The P & T relief valve is designed to open if the water temperature in the tank reaches 210° F (98.8° C), or if internal pressure reaches 150 psi. When water, pressure and temperature reach these settings, water may drip from the valve until the pressure has dropped. A small discharge is normal and is not necessarily a faulty valve. Avoid opening the P & T valve manually as it may continue to leak.

The water heater has an internal air pocket to reduce the possibility of dripping or weeping. Eventually, the expansion of the water will absorb the air pocket. When this occurs, the air pocket will have to be replaced utilizing the following procedure.

CAUTION:

Ensure the water heater tank is cool prior to making any check of the valve.

Re-establishing the Air Pocket:

Step 1: Turn **OFF** the water heater.

Step 2: Turn **OFF** the incoming water supply.

Step 3: Open any hot water faucet closest to the water heater.

Step 4: Pull the handle of the P & T valve until the flow of water stops.

Step 5: Close the P & T valve allowing it to snap shut. Close the hot faucet and turn **ON** the water supply.

Step 6: Turn **ON** the water heater.

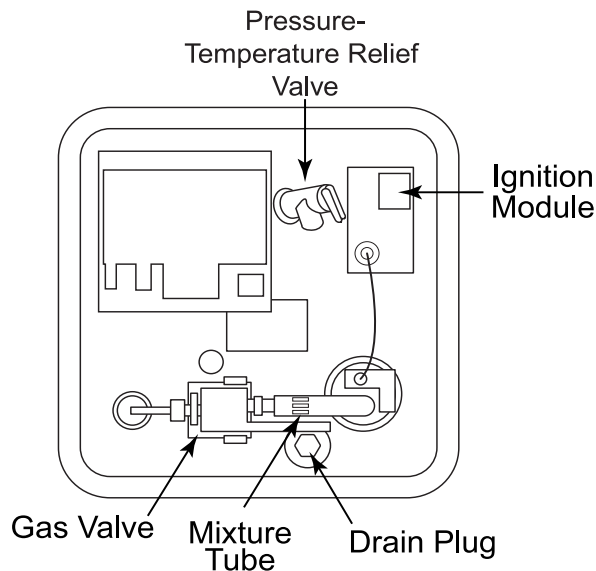
The air pocket is re-established and the process does not need to be repeated until the next discharge of water from the P & T valve. If the discharge does not stop, contact a qualified service center to evaluate the valve and make any required repairs.

Burner Compartment

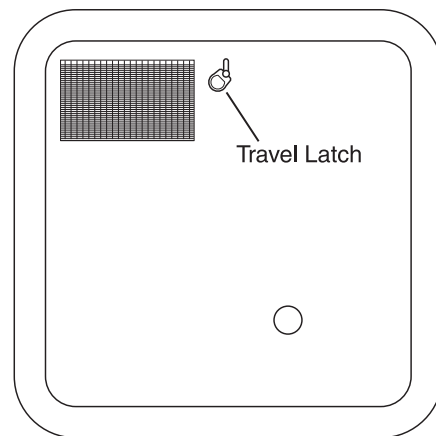
Periodically check the outside service compartment and screen (in the door) for foreign material that can accumulate and prevent the flow of combustion and ventilating air.

NOTE:

DO NOT block any opening.



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Tips

- To conserve LP-Gas, turn **OFF** the water heater when not in use.
- Conserve energy and hot water when showering by shutting off the water when not in use.
- Use caution when hooked to anything less than 50 Amp shore service. The water heater element uses approximately 12 Amps at 120 Volts AC when in operation. Operated appliances in sequence to avoid tripping a breaker.
- Water may drip from the Pressure-Temperature relief valve until the pressure has dropped. Avoid opening the Pressure-Temperature valve manually as collected minerals may cause the valve to leak continually. Valves can be purchased from most hardware stores.
- Operate the water heater using LP-Gas when hooked to 30 Amp shore power to reduce the likelihood of tripping the shore power breaker.

Draining & Storage

If the motorhome is to be stored during the winter months, drain the water heater to prevent freeze damage.

1. Turn **OFF** electrical power to the water heater.
2. Shut **OFF** the primary LP-Gas valve.
3. Open low point drains.
4. Open both hot and cold on all faucets.
5. Remove water heater drain plug.
6. Turn the Bypass lever to **BYPASS**.

NOTE:

Be sure to refill the water heater with water before resuming operation.

Troubleshooting

- If water heater fails to light check the mixture tube for obstructions. Spiders may make nests in the burner tube. It is recommended to clean the burner tube with a brush and not compressed air. Compressed air may not fully remove the obstruction.
- If the indicator light on the switch does not light, and the water heater does not light, ensure the battery cut-off switch at the entry door is on or check for a blown fuse in the house distribution panel.
- If the water heater fails to operate after checking the fuses, the High Temperature safety limit switch may be tripped. Have a qualified technician inspect the water heater.

WASHER-DRYER PREPARED (Optional)

The washer-dryer “prep” package includes the following items:

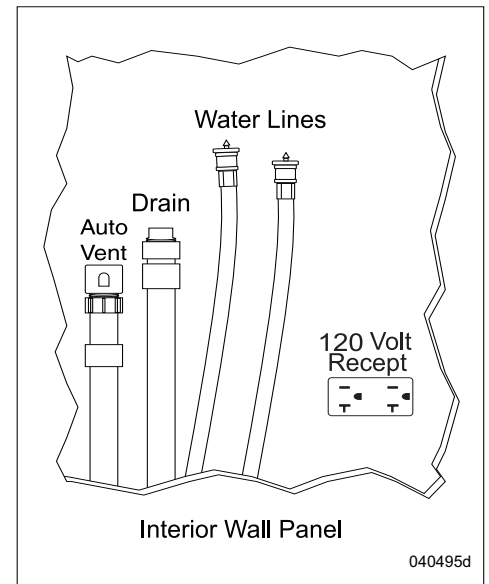
1. Color coded water supply lines: red for hot and blue for cold.
2. A 1½" waste water drain line with threaded cap, P-trap, and an automatic vent cap. This will drain the waste water into the grey water holding tank.
3. A 120 AC Volt receptacle located in the compartment.

NOTE:

Sidewall dryer vents are not part of the prep package. If a sidewall vent is to be installed, properly seal vent to sidewall.

If a washer-dryer is to be installed at a later date, follow all the manufacturer installation instructions. Listed here are further instructions which should be adhered to for safe and reliable operation:

- **DO NOT** connect the clothes dryer exhaust duct to any other duct, vent or chimney.
- **DO NOT** terminate the exhaust duct beneath the motorhome.
- Use proper length fastener when attaching exhaust vent to exterior sidewall. Stainless steel fasteners are best suited for this as they will not rust.
- If the cabinet or closet in which a washer-dryer is installed does not have vented louvered doors, the manufacturer’s installation instructions may require installation of vented doors, or vents to be installed in the doors, for sufficient circulation of air.



Location of specified parts may vary within wall panel depending on floor plan and model.

WASHER-DRYER (Optional)

The automatic washer-dryer is front loading with an extra large door opening for easier access. Several wash and dry programs are available along with variable water temperature settings.

- Always have the door open when selecting and moving the setting switch. This will keep the contacts from arcing. Then shut the door for operation.
- The washer-dryer operates on 120 Volt AC from shore power or the generator.
- The washer-dryer will use approximately 12 to 20 gallons of water per wash cycle.

INFORMATION:

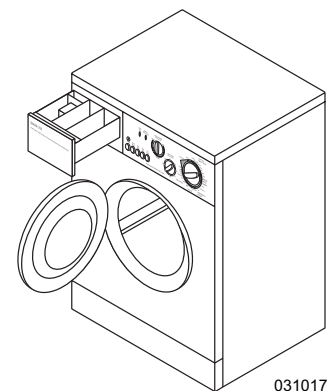
The washer-dryer has many features. Refer to the manufacturer’s manual in the owner’s information file for detailed operating instructions.

WARNING:

Open a window or vent while operating the dryer. The washer-dryer can create negative air pressure inside the motorhome that can accumulate Carbon Monoxide or LP-Gas while operating fuel-burning appliances.

CAUTION:

DO NOT use the washer-dryer while traveling. Suspension movement, combined with the weight of the drum in a wash cycle, can damage the washer-dryer internal components.



Test Procedure

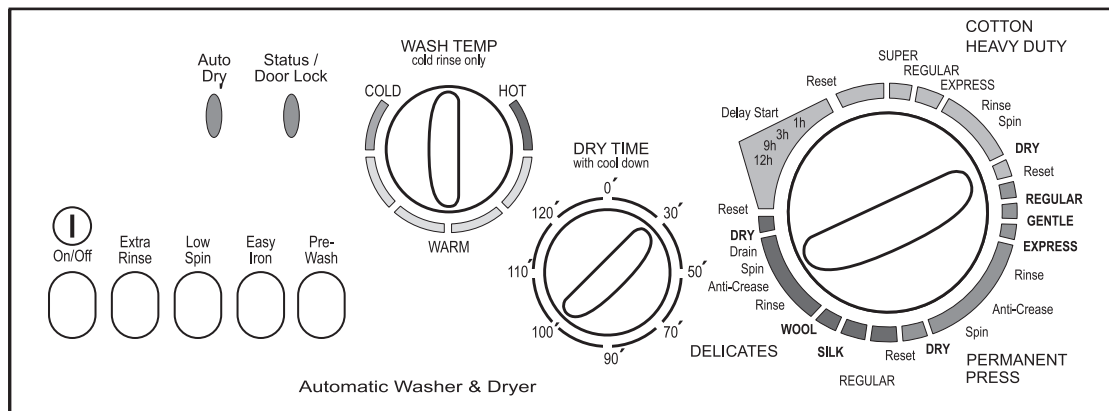
Before using the washer for the first time, after winter storage or a long period of non-use, conduct a simple test procedure to verify that all the hardware and electronic components are functioning. Wipe the interior and exterior of the washer-dryer with a damp cloth to remove dust that has accumulated.

NOTE:

Perform this test before putting the washer-dryer in use for the first time or after the winter months. This will clear the water lines and drum of winterization antifreeze.

Test Procedure Requirements:

- Make sure water lines are secure and water valves are open.
- Hook to city water or turn on the water pump.
- Hook to shore power or start the generator.



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To Conduct the Test Procedure:

1. Set the selector knob to **Reset**.
2. Set the **Dry Timer** knob to **30** minutes. Push the **On/Off** button to **On**. Wait five seconds. The Auto Dry light should be on and the Status/Door Lock light flashes fast then slow.
3. Set the selector knob to a wash cycle. Set **Wash Temp** knob to **Warm**. Water should flow into washer and the drum should rotate both directions.
4. Set the selector knob to **Reset**. Wait five seconds.
5. Set the selector knob to **Spin**. Water should drain and the drum rotation should speed up.
6. Set the selector knob to **Reset**. Wait five seconds.
7. Set the selector knob to **Dry**. Dryer fan should begin and the drum should rotate both directions.
8. Set the selector knob to **Reset**. Wait five seconds.
9. Set the **Dry Time** knob to "**0**". The Auto Dry light should go off.
10. The door will unlock in two minutes or less. The Status/Door Lock light flashes fast, then slow. The door should now open.
11. Push the **On/Off** button to the out (**Off**) position. The Status/Door Lock light should be **OFF**.

WARNING:

DO NOT wash or dry articles that have previously been cleaned, washed, soaked or spotted with gasoline, dry cleaning solvents or other flammable or vaporous substances that could ignite or explode. **DO NOT** add gasoline, dry cleaning solvents or other flammable or explosive substances to the wash water.

CAUTION:

DO NOT use heat to dry articles containing foam rubber or similar textured, rubber-like materials.

To begin a wash load:

- Sort and pre-treat clothes.
- Add the measured amount of detergent suggested by the package directions (maximum two tablespoons).
- Load the laundry loosely into the washer. Close the washer door.
- Turn the **Wash Temp** knob to the desired temperature setting.
- Choose the desired washing cycle option using the selector knob.
- Load wash tray with detergent.
- Push the **On/Off** button to turn the power **On**.
- After the cycle is complete, wait two minutes for the door lock to release before attempting to open the door.

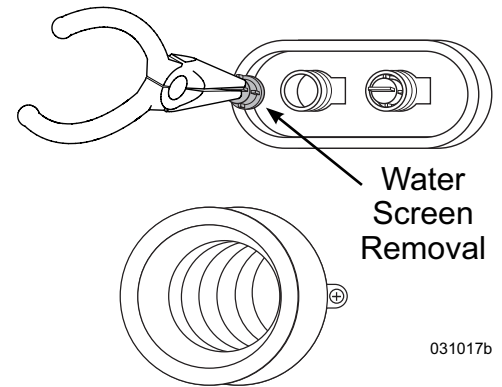
Washer-Dryer Maintenance

Occasionally wipe the exterior cabinet of the washer-dryer with a damp cloth or sponge. Wipe dry with a soft cloth. **DO NOT** use polish on plastic trim. In areas of hard water, detergent can accumulate in the drum. Obtain a packaged water softener. Add quantity as specified by the manufacturer directly to the drum. Run the washer through a complete cycle using hot water. Repeat the process if necessary. Remove hard water deposits using only cleaners labeled as washer safe. Wipe the inside of the washer-dryer door with a soft cloth to remove moisture. Periodically apply a thin coat of paste wax to the inner door, especially to the area that is immediately next to the door window. This will protect the door finish from laundry spills and discoloration.

If water flow to the washer-dryer is reduced, the hot and cold water inlet screens may be clogged. Remove water pressure and undo water lines at the back of the washer-dryer. Use tweezers or pliers to remove screens from fittings. Clean and install screens and water lines. Hook to city water or turn on the water pump. Check for water leaks before using the washer-dryer.

NOTE:

Should the washer-dryer need removal for service, care should be taken as the washer-dryer weighs approximately 170 lbs. Proper accommodations should be made to avoid risk of injury or damage to the cabinetry.



Winterizing the Washer-Dryer

To Winterize the Washer-Dryer with Air Pressure:

1. Hook an airline (regulated to 45 psi or less) to the water inlet of the motorhome.
2. Rotate the selector knob to a wash position with the **Wash Temp** setting on **Warm**. Press the power button to **ON**. Air pressure will clear the hot and cold water lines.
3. After water lines are clear, rotate the selector knob to **Spin**. Allow the pump to drain the drum.
4. Set selector knob to **Reset** and dry timer to zero (**0**). The door will unlock in two minutes or less. Open door and pour in ¼ gallon of RV antifreeze.
5. Set selector knob to **Spin**. The pump will prime with antifreeze. Set selector knob to **Reset** and push the **On/Off** power button to **Off**.

To Winterize the Washer-Dryer Using RV Antifreeze:

Two methods of introducing antifreeze to the water system can be used. Add antifreeze directly to the water tank or use a separate container of antifreeze with water line hooked to the intake side of the water pump.

1. Turn on the water pump. Rotate the selector knob to a wash position with the **Wash Temp** setting on **Warm**. Press the power button to **On**. Allow antifreeze to enter the drum.
2. After water lines are filled with antifreeze, rotate selector knob to **Spin**. Allow the pump to drain the drum.
3. Set selector knob to **Reset** and the dry timer to zero (**0**). The door will unlock in two minutes or less. Push the **On/Off** power button to **Off**.
4. Any remaining liquid should contain a sufficient amount of antifreeze to be protected from freezing.

NOTE:

After winter, perform a Test Procedure before washing or drying any laundry to make sure all antifreeze has purged.

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Equipment • Section 5

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EQUIPMENT - INTRODUCTION

This section covers the basic operation and care of equipment in the motorhome. More detailed information about specific equipment may be found in that particular manufacturer's manual. Optional equipment will be discussed which may not apply to all motorhomes.

INFORMATION:

Detailed information with CAUTION or WARNING instructions for the various electronics, other than what is provided in this section, can be found in the manufacturer's manual.

ENTRY STEP

Operation

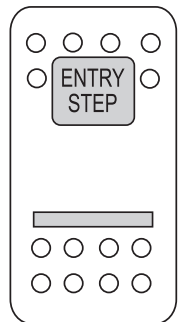
The exterior entry step features retractable steps with amber ground lights, automatic retract when the ignition key is on and a "last out" feature. The step switch (located just inside the door) illuminates when the circuit is active.

NOTE:

When dry camping, turn the Entry Step switch off to prevent unnecessary step actuation and draining of the chassis batteries.

Operating the Entry Step:

- Begin with the entry door closed.
- Turn the **ENTRY STEP** switch on.
- Open the door. The step should extend and lock in the **OUT** position. The step will retract when the door is closed.
- With the door open and the entry step extended, turn the **ENTRY STEP** switch off. This will allow the step to remain out while the door is opened and closed (the amber lights will also be off).
- The first time the door is opened after the ignition is turned off, the entry step will extend and remain extended without turning the entry step switch on. This is the "last out" feature.



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NOTE:

The step will always activate with door movement when the ignition is on, regardless of the power switch position.

Automatic Retract Feature:

- The entry step will automatically retract when the ignition is turned on. This will happen when the door is closed, regardless of the power switch position.

CAUTION:

High curbs can impede step operation. Use care when parked on side streets.

NOTE:

The entry step is self lubricating and requires no maintenance.

If the step fails to operate:

- Verify that the step switch is **ON**.
- Check the main power supply for the step (25 Amp fuse located in the front distribution panel).
- A magnetic door jam switch is used to control step operation. Use a separate magnet to apply a “trigger” to the door jam switch. Rotate test magnet to align polarity field.

WARNING:

If the motorhome is driven with the step in the extended position, there is the possibility of causing major damage to both the step and the motorhome.

Stepwell

The interior stepwell features a cover, step lighting, and a storage compartment in the upper step. This compartment is ideal for storing items such as gloves, tire pressure gauge, flashlights or outside slippers.

Cover:

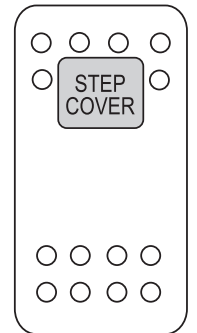
An electrically operated stepwell cover will extend and retract using the switch on the curbside armrest. Power is supplied by a 15 Amp fuse in the roadside front electrical bay.

To operate the Stepwell Cover:

1. Turn **ON** the Battery Cut-Off switch.
2. Press and hold the **Step Cover** switch to the desired direction. Release the switch to stop movement.

CAUTION:

When operating the stepwell cover, make sure there are no pets, shoes or other obstructions in the stepwell area. DO NOT operate the stepwell cover while standing in the stepwell area.



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ENTRY DOOR

The entry door is adjusted and tested at the factory. The door has three separate seals to eliminate wind noise during travel. There is a lock on the door handle and a separate dead bolt for safety and security. The door also has a primary and secondary latching system that ensures secure and safe latching. If necessary, there are adjustments that can be made to maintain entry door performance.

Adjusting the Entry Door Latch:

- Determine which bolt needs adjustment.
- Observe the latch and strike bolt alignment while slowly closing the entry door. **DO NOT** attempt to latch if the alignment is off. If the alignment is correct, allow the latch to catch in the first (primary) position only.
- The latch should move to the second position with only slight pressure applied to the entry door. Upper and lower latches should be evenly timed.

- Press on the entry door to check for further movement of the door.
- The entry handle should operate with little effort to open the entry door. Excessive pressure indicates the bolts are set too far back.
- With a 5/8" box wrench or socket, loosen the movable strike bolt. Make all adjustments in small increments. Tighten the bolt firmly after making adjustments. The bolts should have slight up and down movement for vibration control in travel.
- Test the operation of the dead bolt lock to ensure proper functions.
- Apply silicone weekly to the entry door rubber gaskets to prevent squeaking while the motorhome is traveling. Use a one inch sponge paint brush, sprayed with silicone for easy application.

CAUTION:

When operating the entry door ensure the dead bolt latch is fully in the unlock position prior to closing the entry door. Failure to do so can result in damage to the dead bolt and/or entry door.

Screen Door Maintenance

Changing Screen Door Glass:

- The screen slider is Plexiglas, and can be bowed for removal and replacement.
- Replace with new Plexiglas and reverse the procedure.

Adjusting the Screen Door:

- Loosen the bolts on the hinge side of the screen door; two on the top and two on the bottom.
- The hinge has slots to allow in and out movement to properly adjust the screen. The hinge should fit tightly to the trim of the entry door when the screen door is latched to the door and the door is open.

Removable Screen:

- The top half of the screen door is removable. This allows clear viewing through the entry door glass while traveling.
- To remove the top half of the screen door for travel, rotate clips on the exterior of the and remove the screen.
- To store the screen for travel, use the clips provided on the bottom half of the screen door.

SLIDE-OUT OPERATION

Slide-out room operation incorporates safety features to prevent mechanical damage or physical harm. Slide-out rooms will not operate until all safety requirements are met.

Safety Requirements:

- Ensure the ignition key is in the **OFF** Position.
- The park brake must be applied.

Guidelines to ensure long life of slide-out system:

- Inspect the roof of the slide-out for debris such as pine needles, dirt, leaves, sticks, etc. Any debris left on the top may cause damage to the seals during retraction. If debris is present, wash with soap and water, then rinse.
- When the room is out, visually inspect the wipe seal for dirt or other foreign material and for tears.
- In the event the slide-out room leaks, fully retract the room. If necessary, tape the exterior opening closed with duct tape until repairs to the motorhome can be completed.
- Open a window or vent to equalize pressure during slide-out operation.

NOTE:

Slide-out adjustment is not warrantable after 12 months. DO NOT use any petroleum-based products on the slide-out seal. Petroleum based products can damage the paint and will cause premature aging of the rubber seal.

WARNING:

Move the driver's seat forward before activating the slide-out room. Damage to the upholstery can occur. The outside area must be clear of any obstructions restricting slide-out room operation. Ensure there is five or more feet of clear space outside the slide-out room prior to extending or damage can occur. When retracting the slide-out room, ensure there is sufficient clearance inside the motorhome. Never move the motorhome with any slide-out room extended.

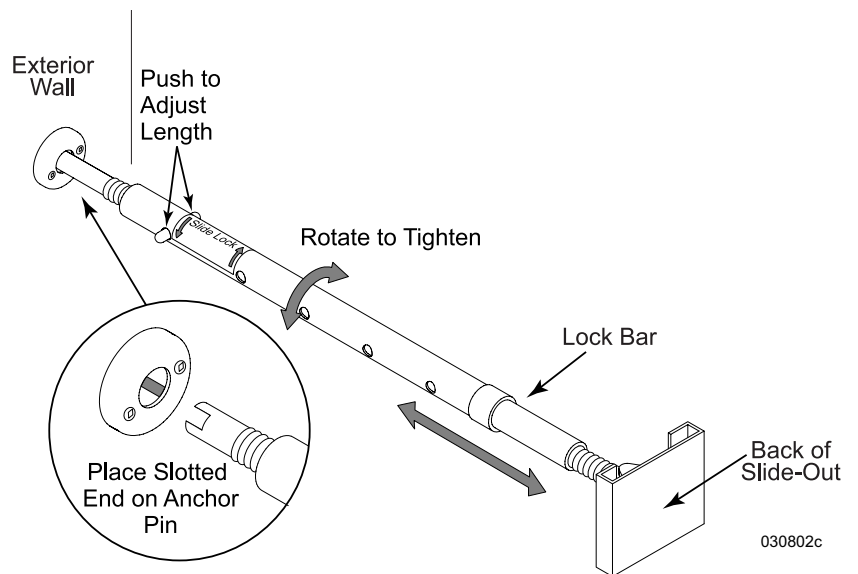
CAUTION:

Continuous operation of the slide-out room can drain the batteries and damage the motor from overheating.

Extending & Retracting Slide-out Rooms

To Extend Slide-out Rooms:

- Move the driver seat forward.
- Confirm that there is at least five feet of clearance outside the motorhome for the slide-out room to extend.
- Ensure the ignition key is in the **OFF** position.
- The park brake must be applied.
- The house batteries are fully charged.
- Be sure all people, pets and objects are clear of slide-out room path.
- Remove the lock bar.
- The slide-out room control switch is on the system monitor panel.
- Press and hold the front slide-out room switch in the **OUT** position. The slide-out room will slowly move to the **OUT** position. Release the switch to stop room movement. To continue the room movement, push and hold the switch in.



- Release the slide-out switch when the room is fully extended (a change in motor sound indicates extension). The slide-out drive motor will not stop automatically; the switch must be released.
- If equipped, extend additional slide-out rooms.
- Level the motorhome with the leveling system.

NOTE:

Perform the slide-out room operation with the air suspension system full. Extensive damage could occur to the slide-out room and awning when extending the slide-out room in snow, sleet, ice or freezing rain. In such conditions, if the slide-out room is extended, clear the awning and ensure free movement prior to operating the slide-out room.

CAUTION:

Dirt and grit trapped under the slide-out room could result in damage to the floor. Continuous operation of the slide-out could cause a drain on the house batteries and damage to the slide-out motor from overheating.

CAUTION:

Remove lock bar prior to extending slide-out.

To Retract Slide-out Rooms:

- Check for sufficient clearance inside the motorhome before retracting the slide-out room.
- Clean the floor, if applicable, to ensure there is no dirt or grit that could result in floor damage during operation.
- Move the driver's seat forward.
- Inspect the exterior to ensure there are no sags in the awning material.
- Remove any debris from the top of the slide-out room.
- Prior to retracting the slide-out room, start the motorhome. Allow the air bags to fully inflate to normal travel height.
- Retract the leveling jacks prior to operating the slide-out.
- Turn the ignition switch **OFF**. The slide-out room will not operate with the engine running.
- The house batteries should be fully charged.
- The park brake must be applied.
- Ensure all people, pets and objects are clear of slide-out room path.
- Press and hold the switch in the **IN** position. The slide-out room will move slowly in. To stop the slide-out room, release the switch. To continue the room movement, push and hold the switch in.
- Rain water can pool on the slide-out awning. Added weight will cause the awning to sag. Upon retracting the room, the material can catch between the top of the slide room and the opening in the motorhome. It will be necessary to retract the room in small increments, allowing the water time to run off.
- Release the switch.
- Install lock bar for travel.

CAUTION:

Check for sufficient clearance on the inside of the motorhome (driver's seat, etc.) before retracting the slide-out room. Never move the motorhome with the slide-out room extended.

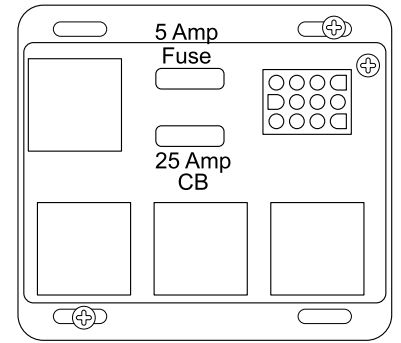
NOTE:

Ensure the floor is clean before retracting the slide-out room. Trapped dirt or grit under the slide-out room can scratch the floor surface.

Manual Override

If the slide-out room does not respond from the switch, check that all the safety features are in place and power requirements are met.

- The ignition key is **OFF**.
- The house batteries are fully charged.
- Ensure the lock bar is removed.
- The battery cut-off switch is **ON**.



If the Slide Room Fails to Operate:

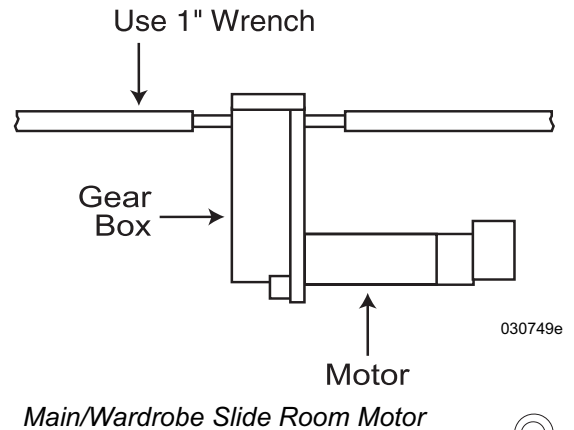
Check the fuse and auto-reset circuit breaker on the slide-out relay module located in the black box in the curbside bay. If the fuses and circuit breakers test okay, it will be necessary to manually override the slide-out mechanism. Follow the steps below to manually override the slide-out room:

WARNING:

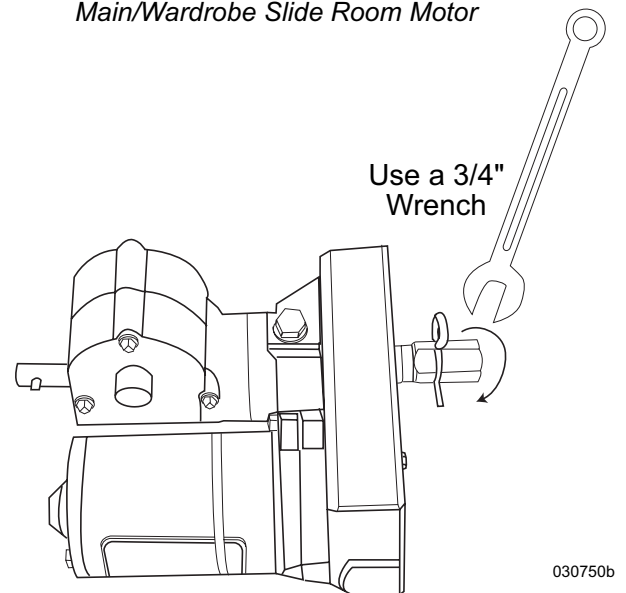
DO NOT work on the slide-out system unless the battery is disconnected. Make sure the floor is clean before retracting the slide-out room.

Manual Override Procedure:

1. The bedroom slide-out motor is located under the bed. Lift the bed and remove the access panel. The main slide and wardrobe motors are located inside the exterior storage bays under the slide-outs.
2. Remove 12 Volt DC from the motor by disconnecting the plug from the slide-out motor to the power supply.
3. Use a 1" wrench (for main and wardrobe slides) or a 3/4" wrench (for the bedroom slide) to turn driveshaft and retract room.
4. Once the slide room has been manually retracted, reconnect power supply. This is necessary to stop the slide room from moving once it's retracted.
5. Take the motorhome to an authorized repair center.



Main/Wardrobe Slide Room Motor

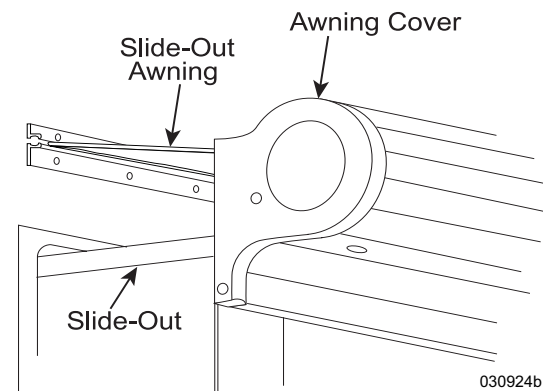


Bedroom Slide Room Motor

AWNINGS

Slide-out Cover

The slide-out cover is automatic. When the slide-out moves in or out, the cover reacts to the slide-out direction. A fixed edge of the slide-out cover is installed into an awning rail, mounted just above the slide-out. A spring-loaded roller with special brackets mounts to the slide-out. In a hard rain, the cover helps prevent water from penetrating the seal of the slide-out.



The slide-out cover will extend automatically, attaining full coverage when the slide-out achieves maximum extension. The slide-out cover retracts automatically and rolls up to the travel position when the slide-out is completely closed.

NOTE:

Water may pool on top of the extended cover. As the slide-out is retracted, the water is removed when the cover retracts. Retract room slowly. Pause three or four times to allow any accumulated water a chance to run off.

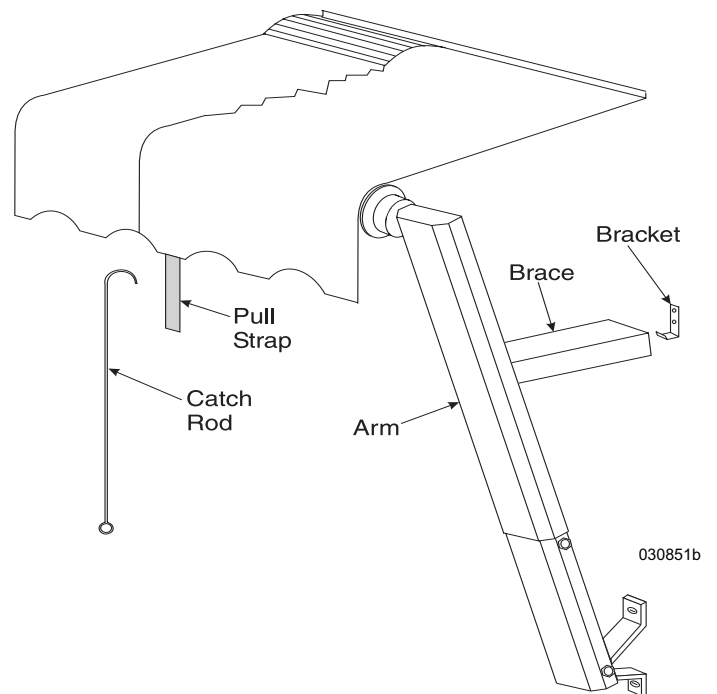
NOTE:

When retracting the slide-out, stop the room approximately halfway. Confirm that the fabric is rolling properly before fully retracting the slide-out.

Door Awning (Optional)

To Extend the Awning:

- Hook the pull strap loop with the awning pull rod.
- Pull strap until awning is at full extension. Pull out inner arms.
- Mate the inner arm slot with the hook on the side of the motorhome. Repeat procedure for other arm.
- Release strap slowly to ensure inner arms are secure. Slide the strap to rear of awning roll tube and tie to rear arm.
- Loosen locking knobs for both arms, and extend arms so the canvas will clear the door while in the open position.



To Retract the Awning:

- Loosen locking knobs for both arms. Lower arms to stop bolts. Tighten knobs.
- Untie the pull strap and slide strap to center of awning roll tube.
- Pull down on pull strap, with a firm grip, until tension is off the inner arms. Fold inner arms and attach them to the Velcro.
- Carefully allow material to wind onto awning roll tube while holding strap in a neutral position. This will allow material to roll up evenly.
- Awning end caps should be against the rubber bumpers. If one end cap is off, pull down on awning pull strap while holding strap slightly to opposite side, allowing awning to roll back up into position.

CAUTION:

When the awning is at full extension do not allow the awning to snap back into the retracted position. Personal injury or damage to the awning or motorhome may occur.

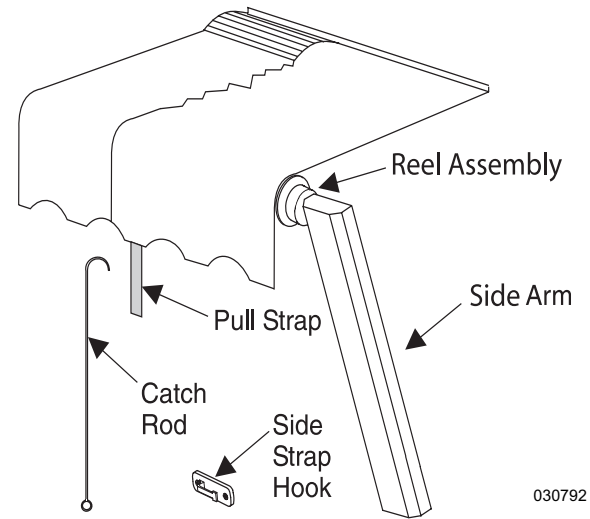
Window Awning (Optional)

To Extend the Window Awning:

- Hook loop of pull strap with catch rod and pull awning, reel assembly and side arms to extend fully away from motorhome.
- Hook pull strap on side strap hook, remove catch rod from pull strap and store.

To Retract the Window Awning:

- Hook catch rod on pull strap, remove pull strap from side strap hook and slowly allow awning to retract.
- Remove catch rod from pull strap and store.

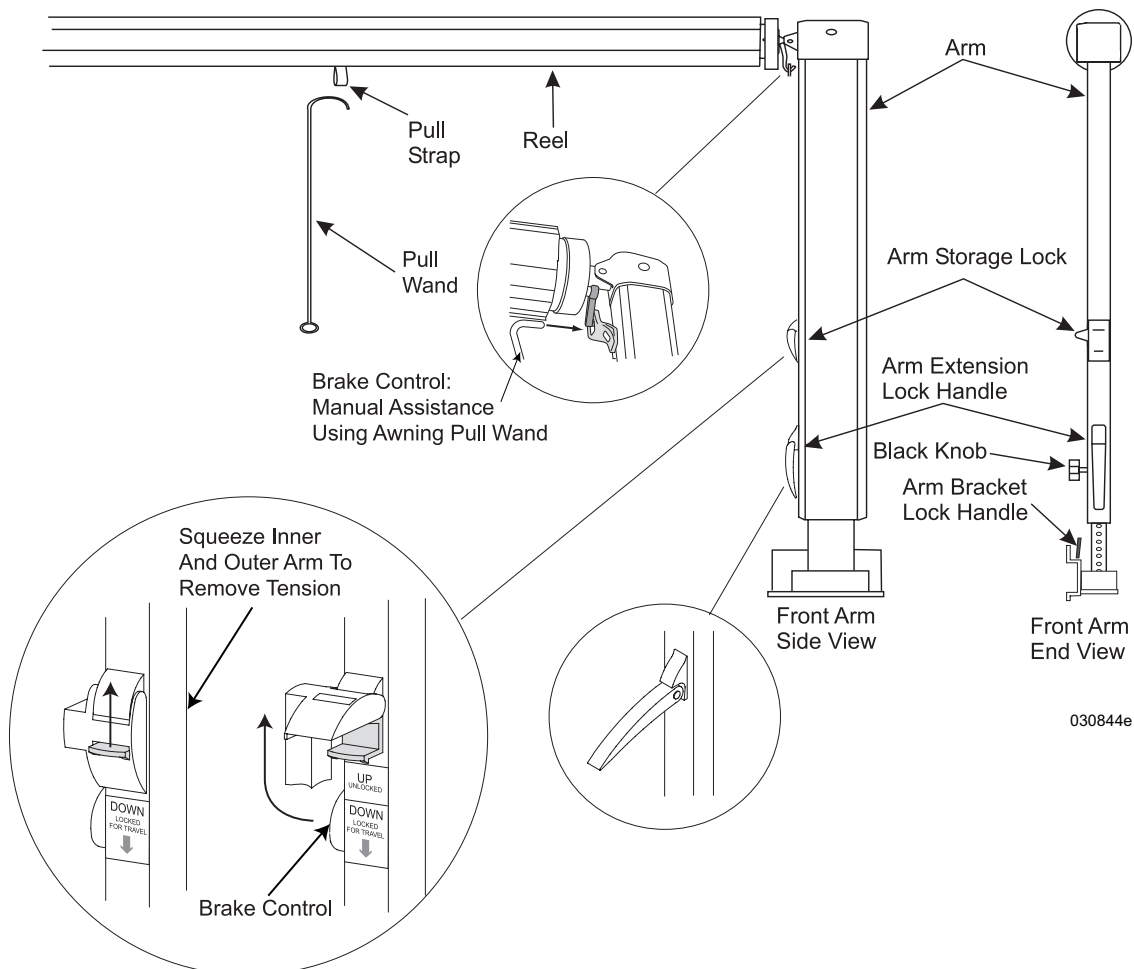


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Patio Awning - Manual

To Unlock the Patio Awning (perform the following procedure for each leg):

1. Loosen the black locking knob located on the backside of the awning leg (only about six turns are needed). This will allow the support brace to move freely.
2. Unlock the travel lock by using one hand to squeeze inner and outer arm to remove tension from storage lock. Push up on tab and swing lock away.
3. Move the brake control on the front leg (only) to the up/unlock position.

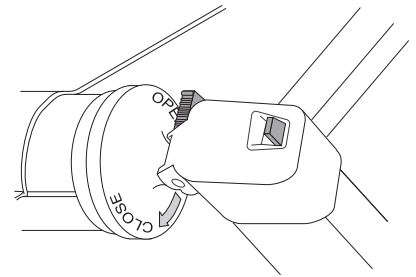


To Extend the Patio Awning:

1. Insert pull wand into loop of the pull strap. Draw the awning away from the motorhome to the desired extension.

WARNING:

Always use the pull strap for extending and retracting awning. Never retract awning while holding onto the awning arm. Hands or fingers caught between the awning arm channel and brace channel during awning retraction may result in serious injury.



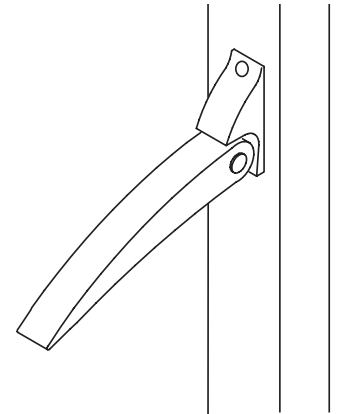
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2. Slide the inner bracing rafters to the top of each arm to ensure bracing is locked in place. Tighten the black locking knob.

NOTE:

Ensure the locking tab on the support brace is latched through the hole in the end cap.

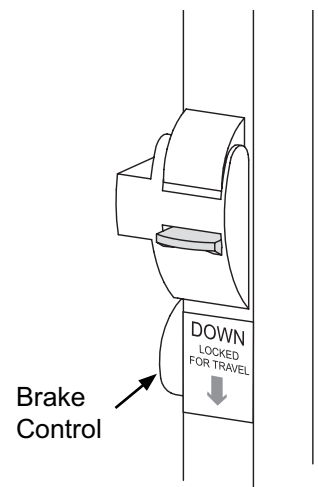
3. If equipped with Canopy Clamps, fasten the clamps at this time.
4. For additional clearance, grasp the outer arm above the Arm Extension Lock Handle with one hand and release the lock with the other hand. Extend the awning to the desired height. Support the awning with one hand and engage the lock handle to set the pin into the hole in the inner arm. Repeat for rear awning arm. Ensure the awning is straight.
5. Slide the center pull strap to one end of the awning and store it by wrapping the strap around the awning leg.



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To Retract the Patio Awning:

1. Loosen the strap from the awning leg if stored.
2. Support the weight of the awning with one hand while opening the extension lock handle and lower the awning until the arms rest on the lower stop bolt. Loosen the two black locking knobs enough to allow the support brace to travel freely.
3. If equipped with Canopy Clamps, remove and store the clamps at this time.
4. Release the locking tab on the end cap of the awning leg and slide the inner support brace down the awning leg to the stop bolt. Repeat for opposite side.
5. While pulling down slightly on the pull strap, slide the brake control down.
6. Keeping downward pressure applied, slide the pull strap to the center of the awning while holding on to the strap.
7. Place the hook end of pull wand into pull strap loop to assist in retracting the awning. Make sure pull wand does not slip out of pull strap loop, allow the awning to roll up to the stored position.
8. Store the pull wand.
9. Verify that the brake control is in the locked or closed position. Snap the arm storage locks into the down position and tighten black locking knobs.

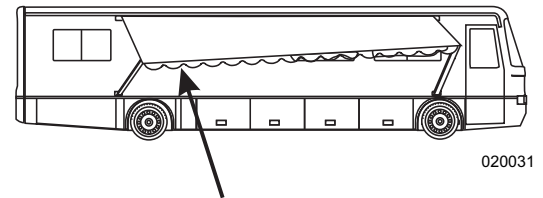


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Rain Release Setting:

After the awning has been extended, choose the rain release position to prevent water build up on the awning. To position the awning in the rain release setting, lower one arm of the awning and leave the other arm in the normal position. This will create enough of a slope for adequate water run off.

Rain Release Setting



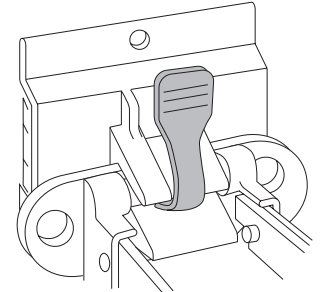
One Arm Lower Than The Other Arm

NOTE:

Water weighs 8.33 lbs. per gallon. The awning was not designed to withstand the 500 to 700 lbs. of water that could accumulate. It is best not to subject the awning and the motorhome to the needless strain.

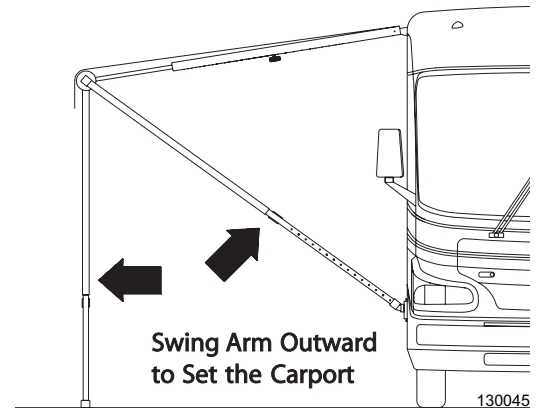
Using the Carport Feature (N/A on Carefree One-Touch Awnings):

1. Unlock and extend the awning as described under “To Unlock the Patio Awning” and “To Extend the Patio Awning.”
2. Unlatch the bottom of the rear arm by pushing in on the lock handle on the arm bracket. Swing the arm away from the motorhome to an upright position.
3. Drive the stakes through the bottom holes in the arm.
4. Raise the rear arm extension lock handle all the way up or to the desired height and lower the lock handle to lock the arms in place.
5. Repeat instructions 2 through 4 for the front arm.



NOTE:

To move the awning out of the carport position reverse the above steps.



Patio Awning (Optional)

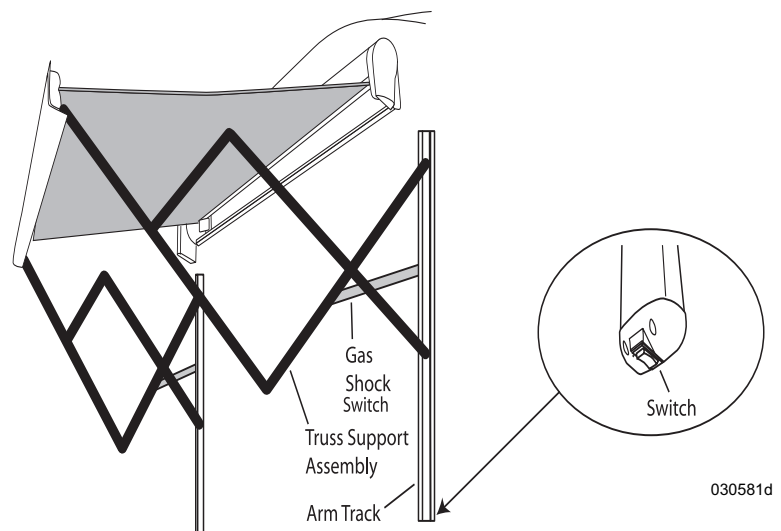
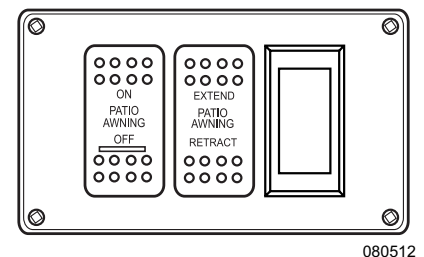
The Eclipse is a box awning that operates on 12 Volts DC by the push of a button. The awning requires 10 feet of lateral side clearance.

To Operate Awning:

- Push and hold switch to extend the awning. Release the switch at any time for partial extension.
- Push and hold the switch to retract awning.
- The interior awning power switch needs to be on to operate both interior and exterior awning switches.

Troubleshooting:

- Ensure ignition is off.
- Check power at 15 Amp mini breaker in front electrical bay on the roadside.



Awning Care & Cleaning

On a monthly basis, loosen hardened dirt and remove dust from the awning with a dry, medium bristle brush. Thoroughly rinse both the top and bottom with a garden hose.

A high-quality acrylic fabric cleaner may be used to help maintain appearance. Carefully follow the instructions on any cleaning product used. Metal surfaces should be cleaned with soapy water and thoroughly rinsed. Allow the awning to thoroughly air dry while extended. Awning maintenance products can be found at RV supply stores.

Acrylic Awnings:

Wash both sides of the awning with a mild soap (i.e., dish soap) and lukewarm water. **DO NOT** use detergents. If necessary, reapply the solution to keep fabric saturated. Rinse the awning thoroughly. Repeat, if necessary, until most of the stains disappear. Contact *Carefree of Colorado* for removal of stubborn stains.

Vinyl Awnings:

Mildew will not form on the awning material itself, but it may form on the dust accumulated on the canopy. A quality vinyl cleaner, such as *Carefree Awning Magic*, will help keep the awning looking new. Be sure to follow the instructions on the container.

Leaks:

It is normal for slight leakage to occur through the fabric where water is allowed to accumulate. If water drips through the needle holes in the stitching use a commercial seam sealer that is available in canvas and trailer supply stores. Paraffin wax may also be applied to the top of the seams. As the awning “weathers” these holes will normally seal themselves.

Soap or chemical residue can “wet” the fabric so that it appears unable to repel water. Rinse the fabric thoroughly and test to see if it is water repellent after it dries. If leakage continues after washing and thoroughly rinsing, please contact *Carefree of Colorado*.

Storm Precautions

The warranty does not cover damage caused by acts of nature; therefore, steps should be taken to prevent damage from occurring due to wind, rain or storms. Retract the awning in inclement weather conditions or when leaving the motorhome unattended. Should the awning need to be retracted while the fabric is wet, extended it as soon as possible to allow it to completely dry.

FANS

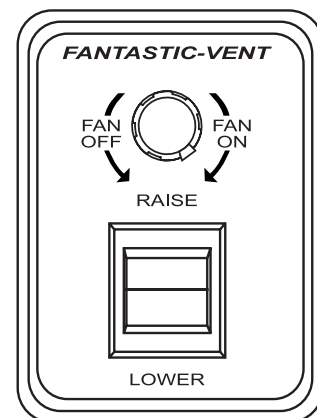
Automatic

Fan Operation:

- Turn on the battery cut-off switch.
- Ensure the vent cover knob, located on the fan, is pressed **IN** to the Automatic position.
- Use the wall switch to raise the vent cover. The vent cover must be open at least 2" before the fan will run.
- Turn power knob clockwise to turn fan on. The power knob also adjusts fan speed.

NOTE:

To override the automatic setting, pull the vent cover knob out to the manual position and close vent. The fan blade will stop spinning when the vent cover is closed.

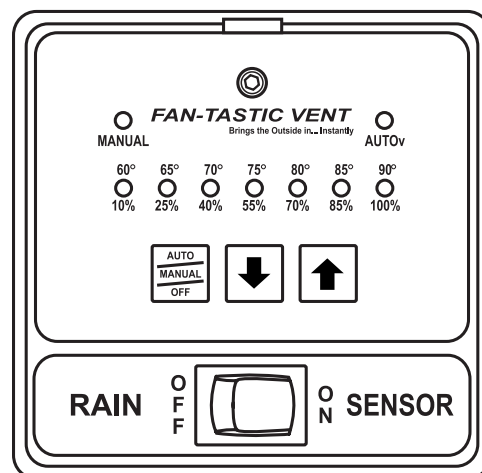


031205b

Automatic with Electronic Thermostat (Optional)

Fan Operation:

- Turn on the battery cut-off switch.
- Ensure the vent cover knob, located on the fan, is pressed **IN** to the **Automatic** position.
- Press the **Auto/Manual/Off** button on the wall switch once. The vent cover will open automatically.
- Use the **up** or **down** arrows to set the thermostat temperature. The fan speed will adjust automatically according to the disparity between ambient and selected temperatures.
- Press the **Auto/Manual/Off** button once more to manually control fan speed. Fan speed is displayed on the wall control in 10% increments. The thermostat is no longer operational in this mode.
- Press the **Auto/Manual/Off** button until all wall control lights are off. The fan blade will stop spinning and the vent dome will automatically close.
- To use the fan as a vent only: Leave the wall control switch off. Pull the vent cover knob down to the manual position and turn the knob to open the vent.



The rain sensor switch may be located on the fan.

031205

NOTE:

To override the automatic setting, pull the vent cover knob out to the manual position and close vent. The fan blade will stop spinning when the vent cover is closed.

Rain Sensor Operation:

- Ensure the rain sensor switch is set to on.
- If the built in rain sensor gets wet the dome will automatically close and the fan will shut off.
- After the sensor dries, the dome will reopen and the fan will start.
- To avoid automatic restart, turn the fan off at the wall control.

Tips for using the fan:

- Operate the fan to keep condensation from accumulating. Condensation occurs naturally from fluctuations in interior and exterior temperatures, humidity, dew point changes, steam from cooking or boiling water and shower usage.
- If the fan fails to operate, check the 4 Amp fuse on the fan and the fuse in the domestic fuse panel.
- To clean the screen remove the eight screws holding it in place. Wash the screen using dish soap and water.
- On hot, sunny days direct airflow by slightly opening the window(s) on the shaded side of the motorhome. The area between the open window(s) and the fan will have maximum air flow.

WARNING:

Do not leave the vent cover open while the motorhome is driven, stored, or unattended for extended periods of time. High winds or other unusual conditions or obstructions may prevent the vent cover from closing. Leakage could result and cause serious damage.

POWER SUNVISOR

The cockpit blinds are 12 Volt DC operating from the Chassis batteries. Power is supplied by a 5 Amp fuse located in the roadside front electrical bay. One blind assembly is used for each window located in the cockpit area.

To Operate the Blind:

- Push the switch down to lower the desired blind.
- Push the switch up to raise.

NOTE:

DO NOT attempt to move or drive the motorhome with any blind in the lowered position.

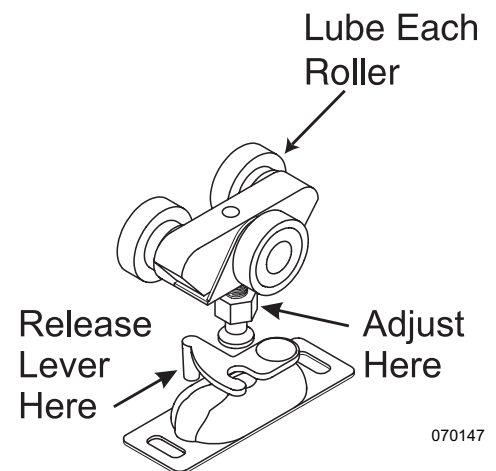
SLIDING DOOR

The sliding pocket door uses two rollers at the top of each door. During the life of the motorhome the sliding door may need adjusting. The sliding pocket door can be adjusted to close tight against the wall. Use a small wrench and turn the adjusting screw upward or downward.

If, for any reason, the pocket door needs to be removed, locate the portion that is secured to the top of the pocket door and rotate the small lever outward to release the latches.

LUBE:

The pocket door rollers should be lubed with just a small drop of oil once a year to help increase the life of the rollers and improve the sliding of the door.



REAR LADDER

The rear ladder allows access to the roof. Care should be used when climbing the ladder. Access to the roof should be limited to cleaning and sealing purposes only. The lower portion of the ladder is removable and stored in the cargo bay.

CAUTION:

The roof surface is a smooth, fiberglass-reinforced polyester resin. This surface will be slick in all conditions. Exercise extreme caution when accessing the roof.

NOTE:

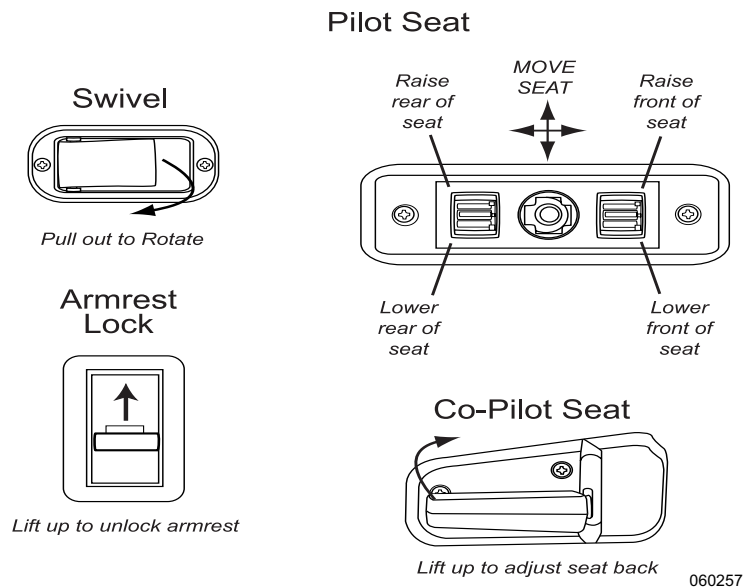
Maximum weight is 300 lbs.

SEAT CONTROLS

The Pilot and Co-Pilot seats are adjustable to provide maximum comfort. Seats must be locked in the forward facing direction while traveling. The battery cut-off switch must be on for the seats to operate.

NOTE:

The seats operate from 12 Volt DC house power. The 15 Amp Fuse is located in the roadside front electrical bay.



Swivel Seats

Swivel Seat Operation:

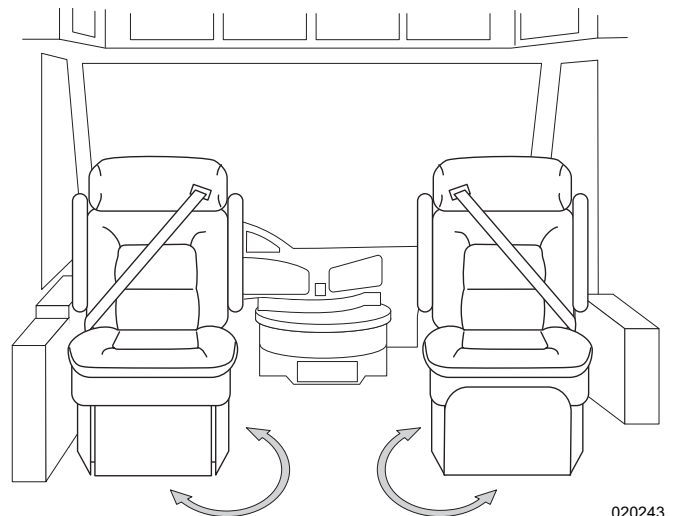
- When swiveling a seat, lift up the swivel lever and rotate to the desired position.
- The passenger seat swivels all the way around when the slide-out is extended.
- When rotating the driver seat, put the steering wheel in the upright position.
- Move the seat forward, then pull the swivel lever up and rotate around to the desired position.

WARNING:

Seats must be locked in the forward facing position while the motorhome in transit.

NOTE:

After either seat is rotated 180°, it must be rotated back in the opposite direction rotation originated from. The 12 Volt DC wiring in the seat may disconnect if rotated 360°.



SOFA BED

There are several sofa variations that can be installed in the motorhome. The standard sofa is commonly referred to as a “jackknife” sofa. This style sofa has storage space below the seat and a removable front panel. The sofa will pull up and out, at the front of the seat then lay flat to form the bed/sleeper area. Cushions are not removable.

NOTE:

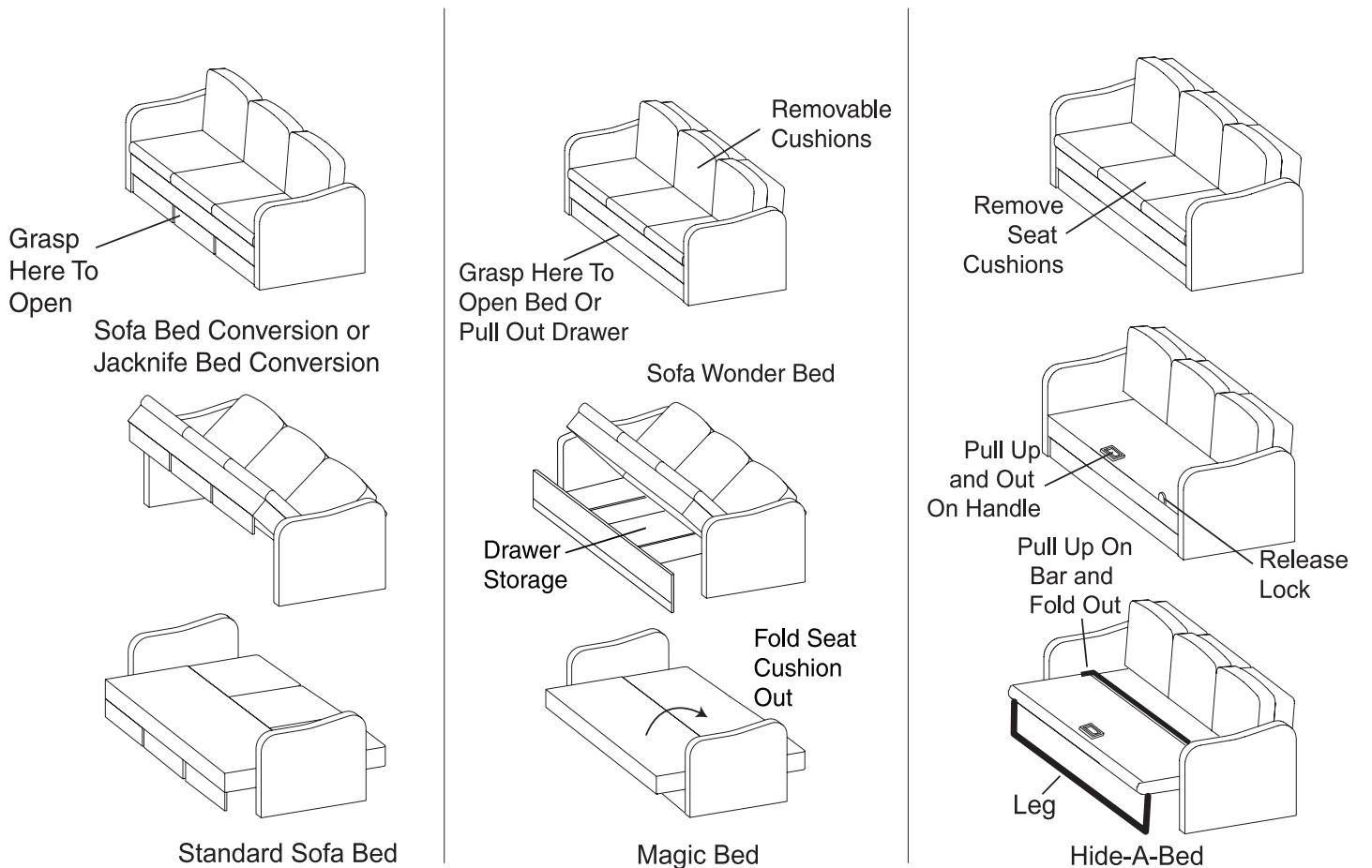
Sofas will have a locking mechanism that must be released to convert the sofa to a bed.

Several optional sofas that can be installed:

- Sofa Bed
- Convertible Sofa
- Electric Bed
- Air Coil Mattress

Convertible Sofa:

This sofa is most commonly called the “Hide-A-Bed.” This bed is similar to the ones found in many home guest rooms. The conventional sofa has a spring mattress. The newest addition to this style of hide-a-bed is the Air Coil Mattress.



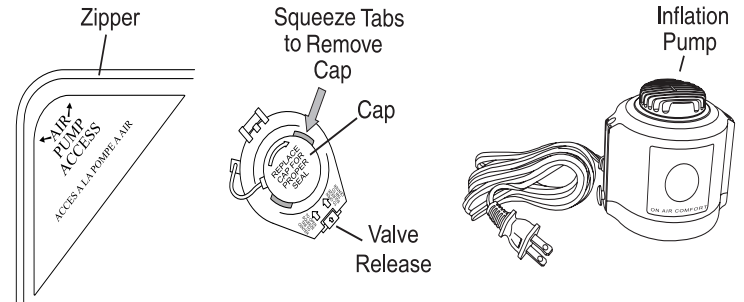
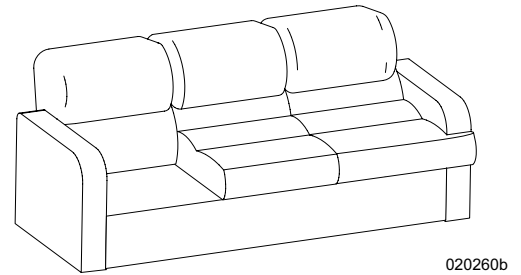
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Air Coil Mattress:

The Air Coil Mattress inflates and deflates in a matter of seconds. Use the hand-held electric pump to inflate the mattress. The pump operates from any 120 Volt AC outlet.

To Inflate the Mattress:

- Remove and store seat cushions.
- Open the convertible sofa and fully extend the mattress (may be necessary to extend slide-room).
- **Unzip** the corner of the mattress labeled “Air Pump Access” to access the pump valve.
- Push down on the valve to ensure it is locked in place.
- Open the cap on the valve.
- Plug the pump motor into a wall outlet. Hook to shore power, start the generator or turn on the inverter.
- To turn on the pump, place it on the valve and turn the pump ¼ turn. The pump will be locked in place.
- Inflate the mattress to desired firmness.
- Remove the pump, replace the valve cap and zip up the mattress cover.



To Deflate the Mattress:

1. Remove bedding items.
2. Unzip the corner of the mattress where the air valve is located.
3. Lift the valve release.
4. Once deflated, close the valve release, zip up the mattress cover and close the convertible sofa.

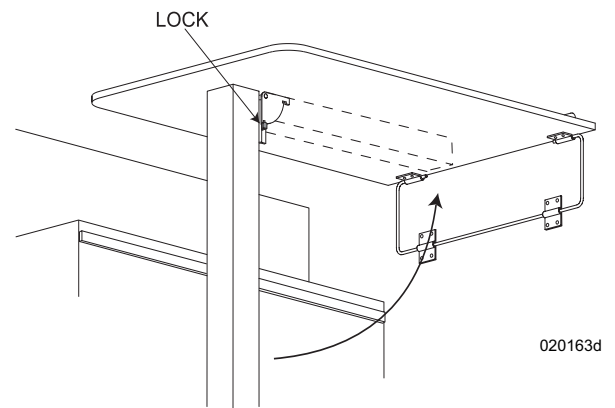
Electric Bed:

The electric sofa sleeper bed uses 12 Volt DC to operate the slide mechanism.

DINETTE BED CONVERSION (Optional)

To Convert Booth Dinette into a Bed:

- Lift seat cushions to an angled vertical position.
- With a firm grip, lift front edge of the table approximately six inches and push table leg lock to side.
- Swing the table leg up and lock into a horizontal position.
- Continue lifting table until table stays are clear of retainers. Pull outward and lower table down.
- Use both seat cushions and one back cushion for a mattress. Leave one back cushion in a vertical position.



WARNING:

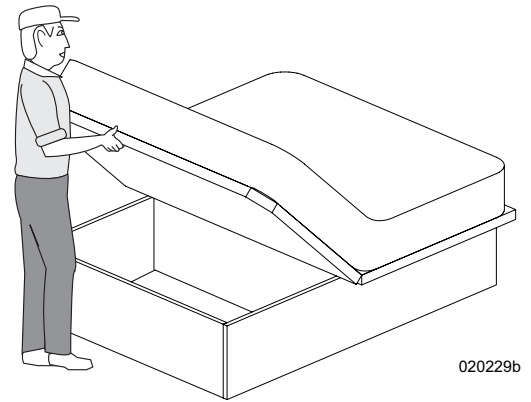
DO NOT occupy the booth dinette, if not equipped with safety belts, or dining chairs while the motorhome is in motion. To avoid personal injury to occupants in case of an accident or sudden stop, chairs must be stored in an enclosed area or secured with tie down straps while the motorhome is in motion.

STORAGE - UNDER BED

To use the storage compartment located under the bed, locate and unlock the bed deck latches. Lift up the bed by the front edge of the mattress platform. Gas struts hold the mattress and platform open.

NOTE:

DO NOT over stress gas struts by rapidly opening or losing the bed access cover, as this action can damage the struts or mounts. In extreme cold, gas struts may not hold the mattress platform in the open position.



RADIO - DASH

The dash radio will control the multi-functions for the dash audio. There are many features associated with the dash radio. The tuner will hold pre-set AM and FM stations. Turn the radio power off at the dash.

Operation:

- Turn **ON** the house power disconnect switch.
- Turn **ON** house battery cut-off switch, located at the entry door.
- Turn **ON** the radio power switch at the dash panel.
- To turn the radio **ON**, press the **ON** button.

Clock Adjust:

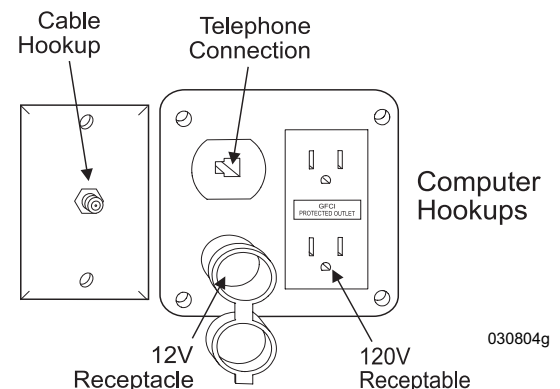
- Press and hold the menu button until clock adjust is displayed.
- Press the left and right buttons until the desired time is displayed.
- Press the menu button once the correct time is displayed.

TV & ENTERTAINMENT COMPONENTS

Entertainment center components are carefully selected to provide the highest quality in audio and visual enjoyment. The following paragraphs will discuss the components and their operation. Use the instructions given in the Video Selector Box section to use these components.

Connections - TV Cable, Computer & Phone

The motorhome is equipped with cable TV and phone hook-ups, located in the electrical service center. For convenience, there are auxiliary outlets located at the co-pilot seat and on the optional computer desk. This connection is set up for a telephone or laptop computer. Entertainment connections are provided for convenience in a passenger bay. These include telephone jack, cable TV hook-up, and a 120 Volt AC electrical outlet.



Television (Front) Lock-out Feature

The ignition switch controls the outlet for the front TV. Only with the ignition **OFF** will the front TV operate. The TV operates on 120 Volt AC power only. This power can be provided by shore power, the generator or the inverter. Viewing time of the TV from the inverter depends on the state of charge of the house batteries and any additional 12 Volt DC circuitry which is being operated.

Television Antenna

The television antenna is a manual crank style antenna with built in electronics that use 12 Volts DC to boost signal strength. Signals that are weak or fuzzy can be amplified by pressing the black selector button. The green LED will illuminate when the antenna boost is in use. The antenna and booster work together to provide the best possible picture for most situations. Certain conditions may occur when no amplification is needed, and in fact may make the picture worse. The television station will send a signal that resembles the waves or rings of water from a rock thrown into a still pond. The radiating television signal can rebound off an object such as a mountain. The antenna will receive a signal from the initial pass and then receive an additional signal from the rebound, resulting in a split or double image. In this case, the picture may be improved by no amplification or even lowering the antenna.

CAUTION:

Do not move motorhome with antenna in the raised or partially raised position and risk damage by tree limbs or wires. Worm gear damage or breakage may result.

WARNING:

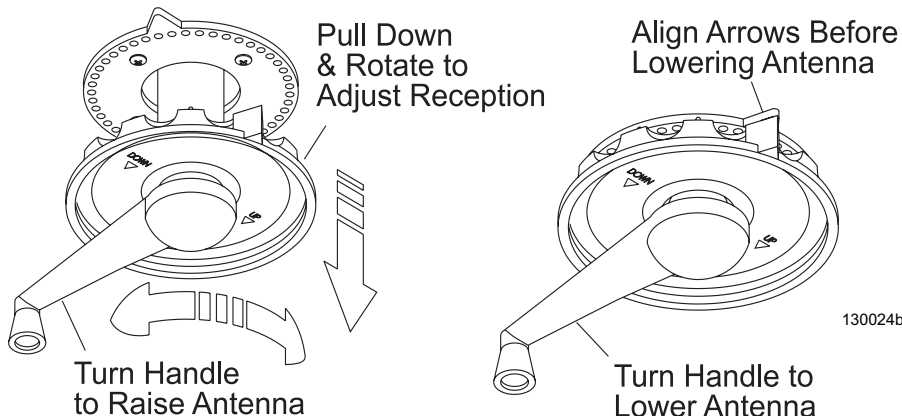
Visually inspect the area for obstructions or overhead electrical wires before raising the TV antenna. DO NOT raise the antenna near overhead electrical wires as contact may result in serious injury or death. Damage to the antenna, severe shock, personal injury or death can occur from inadequate clearance.

To Raise the Antenna:

- Rotate the crank handle clockwise to raise the antenna (approximately 14 ½ turns).
- Pull down on the outside directional wheel and rotate the antenna until the best picture is obtained. The directional wheel is spring loaded.

To Lower the Antenna:

- Pull down on the directional wheel and align arrows together.
- Rotate the crank handle counterclockwise to lower the antenna fully into the cradle. Make an outside visual inspection to ensure the antenna is properly stowed.



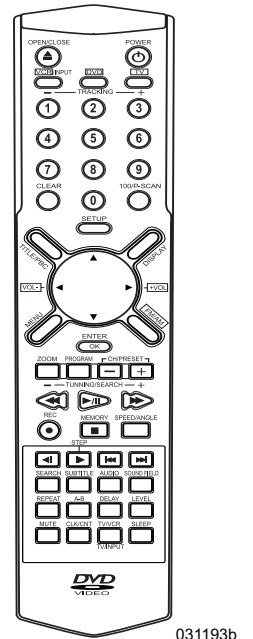
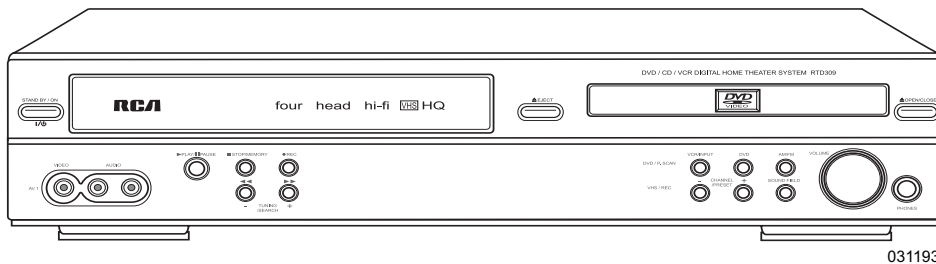
DVD Player (Optional)

The DVD player is a multi-function component that plays Digital Video Discs and has a built in radio and amplifier. The power button on the DVD player must be pushed on to place the system in Stand-by mode. The DVD player will then respond manually or when using the remote control.

Home Theater System (Optional)

The remote for the Home Theater system is the most versatile of all the items of equipment. The programmable remote can control the television if the manufacturer's codes are programmed. A complete listing of the manufacturer's codes is located in the A/V System Guide supplied in the warranty information file.

The Home Theater System can be used as a tuner for radio listening. A built in DVD player enables DVD, CD and Video CD to play through the televisions.

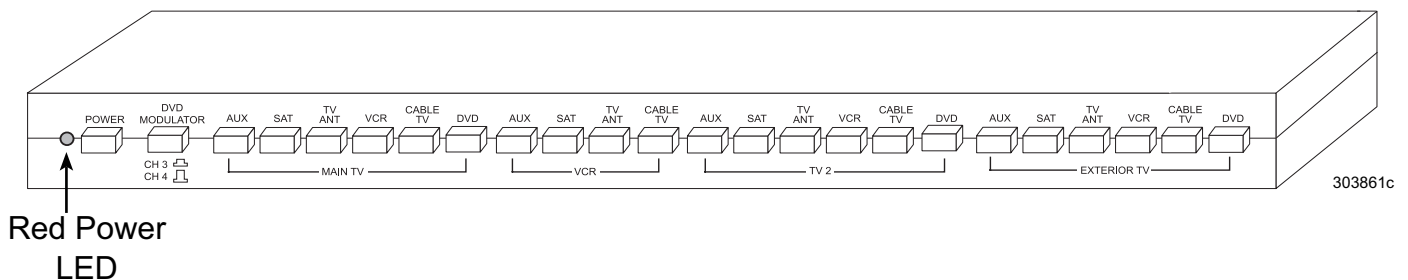


Video Selector Box

The motorhome is equipped with a video selector box that has five inputs and four outputs. The video selector box interfaces the different input signals from the various components to the televisions and VCR.

Features Include:

- Five Inputs: Satellite Receiver (Optional), TV Antenna, VCR, Cable TV and Auxiliary.
- Four Outputs: Main TV, TV2 (Bedroom TV), VCR, Exterior TV.
- Built-in 12 Volt TV antenna amplifier.
- Independent viewing of signals at different televisions, with a record option from the VCR.



Operating the Components

To Watch TV Using the Antenna:

Press the **TV ANT** button located above the section marked **MAIN TV** on the switchbox. Turn on the TV and select a channel. Fringe area reception can be improved by pressing the **Power** button on the switchbox. Follow the same procedure for the optional bedroom TV.

NOTE:

The picture quality from the outdoor TV antenna varies depending on the location of the TV station in relationship to the location of the TV antenna. If picture quality is poor, turn the POWER button on the Video Selector Box. Turn off when not viewing from the antenna.

To Watch TV Using the Shore Cable Signal:

Press the **CABLE TV** button above the section marked **MAIN TV**. Turn on the TV and select a channel.

NOTE:

To view Cable TV signals, hook a 75-Ohm cable from the supplied service to the Cable TV input in the Water Service Compartment. Cable TV inputs are available at many of today's campgrounds.

To Play a DVD:

Press the **POWER** button on the DVD player. Press the **SOURCE** button on the DVD player or select DVD on the DVD remote. Turn on the TV and select **Channel 3**. Press **DVD** on the Video Selector Box. Open the tray and place a disc on the tray label side up. Press **PLAY** on the DVD remote. Adjust the volume using the TV remote.

To Play a DVD on the Optional Surround Sound System:

Turn on the TV and Surround Sound System. Select **Channel 3** on the TV and press **DVD** on the Video Selector Box in the section marked **MAIN TV**. Press the **SOURCE** button on the Surround Sound remote until **DVD** displays. Place a DVD on the tray, label side up, and press **PLAY** on the Surround Sound remote. For full surround effect reduce TV volume to zero using the TV remote and adjust the surround volume using the Surround Sound remote.

BEDROOM TV SWIVEL

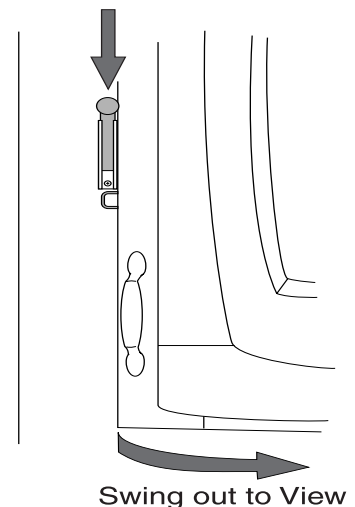
Bedroom TV Swivel (available on certain models):

- Unlock the TV (only when the motorhome is parked).
- Pivot the TV outward to desired angle.
- Stow the TV into the cabinet when preparing for travel. Lock the TV into position.

CAUTION:

Failure to lock the TV in the travel position can result in damage to the TV and cabinetry.

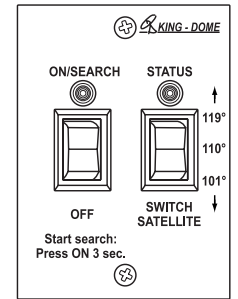
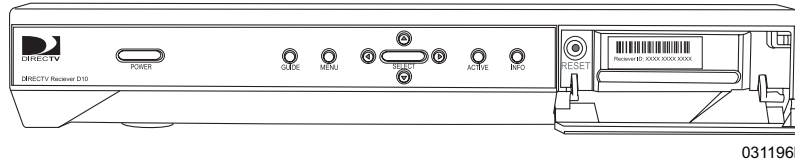
Secure for Travel



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SATELLITE SYSTEMS (Optional)

The self-contained stationary, automatic satellite TV system automatically acquires and tracks DirecTV®, DISH Network™ and Bell ExpressVu satellite signals throughout the continental United States when the motorhome is in a stationary position. Satellite service requires subscription.



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NOTE:

The satellite is a self-acquiring satellite TV antenna for use when the motorhome is stationary. The system is not designed to track the TV satellite when the motorhome is in motion.

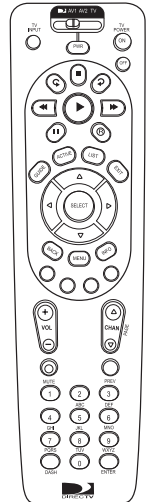
NOTE:

For specific satellite coverage areas and providers see the OEM manual.

The Internal Receiver Descrambler (IRD) receives satellite signals from the antenna for decoding, processing, and channel selection, and then sends those signals to the TV for viewing. The IRD also provides the interface for the user to activate authorization for reception.

INFORMATION:

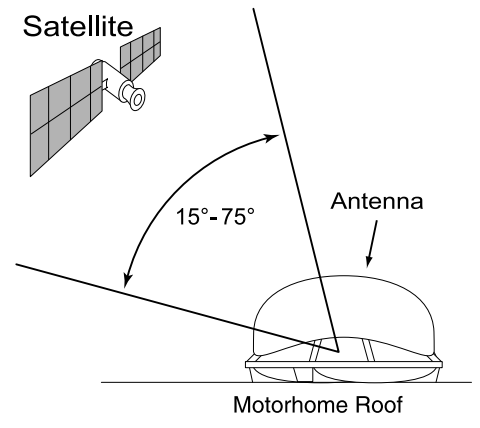
Refer to the IRD User's Manual for complete operating instructions.



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The satellite system requires a clear view of the southern sky to receive satellite signals. Ideal antenna site has an unobstructed view of 15° to 75° in the Southern horizon.

If the satellite antenna receives intermittent signals, or cannot locate the satellite, check around the motorhome for objects that could be blocking the signal, such as trees, building, etc. The satellite antenna must be located in the selected satellite's coverage area in order to receive a signal.



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NOTE:

The satellite receiver must be turned on for the system to function.

NOTE:

As part of the startup process, the System will default to channel 200, a program directory. This is the system's means of verifying that it has identified and is tracking the correct satellite. Once channel 200 appears, wait at least another 30 seconds before changing the channel to ensure that the system has completed the startup routine.

For Dish 500 subscribers:

After being locked onto a satellite Dish 500 subscribers can switch back and forth between the 110 and 119 satellites.

To switch satellites:

Press and hold the **three-position** switch for one second. **UP** will switch to 119, **DOWN** will switch to 110.

System Start-up:

- Upon power-up, the system performs a set of start-up routines.
- Antenna then searches for a TV satellite.
- After locating a satellite, the IRD data connection determines whether the satellite signal can be decoded. If so, the antenna locks onto and tracks the satellite.

NOTE:

Once the startup procedure is complete and the antenna is locked onto the correct satellite, the power switch may be turned off to avoid unnecessary discharge of house battery power. Because the antenna LNB receives its power from the IRD, the antenna will continue to receive the satellite TV signals and relay them to the IRD.

NOTE:

If the antenna is unable to locate the desired satellite, refer to the OEM Manual for possible causes and corrective actions.

“Instant On” Operation:

As part of operation, the satellite routinely saves its position to memory. When turned on the system notes the last saved position, and if the motorhome has not changed location, the antenna will immediately acquire the signal. If the motorhome moves after the system is turned off, the antenna will quickly carry out normal initialization routine to re-acquire the satellite. To turn the system **off**, press the **POWER** button.

NOTE:

It is highly recommended that the system be turned off prior to moving the motorhome. The system will not track a satellite while the motorhome is in motion.

The satellite system requires the following preventive maintenance for optimum performance:

Monthly:

- Wash the exterior of the radome and base plate assembly with fresh water; a mild detergent may be added to remove grime. **DO NOT** spray the radome directly with high-pressure water.
- **DO NOT** apply abrasive cleaners or volatile solvents, such as acetone, to the ABS dome.

Annually:

- Have the satellite system inspected by a professional RV Technician or satellite installer.
- Apply a treatment of full strength liquid dish detergent to the dome surface and allow it to dry to provide a film on the dome surface that causes moisture to bead up and roll off.

NOTE:

If a need arises to paint the radome, ONLY use non-metallic automotive paint to avoid degrading the RF signal strength and the reception quality.

INFORMATION:

For information on warranty, repair, and liability policies, refer to the complete warranty statement provided with the OEM Manual.

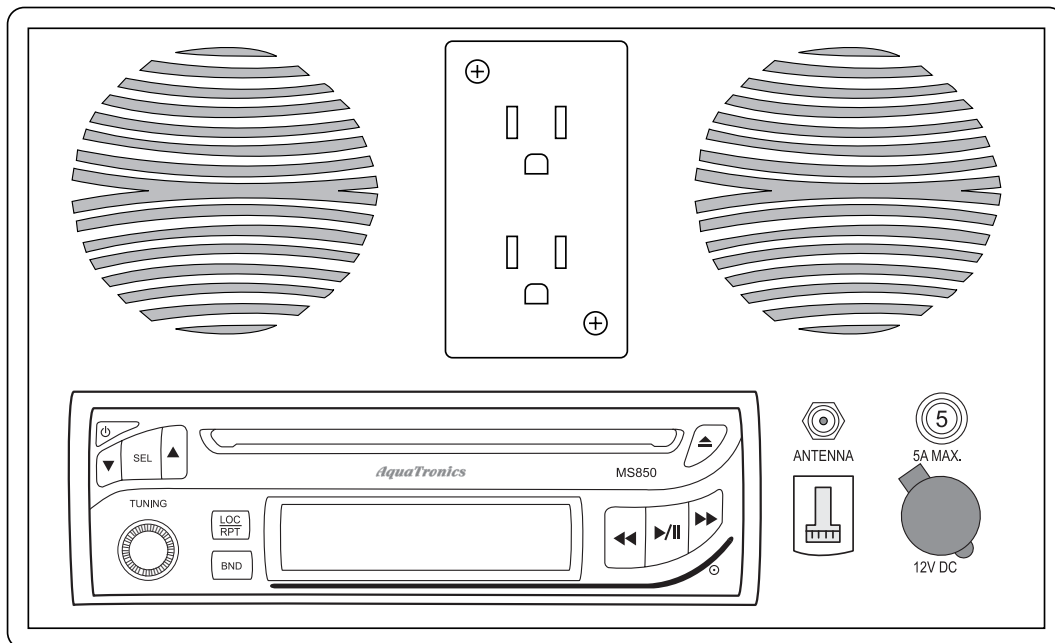
NOTE:

The satellite system has been designed to be maintenance and trouble free. For optimum signal strength, keep the dome clean from dirt, bugs and other debris. Periodic washing of the dome with mild soap and water is recommended. If the motorhome is to be stored for long periods of time it is recommended that the system be put through a search procedure on a quarterly basis to keep all moving parts in good working order.

ENTERTAINMENT CENTER - EXTERIOR (Optional)

Functions:

- **ON/OFF Power Button** - Press this button to turn the unit on or off.
- **Volume Control** - Press up button to increase volume and down button to decrease.
- **Select Button** - Selects audio function (volume, treble, bass, balance or fade) to be adjusted with Volume controls.
- **AM/FM Band Selector** - Changes radio band during radio use.
- **Tuner** - To manually tune in a station turn knob in appropriate direction.
- **Disc Slot** - Gently insert CD label side up until loading mechanism engages.
- **Track Select** - Used to scan forward or back from track to track.
- **CD Play/Pause Button** - Press this button to pause playback. Press again to resume play.
- **Repeat (RPT) Button** - Push button to repeat current track. Track will repeat until button is pushed again.
- **Disc Eject** - Push button to stop, play or eject CD or change to radio function, depending on current function.



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NEPTUNE 2006

Water Systems • Section 6

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WATER SYSTEMS - INTRODUCTION

This section contains information about the operation and care of the various water system equipment found in the motorhome. Optional water equipment will also be discussed, so not all information may be applicable to the motorhome. More detailed information with **CAUTION** or **WARNING** instructions for the various equipment, other than what is found in this section, can be found in the manufacturer's manual in the owner information box.

It is hard to imagine how much water is used by the average person. Newcomers to a self-contained motorhome soon discover water does not last long unless consumption is drastically reduced. For example, less water can be used for showering if the shower is turned off while soaping down, then turned back on to rinse. This way a good shower uses a couple gallons of water or less. There is plenty of water to meet personal needs once habits are adjusted.

Fresh Water System:

The fresh water system consists of the fresh water tank, water pump, water filter(s) and a water hose (not supplied) for potable water use only. Proper care of the hose is necessary. After each use, drain the water hose and screw ends together. Attach the regulator and plug to keep out insects and debris.

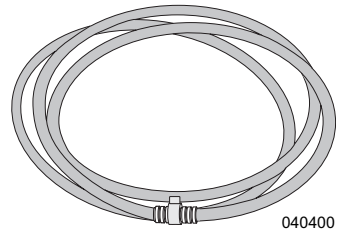
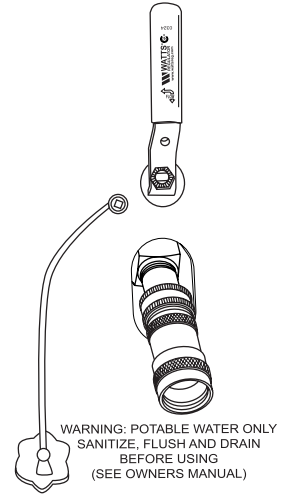
Waste Water System:

The waste water system consists of a waste holding tank (grey water), a sewage holding tank (black water), flush system, toilet and drains.

WARNING:

Water is electrically conductive. DO NOT use any electrically powered item or electrical outlet that may be exposed to a water source, such use can result in a serious shock causing injury or death.

TO WINTERIZE SYSTEM
SEE OWNERS MANUAL

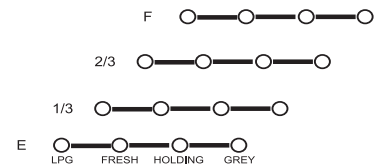


Water Hose (not supplied): Screw ends of hose together before storage to prevent dust and insects from entering the hose and leakage from occurring.

WATER TANKS

Measurements & Calibration

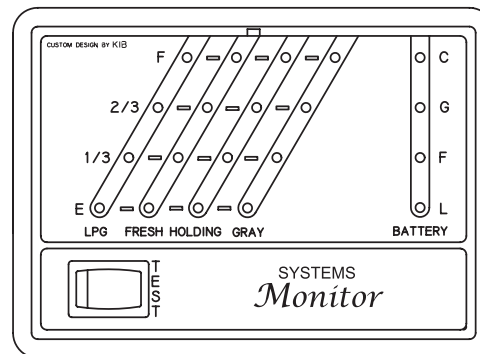
The monitor panel is located on the main Status Monitor Panel in the hallway area. A second monitor is located in the service bay. The switch marked **TEST** is a momentary switch which requires being held down while testing the level of the storage tanks. Read the scale for the desired storage tank that is to be monitored. Each scale uses colored lights along with a corresponding scale reading.



Monitor Panel

The lights and scale indications are as follows:

- **Green** lamps indicate good or normal ranges.
- **Amber** lamps indicate fair or partial ranges.
- **Red** lamps indicate full or empty ranges (depending on the scale), which are in the critical range.



Service Bay Monitor

WATER - POTABLE

City Hook-Up

- Connect a potable water hose with a regulator to the City/Fresh Water Hook-up located in the service center on the roadside of motorhome.
- Turn the city water/tank fill valve to the **City Water** position (as shown).
- Turn on the water supply.
- The water pump can either be **off** or **on**. It will not affect the water pump to leave it on.
- The City Water Hook-up in the service center has a built in pressure regulator and one way check valve. The pressure regulator limits the water pressure to approximately 45 PSI.

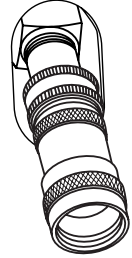
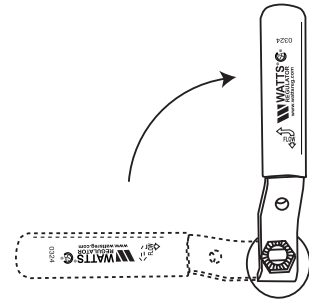
NOTE:

When connecting the motorhome to fresh water be sure to use a hose manufactured and labeled for potable water to ensure that the hose will not flavor the water.

CAUTION:

Some outside water sources develop high water pressure, particularly in mountainous regions. High water pressure is anything over 55 psi (pounds per square inch). Excessive water pressure may cause leaks in water lines and/or damage the water heater. An additional pressure regulator can be connected to the city water faucet to regulate the pressure to the potable water hose. Excess pressure on a hot day can cause the water hose to swell and burst.

TO WINTERIZE SYSTEM
SEE OWNERS MANUAL



WARNING: POTABLE WATER ONLY
SANITIZE, FLUSH AND DRAIN
BEFORE USING
(SEE OWNER'S MANUAL)

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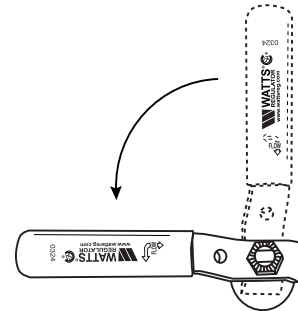
Fresh Tank Fill

- Connect a potable water hose to the City/Fresh Water Hook-up located in the service center on the roadside of the motorhome.
- Turn the City Water/Tank Fill valve to the **Fresh Water Fill** position (as shown).
- Turn **ON** the water supply.
- The water pump should be **OFF**.
- The water tank is full when water comes out the tank overflow pipe located on the curbside of the motorhome. Shut the water supply off as soon as possible.

NOTE:

When filling the fresh water tank, do not leave the hose unattended. Watch for water to come out of the overflow located at the curbside of the motorhome in front of the drive axle. Turn water off before a full blast of water comes out.

TO WINTERIZE SYSTEM
SEE OWNERS MANUAL



WARNING: POTABLE WATER ONLY
SANITIZE, FLUSH AND DRAIN
BEFORE USING
(SEE OWNERS MANUAL)

040532

WATER PUMP

The water pump pressurizes the fresh water system when not connected to city water. The water pump is self-priming, operating on demand as water is used. The water pump is located behind the plumbing service center.

WARNING:

Before leaving the motorhome for extended periods of time (i.e. overnight or longer) be sure that the city water and the water pump has been turned off. Damage from neglect will be the responsibility of the owner, not the manufacturer.

The water pump can be operated from the following locations:

- Monitor Panel
- Plumbing Service Center

To turn the water pump ON or OFF:

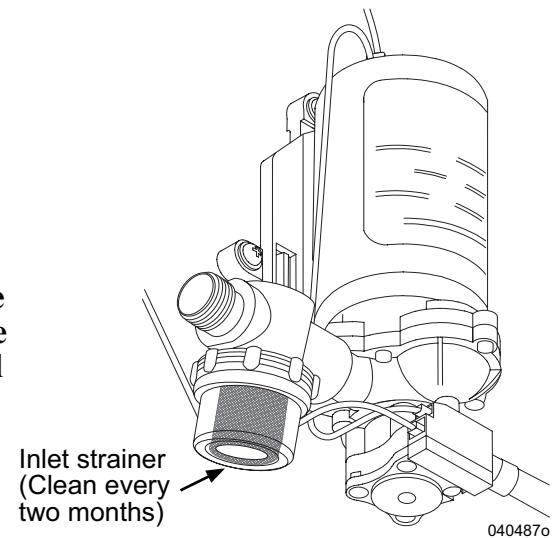
- Momentarily press the water pump switch. The indicator lamp will illuminate when the water pump is turned on.

CAUTION:

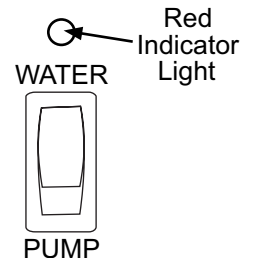
DO NOT continue water pump operation if the fresh water holding tank is empty. Damage to the water pump or electrical supply system may result.

Using the water pump to pressurize the fresh water system after removal from storage:

- Close all drain valves and low point drains.
- Fill the fresh water tank.
- Open the hot and cold water valves of each faucet.
- Turn the water pump on. Wait for the water lines to fill.
- Close each faucet when it delivers a steady stream of water (cold first).



Water Pump: Located in Plumbing Service Center



Monitor Panel Water Pump Switch: Located in hallway.

Water Pump Troubleshooting

Vibration induced by road conditions can cause the plumbing or pump hardware to loosen. Check the water pump system for components that are loose. Many symptoms can be resolved by tightening the hardware. Check the following items:

Water pump will not start or blows the fuse:

- Check the electrical connections at the water pump, located in the Roadside water bay, fuse or breaker, water pump switch and ground connection.
- Check the electrical connections at the latching controller.
- Is voltage present at the pump? If voltage is present, the pressure switch may be faulty.
- Is the latching controller grounding the water pump?
- Check the charging system for correct voltage and good ground.
- Check for an open or grounded circuit or motor.
- Check for a seized or locked diaphragm assembly (water pump frozen).

Water pump will not prime or sputters (no discharge/motor runs):

- Is the pump inlet strainer clogged with debris?
- Is there water in the tank, or has air collected in the water heater?
- Is the inlet tubing and plumbing sucking in air at plumbing connections (vacuum leak)?
- Check for proper voltage with the pump operating.
- Check the pump housing for cracks or loose drive assembly screws.

Water pump will not shut-off or continues to run when the faucet is closed:

- Check to see if the fresh water/tank fill valve is completely closed.
- Check the output (pressure) side plumbing for leaks and inspect for a leaky toilet or valves.
- Look for a loose drive assembly or pump head screws.

Water pump is noisy or rough in operation:

- Check for plumbing that may have vibrated loose.
- Does the mounting surface multiply noise (flexible)?
- Check for mounting feet that are loose or compressed too tight.
- Look for loose pump head to motor screws.

Water pump is rapid cycling:

- Look for restrictive water flow in the faucets or shower heads.

WATER FILTER

The motorhome is equipped with a filtered water dispenser at the galley sink. A diverter hose is installed at the factory and the water filter is secured on a clip next to the diverter hose. The water filter will need to be installed by the motorhome owner.

Replacing/Installing Water Filter or Diverter Hose:

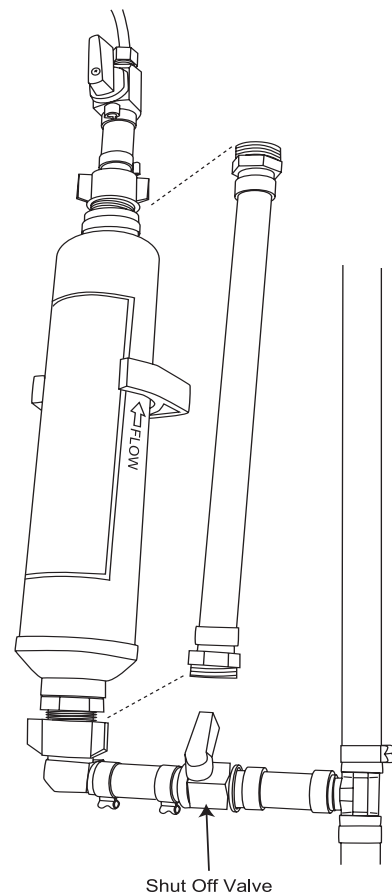
- Close the shut-off valve on the inlet side of the water filter.
- Turn on the water dispenser to relieve pressure in the line.
- Remove the water filter/diverter hose by unscrewing the fittings at the top and bottom.
- Replace with filter or install diverter hose and open the valve.
- According to the **FLOW** label on side of filter.
- Check for leaks.

NOTE:

Check the filter or diverter hose for leaks after installation to prevent damage to the motorhome.

NOTE:

Replace the water filter every six months. Remove the water filter and install the diverter hose when winterizing the motorhome.



Shut Off Valve: Shown in closed position.

WATER SYSTEMS

Troubleshooting

Water system problems are generally caused by improper use or lack of attention. Improper winterizing, poor maintenance, road vibration and campsite water pressure variations are common culprits of water system failure.

Check all plumbing connections for leaks at least once a year. If the water pump runs when a faucet is not open, check for a water leak. Close drain valves. If the pump continues to run, take the motorhome to an authorized dealer for service.

Disinfecting Fresh Water

Disinfecting the water system with household bleach (super chlorination) protects against bacteriological or viral contamination from common water sources.

When to disinfect the fresh water system:

- If the motorhome is new.
- If the motorhome has been in storage.
- Every three months during use.

To Disinfect the Water System:

1. Remove water filter in galley and install diverter hose.
2. Drain the fresh water tank. Close drain when done.
3. Prepare a disinfecting solution: Multiply tank capacity (in gallons) by 0.13. The result is the amount (in ounces) of household bleach to pour into fresh water tank. This yields a 50 PPM (parts per million) disinfecting solution in the water system that will act as a quick-kill dosage for harmful bacteria, viruses and slime-forming organisms. Concentrations higher than 50 PPM may damage the water lines and/or tanks.
4. Attach a 5' to 10' potable water hose to the fresh water fill connection.
5. Use a small funnel to pour the correct amount of disinfecting solution into the hose.
6. Hook one end of another potable water hose to the short hose and the other end to a water source.
7. Use the water pressure to push the disinfecting solution into the tank.
8. Top off tank with fresh water.
9. Turn on the water pump in the motorhome.
10. Open each faucet and run the water until you smell a distinct bleach odor.
11. Turn off all faucets and allow the system to stand for four hours.
12. Drain the fresh water tank of the mixed solution.
13. Fill the water tank with fresh water. Thoroughly flush hot and cold lines with fresh water. Repeat this process until the chlorine bleach smell is no longer detectable in the water system.
14. Install a new water filter.

INFORMATION:

Household bleach is 5.25% Sodium Hypochlorite. Higher concentrations increase PPM Ratio.

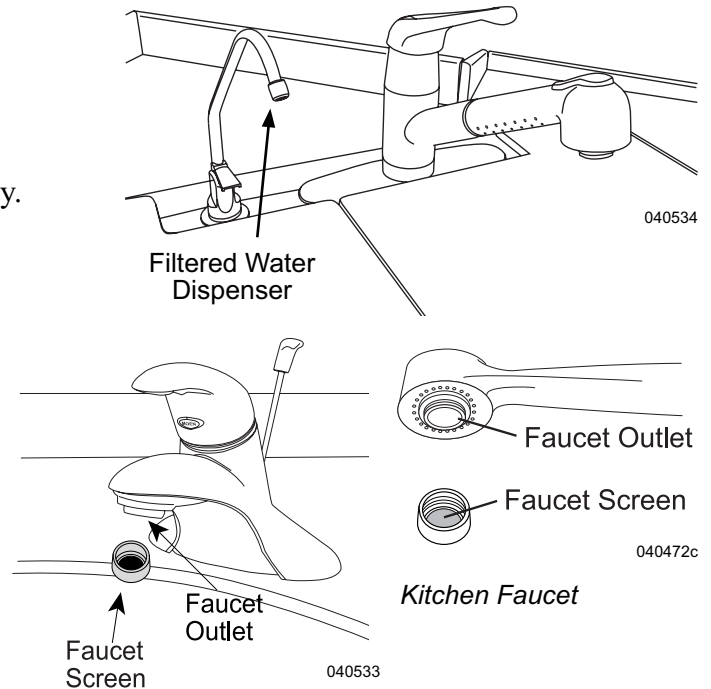
FAUCETS

The kitchen faucet head has a flexible hose allowing the faucet head to be removed from the base. O-rings seal the faucet head to the base preventing water from dripping into the cabinet. Push the slide bar to select either stream or spray.

Fresh water may contain lime deposit or debris that will attach to the faucet screen and restrict or plug the flow of water. All faucet screens should be checked and cleaned every two weeks of use.

To clean faucet screens:

- **Unscrew kitchen** - screen retainer from faucet head.
- **Lavatory/vanity** - remove threaded collar from faucet outlet.
- Clean screen using a small soft brush, if necessary, and a de-liming solution.
- Install screen and check water flow.



WASTE WATER SYSTEMS

Proper Waste Disposal

Dumping raw sewage from toilet holding tanks, except at authorized dumping stations, is universally prohibited. Most National, State and private parks have either a central dump facility or campsite hook-up for sewage. Many modern rest areas along the interstate now have dump stations available. Woodall's Campground Directory, Trailer Life's RV Campgrounds and Services Directory, Rand McNally's Campground and Trailer Park Guide, Good Sam Park Director (Good Sam Club), and other similar publications list dumping stations. Some major oil companies offer dump facilities at selected stations.

What Not to Put in Waste Holding Tanks

- **DO NOT** use strong or full strength detergents to deodorize and disinfect. Use odor control chemicals made especially for holding tanks.
- Automotive antifreeze, ammonia, alcohol or acetone in holding tanks will dissolve plastic.
- **DO NOT** put large table scraps in the tanks. They could stick in or damage the valve seals.
- Facial tissue is thicker, softer and stronger than a rapidly dissolving tissue. White toilet paper dissolves faster than colored. Paper designed specifically for holding tanks is available at most RV supply stores.

TIP:

To test tissue dissolving ability, immerse one tissue square into a jar of water. Shake the jar five times to determine if the tissue disintegrates into pieces or remains in one piece. DO NOT use any type of tissue that remains in one piece.

NOTE:

Never dispose of sanitary supplies or other non-dissolving items into the system. Facial tissue, wet strength tissue, paper towels or an excessive amount of toilet tissue can create clogging in the holding tank system.

CAUTION:

DO NOT use products that contain petroleum distillate or ammonia in place of RV odor controlling chemicals. Petroleum distillate or ammonia will damage the plastic holding tanks and seals.

What to Put in Holding Tanks

Black Water Tank:

Before initially operating the toilet, treat the sewage holding tank with a pre-charge of water and an odor-control chemical (available at most RV supply stores). First, add approximately three gallons of water to the holding tank. Next, mix the chemicals, in accordance with the manufacturer instructions, with approximately one gallon of water. Pour mixture through toilet to the holding tank. Be careful not to spill the chemical on your hands, clothing, toilet bowl or carpet. Hot weather conditions may require adjusting the amount of chemical used to control odor. Repeat the chemical pre-charge to the holding tank each time the tank is cycled.

WARNING:

Most chemical mixtures for holding tank odor control are poisonous. Follow the product manufacturer's directions and warnings when using a holding tank additive. DO NOT use any products that contain petroleum distillate or ammonia in place of RV odor controlling chemicals. Petroleum distillate or ammonia will damage the ABS plastic holding tanks and seals.

Grey Water Tank:

The grey water waste tank stores the sink, shower and clothes washer drain water. A reduced mixture of chemicals may help to control odor in the grey tank.

Ensure that there is enough liquid in the holding tanks prior to dumping the waste holding tanks to provide a smooth flow through the valve, drain pipe and drain hose. Empty the waste holding tanks weekly to prevent stagnation and overfilling.

Waste Drain & Sewage Tanks

The waste drain system provides adequate and safe storage and/or discharge of waste materials. The drain system uses ABS plastic piping and fittings connected to sinks, shower, toilet and holding tanks draining to an outside termination. The motorhome should be reasonably level for optimum operation of the waste systems. The wastewater holding system consists of a grey water tank that stores the sink, shower and laundry washer drain water, and a black holding tank that stores waste from the toilet.

Drain valves and a tank flush system dispose waste through a common termination. Each holding tank has a separate drain valve dumping the waste water (grey water) and sewage (black water) through a common single discharge outlet. The tank drain valves are located in the service center on the roadside. Use the Systems Control Center to monitor tank levels. When ready to drain the tanks, drain the sewage tank first. Next, flush the black tank with the flush system. Close black tank valve after flushing tank. Drain the grey water tank. Using this sequence helps to flush solids from the sewer hose. When traveling, it is recommend both holding tanks be empty or less than half full.

Waste Drain Hose

A flexible 3" sewer hose attaches between the termination drain and the shore facility. The termination drain is adjustable and should be periodically exercised. Sewer hoses usually come in 10 or 20' lengths. The sewer hose is stored in a tube accessed through a door on the roadside next to the rear tire. The shore fitting for the sewer hose may be a 3 or 4" male or female thread pipe or a 4" pipe with no threads, covered by a metal plate. Different styles of adapters are available to fit most configurations. Hose ladders may also be purchased to support the hose.

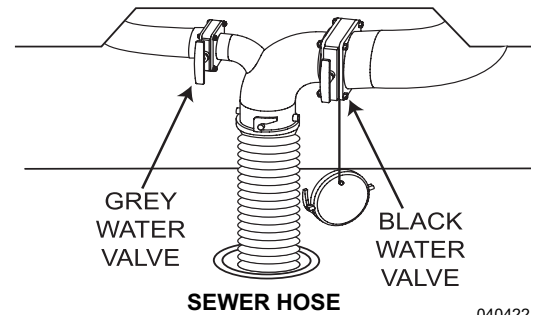
It is important that the hose remains secure. **Always tighten clamps and restraining devices before use.** Lay the hose in line between the termination outlet and the shore fitting. Restrain the hose to prevent movement during use. Wear protective and/or disposable gloves when handling the sewer hose.

To Exercise the Termination Drain:

- Grasp the drain firmly on both sides of the drainpipe.
- Swivel the pipe up and down several inches to exercise the internal O-rings.
- The drainpipe may be left in the upward position to prevent residual material from leaking out.

To Attach the Hose:

- Remove sewer hose from carrier.
- Remove termination cap. Align coupler tangs with termination tabs. Twist coupler clockwise 90° locking coupler to termination outlet.
- Unscrew the access deck plate and feed the drain hose through the opening.
- Rotate the drainpipe downward for maximum flow.
- Attach the other end of the hose to the drain service. Restrain hose to prevent movement during use.
- Open the (small) grey water valve.



Plumbing Service Center: Located on roadside.

The black water valve remains closed until the tank is full or until time of departure to help prevent clogging. Use the outside faucet or shower attachment for washing or rinsing the sewer hose after dumping the black tank.

LUBE:

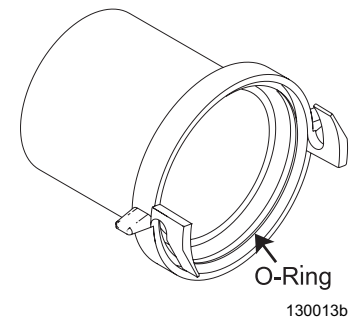
Lubricate the O-ring on the sewer hose adapter periodically with silicone spray.

NOTE:

Close the grey water valve 24 hours prior to departing to allow the tank to fill with liquid to help in the dumping process.

NOTE:

Use care when connecting the sewer hose adapter to the termination outlet in cold weather.



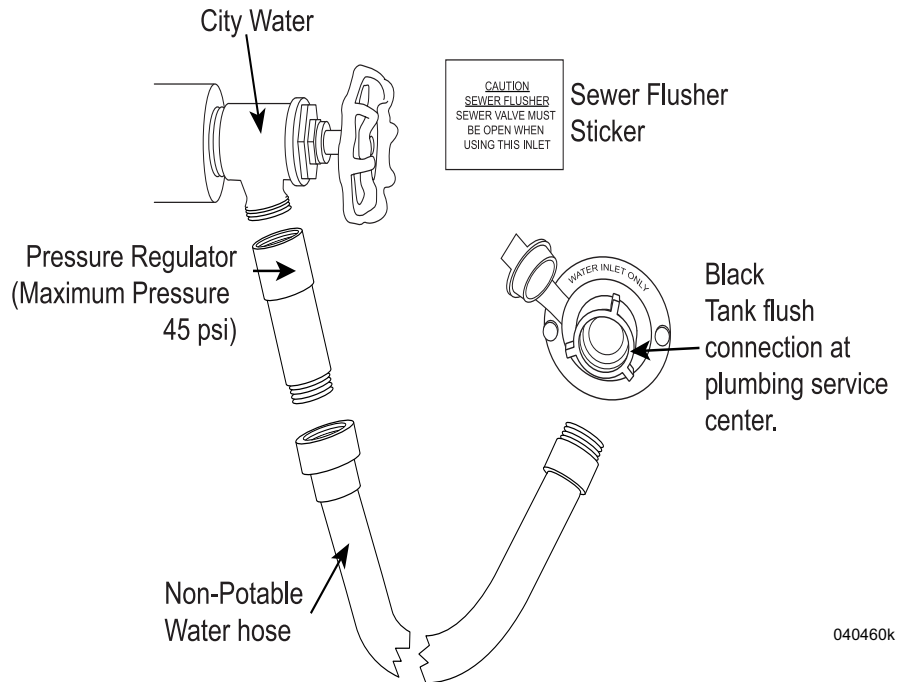
Hose adapter clamped to end of sewer hose.

Black Tank Flush

The motorhome comes equipped with a power flush nozzle, located in the black tank to help reduce solid build-up. Flush the tank each drain cycle. Failure to thoroughly rinse the tank may result in accumulated solids and clogged spray nozzles.

Dumping the Tanks:

1. When preparing to dump the black tank, first close the grey water valve.
2. Fill the grey tank to at least 50% by running water in the shower or sinks.
3. Use the Systems Control Center to observe tank fluid levels. When the grey tank is 50% full, stop filling the tank.
4. Attach waste drain house to system.
5. Open the black water valve. Allow the black tank to drain.
6. Connect a non-potable water hose, with pressure regulator, to the flush system fitting located in the service center.
7. Turn on the faucet and allow water to rinse the black tank at least three minutes. Never operate the system unattended. Ensure the water flows freely through the sewer hose.
8. When completed, turn off the faucet and close the black water valve.
9. Open the grey water valve. The water in the grey tank will flush remaining solids from the sewer hose. The grey valve remains open until the next drain cycle, or time of departure.



WARNING:

Never operate the flush system unattended. Flooding may occur. Use the tank flush system each time the holding tanks are cycled. Failure to routinely use the flush system will result in a clogged spray nozzle. Turn off the water supply when finished flushing the tank.

10. When preparing for travel, close both black and grey valves. Undo restraining devices from the sewer hose. Disconnect the sewer hose from the termination outlet by rotating the fitting counterclockwise 90°.
11. Drain the sewer hose using a hand over hand method working the sewer hose towards shore fitting. Rinse the sewer hose with outside facility and repeat the hose drain process.
12. Remove the sewer hose from shore fitting. Install sewer hose in carrier and lock door. Secure the termination cap (required by law in some states).
13. If desired, add chemicals to the tanks to control odor. Follow the directions given by the manufacturer of the chemical.

NOTE:

Dump the black tank before driving.

Waste Pump (Optional)

The waste pump is a self-priming impeller pump designed to minimize clogging when draining the tanks. The system comes with a 1 1/2" outlet hose with sewer pipe adapter and a 13 gallon per minute macerator pump.

To Empty the Black Tank:

- Ensure the connector on the macerator pump to the termination point on the dump connection is secure. Ensure waste pump outlet hose is secure.
- Remove the drip cap at the bottom of the sewer pipe adapter.
- Insert the adapter into the sewer connection.
- Open the solid (black) waste drain valve at the plumbing service center.
- Turn on the macerator pump using the switch on the service center panel.
- When the black tank is empty, turn off the pump.

To Flush the Black Tank:

- Ensure the sewer pipe adapter is inserted in the facility sewer connection.
- Ensure the solid waste drain valve is open, the liquid waste drain valve is closed and the grey tank is at least 50% full.
- Connect a non-potable water hose with pressure regulator to the flush system fitting in the plumbing service center. Turn on the water supply and waste pump. Allow the water to rinse the black tank for at least three minutes. Never operate the system unattended. Ensure the water flows freely through the waste pump outlet hose.
- When completed turn off the faucet.
- Close the solid waste drain valve and open the liquid waste drain valve. Turn on the waste pump. The water in the grey tank will flush the remaining solids from the sewer hose. The liquid waste drain valve remains open until the next drain cycle or time of departure.

When Preparing for Travel:

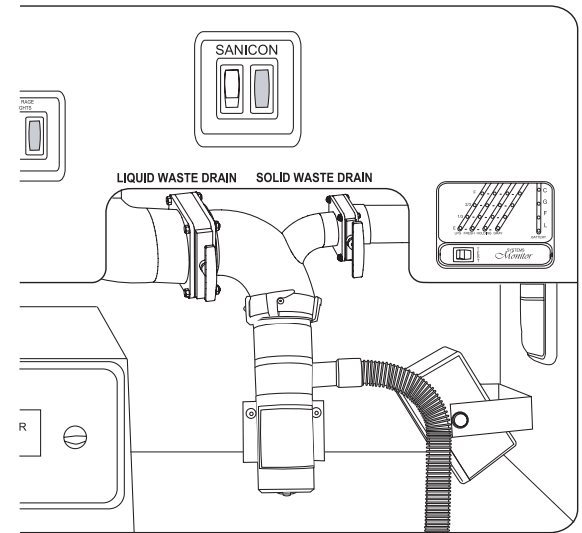
- Empty the tanks and close both the solid and liquid waste drain valves. Undo restraining devices from the waste pump outlet hose. Drain the hose using a hand over hand method while working the hose toward the shore connection. Remove sewer pipe adapter from shore fitting and install drip cap. Coil and store hose in water bay.
- If desired, add chemical to the tanks to control odor. Follow the directions given by the manufacturer of the chemical.

NOTE:

Drain both waste tanks before traveling.

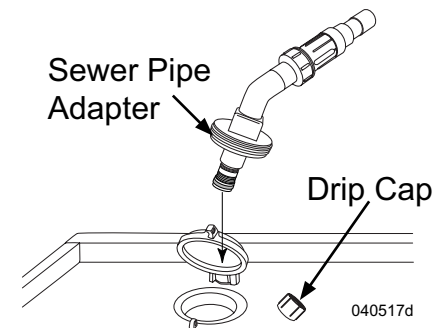
Troubleshooting:

- The house battery disconnect switch (in battery compartment) must be on to operate the macerator pump.
- 12 Volt DC power for the macerator pump is supplied by the house batteries and is protected with a 20 Amp mini breaker located in the battery bay in the electrical enclosure.



Typical Dumping System Layout.

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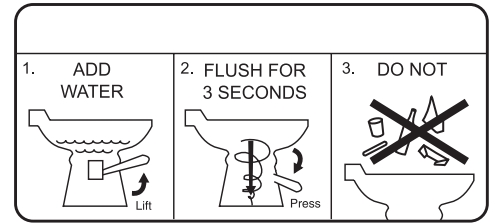
Inserting sewer pipe adapter into sewer connection.

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TOILET

Operating Instructions

The toilet operates from either the fresh water tank or city water supply. The water pump must be turned on or the city water connected. The toilet flushes directly into a sewage holding tank (black water).



040416

NOTE:

To prevent accumulation of solids below toilet, add several gallons of water to the holding tank before use.

CAUTION:

Most chemical mixtures for holding tank odor control are poisonous. Follow the product manufacturer's directions and warnings when using any holding tank additive.

Toilet Operation:

- Using a foot, lift up the flush lever to add water to the bowl. Generally, more water is required only when flushing solids.
- To flush the toilet, push the lever all the way down until the sewage leaves the toilet.



040491

NOTE:

The optional porcelain toilet is equipped with two separate foot levers: one for filling and the other for flushing.

Water flow pressures vary at different locations; therefore, holding the flush lever down for several seconds may be required. Release the flush lever by allowing it to snap back, which permits positive sealing around the flush ball. A small amount of water should remain in bowl.

NOTE:

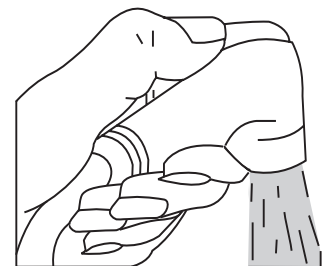
Holding flush lever down longer than necessary results in excessive water usage.

Cleaning & Maintenance

Cleaning the Toilet:

The toilet should be cleaned regularly for maximum sanitation and operational efficiency. Clean the toilet bowl with a mild bathroom cleaner. **DO NOT** use chlorine or caustic chemicals, such as drain opening types, as they will damage the seals.

Clean out the system by flushing several gallons of fresh water through with one cup of dry laundry detergent. Add odor control deodorant, in the amount specified for the holding tank capacity, after cleaning and every few days during use.



040397

Maintenance - Checking for leaks:

To find leaks, check behind or under toilet. Take four or five sheets of toilet tissue and wipe all the seams and water line connections. Start at the top of the unit and work downward. When the tissue comes in contact with leaking water it will immediately change texture.

NOTE:

If the motorhome is in storage, spray silicone on the toilet bowl valve and work it back and forth. Perform this maintenance monthly (silicone will evaporate in about 30 days).

Troubleshooting:

• Leaks:

- **Back of toilet:** check water supply line connection.
- **Between closet flange and toilet:** Check the screws for tightness. If the leak continues, remove the toilet and check flange height. Adjust the height, if necessary, to 7/16" above floor. Replace the flange seal if it is damaged.

Poor flush:

- A good flush should be obtained within two to three seconds. If the problem persists, remove the water supply line and check the flow rate. The flow rate should be at least ten quarts (9.5 liters) per minute.

Bowl will not hold water:

- Check for foreign material in the valve blade groove in the flush drain.

NOTE:

Most chemical mixtures for holding tank odor control are poisonous. Follow the product manufacturer's directions and warnings when using any holding tank additive.

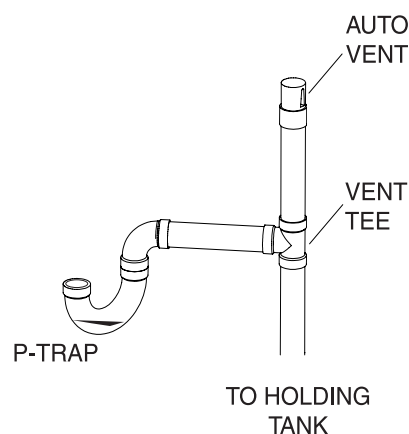
Drain Traps & Auto Vents

Drain Traps:

Sinks, shower and clothes washer drains incorporate a water trap (P-Trap) and auto vents to prevent waste water holding tank odor from entering the motorhome. P-Traps are usually within 54" of a vent tee and must contain water to block odors. During storage, water can evaporate and allow odor into motorhome. If odor is detected, run water into sinks, shower and clothes washer to fill P-Traps.

Auto Vents:

The auto vent is designed to assist in the smooth flow of water in the drain without creating a vacuum. The auto vent, if stuck in the open position, can allow grey odors to enter the motorhome. Some auto vents can double as "clean outs" in the event the line needs to be snaked out.



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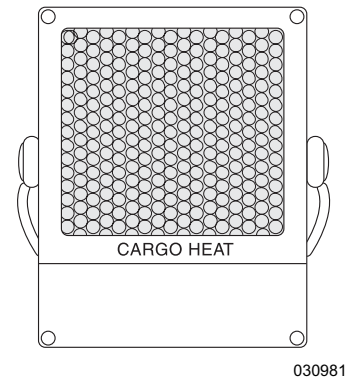
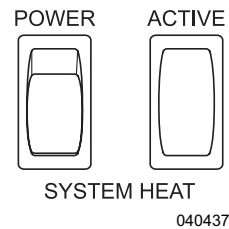
COLD WEATHER CONDITIONS

The motorhome is not designed for extended use in below freezing (32°F/0°C) weather. There are precautionary measures that can be taken during extended cold weather use.

Interior water lines, fixtures, and drains above the floor are normally protected from moderate freezing temperatures as long as the furnace is operating. Cold temperatures can adversely affect water systems below the floor level because the LP-Gas furnace heat does not provide heat to these components. A supplement 12 Volt bay heater and thermal snap disc are located in the water service bay. The System Heat switch on the monitor panel operates the bay heater and should be turned on when ambient temperature approaches 44°F (+/- 6°F) and freezing temperatures may occur.

System Heat Operation

1. Turn the Systems Heat switch **ON** to supply power to the snap disc thermostat.
2. When the bay temperature reaches 40°F (+/- 6°F), the snap disc thermostat will close. The bay heater and the systems heat Active light will turn on. The heater will continue to operate until bay temperature reaches 55°F (+/- 6°F). The bay heater and Active indicator light will turn **OFF**.



12 Volt DC Bay Heater.

NOTE:

The bay heater consumes about 20 Amps when operating. House battery power can be quickly consumed. It is recommended to hook to shore power when using Systems Heat.

Cold Weather Storage

If the motorhome is stored where freezing temperatures may occur, drain the domestic fresh water loop. Drain the fresh water tank by opening the fresh tank drain valve in the plumbing service center.

NOTE:

Icemakers, water filters, and water heaters use domestic water and should be drained and stored in accordance with the manufacturer's recommendation for winterization.

WINTERIZATION

The fresh and waste water systems require winterization when the motorhome is placed in storage. To winterize, use compressed air to evacuate all liquids and/or antifreeze to replace all liquids.

The recommended method of winterizing is using air pressure to remove liquids that may freeze and cause damage to the various systems and appliances. The lines can then be left empty, or filled with an FDA approved RV antifreeze. When plumbing lines are drained, antifreeze is not necessary, and the decision to use antifreeze is left to the motorhome operator.

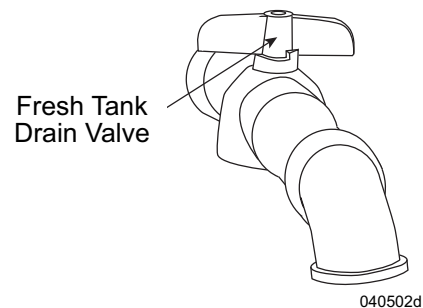
NOTE:

ONLY FDA approved RV antifreeze should be used to winterize the water systems in the motorhome.

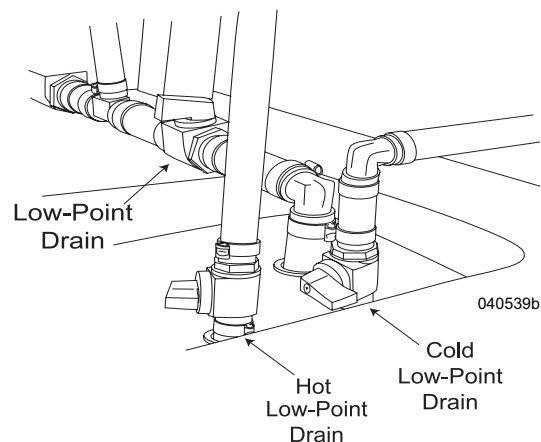
Using Air Pressure

Access to an air compressor and an adapter to connect the air line regulator to the water system is necessary. The air coupler in the engine compartment, which is part of the chassis air system, may also be used. Air adapters used for winterizing are available at RV supply locations. When attached to the water lines, air pressure should not exceed 40 PSI. Higher pressure can damage the lines.

1. Empty and flush the holding tanks.
2. Drain the fresh water tank by opening the drain valve located inside the water service center of the motorhome.
3. Open all low-point drain valves and allow the water to drain.
4. Remove water heater exterior access panel. Open the high temperature/pressure relief valve to vent water heater. Remove drain plug to allow tank to drain. Replace plug. Place water heater bypass valve in bypass position (accessed from interior).
5. Remove filter in galley corner and install diverter hose.
6. Connect an air hose with regulator to the City/Fresh Water Fill connection, with valve positioned for **City Water**. Set regulator for 40 psi and turn on air. (Air adapters for winterizing are available at RV supply locations.)
7. When water stops flowing from the drain valves, open and close the faucets one at a time, hot and cold, until only air comes out. **DO NOT** forget any outside faucets.
8. Hold the toilet flush mechanism open until the water has stopped running.
9. Disconnect the air hose with adapter.
10. Close all valves and faucets.
11. One (1) gallon of FDA approved RV antifreeze is needed to protect various water drain lines in the motorhome. Pour 1 pint into both the kitchen and bath shower drains. Pour 2 pints into the bath sink drain. This will protect the P-traps, with some of the antifreeze going into grey tank to protect the drain valve. Open the valve on the toilet. Pour another 3 pints into the toilet, letting the antifreeze run into the black tank to protect the drain valve. Use a soft cloth to wipe out the sinks, shower and toilet (after the antifreeze is poured in) to protect the surfaces from stains. Pour the last pint into the washer-dryer drain.



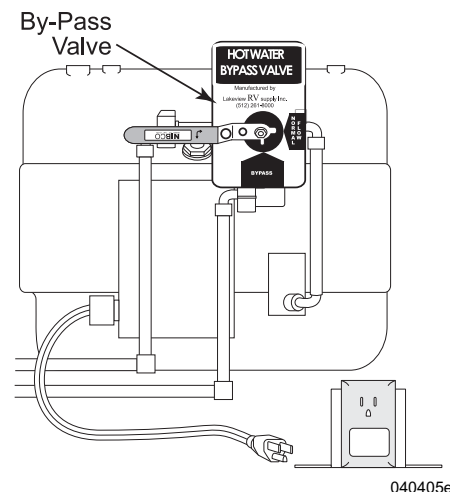
Fresh Water Tank Drain Valve: Located in bay, next to plumbing service center.



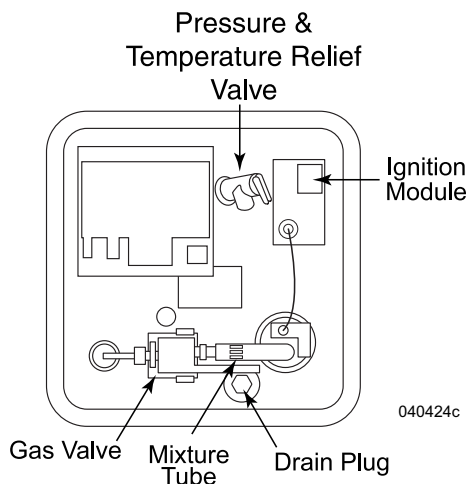
Open all low point drains to drain fresh water system. Valves shown in closed position.

WARNING:

Ensure the water is not hot when draining the low-point drain lines. Hot water from the lines can cause burn injuries.

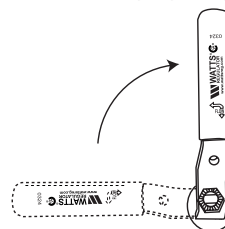


Place bypass valve in bypass position. Valve shown in normal flow position.



Open the high pressure/temperature relief valve to vent the water heater.

TO WINTERIZE SYSTEM
SEE OWNER'S MANUAL



WARNING: POTABLE WATER ONLY
SANITIZE, FLUSH AND DRAIN
BEFORE USING
(SEE OWNER'S MANUAL)

040532b

Standard City/Fresh Water Fill Connection. Valve shown in City Water Position.

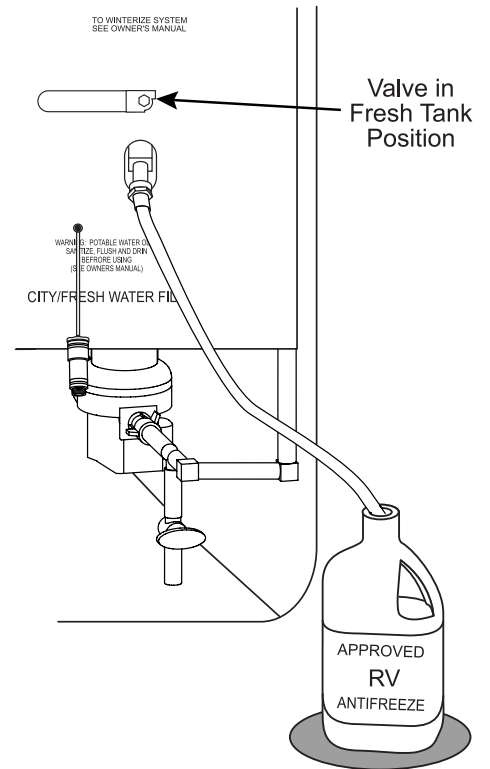
Using Nontoxic Antifreeze

Approximately three gallons of FDA approved RV antifreeze is required to winterize the motorhome.

CAUTION:

It is recommended that a qualified RV service technician familiar with motorhomes, such as an authorized dealer, perform the winterizing procedure.

1. Empty and flush the holding tanks.
2. Remove water dispenser filter in galley corner and replace with diverter hose.
3. Close all faucets, drain valves and low point drains.
4. Turn water heater bypass valve to bypass position. Remove drainplug and drain water heater.
5. Connect the supplied winterizing hose to the Fresh Tank Fill/City Water connection at the service center.
6. Turn the Fresh Tank Fill/City Water Valve to the **Tank Fill** position.
7. Close the winterization valve located between the water pump and fresh water tank.
8. Insert winterizing hose into the container of antifreeze.
9. Turn **on** the pump.
10. Open all faucets, one at a time, hot and cold starting with the faucet farthest from the pump. Turn the faucet off when antifreeze appears. Hold the toilet flush mechanism open until antifreeze appears.
11. Use a soft cloth to wipe out the sinks and shower to protect surfaces from antifreeze stains.
12. One gallon of FDA approved RV antifreeze is needed to protect various water drain lines in the motorhome. Pour one pint into both the kitchen and bath shower drains. Pour two pints into the bath sink drain. This will protect the P-traps, with some of the antifreeze going into the grey tank to protect the drain valve. Open the valve on the toilet. Pour another three pints into the toilet, letting the antifreeze run into the black tank to protect the drain valve. Use a soft cloth to wipe out the sinks, shower and toilet (after the antifreeze is poured in) to protect the surfaces from stains. Pour the last pint into the washer-dryer drain.
13. Disconnect power to the water pump.



Adding antifreeze to fresh water system.

NOTE:

Clean up antifreeze spills immediately to prevent permanent staining.

NOTE:

Ensure the water is not hot when draining the low-point drain lines. Hose water from the lines can cause burn injuries.

NOTE:

Some items require special winterizing instructions, which can be found in the specific owner's manuals.

De-Winterization

Drain and fill the fresh tank with water and connect the power to the water pump. Operate all faucets, one at a time, until clear water is present if the nontoxic antifreeze method is used.

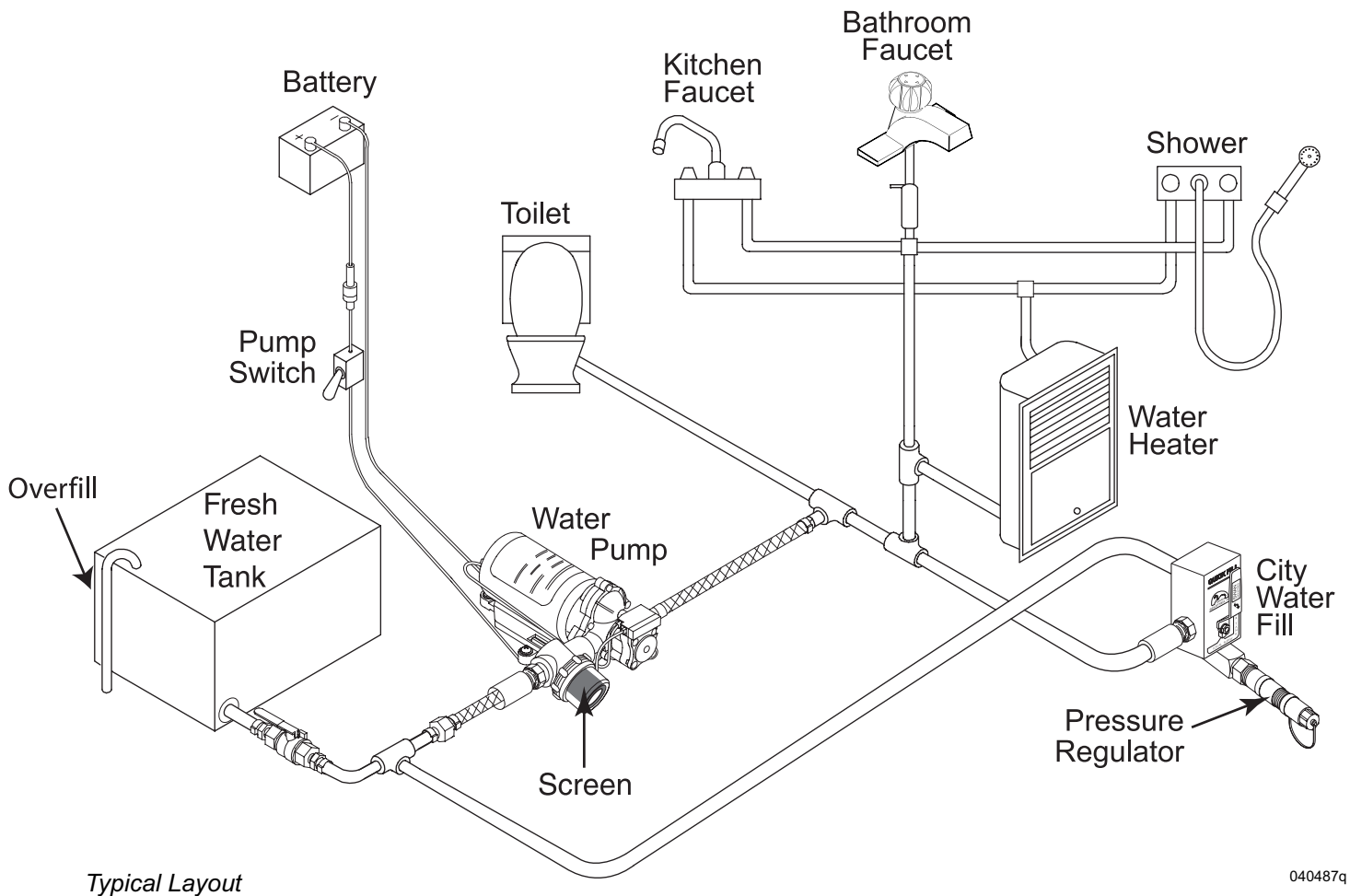
NOTE:

Depending upon duration of storage, the fresh water tank may need to be sanitized.

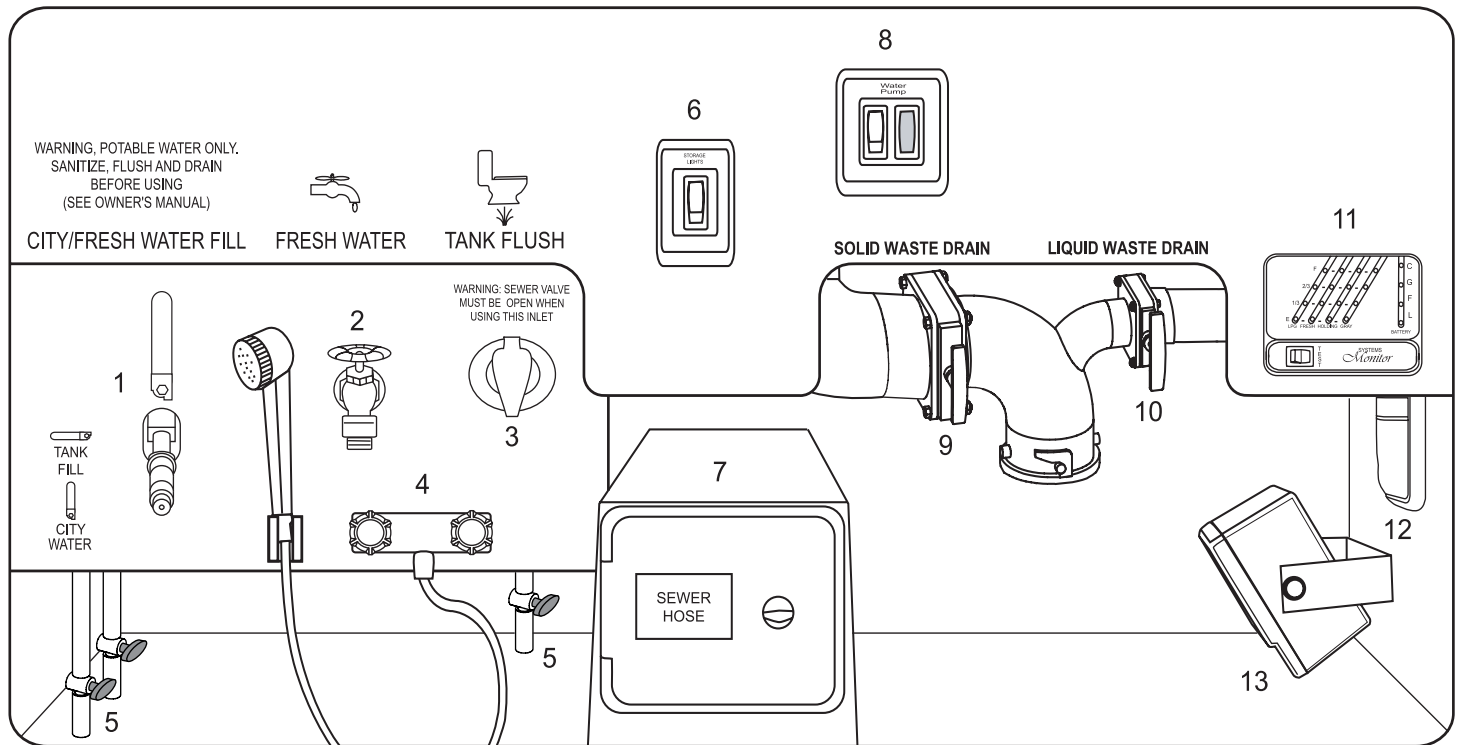
CAUTION:

The first two trays of ice from the icemaker may contain contaminants. Discard and replenish the icemaker as necessary.

WATER SYSTEM DIAGRAM



SERVICE CENTER



040543d

NOTE:

Layout of Service Center and location of components may vary with floor plans.

NOTE:

The fresh water drain may be located in a bay next to the service bay.

- | | |
|--------------------------------|--------------------------|
| 1. City/Fresh Water Fill Valve | 8. Water Pump Switch |
| 2. Fresh Water Valve | 9. Black Tank Dump Valve |
| 3. Black Tank Flush Connection | 10. Grey Tank Dump Valve |
| 4. Outdoor Shower Assembly | 11. System Monitor |
| 5. Low Point Drains | 12. Bay Light |
| 6. Storage Light | 13. Bay Heater |
| 7. Sewer Hose Storage | |

NEPTUNE 2006

LP-Gas Systems • Section 7

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LP-GAS SYSTEMS

This section contains safety information and operating instructions for the Liquefied Petroleum Gas (LP-Gas) system and related equipment in the motorhome. Some items discussed may not be applicable to all motorhomes. More detailed information with **CAUTION** or **WARNING** instructions for various equipment other than what is found in this section, can be found in the equipment manufacturer's manual in the owner's information box.

The LP-Gas tank mounted in the motorhome contains liquid petroleum gas that is under high pressure. As fuel is used, the liquid vaporizes and passes through the primary tank valve to a regulator that reduces pressure. Low-pressure gas is then distributed to components through a pipe manifold system.

Component lighting problems are commonly caused by air in the manifold system or incorrect gas pressure. **DO NOT** attempt to adjust the regulator. Adjustments need to be made by a dealer or an authorized service person with the proper equipment.

In higher elevations or extreme cold weather (10° F/-12° C or lower) a shortage of LP-Gas may be experienced. If LP-Gas is going to be used in higher elevations or cold climates for a long period of time, have an authorized service person adjust the LP-Gas regulator for these conditions.

Have the LP-Gas system tested by an authorized dealer or service center at least once a year and before every extended trip. The test will include having the system checked for leaks and the regulator pressure checked and tested for functionality. Although the manufacturer and the dealer test the system carefully for leakage, travel vibrations can loosen fittings.

Leaks (identified by the odor of rotten eggs or sulfur) can be easily found by applying a leak detector solution on all connections. Never light a match, have an open flame or use any spark producing equipment or appliance to test for leaks.

Leaks can usually be repaired by tightening the fittings. If not, shut off the primary gas valve at the tank. Hand-tighten the primary valve only. **DO NOT** use a wrench or pliers as over tightening may damage valve seats and cause leaks. If a leak is suspected, immediately see an authorized dealer or service center for repairs.

WARNING:

LP-Gas is highly volatile and extremely explosive. DO NOT use matches or a flame to test for leaks. Only approved LP-Gas leak-testing solution should be used for leak detection. Unapproved solutions can damage copper tubing and brass fittings. A liquid dish soap solution of 10 parts water may be used. Shake the solution until bubbles form and then apply the mixed solution to fittings and accessory control valves. All fittings tested should be thoroughly rinsed and dried after testing. Never attempt to adjust LP-Gas regulators. Only qualified service personnel should perform any maintenance or repair to the LP-Gas system.

WARNING:

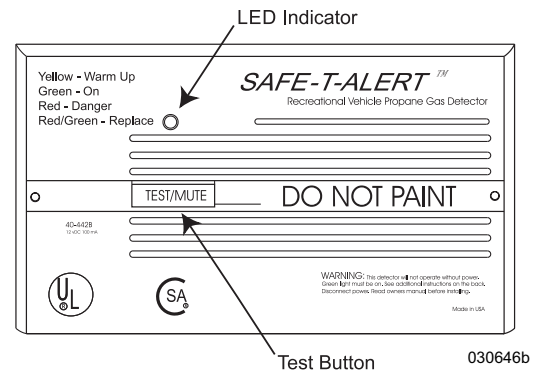
When storing portable LP-Gas tanks that are not connected to an LP-Gas system, install an approved plug in the tank outlet hole to prevent leaks. DO NOT store or transport empty LP-Gas tanks, portable tanks, gasoline or other flammable liquids in the interior area of the motorhome. Keep open flame and spark producing materials away from the LP-Gas area. Shut off all appliances and the primary LP-Gas tank valve when the motorhome is in storage. If this warning is ignored, a fire or explosion could result.

NOTE:

It may be illegal to travel in some states and Canadian provinces with the primary LP-Gas valve open. Failure to comply with these State and Canadian province requirements may result in fines and/or pose a safety hazard.

LP-GAS DETECTOR

The LP-Gas detector is required safety equipment in RVs. **American National Standards Institute (ANSI) A119.2 - Fire & Life Safety 3-4.8 LP Gas Detectors states** “A LP-Gas detector must be installed in any RV that contains an LP-Gas appliance and an electrical system. The LP-Gas detector must be listed as suitable for use in recreational vehicles under the requirement of UL 1484 Residential Gas Detectors, and installed according to the terms of its listing.”



About the LP-Gas Detector:

Be aware of the difference between a leak versus LP-Gas escaping from an unlit, open burner. Pure LP-Gas vapors from a leaking pipe or fitting are heavier than air and will build up heaviest concentration at the leak and float down to mix with air. LP-Gas from open burners is intentionally mixed with air to induce burning and dissipate into the air. When mixed with air, LP-Gas becomes only marginally heavier and will expand outward. If a burner is left on, the area around the burner, range, and adjoining counter space will be combustible and can cause injury and damage if ignited. This condition can exist for an extended time period before the presence of gas is detected and the alarm sounds.

NOTE:

The LP-Gas detector only indicates the presence of propane gas at its sensor. Combustible levels of LP-Gas may be present in other areas. This detector is intended for the detection of LP-Gas ONLY.

The LP-Gas detector is not designed to detect other types of gas. However, other volatile gases (nuisance gases), most of them flammable in various concentrations, may cause the detector to alarm. Some products that may cause the detector to alarm are alcohol, liquor, kerosene, gasoline, deodorants, colognes, propellant used in spray cans and cleaning solvents. Sulfated batteries can also set off the alarm. In some cases, vapors from glue and adhesive used in the manufacturing of the motorhome can cause the detector to alarm for several months after the date of manufacture. If it is determined that the detector has false alarmed because of the above mentioned nuisance gases, reset the detector and ventilate the motorhome with fresh outside air.

NOTE:

Take precautions to ensure one of these nuisances has not masked an actual LP-Gas alarm condition.

The detector draws less current than one instrument panel lamp and will operate to detect gas until the battery is drained down to 7.0 Volts. The detector must be supplied with a voltage higher than 7.0 Volts, for it to operate properly. If the power source is disconnected, or if the power is otherwise interrupted, the detector will not operate.

The LP-Gas leak detector has a self-check circuit running at all times while the detector is powered. In the event that the circuitry fails, a failure alarm will sound and the operating indicator will cease to light.

LP-Gas Detector Operation:

Upon first application of power, the LED will flash yellow for three minutes while the detector is stabilizing. At the end of the start cycle the LED will turn green, indicating full operation. If the detector senses unsafe levels of LP-Gas, it will immediately sound an alarm. The LP-Gas detector draws power from the chassis batteries, with a current draw of less than 1/10th of 1 Amp.

CAUTION:

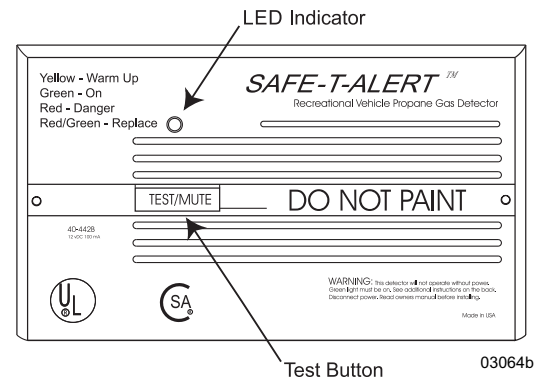
The detector will not alarm during the three minute warm-up cycle.

Testing

Press the **TEST** switch any time during the warm up cycle, or while in normal operation. The LED should flash red and the alarm should sound. Release the switch. This is the only way the detector should be tested. The test feature checks full operation of the detector.

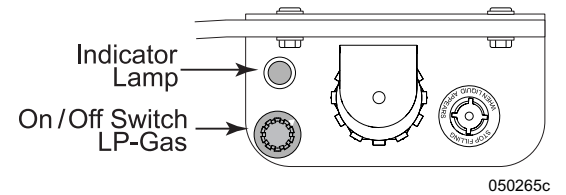
WARNING:

Test the operation of this detector after the motorhome has been in storage, before each trip and at least once per week during use.



Alarm

The red LED will flash and the alarm will sound whenever dangerous levels of LP-Gas are detected. The detector will continue to alarm until the gas clears or the Test/Mute switch is pressed.



Alarm Procedures:

1. Turn **OFF** all LP-Gas appliances (stove, water heater, furnace, refrigerator), extinguish all flames and smoking material. Evacuate immediately, leave doors and windows open.
2. Turn **OFF** primary valve on the LP tank (accessed from under the motorhome at the remote switch).
3. Determine and repair the source of the leak. If necessary, contact a qualified professional for service.

WARNING:

DO NOT operate any electric switch or the remote LP-Gas switch during an alarm. This can produce a spark and ignite the gas. Turn off the primary LP-Gas valve on the tank.

Potential Sources of LP Gas Leaks When Operating the Motorhome:

- | | |
|--|---|
| <ul style="list-style-type: none">• Cooktop Burners• Oven• Refrigerator• Water Heater | <ul style="list-style-type: none">• Defective LP-Gas Connection• Defective Regulator• Portable Propane Powered Appliances/Accessories• Furnace |
|--|---|

CAUTION:

DO NOT re-enter until the problem is corrected.

Alarm Mute:

Press the Test-Mute button when the detector is in alarm.

1. The red LED will continue to flash and the alarm will beep every 30 seconds until the gas level has dropped to a safe level.
2. The LED will flash green until the end of the Mute cycle.
3. If dangerous gas levels return before the end of the Mute cycle, the alarm will beep four times and return to phase 1.
4. After two minutes the detector will return to normal operation (solid green) or resound the alarm if dangerous levels of gas remain in the area.

Fault Alarm:

Should the microprocessor sense a fault in the gas detector, a fault alarm will sound twice every 15 seconds. The LED will alternately flash red to green and the **MUTE** switch will not respond to any command. The gas detector must be repaired or replaced.

Maintenance

1. Vacuum the dust off the detector cover weekly (more frequently in dusty locations) using the soft brush attachment of the vacuum.
2. **DO NOT** spray cleaning agents or waxes directly onto the front panel. This action may damage the sensor, cause an alarm or cause a detector malfunction.

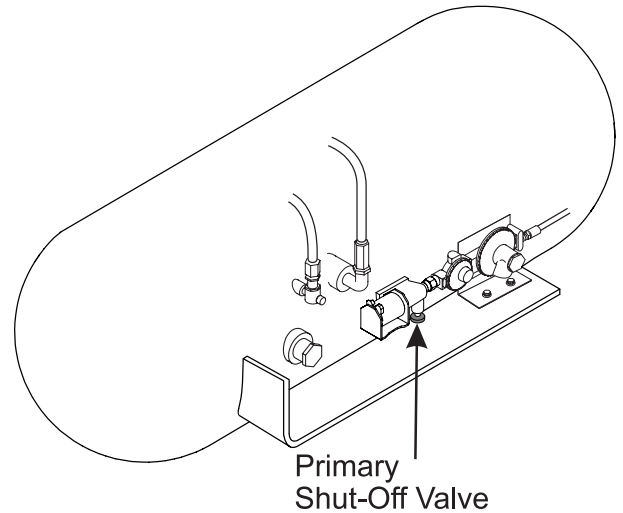
LP-GAS EMERGENCY PROCEDURES - CHECKLIST

If you smell gas (a rotten egg or sulfur smell), perform the following steps immediately:

- Shut off LP-Gas appliances.
- Turn off the primary shut-off valve at the LP-Gas tank.
- **DO NOT** operate any electric switch. This can produce a spark and ignite the gas.
- Open windows and doors.
- Evacuate the motorhome. Stay clear of the surrounding area.
- Keep all sources of ignition out of the area.
- Contact a qualified service technician to find the source and repair the gas leak.

WARNING:

A fire or explosion from ignited gas or gas fumes can cause serious injury or death.



050267c

LP-GAS TANK

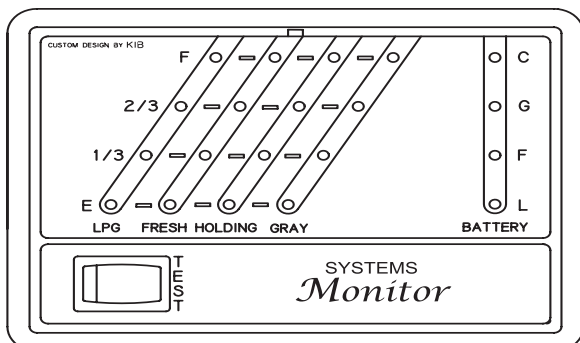
Measurement

Tank Measurement:

To measure level of a tank, press the Tank Test switch on display panel. Observe the indicator lamps corresponding to the tank of interest.

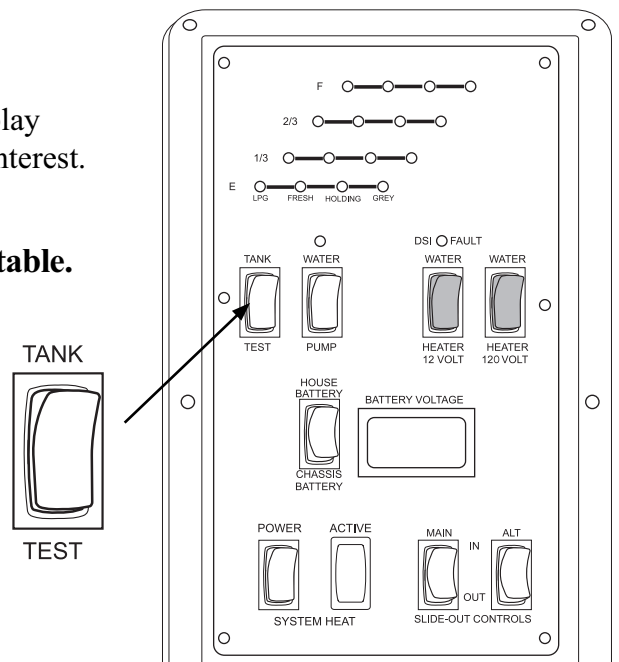
NOTE:

Calibration of the LP-Gas gauge is preset and not adjustable.



030466e

Systems Monitor Located in Plumbing Service Center (Optional)



0601581

Systems Monitor Panel in Hallway.

Tank Capacity

LP-Gas Tank Capacity	
All Models	*38 Gallons
<small>*Actual filled LP-Gas capacity is 80% of listing due to safety shut-off required on tank.</small>	

NOTE:

This chart reflects product specifications available at the time of printing. Floor plans introduced thereafter may not be reflected in the chart. All other information contained throughout the manual will still apply.

NOTE:

LP-Gas tank capacity is estimated based upon calculations provided by the tank manufacturer and represents approximate capacity. The actual usable capacity may be greater or less than the estimated capacity.

Tank Filling

Woodall's Campground and Trailer Guide, and other similar publications, list refueling stations. Many travel parks sell LP-Gas. Before filling the LP-Gas tank, shut off pilot lights, appliances and igniters to prevent a fire or explosion. Have a trained service person fill the LP-Gas tank.

NOTE:

If the tank is new and being filled for the first time, inform the service technician to purge any air from the tank before filling.

The LP-Gas tank fill is located in the curbside compartment. When the tank is filled to the proper level, there is space available for the conversion of liquid into gas. If a tank is over-filled, it may cause the safety valve to release pressure. When this happens, a strong rotten egg odor near the tank and/or a hissing noise may be detected.

LP-Gas exists in both liquid and vapor form within the tank. A "Full" tank is approximately 80% liquid. The pressure inside the tank varies with the temperature of the liquid. All tanks are required to be equipped with a safety pressure relief device. The purpose of the safety valve is to release excess pressure.

WARNING:

Before entering any type of refueling station turn off all LP-Gas operated appliances, the pilot light and tank remote switch. Most LP-Gas appliances used in recreational vehicles are vented to the outside. When parked close to a gasoline pump it is possible for fuel vapors to enter this type of appliance and ignite, resulting in an explosion or fire.

NOTE:

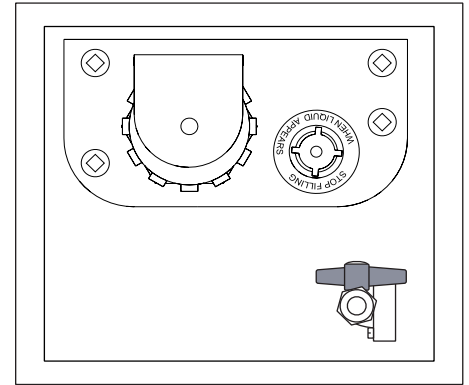
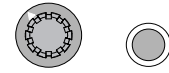
Actual full liquid capacity is 80% of full tank capacity.

WARNING:

Extinguish all sources of heat, sparks, flames and smoking materials within a 50' radius during the fueling process.

Filling the LP-Gas Tank:

1. Turn **OFF** pilot lights, all appliances and the engine. Close all vents, doors and windows to prevent vapors from entering the motorhome. Turn off the electric valve.
2. Remove dust cover. Screw Fill nozzle to fill valve.
3. Turn **ON** dispensing pump, then open 80% bleed valve.
4. Open valve on fill nozzle and dispense liquid into the tank.
5. Close valve on fill nozzle as liquid just begins to expel from 80% bleed valve. The overfill protection valve prevents filling the tank to more than 80% of the rated capacity.
6. Close 80% valve and shut off dispensing pump.
7. Open high-pressure bleed valve on fill nozzle to remove pressure between dispensing pump and fill nozzle. Remove nozzle from the fill valve.
8. Install the dust cover.
9. LP-Gas appliances (especially the refrigerator) may have difficulty starting after a period of non-use. To speed the process of supplying fresh fuel to the appliances, light the stove first.



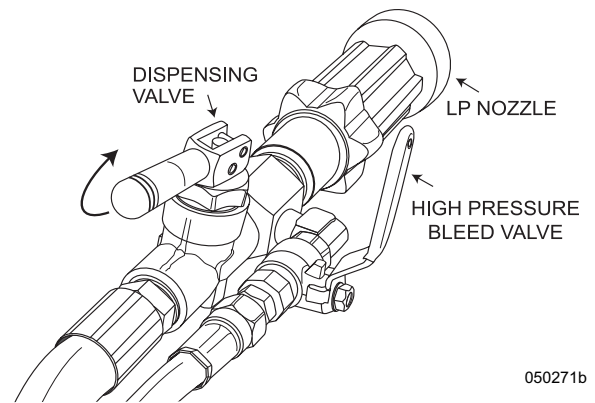
050269

WARNING:

It is common for small amounts of LP-Gas to escape and evaporate during the fueling process. Protect bare skin. Instant freezing will occur if exposed to LP-Gas.

CAUTION:

Pressure inside LP-Gas tanks can reach over 200 psi when exposed to direct sunlight. A high-pressure safety relief valve will purge excess high pressure, if necessary. LP-Gas will stop vaporizing as the LP-Gas tank temperature approaches -44° F.



050271b

Typical nozzle at a fill station

Tank Operation

- Open the primary shut-off valve located on the LP-Gas tank.
- Turn on the electric LP-Gas valve to allow gas to flow to the appliances.
- Turn **OFF** the electric valve and the primary valve on the LP-Gas tank when the tank is being filled, when driving, in between trips and when in storage.
- Hand-tighten the primary valve only. **DO NOT** use a wrench or pliers, as this will over-tighten the valve.
- The primary valve is designed to be closed by hand. Over-tightening the valve may permanently damage the valve seat.

NOTE:

In some states and Canadian provinces, it may be illegal to drive the motorhome while primary valve on the LP tank is open.

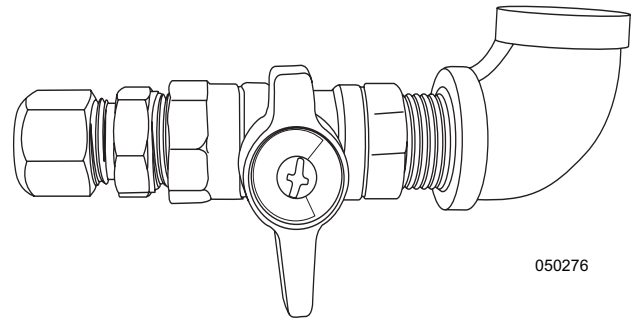
Accessory Hookup

Exterior Gas Line Hookup Prep:

An auxiliary remote LP-Gas hookup is for external LP-Gas accessories and is to be used for external components only. For safety, only approved LP-Gas quick disconnect fittings and flexible hose should be used to connect external accessories to the remote hookup. A LP-Gas Quick Disconnect fitting should be installed by a qualified agency as defined in the Nation Fire Protection Association **NFPA (Fire) 54-02** code.

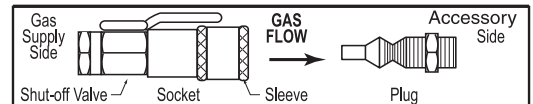
NOTE:

Every time the remote hook-up is used, check for leaks on all connections. If a leak is detected, turn off the primary valve at the main LP-Gas tank. Contact a qualified service center for the necessary repairs.



Located at LP-Gas fill point

QUICK DISCONNECT FITTING



NOTE:

COUPLING TO BE INSTALLED BY A QUALIFIED AGENCY AS DEFINED IN THE NATIONAL FUEL GAS CODE (NFPA 54)

INSTALLATION INSTRUCTIONS

- 1) INSTALL SOCKET WITH SHUT-OFF VALVE ON THE GAS SUPPLY SIDE
- 2) INSTALL PLUG ON THE ACCESSORY SIDE
- 3) LEAK TEST USING SOAPY WATER SOLUTION

OPERATING INSTRUCTIONS

TO CONNECT:

- 1) CLOSE SHUT-OFF VALVE
- 2) PULL SOCKET SLEEVE BACK
- 3) INSERT PLUG; RELEASE SLEEVE
- 4) PUSH PLUG INTO SOCKET UNTIL SLEEVE SNAPS FORWARD
- 5) OPEN SHUT-OFF
- 6) LEAK TEST USING SOAPY WATER SOLUTION

TO DISCONNECT:

- 1) CLOSE SHUT-OFF VALVE
- 2) TO RELEASE PLUG, PULL SLEEVE BACK AWAY FROM PLUG; PULL OUT PLUG
- 3) INSERT PLUG; RELEASE SLEEVE
- 4) LEAK TEST USING SOAPY WATER SOLUTION



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LP-GAS FUNDAMENTALS

# Capacity	Gallon Capacity	BTU Capacity
5	1.18	107,909
10	2.36	215,807
11	2.59	237,387
20	4.72	431,613
30	7.08	647,420
40	9.43	863,226

CONVERSIONS

Gallons to Liters (1 Gallon = 3.785 Liters)
 Fahrenheit to Celsius ($F^{\circ} - 32 \div 1.8 = C^{\circ}$)
 11 in. Water Column = 6 1/4 ozs. per sq. in. pressure.
 27.7 in. Water Column = 1 lb. per sq. in. pressure.

The above capacities allow for 20% vapor space on each cylinder.

Data taken from the National Fire Prevention Association (NFPA). Pamphlet #58-1998.

LP-Gas Statistics:

Pounds Per Gallon	4.24
Specific Gravity of Gas	1.50
Specific Gravity of Liquid	.504
Cubic Feet Gas Per Gallon of Liquid	36.38
Cubic Feet Gas Per Pound	8.66
BTUs Per Gallon	91,502
BTUs Per Pound	21,548
Dew Point in Degrees Fahrenheit	-44° F
Vapor Pressure at 0° F	31
Vapor Pressure at 70° F	127
Vapor Pressure at 100° F	196
Vapor Pressure at 110° F	230
Flash Point	842° F

Basic Facts About LP-Gas:

- LP-Gas detectors are a federal requirement on all LP-Gas equipped recreation vehicles.
- LP-Gas is a by-product produced by refining oil.
- Odor is added to LP-Gas after the refining process.
- Each liquid gallon of LP-Gas produces 91,502 BTUs (British Thermal Units).
- Temperature affects pressure of LP-Gas. Internal tank pressure can exceed 200 psi.
- Tanks or valves contain pressure relief valves. The relief valve opens at 125% above tank rating.
- LP-Gas stops vaporizing at -44° F.
- Standard LP-Gas operating pressure is 11" of Water Column or approximately 6 1/4 ounces per square inch.
- An inch of Water Column is a measurement of applied pressure to one side of a U-Tube 1/2 filled with water at sea level. The amount of pressure required to raise the water level 11", represents 11" of Water Column.

NOTE:

The above information is not a complete guide for the use of LP-Gas tanks or appliances. In cold climates keep LP-Gas level above 50% to keep vaporization of LP-Gas at the highest level.

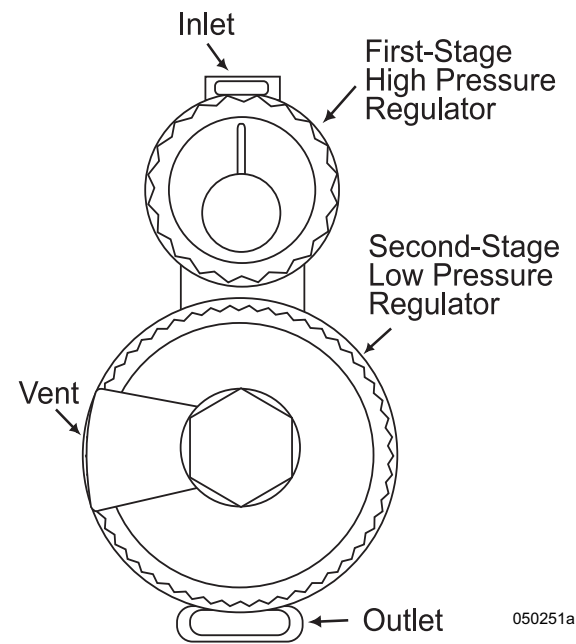
LP-GAS REGULATOR

LP-Gas is compressed into liquid form in the tank. Only the vapor is used during combustion by an appliance. As vapor is removed from the tank, the remaining liquid will vaporize to maintain pressure that is removed during consumption. This process will continue until there is no liquid remaining in the tank.

Temperature affects the vaporizing action of the liquid. If temperature of the liquid is - 44° F, the liquid remains stable with tank pressure, about 0 psi. If liquid temperature is 100° F, the liquid quickly vaporizes with tank pressure, about 200 psi. Vapor pressure must remain relatively consistent, regardless of temperature, for the appliance heat output to remain stable. Vapor pressure regulation is performed by the regulator.

The motorhome two-stage regulator reduces vapor pressure so that it is safe for use. The first stage of the regulator reduces tank pressure to a range of 10 to 13 psig (pounds per square inch gauge). The second stage further reduces pressure to a working pressure of 0.4 psig (11 Inches of Water Column or about 6¼ ounces psi.). A vent is installed to allow the internal diaphragm to move with atmospheric pressure change. It is important to keep the vent clean and clear of obstruction or corrosion. If the vent becomes clogged, pressure from LP tank may cause erratic pressure regulation. If there is any corrosion, contact a qualified LP-Gas service technician. The regulator is mounted so that the vent faces downward. If the vent becomes clogged, clean it with a toothbrush.

Under normal atmospheric conditions an LP-Gas regulator will not freeze, nor will the LP-Gas. Vapor passing through the regulator will expand and cool, condensing moisture in the gas. The moisture will freeze, build up and block the vent. The possibility of freeze up is greatly reduced with the two-stage regulator.



050251a

To Prevent Freeze Up:

- Ensure the LP-Gas tank is totally free of moisture prior to filling.
- Ensure the tank is not overfilled.
- Keep the valve closed when the tank is empty.

If A Freeze Up Occurs:

- Have an LP-Gas distributor purge the tank.
- Have the LP-Gas distributor inject methyl alcohol in the tank.

Damage to the regulator can occur when the tank is overfilled. The regulator is designed to work with vapor only. This is why the tank is filled to only 80% of its liquid capacity. The other 20% allows for vaporization of the liquid. The primary vapor valve is located in the vapor section of the tank. In an overfilled tank, liquefied petroleum can fill the regulator. As the liquid vaporizes, it can freeze the diaphragm. High tank pressure on a frozen diaphragm can cause a rupture and result in erratic pressure regulation. This is why it is important to have the LP-Gas pressure checked for proper pressure and accurate regulation during appliance operation. Erratic pressure regulation dramatically affects refrigerator operation on LP-Gas.

Manometers:

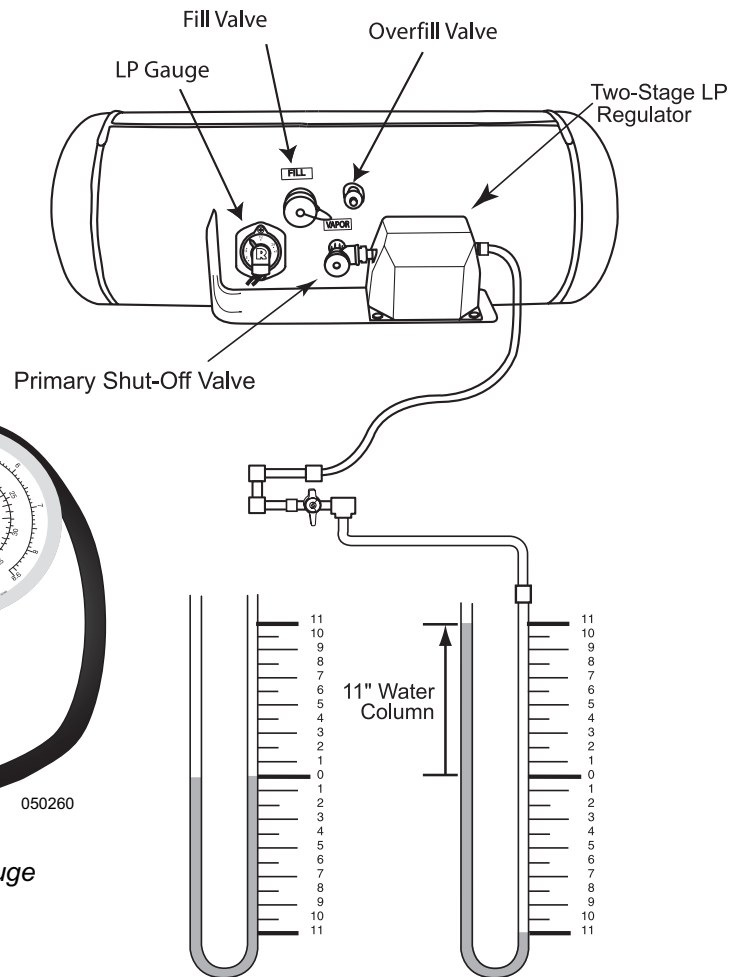
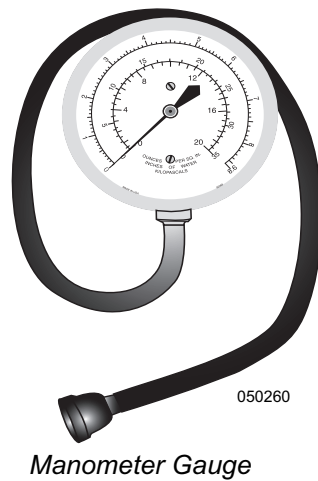
The manometer is the best way to accurately determine LP-Gas pressure. There are two different styles of manometers: Gauge and U-tube. Gas pressure is measured in Inches of Water Column. This is the amount of pressure applied to one side of a U-shaped tube half filled with water. The amount of pressure needed to raise the column of water 11" represents 11" of Water Column.

WARNING:

DO NOT attempt to adjust the regulator. Adjustments require special equipment. Failure to follow these instructions may result in a fire or explosion, and can cause severe personal injury or death. DO NOT operate LP-Gas appliances until the LP-Gas pressure is checked and a leak down test is performed!

TIP:

Attach the manometer gauge to the accessory hookup line to avoid loosening any interior LP-Gas line connections.



LP-GAS HOSE INSPECTION

It is suggested by the hose manufacturer that the LP-Gas supply hoses used on the motorhome undergo regular inspection. As a guideline, we suggest that all flexible LP-Gas lines connecting the slide-out, appliances and tanks be inspected in the spring and fall of each year by a qualified RV technician.

According to the manufacturer, inspection should consist of the following procedures, and performed when the hose is not under pressure:

INSPECTION:

Inspect the outside cover of the hose for blistering, abrasion or cuts and coupling slippage. Cuts in the hose cover that expose or damage the reinforcement are cause for replacement. Hose strength is controlled by the plies of reinforcement and damage in this area cannot be tolerated. Small cuts, nicks, or gouges that do not go completely through the cover are not cause for replacement of the hose.

NOTE:

Pricking of the cover in the manufacture of this type of hose is common and necessary for satisfactory hose performance. Consequently, the uniformly pricked cover should not be viewed with alarm.

- Damage to the textile reinforcement or wire braid is cause for hose replacement. Wire braid reinforced hose, which has been kinked or flattened so as to permanently deform the wire braid in the unpressurized state, shall be removed from service.
- Blistering or loose outer cover is cause for hose replacement.
- Examine couplings for slippage. Slippage is evidenced by the misalignment of the hose and coupling and/or the scored or exposed area where slippage has occurred. Any evidence of slippage is cause for hose replacement.
- It is important that if a damaged LP-Gas hose is found, the source of the damage be determined and corrected prior to the replacement of the LP-Gas hose.

NOTE:

Only a qualified RV technician should complete replacement of LP-Gas components.

It is also suggested, that the flexible LP-Gas supply lines on your recreational vehicle be replaced every ten (10) years. The manufacturer of the LP-Gas supply lines recommended this schedule after performing extended testing and determining that the failure rate may increase after this period of time. The motorhome manufacturer recommends following these guidelines to assure continued safety and dependable use.

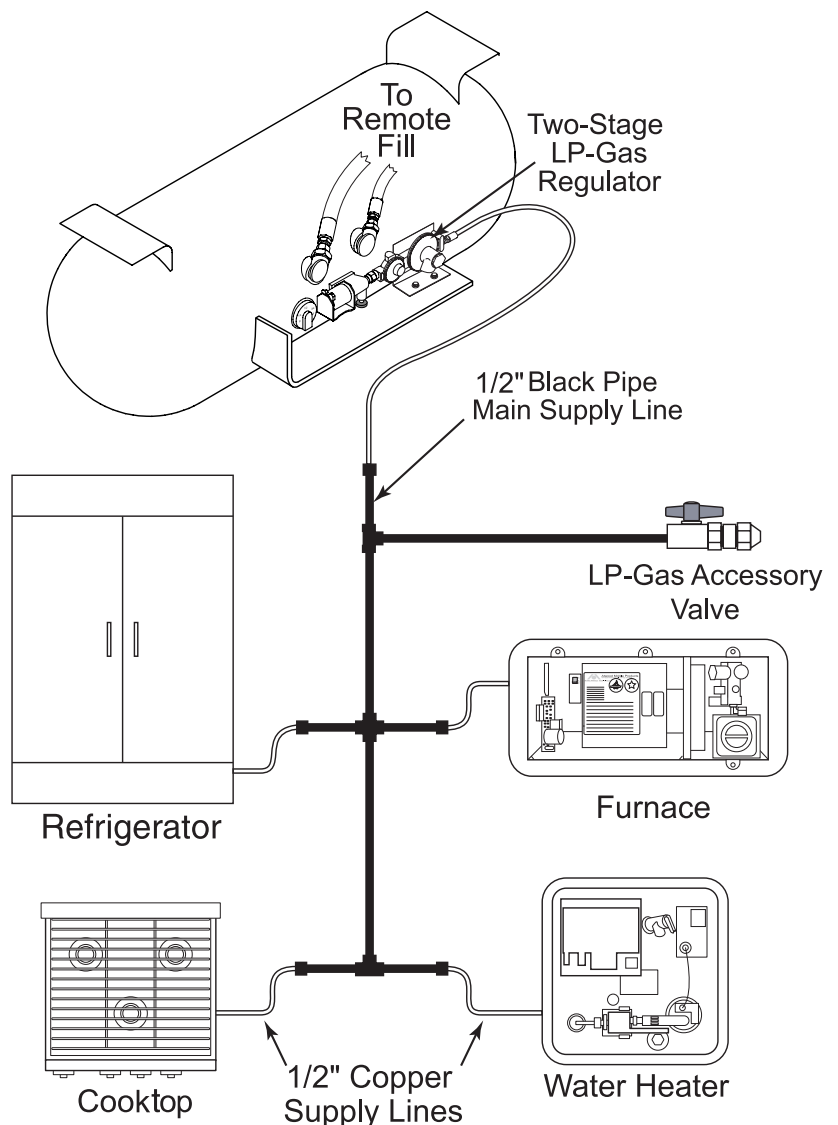
LP-GAS DISTRIBUTION LINES

A primary manifold black steel pipe running throughout the motorhome distributes LP-Gas to secondary lines. All secondary lines leading to gas appliances are made of copper tubing with flared fittings. If any lines rupture do not attempt to splice them. Always run a new line. It is recommended that gas distribution work be performed by an authorized dealer or an authorized service technician. When removing or servicing any gas appliance, manually close the primary valve located on the LP-Gas tank. This will prevent dangerous gas leakage that could result in an explosion and possible serious injury.

INSPECTION:

Inspect the rubber flexible lines, twice a year, for abrasions, tears, kinks or other signs of damage.

If a gas leak is suspected, get the system inspected and repaired by a qualified service technician as soon as possible.



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LP-GAS CONSUMPTION

Each gallon of LP-Gas produces 91,502 BTUs of heat. One 27 gallon tank produces two million BTU's. Total consumption depends on the rate of usage by each appliance and the operating time. The stove typically uses the most LP-Gas.

Determine Fuel Consumption:

To determine approximately how many hours an LP-Gas appliance will operate on one gallon of LP-Gas, use the following formula:

- LP-Gas appliances are rated in Input BTU (British Thermal Units). The rating is usually stamped or printed on a tag affixed to the appliance. For example: the Input rating of the appliance is 10,000 BTUs.
- One gallon of LP-Gas produces 91,502 BTUs.
- Divide the amount of BTUs of one gallon of LP-Gas (91,502) by the rating on the appliance in this example 10,000. Net continuous operation time for one gallon of LP-Gas for this appliance would be approximately 9.2 hours.

The above formula can be useful when trying to determine the approximate length of time a tank of LP-Gas will last. Generally, LP-Gas appliances do not operate continuously. An example would be the typical cycling of the furnace or water heater.

Determining how long a tank of LP-Gas will last:

- Combine the BTU input totals of all appliances, and the approximate length of time these appliances operate per day.
- Multiply the number of liquid gallons in the LP-Gas tank by 91,502.
- Divide the total of BTUs of the LP-Gas tank by the total number of BTUs the appliances consume, equals the approximate number of hours of operation before refueling.

WARNING:

LP-Gas is highly volatile and extremely explosive. Never use matches or open flame to test for leaks. Use only approved LP-Gas leak testing solution to test for leaks. Unapproved solutions can damage copper tubing and brass fittings. Never attempt to adjust LP-Gas regulators without the use of proper equipment. Improper LP-Gas regulator adjustment will affect the performance of LP-Gas operated appliances. Incorrect flame or explosion can occur. Only qualified personnel should perform any maintenance or repair to the LP-Gas system.

Typical Appliance BTU Ratings

Cooktop

Small = 5,000 BTU

Large = 9,000 BTU

Refrigerator

2-door 1,500 BTU

4-door 2,200 BTU

Water Heater

10 Gal. = 10,000 BTU

Furnace*

40,000 BTU

35,000 BTU

2 - 25,000 BTU

**Depending on floorplan*

LP-GAS SAFETY TIPS

LP-Gas is one of the safest and most reliable fuels available on the market when handled properly. LP-Gas, however, does have a great explosive "potential" if handled improperly. Danger is minimized by becoming familiar with and following a few safety precautions, and by learning how to properly operate LP-Gas appliances. Use of LP-Gas requires the responsibility to enforce extra safety measures.

The motorhome is equipped with many LP-Gas operated appliances because it is a convenient and efficient source of fuel. LP-Gas appliances must be operated and maintained in accordance with the product manufacturer's instructions.

The National Propane Gas Association (**NPGA**) has a special service program offered called **GAS®** (Gas Appliance System) Check. The **GAS®** Check program is aimed at educating users about the convenience of propane with safety and peace of mind. For information on the **NPGA Gas® Check program, call (202) 466-7200 or visit www.npga.org.**

LP-Gas Tanks and Cylinders:

Tanks are built to American Society of Mechanical Engineers (**ASME**) Code. The cylinders are built to **DOT** (Department of Transportation) Code. The major difference between cylinders and tanks is in required testing and inspection procedures, and in construction of the containers. Both tanks and cylinders are required to undergo pressure testing and inspection; however, the procedures for how they are tested and inspected differ.

The difference between the two codes are that the valves, fittings and brackets are located only on the ends of the **DOT** cylinders; however, on the **ASME** tanks they may be located on ends, as well as the sides. There is also a difference in how the tanks are rated. Required tank ratings are in gallons (**ASME ratings**) or pounds (**DOT**) water capacity. The Federal **DOT** (Department of Transportation) regulations require periodic inspections and re-qualifications of cylinders.

American Society of Mechanical Engineers (**ASME**) tanks or bulk containers are generally used in motorhomes, and are permanently mounted on to the unit.

An alloy steel two-piece welded and brazed tank is used on all towable products. The marking on the collar, **DOT 4BA240**, identifies the **DOT** specifications and service pressure. Other pertinent information included on the collar is the water capacity (**WC**) and the tare weight (**TW**), both which are measured in pounds, and the manufacture date (one of the most important items). There is a required 12 year re-qualification. The final piece of information is Dip Tube (**DT**) length. This is part of the overfill protection and maximum liquid allowance in the cylinder.

Maintenance and Safety Tips for the LP-Gas Refrigerator and Furnace:

- Have the refrigerator and furnace systems inspected annually by an authorized service center.
- Before firing up the refrigerator or using the LP-Gas furnace for the first time each season, have the venting system checked for blockage. Insects may have built nests that will obstruct flow.
- At the first indication of incomplete combustion (yellow flame instead of a blue flame or soot is present) contact a service technician immediately. Improper combustion can cause Carbon Monoxide buildup, which is potentially fatal!

Maintenance and Safety Tips for the LP-Gas Range:

- Burner flame should be a blue color, indicating complete combustion. If not, have the unit serviced by a qualified technician.
- **DO NOT** cover the oven bottom with foil. Air circulation will be restricted.
- Never use LP-Gas ranges or ovens for heating purposes.
- Always have pot handles turned inward.
- Ensure children understand never to turn or play with the knobs on the front of the LP-Gas range.

Maintenance and Safety Tips for the LP-Gas Water Heater:

- Have the water heater venting system inspected annually or before first use of the season.
- Keep flammable substances away from the water heater. **DO NOT** store items close to it as this may block the airflow the water heater needs to operate completely.
- At the first indication of the incomplete combustion (yellow flame instead of a blue flame or soot is present) call a service technician immediately. Improper combustion can cause Carbon Monoxide buildup, which is potentially fatal!

NEPTUNE 2006

Electrical Systems - House • Section 8

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HOUSE ELECTRICAL - INTRODUCTION

The motorhome 120/240 Volt AC system can be operated from three different power sources: shore power, the on-board generator or the inverter/charger. Shore power is the most efficient and should be used whenever possible. The generator can be used when shore power is unavailable. The inverter/charger supplies silent AC power using the house batteries of the motorhome. The AC power output is limited and should be used sparingly.

Two different sources supply the main AC circuit breaker panel with power: the 50 Amp shore power cord or the on-board generator. The power source used is automatically selected by a switching device known as a transfer switch. The inverter supplies AC power to the sub-panel.

WARNING:

The electrical system is engineered and tested for complete safety. Circuit breakers and fuses protect the electrical circuits from overloading. When planning modifications or additions to the electrical system, we strongly recommend consulting the dealer for assistance to ensure continued integrity and safety of the electrical system. Please note that any modifications may void the warranty.

WARNING:

Water is electrically conductive. DO NOT use any electrically powered item or electrical outlet that may be exposed to a water source. Such use can result in a serious shock causing injury or death.

Shore Power:

The motorhome is equipped with a shore power cord to connect the motorhome to outside electrical services. Shore power service is the most efficient source of electrical power. The plug end of the shore power cord is 50 Amp, 240 Volt AC. When this type of power service is not available, electrical adapters will be required to allow a proper and safe connection to the electrical service supply.

NOTE:

When 50 Amp shore service is not available, care will have to be used when operating the appliances and using the outlets to avoid overloading the shore power service.

Generator:

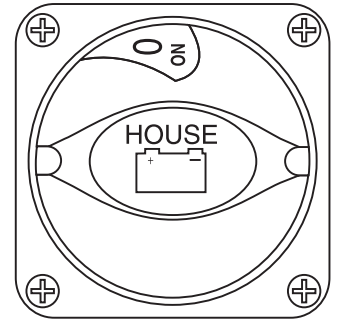
The generator can be selected for use when shore power is unavailable. The maximum amount of generator output power, measured in watts, is calculated at an elevation of 500 feet above sea level. This figure will decrease slightly at higher altitude. Ambient temperature also effects total maximum output. The amount of AC electrical load applied to the generator determines fuel consumption.

Inverter/Charger (Optional):

The Inverter/Charger provides silent AC power when shore power is unavailable, and the generator is not selected as a secondary power source. This device has limited AC power output, measured in watts, and operates only selected appliances and outlets. The Inverter/Charger is an auxiliary 120 Volt AC power source that inverts 12 Volt DC house battery power to 120 Volts AC. The Inverter/Charger also converts 120 Volts AC power (supplied from either shore power or the generator) to 12 Volts DC power for recharging batteries. When dry camping, the Inverter/Charger may be used to supply power to selected outlets.

BATTERY DISCONNECT - HOUSE

The main house battery disconnect switch turns the house battery power supply on or off by disconnecting 12 Volt DC power to the following items: inverter, domestic fuse panel in the bedroom, domestic fuse panel in the front roadside electrical bay. Turn the house battery disconnect switch off when the motorhome is going to be stored, or before performing electrical maintenance. If possible, leave the motorhome plugged into an AC source with the battery disconnect switch on to help prevent the possibility of dead house batteries. Turning off the battery cut-off switch at the entry door will not turn off all DC electrical items or other parasitic loads present on the house battery. Some are federal mandate items such as the LP-Gas detector. If an AC power source is not available, and the motorhome is going to be stored for more than 48 hours, it is recommended to turn the house battery disconnect switch off.

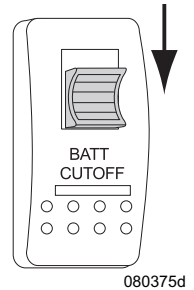


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Located in the battery compartment, curbside.

BATTERY CUT-OFF SWITCH

The battery cut-off switch is located inside next to the entry door. This switch controls the 12 Volt DC power to the domestic fuse panels. The switch locks into the center position to prevent interior DC power from being accidentally turned on or off. When the switch is activated, power is supplied to all interior DC lighting and DC operated appliances. Some appliances will require both DC and AC power to operate, such as the roof air conditioner. This switch is helpful when dry camping to conserve house battery power. Refrigerator and inverter operation are unaffected by the operation of this switch. When the interior house power is off, there are still parasitic loads on the house batteries, and therefore is not a substitute for the main battery disconnect switch.



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Release
Lock

To Turn the Interior Power ON or OFF:

- Simultaneously push the spring-loaded lock down and push the switch.

CAUTION:

To avoid flash damage to electrical contacts, turn off the interior lighting before activating or deactivating the battery cut-off switch.

SHORE POWER HOOK-UP

The power requirement for the motorhome is 30 Amp 120 Volt or 50 Amp 240 Volt AC single phase. The shore cord is stored in the rear roadside compartment. If 50 Amp shore power service is available, connect the supplied shore power cord. If less than 50 Amp service is available, electrical adapters will be required.

CAUTION:

Avoid flash damage to the electrical system contacts. Before plugging the motorhome into shore power, starting the generator or using the inverter make sure all the appliances are off.

WARNING:

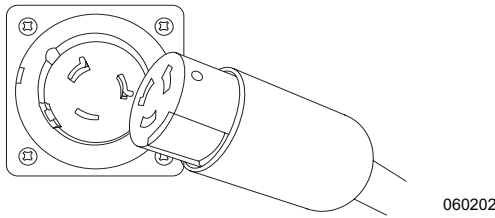
Keep fingers away from metal contacts of the shore plug end. DO NOT stand in water when making electrical connections. Serious electrical shock and personal injury can occur. To avoid the risk of electrical shock, turn the circuit breaker off at the power supply outlet before making the shore power connection.

CAUTION:

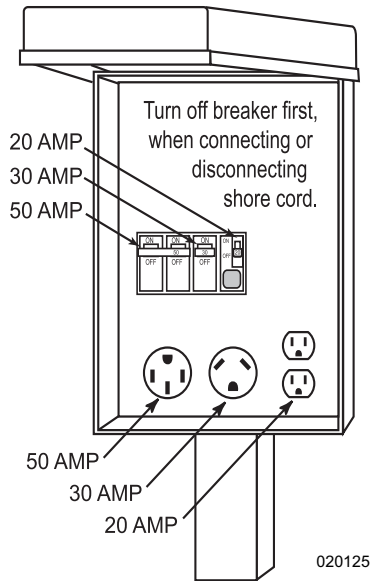
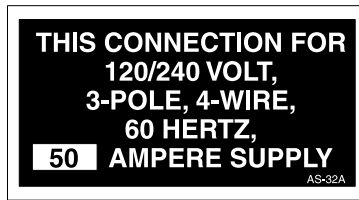
DO NOT remove cover from shore power supply to troubleshoot electricity to the motorhome. Serious personal injury or death may occur. If there is no power to the motorhome inform the park manager. It is the park manager's responsibility to fix problems with the shore power hook-up.

Plugging in the Shore Cord:

- Located in the roadside compartment is the shore power cord.
- Unscrew the deck plate and insert end of the shore cable through the deck plate.
- If 50 Amp service is not available, install the proper electrical adapter(s) to the opposite end of the cord.
- Always turn off the shore power breaker to the power supply outlet before connecting or disconnecting the shore cord. This will prevent an accidental shock and flashing of electrical contacts.
- Make the connection to the outlet and turn the shore power breaker on. The transfer switch should make an audible click.



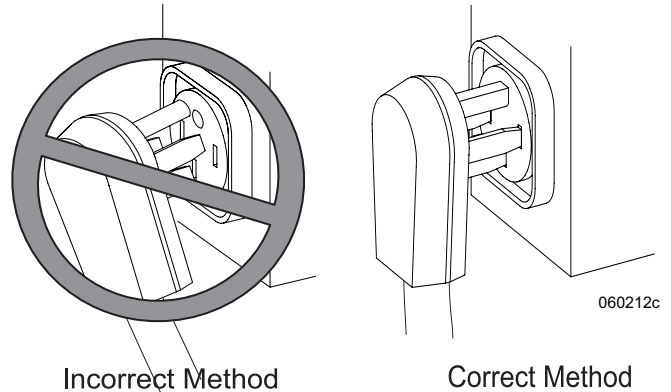
Shore cord connection to the motorhome



Typical Power Pedestal

Disconnecting the Shore Cord:

- Turn **OFF** all AC appliances. This will prevent accidental shock and flashing of electrical contacts when disconnecting.
- Turn **OFF** the shore power breaker.
- Grasp electrical cord housing. Work cord out and away from socket without touching electrical contacts.
- Straighten and clean cord.
- Stow in Compartment.



Shore cord connection to the power outlet

When Hooked to 50 Amp:

After verifying proper voltage, wait approximately one minute for the inverter/charger to stabilize charging of the batteries before starting air conditioners or other large AC loads.

When Hooked to 30 Amp:

Wait approximately one hour before operating electric appliances. This will allow time for the inverter to stabilize charging the batteries. Use caution when operating appliances to avoid overloading the supplied shore service breaker. Operate appliances and outlets in sequence rather than all at the same time.

NOTE:

No waiting period is necessary on motorhomes equipped with a converter.

CAUTION:

If shore power service is limited to 15 or 20 Amps, use of light duty extension cords and electrical adapters will create voltage loss through the cord and at each electrical connection. Line voltage loss and the resistance at each electrical connection, can be a hazardous combination. Damage to sensitive electronic equipment may result!

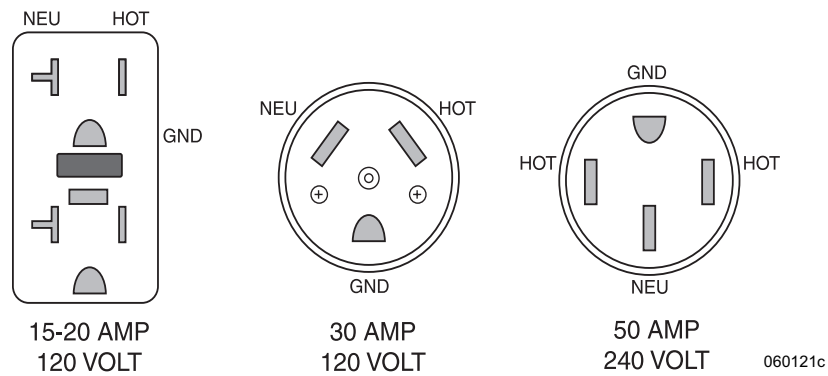
WARNING:

Avoid the risk of electrical shock or component damage by disconnecting from shore power during electrical storm activity. Use the Inverter/Charger or start the generator, if AC power is needed.

Power Supply:

Different amperage supplies vary greatly in the amount of available current.

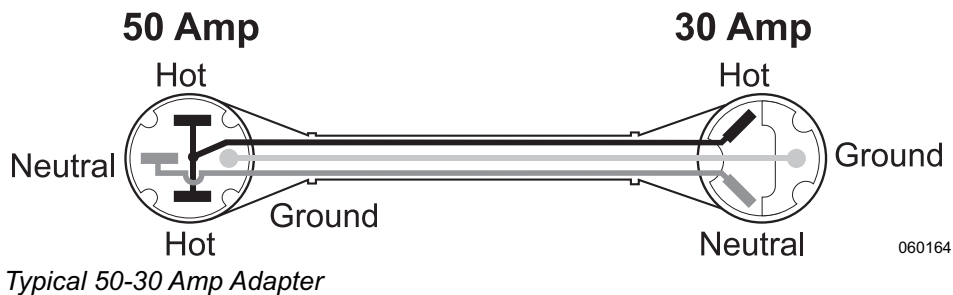
- The continuous amount of current through a breaker or fuse is only 80% of its rated capacity.
- 50 Amp 240 Volt AC shore power service consists of two power supply conductors (120 Volts AC each), a neutral and a safety ground. The 50 Amp breaker simultaneously limits each power supply conductor to no more than a short-term maximum of 50 Amps for each conductor. The 50 Amp 240 Volt service actually provides 80 continuous amps.
- Use care when hooked to anything less than 50 Amp shore service. Shore power service less than 50 Amps consists of one power supply conductor, a neutral and a safety ground; 30 Amp shore service is limited to 24 continuous Amps; 20 Amp shore service is limited to 16 continuous Amps.



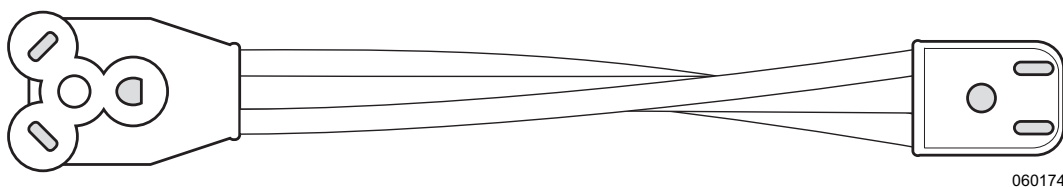
Three types of shore power outlets most commonly used.

Electrical Adapters:

There are many different electrical adapters to suit a variety of needs. Only UL approved adapters should be used. The most common adapter is a 50-30 Amp adapter. The type of connector adapts the 50 Amp shore cord to a 30 Amp shore power outlet. Another common adapter is the 30-20 Amp adapter. Always install the adapter to the cord prior to making the connection to the outlet.



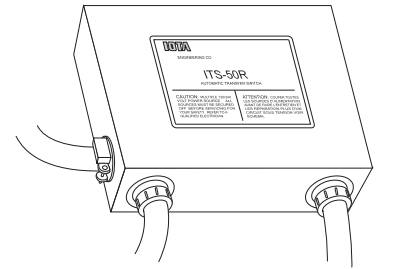
Typical 50-30 Amp Adapter



Typical 30-20 Amp Adapter: Adapts 30 Amp Shore Cord to 20 Amp Shore Power Outlet

TRANSFER SWITCH

The transfer switch automatically transfers AC power from the shore power cord or generator through the transfer switch to the 120/240 Volt AC breaker panel. When using the generator as the power source, the transfer switch has a time delay built into it before transferring power to the AC breaker panel. This allows the generator time to warm up before applying an AC load. When operating the generator while hooked to shore power, the transfer switch automatically selects generator power as priority over shore power.



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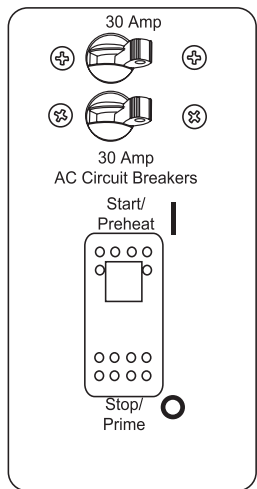
NOTE:

The shore cord is not electrically connected to the generator. When the generator is operating, the electrical contacts of the unplugged shore cord are not electrically energized.

NOTE:

DO NOT have appliances on or AC loads plugged into outlets when hooking up to shore power or starting the generator to prevent damage to the transfer switch contacts. The transfer switch will begin to disengage at approximately 90 Volts AC. Operation at this voltage may damage the transfer switch, appliances or other items plugged into outlets. Start the generator and disconnect from shore service until the shore service supply voltage stabilizes.

GENERATOR - 120 VOLT AC



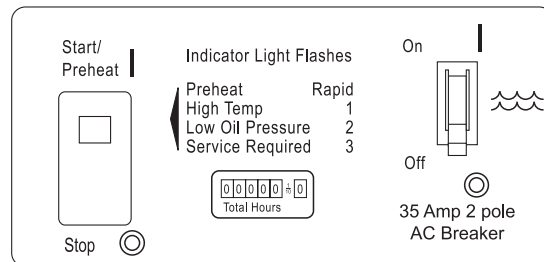
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5.5 Kw Control Panel

The generator is located in the front compartment of the motorhome.

The generator can be started from the following locations:

- Generator remote switch on the dash.
- Generator control panel located on the generator.



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Optional 8 Kw Control Panel

Pre-Start Checks

Prior to the first start of the day perform a general inspection including oil and coolant levels. Keep a maintenance log on number of hours in operation since the last service. Perform any service or maintenance that may be due.

Before Starting the Generator:

- Clear people and animals from hazards of electrical shock and moving parts.
- All appliances and other large AC electrical loads must be **OFF**.

NOTE:

The generator may require priming. To prime hold control switch in the OFF position. Repeat if necessary. The diesel generator fuel pick-up tube is cut to approximately ¼ tank to prevent the main engine from running out of fuel.

Starting the Generator

Push and hold the control switch in **START** position until the generator starts. Release switch. The control switch may flash up to 15 seconds, indicating engine preheat.

WARNING:

Excessive cranking can overheat and damage the starter motor. DO NOT crank the engine for more than 30 seconds at a time, in two minute intervals. If the generator fails to start, refer to the manufacturer's manual.

WARNING:

When the motorhome is parked, position the dash air conditioner vent control in the OFF position to prevent exhaust gases from entering the motorhome during generator operation.

Engine exhaust contains Carbon Monoxide, an odorless and colorless gas. Carbon monoxide is poisonous and can cause unconsciousness and/or death. Inspect the exhaust system thoroughly before starting the generator. **DO NOT** block the exhaust pipe, or situate the motorhome where the exhaust may accumulate around the motorhome or nearby vehicles. Operate the generator only when safe dispersion of exhaust can be assured. Monitor outside conditions to ensure the exhaust continues to safely disperse.

WARNING:

When parking near high grass, be sure that the hot exhaust gases or the exhaust pipe does not contact the grass and ignite, resulting in a fire.

CAUTION:

An exhaust extension adds weight and stresses the generator exhaust system. Damage to the exhaust piping or exhaust manifold can result, allowing Carbon Monoxide gases to accumulate under or leak into the motorhome.

Stopping the Generator

Turn off the appliances and disconnect other AC loads being used. Allow the generator to run unloaded for at least one minute before shutdown to allow the engine to cool. Momentarily push the control switch to the **STOP** position. Release the switch.

Powering the Equipment

The AC output of the generator powers the motorhome air conditioners, the AC Inverter/Charger, all appliances and items plugged into the electrical outlets of the motorhome. The number of electrical appliances that can be operated at any given time depends upon how much power is available from the generator. If the generator is “overloaded” or a short circuit causes “over current,” either the generator will shut down or the circuit breaker will trip. If power consumption, in total, exceeds the generator power output, compensation for temperature and elevation may be necessary. Operate appliances in sequence, rather than all at the same time.

Compensation for temperature and elevation may also be necessary. The generator’s maximum output is rated at 500 feet above sea level. Beyond this point, the generator will lose approximately 3% of its rated power for every 1000 feet gained in elevation. High and low temperatures can also affect generator output. Counteract these effects by operating appliances in sequence rather than at the same time.

NOTE:

The generator may shut down when loaded nearly to full power and an air conditioner (or other large motor load) cycles on. For a brief moment during start up an electric motor can draw up to three times the rated power. For this reason it may be necessary to operate some appliances in sequence when air conditioners or other large motor loads are on.

INFORMATION:

The generator may shut down for reasons other than an overload. If a blink code appears on the control switch, refer to the manufacturer’s manual to obtain an explanation for the code.

Generator Fuel

There is always a possibility fuel may be contaminated. Diesel fuel may contain water or a microbe growth (black slime). Any contamination of fuel will greatly reduce the total output of the generator, and may cause erratic AC output.

NOTE:

The motorhome manufacturer does not cover damage to the generator caused by fuel contamination, or to appliances due to erratic AC voltage.

AVERAGE FUEL CONSUMPTION	DIESEL 5,500 WATTS (gal./hr.)	DIESEL 8000 WATTS (gal./hr.)
No Load	.25	.13
Half Load	.41	.49
Full Load	.66	1.02

Resetting the Circuit Breaker

If a circuit breaker trips in the main AC breaker panel, or on the generator control panel, there may be a short circuit or too much load.

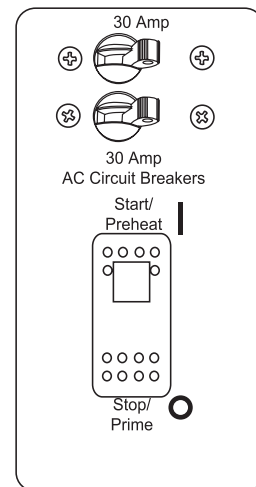
NOTE:

The generator will continue to run after a circuit breaker trips.

If a circuit breaker trips, disconnect or turn off as many loads as possible. To reset the circuit breaker, switch the circuit breaker to **OFF**; then switch back to **ON** to reconnect the circuit. If the circuit breaker immediately trips, the electrical distribution system has a short or the circuit breaker is faulty. Call a qualified electrician. If the circuit breaker does not trip, reconnect a combination of loads that will not overload the generator or cause the circuit breaker to trip again. Remember to compensate for elevation and temperature changes when re-connecting loads.

NOTE:

An appliance or load may have a short if it causes a circuit breaker to trip after re-connection. DO NOT continue to reset breaker. Have the problem corrected before resuming operation.



020159i

5.5 Kw Control Panel

Generator Exercise

If use of the generator is infrequent, exercise the generator once a month by operating it at approximately half the maximum rated output for two hours. This exercise helps to promote better starting, more reliable operation and longer engine life. This procedure drives off moisture, lubricates the internal engine parts, replaces the old stale fuel with a fresh supply, and also promotes removing oxides from the electrical switches and contacts.

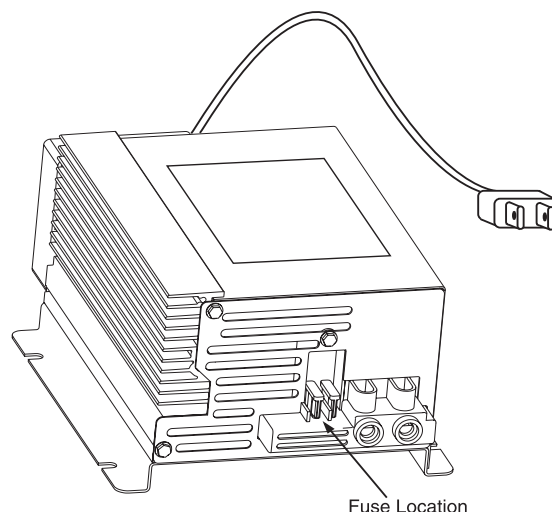
NOTE:

Avoid short run periods of the generator. Run the generator set under a load for a minimum of one-half hour.

CONVERTER

The power converter is located in the rear roadside bay with the power cord. The power converter automatically charges and maintains the house batteries when either the generator or shore power is engaged. The converter converts AC power to 12 Volt DC power for charging batteries. Tests can be performed to ensure the power converter is functioning properly.

- Output on terminals should read 13.6 Volts DC +/- .3 Volts.
- Inspect the fuses to ensure they are not blown.
- The power requirement for the converter is 120 Volts AC.
- Good air flow is required. Do not store anything on converter.



Typical View of Converter

060087

If converter output is correct, but the battery is not charging, there may be a problem with an open wire between the converter and battery. If the fuses are blown, the battery was connected in reverse. It only takes one second of reverse connection to blow the fuse.

If the power requirement for the converter is met, the fuses are good, and there is no output from the converter, the converter is bad and will need to be replaced.

NOTE:

Do not store objects close to the converter. This may disrupt the air flow to and from the converter, possibly causing damage due to overheating.

INVERTER (Optional)

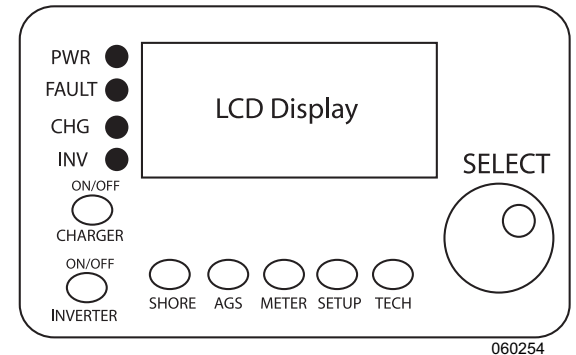
The inverter performs two functions: converting DC battery power to AC electrical power and charging the batteries when hooked to shore power or operating from the generator. Use the inverter to supply AC power when shore power is not available and the generator is not going to be used as a secondary AC power source. The inverter supplies AC power to most outlets and appliances. It is important to remember that using the inverter quickly consumes house battery power. Turn off the inverter when not in use to conserve house battery power. The remote control panel is used to change the variable settings.

NOTE:

The inverter option eliminates the standard converter.

Providing AC Power with the Inverter

Press the **INVERTER ON/OFF** switch to turn on the inverter. If the inverter does not sense AC power from the generator or shore power, it will provide AC power from the motorhome batteries to most outlets and appliances. If the generator is started or the motorhome is connected to shore power, the inverter will automatically begin charging.



Battery Charging with the Inverter

The inverter will automatically begin charging when AC power is supplied from shore service or the generator. The inverter uses a three-stage charge cycle to charge the batteries. If desired the charger may be turned off.

To turn the charger ON and OFF:

- Press the switch marked **CHARGER ON/OFF** on the remote panel.

NOTE:

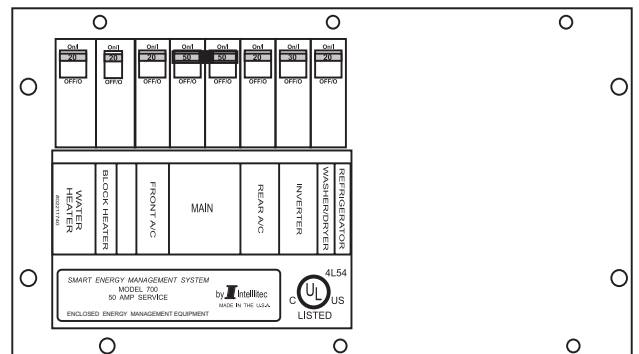
Refer to the OEM manual located in the Owner's Information File Box for detailed instructions.

Factory Default Settings

Function	Default
Search	5 Watts
Low Battery Cutoff	11 Volts DC
Battery Bank	400 AH
Battery Type	Liquid Lead Acid
Charge Rate	80%
Contrast	75%

DISTRIBUTION PANEL (50 AMP)

The AC distribution panel is located in the bedroom. The main AC panel 120 Volt circuit breakers receive power from the transfer switch, which is powered by either shore power or the on-board generator. Power is introduced into the panel to the 50 Amp **MAIN** breaker first, followed by power being fed into the individual branch circuit breakers. The panel label describes the breaker layout and the item, outlet or appliance to which they pertain.



060101b

WARNING:

This panel contains high voltage which can cause serious injury or death. Before beginning any work or testing procedures involving the electric panels, or any of the branch circuits, be sure the motorhome is unplugged from shore power and the generator is not running. Certain testing procedures can require the AC power to be on. Only qualified personnel or personnel with electrical backgrounds should attempt any testing procedures.

Circuit Breaker

Branch circuit breakers supply AC power to the different items or loads. Should a breaker trip from over current use, or a short circuit condition, the load should be tested or disconnected to determine the reason the breaker tripped. If no cause is found, or not readily apparent, reset the breaker by toggling the breaker to the **OFF** position, then back to **ON**. Should the breaker trip again after the load is re-applied, there may be a fault with that particular load. **DO NOT** continue to reset breaker until the problem has been diagnosed and corrected.

The internal configuration of the circuit breaker is designed to trip when excess current causes the breaker to heat up. The trip action of the circuit breaker can occur within milliseconds due to the speed at which electricity can travel. Breakers are designed to operate at a continuous load of 80% of the breaker's rated capacity. For example: A breaker with a 20 Amp rating will operate a continuous 16 Amp load. This design leaves a small amount of working capacity within the breaker. When an inductive load is applied, such as when an electric motor turns on, the motor starts to spin and current consumption may momentarily exceed the rated capacity of the breaker. As the electric motor comes up to operating speed, the electric motor's current consumption will decrease. The AC current load then falls back into the breaker's rated 80% set point. This electric principle should be kept in mind when using anything other than 50 Amp shore service and using appliances with electric motors, such as air conditioners.

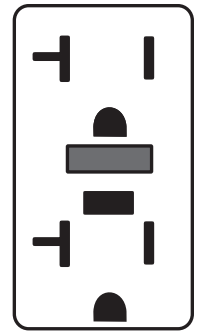
When using outlets, care should be considered when applying loads such as electric motors, heaters, coffee makers, toasters, hair dryers or other large current consuming loads. The current rating is usually stated on most electrical items. The current rating will either be rated in amps or watts. Current ratings stated on electrical items will change slightly with voltage fluctuations. As voltage increases, current consumption decreases. As voltage decreases, current consumption increases. This may explain why in some instances items operated at borderline voltage to current tolerances may seem fine in one location but problematic in another.

NOTE:

To calculate watts to amps simply divide the watt figure by the voltage of which the item operates from. For example: The electrical item is rated at 1370 watts. Divide that by the operating voltage of 115 Volts which equals 11.913 Amps. Use this formula to calculate the amount of load to the available power supply.

GFCI Outlets

A ground fault circuit interrupter (**GFCI**) is incorporated in an outlet. The **GFCI** offers two types of protection. One type of protection is from over-current or shorts to guard against hazardous ground fault currents that can result in injury or death. Ground fault currents flow from the power terminal through a person to the ground. For example: touching a faulty appliance while standing on, or making contact with, an electrical ground such as a water fixture, bath tub or the earth. The **GFCI** will offer protection against the type of shock that can result from faulty insulation, wet wiring from inside an appliance, or any device or equipment plugged in or wired to that circuit. The ground fault portion of the outlet uses sensitive electronics inside the outlet to detect a ground fault problem. The electronics monitor the normal current of power, flowing to the hot or black wire through the load (eg. a light bulb or appliance) and coming back on the neutral, or white wire. If just a small amount of the current comes back on the safety ground wire, the electronics will trip the outlet, stopping the flow of electricity. The amount of current it takes to trip the device from a ground fault varies slightly from the different outlet manufacturers (approximately 30 milliamps or less).



060072
GFCI Outlet

Electrical shocks resulting from ground faults can be felt, but such a shock is considerably less than one without ground fault protection. People with heart conditions, or other conditions that make them susceptible to shocks, can still be seriously injured. A **GFCI** outlet will not protect against shock from a normal current flow. For example, a shock from touching both metal prongs of an electrical cord or appliance while plugging it in.

WARNING:

If an outlet continually trips, DO NOT continue to reset the outlet until the problem has been identified and corrected.

NOTE:

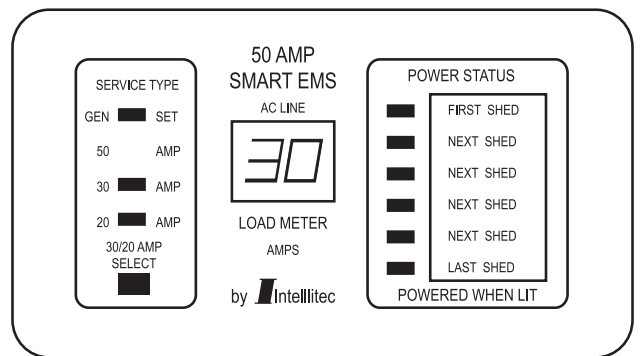
The ground fault outlet should be tested once a month to ensure it is operating. Use the TEST button on the outlet. It should trip with an audible “click.” The outlet will not trip if AC power is not present at the device. If power is present and the device will not trip, replace it before using that circuit.

NOTE:

One milliamp is 1/1000 of one amp.

Energy Management System (Optional)

The Energy Management System is easily identified by the remote display panel located inside motorhome. The 50 Amp Smart EMS consists of two elements: a display panel and a bedroom distribution panel. The distribution panel is a completely self-contained 120/240 Volt AC power distribution and energy management system intended to be used in recreational vehicles. Housed in a sheet metal enclosure with removable front panel, it provides circuit protection for all the 120 Volt AC loads in the motorhome and a system of energy management to minimize the over-loading and tripping of circuit breakers.



With 30 Amp Input

060082

Circuit Breakers:

The distribution panel offers slots for eight single or dual, standard 120 Volt circuit breakers. Two of these breakers, located in the two center positions, are 50 Amp units that act as a main input protection for each of the lines supplying the remainder of the branch breakers (up to 12).

Energy Management:

The 50 Amp Smart EMS automatically senses the available power to the motorhome, determining whether it is connected to a 30 Amp 120 Volt AC shore power source, 50 Amp shore power source or generator source. Depending upon available power, the EMS controls the operation of 6 possible loads as indicated on the distribution panel. These are typically heavier loads that can be postponed until the correct current is available. If the available power source is 30 Amp 120 Volt AC shore power, the EMS attempts to keep the total 120 Volt current draw to less than 30 Amps.

Operation:

If 120 Volt AC is not available at the distribution panel (L1 or L2 outputs) the system shuts itself off. This prevents the system from drawing current from the 12 Volt DC battery supply when not in operation.

When 120 Volt AC power is applied, the system automatically powers up and determines the nature of the power source. On 50 Amp Shore power, the load meter will not indicate Amp load. If less than 50 Amp service is present at the distribution panel L1 and L2 inputs, the system will assume that 30 Amp shore power is available and the energy management feature will be enabled. If only 20 Amp service is available, the user must select the 20 AMP service mode by momentarily pressing the 20/30 Amp select switch on the Control Panel.

If the generator is running, 120 Volt AC will be present at the distribution panel L1 (Line 1) and L2 (Line 2) inputs. In this mode the energy management feature is disabled and all control relay contacts are closed, energizing all of the controlled loads. The control module sends a signal to the display panel causing the load meter to display actual load current, the **GEN SET** service indicator to light and all power status indicators to light.

Initially, all relay contacts are closed and the total current is monitored. If the total current should exceed the service limit, the system will turn off the first load in the shedding table and calculate the amount of current that was removed. This value is placed in memory. If the current remains above the service limit, the system will turn off the next load in the shedding table, again calculating the amount of current that was removed and placing this value in memory. The system continues to turn off loads until the total current falls below shore power amperage or all of the six controlled loads have been shed. Through this process the system has learned the amount of current that each particular load draws. This feature compensates for the differences in current draw over a range of line voltage and ambient temperature by re-learning the load each time it is shed.

The 50 Amp Smart EMS now waits until the total current is lower than the service limit and enough current is available (as compared with the amount in memory for the last load shed) before turning that load back on. This assures that there is sufficient current to operate the load.

NOTE:

There is a two minute minimum delay period after a load is shed before the load will be turned on again to prevent air conditioners from turning on with head pressure.

Three Hour Averaging:

The RVIA (Recreational Vehicle Industry Association) in conjunction with the NEC (National Electrical Council) have established rules regarding the rating of electrical systems and the use of energy management systems. One of these rules requires that, if any energy management system is used, the average total load current for the system over a 3 hour period be limited to 80% of the service rating. For that reason the 50 Amp EMS calculates the average running current for the system and, if it exceeds 80% of the service rating, the EMS sheds loads to reduce the average current below that limit.

For example, if a system operating under 120 Volt AC, 30 Amp service has been running at the 30 Amp limit for three hours, the EMS will change its shedding threshold to 24 Amps and turn off loads until the 24 Amp limit is attained. If the user selects the 20 Amp service mode this limit will translate to 16 Amps. Because the EMS calculates a running 3 hour average, if the average load current drops below the limit the system will restore power to loads based on their impact on the limit.

NOTE:

If the system is in the averaging mode the decimal point at the lower right corner of the load meter on the display panel will illuminate.

Display Panel:

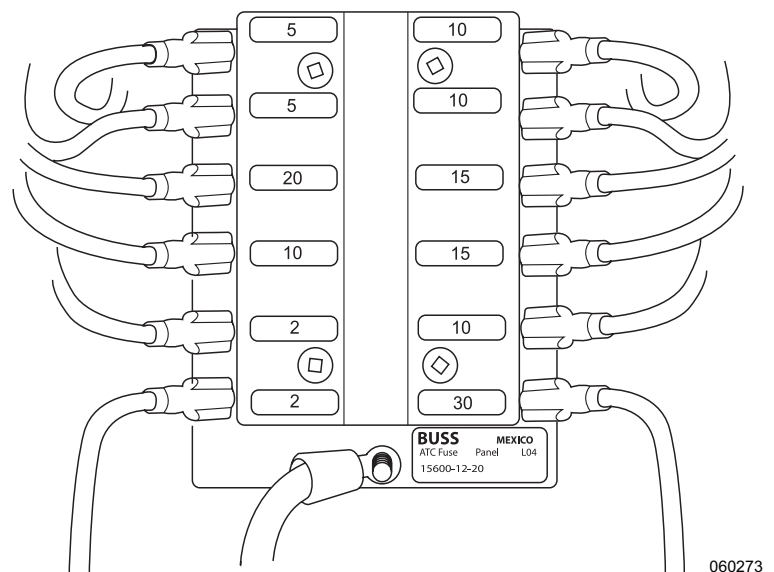
The display panel connects to the distribution panel located in the bedroom. Six power status LEDs indicate power is applied to those loads. These LEDs are on when the power is applied. The load meter has a two digit display to indicate the amount of current actually being drawn by all the appliances in the motorhome.

Four service type LEDs indicate the source for 120/240 Volt AC power. Three of these sources are automatically detected and indicated by the EMS: Gen Set Service, 50 Amp Service and 30 Amp Service.

The 20 Amp service mode is not automatically detected and the operator must manually select the 20 Amp mode when 20 Amp service is available. The service select button allows the current threshold to be set to either 30 Amps or 20 Amps to match the incoming service.

DISTRIBUTION PANEL - HOUSE 12 VOLT

The 12 Volt DC house distribution panel contains fuses (located in the bedroom) that protect the electrical circuits. These fuses are a standard automotive type.



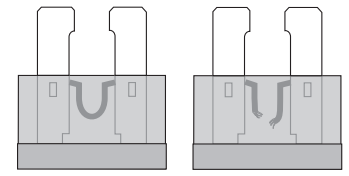
Fuse Panel: Located in bedroom closet.

Fuses

The 12 Volt DC fuses, located in this distribution panel, service the interior house lighting, ventilation fans, monitor panel, furnace and water heater. Should a fuse blow it will be evident by the broken metal strip located in the center of the fuse. Replacement fuses should be of the same amperage. If a higher rated fuse is installed it can damage the wiring. Fuse current set points follow much of the same electrical principle as the 120 Volt AC breakers. Using 12 Volt DC as the electromotive force can make it more susceptible to outside influences, such as corrosion from weathering or oxidation.

The large variety of applications this voltage can be used in makes it a staple for most of the recreational vehicle and automotive industries. The danger from shocks with this voltage is minimized, but can still occur. A good example is when a magnetic field is generated, then collapses when the power supply is cut. The result is a discharge that can reach tens of thousands of volts for a short time period. Care should be used when working with this voltage as current values can be quite high, like in the case of battery cables. Shorting a battery cable to ground with a battery at a reasonable state of charge can result in a fire or serious personal injury from a burn.

AMPERAGE	COLOR
1	BLACK
2	GRAY
3	VIOLET
4	PINK
5	GOLD
7.5	BROWN
10	RED
15	BLUE
20	YELLOW
25	CLEAR
30	GREEN



GOOD FUSE BLOWN FUSE
ATO Fuse 060086B

BATTERIES

House Batteries

House batteries are designed to operate with 12 Volt DC operated lights and appliances. The alternator and converter maintain and charge the house batteries.

- **Converter:** Converts 120 Volt AC power from shore power or the generator into 12 Volt DC for battery charging (optional inverter also performs this function).
- **Alternator:** When the engine is running, the alternator maintains the chassis battery voltage. When chassis battery voltage reaches approximately 13.5 Volts, a solenoid is engaged (located in the battery box) which allows the alternator to maintain house battery voltage.

NOTE:

The alternator is not a battery charger. It is designed to maintain proper electrical system voltage. Low battery State of Charge (SOC) or a dead battery may overheat and damage the alternator.

Types of House Batteries:

- Liquid Lead Acid (LLA)
- Absorbed Glass Mat (AGM)
- Gel Cell

NOTE:

Tap water contains minerals which can alter battery chemistry and ruin the battery. Use only distilled water when refilling the LLA battery.

CAUTION:

Many types of petroleum based products or battery by-products can damage the paint finish. DO NOT allow these types of chemicals to get on the paint finish. If chemicals do splatter onto the finish, rinse the surface immediately with plenty of water and a mild automotive detergent.

Battery Maintenance

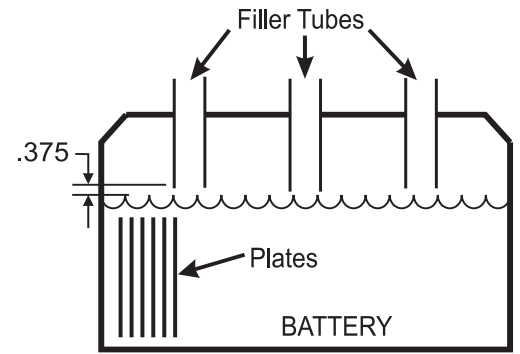
Liquid Lead Acid (LLA) battery cells should be checked at least once a month. The level should be above the top of the plates, but not overfull. The electrolyte level should be approximately 3/8" below the well to allow room for expansion while the battery is being charged. Over-filling the battery will allow the electrolyte solution to boil or gas out of the battery cap. Remember to use only distilled water to refill the battery. A battery with a low electrolyte level will rapidly boil out the water once the plates have been exposed to air.

Periodically check the batteries for corrosion and cracks. Replace vent plugs that are cracked or missing. Keep the top of the batteries clean. The accumulation of electrolyte and dirt may permit small amounts of current to flow between the terminals, which can drain the battery.

Check the battery connections for tightness and corrosion. If corrosion is found, disconnect the cables (mark cable locations) and carefully clean them with a mild solution of baking soda and water, or an aerosol product specifically designed for battery maintenance. **DO NOT** allow cleaning solution to seep into the battery and damage the electrolyte balance. Use water to rinse the top of the battery and surrounding area when done. Carefully hook the cables back to the battery. The battery cable to battery terminal connections should be metal to metal. Coat the terminals with petroleum jelly or an anti-corrosion grease.

WARNING:

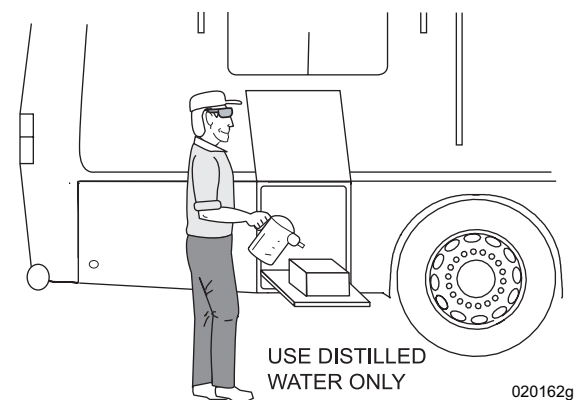
Liquid lead acid batteries produce hydrogen gas while being charged. This is highly explosive. DO NOT smoke around batteries and keep all source of ignition or flames away from batteries. The hydrogen gas may explode resulting in fire, personal injury, property damage or death.



Battery State of Charge	Spec. Gravity	Voltage
100%	1.265	12.7
5%	1.225	12.4
50%	1.190	12.2
25%	1.155	12.0
Discharged	1.120	11.9 or Less

NOTE: The distilled water level in battery should be 3/8" below the filler tube.

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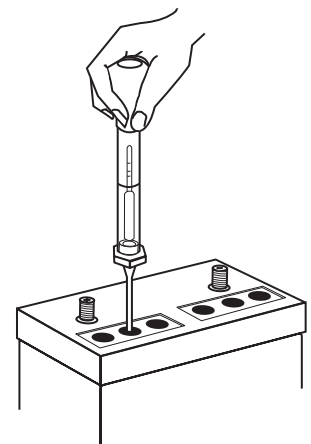
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Testing the Battery

A battery can be tested and monitored several ways. The Monitor Panel on the Systems Control Center in the hallway shows the voltage of the house batteries. The most efficient way of testing the LLA batteries is to check the electrolyte solution using a hydrometer.

Checking the Electrolyte Solution:

Hydrometers are available in different types, such as cylinder graduation (shown here) or floating ball types, and can be purchased from most auto parts stores.



030816b

Hydrometer (cylinder type)
shown testing LLA type battery.

The hydrometer tests the battery electrolyte solution, measured in specific gravity. Distilled water has a specific assigned gravity of 1,000. The hydrometer is calibrated to this mark. Pure sulfuric acid has a specific gravity reading of 1,840. The acid is 1.84 times heavier than water. The electrolyte solution is about 64% water to 36% acid (fully charged battery). Hydrometers with cylinder graduation are graphed and the exact state of specific gravity can be determined.

Temperature and recent battery activity (charging or discharging) affect the hydrometer readings. It is best to check the battery when it has been “at rest” for at least three hours, although readings taken at other times will give a “ballpark” figure. When using the hydrometer, draw the electrolyte solution up into the tube. Allow the hydrometer to attain the same temperature as the electrolyte solution. Note the reading for that cell. Complete the same test for the rest of the cells on that battery bank.

The hydrometer is calibrated at 80° F. Temperature affects the hydrometer readings. The higher the electrolyte temperature, the higher the specific gravity reading. The lower the temperature, the lower the specific gravity reading. Add or subtract four points for each 10° variance from the temperature correction chart. Readings between cells should not vary more than 50 points.

If one cell in a particular battery bank being tested is at a 50% state of charge while the others are indicating a full charge, charge only that battery to see if the low cell will come up. At the same time, do not over charge the “healthy” cells.

If the low cell does not come up after charging, this battery can damage the rest of the battery bank and should be replaced. An accurate digital volt meter + - .5% will also give an indicator of the battery’s state of charge.

Placing a load on the battery:

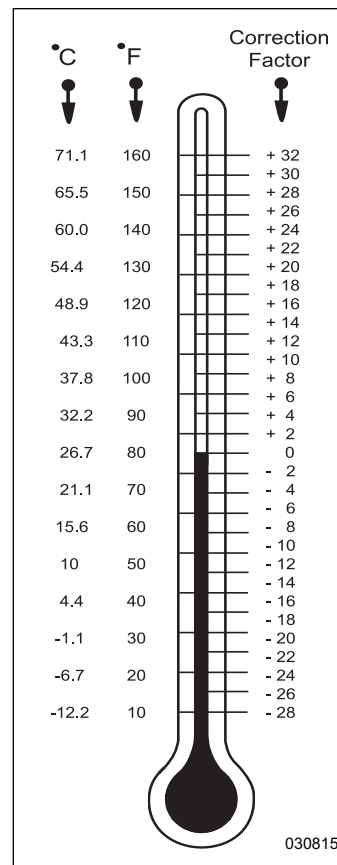
Another test is to place a specific load on the battery for a predetermined length of time equal to that particular battery’s rating. This machine is usually an adjustable carbon pile that can vary the load being applied to the battery(s) while monitoring voltage to see if they will perform to their specific rated capacities.

NOTE:

See the chart for temperature compensation. Liquid levels should be even between the cells of the battery being tested as it will affect the accuracy of the test.

WARNING:

Sulfuric acid in the batteries can cause severe injury or death. Sulfuric acid can cause permanent damage to eyes, burn skin and eat holes in clothing. Always wear splash-proof safety goggles when working around the battery. If the battery electrolyte is splashed in the eyes, or on skin, immediately flush the affected area for 15 minutes with large quantities of clean water. In case of eye contact, seek immediate medical aid. Never add acid to a battery once the battery has been placed in service. Doing so may result in hazardous splattering of electrolyte.



Temperature Correction Chart

Calculating Run Times:

Calculating run time figures when operating 120 Volt AC electrical items with an inverter can be exponential due to battery characteristics. Flow characteristics of electrons vary with different battery types and chemical compositions. Deep cycle batteries are generally designed to slowly release a majority of their charge capacity. Deep cycle batteries are rated in amp hours (Ahrs) with the discharge occurring over an extended period of time before the battery is charged. Engine starting batteries are designed to quickly release large amounts of current for short durations, without depleting battery reserves. Commercial type batteries bridge the gap of deep cycle and engine batteries. Commercial batteries release medium amounts of current over a longer period of time but they are not designed to cycle their charge capacity.

The working range of a deep cycle battery is between 50 and 100% state of charge (SOC). Deep cycle batteries should not be cycled below 50% state of charge. Discharging a deep cycle battery below 50% state of charge shortens the life of the battery. Deep cycle batteries use an amp hour rating which is usually calculated over a 20 hour discharge interval. For example: A deep cycle battery with a rated capacity of 100 Ahrs. is designed to release current at the rate of 5 Amps per hour. Multiply a 5 Amp load over a 20 hour discharge period equals the rated 100 Ahr. capacity. These discharge figures are calculated with the battery starting at 100% state of charge with the battery at 80° F when the discharge cycle begins. However, increasing the discharge load applied to the battery from 5 Amps to 10 Amps on a 100 Ahr battery does not yield ten hours of discharge time. This is due to the internal reactions which occur when a battery is discharging. Actual discharge time for a 10 Amp load may be closer to eight hours of discharge time. Increasing the load applied to the battery to 20 Amps will not yield five hours discharge time but may be less than three hours. It might be understood as a point of diminishing return.

Calculating applied loads to an inverter to approximate run time from the battery amp hours available is not an equal trade up when voltage is inverted and amperage is calculated. When the inverter is used to operate an AC load it uses approximately ten times the DC current needed from the battery when inverting 12 Volts DC to operate the 120 Volt AC item. There is also a small efficiency loss of about 10% when inverting. For example: When using the inverter to operate an AC electrical item, which has a current draw rating of 2 Amps, the inverter will use over 20 Amps DC power from the batteries.

Determining Current Consumption:

First determine the amount of current used by an AC item. For example: The television is rated at 200 watts at 120 Volts AC. Calculate watts to amps. Divide 200 watts by the operating voltage of 120, this equals 1.6 Amps. Multiply 1.6 Amps AC current by a factor of ten the inverter will use, this equals 16 Amps DC battery current. Add the revised 10% efficiency loss figure, this calculates to a total of 17.6 Amps DC. If the battery bank capacity is rated at 500 Ahrs., actual elapsed time to the suggested 50% state of charge would net viewing time for the television at approximately 13 hours in ideal conditions.

The run time figure will vary greatly with the actual state of charge of the battery bank when the discharge process begins. Ambient temperature, combined with other working loads, such as lights and parasitic loads applied to batteries, affect run times. Calculating the exact run time is not precise due to all the variables and equations involved; however, an approximate time figure can be obtained. Proper battery maintenance and charge cycles affect battery performance. Observe the battery condition with hydrometer and voltage readings. Use only distilled water when filling batteries. To achieve the highest quality of battery performance and longevity maintain the batteries in their proper operating range.

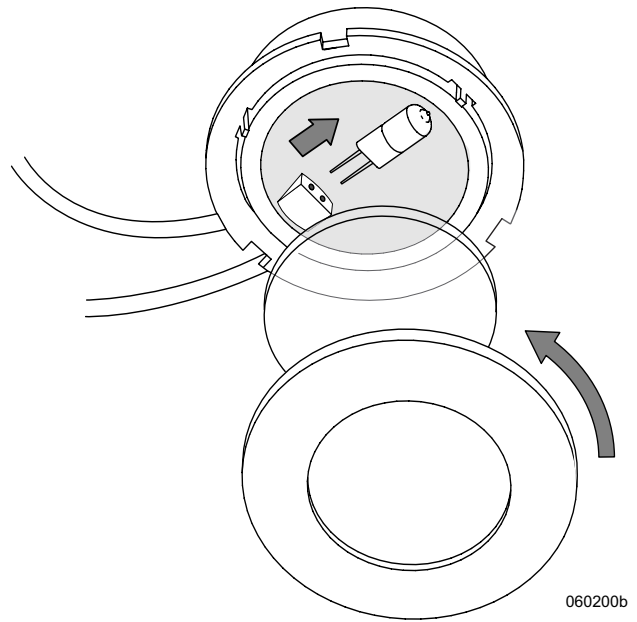
LIGHTS

Interior Halogen

The bulbs inside the halogen lighting are replaceable.

To Replace a Bulb:

1. Remove outer trim ring by rotating outer trim ring counterclockwise.
2. Remove safety lens by pressing lens towards a retaining tab. Pull lens down and away.
3. Carefully grasp and pull bulb from socket.
4. Use a clean cloth or piece of tissue to grasp new bulb.
DO NOT touch bulb directly as this can cause a “hot spot” and may result in immediate bulb failure.
5. Align contacts of bulb with terminals in fixture base. Insert bulb until contacts are firmly seated.
6. Replace safety lens.
7. Align tabs in trim ring with slots in fixture base. Rotate lens clockwise until trim ring locks into place.



CAUTION:

DO NOT touch halogen lighting while on. They can cause a burn. Do not touch replacement bulbs. Oil in the hands can cause a “hot-spot” to occur. If the bulb is touched, clean bulb with alcohol.

Map Lights

The overhead map lights are powered by 12 Volts DC and require the battery cut-off switch at the entry door to be turned on for power.

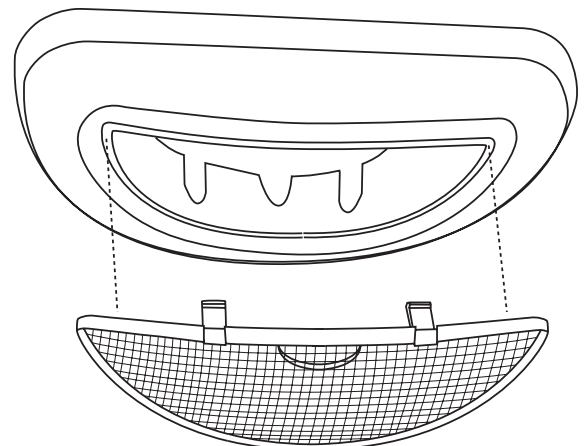
Overhead Lights:

Turn the headlight switch fully counterclockwise to turn the overhead map lights on. Swivel the lens to direct lighting.



To Replace a Bulb:

1. Insert a small screwdriver into the slots on the map light lens to release locking tabs.
2. Replace with a 12 Volt, type 906 bulb.
3. Install cover.



If Map Lights Fail to Operate:

- Ensure Battery Cut-off switch is turned on.
- Check fuses in front electrical bay on the roadside.

INTERIOR BULB CHART	
LOCATION	BULB NUMBER
WALL LAMPS	12V 912 or 921
CEILING LIGHTS	GE F IST8-CW
COSMETIC/VANITY LAMP	93 or 1003
PORCH LIGHT	1141
ROUND 3" HALOGEN CEILING LIGHT	12V 10W 4J
MAP LIGHT (OVERHEAD)	12V TYPE 906
DASH LAMP	GE 161
BEDROOM CABINET LIGHTS	Sylvania 912 or 921
DINETTE	921

NEPTUNE 2006

Electrical Systems - Chassis • Section 9

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CHASSIS ELECTRICAL - INTRODUCTION

A majority of the chassis electrical functions are designed to operate from 12 Volt DC (direct current) power. This is why the chassis battery plays such an important role in the function of the motorhome. Therefore, it is important to keep the 12 Volt DC system(s) in good working order. These systems, with their incorporated electronics, are voltage sensitive. If DC voltage is not within specification, some electronic items may be damaged.

The two different systems, chassis and house, have their own batteries. The chassis battery supplies 12 Volt DC power to the front distribution panel located in an outside compartment by the roadside front wheel. This panel contains mostly engine system fuses and wiring such as headlights, taillight, dashboard functions, gauges, etc.

WARNING:

When welding is involved for motorhome repair or modification, only qualified, experienced technicians should weld on the chassis. Improper welding procedures and materials may weaken the assembly or result in damage that is not obvious and may not cause an immediate problem or failure. Unauthorized modifications or repairs to the chassis could result in a forfeiture of warranty coverage.

DANGER:

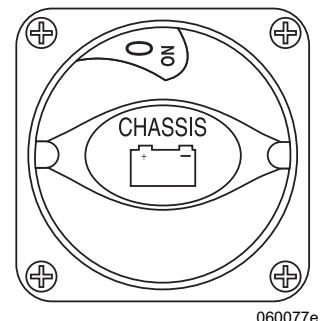
Due to the sensitive nature of the electronics on the chassis, the following precautions are required to protect electrical components in the motorhome chassis:

- 1. Disconnect the (+) positive and (-) negative battery connection.**
- 2. Cover electronic control components and wiring to protect from hot sparks.**
- 3. Disconnect the terminal plugs from the engine Electronic Control Unit, located on the passenger side of the engine block.**
- 4. Disconnect all the plugs from the transmission Electronic Control Unit, located in the roadside front electrical bay.**
- 5. Disconnect the wiring from the alternator.**
- 6. Do not connect welding cables to electronic control components.**
- 7. Attach the welding ground cable no more than two feet from the part to be welded.**

BATTERY DISCONNECT - CHASSIS

The main battery disconnect switch, located in the battery compartment, controls the DC power to the front electrical bay. Most chassis and engine functions are interrupted when the battery disconnect is turned off. Some electronic components of the engine and transmission require a constant power source, and will continue to draw power when the disconnect is off.

Turn the main battery disconnect switch off when the motorhome is going to be stored for more than 48 hours, or when performing electrical maintenance.



Battery Disconnect located in Battery Compartment

BATTERY - CHASSIS

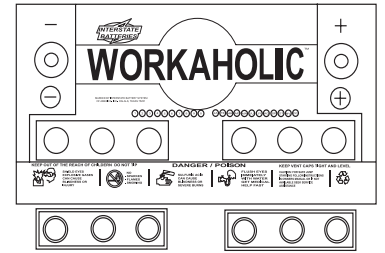
The chassis battery is designed for high output cranking power. The chassis battery is equipped with thin plates (as opposed to the thick plates of deep cycle batteries) to allow a high output of current for a short period of time. This is measured in “Cold Cranking Amps,” which represent the amperage output that can be sustained for 30 seconds at 0° F without falling below a manufacturer-specific voltage.

The thin plates of the chassis battery will warp if the battery is discharged and thereby reduce battery capacity. Turn off the chassis battery disconnect switch if storing the motorhome for more than 48 hours to help prevent battery discharge.

The chassis batteries are located in the rear curbside compartment. Keep the tray and mounting hardware tight and corrosion free.

NOTE:

Replacement batteries should have the same CCA rating.



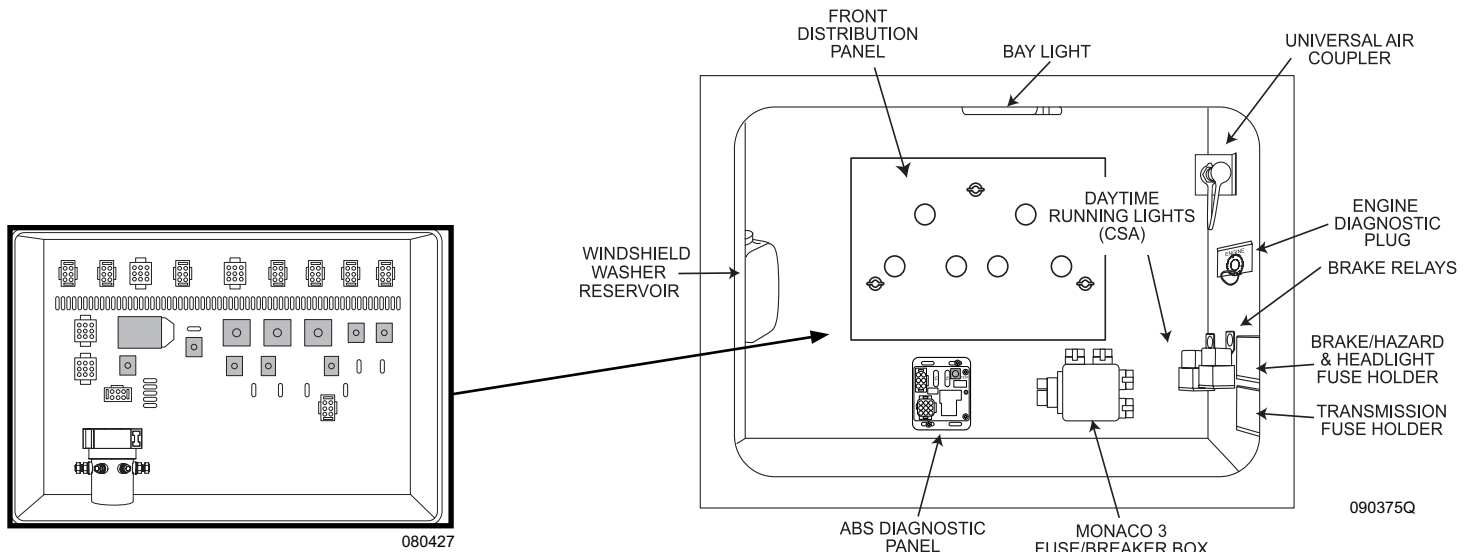
Battery shown with cover and with cover removed. The battery requires cutting plastic to remove cover.

FUSES & CIRCUITS

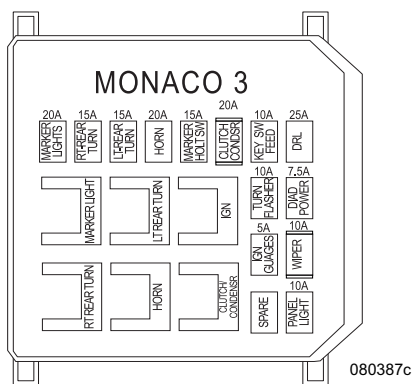
Front Distribution Panel

The front electrical panel is located in the front roadside compartment and contains the fuses, self resetting supply circuit breakers, solenoid and relays.

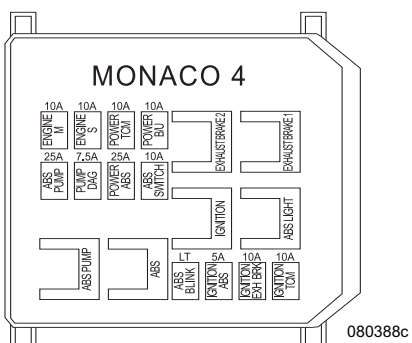
The automotive fuses and emergency flashers are located in the front electrical panel. The fuses are the standard plug-in type (ATO). When a fuse blows, the wire in middle of the plastic case will be broken. A bad or blown fuse must be replaced with a fuse of the same rating and type. Using a fuse of a different type rating will defeat the circuit protection provided by the fuse, which could result in damage to the motorhome’s electrical system. If a fuse has been replaced and it blows repeatedly, that may be an indication that a fault exists or an electronic component has failed. It is recommended that the motorhome be taken to a qualified RV technician before any future use to diagnose and repair the problem.



Circuits are identified on the fuse label located on the inside of the electrical cover. Remove three wing nuts, turn cover over to view.



Located in Front Bay



Located in Battery Bay

FUSE NO.	DESCRIPTION	MAX FUSE SIZE	P/N 03212843	FUSE NO.	DESCRIPTION	MAX FUSE SIZE	FUSE NO.	DESCRIPTION	MAX FUSE SIZE		
			<u>CHASSIS</u>						<u>SWITCHED HOUSE 12 VOLT</u>		
4-1	STEP MOTOR	25		4-19	STEP/ISO SENSE	7.5	4-33	DRV POWER SEAT	15A c.b.		
5-2	STEP SWITCH	7.5		5-20	LEVELING JACKS	15	5-34	PASS POWER SEAT	15A c.b.		
6-3	SPARE	15		6-21	SPARE	2	6-35	STORAGE LIGHTS	15		
3-4	CHASSIS READ OUT	3		3-22	SLIDE-OUT RELAY	15	3-36	SERVICE LIGHT / LP SOL	7.5		
2-5	LEVEL AIR/HYD	15		2-23	SPARE	15	2-37	POWER CORD REEL	15		
1-6	AIR LEVEL COMP.	15		1-24	SPARE	15	1-38	POWER HOSE REEL	15		
4-7	SPARE	15					2-39	SPARE	20		
5-8	STEP COVER	15		<u>ACC #1</u>			1-40	BAY 12 V RECEPT	15		
6-9	SUNVISOR	5		2-25	REAR VISION	5	4-41	DASH RADIO	5		
3-10	CB RADIO PREP	15		1-26	POWER GEAR JACKS	5	7-42	SNAKE LIGHT	15		
2-11	SPARE	15		4-27	ADJUSTABLE PEDALS	10	8-43	SPARE	3		
1-12	SPARE	15		7-28	SPARE	15	9-44	POWER TOILET	15		
				8-29	ACCESSORY	15	6-45	STEP WELL LIGHTS	15		
				9-30	AIR DUMP	15	3-46	SPARE	15		
				6-31	AIR LEVELING	15	4-47	LP/CO DETECTOR	3		
				3-32	FOG LAMPS	15	5-48	FREEZER	15		
				<u>NON SWITCHED HOUSE 12 VOLT</u>			6-49	DRIVER S/O INT PWR	15		
				4-66	RADIO MEMORY	10	3-50	PASS S/O INT PWR	15		
				5-67	REFER	5	2-51	DRIVER S/O CEILING LTS	15		
				6-68	AIR LEVELING	15	1-52	PASS S/O PWR BED/LAV	15		
				3-69	SPARE	10	4-53	MAP LIGHT	7.5		
				2-70	SNAP DISC	5	5-54	12VOLT COMP RECEPT	15		
				1-71	HOUSE READ OUT	3	6-55	BATT BOOST	5		
				<u>RELAY FUSE</u>			3-56	DASH FANS	15		
1-59	POWER AWNING	10		<u>CIRCUIT BREAKERS</u>			2-57	SPARE	7.5		
2-60	IGN LOCK OUT	15					1-58	SERV LT AUX 12V PWR	15		
3-61	SIDE DOCKING	10									
6-62	N/A	15									
5-63	N/A	15									
4-64	N/A	15									
65	MARKER LIGHTS	10									
				<u>INTERIOR FUSE PANEL</u>							

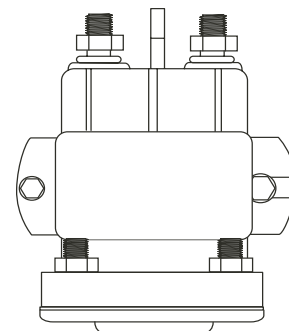
Front Distribution Fuse Panel

080427g

Battery Boost Solenoid

The battery boost solenoid is located in the battery compartment. A dash-mounted momentary switch is added to provide a boost for the engine batteries from the house batteries in case the chassis batteries are weak and will not crank the engine.

When traveling, the solenoid is engaged, charging both the house and chassis batteries at the same rate of voltage.

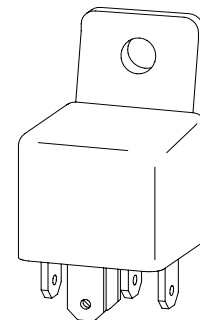


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Relays

The motorhome uses various relays to operate electrical equipment such as lights and motors. If a relay needs to be replaced, carefully record the location of each wire and all markings or labels.

Relays can look the same in appearance, but differ in function. Note that on the side of the relay is a schematic drawing identifying if the relay is 87 or 87a relay. These current ratings differ, and if mixed, will create problems. Ensure the replacement relay is of the current rating to assure proper operation.

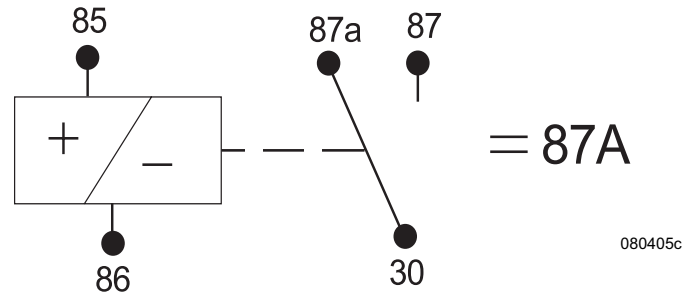
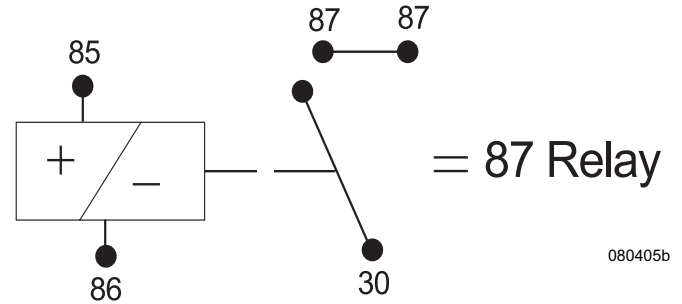


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Another indicator to the type of relay is the post or legs. Turn the relay over and look at the post.

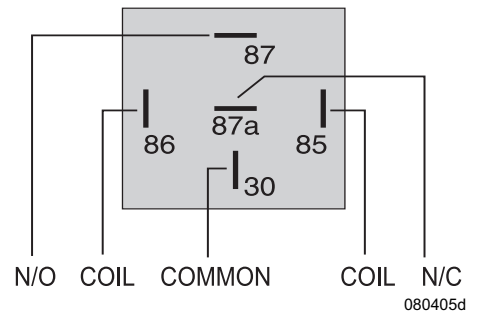
Note the differences between the numbered posts:

1. The 30 post is the incoming fuse and/or breaker power. Some relay applications supply power to the 30 post. Some use it for ground. The 30 post can be used many different ways.
2. The 85 post is one side of the coil, tripped different ways.
3. The 86 post is the opposite side of the coil, tripped different ways.
4. The 87 posts are not common to the 30 post until the relay is tripped. When the relay trips, both 87 posts are common to the 30 post.
5. Using an 87a relay, the 30 post and the 87a post are common. When the coil is tripped, the 87a post becomes inactive and the 30 post becomes common to the 87 post located on the outside of the relay.

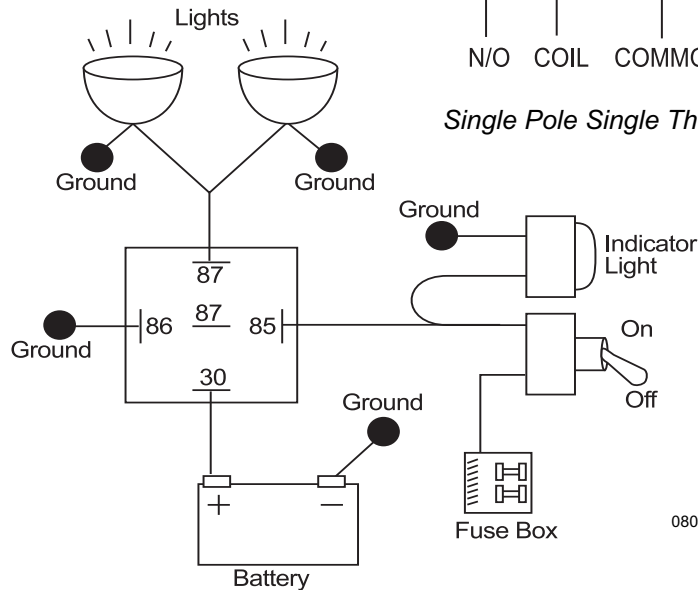


A Single Pole Single Throw relay (SPST) is an electromagnetic switch consisting of a coil (terminals 85 & 86), one common terminal (30), one normally closed terminal (87a), and one normally open terminal (87).

When the coil of the relay is at rest (not energized) the common terminal (30) and the normally closed terminal (87a) have continuity. When the coil is energized, the common terminal (30) and the normally open terminal (87) have continuity.



Single Pole Single Throw Relay.



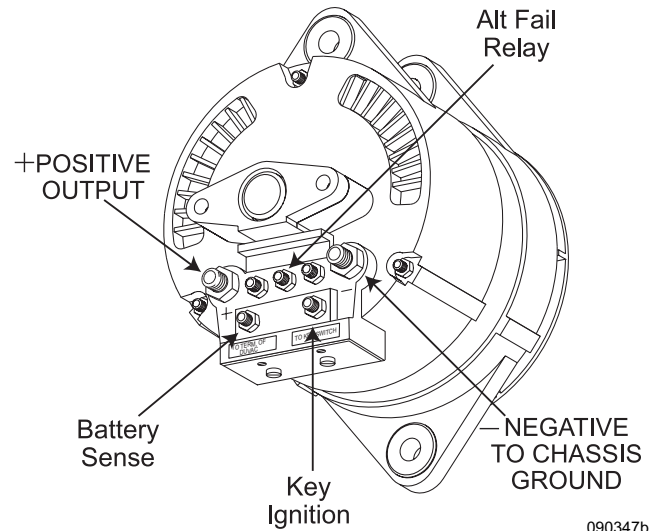
NOTE:
When there is power applied to the coil, the coil sets up a magnetic field in the windings. When the power is removed, the field collapses. A momentary high voltage discharge will occur. This is how an ignition coil works.

ALTERNATOR

The alternator is designed for output through the engine operating range. When traveling, keep an eye on the voltmeter in the dash area. Normal readings should be between 13 to 14.5 Volts DC. Voltage indications higher or lower indicate a potential problem with the charging system. If the alternator output drops below an acceptable level, a charge indication warning lamp will illuminate.

The alternator replaces amp hours the chassis battery used to start the engine. The amount of charge the alternator sends to the chassis battery is dependent on the amount of time the engine is operated. Repeatedly starting the engine for short periods may not be enough operating time to adequately replace the amp hours the chassis battery uses to start the engine.

The function of the alternator is an electrical system voltage maintainer, not a battery charger. When the engine is operating, the alternator maintains electrical system voltage relative to a load, such as headlights and windshield wipers. When a heavy load is placed on the alternator, such as trying to charge dead house batteries, the operating temperature of the alternator will increase. Excess operating temperature of the alternator for extended periods of operation can lead to premature failure of the alternator. If the house batteries are in a low state of charge, it is recommended to charge the house batteries with the inverter or an auxiliary battery charger before driving the motorhome.



CAUTION:

Long-term use of the inverter to operate the microwave while in transit will damage the alternator. Use the generator to operate the microwave while in transit.

Alternator Testing Procedure

Alternator Testing:

- Check all wiring for burnt or loose electrical connections. Repair as needed.
- Check all grounds and electrical connections to confirm they are clean and tight.
 - A. Alternator ground to chassis frame.
 - B. Motor block ground to chassis frame.
 - C. Chassis battery ground to chassis frame.
- Inspect the alternator for damage. A broken fan blade can damage an alternator or throw it out of balance.
- Check belt, pulley and fan for wear. Replace as needed.
- Do not disconnect the battery, or battery wire, from the alternator with the engine running as this can damage the alternator or regulator.
- The pulley for the alternator should be torqued to 80 foot pounds.
- Chassis battery voltage with the engine off should range from 12.2 to 12.7 Volt DC.
- Chassis battery voltage with the engine at idle should range 13.5 to 14.2 Volts DC.
- Output of the alternator range is 13.6 to 15.4 Volts DC. Connect a volt meter to the (B+) terminal of the alternator and chassis ground. Idle the engine up to 1200 RPM.
- Connect a clamp-on amp-meter, if available, to the positive battery cable to verify battery state/rate of charge.

NOTE:

The alternator is not a battery charger, but it is designed to maintain proper electrical system voltage. A battery with a low state of charge, or a dead battery, may overheat and damage the alternator.

STEERING COLUMN

Tilt & Telescope

Tilt and telescope steering wheel control lever:

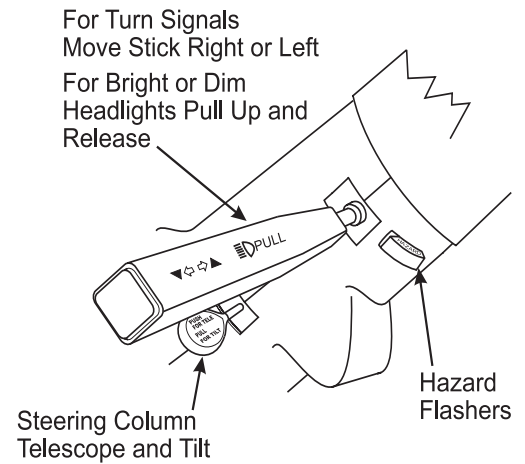
- To tilt the steering wheel: Pull the lever up and tilt the steering wheel to the desired level. Release the lever to lock the steering wheel in the new position.
- To telescope the steering wheel: Push and hold the lever down. Move the steering wheel to the desired location. Release the lever to lock the steering wheel in the new position.

Turn indicator and headlight high/low dimmer control:

- Push the lever forward to activate right turn indicator circuits when the ignition is on.
- Pull the lever back to activate left turn indicator circuits when the ignition is on.
- Pull the lever up to select high/low beam circuits when the headlights are on.

Hazard Flashers:

- The flasher button is located on the steering column.
- To turn on the four way flashers, pull out on the flasher button. The turn signal alarm will sound.
- To turn off the flashers, push the button in.



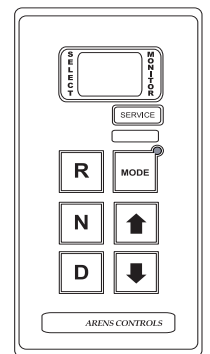
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CONSOLE

Transmission Shift Selector

Transmission Key Pad:

The transmission shift selector keypad is used to select and display gear selection. It also displays various transmission modes, oil level and transmission fault codes and is a useful troubleshooting aid when abnormal operating conditions exist. **See Section 10 for detailed operating instructions.**



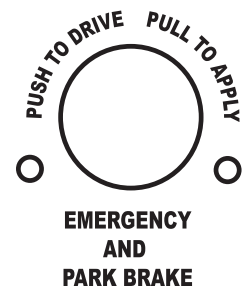
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Parking Brake

The parking brake system is activated by pulling the push-pull control knob (located on the driver's left console panel). Pushing in the knob releases the brake. Prior to driving, allow time for the air compressor to build up sufficient air pressure to shut off the low air warning lamp.

WARNING:

The parking brake can possibly be accidentally released if the air system is charged. It is advised to fabricate a device to be placed under the parking brake handle preventing small children and pets from releasing the brake when parked. A wooden clothespin clasped to the shaft will be suitable.



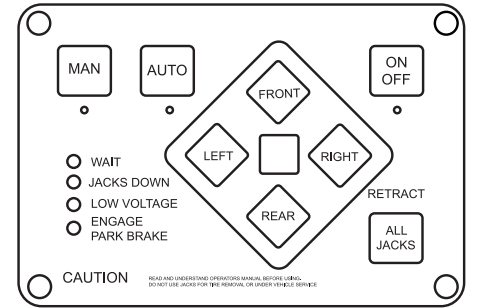
park brake.eps

Leveling Controls

The three-point hydraulic leveling system is operated from the control module to manually level the motorhome. The control features a warning system with a flashing light and an audible alarm to alert of a jack down.

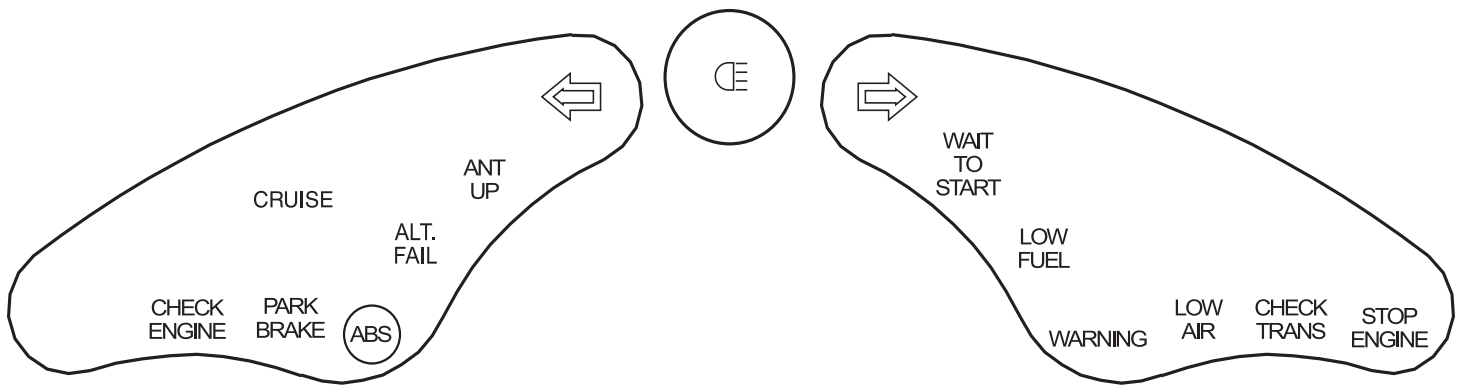
NOTE:

Hydraulic leveling works only with the ignition in ACC or ON position.



DASH Indicator Lamps

The indicator lights, activated under various conditions, can inform the operator of potential problems, provide switch status or aide in troubleshooting malfunctions.



Check Engine:

Problem with the Cummins Engine. Refer to OEM manual.

Park Brake:

Parking/emergency brake is applied.

ABS:

ABS possible fault in the ABS brake system. Also indicates faults codes for service technicians.

Cruise:

Cruise control is engaged.

Alt Fail:

Failure within the alternator charging system.

WARNING:

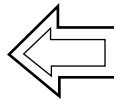
If the Alt Fail lamp illuminates, pull over immediately and shut off the engine as overheating can instantly occur. Inspect the serpentine belt.

Ant Up:

TV antenna is not resting flat in the storage cradle.

Left Turn:

Left turn indicator circuits active.



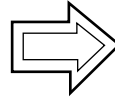
High Beam:

High beams are on when illuminated.



Right Turn:

Right turn indicator circuits active.



Wait to Start:

Monitors the intake air heater and intake manifold temperature.

Low Fuel:

Fuel level in fuel tank is becoming low.

Warning:

Out of range condition exists within the engine protection circuits.

Low Air:

Air tank pressure is low and the air system may not operate properly.

CAUTION:

Low Air Lamp only illuminates when a low air indication is present. Check the operation of the Low Air Lamp when air tank is drained.

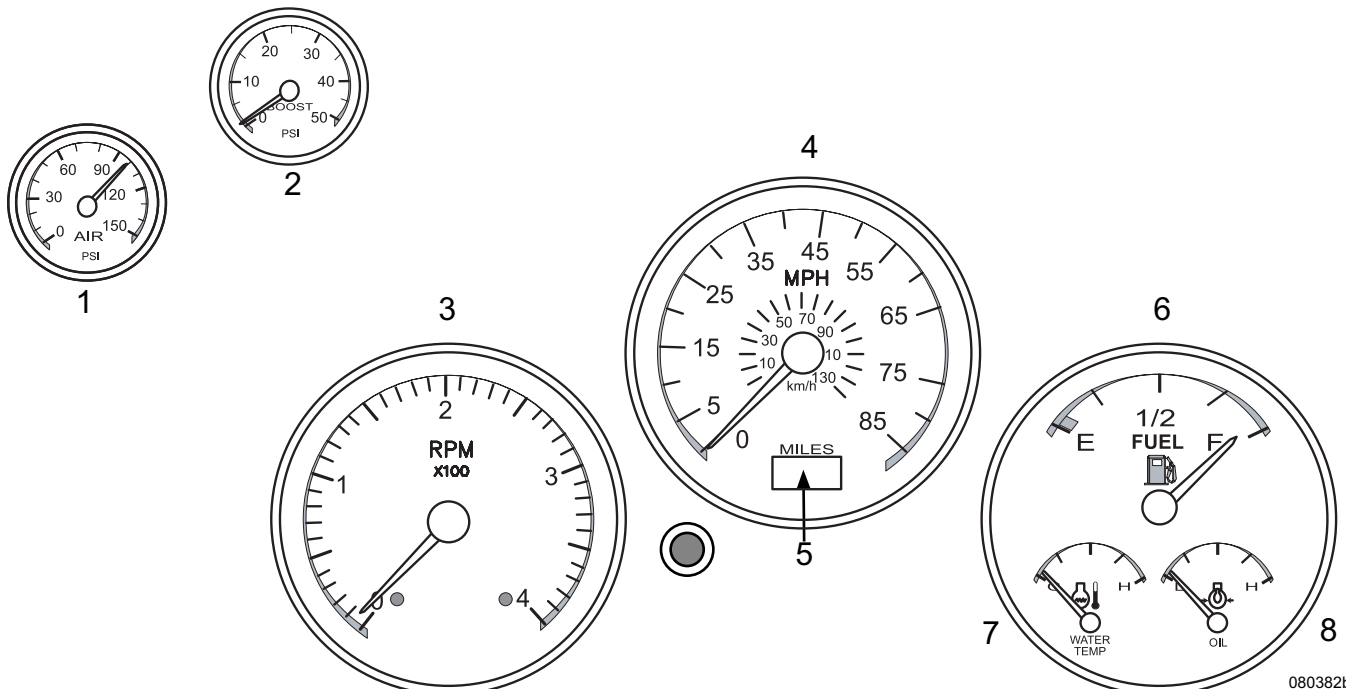
Check Trans:

Alerts of problems related to the Allison Transmission.

Stop Engine:

Alerts of severe out of range condition within the engine protection circuits. Pull over and shut the engine off to avoid severe engine damage.

Gauges



080382b

1. Air Pressure Gauge:

Two separate needles indicate air system pressure of the front and rear air tanks. The normal air system operating pressure is 105 to 120 psi. These air pressures are preset at the factory. If the air system does not maintain normal operating pressure, it is an indication of a malfunction in the air system. Use caution and stop the motorhome in a safe area. Contact a qualified technician immediately.

NOTE:

It is not safe to drive the motorhome with low air pressure. Damage can occur to the suspension and/or drive shaft, and operation of the air brake system can also be affected.

2. Turbo Boost Gauge:

The turbo boost gauge indicates the boost pressure produced by the engine turbocharger.

3 Tachometer:

Displays the engine speed in revolutions per minute (RPM). Normal low idle speed can vary from 700 RPM to 875 RPM.

4. Speedometer:

Indicates the speed in MPH and KPH.

5. Odometer/Trip Meter:

Records the mileage driven as well as total mileage on a trip. To operate, push the round black button under the speedometer. This changes the odometer mileage reading to the trip mileage reading. The same button sets the trip mileage back to zero when held for two to three seconds. Release the button and momentarily press the button again. This changes the trip mileage reading to the odometer mileage reading.

NOTE:

Odometer reading is indicated in miles.

6. Fuel Gauge:

The fuel gauge will register the approximate fuel level in the tank when the ignition switch is in the run position.

NOTE:

Fuel mileage varies with driving style and road conditions. Always average more than one tank of fuel to obtain a more accurate figure. The diesel generator uses fuel from the main tank and will affect fuel mileage figures. The diesel generator will not operate below ¼ tank to ensure there is enough fuel to run the main engine.

7. Engine Coolant Temperature Gauge:

Under average conditions, the gauge will read between 160° F and 212° F. Monitor this gauge frequently when climbing hills, towing, or in high ambient temperatures. Overheating may be a result of any of the following conditions:

- Low coolant level.
- Fan failure.
- Mechanical failure of the hoses or belts.
- Blockage of radiator fins.
- Climbing a long hill on a hot day.
- Towing a heavy trailer.
- Idling for long periods of time.

8. Engine Oil Pressure Gauge:

Indicates the pressure of the oil, not the amount of oil in the system.

INFORMATION:

Please refer to manufacturer's instructions for specific oil pressure recommendations.

NOTE:

When operating the engine cold, the pressure will be considerably higher due to increased viscosity (thickness) of the oil.

WARNING:

If oil pressure drops and the WARNING lamp illuminates, stop the engine and check oil level.

Switches

Two types of switches are used: lighted and non-lighted. Each switch has the item or function it controls printed on the switch. Press the top of the switch to start the function and the bottom to stop the function. The following is a list of switches used and their functions.

Driver Console:

MIRROR HEAT:

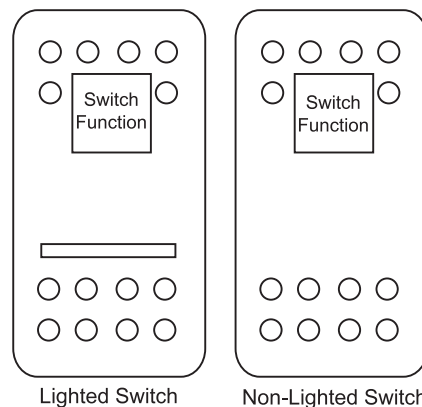
The switch turns on the heaters in outside rearview mirrors. Mirror heaters should be used when defogging or deicing is needed.

AIR DUMP:

Dumps air from the air bags. It may be an aid in leveling the motorhome. Releasing the air from air bags will give the leveler more range of travel for leveling. Ignition must be in accessory or run position.

NOTE:

Never drive the motorhome with the air bags deflated. This may damage the motorhome.



Lighted Switch

Non-Lighted Switch

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CRUISE POWER:

Enables the cruise control.

SET/RESUME:

The cruise **Power** and **Set/Resume** switches are used together to provide cruise operations and can be used to control engine idle.

To Establish Cruise Speed:

Accelerate to the desired speed. Press the switch to **SET**.

To Cancel the Cruise Control:

Step on the brake. Press the switch to **RESUME** to accelerate to the pre-programmed speed. Turning the Cruise Power switch **OFF** cancels the cruise control.

Controlling Engine Idle:

- Turn cruise control **ON**.
- Press **RESUME** momentarily to set idle at 950 RPM.
- Press **SET** momentarily, to set engine RPM at 1150.
- Press and hold **RESUME**, engine idle slowly increases. Release when desired RPM is obtained.
- Press and hold **SET** to slowly lower RPM. Release when desired RPM is obtained.

WARNING:

DO NOT use cruise control in heavy traffic or on roads that are winding, slippery or unpaved. DO NOT shift the transmission into “N” (Neutral) with the cruise control on. High engine RPM run up will occur until the cruise control is turned off.

BATT BOOST:

In the event the motorhome chassis battery has been drained and cannot start the engine, this switch momentarily “jumps” the domestic battery to the motorhome chassis battery to assist in starting the engine.

ICC FLASH:

This function is the ICC (Interstate Commerce Commission) courtesy lamp. When the headlights are ON, the taillights and all marker lights go off as long as the switch is pressed.

EXH BRAKE:

This is an auxiliary braking device. On flat, dry road conditions apply the exhaust brake until speed is reduced. The exhaust brake is very effective for speed control in town and on local routes. Use the exhaust brake to slow down when preparing to exit onto an off-ramp, when approaching traffic lights or when approaching slowed or stopped traffic. The exhaust brake is not a substitute for the service brakes. Do not neglect service brake maintenance.

Center Console:

LH SHADE:

Operates the driver side power sun visor.

PASS SHADE:

Operates the passenger side power sun visor.

RADIO:

Applies power to the dash radio. This will allow the radio to be turned ON and OFF, independent of the main radio switch.

GEN START:

The generator automatically initiates a preheat cycle when the switch is pressed to START. The preheat cycle is indicated by the light on the switch flashing rapidly. Depending on ambient temperature the preheat cycle may last up to 10 seconds. For detailed operating instructions, see section eight.

STEP COVER:

Extends and retracts the step cover.

Right Side Dash:

CEILING LIGHT:

Turns the front overhead lights on and off.

PORCH LIGHT:

Turns the outside porch light on and off.

ENTRY STEP:

Provides power to the Entry Step.

BATT CUTOFF:

Turns power ON and OFF to interior 12 Volt panel.

Passenger Console:

STEP LIGHT:

Turns step lights on and off.

STOR LIGHT:

Turns lights on and off in basement storage bays.

STEP COVER:

Extends and retracts the step cover.

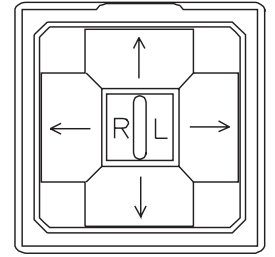
PASS SHADE:

Operates the passenger side power sun visor.

Controls

MIRROR ADJUST:

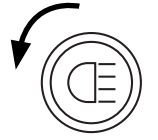
To adjust the outside mirrors, the small selector in the middle of the switch must be placed in the desired side. The middle position is to prevent accidental bumping of the switch and changing the mirror position. The outside mirrors are easily adjusted with the Allen wrench. After taking delivery of the new motorhome it will be necessary to sit in the driver's seat and adjust both the driver and the passenger mirrors.



080378

HEADLIGHT:

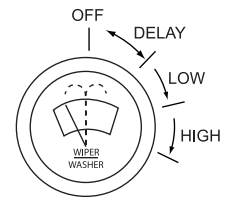
Pull one click to operate the parking lights. Pull two clicks to operate the headlights. Rotating the headlight switch clockwise will dim the dash lights. Turn counterclockwise to power both sets of map lights.



080332

WIPER/WASHER:

Wiper operations are controlled when rotating the knob to the right. When the knob is rotated from **OFF** to **DELAY**, the wiper will turn on and time delay between wipes will occur. The amount of delay time changes as the knob is rotated. A continuous low or high speed can be obtained by rotating the knob to the appropriate position. The wipers will be turned **OFF** with the switch in the **OFF** position. When the knob is pushed in, washer fluid will be dispensed from the system and the wipers will turn on momentarily.



Wiper Control

080339b

Dash Air Conditioner & Heater Controls

The system is designed to only provide heating, cooling and defrost for the pilot and co-pilot area. The system is not capable of heating or cooling the entire motorhome.

Blower Control Switch:

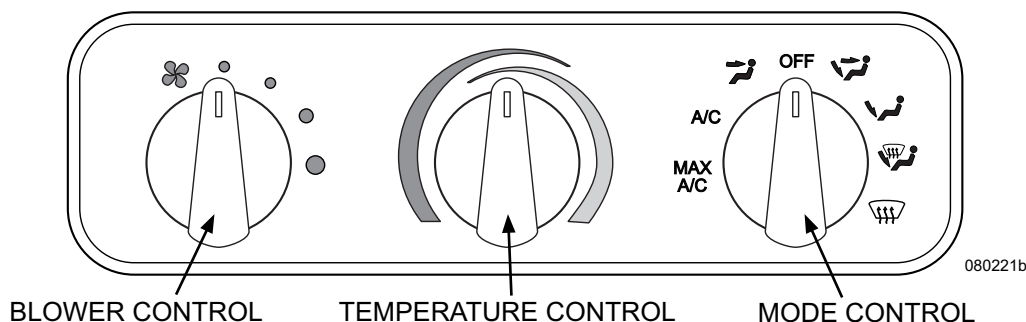
This switch controls the four speeds of the blower motor. This is one of the best and most effective ways of controlling temperature. The blower will not activate until the Mode Control Switch is set to any position other than Off.

Temperature Control Switch:





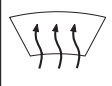
Setting the switch to the Red zone controls an electric water valve regulating the amount of engine coolant passing through the heating coils in the system. Rotating to the Blue zone sets the cut-in/cut-out temperature of the air conditioning compressor on the engine.

Mode Control Switch:

This switch directs air flow by opening or closing damper doors. Use the Mode Control Switch to direct airflow where it is needed to maximize comfort in the cockpit area.



080221b

MAX A/C	MAX A/C - Recirculated air is drawn from the passenger area and discharged through the dash louvers.
A/C	A/C - Fresh Air is drawn from outside into the system and discharged through the dash louvers.
	VENT - Fresh air is drawn in and discharged throughout the dash.
OFF	OFF - The blower motor does not operate. The fresh air inlet door will close, minimizing outside air infiltration into the motorhome.
	BI-LEVEL - Fresh air is drawn in and discharged through the dash and the floor.
	FLOOR - Fresh air is drawn in and discharged through the floor louvers.
	MIX - Fresh air is drawn in and discharged through the floor and defrost louvers. The A/C system operates to dehumidify the discharged air.
	DEFROST - Fresh air is drawn in and discharged through the defrost louvers. The A/C system operates to dehumidify the discharged air.

090273 - 277

Heat and Defrost Operation:

The air conditioning compressor operates in all modes except **VENT**, **FLOOR** and **OFF** to dehumidify the air. Rotate the temperature control switch to set discharge air temperature.

- Set the Mode Control Switch to the desired position.
- Set the Temperature Control Switch to the red zone.

A/C Operation:

The air conditioning compressor operates in all modes, except vent, floor and off, to dehumidify the air. Rotate the temperature control switch to set discharge air temperature.

- Setting the Mode Control Switch to **A/C** will allow outside air into the system.
- Setting the Mode Control Switch to **MAX A/C** will recirculate inside air. Select this position when maximum cold air is desired.
- Set the Temperature Control Switch to the blue zone.

Operating Hints and Tips:

- Air intake and discharge temperatures are greatly affected by ambient temperature and relative humidity.
- A large amount of cooling capacity is used to dehumidify air as well as cool it. After three to five minutes of **A/C** compressor operation, discharged air temperature should be approximately 30° F cooler than the fresh or recirculated air entering the **A/C** system.
- The air system on the motorhome must have adequate pressure to operate the damper doors.
- At the beginning of the day, activate the compressor with the engine at idle. This will avoid sudden high speed activation resulting in damage from lack of internal compressor lubrication.
- The dash **A/C** and heater system should be used monthly to keep the compressor lubricated.

Winter Use:

- De-ice the windshield using the Defrost mode.
- Higher temperature discharge air will occur with the blower set to a lower speed setting until the engine has reached normal operating temperature.

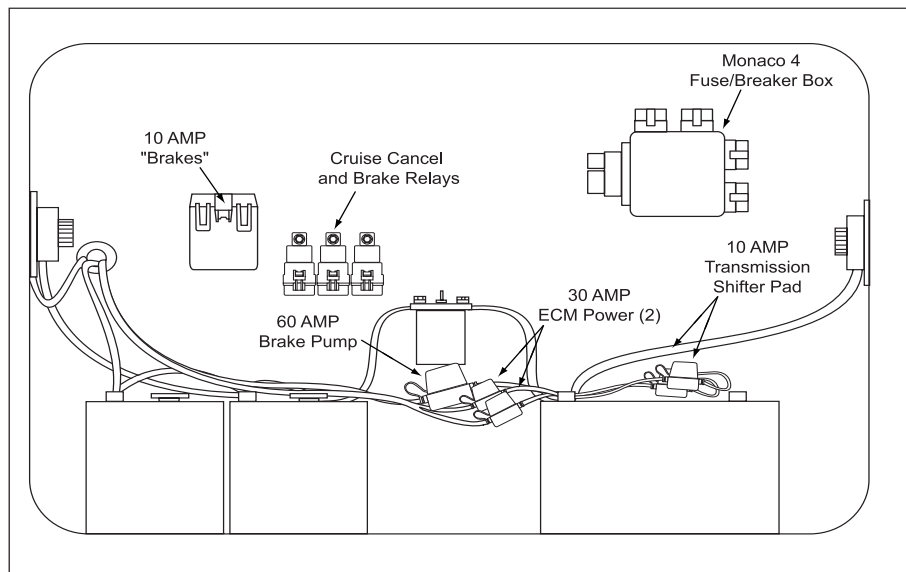
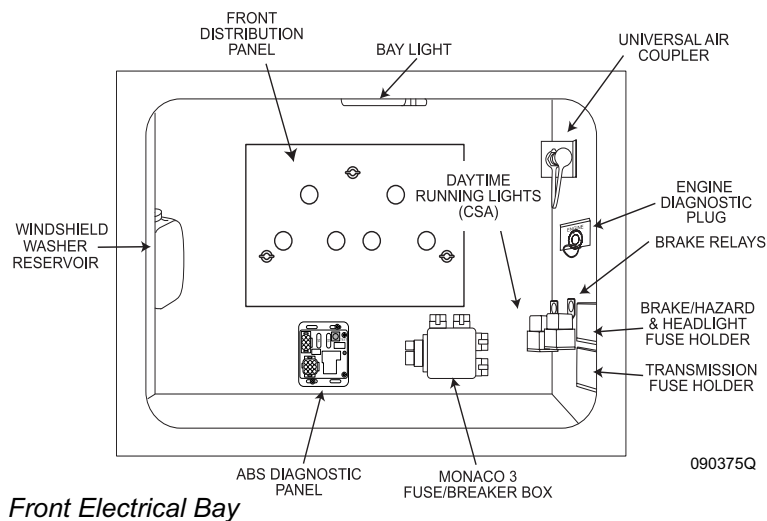
Summer Use:

- Close all windows and vents to hot, humid outside air.
- **MAX A/C** and **HI** blower will provide a quick cool down.
- Using a lower blower speed will produce cooler discharge air.

Heater:

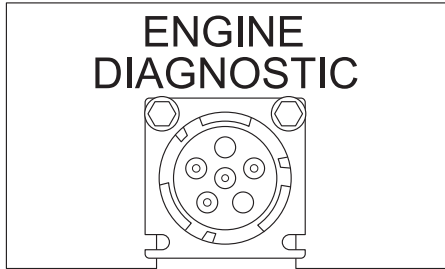
The heater warms the air in the dash area. Engine coolant is passed from the radiator to an electronic water valve. The water valve, when open, will allow the coolant to flow through the heater core. The heater core is tubing and fins. Air is drawn into the system by a blower motor through the outside recirculation door opening. Air is blown through the **A/C** evaporator core and then through the heater core. Coolant flows through the heater core when the temperature control is in the **WARM** position. Coolant flow bypasses the heater core when the temperature is in the **COOL** position. In either position air flow is felt at the discharge vents.

CHASSIS FUSE LOCATIONS (Typical)

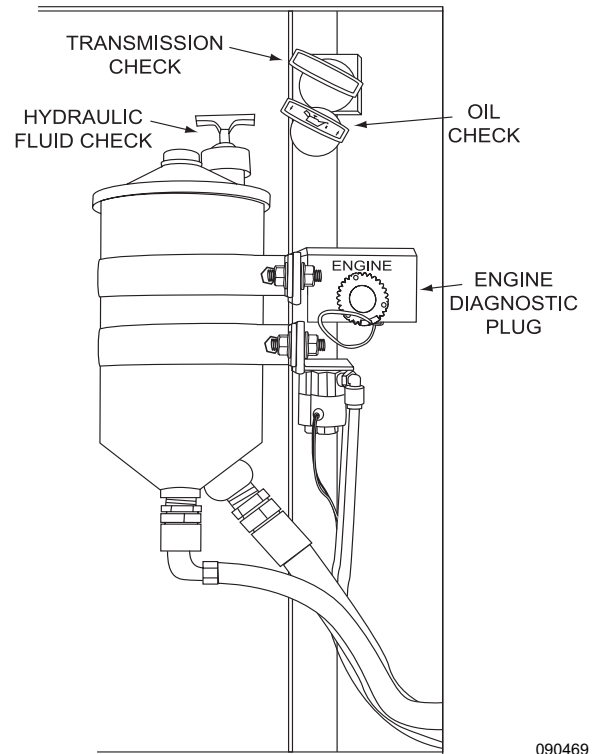


DIAGNOSTIC PLUG LOCATION

An engine diagnostic plug is located in the rear engine compartment, left of the steering column, and in the front electrical bay.



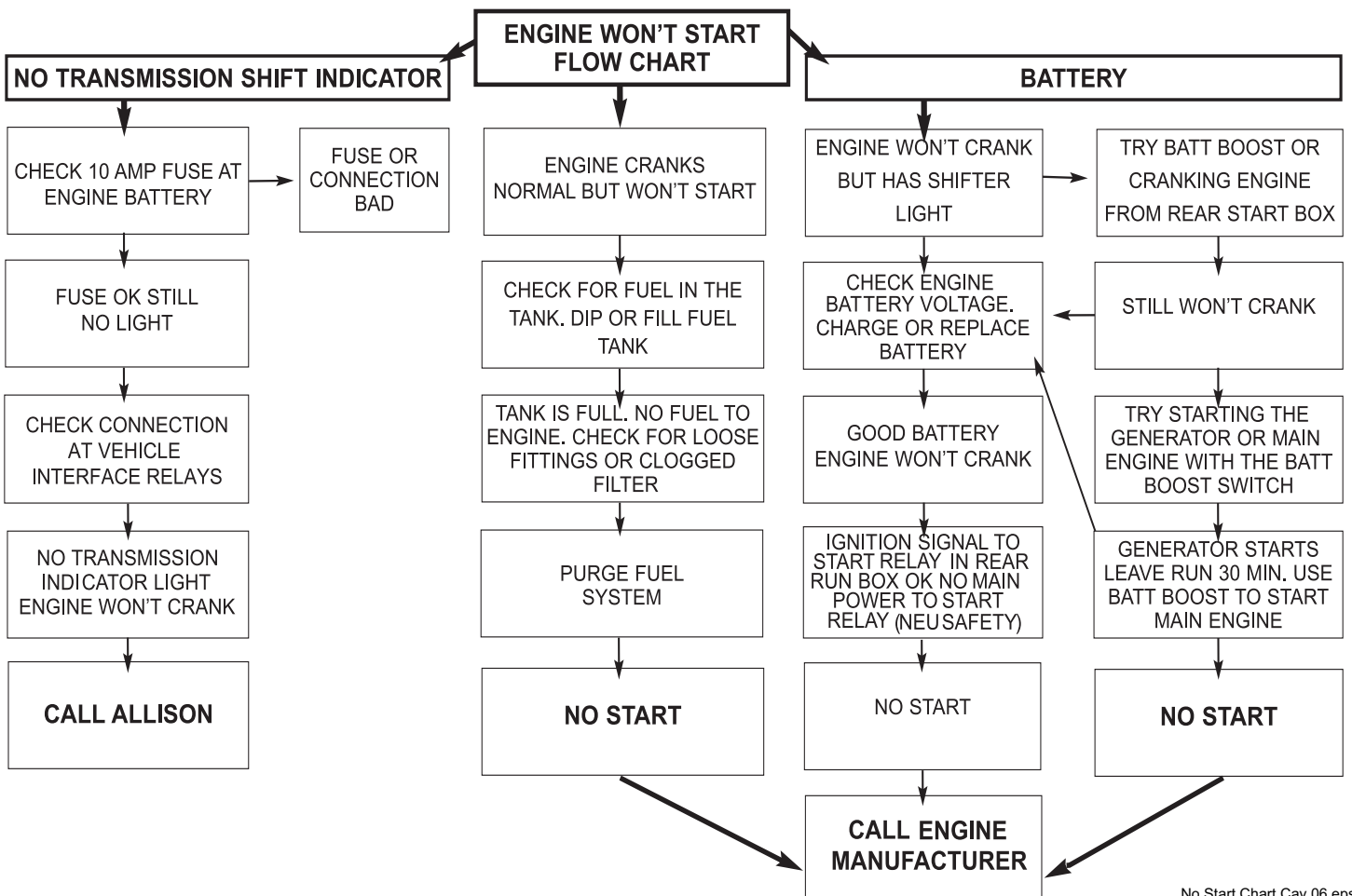
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Engine Compartment

ENGINE "NO START" FLOW CHART



No Start Chart Cay 06.eps

NEPTUNE 2006

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CHASSIS - INTRODUCTION

This section contains information and instruction regarding various components of the motorhome chassis. Follow the guidelines and procedures to help understand and operate the motorhome. Complete instructions for engine and transmission are located in their respective operators manual included in the Owner's Information File Box.

WARNING:

When welding is involved for motorhome repair or modification, only qualified, experienced technicians should weld on the chassis. Improper welding procedures and materials may weaken the assembly or result in damage that is not obvious and may not cause an immediate problem or failure. Unauthorized modifications or repairs to the chassis could result in a forfeiture of warranty coverage.

Due to the sensitive nature of the electronics on the chassis, the following precautions are required to protect electrical components in the motorhome chassis.

- 1. Disconnect the (+) positive and (-) negative battery connection.**
- 2. Cover electronic control components and wiring to protect from hot sparks.**
- 3. Disconnect the terminal plugs from the engine Electronic Control Unit located on the curb side of the engine block.**
- 4. Disconnect all the plugs from the Allison Electronic Control Module.**
- 5. Disconnect the wiring from the alternator.**
- 6. Do not connect welding cables to electronic control components.**
- 7. Attach the welding ground cable no more than two feet from the part to be welded.**

The Roadmaster chassis design provides exceptional balance, handling and braking characteristics. The Roadmaster chassis is an engine and frame unit featuring an all steel frame design, providing greater structural integrity and uniform stress distribution. Incorporated in the Roadmaster chassis is the air suspension system, with four air bags and Monroe gas shock absorbers. This design provides the smoothest ride, best handling and trouble free service while delivering excellent drivability. The chassis also has a three-point hydraulic leveling system. The Roadmaster chassis design offers unsurpassed ease of maintenance and service.

The towing system rating incorporated in the construction of the frame is 7,000 lbs. towing and 700 lbs. tongue weight.

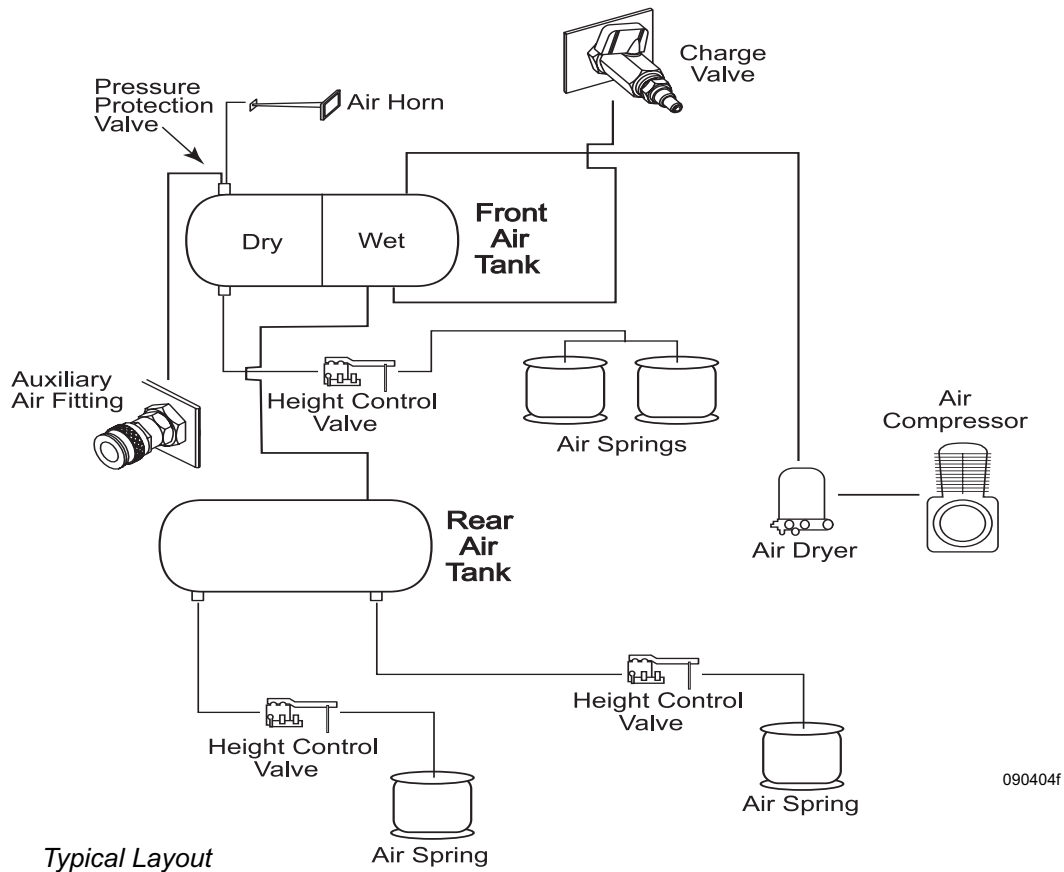


Roadmaster's exclusive rail chassis with air suspension consists of front and rear axles with trailing links. A panhard bar on each axle controls side motion. Each axle mounts to the trailing links that are connected to the chassis. The suspension control arms attach to the frame through bushings that do not require lubrication. The preset suspension ride height automatically maintains proper suspension height throughout the load range.

AIR SUPPLY SYSTEM

The air compressing system on the motorhome includes a compressor, governor, dryer, front tank and rear tank. The compressed air system operates several items, including brakes, suspension, optional air horns and air gauge. The air system is charged by a gear driven air compressor mounted on the engine. As engine speed increases, compressed air output increases. When the air is compressed, heat is generated. Heat dissipates as the air is discharged from the compressor. Moisture condenses in the compressed air as it cools and enters the air dryer to be filtered. The filtered air charges the front air tank, which is divided into a wet and dry side. The compressed air enters the wet side before entering the dry side. A discharge line from the dry side of the front air tank charges the rear air tank. Discharge lines use inline check valves to prevent a back flow of compressed air.

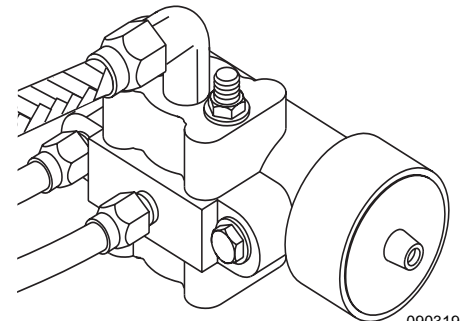
The pneumatically operated items are divided into two categories: brakes and accessory air. Brakes have full use of supplied air pressure. Accessory air items, such as optional air horns, receive air through pressure protection valves (PPV). The PPV will not allow compressed air flow until approximately 60 psi. In the event of an air system problem, the pressure protection valve will leave a reserve air charge for braking. Pressure protection valves are installed for safety.



Air Governor

The air governor regulates the air compressor to cut-in and cut-out, keeping the air system in the approximate operating range of 90 to 120 psi, and sending an air purge signal to the air dryer.

Cut-in pressure of approximately 90 psi is factory preset from the governor manufacturer and is not adjustable. Cut-out pressure is calibrated to 120 psi. When cut-out pressure is reached, the governor will send an air purge signal to the air dryer. This opens the purge port of the air dryer, expelling moisture. The purge action of the air dryer is identified by the short release of air at the rear of the motorhome.



Air Governor: Mounted to engine on curbside.

Air Storage Tanks

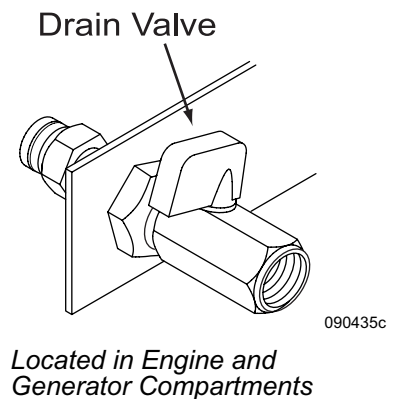
The front and rear air tanks should be manually drained once a month, or more, depending on operating conditions where humidity is high. Open the drain valves (located in engine and generator compartments) until all air is purged from the tanks, allowing five extra minutes for moisture to expel. Remember to close the tank drain valves. Both air tanks have a pressure relief valve which are set to release at approximately 150 psi.

To Drain the Tanks:

- Slowly open the drain valves as moisture will be expelled under pressure. After all moisture and air is purged from the tanks, the valves should remain open an additional five minutes to allow any remaining moisture a chance to drain.
- Close valves and start engine. Check valves for leaks.

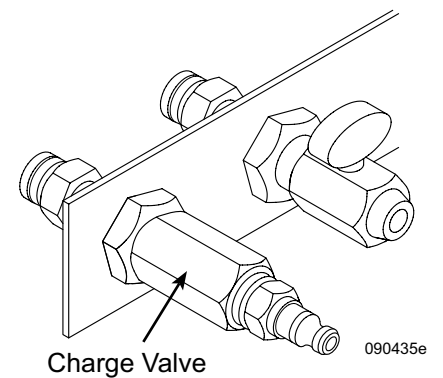
WARNING:

Wear safety glasses to prevent eye injury from expelled moisture. Open drain valves slowly as moisture will be expelled under high-pressure.



Air System - Charging (External)

The air system on the motorhome can be charged from an external air supply source. Located in the generator compartment is a type C automotive male fitting. Caution should be used when charging the air system from this fitting. The air supplied from an external source may contain moisture. Compressed air introduced into the air system on the motorhome from this fitting is not filtered by the air dryer. The auxiliary air charge fitting will charge the front and rear air tanks. A check valve is installed to prevent air from escaping.

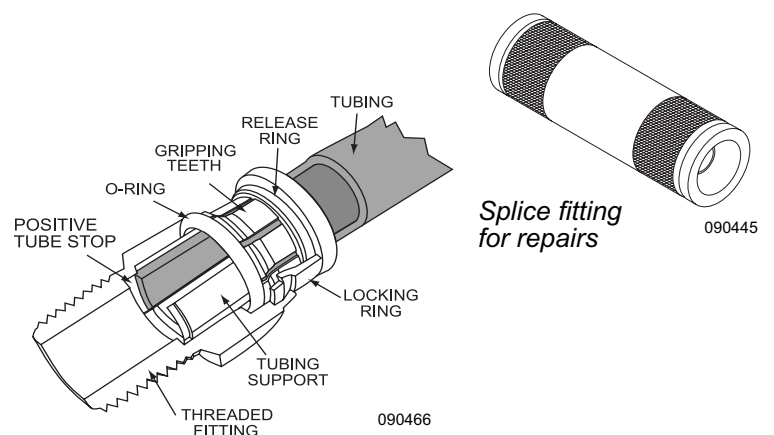


CAUTION:

The external air supply source should be regulated to charge the air system on the motorhome no higher than 140 psi. Damage to the air system or pneumatically operated items may occur.

Air Fittings

Push-in fittings, used to connect air hoses between pneumatic operated items, are designed for quick and easy maintenance and repair. Sizes and types of fittings vary for different applications. Threaded fittings adapt the push-in fittings to connect pneumatically operated items. Main parts include the release ring, locking ring, solid brass body and special rubber compound O-ring. Damaged hoses can be repaired by splicing.



Cut-away of push-in fitting.

To Disconnect Hose:

- Push hose into fitting.
- Push release ring down against locking ring portion of the fitting body.
- While holding the release ring down, pull hose away from fitting.

To Connect Hose:

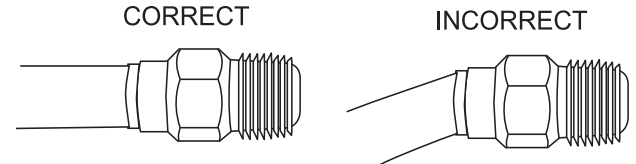
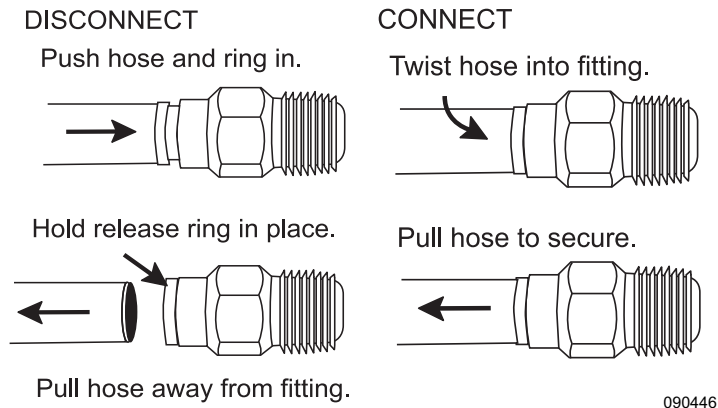
- Push hose into fitting through the release ring and the O-ring, using a slight twisting motion to seat firmly against the internal tube stop.
- Pull hose away from fitting to expand and set inner seal. Ensure hose is properly retained in fitting.

NOTE:

Cut the hose as squarely as possible when using a fitting to ensure an even seal. The cavity of the positive tubing stop provides support to prevent leakage.

WARNING:

Do not remove air hoses from fittings while system is pressurized. Serious personal injury may occur.



Air Coupler - Universal

The remote air supply coupler is located in the front roadside bay. The female fitting accepts type C automotive male air fittings. The auxiliary air fitting may be used to inflate tires, air mattresses or other pneumatic items, but is not designed to charge the air system on the motorhome. The air supply for the auxiliary air fitting is charged from the front air tank through a pressure protection valve.

To Use the Universal Air Coupler:

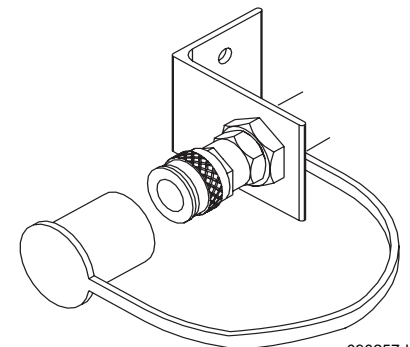
- Remove the plastic protective dust cap.
- Using a firm grip, insert the air fitting into auxiliary air supply. The locking collar is spring loaded and will lock automatically when the fitting is properly inserted.

To remove fitting:

- Firmly grip the air hose near the fitting to prevent recoil.
- Slide the locking collar back to release fitting. The collar will lock into the open position when fully retracted.
- Replace the protective dust cap when finished.

NOTE:

There are small air pressure restrictions in the pressure protection valve and tire stem valve. Due to this restriction, the maximum amount of tire pressure achieved when the system is used to fill a tire is approximately 95 to 105 psi, with the air system on the motorhome charged to 120 psi. Maximum outlet air pressure is achieved when the air system completes the fill cycle indicated by the purge cycle of the air dryer.



Located in Front Electrical Bay

AIR DRYER

The air dryer, located underneath the motorhome between the frame rails in front of the drive axle, removes moisture from the compressed air system to prevent freezing of brakes or other pneumatically operated items.

The air dryer has three functions: cooling, filtering and drying the air going through the motorhome air system. If an excessive amount of water is present when performing the monthly air tank drain service, the filter for the air dryer may need to be changed.

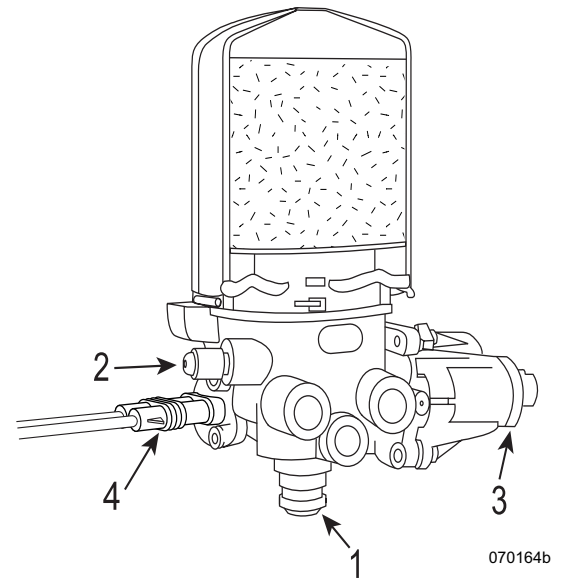
Operation:

During system pressure build-up, compressed air passes into the air dryer where the filter system removes contaminants and passes the air into the drying stage. When the compressor unloads, the water is expelled and the dry air flows back through the dryer, drying the desiccant for the next cycle. Initially, moisture condenses in the base of the dryer. Moisture-laden air passes through the desiccant bed in the air dryer cartridge and is dried.

- The compressor intakes water vapor with the air. The water vapor condenses as it cools.
- The air dryer prevents water accumulation in air lines that could damage seals and valves and wash away lubricants.
- The air dryer also prevents water in the air lines that can freeze and damage air system components.

Air Dryer Components:

- 1. Purge Valve:** A valve located on the bottom of the air dryer base that remains open during a compressor unload cycle to allow collected moisture, condensation and contamination to expel from the air dryer during the purge cycle.
- 2. Pressure Relief Valve:** Protects the air dryer from over-pressurization.
- 3. Regeneration Valve:** Controls regeneration of the desiccant by allowing air from the supply and secondary tanks to bypass the outlet check valve.
- 4. Heater Power Harness:** Twelve-inch cable with a Metri-Pack plug provides an electrical connection to air dryer heating unit.



In extreme cold, verify that the air dryer heater is in good working order. The 100-watt heater in the air dryer is controlled by ignition power. The heater turns on below 45° F and off when the air dryer temperature is above 86° F. The fuse for the heater is located in the front electric bay, roadside.

WARNING:

Remove all pressure from the air system before disconnecting any component, including the desiccant cartridge. Pressurized air can cause serious personal injury.

Desiccant Cartridge

The replacement kit contains one cartridge and one O-ring.

To Replace the Cartridge:

1. Loosen and remove the old cartridge. Use a strap wrench, if necessary.
2. Remove and discard the O-ring from the dryer base.
3. Inspect and clean the seal seat. Repair any minor damage.

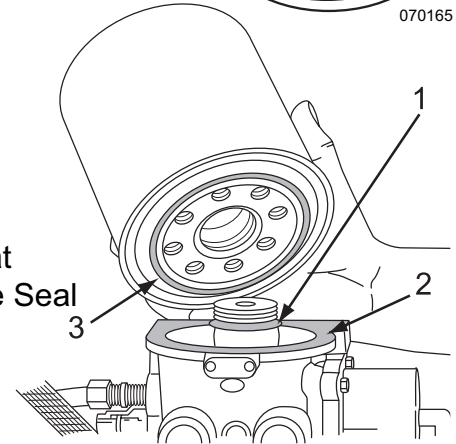
NOTE:

If the seats are damaged so badly that a tight seal cannot be maintained, replace the air dryer.

4. Install a new O-ring.
5. Lubricate the O-Ring on the stem with a thin layer of grease.
6. Lubricate the cartridge seal with a thin layer of grease.
7. Thread the replacement cartridge onto the base until the seal touches the base. Tighten the cartridge ONE additional turn. **DO NOT OVERTIGHTEN.**



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1. O-Ring
2. Seal Seat
3. Cartridge Seal

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REPLACEMENT REQUIREMENTS

Components	When to replace?	Why?
Desiccant Cartridge	<ul style="list-style-type: none">• Every two to three years.• When compressor is replaced.• Water in supply tank.	<ul style="list-style-type: none">• Preventive maintenance.• Contaminated cartridge.• Saturated or contaminated cartridge, high duty cycle (wrong application of air dryer).

Desiccant-Type Air Dryer

1. Warm, humid air from the compressor condenses into either water or water vapor before entering the air dryer.
2. A desiccant-type air dryer protects the motorhome air brake system by drying moisture-laden air before it passes through the air reservoirs and into the brake system.
3. Water collects in the base of the dryer when warm air condenses the water before it enters the dryer, or inside of the dryer before the water reaches the desiccant.
4. The desiccant material then removes additional water vapor, further drying the air.
5. During regeneration phase, the regeneration valve and pressure-controlled check valve remove water from the desiccant bed with a backflow of dried, expanded system air.

Air Dryer Cycle

The governor turns the compressor on when the supply tank pressure drops below cut-in pressure. Compressed air passes into the air dryer at the inlet port:

1. Moisture-laden air and contaminants pass through the desiccant.
2. Moisture is retained by the desiccant. Moisture also collects in the base of the dryer.
3. When the compressor unloads the purge valve opens. The governor turns the compressor off when the system reaches cutout pressure (approximately 120 psi).
4. The dryer purges and expels water collected in the dryer base.
5. When the regeneration valve opens, the dry system air flows back through the dryer. A small charge of air from the front air tank backflows through the filter. The backflow dries the desiccant, preparing it for the next cycle.

AIR SPRING INSPECTIONS

Listed below are items that can be checked when the motorhome is in for periodic maintenance.

NOTE:

Never attempt to service the air suspension on a motorhome with the air spring inflated.

- Inspect the Outer Diameter (OD) of the air springs. Check for irregular wear or heat cracking.
- Inspect the air lines to make sure contact does not exist between the air line and the OD of the air springs. Air lines can rub a hole in an air spring very quickly.
- Check to see that there is sufficient clearance around the complete circumference of the air spring while at maximum diameter.
- Inspect the OD of piston for buildup of foreign materials. (On a reversible sleeve style air spring, the piston is the bottom component of the air spring.)
- The correct ride height should be maintained. All motorhomes with air springs have a specified ride height established by the manufacturer. This height should be maintained within ¼". This dimension can be checked with the motorhome loaded or empty.
- The leveling valves (or height control valves) assist in ensuring the total air spring system works as required. Clean, inspect and replace if necessary.
- Make sure to check shock absorbers for leaking hydraulic oil and worn or broken end connectors. If a broken shock is found, replace it immediately. The shock absorber will normally limit the rebound of an air spring and keep it from over-extending.
- Check the tightness of all mounting hardware (nuts and bolts). If loose, tighten. Do not over-tighten.

Cleaning:

The approved cleaning method is to use soap and water, methyl alcohol, ethyl alcohol or isopropyl alcohol. Unapproved cleaning methods include all organic solvents, open flames, abrasive and direct pressurized steam cleaning.

HEIGHT CONTROL VALVES

Height Control Valves (HCV) inflate or deflate air springs to maintain proper suspension height throughout the load range. Two Height Control Valves are installed at the rear drive axle to control rear suspension height and left or right tilt of the motorhome. A separate HCV is installed to control front suspension height. The three HCVs mount to the main frame of the motorhome, above the axles, with a linkage rod connecting the valve to the axle.

Actuating components inside of the valves are oil dampened to reduce valve reaction to momentary suspension bounce and rebound. When a constant suspension change occurs, such as a load change or weight transfer through a sustained corner, the valve reacts by adding or purging air from the air springs as needed.

The air springs mount between the main frame rails and the trailing links. There is a specified distance the air spring must maintain between the mounting plates. Other than specified distance between the plates will compromise ride quality and handling, and affect shock absorber travel, drive shaft angle, as well as various other running gear components.

Should it become necessary to check the suspension ride height, start with the motorhome on a flat level surface. The air system must be fully charged with the suspension normalized at ride height. Specified distances may vary plus or minus ¼". Small offset adjustments to the rear valves may be necessary to compensate for slight tilt. Example: Adjusting the curbside rear height control valve up will pivot the roadside front corner down.

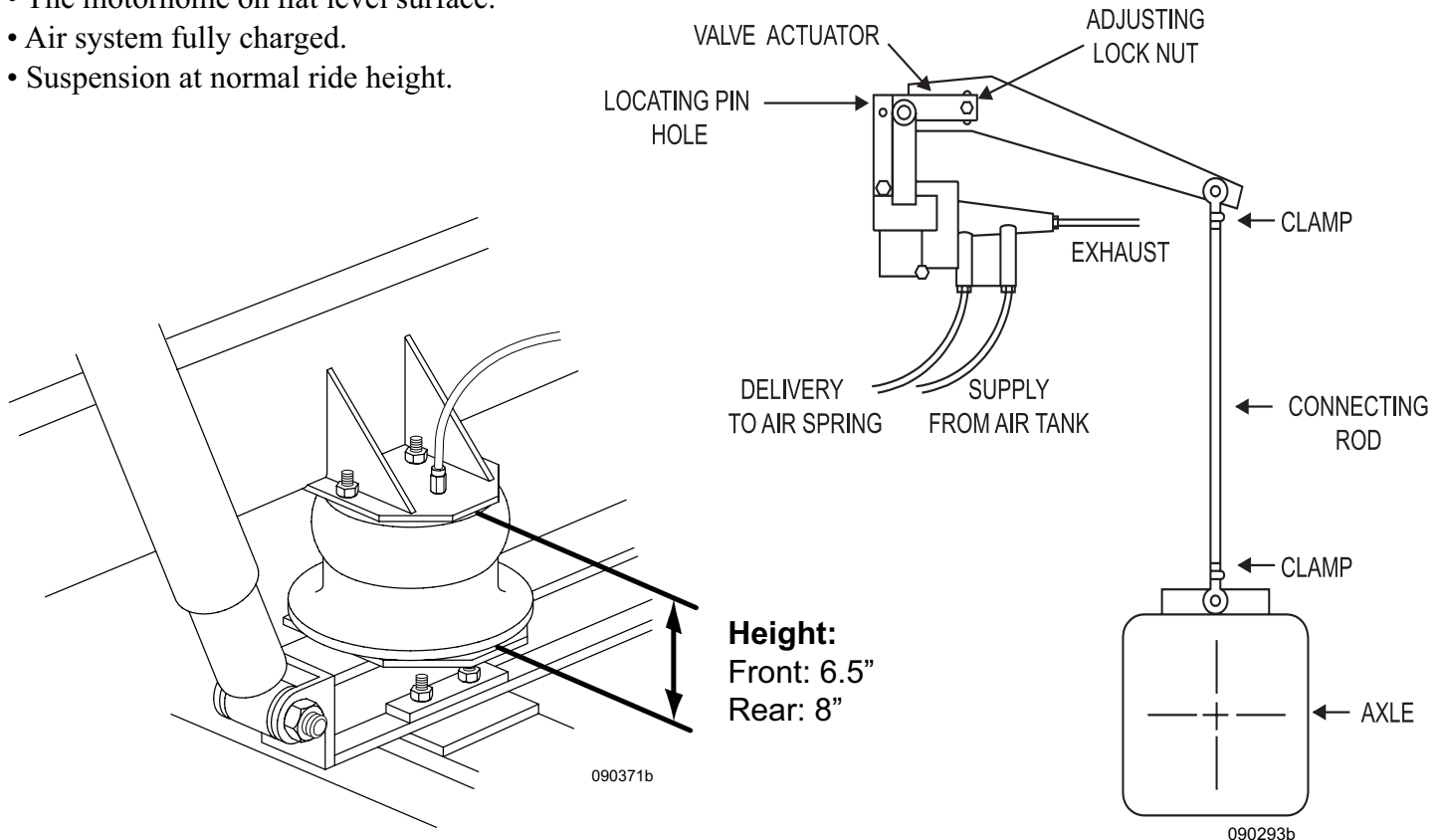
NOTE:

Drive shaft angle is affected by the suspension ride height. Improper drive shaft angle can damage suspension or shorten the life of universal joints. Shock absorbers and air springs are in travel centers at proper ride height.

Adjusting Ride Height

Preparations to adjust the suspension ride height:

- The motorhome on flat level surface.
- Air system fully charged.
- Suspension at normal ride height.



Check the distance in the front:

1. Measure the distance between the mounting plates of the air springs.
2. If the measurement is off, loosen the adjusting lock nut at the eccentric slot on the valve.
3. Move the plastic arm up to raise suspension height and inflate all the front air springs. Move the plastic arm down to lower suspension height and deflate the air springs. Make adjustments in small increments.
4. After obtaining the specified distance, insert a 1/8" or 7/64" twist drill bit into the plastic arm and valve body. This will center the travel of internal piston. Tighten adjusting lock nut between 60 to 80 in/lbs.
5. Check adjustments made by using the Air Dump switch to deflate air springs. Start the engine and allow the air system to become fully charged. Allow the suspension to adjust and come to a neutral setting.
6. Re-check the suspension height measurement. Follow the same procedure for each rear control valve.
7. Re-check the front suspension height after adjusting the rear height control valves.

NOTE:

Do not modify length of the linkage rods. Make any necessary adjustments using eccentric slot on the ride height control valve.

BRAKE SYSTEMS***Air Brakes***

The air brake system on the motorhome differs from a conventional automotive hydraulic braking system and should be treated differently. Proper maintenance and lubrication are the keys to keeping the air brake system in proper working order.

Consideration needs to be given to stopping distance and air system pressure. The motorhome requires longer stopping distance. Each brake application uses air from the air system, and engine speed is directly proportional to how fast that air system is replenished. Prepare for downhill grades. It may be necessary to select a lower gear and/or use the engine brake. Use individual short brake applications down long hills, rather than "riding" the brakes, to extend the life of the brake lining. Avoid overheating the brakes. Hot brakes have less stopping power. When maneuvering the motorhome around small areas, or backing into spaces, several individual brake applications might be made. Watch the air gauge. When preparing to back into a space swing the motorhome so it is aligned with the parking slot before backing up.

The air braking system on the motorhome is equipped with low air pressure warning system safety feature. Should a low air condition arise while the motorhome is in operation, a warning buzzer will sound and a dash warning light will illuminate at approximately 60 to 65 psi (pounds per square inch) to alert the operator.

A simple mechanical explanation of what occurs when a brake application is made is as follows: The air system supplies air to the foot brake, or treadle valve. Pushing down on the treadle valve supplies an air charge signal to a sealed brake chamber that consists of a spring and air bladder. The air charge signal pushes on the bladder and extends a threaded rod connected to the automatic slack adjuster. The slack adjuster rotates the S-cam expanding the shoes against the drum.

Park & Emergency Brake System

The Park and Emergency Brake System (Spring Brakes) applies to the rear drive axle only. When the park brake is applied, air is released from the rear brake chambers, allowing the large spring in each rear brake chamber to manually push the brake pads against the rotor. The air system must be charged above 35 psi to allow the park brake to release. Pushing down on the park brake handle charges the rear brake chambers with air pressure, overriding the emergency brake springs and releasing the brakes. In the event of air loss, while the motorhome is under operation, the park brake will automatically apply (this occurs at approximately 30 psi) acting as an automatic emergency brake system.

When preparing to depart, allow the air system to achieve full air pressure as indicated by the air gauge needles. Listen for the air dryer to purge, indicating that the air dryer is functioning. Look and listen for abnormalities. Abnormal air pressure readings by either needle of the air gauge alerts the operator to have the air system checked to avoid an untimely failure.

Should a failure occur in the air system, preventing the air pressure from building, it may become necessary to “cage” the spring brakes. This is an emergency procedure only. Caging the rear air brake chambers manually overrides the spring brakes and allows the motorhome to move. This procedure does not affect normal service braking.

NOTE:

When the park brake is released, the Park illumination lamp will remain lit until air system pressure is above 65 psi.

WARNING:

When parked, if the air tank is not depleted, there is the possibility of an accidental release of the parking brake. Traveling with small children and/or pets may require a small block to be fabricated to prevent accidental release. The block should be placed under the knob on the dash panel. A wooden clothes pin, clasped at the base of the shaft, will work.

Brake Adjustment/Slack Adjuster

The motorhome is equipped with automatic slack adjusters. As brake lining wears, the slack adjusters will automatically ratchet on the return stroke as needed. This ratchet action will keep the brake lining at proper adjustment. Brake adjustment should not be necessary. Automatic slack adjusters and the connecting S-cam shaft require periodic lubrication and inspection.

NOTE:

Replacement parts should be of the same original equipment size and type. Mixing brake components may result in unequal braking action. Brake adjustments are part of normal maintenance of the motorhome. Brake adjustments are not covered by the manufacturer.

WARNING:

Brake lining may contain asbestos material and should only be serviced by qualified service technicians who are trained in the appropriate precautionary procedures. If any loss of braking effectiveness or abnormal braking indications are noticed, the brakes and slack adjusters should be inspected by a qualified brake technician.

Backup Brake Systems

The motorhome air braking system is equipped with several backup safety systems and warning alarms in the event of air system failure. For example: should the air compressor fail to charge the air system and low air gauge readings go undetected, a low air pressure warning buzzer will sound and a low air pressure dash warning indicator lamp will illuminate. These warning indicators occur at approximately 65 psi. This will alert the operator of an impending situation. If the motorhome is allowed continued operation, the pneumatic emergency spring brake relay valve, installed in the air system, senses the low air pressure condition and will release the air charge from the spring brake air chambers on the rear drive axle. In this case, the park brakes will automatically apply at approximately 30 psi. This safety back-up system acts as an automatic emergency brake system.

Another backup system is the air system separation of the front and rear brakes, implemented by using two air tanks. One tank is located in the front and the other is located in the rear. This separation allows the front air tank to operate the front brakes and the rear tank operates the rear drive axle brakes. This tank division gives reassurance in case one tank experiences a failure of an accessory air item allowing the compressed air to escape. Accessory air items are other pneumatically operated items such as the air horn, vacuum generator, etc. The accessory air items operate only when air tank pressures exceed 65 psi. This is done with pressure protection valves. Should an accessory air item fail, the pressure protection valve (PPV) reserves the remaining air pressure of 65 psi for braking. This will leave the motorhome with one air tank fully charged for safety backup.

In another situation, whereby all compressed air has escaped from the rear air tank, a pneumatic backup safety valve is installed. This is the safety inversion valve. The inversion valve senses the absence of rear air tank pressure. In this case the inversion valve will allow the operator to make a modulated spring brake application, made in conjunction with the emergency spring brake relay valve. The inversion valve allows the front air tank pressure to recharge the rear brake chambers after the modulated spring brake application has been made. This back-up system implements use of all the brakes, allowing the operator to bring the motorhome to a safe stop.

NOTE:

In case all compressed air escapes from the front air tank, the operator will still have full use of the rear brakes.

BRAKE - AUXILIARY

Auxiliary braking systems are designed to supplement the standard wheel braking system. These devices are not designed to bring the motorhome to a complete stop; however, they can assist in controlling the speed of the motorhome. Use of the engine braking system can save on costly service brake repairs.

EXHAUST BRAKE

The Pac Brake exhaust retard system is an auxiliary braking device that is attached directly to the engine turbocharger. The exhaust brake operates by using a dash switch. The dash mounted switch will operate the exhaust brake when dash switch is **ON** and throttle is released.

When the exhaust brake is activated, a flapper inside the exhaust brake moves and restricts the flow of exhaust gases. This causes an increase of exhaust pressure within the engine. Increased exhaust back pressure quickly slows the engine speed resulting in powerful engine braking action. When the exhaust brake is activated, the amount of engine braking power developed is related to engine speed (RPM). When an exhaust brake application is made, the engine braking affect increases with higher engine RPM.

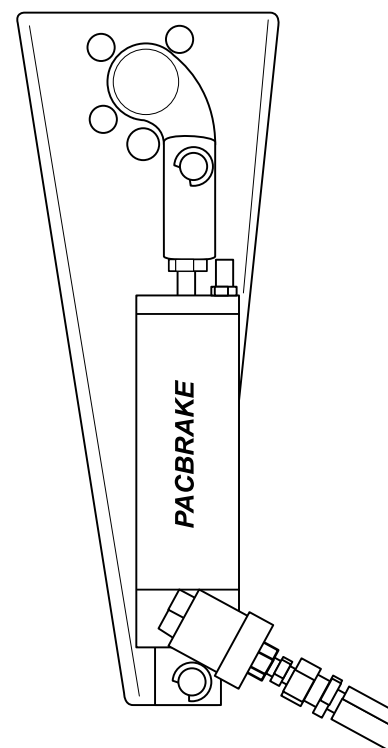
The exhaust brake is wired to the electronically controlled transmission. When the exhaust brake is activated going down a hill, it will help control road speed or sufficiently slow the road speed until the Allison Transmission can automatically downshift to the next lower gear. Downshifting automatically occurs from high gear down to second gear. Certain road conditions and engine speeds may require the transmission be manually shifted down in order to generate adequate engine RPM and increase the engine brake effect.

NOTE:

The brake lights will illuminate while the Exhaust Brake is applied.

NOTE:

Activating the Exhaust Brake switch will cancel the cruise control.



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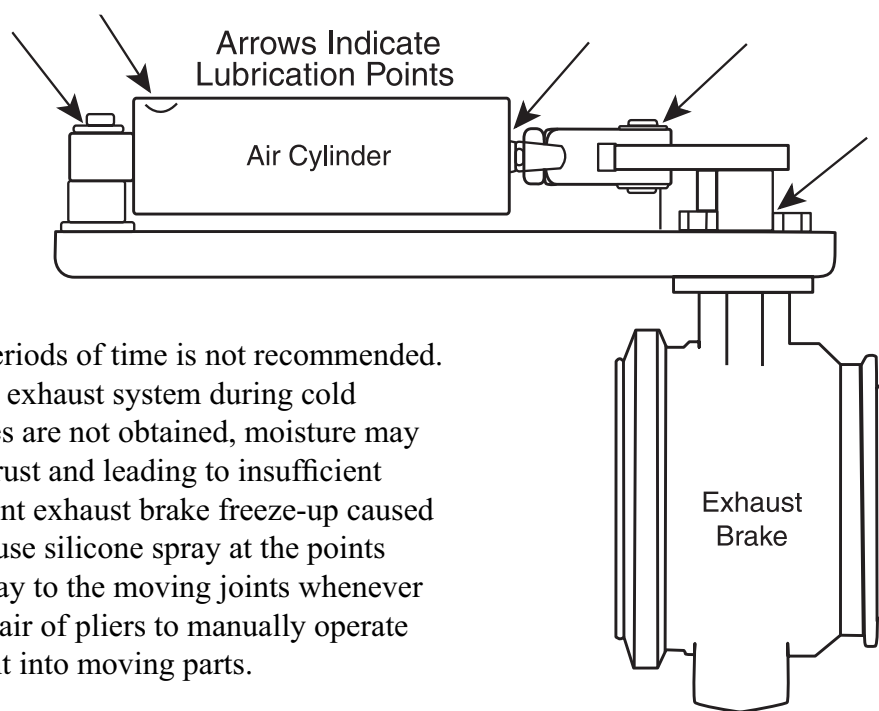
Maintenance

Contributing causes such as moisture, dirt, carbon and improper use can produce failure with the exhaust brake.

Starting the engine and idling for short periods of time is not recommended. Moisture is created within the engine and the exhaust system during cold startups. When normal operating temperatures are not obtained, moisture may get trapped in the valve housing resulting in rust and leading to insufficient operation of the exhaust brake. To help prevent exhaust brake freeze-up caused by periods of non-use, it is recommended to use silicone spray at the points shown. Apply liberal amounts of silicone spray to the moving joints whenever the motorhome is parked for storage. Use a pair of pliers to manually operate the valve several times and work the lubricant into moving parts.

NOTE:

Do not use petroleum-based lubricants as these will burn off and possibly create a fire hazard.



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Problems related to electrical symptoms:

- Will not activate or deactivate.
- Intermittent **ON/OFF** operations.
- Actuates with the switch **OFF**.

Problems related to mechanical symptoms:

- Slow operation.
- Delays in operation.
- Limited performance.

INFORMATION:

Refer these problems to the dealer for diagnosis.

ABS SYSTEM (ANTI-LOCK BRAKES)

The motorhome is equipped with an anti-lock braking system (ABS) and automatic traction control system (ATC). The ABS system monitors wheel rotation speeds by using a 100-tooth magnetic tone ring mounted to the hub. Revolving with the wheel, the magnetic tone ring is polarized giving positive and negative pulsations. A stationary sensor is mounted adjacent to the tone ring monitoring the magnetic pulses. The pulses are monitored by the ABS electronic control unit (ECU).

The ECU monitors all available wheel sensors at the rate of 100 times per second. The ECU controls Pressure Modulator Valves. Pressure Modulator Valves have two electric over air solenoids, a hold solenoid and a release solenoid. The modulator valves are open under normal braking, allowing a straight through air signal from the treadle valve to the brake chamber. Should a wheel lose traction under a braking application, the ECU will energize the hold solenoid of the Pressure Modulator Valve to interrupt the air signal from the treadle valve to the brake chamber. The release solenoid vents the existing air signal, at the brake chamber to the atmosphere, allowing the skidding tire to regain traction. Skidding tires have less tractive efficiency. It is possible, under certain conditions, to have the wheel(s) skid with a normal functioning ABS system.

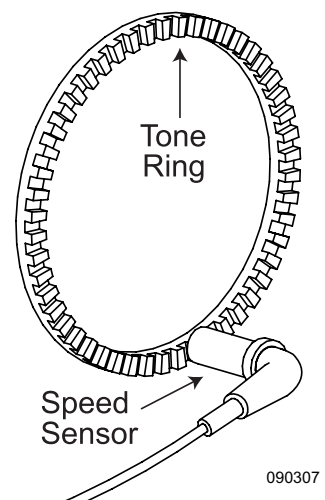
The ABS itself does not apply additional braking power. The purpose of the ABS is limiting brake torque to prevent wheel locking that results in the loss of lateral stability, and increased stopping distances. Cautious driving practices and maintaining adequate safe distances when following vehicles is the key to safe motorhome operation.

WARNING:

The ABS/ATC system is designed to increase tire to road surface traction but cannot overcome naturally occurring laws of physics. The ABS/ATC system, combined with safe driving practices, will reduce the possibility of wheel skid and loss of lateral stability.

ABS Component Function:

- Speed sensors and tone rings on each wheel monitor wheel rotation.
- Each speed sensor communicates wheel rotation pulses to the Electronic Control Unit.
- ECU receives the speed sensor inputs, interprets the signal pulses, calculates speed and acceleration rates of each wheel.
- Based on the speed sensor input, the ECU detects impending wheel lock and operates the ABS Modulator Valves required for proper control. The Modulator Valves can be operated in the air, release or hold modes to regulate air pressure to the brake chambers.
- The braking force is applied at a level which minimizes the stopping distances while maintaining as much lateral stability as possible.



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ABS Warning Lights:

The ABS will perform a dash indicator lamp check and self-diagnostic test each time the ignition is switched to the on position.

- When the ignition is turned on, the ABS indicator illuminates momentarily (2.2 seconds), verifying the self-diagnostic test. If the ABS light illuminates while the motorhome is being operated, there is a fault in the anti-lock brake system on the drive axle or steer axle. This fault will not affect normal service braking. The motorhome will need to go to a service center to repair the problem.

ABS Diagnostic Button:

By properly actuating the ABS diagnostic button, system configuration codes and fault codes can be retrieved as blinked sequences on the ABS warning light. System configuration codes are sequences of four blinked digits while fault codes are sequences of two blinked digits. Refer to an authorized Eaton/Roadranger Service Center for a list of blink code sequences. If the Diagnostic button is not pressed correctly for a specific readout, stop and start over at the beginning of the procedure. All blink codes are displayed by the ABS warning light only. The ATC light does not display blink codes.

NOTE:

All blink codes are displayed by the ABS warning light only. The ATC light does not display blink codes.

INFORMATION:

Contact a certified Eaton service repair center at (800-826-4357) for more information.

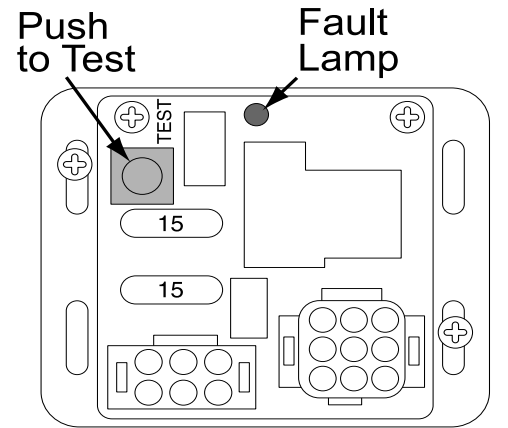
1. Write down system configuration codes and fault codes.
2. If the system configuration is correct, clear the fault codes. The process for clearing the fault codes and reconfiguring the ECU is the same when using the diagnostic button.
3. After clearing fault codes, retrieve the fault codes once again to confirm the inactive fault codes were cleared. Only active codes should display.

Reading Configuration Codes:

1. Turn the ignition key to on.
2. Apply and release air brakes.
3. Press and hold the test button for two seconds and release, immediately press the test button a second time for two seconds and release.
4. The four-digit configuration code is retrieved and should display 1-2 pause 4-5.

Retrieving Fault Codes:

1. Turn the ignition key to on.
2. Apply and release air brakes.
3. Press and hold the test button for two seconds and release.
4. Two-number blink codes are retrieved. A two-digit display of 1-1 indicates no faults; the ABS system is functioning properly.



Located in Front Electrical Panel.

080428b

Clearing Fault Codes and/or System Configuration:

1. With the ignition off, press and hold the **TEST** button.
2. Turn the ignition key to on while pressing the **TEST** button.
3. Wait two seconds and release the **TEST** button.
4. Press and release the brake pedal.
5. The ECU is reconfigured to match connected components and to clear fault codes.
6. Repeat the “Retrieving Fault Codes” procedure to verify that fault codes are cleared.

FRONT AXLE

While driving the motorhome, be aware of any changes in the feel of steering and have the system checked when noting apparent differences. It is normal to hear some hydraulic noise from the steering, especially when the steering is at maximum, or while turning the wheel when the motorhome is parked. Investigate any unusual or loud noises that occur. Begin by checking the level of the hydraulic fluid. Traveling at slow speeds over rough terrain may cause a “clunking” noise to emanate from the steering column. However, if noise occurs on smooth terrain, while sharply turning back and forth, the steering column should be inspected and repaired as necessary.

Shimmy and looseness should be checked and corrected as soon as possible. If looseness is felt in the steering, the steering linkages can be observed while someone turns the steering wheel left and right. Watch the linkages for evident play or uneven interaction between components to help pinpoint a problem. Wheel bearings should be cleaned and repacked with high temperature disc brake grease every 30,000 miles. Have the steering system checked for damage after a severe impact, such as striking large potholes or curbs, and front-end collisions. Observe the alignment of the steering wheel; a change in the alignment may indicate damage to the steering components or suspension.

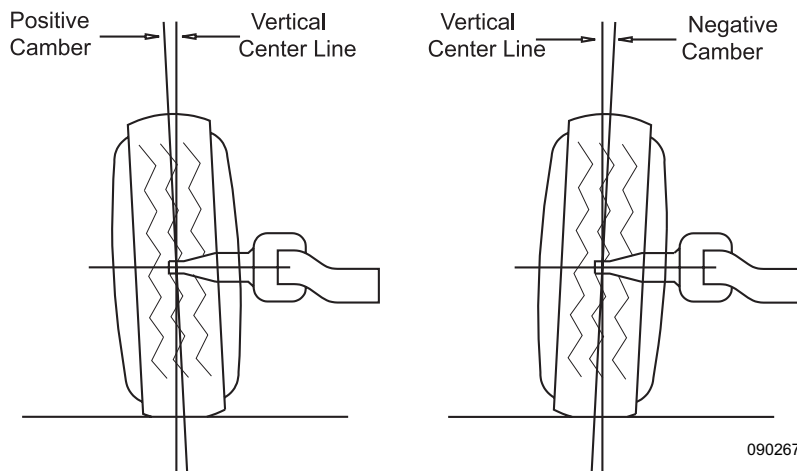
Maintenance for the system entails adequate lubrication. Use only a hand operated grease gun on the fittings. Grease fittings for the steering system are found on the both ends of the drag link (the bar connecting the steering gear to the axle), and on the steering drive shaft located between the steering wheel and steering gear. The correct wheel alignment promotes longer tire wear and ease of handling while minimizing the strain on the steering system and the axle components. Use **NLGI #2** Lithium soap base lubricant for all steering linkage and brake components.

Alignment

Camber:

Camber (as shown) is vertical tilt of wheel as viewed from the front of the motorhome. This is machined into the axle when manufactured and is not adjustable.

- **Positive** camber is an **outward tilt** of the wheel at the top.
- **Negative** camber is an **inward tilt** of the wheel at the top.

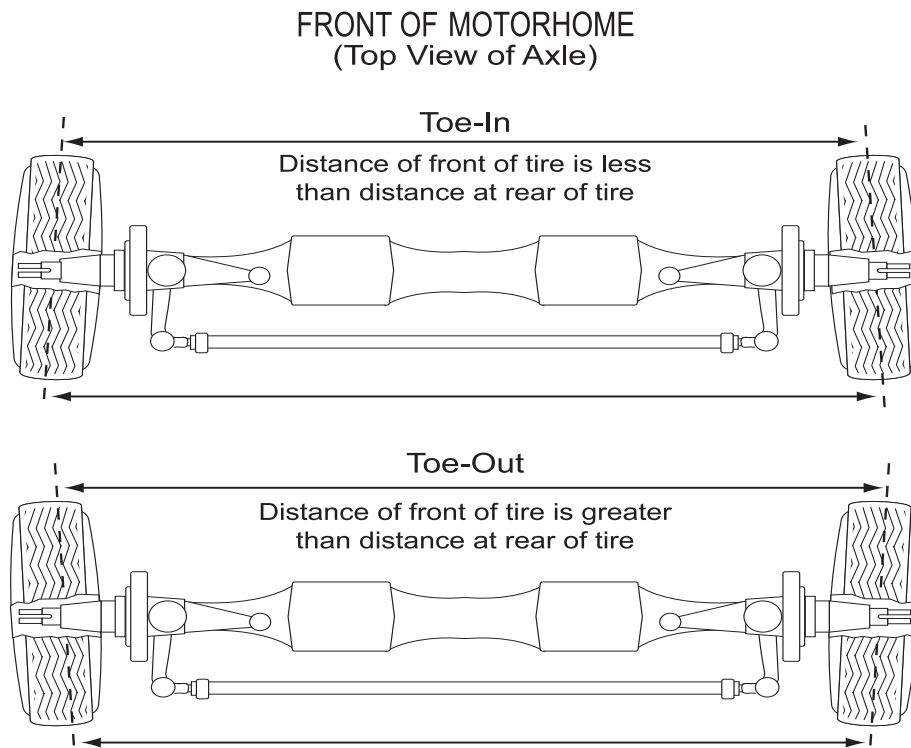


Toe Setting:

The toe setting represents different distances between the front and rear of the tires (measured at the vertical center line of the tires).

Toe-in: Occurs when the tire front distance is less than the tire rear distance.

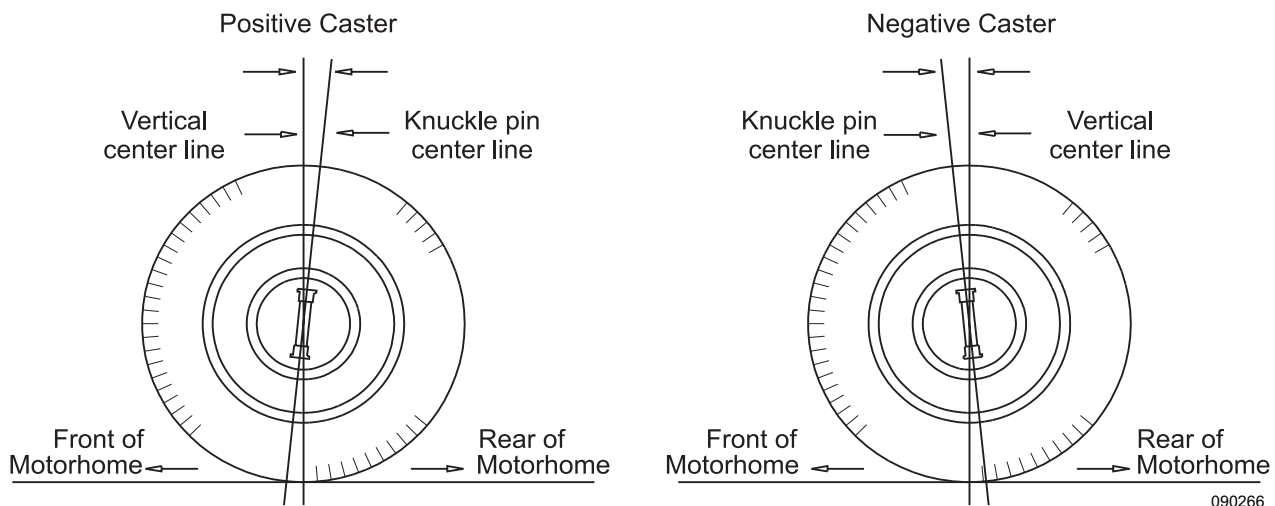
Toe-out: Occurs when the tire front distance is greater than the tire rear distance.



Wheels are generally set with initial toe-in. As the motorhome operates tires tend toward a toe-out condition. By starting with an initial toe-in setting, a desirable “near zero toe-in” can be achieved when the motorhome is in motion. Incorrect toe settings, where toed-in or toed-out, can have a significant affect on tire wear. The toe setting is adjusted by lengthening or shortening the cross tube.

Caster Adjustments:

Caster is the fore and aft tilt (toward the front or rear of the motorhome) of the steering kingpin as viewed from the side of the motorhome.



- **Positive caster** is the tilt of the top end of the kingpin **toward the rear** of the motorhome.
- **Negative caster** is the tilt of the top end of the kingpin **toward the front** of the motorhome.

	Left Front	Right Front
Camber	1/4° (± 7/16)	0° (± 7/16)
Caster*	6.5° (± 1°)	6.5° (± 1°)
Total Toe	1/16° (0.1°)	

**The difference between Right and Left Caster must not exceed 1°.*

NOTE:

Motorhome must be at ride height for proper alignment.

Setting the caster angle more positive than specified may result in excess steering effort and/or shimmy. Decreasing the angle may result in the motorhome wandering or poor steering return to center. The caster angle is determined by the installed position of the steer axle.

Wet Hub

The front axle uses oil to lubricate the wheel bearings. The oil is drained and refilled without removing the wheel end assembly. Remove the hubcap to access the bearing cover and drain plug. **Inspect the oil level before every trip or every 1,000 miles.**

To inspect the oil level:

- Remove the chrome hubcap.
- Locate the full and add mark on the outside of the clear plastic cover.
- If the lubricant level is low, add the recommended fluid until full.

The recommended oil change interval is based on the operating conditions, speeds and loads. Limited service applications may allow the recommended interval to be increased. Severe applications may require the recommended interval to be reduced.

INFORMATION:

For more information, contact a Westport Axle service representative.

Recommended Change Interval:

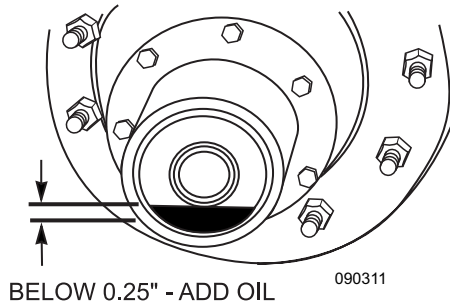
- Change the fluid whenever the seals are replaced, the brakes are relined or at 30,000 miles (48,000km). However, check the lubricant twice a year (spring and fall) for contamination. Change as needed.
- If yearly mileage is less than 30,000 miles, change the fluid twice a year (spring and fall).

Lubricant Type:

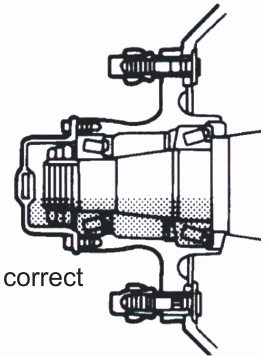
- EP S.A.E. 90w. Specifications, minimum ambient temperature - 15° F (-26.1° C). There is no maximum ambient temperature. Lubricant temperature must never exceed 250° F (+121° C).

To Drain:

- Place a suitable container below the bearing cover and remove the drain plug. If the cover does not have a drain plug, remove the screws retaining the cover plate to drain the lubricant.
- Replace plug or cover plate and fill bearing assembly with the recommended lubricant.



Shading indicates correct amount of oil



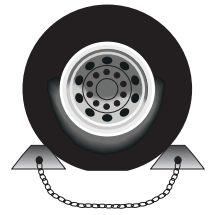
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Lubrication Maintenance Safety

The front axle components require periodic lubrication maintenance.

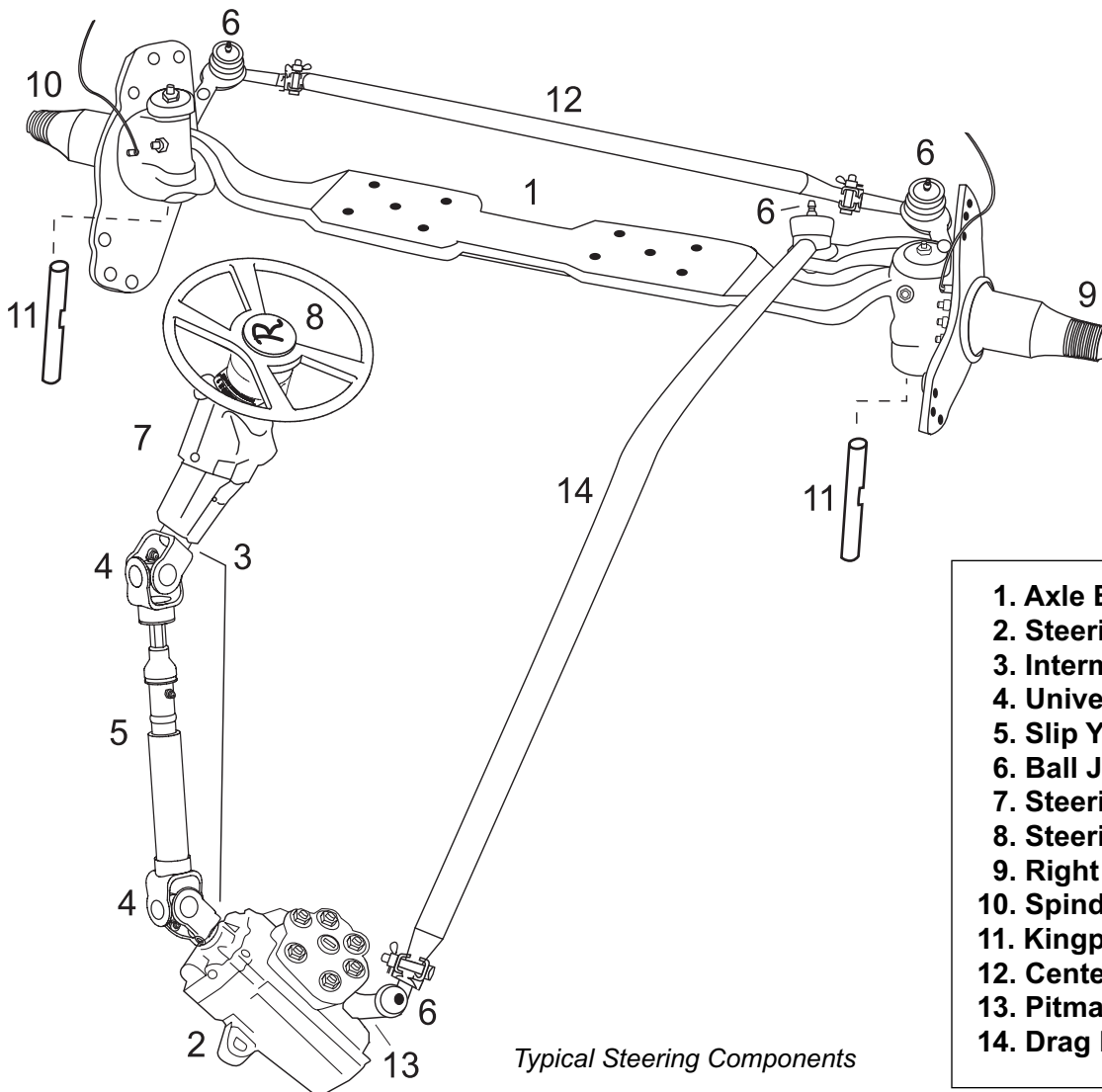
WARNING:

Chock wheels for safety prior to accessing components underneath the motorhome.



090368

Steering Components



- | |
|--|
| <ol style="list-style-type: none"> 1. Axle Beam 2. Steering Box 3. Intermediate Steering Shaft 4. Universal Joints 5. Slip Yoke 6. Ball Joint 7. Steering Column 8. Steering Wheel 9. Right Knuckle Assembly 10. Spindle 11. Kingpin 12. Centerlink 13. Pitman Arm 14. Drag Link |
|--|

Typical Steering Components

Steering Column

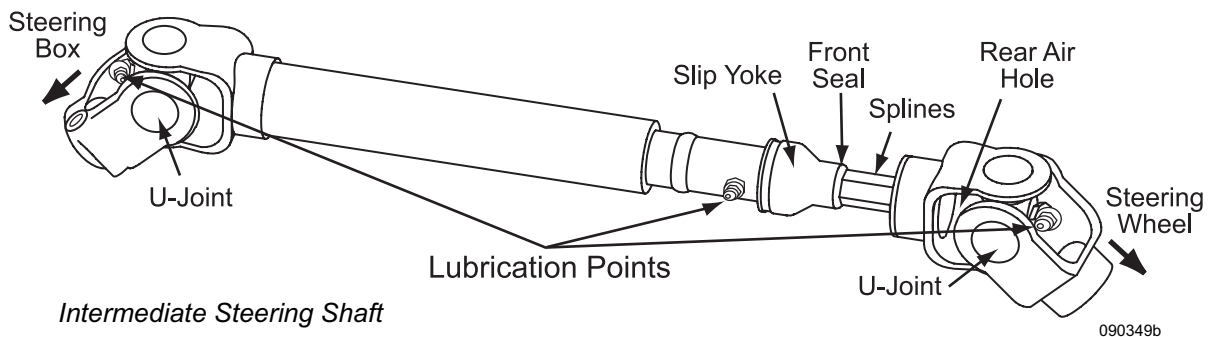
The intermediate steering shaft connects the steering wheel to the steering box. Service the intermediate steering shaft universal joints and slip yoke every 30,000 miles or annually. Remove the steering column cover to access the upper universal joint and slip yoke. The lower universal joint is accessed from underneath in the generator compartment behind the front electrical box.

Greasing the Intermediate Steering Shaft Universal Joints:

1. Check the intermediate steering shaft for looseness. Repair if loose or worn.
2. Apply the specified grease at the grease fitting on the universal joint. Apply until the new grease purges from all the seals.
3. If the new grease does not purge from the seals, disassemble and clean the joint or replace the universal joint. Do not lose the needle bearings.

Greasing the Intermediate Steering Shaft, Slip Yoke and Splines:

1. Check the intermediate steering shaft for looseness. Repair if loose or worn.
2. With finger, cover the rear air hole so grease flows to the front seal. Apply the specified grease at the grease fitting on the slip yoke. Apply until new grease purges and forces finger away from the air hole in the end of the slip yoke. Greasing interval is yearly or every 30,000 miles.

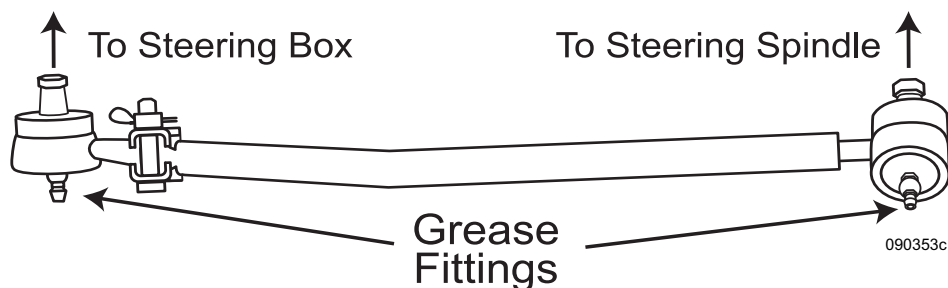


Drag Link

The drag link connects the steering box pitman arm to the steer axle. The movable joint (ball joint) uses sealed boots to prevent water intrusion. Do not rupture the boot when applying grease. Grease interval is six months or every 5,000 miles.

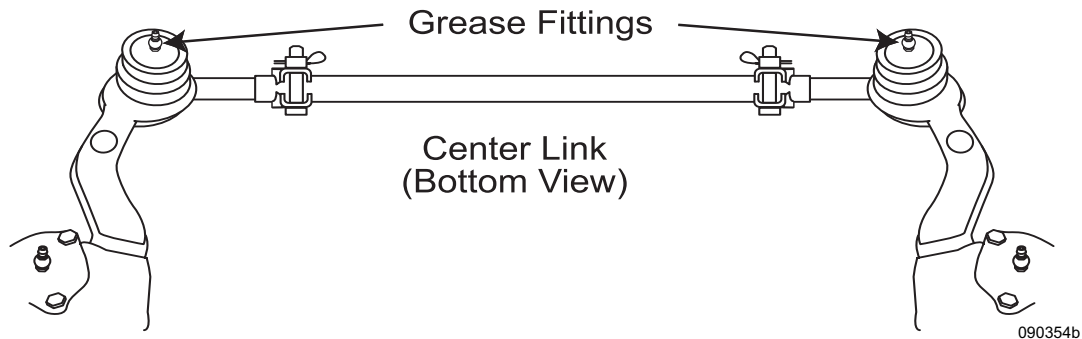
NOTE:

It will be necessary to start the motorhome and turn the steering wheel to access fitting(s).



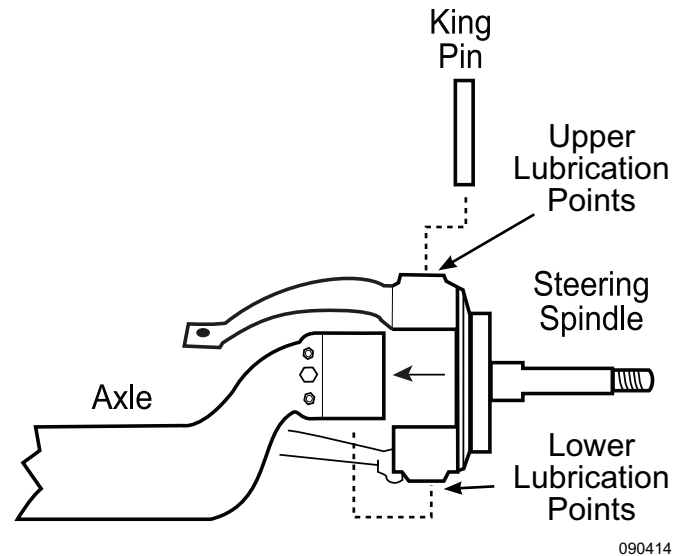
Center Link

The center link is located on the backside of the steer axle. The center link attaches the two wheels together causing the right front to track with the left front. Greasing interval is every six months or 5,000 miles.



Steering Spindles

The steering spindles attach to the front axle and pivot on the kingpin. The wheel end assembly and brake system attach to the spindle. There are upper and lower lubrication points for the kingpin. The drag link attaches to the roadside spindle. After initially lubricating the roadside and curbside kingpins, rotate the steering assembly lock to lock (full left to right) then move assembly back to center. This purges remaining air pockets. Continue lubricating the kingpins until new grease purges with no air pockets. Greasing interval is every six months or 5,000 miles.



Control Arm Bushings

Control arms align the axles perpendicular with the frame. The panhard bar controls side to side motion of the axles in the frame. Control arm bushings and panhard bar bushings do not require lubrication.

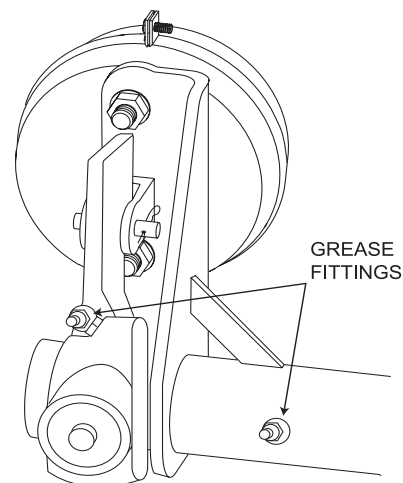
Steering Gear

The M-100 series Sheppard steering gear requires no maintenance. Using hydraulic pressure to assist rotating the output shaft of the steering gear provides power steering. Located at the end of the input shaft of the steering gear is a poppet valve and worm drive. The poppet valve directs the hydraulic fluid pressure to a type of spool. There are worm drive threads in the center of the spool. When in the center position, pressurized hydraulic fluid bypasses the spool. When a turn is made, the poppet valve shifts to one direction or the other, directing the hydraulic pressure to one side of the spool depending on turning direction. The hydraulic fluid is then cooled before returning to the reservoir. Inspect for signs of leakage when performing fluid level checks. Changing the hydraulic filter at regular intervals will help ensure trouble free operation.

Front Brakes

The slack adjuster and camshaft need to be lubed periodically to ensure proper brake operation. Lubricate every **10,000 miles** or **three months**.

*Typical Air Drum Brakes:
Lubricate until new grease
appears at exit points.*



DRIVE AXLE & DRIVE SHAFT

Drive Axle:

The chassis drive axle is a single reduction axle. The differential gears consist of a hypoid pinion and ring gear set and bevel differential gears. The differential carrier can be removed from the axle housing as a unit in order to perform repairs.

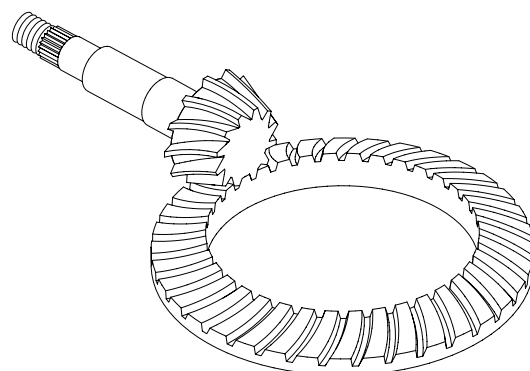
All power from the engine to the rear tires is transferred through the rear axle. For this reason, it is important that maintenance be performed on the axle as required to avoid premature wear of the gears and bearings in the axle.

Drive Axle Lubricant:

The rear axle is filled with synthetic gear oil meeting MIL-L-2105D specifications. Change interval is every 250,000 miles, or 36 months, whichever occurs first.

During lubricant change, fine metal particles will be observed clinging to the magnetic fill and drain plugs of the axle. These particles are normal wear particles from the axle components, but will cause faster than normal wear of the axle components if allowed to circulate through the lubricant. It is recommended that the magnetic plugs be tested, if not replaced, at each lubricant change. These plugs should have sufficient magnetic strength to pick up a 1.5 pound weight of low carbon steel. Never replace a magnetic plug with a non-magnetic "pipe plug" as they will not keep the lubricant clear of metal particles or seal properly.

The level of lubricant in the rear axle should be checked every 30,000 miles or annually, whichever comes first. This will ensure adequate lubricant in the axle for proper operation.



Ring and Pinion Gears

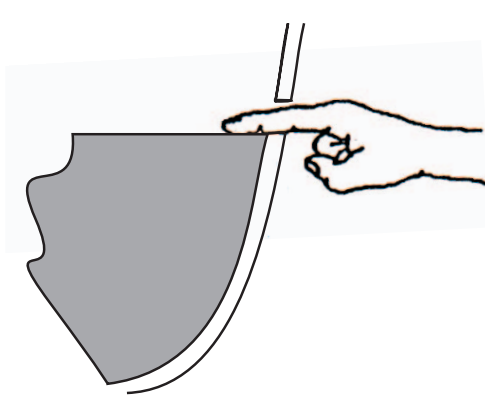
Proper Drive Axle Lubricant Level:

Regular inspection of the drive axle lube levels is an essential maintenance procedure.

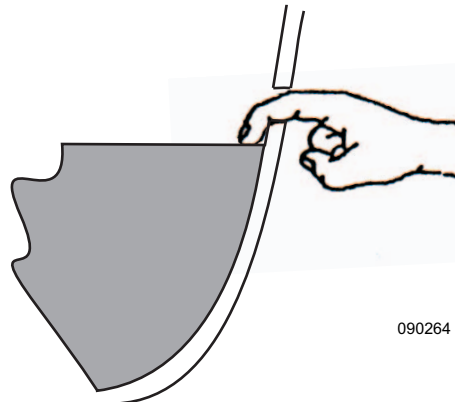
- With the motorhome parked on a level surface and rear axle warm, place a large container under axle.
- Clean the area around the fill plug, which is located approximately halfway up the axle housing bowl.
- Remove the fill plug and observe the lubricant level.
- The lubricant should be level with bottom of the hole.
- Important: The lube level close enough to the hole to be seen or touched is not sufficient. The lube must be level with the hole.
- Correct the level as necessary.
- Re-install the fill plug and tighten to 35 to 50 ft. lbs.

NOTE:

While checking the lube level, also check the housing breathers. Clean the breathers if dirty or replace them if damaged.



Correct Oil Level

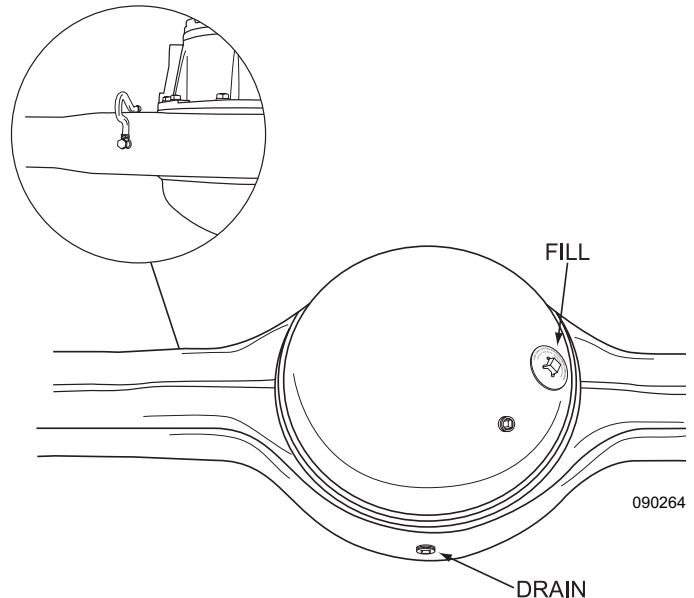


Incorrect Oil Level

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To Drain and Replace Lubricant:

1. Place a large container under the axle.
2. Remove drain plug and allow axle to completely drain.
3. Properly dispose of oil.
4. Clean the drain plug and test (replace the drain plug if needed).
5. Install and tighten drain plug to 35 to 50 ft. lbs.
6. Clean the area around the fill plug from the axle-housing bowl.
7. Fill the axle with approved lubricant until the level is even with the bottom of the fill plug hole.



090264

WARNING:

When checking or changing the lubricant, always ensure that the axle is not hot. Oil temperature 90° F or hotter can easily cause severe burns.

Drive Shaft:

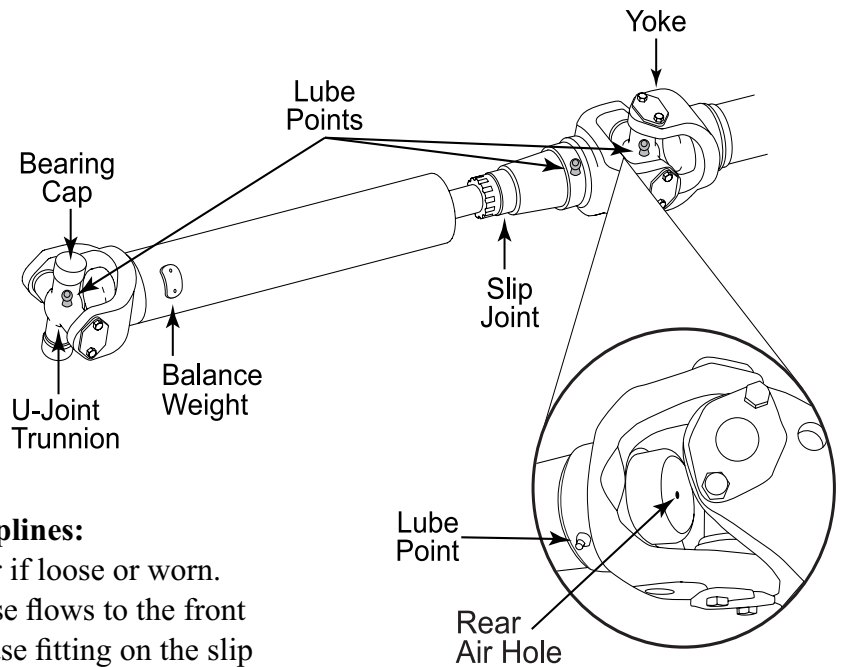
The drive shaft transfers the power produced by the engine to the drive axle. A worn or out of balance driveline causes chassis vibration that generally increases in intensity with road speed.

NOTE:

It will be necessary to move the motorhome forward or backward to access all fittings on the drive shaft.

Greasing the Drive Shaft Universal Joints:

1. Check the drive shaft for looseness.
Repair if loose or worn.
2. Apply the specified grease at the grease fitting on the universal joint.
Apply until new grease purges from all the seals.
3. If new grease does not purge at the seals, loosen the bearing cap bolts and re-grease until all four caps purge. If new grease still does not purge, disassemble and clean or replace the universal joint.



Greasing the Drive Shaft Slip Yoke and Splines:

1. Check the drive shaft for looseness. Repair if loose or worn.
2. With finger, cover the rear air hole so grease flows to the front seal. Apply the specified grease at the grease fitting on the slip yoke. Apply until new grease purges and forces finger away from the air hole in the end of the slip yoke. Greasing interval is 5,000 miles or every six months.

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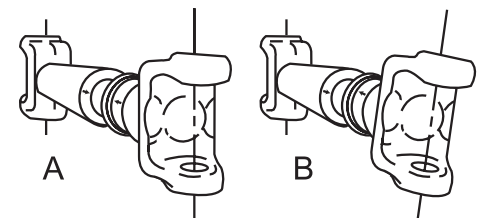
WARNING:

Rotating shafts can be dangerous. Rotating shafts can snag clothes, skin, hair, hands, etc. causing serious injury or death. Do not work on or near a shaft "with or without a guard" when the engine is running.

U-Joint Angles, Phasing & Drive Shaft Balance

Correct U-joint working angles, U-joint phasing, and drive shaft balance is vital to maintaining a quiet-running drivetrain and long life of drivetrain components (including drive shaft components).

When in phase, the slip yoke lugs (ears) and tube yoke lugs (ears) are in line. Normally this is the ideal condition and gives the smoothest running shaft. There may be an alignment arrow stamped on the slip yoke and on the tube shaft to assure proper phasing when assembling these components. If there are no alignment marks, they should be added before disassembly of the shaft to assure proper reassembly.



A. In Phase

B. Out of Phase

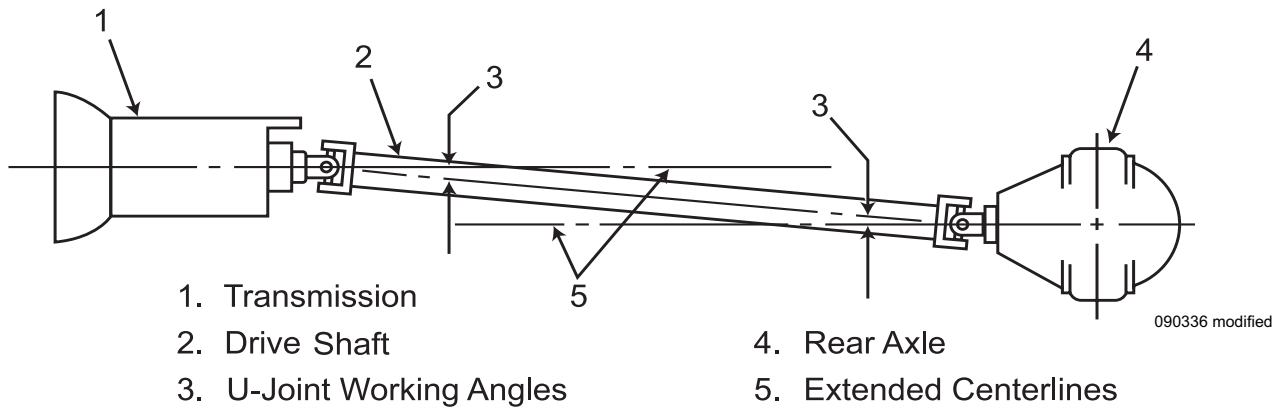
090337

Phasing is relatively simple on a two-joint set, be sure that the slip yoke lugs and the tube yoke lugs are in line.

The U-Joint working angle is the angle formed by the intersection of the drive shaft centerline and the extended centerline of the shaft of any component to which the U-joint connects. Because the double oscillating motion of a U-joint that connects angled shafts causes a fluctuating speed difference between the shafts, the effect created by the U-joint at one end of the shaft must cancel the effect created by the U-joint at the other end. This is done by making U-joint working angles at both ends of the drive shaft approximately equal, with the U-joints in phase. If the yoke lugs at both ends of the shaft are lying in the same plane (a plane which bi-sects the shaft lengthwise), the U-joints will be in phase.

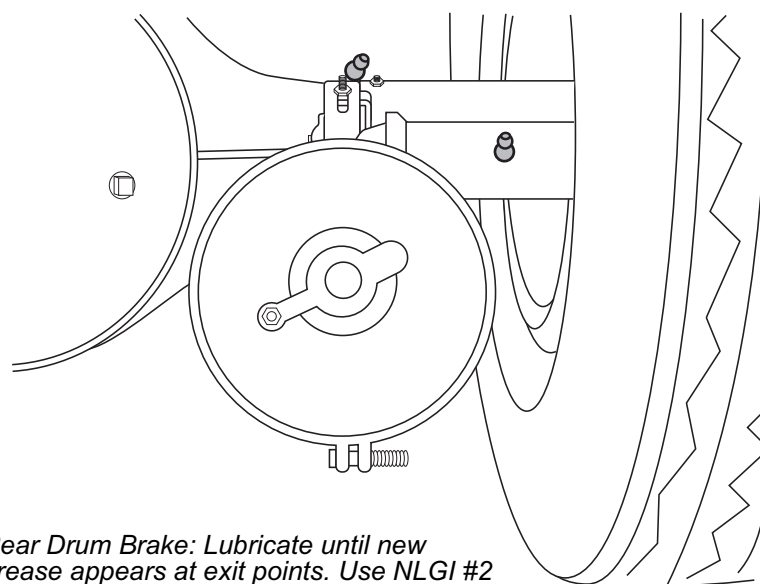
Any condition which allows excessive movement of a drive shaft will cause imbalance: loose end yoke nuts, loose U-joint bearing cap retaining capscrews, worn U-joint trunnions, bearings and worn slip-joint splines.

Among the most common causes of U-joint and slip joint damage is lack of lubrication. To keep the motorhome operating smoothly and economically, the drive shaft must be carefully checked and lubricated at regular intervals.



Lubrication Maintenance

The slack adjuster and camshaft need to be lubricated periodically to ensure proper brake operation. Lubricate every 10,000 miles or **three months**.



090350c

SHOCK ABSORBER

The shock absorber is a hydraulic device used to dampen suspension/body movement. Road surface irregularities are compensated for by the shock absorber. The roadmaster chassis incorporates the “Monroe” shock in the design of the air suspension system or the Koni shocks with the optional deluxe suspension system. This shock absorber is a telescopic, mono tube unit filled with nitrogen gas and hydraulic oil. The result of the mixture is uninterrupted damping for the smallest of wheel deflection.

By design, a self lubricating seal is used which will allow approximately 10% of the total oil capacity to pass onto the piston rod. The gradual process of oil loss does not affect the performance of the shock absorber during the service life. This process will be evident after a long period of service by an oil film on the body of the shock absorber. The appearance of a coating or film on the body or rod is completely normal, it is an indication the shock is functioning normally.

Road holding, handling, balance and braking characteristics all can be contributed to the shock absorber. The operating conditions for which the shock absorber must endure will determine the life span. However, since the only moving part is the piston rod, there are no springs, hinges or pins to wear out, get weak or deteriorate.



090315

LEVELING SYSTEM

A remote control panel located next to the pilot’s seat operates the three-point, fully automatic, electro-hydraulic leveling system. The warning system consists of a **Jacks Down** light and an alarm that sounds when any jack is extended and the transmission is shifted out of **Park** or the parking brake is released. The leveling system pump is located in the roadside generator compartment. A 15 Amp system fuse is located in the front distribution box.

CAUTION:

The hydraulic jack system is designed to reduce sight selection problems and stabilize the motorhome when parked. No single jack should be used solely to level the motorhome. Using an improper leveling process can result in applying excess torsion stress/twist to the chassis, frame and body, resulting in damage to the windshield and/or entry door malfunction. The leveling jacks are not designed for changing tires. This can cause problems with the suspension system, frame alignment and damage to the windshields. Never use the jacks to elevate any wheel position off the ground.

CAUTION:

Before leveling the motorhome, survey the area around and under the motorhome to ensure potential jack contact points are clear of obstructions and depressions.

CAUTION:

Hot asphalt, gravel or dirt may not support the weight that is placed on the hydraulic jack pads. Place thick plywood under the jack pads to help disperse the weight. If blocking up a rear jack pad to gain added clearance when the motorhome is on a slope, place a wheel chock at the opposite set of rear wheels to prevent the motorhome from rolling.

WARNING:

Never access the underside of the motorhome when jacks are operating. Serious personal injury may occur.

Leveling System Safety Features:

The leveling system has safety features to prevent a jack from extending during travel. The control panel will not activate until these safety features are in place.

- The ignition switch is in the **ON** or **ACC** position.
- The transmission is in **NEUTRAL**.
- The parking brake is applied.

Warning Features Include:

- Flashing lights on the control panel and an alarm that sounds when a jack is down and the parking brake is released or the transmission is shifted out of Park.
- The alarm may activate momentarily when driving over rough roads, or negotiating curves and corners. This usually indicates a low fluid level in the reservoir.

WARNING:

Keep all people clear of the motorhome during the leveling procedure. Never expose hands or other parts of the body near hydraulic leaks. Hydraulic lines are under high pressure. Oil leaks may cut and penetrate the skin causing serious injury.

Automatic Leveling Procedure:

- Select a level site if possible. Excessive slopes may prevent the jacks from leveling the motorhome.
- Place the gear selector in Park.
- Apply the parking brake.
- Turn the ignition switch to the **ON** or **ACC** position. Do not start the engine.
- Press the **ON/OFF** button on the control panel. The **ON/OFF** LED will illuminate when the system is operational.
- Push the **AUTO** button to begin leveling.

NOTE:

While automatic leveling is engaged, do not allow people or pets to move around in the motorhome until the green Power Gear level light illuminates. Movement may prevent system from functioning properly.

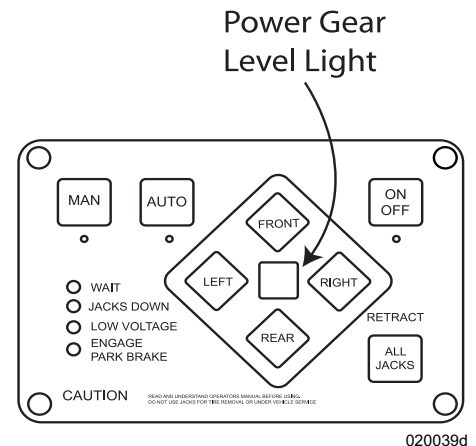
- When the motorhome is level, the green Power Gear level light will illuminate.
- To make further adjustments, push and hold the manual (**MAN**) button for approximately five seconds until it illuminates. Push the appropriate jack button to adjust motorhome to preference.
- Push the **ON/OFF** button to turn system off.

CAUTION:

Never lift the wheels off the ground when leveling motorhome.

CAUTION:

DO NOT move the motorhome while jacks are in contact with the ground or extended. Damage to the jacks may occur.



Jack Retract Procedure:

- Turn coach ignition switch to **ON** or **ACC**.
- Push the **ON/OFF** button on control pad. The **ON/OFF** light and **JACKS DOWN** light will illuminate.
- Push and release the **RETRACT ALL JACKS** button. All jacks will automatically return to fully retracted position.
- After the **JACKS DOWN** light goes out, push the **ON/OFF** button to turn system off.

NOTE:

Always perform a visual inspection of leveling jacks to make sure they are fully retracted prior to moving the motorhome.

If the jacks fail to extend or retract:

- Apply the park brake, turn the ignition to the **ON** or **ACC** position and place the transmission in Park.
- If jacks still do not operate, check the leveling system fuse in the front distribution box. Also check the automatic leveling control module located in the top of the curbside storage bay. Ensure all connections are tight.

NOTE:

The hydraulic pump is equipped with an internal thermal breaker for protection against overheating. If the pump is used repeatedly in a short period of time the breaker will trip. It resets automatically in 5 to 30 minutes.

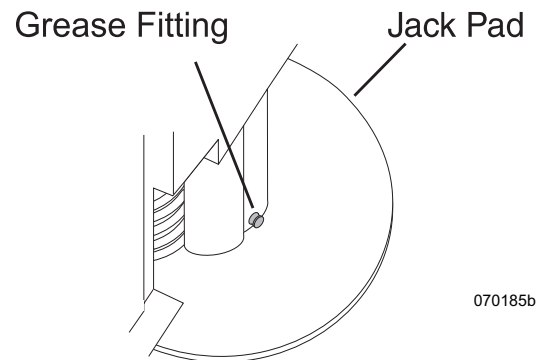
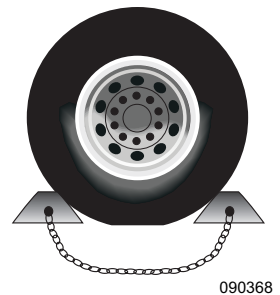
Drive-away Protection:

When the ignition switch is set to the **RUN** position with the jacks extended, the **JACKS DOWN** indicator will light and the warning bell will activate if the transmission is taken out of park or the park brake is released. The system will then automatically retract all jacks until jacks are fully retracted or the park brake is reset and the transmission is placed in Park. A full visual inspection is required to confirm full retraction of jacks before moving motorhome.

Maintenance:

Occasionally, while the jacks are fully extended, use *Dexron III*[®] to wipe and clean the jack rod. This will serve as a solvent as well as a lubricant and will help prevent moisture damage to surface of the jack rod. Occasional oil or grease on the extended jack rod is normal and aids in the lubrication of the rod.

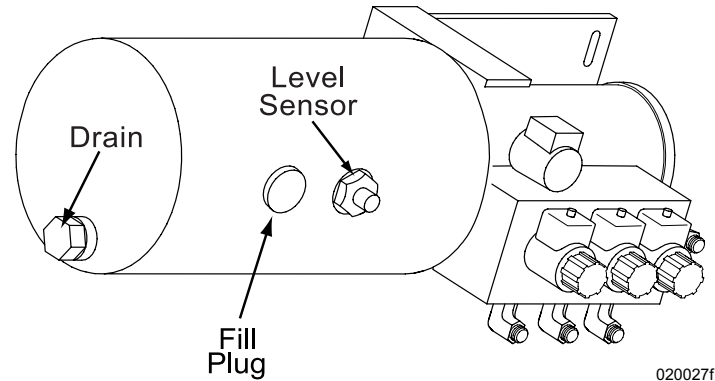
- Remove dirt and road debris from the jacks as needed.
- Check the fluid level every month. The fluid level should be within ¼" of fill port lip and checked with all jacks retracted.
- Inspect and clean all hydraulic pump electrical connections every 12 months.
- For jacks equipped with a grease fitting at the bottom of the cylinder, two pumps of grease should be sufficient for 20 to 30 uses. **DO NOT** over grease. Damage to the rod seal will occur with over greasing.



Adding Fluid:

When the leveling system makes unusual noise during jack operation, it may indicate a low fluid level. If the system alarm sounds when driving around corners or over bumpy roads, this usually indicates low fluid level.

1. Chock a wheel fore and aft for safety.
2. Ensure all jacks are retracted.
3. Unscrew the reservoir cap from the top of the pump. Slowly fill the reservoir with *Dexron III*[®] automatic transmission fluid until ¼" from the fill plug.
4. Replace the reservoir cap. The reservoir is now at the proper level.



ENGINE GENERAL INFORMATION

The diesel engine operates differently from the conventional gasoline engine. Gasoline engines control engine speed using a butterfly throttle plate controlling air/fuel mixture inlet flow. As the throttle plate opens, vacuum created by the piston velocity draws the metered fuel/air charge into the combustion chamber, then ignites from a controlled electric ignition source. Closing the throttle plate limits the fuel/air supply, slowing engine speed, increasing intake manifold vacuum.

The diesel engine in the motorhome controls engine speed by varying fuel supply only. No throttle plates are used. An exhaust driven turbine system (turbocharger) compresses the fresh air supply into the engine. The fuel is injected under pressure into the combustion chamber. Ignition of fuel/air charge occurs from heat generated by rapid high compression. The turbo boost gauge registers amount of intake manifold pressure measured in lbs./in². Therefore, no intake manifold vacuum exists.

Diesel engine RPM (revolutions per minute) operating speeds are generally much lower than that of the gasoline engine. Peak torque and horsepower output values occur at much lower engine speeds. Idle speeds between the two engine types are similar, however maximum engine speeds are quite different. The gasoline engine generally is not regulated to a maximum engine speed. The maximum engine speed on a diesel engine is controlled by an engine speed governor set by the engine manufacturer.

WARNING:

Do not operate a diesel engine where there are or can be combustible vapors. Vapors can be drawn through the air intake system and cause engine acceleration and over-speeding, resulting in fire, explosion and extensive property damage. Numerous safety devices are available, such as air intake shutoff devices, to minimize risk of an engine over-speeding where an engine (due to its application) might operate in a combustible environment, such as fuel spills or gas leaks.

NOTE:

The engine dataplate, located on the curbside front of the engine block, shows specific facts about the Cummins engine.

INFORMATION:

The equipment owner and operator is responsible for safe operation of engine. Consult your engine manufacturers owners manual or authorized repair location for more information.

The Cummins diesel engine is a 6-cylinder, in-line engine. An electronic fuel control system supplies fuel to the cylinders. This allows for precise fuel delivery, resulting in efficient operation, as well as built-in diagnostics to monitor engine operation.

The engine electronics also enable the use of programmable monitoring features that may cause limited engine power/vehicle speed when certain conditions arise. These features limit the operation of the engine when conditions that may damage the engine are encountered. These conditions may include such events as low oil pressure and high coolant temperature.

When the engine electronics encounter such a condition, it limits the amount of power produced by the engine to help prevent or limit damage.

It is possible however, for the engine to be damaged when corrective action is not taken immediately in such conditions. Operation of the engine while in the limited operation mode may result in serious engine damage. If a sudden loss of power is noticed in conjunction with the engine warning lights illuminating (**STOP ENGINE**, **CHECK ENGINE** or **WARNING**), pull off the road as soon as it is safely possible and evaluate the situation.

INFORMATION:

Refer to the OEM for additional information concerning the operation, description, maintenance, and warranty information for the engine.

Diagnostic Fault Codes

The engine ECM will record three types of fault codes; Electronic Control System Faults, Protection System Faults and Maintenance Indicators. All faults recorded will be ACTIVE or INACTIVE. Not all faults will light an indicator when they are ACTIVE.

Illuminated Lamps:

WARNING - Indicates a failure has occurred, but the motorhome can be operated without progressive damage. The motorhome should be serviced to diagnose the failure and repaired at the first opportunity. The indication is not considered an emergency.

Solid red STOP ENGINE - Indicates a major failure has occurred that can result in progressive damage or affect safe operation of the motorhome. The motorhome should be shut down as soon as safely possible and remain shut down until the fault can be repaired.

Flashing red STOP ENGINE - Indicates the engine control system has started the shut down sequence. The shut down timer will give the operator 30 seconds to find a safe stopping point.

CHECK ENGINE - Indicates the engine requires maintenance or fluids. The motorhome should be serviced to correct the problem. If ignored, some maintenance conditions can cause improper engine operation and even progressive damage.

To Retrieve Active Fault Codes:

1. Turn the ignition key OFF.
2. Turn the ignition key ON and immediately apply three full throttle applications.
3. Observe Check Engine and Stop Engine lamps.
 - a. If no active codes are recorded, both lamps will remain illuminated.
 - b. If an active code is recorded, both lamps will momentarily illuminate and flash the fault.
 - c. When codes are retrieved, turn OFF the ignition switch.

The fault code will flash in the following sequence:

- The yellow Check Engine lamp will flash.
- There will be a short one to two second pause.
- The fault code will flash on the red Stop Engine lamp.
- There will be a short one to two second pause between each number.
- When the number has finished flashing in Stop Engine, the Check Engine lamp will appear again. The fault code will repeat the sequence.

Each fault code will flash twice before advancing to the next code.

STARTING PROCEDURE

Normal Starting

When starting the engine, always use the following procedure.

1. Turn off the vehicle headlights and any other auxiliary equipment prior to starting to ensure that all available battery power is available for the starter motor.
2. Ensure that the park brake is applied and that the transmission is in **NEUTRAL**.
3. Turn the ignition switch to the **ON** position.
4. Observe the dash warning lights. The **CHECK ENGINE** and **CHECK TRANS** lights should illuminate and then cycle off. If any of the warning lights fail to come on, investigate and correct the cause of the problem. If the **CHECK ENGINE** light remains on, or re-illuminate after starting, the engine ECM may have detected an engine systems fault. Refer to the diagnostics section of the OEM Engine Manual for corrective action. If the **CHECK TRANS** fails to illuminate, or remains on after starting, refer to the Transmission Operator's Manual for corrective action.
5. The **WAIT TO START** light should illuminate and then go out.
6. Pressing or holding the throttle down is not needed. Turn the ignition switch to the **START** position and crank the engine. The electronic controls on the engine will automatically deliver the correct amount of fuel for the engine to start.
7. Release the ignition switch to the **ON** position immediately after the engine starts.
8. Allow the engine to idle with no load for three to five minutes. Observe all gauges and warning lights during warm-up.

NOTE:

To avoid starter motor damage, do not crank the engine for more than 15 seconds at one time. If the engine fails to start, wait two minutes before attempting to start the engine again.

NOTE:

Oil pressure should be indicated within 15 seconds after the engine has started. Do not increase engine speed until the oil pressure gauge indicates normal. If no oil pressure is indicated within 15 seconds, stop the engine. Do not attempt to operate. The engine will need to be inspected and repaired prior to re-start.

If the engine fails to start, follow procedures for ***“Engine Will Not Start - Troubleshooting”*** in **Section 9**.

WARNING:

Never attempt to start the engine by “jumping” relays or any means other than using the ignition start switch or the remote start switch. Do not attempt to start the engine unless all persons are clear of the engine before starting.

Cold Weather

In sub-freezing or extreme cold, engine oil becomes thick and battery output is reduced. Thick oil, combined with less amperage available from the battery, increases difficulty in starting the engine. It is possible to operate diesel engines in extremely cold environments when the engine is properly equipped with the correct lubricants, fuels and coolant.

The engine electronic system is equipped with cold start strategy referred to as cold mode. Cold mode limits the power until coolant temperatures reaches 82° F. The engine in cold mode will idle at 800 RPM until the throttle or service brake is pressed. The engine will then drop to the programmed low idle speed.

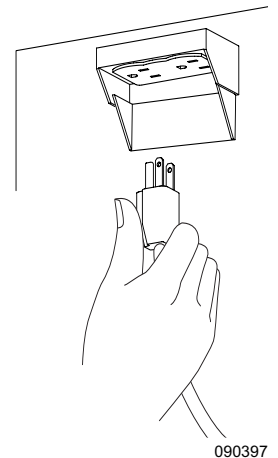
NOTE:

Power will be noticeably reduced if the motorhome is operated while in cold mode.

It may be necessary to pre-heat the engine due to ambient temperature. If it is necessary to pre-heat the engine, it is recommended to use the block heater outlet in the engine compartment. The block heater will heat engine coolant and the interior. An indication of 100° F or higher of the engine temperature gauge is sufficient for the engine to start.

Engine Block Heater:

The block heater cord is located in the rear (exterior) engine compartment. The cord may be plugged into the outlet directly above the radiator. The block heater requires 120 Volt AC to operate. Hook to shore power, as this is more efficient. The generator may be difficult to start and it may take some time to pre-heat the engine. The block heater, depending on engine size, is rated between 1000 and 1500 watts. The block heater cord may be connected to a separate power cord as long as the power cord is rated for 1500 watts and the outlet used must have a GFCI protected rate of 20 Amps. The engine may require several hours of pre-heating before it will start. It is recommended to start pre-heating the engine the night before departure. Remember to unplug the separate power cord.



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NOTE:

The inverter should never be used for the power source. Rapid battery drain and inverter shut down will occur.

Tips:

1. When operating below 32° F, the block heater enhances engine cold-start strategy by easing cranking and helping to prevent engine misfire and white smoke during starting.
2. Always follow recommended oil, fuel, and coolant specifications as outlined in the OEM Engine Manual. Proper oil viscosity and coolant concentration eases engine starting and helps to avoid engine damage.
3. Allow the engine to idle until sufficiently warmed for operation. Utilize the **fast idle** feature to quicken the process. Wait to operate the motorhome for at least three minutes or until the coolant temperature begins to move.
4. Check the air inlet and filter daily, or as necessary, when driving in snow conditions.
5. Demand on batteries increase during winter; check and service the batteries frequently to help ensure trouble-free starts.
6. Start out slowly to allow the transmission and axle lubricants time to circulate and warm before putting them under full load.

WARNING:

Do not use ether cold starting aids to start the engine as damage may occur.

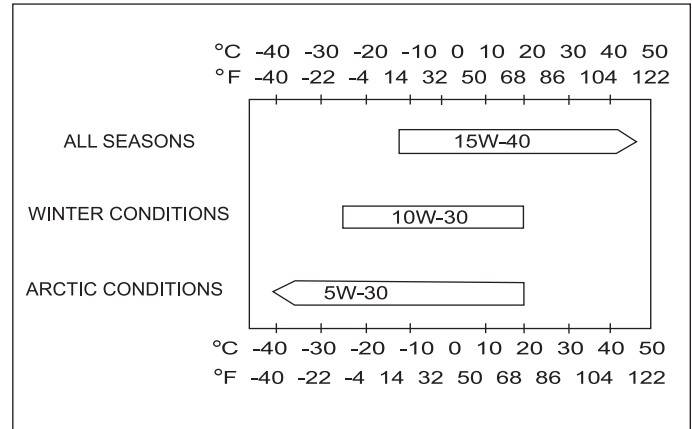
ENGINE OIL

Cummins Engine Requirements:

The maintenance guidelines in the Cummins Operation & Maintenance Manual are the recommendations for the engine to extend the engine life and improve performance, resulting in cost efficient operations. A good maintenance schedule begins with a daily awareness of the engine and its various systems.

A high grade 15W-40 multi-viscosity heavy duty lubricating oil meeting Cummins Engineering Specification CES 20071 or CES 20076, American Petroleum Institute (API) specification CH-4 which can be used as an alternative to CES 20071 is recommended. Lubricating oils meeting API CG-4 specifications may be used at a reduced drain interval. The engine uses Pennzoil 15W-40 heavy duty engine lubricating oil that meets Cummins specifications. A critical factor in maintaining engine performance and durability is the use of high grade multigrade lubricating oil and strict adherence to the maintenance service intervals.

LUBRICATING OIL RECOMMENDATIONS AND SPECIFICATIONS



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A straight weight or monograde lubricating oil is not recommended. Shortened drain intervals may be required as determined by a close monitoring of the lubricating oil condition by means of an oil sampling program. The use of oil analysis to extend drain interval is not recommended. There are numerous variables which is the basis of the recommendation.

Synthetic oils API category III specifications are recommended for extreme cold temperatures only. Low viscosity oils used for winter operations will aid in starting. Synthetic oils, or oil with adequate low temperature properties used for Arctic operations where the engine cannot be kept warm when shut down, will aid in starting. The use of synthetic oils should not be used to extend drain intervals. Extended oil change intervals can decrease engine life and possibly affect the engine warranty.

Oil additives should not be used unless the oil supplier or oil manufacturer has been consulted and provided positive evidence or data establishing satisfactory performance in the engine.

NOTE:

The engine does not require a “break-in” procedure.

INFORMATION:

Refer to the Engine Manufacturers Owners Manual for details on the oil maintenance schedule.

ENGINE SHUTDOWN

General guidelines for shutting the engine down are fairly simplistic. Allow the engine to idle three to five minutes after a full load operation to allow adequate cool down of pistons, cylinders, bearings and turbocharger components. Under normal driving conditions, exiting the highway is generally lighter engine operation and the need for the three to five minutes is not necessary.

Extended Engine Shutdown

When the motorhome has been sitting for extended periods, 30 days or more, verify all the fluid levels are correct. Follow the normal starting procedures. If the oil pressure gauge does not register within 15 seconds, shut off the engine immediately to avoid damage. Consult the engine manufacturer owner's manual for guidelines on troubleshooting low oil pressure, or contact a qualified service technician. Allow the engine to idle for five minutes before operating under a load.

COOLANT SYSTEM

The cooling system consists of a radiator mounted at the rear side of the motorhome, cooling fan, transmission cooler, and a charge air cooler. Steel tubes and radiator hoses allow engine coolant to flow between the radiator and the engine. The fan draws air from the outside of the motorhome, through the radiator and into the engine compartment. These components working together ensure that all the chassis systems maintain proper operating temperatures. A problem with one component may cause problems with an entirely different system.

After the engine reaches proper temperature, the water regulator (thermostat) on the engine opens and allows coolant to flow from the engine, through the upper radiator hose and into the radiator. The coolant is cooled in the radiator and flows through the transmission cooler and back to the engine through the lower radiator tube. A bypass tube installed between the thermostat housing and lower radiator tube functions to supply coolant to the transmission cooler under certain conditions to ensure proper cooling.

The charge air cooler cools intake air for the engine after it has passed through the turbocharger. This is necessary due to the heat generated as the intake air is pressurized, and subsequently heated. With the components working together to maintain the engine and transmission at the proper temperature, proper maintenance of the cooling system is very important. One neglected component could result in cooling problems.

Maintenance of the cooling system includes maintaining proper coolant levels with coolant mixture, regular inspection of system components, flushing the coolant system with approved cleaners and ensuring that the exterior of the radiator and other external coolers are kept clean of debris.

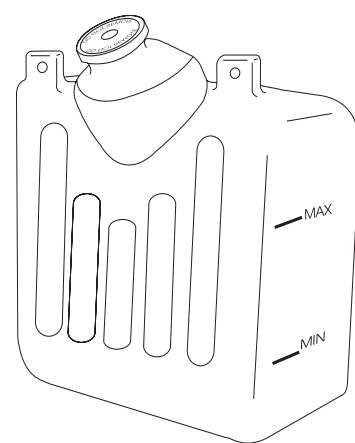
The engine coolant level should be checked daily to ensure that it is at the proper level. At the rear of the motorhome is a plastic translucent surge tank. Under certain lighting conditions it may be difficult to see the level of the coolant in the surge tank and a flashlight held behind the surge tank should enable easier viewing.

Engine Coolant Reservoir:

The engine coolant reservoir is connected to the radiator by a hose. When the motorhome is driven, coolant heats and expands. Expansion-displaced fluid flows from the radiator into the reservoir tank. The coolant cools and contracts when the engine is stopped, and coolant is drawn back in the radiator by a vacuum. Thus, the radiator is kept filled with coolant to the desired level at all times, resulting in increased cooling efficiency. The coolant level should be at, or slightly above, the appropriate mark on the reservoir tank when the system is cold.

CAUTION:

To avoid scalding hot steam or coolant from being released from the engine cooling system, never remove the reservoir cap while the engine is running or hot. Failure to follow this warning may result in damage to the engine's cooling system and possibly cause severe personal injury.



Coolant Levels:

- Check the coolant level daily or when refueling.
- If the coolant is below the **MIN** mark, the low coolant alarm will sound and the low coolant light will appear on the dash.
- The coolant level should remain between the **MAX** and **MIN** level in the reservoir.

INSPECTION:

Stop the motorhome and inspect the coolant level before continued operation.

INFORMATION:

Refer to the Engine Manufacturer Owner's Manual for details on engine coolant maintenance.

NOTE:

Have an inspection performed of the surge tank cap seal and have the cap pressure tested at each oil change. The reservoir cap is rated at 16 psi.

Coolant Types:

- Coolant must meet ASTM 04985 (6M6038M) specifications.

INFORMATION:

Refer to OEM manual for detailed antifreeze information.

Adding Coolant:

If the addition of coolant is necessary, remove the cap from the surge tank and add the proper mixture of coolant to the system until it reaches the proper level. If coolant is lost from the engine, it is required to open the petcock at the top-left of the radiator (NOT the drain petcock at the bottom of the radiator) when adding coolant.

Adding straight water or antifreeze to the system creates an imbalance of the coolant mixture. While adding small amounts occasionally may not affect the mixture greatly, large amounts (½ gallon) or frequent “top-offs” will.

Glycol antifreeze, usually in the form of ethylene glycol or propylene glycol, provides an increased boiling point of the coolant mixture, increased freeze protection, and helps prevent water pump cavitation (air bubbles in the coolant mixture that can result in wear of the engine). While the ratio of water and glycol can be adjusted to meet differing anti-boil and freeze protection, it is recommended that a mixture of 50% water and 50% glycol be used. This 50/50 mixture provides freeze protection to -34°. The water in the coolant system serves as a base. It is critical to use as pure of water as possible. Salts and other minerals in the water can solidify in the cooling system causing scaling and clogging of the radiator.

Coolant System Maintenance

Inspect other components of the cooling system when performing maintenance. Have an inspection performed of the surge tank cap seal and have the cap pressure tested at each oil change. The charge air cooler and radiator also require inspection for cracks, broken welds, secure mounting, and general cleanliness.

It may be necessary to clean the radiator and external coolers more often under certain conditions. Road debris and other contaminants can block the radiator and cooler fins resulting in reduced cooling system performance. Blockage can vary depending on road, climate, and regional conditions. Check the radiator and external coolers weekly for blockage, and clean as required.

Compressed air is recommended to clean the radiator and external coolers. In the event that road grime, oil, or inadequate cleaning with compressed air is encountered, a high pressure washer and degreaser may be used with caution to avoid excess pressure that can bend the radiator fins.

Refer to the OEM manual for detailed maintenance and service procedures. These services include: draining the engine coolant, flushing/cleaning the cooling system, inspecting the water pump standpipe, replacing the thermostat, gasket and seal, and replacing the coolant and SCA element.

Coolant Hoses:

Rotten, swollen and worn hoses, as well as loose connections, are frequent causes of coolant system problems. Overheating can be caused by a collapsed hose or a clog caused by rubber shedding from a rotten hose. Replace any hose found to be cracked, swollen or damaged. Connections should be inspected periodically and hose clamps tightened.

INSPECTION:

Check all hoses, clamps, and fittings for leaks due to cracking, softness, and loose clamps/fittings. Look for signs of fluid leaks, damaged end fittings, ballooning, chafed, kinked, or crushed hoses, and loose clamps and fittings. Correct any deficiencies found.

Coolant Overheated:

If the engine is overheated, never pour cold coolant into a hot engine. The sudden change in temperature may crack the cylinder head or block. If the engine is hot, fill slowly to prevent rapid cooling and distortion of engine castings.

INSPECTION:

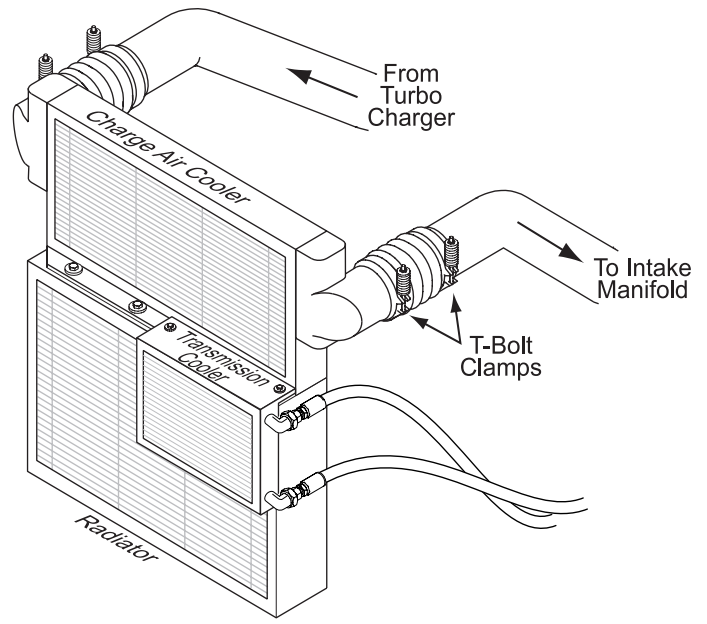
Inspect the radiator core and CAC for dirt and debris build-up. Wash any accumulations using high-pressure water, being careful not to damage the fins from excessive pressure. Grease or oil build-up should be treated first with a non-caustic degreaser to ensure a thorough cleaning.

Coolant System - Thawing:

If the coolant system becomes frozen, the motorhome must be towed. Place the motorhome in a warm area until completely thawed. If the engine is operated when the cooling system is frozen it will result in engine overheating due to insufficient coolant circulation. Once thawed, check engine, radiator and related components for damage caused by expansion of frozen coolant.

CHARGE AIR COOLER

The diesel engine uses compression to ignite the fuel/air charge. To increase compression inside the combustion chamber (resulting in increased power output) a turbocharger is added to the engine. The turbocharger is a paired housing assembly with impellers inside each housing connected by a common shaft. One impeller is propelled by the engine exhaust, which drives the other impeller. The function of the other impeller is to increase compression inside the combustion chamber by forcing air into the intake manifold. This process works well, however, the intake air charge is heated two different ways. Through convection by the exhaust gases driving the turbocharger and any time air is compressed heat is produced. This has a negative effect inside the combustion chamber resulting in lost power potential. Therefore, a Charge Air Cooler (CAC) is installed to cool the intake air before it enters the engine.



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The CAC may be mounted to either the top or side of the radiator. The CAC performs the same function as a radiator, cooling air instead of liquid. Ambient air passing through the CAC will cool the engine intake air charge. After leaving the turbocharger, intake air is compressed and heated to approximately 300° to 375° F, depending on the engine load and throttle position. Before air enters the intake manifold, the CAC cools the intake air temperature to the engine manufacturer specifications. Lowered intake air temperatures reduce exhaust emissions, improve fuel economy and increase horsepower. The CAC will continually expand and contract up to ¼" as throttle increases and decreases.

Visually inspect the charge air cooler every six months for dirt and debris that may block the fins. If the motorhome develops an oil leak, there is a possibility that the oil will coat the fins of the CAC. Dust will adhere to the oil film and eventually clog the fins, greatly reducing cooling efficiency. When the oil leak is repaired, the CAC must be thoroughly cleaned.

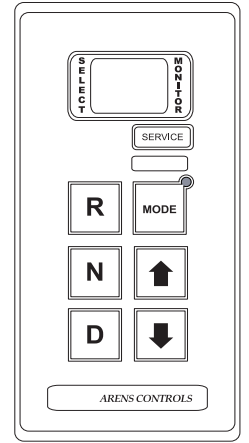
During each oil change inspect the engine side of the radiator/CAC assembly for foreign objects that may cause restriction.

Spraying degreaser on the charge air cooler, as well as using a steam cleaner, will not damage the CAC. However, pressure washer and steam cleaner nozzles placed too close to the CAC can bend the fins. The recommended cleaning procedure for the CAC and the radiator, is to use a bucket of mild soap and water. Carefully wash with a bristle brush then rinse using a garden hose, with minimum water pressure, standing back a distance to avoid bending the fins.

TRANSMISSION

The Allison MH-2500 series transmission is a fully automatic, torque-converter driven, electronically controlled transmission. The electronic controls provide automatic gear selection in all drive ranges and automatic engagement of the torque converter lockup clutch.

The electronic control system has five major components: the Transmission Control Module (TCM), engine throttle position sensor, three speed sensors, Neutral Start Back Up (NSBU) switch and the control valve module. The TCM processes information received from the throttle position sensor, speed sensor, NSBU switch and control valve module. The electronic control system optimizes shift quality by using “Adaptive Shifting.” A wide variety in shifting under varied conditions is required before optimizing the shift quality. Generally, five typical shifts of a shift type are needed for shift calibration.



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Transmission Key Pad Functions:

- Selects **Neutral** by pressing **N**. The area around the N button has a raised ridge so the driver can orient his hand to the Neutral button by touch.
- Selects **Reverse** gear by pressing **R**.
- Selects the forward **Drive** range by pressing **D**. The **SELECT** and **MONITOR** will indicate **D1**, indicating the transmission is in 1st gear. Throughout the subsequent upshifts or downshifts, the **SELECT/MONITOR** display will indicate the gear the transmission is in.
- The **upshift** and **downshift** arrow buttons are used to select a higher or lower forward range. These buttons are not functional in Neutral or Reverse. One press changes the gear selected by one range. If the **up** or **down** arrow button is held continuously, the range will continue to change up or down until the button is released or until the highest/lowest possible gear is selected.
- The **Mode** button enables Economy Mode.

Economy Mode:

Economy Mode affects the upshift schedule D-3, D-4, D-5 and downshift schedule D-5, D-4, D-3. During highway driving with the cruise control set between 55 to 65 mph, setting the transmission to Economy Mode eliminates about 99% of transmission downshifts from fifth to fourth when incurring a slight incline or overpass.

In city driving, with the transmission set to Economy Mode, the transmission will upshift approximately 200 RPM sooner using less fuel with reduced engine noise. **DO NOT** use Economy Mode while traveling in mountain terrain. The lower RPM shift schedule will reduce the flow of antifreeze, lubricating oil and airflow through the radiator resulting in increased transmission and engine temperature.

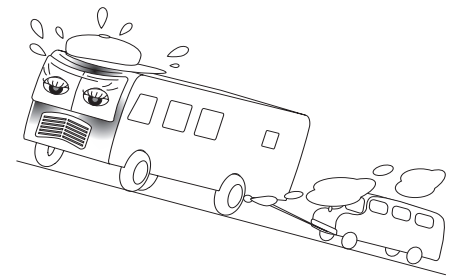
- **To Enter Economy Mode:**
Press the MODE button. The LED will illuminate.
- **To Exit Economy Mode:**
Press the MODE button. The LED will extinguish.

CAUTION:

Do not use the economy mode in heavy stop and go traffic or mountainous terrains. Frequent shifting occurs when in Economy Mode while using heavy throttle, increasing transmission fluid temperature. Exit Economy Mode until road conditions improve.

NOTE:

The display will change to a default reading of D-3 when the Auxiliary Braking device is used. This setting is pre-selected at the factory and can only be altered by an authorized Allison Service center. The transmission is not actually in third gear. This is only a reference point so the transmission will optimize engine braking efficiency.



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Service:

If the Service display is illuminated a fault may exist with the Shift-By-Wire system. A qualified service technician should inspect the system.

Flashing Display:

In the event the Display area begins to flash, the transmission has inhibited shift operations. This is an indicator that range shifts requested might not occur. Certain operating conditions when detected by the TCM will inhibit shifting to protect from damaging operations. This is in response to diagnostic trouble codes received by the transmission control system.

Shift inhibits fall within certain categories. Above-idle neutral range shifts vary from **N** (Neutral) to **R** (Reverse) or **N** (Neutral) to a forward range when the idle is in excess of 900 RPM (above-idle). Forward/Reverse directional shifts are not permitted when measurable output shaft speed is detected.

NOTE:

Sudden movements or lurching the motorhome with an open throttle can result in damage to transmission. Avoid this condition by shifting into gear only when the engine is at normal idle.

Certain unusual transmission operating conditions detected by the TCM will temporarily limit transmission operations. These conditions are transmission problems. The TCM will lock the Transmission in a safe gear range to permit the motorhome to be driven to a service location. The TCM may not respond to additional shift requests. Upshift and downshift may not occur and directional changes will not occur. Consult the Allison Operator's manual for more information.

Troubleshooting:

1. Turn ignition switch to **ON**. Do not start the engine. If the display on the Shift Selector does not illuminate, go to the following information under **Electrical Troubleshooting**. If the display illuminates, **N** should be displayed (left character will be blank)? If not, press **N** and see if the transmission shifts. If not, go to **Electrical Troubleshooting**. If it shifts, proceed to the next step.
2. Start the engine. If the engine starts, the transmission is in Neutral and the display should indicate **N** - proceed to the next step. If the above does not occur, go to the following information under **Electrical Troubleshooting**.
3. Press the **R** button for Reverse. If **RR** is displayed and the backup warning beeper sounds, the transmission is in Reverse - proceed to the next step. If not, go to the following information under **Electrical Troubleshooting**.
4. Press the **D** button for Drive. **D1** should display. If **DD** is displayed the J1939 is not working or the connector is not making contact. If **D3** is displayed, the Transmission TCM is in the "Limp Home Mode" (3rd gear). Contact Allison at 800-524-2303 for further instructions.
5. With the Transmission in Drive, perform the following checks in the order they appear on the chart:

If all ranges show up correctly, the Shift-by-Wire System is functioning normally. Proceed with Transmission Diagnosis per Allison Troubleshooting Procedures. If not, contact *Arens Control* at (847) 844-4700 for further instructions.

Press Button	Correct Display
D	D1
Down Arrow	41
Down Arrow	31
Down Arrow	21
Down Arrow	11
Up Arrow	21
Up Arrow	31
Up Arrow	41
Up Arrow	D1

Electrical Troubleshooting:

If there is no power to the Shift-by-Wire System when the ignition is on, check the following fuses and connections at the front distribution panel located below the driver's window:

- Check the fuse inside the bay door to the right. The fuse holder is labeled “**TRANS 15.**”
- Check ignition fuses on electrical panel.
- Check the grounds located at the ground posts on the right side of the fuse panel.

Remove the Shift Selector from the Console (two U-brackets from underneath) and check to see if the connector in the back is firmly plugged in. If so, run a continuity check of each of the wires listed above. If the display still does not illuminate, replace the Shift Selector.

If the Shift Selector display illuminates and the transmission does not shift into the various ranges, inspect the two connectors on the Actuator Assembly on the left side of the transmission. One is on a pigtail, and the other is plugged directly into the position sensor. Ensure both connectors are in good condition (no pushed out pins or damage) and properly connected.

Transmission Check Light

The electronic control system is programmed to inform the operator of a problem with the transmission system and automatically take action to protect the operator, motorhome and transmission. When the TCM detects a range inhibit or shift inhibit condition, the TCM restricts shifting, turns the **CHECK TRANS** light on the instrument panel and registers a diagnostic code.

NOTE:

For some problems, diagnostic codes may be registered without the ECU activating the CHECK TRANS light. The Allison Transmission authorized service outlet should be consulted whenever there is a transmission related concern. They have the equipment to check for diagnostic codes and to correct problems which arise.

Each time the engine is started the **CHECK TRANS** will light, then turn off after a few seconds. This momentary lighting is to show that the status light circuits are working properly. If the **CHECK TRANS** light does not illuminate during start up, or if the light remains on after start up, the system should be checked immediately. Continued illumination of the **CHECK TRANS** light during vehicle operation (other than start up) indicates that the TCM has signaled a diagnostic code.

Preventive Measures

Help the electronic control system oversee the operation of the transmission. Minor problems can be kept from becoming major problems if you notify an Allison Transmission distributor or dealer when one of these conditions occur:

1. The shifting feels odd.
2. The transmission leaks fluid.
3. Unusual transmission-related sounds (changes in sound caused by normal engine thermostatic fan cycling, while climbing a long grade with a heavy load, have been mistaken for transmission-related sounds).
4. The **CHECK TRANS** light comes on frequently.

Periodic Inspections:

For easier inspection, the transmission should be kept clean. Make periodic checks for loose bolts and leaking fluid lines. Check the condition of the electrical harnesses regularly. Check the engine cooling system occasionally for evidence of transmission fluid which would indicate a faulty oil cooler. Report any abnormal condition to the Allison dealer.

Because the transmission fluid cools, lubricates and transmits hydraulic power, it is important that the proper fluid level be maintained at all times. If the fluid level is too low, the converter and clutches do not receive an adequate supply of fluid. If the fluid level is too high, the fluid can aerate. Aerated fluid can cause the transmission to shift erratically or overheat.

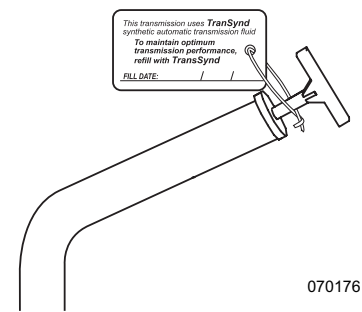
NOTE:

The motorhome should be stationary for approximately two minutes prior to checking the fluid levels to ensure fluid is stabilized.

TRANSMISSION LUBRICATING FLUID

Transmission performance, reliability and durability are important influences in the type of fluids used. The Transmission is filled with TranSynd™ synthetic transmission fluid.

The dipstick and an oil fill are located between the engine and transmission underneath the engine access door in the bedroom. A small tag has been attached to the dipstick identifying the use of TranSynd™ synthetic transmission fluid. A remote fill has been installed in the rear of the motorhome. The orange colored cap can identify this.



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CAUTION:

Use of any type of transmission lubricating fluid other than TranSynd™ will void the warranty.

Fluid and Filter Change Interval:

The transmission has two filters: a main filter and a lube filter. Change the main filter at the first 5,000 miles. Thereafter follow the service intervals listed in the transmission OEM (Original Equipment Manufacturers) manual. Fluid and filters may require changing earlier than recommended in the transmission OEM manual, depending on the severity of operating conditions. Fluid must also be changed whenever there is evidence of dirt or high temperature operation as indicated by discoloration, strong odor or fluid analysis. Local conditions, severity of operation or duty cycle will dictate more or less frequent service intervals.

CAUTION:

Do not mix Dexron III® transmission fluid with TranSynd™ Synthetic transmission fluid.

NOTE:

Be sure to retain the receipt for proof of the initial Main filter change. Refer to the Allison transmission owner's manual or contact an authorized Allison service center for service intervals.

Transmission Fluid Level - Cold Check

Cold Check - Manual Check Procedures:

The concept of a cold check is to determine adequate fluid level for safe operating until hot check can be performed.

To Check the Fluid When Cold:

- Park the motorhome on a level surface. Set the parking brake.
- With the engine operated at a low idle, put the transmission in **N** (Neutral).
- Chock the wheels to prevent the motorhome from moving.
- Allow the engine to run at idle (500 to 800 RPM) for one minute.
- Apply the service brakes and shift to **D** (Drive), then to **N** (Neutral) and next to **R** (Reverse) to fill the system. Finally shift to **N** (Neutral) and release the service brakes. Allow the engine to continue to run at idle (500 to 800 RPM).
- Remove the dipstick and wipe clean. Reinsert the dipstick fully into the tube and remove to check fluid level. Repeat this to verify the reading if needed.
- Safe operating level is anywhere within the **COLD CHECK** band on the dipstick. The fluid level is sufficient enough to operate until a Hot Check can be performed.
- If the level is not within this band, add or drain the fluid as necessary to put the level to the middle of the **COLD CHECK** band.
- Perform the Hot Check at the first opportunity after reaching normal operating temperatures (160° to 200° F/71° to 93° C).

CAUTION:

Low or high fluid level can cause overheating and irregular shift patterns. These conditions can damage the transmission if not corrected.

Transmission Fluid Level - Hot Check

- The fluid level rises as the temperature increases. The fluid must be hot to ensure an accurate check.
- Be sure the fluid has reached normal operating temperature (160° to 200° F/71° to 93° C). If a transmission temperature gauge is not present, check the fluid level when the engine water temperature gauge has stabilized and the transmission has been operated under the load for at least one hour.
- Park the motorhome on a level surface and shift to **N** (Neutral). Apply the parking brake and allow the engine to idle (500 to 800 RPM).
- After wiping the dipstick clean, check the fluid level. Safe operating level is anywhere within the **HOT RUN** band on the dipstick.
- The width of the **HOT RUN** band is approximately one quart of fluid at normal temperature range.
- If the level is not within this band, add or drain the fluid as necessary to put the level within the **HOT RUN** band.
- Be sure that the fluid level checks are consistent. Check the level more than once. If the readings are not consistent check to be sure that the transmission breather is clean and not clogged. If the readings are still not consistent, contact the nearest Allison distributor or dealer.

FUEL SYSTEM

Fuel Requirements

Low sulfur #2 diesel fuel or #1 and #2 commercial winter blend diesel fuels are the most common commercially available and recommended for use. The use of #2 diesel fuel will result in optimum engine performance.

Try to obtain fuel from sources that are serviced often such as large truck service facilities. The fuel supply is fresh and the possibility of introducing contaminants or water into the fuel system is reduced. It is important to not empty the engine of fuel. The fuel system on the engine is sensitive to air. If the engine is allowed to run out of fuel, the fuel system will need to be thoroughly primed before the engine will start. Refer to the Fuel Filters article for priming instructions.

WARNING:

Do not mix gasohol with diesel fuel. This mixture can cause an explosion.

NOTE:

If the engine has run out of fuel it will need to be primed. Refer to *Fuel Filters* for instructions on priming the fuel system.

NOTE:

Due to the precise tolerances of diesel injection systems, it is extremely important that fuel be kept clean and free of dirt or water. Dirt or water in the system can cause severe damage to both the fuel pump and the fuel injectors. Fuel additives for lubricity are not recommended. There are numerous diesel fuel additives to help remove moisture from fuel, prevent microbe growth and to prevent gelling during cold weather. Before adding any type of fuel additive or extender, consult the Manufacturer's Owner's Manual.

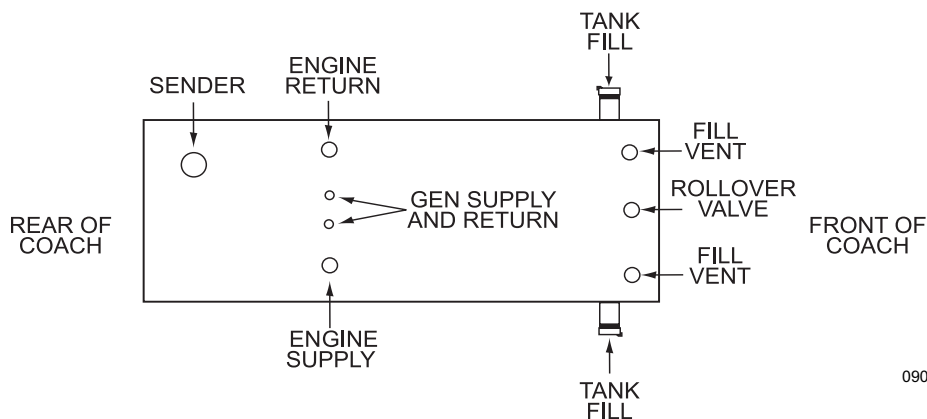
Fuel Tank

The diesel fuel tank is made of steel. Pick-up and return lines are on the roadside. The engine pickup tube is cut at a 45° angle to allow optimum flow to the engine. The generator tube is set to approximately ¼ of a tank. This will prevent depleting the fuel supply while dry camping.

Internal baffles slow fuel slosh. A check valve placed at the bottom of the baffle, at the end of the tank with the pick-up tube, prevents fuel starvation through long corners when fuel supply is low.

NOTE:

Fill the fuel tank if the motorhome is going to be stored for any length of time to reduce the amount of potential condensation. After storage, check the vent tube for blockage. It is not uncommon for insects to plug the vent tube. If pressure or vacuum exists when the fuel cap is removed, the vent tube may be blocked. The end of the vent tube is located on the curbside of the fuel tank, near the bottom.



Fuel Sender

The “Centroid” fuel sender has no moving parts and works by measuring capacitance (electrical property) between inner and outer tubes in the tank. The more fuel between the tubes, the higher the reading. Electronics in the “hockey-puck” head of the sender convert the capacitance to current to drive the fuel gauge.

The “Centroid” sender has four connections:

- 1 & 2 - Positive (POS) and Negative (NEG):** Battery voltage to run the electronics in the sender head.
- 3 - SEND:** Connects to the SEND terminal of the gauge on the dash.
- 4 - ALARM:** Makes a connection internally to the negative (NEG) terminal when the low fuel alarm level is reached (when fuel gauge reads about $\frac{1}{8}$ of a tank). This turns on the fuel indicator light on the dash and is not adjustable.

Adjustments:

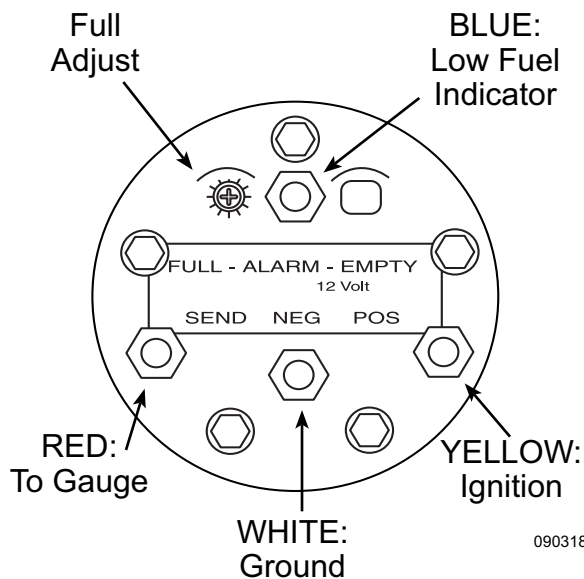
The “Centroid” sender has two adjustments:

- 1 - EMPTY:** Adjusts for length of sender. It has been set at the factory, covered with a sealant and should not be changed.
- 2 - Full Adjustment (FULL):** The full adjustment can be used to correct for slight differences between fuel meters. During installation, it has been factory calibrated and should not need re-adjustment.

The correct adjustment technique, with a full tank of fuel, is to start with the full adjustment screw completely clockwise. This should cause the reading to be above full. Adjust slowly, rotate counterclockwise, until the full mark on the gauge is reached. The intent is to always adjust downscale rather than upscale.

Troubleshooting:

- A. Electronic Output:** The sender has a transistorized output to prevent an ohmmeter from getting a correct reading of its output resistance.
- B. Fuel Only:** The sender will not work correctly in conducting fluids such as water (it will read above full all the time in water). One possibility is that when there is a constant above-full reading there may be water in the bottom of the fuel tank.
- C. Contact Centroid:** Probably 90% of the return Centroid tests work okay on the bench. If you have incorrect readings contact Centroid (**telephone: 800-423-3574**, or preferably, **fax: 386-423-3709**) with the symptoms. A short, “fill in the blanks” troubleshooting test is provided to test the sender. It is easier to find the problem that way than after the sender has been removed from the system, since the problem is not necessarily with the sender.



Fuel Lines & Hoses

Make a visual check for fuel leaks at all engine-mounted fuel lines, connections and at the fuel tank pick-up and return lines. Leaks in this area may best be detected by checking for accumulation of fuel under the tank. Engine performance and auxiliary equipment is dependent upon the ability of flexible hoses to transfer lubricating oil, air, coolant and fuel. Maintenance of hoses is an important step in ensuring efficient, economical and safe operation of the engine and related equipment.

INSPECTION:

Check all hoses, fittings, clamps and ties daily as part of the pre-start inspection. Examine hoses for leaks and ensure they are not touching shafts, couplings or heated surfaces - including exhaust manifolds, sharp edges or other obvious hazardous areas. Over time, vibration from the engine and road can move or fatigue clamps and ties. To ensure continued proper support, inspect fasteners frequently and tighten or replace them as necessary.

Fuel Filters

The fuel filters are located on the curbside frame rail, next to the engine. The primary fuel filter has a drain and a clear sediment bowl, located at the bottom of the filter. Water (by weight) is heavier than fuel and will collect in the sediment bowl. Water can accumulate in the fuel from condensation in the fuel tank or contamination upon refueling.

The appearance of water in the sediment bowl is easily identified by the inability of water to mix with the fuel forming small pools. The water should be drained at the first opportunity. If water passes through the filters it can cause engine misfire and damage fuel injectors.

Shut off the engine and open the drain valve. Turn the valve counterclockwise approximately 1½ to 2 turns until draining occurs. Drain the fuel/water separator of water and sediment until clear fuel is visible. Turn the valve clockwise to close the drain valve.

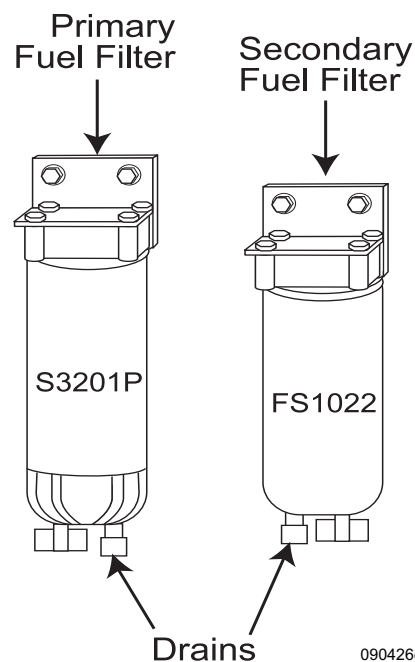
NOTE:

Replace the primary filter every six months or 15,000 miles. Refer to the engine OEM manual for secondary filter replacement intervals.

NOTE:

Always use a container when draining or changing the fuel filters. Dispose of the container properly. The water and sediment can contain petroleum products. Consult the local waste disposal agency for recommended disposal guidelines

In the event the engine runs out of fuel, the lift pump on the fuel pump will run for approximately one minute with the ignition on. The ignition may have to be turned on and off several times before attempting a start. If unable to restart, contact the nearest Cummins Center or phone **1-800-343-7357** for **Cummins Customer Assistance**.



HYDRAULIC SYSTEM

Check for oil leaks under the motorhome and around hose fittings when performing a walk around and pre-check of the motorhome. If a hose connection appears to be leaking, clean the filter and the surrounding area. If seepage continues, have the problem corrected to prevent an untimely failure.

Hydraulic Reservoir (Power Steering)

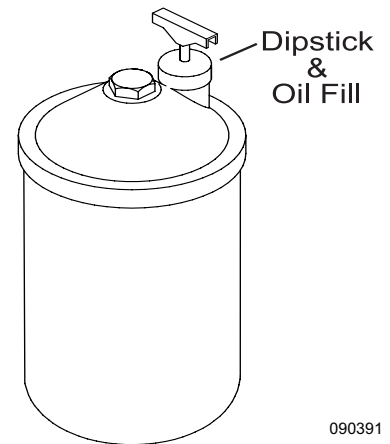
The power steering reservoir with internal filter is located at the rear of the engine. The hydraulic filter assembly, located inside the reservoir, is rated at ten micron*. The reservoir is filled with *Dexron III*[®] Automatic Transmission Fluid from the factory.

Filter assembly: Nelson 91085G

Element number: Fleetguard LF634 (ten micron*)

The primary function of the power steering reservoir is to keep the steering system free of contamination and to dissipate excessive heat that builds during extreme operating conditions.

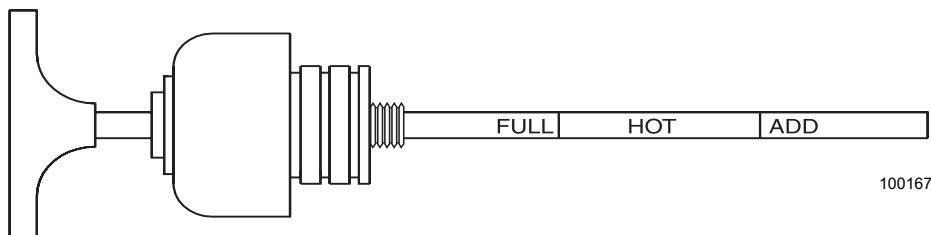
Check the oil level in the reservoir every 6,000 miles or three months. The oil dipstick fill is located on top of the reservoir in the rear compartment. The oil level should be kept between the full and add marks on the dipstick. If adding of fluid is required, use only *Dexron III*[®] Automatic Transmission Fluid.



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Checking the Fluid Level:

1. Start the engine and allow it to reach normal operating temperature.
2. While the engine is at idle, turn the steering wheel left and right several times.
3. Shut the engine **OFF**.
4. The easy grip handle is rotated counterclockwise to remove the dipstick.
5. Check the fluid level on the “**HOT**” side of the dipstick. It should be in the area of “**HOT**” on the dipstick. This is the normal range. **Do not exceed the full mark.**
6. If the fluid level is low, add fluid in small amounts, continuously checking the level until the “**FULL**” mark is reached.
7. Insert the easy grip handle back in the reservoir and rotate clockwise until securely fastened.



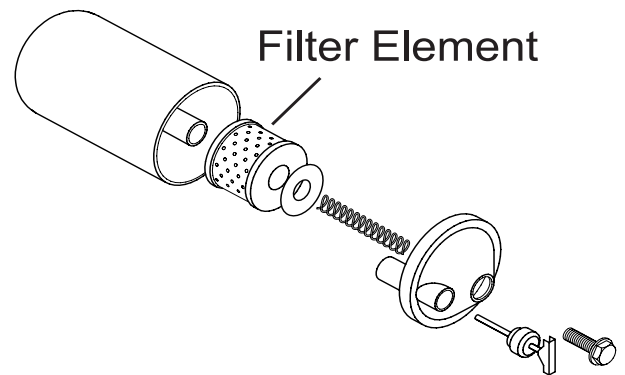
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Hydraulic Filter (Power Steering)

Change the hydraulic oil filter every 15,000 miles, or once a year, for cellulose element. A synthetic media filter is available, which will extend the interval to once every five years.

Changing the hydraulic oil filter:

1. Using a 15/16" wrench, loosen the center cover bolt.
2. Remove the bolt and cover plate to access the spring and filter.
3. Remove the spring and washer to remove the filter assembly.
4. After replacing the filter assembly, reverse the process to re-assemble the reservoir.
5. When attaching the cover plate in the rubber cover seal, check for any damage.

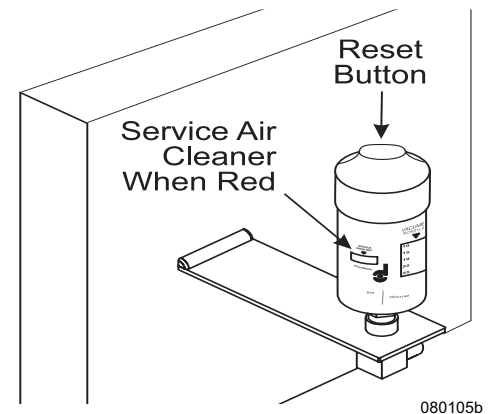


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AIR FILTER

Air Filter Minder

The air filter restriction indicator relays the amount of restriction present in the air intake system and should be inspected before each trip. If the yellow indicator approaches the red (top) area of the air restriction indicator, it is signaling that the air filter is becoming excessively dirty.



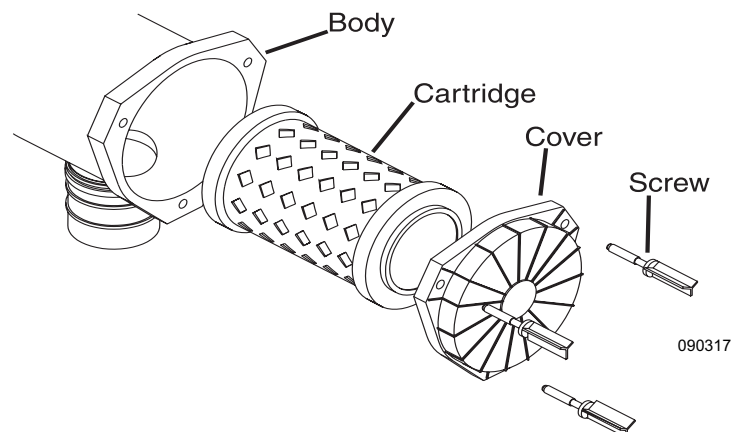
Changing the Filter

To replace air cleaner remove screws and cover from air cleaner body. Remove air cleaner cartridge and discard. Install new air cleaner cartridge and secure with cover and screws.

Located in rear engine compartment.

WARNING:

Do not start the engine with the air cleaner removed and do not remove it while the engine is running.



LUBRICATION MAINTENANCE

Performing regular scheduled maintenance ensures reliable operation and optimum service life of the various chassis components. Completed maintenance brings peace of mind knowing the various components have received proper service. Failure to follow maintenance guidelines, or perform scheduled maintenance, results in inefficient operation, premature component wear or component failure resulting in breakdown.

Maintenance schedules are usually performed at certain mile or time intervals. When performing high level procedures, lower level service should also be performed.

NOTE:

Maintenance schedules are based on normal operating conditions and use. Operating under unusual or adverse condition shortens service intervals.

NOTE:

Engine and transmission service intervals are listed in their respective manuals.

Proper Lubricant Waste Disposal:

When performing service maintenance on the engine, transmission or rear axle, waste fluids and filters should be properly disposed of or recycled. Package used oils, antifreeze and other fluids in sealed containers. In many cases used oil is accepted free of charge at county disposal sites. Waste fluids are toxic to pets and other animals. Waste fluids should not be left in open containers. The sweet odor of antifreeze is attractive to pets, but highly toxic.

CAUTION:

Properly dispose of used antifreeze and waste oil. Animals like the sweet odor of antifreeze and may ingest it if left in open containers. Wipe up any fluid spills. Pets may lie in puddles of fluid, many of which are irritants and can cause severe chemical burns if not properly washed.

Lubricant Classification:

Lubricants are manufactured in many forms for a variety of applications. There are many different oil and grease consistencies each with a designed application. To properly select a particular type of lubricant for a specific application, the component must be evaluated. Component stress loads, ambient temperature, working temperature and environmental exposure are just a few of the variables to consider. Select the proper lubricant for its intended application. As an example: selecting high viscosity grease to lubricate a lock cylinder results in sluggish lock cylinder operation especially in a cool environment. Conversely, using graphite to lubricate a component that is under extreme temperature and load will result in component failure.

Grease ratings and their base compounds are especially important when selecting a lubricant type for an intended application. Some grease compounds are manufactured for multi-use application. These are acceptable if the grease rating is in accordance with the manufacturer's recommended lubricant type and rating.

Lubricants:

Many chassis components require lubrication. The types of lubricants used will vary with the application of the component. A component may fail prematurely due to lack of lubrication or from using an incorrect lubricant type. The component manufacturer usually recommends a particular type of lubricant with a minimum approval rating. Most lubricants are tested under strict guidelines set by the **ASTM** (American Society for Testing and Materials). The **NLGI** (National Lubricating Grease Institute) helps disperse information to the grease production industry. Grease containers usually have an approval rating by the **SAE** (Society of Automotive Engineers), Mil Spec (Military Specification), **API** (American Petroleum Institute) or by other recognized and accepted organizations. The correct lubricant type with an approved specific rating must be used whenever applying, changing or adding any lubricant. When purchasing lubricants for a specific application be sure the label affirms the type of lubricant required with the tested rating by the term “meets or exceeds” in accordance with the manufacturer specifications.

Lubricating greases are made from different base compounds giving the grease different lubricating consistencies, properties and maximum operating temperatures. Most containers list the base compound and maximum operating temperature usually listed as melting point or drip point. Lubricating components, such as brake component for example, require a high temperature special base compound grease. Lubricating this type of component with other than specified grease type will result in inadequate lubricating qualities resulting in component malfunction or failure.

INSPECTION:

When performing any scheduled maintenance, inspect the area around where you are working. For example; when changing the oil look at the rear differential. Inspect for visual signs of fluid leaks.

Most fluids and lubricants have a distinct odor, which can be used to detect early signs of trouble. Generally, odors are most detectable soon after parking. Unusual sounds are another method of detecting a problem early. There are many types of sounds that are normal, such as the cyclic purging of the air dryer. Become familiar with the different sounds. If something sounds odd, smells peculiar or looks unusual investigate the situation.

Greasing:

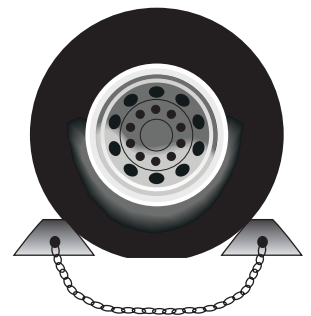
Thoroughly clean all Zerk grease fittings before applying new lubricant. Keep paper towels or disposable rags handy when greasing. When lubricating items such as drive shafts and steer axle components, continued grease application is generally required until new grease appears at exit points.

Some items use sealed boots around the component to prevent moisture intrusion. When greasing these types of components, care must be given to prevent excess lubricant pressure from rupturing the seal.

WARNING:

Always chock wheels before going underneath the motorhome.

Brake actuating components require lubrication to keep the actuating components freely operating. Avoid contaminating brake linings with lubricant. Particular care and attention to details should be taken when lubricating brake actuating components. Wheel removal may be necessary to gain access the grease fittings.



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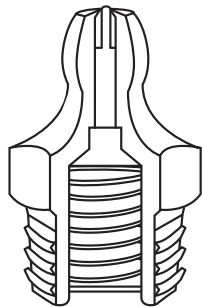
To apply grease:

- Clean the grease fitting. Initially operate grease gun until new lubricant discharges from nozzle, then wipe nozzle clean to avoid introducing contaminants into the component.
- Snap nozzle onto grease fitting.
- Nozzle must line with the grease fitting during the application process. If the nozzle is not in line, lubricant will collect around nozzle and grease fitting, failing to lubricate the component.
- Wrap the nozzle with a paper towel or rag to prevent contamination and accidental soiling of other areas.

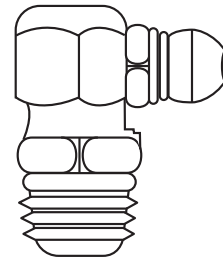
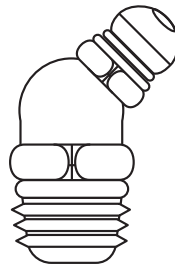
If the component does not accept grease the Zerk fitting may be plugged or damaged. Zerk fittings are replaceable and generally available at most auto supply stores. Zerk fittings come in a variety of angles depending on the application. Every effort should be made to lubricate the component, as neglect will only result in premature component failure.

NOTE:

Some grease fittings may not be accessible until the steering wheel is turned or the motorhome is moved slightly.

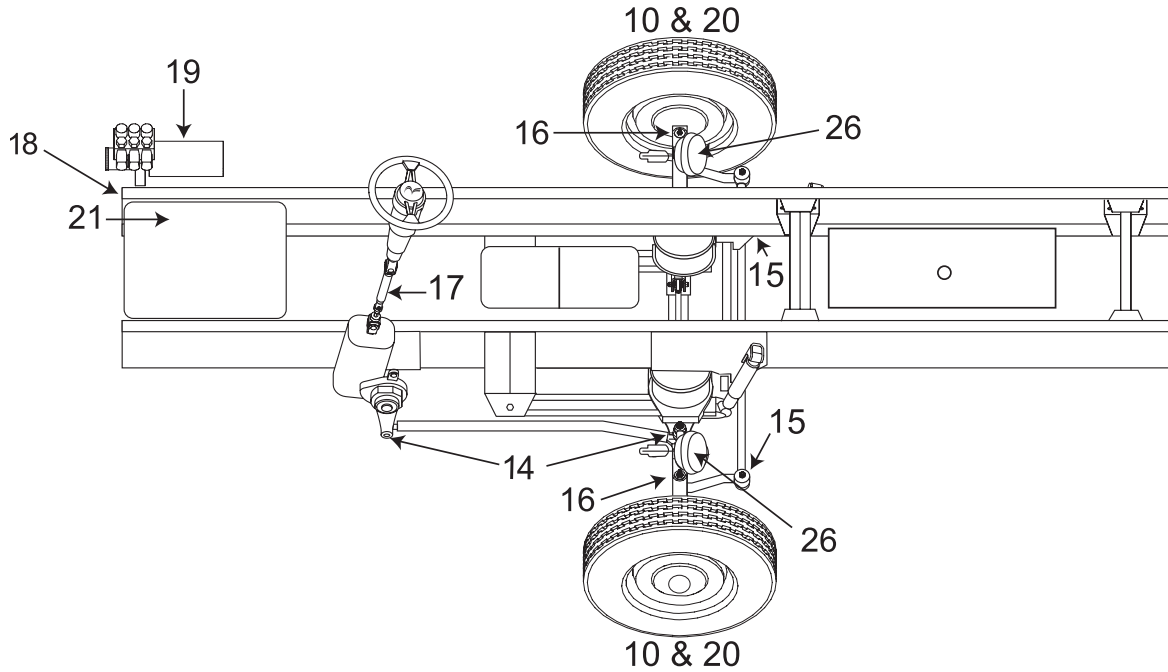


Typical Zerk Fitting



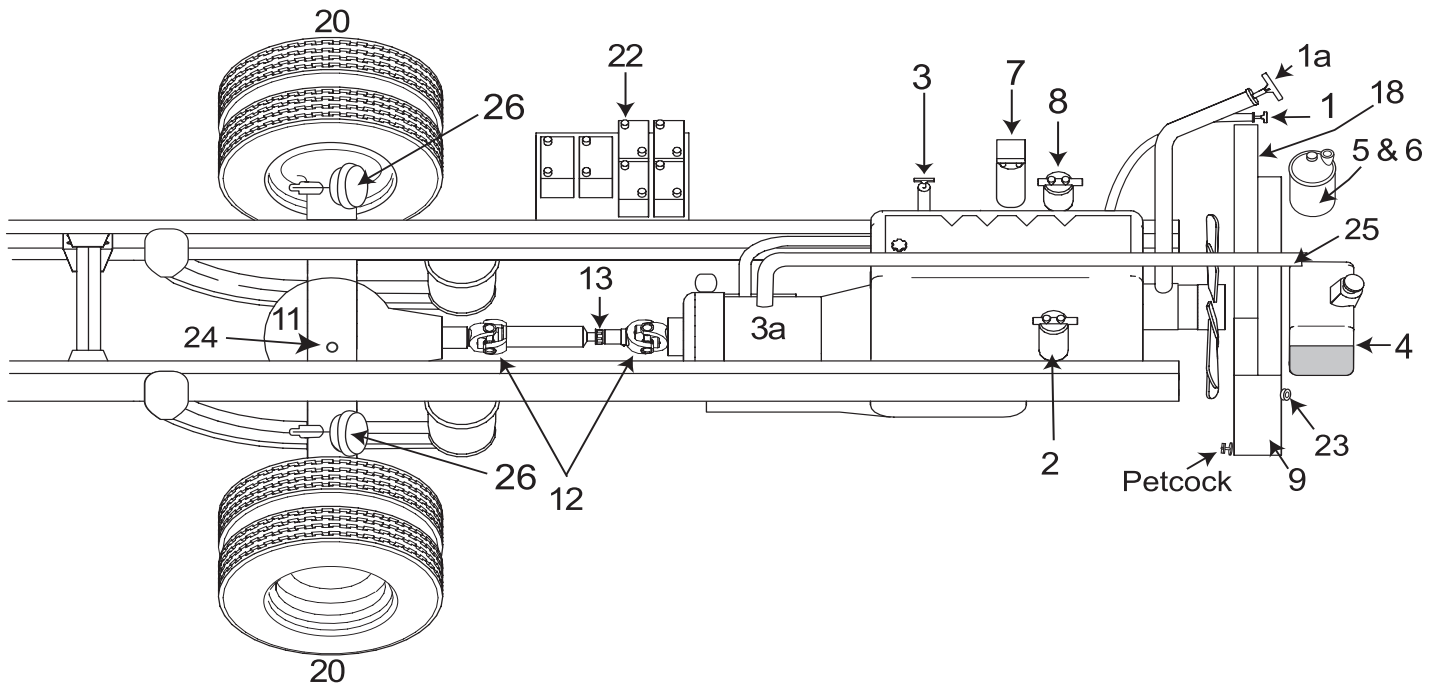
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LUBRICATION CHARTS



070166h

	Component:	Action:	When:	Code
1.	Engine Oil Dipstick	Keep to Full Mark	Before Each Trip + Daily Enroute	EO
1 a.	Engine Oil Fill	Drain	Refer to OEM Manual	OEM
2.	Engine Oil Filter	Replace	At Oil Change	OEM
3.	Transmission Dipstick	Keep to Full Mark	Refer to OEM Manual	TS
3a.	Transmission	Drain	Refer to OEM Manual	OEM
	Transmission Filter	Replace	Refer to OEM Manual	TS
4.	Engine Coolant Surge Tank	Maintain Level	Before Each Trip + Daily Enroute	AF
5.	Hydraulic Fluid Reservoir	Maintain Level	Before Each Trip + Daily Enroute	TF
6.	Hydraulic Filter	Replace	15,000 or Annually	TF
7a.	Filter Fuel/Water Separator (Primary)	Inspect/Replace	Before Each Trip/15,000 or 6 Months	FF
8.	Filter Fuel (Secondary)	Replace	Refer to OEM Manual	FF
9.	Radiator/Charge Air Cooler	Inspect	Weekly	OEM
10.	Axle Hubs	Inspect Level/Replace	1,000/30,000 or Annually	GO
11.	Rear Differential	Change Fluid	250,000 or 3 Years	MP
12.	Drive Shaft Universal Joints	Grease-2 Fittings	5,000 or 6 Months	CL
13.	Drive Shaft Slip Yoke	Grease-1 Fitting	5,000 or 6 Months	CL
14.	Drag Link	Grease-2 Fittings	5,000 or 6 Months	CL
15.	Center Link	Grease-2 Fittings	5,000 or 6 Months	CL
16.	Spindles/Kingpins	Grease-2 Fittings ea.	5,000 or 6 Months	CL
17.	Steering Intermediate Shaft	Grease-3 Fittings	30,000 or Annually	CL
18.	Air Tank Drains	Drains	Monthly	-
19.	Leveler Reservoir	Keep to Full Mark	6,000 or 3 Months	TF
20.	Tire Pressure	Check	Before Each Trip + Daily En route	-
21.	Generator	Refer to OEM Manual	Refer to OEM Manual	OEM
22.	Batteries	Inspect	Every 2 Weeks	DW
	Battery Terminals	Apply Coating	10,000 or Quarterly	P
23.	Air Filter Minder	Inspect	Before Each Trip + Daily En route	--
24.	Axle Breather Vent	Inspect & Clean	250,000 or 3 Years	--
25.	Transmission Remote Fill	--	--	--
26.	Slack Adjuster/Cam Shaft	Grease-2 Fittings ea.	10,000 or 3 Months	CL



070167k

Lubrication Code Chart:	
CL-4	U-Joints located inside coach under steering cover. Use chassis lubricant.
EO	Engine oil as recommended by engine manufacturer.
OEM	Refer to the Original Equipment Manufacturer's manual.
MP	API GL-5 or MT-1 type gear lubricant - SAE 75W-90, Synthetic
GO	EP-SAE 90 Gear Oil
CL	Chassis lubricant should be a high quality non corrosive multi-purpose lithium soap base lubricant that is water resistant and designed to withstand extremely high operating temperatures.
TF	Transmission fluid. Use Dexron III® transmission fluid only.
AF	Antifreeze as recommended by engine manufacturer.
BF	Dot-3 Brake Fluid
FF	Fuel Filter
CBL	Clay-based Lubricant
HT	High Temperature Bearing Grease
TS	TranSynd™
DW	Distilled Water
P	Petroleum Jelly

NOTE:

Service must be performed every twelve (12) months, regardless of actual mileage, to protect seals, bearings and gaskets from drying out and failing. The motorhome must be started and driven for at least 20 miles every two weeks. It is important to remember the generator maintenance interval is based on hours of usage. Consult the OEM manual for the generator service interval.

SPECIFICATIONS CHARTS

Tank Capacities

Tank Capacities (Approx. Gallons) All Models	
Grey Water	52 gallons
Black Water	52 gallons
Fresh Water	92 gallons
Diesel Fuel	75 gallons
LP-Gas*	38 gallons
Water Heater	10 gallons

*Actual filled LP-Gas Tank Capacity is 80% of listing due to safety shutoff required on tank.

NOTE:

All tank capacities are estimated based upon calculations provided by the tank manufacturers and represent approximate capacities. The actual “usable capacity” may be greater or less than the estimated capacities based upon fabrication and installation of the tanks.

NOTE:

This chart reflects product specifications available at the time of printing. Therefore any floor plans introduced thereafter may not be reflected in the chart. All other information contained throughout the manual will still apply.

Engine Specifications

ENGINE SPECIFICATIONS	ISB
Cubic Inch Displacement	5.9 L/359 CI
Engine Torque	600 lbs./ft. @ 1600 RPM
Rear Axle Ratio	4:78:1
Alternator Amp Size	160 Amp

Chassis Fluid Capacities

CHASSIS LIQUID CAPACITIES	ISB
Engine Oil	17 Qts.
Transmission Oil (initial amount)	14.8 Qts.
Transmission Oil (with service)	10.5 Qts. w/filter
Radiator Coolant (initial amount)	11.5 Gal.
A/C Refrigerant (initial amount)	3.5 lbs. 134 A
Rear End	16 Qts. Approx.

Generator Specifications

5.5 Kw

SERVICE INFORMATION



Refer to operator's manual for maintenance specifications and adjustments

Air Cleaner	140-3351
Oil Filter	185-7444
Fuel Filter	149-2513
Oil Capacity	2Qts w/ oil filter
API Designation	CE

Temp	SAE Viscosity
5 - 120 F	15W - 40
(-13 F) - 68 F	10W - 30
(-40 F) - 68 F	5W - 30

If service parts are needed the Onan distributor can be located in the yellow pages under Generators-Electric. In the USA or Canada call 1800-888-Onan

Radiator Cap Under Cover

98-7995 *TMI*

8 Kw

SERVICE INFORMATION

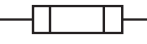


Refer to operator's manual for maintenance specifications and adjustments.

Air Cleaner	-	140-2897
Oil Filter	-	185-5409
Fuel Filter	-	149-2513
Oil Capacity	-	3 Qts w/oil filter
API Designation	-	CE

Temp	SAE Viscosity
5° - 120°F	15W-40
(-13°F) - 68°F	10W-30
(-40°F) - 68°F	5W-30

If service/parts are needed the Onan distributor can be located in the yellow pages under Generators-Electric. In the USA or Canada call 1-800-888-Onan

DC Fuse & Radiator Cap Under Cover.

020159j 060148c

Filters & Belts

FILTERS & BELTS	Manufacturer	Number
Oil Filter	Fleetguard	LF 3970
Fuel Filter (Primary)	Fleetguard	53201P
Fuel Filter (Secondary)	Fleetguard	FS 19596
A/C Belt	Dayco	15410
Air Filter	Donaldson	P527484
Alternator Belt	Cummins	3955169
Power Steering Filter	Nelson	84365A

BATTERY SPECIFICATION CHARTS

Application	AH (20 HR)	CCA†	RC (25A @ 80° F) Minutes
12 Volt Chassis* Group 31p - MHD (2 each)		950	195
6 Volt Domestic** U2200 (4 each)	450		75 Amp @ 80° F = 230 Min.

*Batteries connected in parallel. **Four batteries connected in a Series/Parallel configuration. †CCA Ratings are 0° F. These are the minimum requirements.

Approximate Hours of Ampere Load					
**U2200	5 AMPS	10 AMPS	15 AMPS	20 AMPS	25 AMPS
	110	44	25	18	14

**Four batteries connected in a Series/Parallel configuration.

Battery State of Charge vs Voltage/Specific Gravity			
Voltage	Specific Gravity	State of Charge	Depth of Charge
12.65	1.265	100%	0%
12.45	1.225	75%	25%
12.25	1.190	60%	50%
12.05	1.145	25%	75%
11.90	1.100	0%	100%

Voltage Reading: Battery fully charged at rest for one hour.

Engine Cold Cranking Amp Requirements			
Cummins ISB	1190	CCA	12 VOLTS

CCA Ratings are at 0° F. These are the minimum requirements.

METRIC/U.S. CONVERSION CHART

U.S. Customary to Metric			Metric to U.S. Customary			
Measurement	Multiplied By	Equals/Measurement	Multiplied By	Equals		
Length						
inches (in)	25.4	millimeters (mm)	0.03937	inches (in)		
inches (in)	2.54	centimeters (cm)	0.3937	inches (in)		
feet (ft)	0.3048	meters (m)	3.281	feet (ft)		
yards (yd)	0.9144	meters (m)	1.094	yards (yd)		
miles (mi)	1.609	kilometers (km)	0.6215	miles (mi)		
Area						
square inches (in ²)	645.16	square millimeters (mm ²)	0.00155	square inches (in ²)		
square inches (in ²)	6.452	square centimeters (cm ²)	0.15	square inches (in ²)		
square feet (ft ²)	0.0929	square meters (m ²)	10.764	square feet (ft ²)		
Volume						
cubic inches (in ³)	16387.0	cubic millimeters (mm ³)	0.000061	cubic inches (in ³)		
cubic inches (in ³)	16.387	cubic centimeters (cm ³)	0.06102	cubic inches (in ³)		
cubic inches (in ³)	0.01639	liters (L)	61.024	cubic inches (in ³)		
fluid ounces (fl oz)	29.54	milliliters (mL)	0.03381	fluid ounces (fl oz)		
pints (pt)	0.47318	liters (L)	2.1134	pints (pt)		
quarts (qt)	0.94635	liters (L)	1.0567	quarts (qt)		
gallons (gal)	3.7854	liters (L)	0.2642	gallons (gal)		
cubic feet (ft ³)	28.317	liters (L)	0.03531	cubic feet (ft ³)		
cubic feet (ft ³)	0.02832	cubic meters (m ³)	35.315	cubic feet (ft ³)		
Weight/Force						
ounces (av) (oz)	28.35	grams (g)	0.03527	ounces (av) (oz)		
pounds (av) (lb)	0.454	kilograms (kg)	2.205	pounds (av) (lb)		
U.S. tons (t)	907.18	kilograms (kg)	0.001102	U.S. tons (t)		
U.S. tons (t)	0.90718	metric tons (t)	1.1023	U.S. tons (t)		
Torque/Work Force						
inch-pounds (lbf.in)	11.298	Newton-centimeters (N.cm)	0.08851	inch-pounds (lbf.in)		
foot-pounds (lbf.ft)	1.3558	Newton-meters (N.m)	0.7376	foot-pounds (lbf.ft)		
Pressure/Vacuum						
inches of mercury (inHg)	3.37685	kiloPascals (kPa)	0.29613	inches of mercury (inHg)		
pounds per square inch (psi)	6.895	kiloPascals (kPa)	0.14503	pounds per square inch (psi)		
Measurement	Subtract	Divide By	Equals/Measurement	Multiply By	Add	Equals
Temperature						
degrees Fahrenheit (°F)	32	1.8	degrees Celsius (°C)	1.8	32	degrees Fahrenheit (°F)

MAINTENANCE RECORDS

After 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. **In addition, retain all maintenance receipts.** The owner information portfolio is a convenient place to store them.

LUBRICATION SERVICE RECORD

**KEY TO
SERVICES**

A – Lubrication & Inspection
 A1 – Motor Oil & Filter Change
 A2 – Transmission Oil Change

A3 – Drive Axle Oil Change
 A4 – Wheel Bearing Service
 B – Prescribed Service

C – Prescribed Service
 D – Prescribed Service
 E – Prescribed Service

MILEAGE	SERVICES									JOB PERFORMED	
	A	A1	A2	A3	A4	B	C	D	E	DATE	BY
1											
2											
3											
4											
5											
6											
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