MONACO® MOTORHOME LIMITED WARRANTY

WHAT THE PERIOD OF COVERAGE IS:

This Limited Warranty provided by Monaco® ("Warrantor") covers those components, assemblies and systems of your new motorhome not excluded under the section "What is Not Covered" and 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, this Limited Warranty provided by Warrantor covers the steel or aluminum frame structure, only, 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, only, 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 Monaco 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.

LIMITATION AND DISCLAIMER 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 below.

WHAT WE WILL DO TO CORRECT PROBLEMS:

Warrantor's sole and exclusive obligation is to 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 that are excluded from coverage shall be considered "good will" repairs, which shall not alter the express terms of this limited warranty. If the repair or replacement remedy fails to successfully cure a defect after Warrantor received a reasonable opportunity to cure the defect(s), your sole and exclusive remedy shall be limited to Warrantor paying you the cost of having an independent third party perform repair(s) to the defect(s).

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:

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 moisture inside the motorhome; defacing, scratching, dents and chips on any surface or fabric of the motorhome, not caused by Warrantor; owner maintenance, including by way of example wheel alignments and resealing exterior sealant areas; 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 AND 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, INCLUDING BY WAY OF EXAMPLE FUEL AND TRANSPORTATION EXPENSES TO DELIVER THE PRODUCT TO THE SERVICING DEALER, HOTEL ROOMS, LOST WAGES AND MOISTURE DAMAGE SUCH AS MOLD AND MILDEW. 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:

THIS LIMITED WARRANTY DOES NOT "EXTEND TO FUTURE PERFORMANCE." ANY ACTION TO ENFORCE THIS LIMITED WARRANTY OR ANY IMPLIED WARRANTIES SHALL NOT BE COMMENCED MORE THAN 90 DAYS AFTER THE EXPIRATION OF THE ONE YEAR WARRANTY COVERAGE PERIOD DESIGNATED ABOVE. IF YOU USE YOUR MOTOR HOME FOR COMMERCIAL OR BUSINESS PURPOSES, ANY ACTION TO ENFORCE THIS LIMITED WARRANTY 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. THE PERFORMANCE OF REPAIRS SHALL NOT SUSPEND THIS LIMITATIONS PERIOD FROM EXPIRING. 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.

LARGER PRINT VERSION AVAILABLE WITHIN THE OWNER'S MANUAL AND UPON REQUEST ADDRESSED TO YOUR SELLING DEALER OR WARRANTOR'S WARRANTY DEPARTMENT.

111506

ROADMASTER® CHASSIS LIMITED WARRANTY

WHAT THE PERIOD OF COVERAGE IS:

This Limited Warranty provided by Roadmaster® ("Warrantor") covers your Roadmaster Chassis for thirty-six (36) months from the original retail purchase date or the first 50,000 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, this Limited Warranty covers your new Roadmaster Chassis for Ninety (90) days from the original retail purchase date 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. This Limited Warranty applies to all owners, including subsequent owners, of the Roadmaster Chassis. However, a subsequent owner must submit a warranty transfer form. 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.

LIMITATION AND DISCLAIMER 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 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. Also see the section "What the Warranty Does Not Cover" set out below.

WHAT WE WILL DO TO CORRECT PROBLEMS:

Warrantor's sole and exclusive obligation is to 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 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 that are excluded from coverage shall be considered "good will" repairs, which shall not alter the express terms of this limited warranty. If the repair or replacement remedy fails to successfully cure a defect after Warrantor received a reasonable opportunity to cure the defect(s), your sole and exclusive remedy shall be limited to Warrantor paying you the cost of having an independent third party perform repair(s) to the defect(s). Warrantor may use new and/or remanufactured parts and/or components of substantially equal quality to complete any repairs. 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:

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:

91320 Coburg Industrial Way
Coburg, Oregon 97408

In the event the Roadmaster Chassis 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: 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, radiator, 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 AND INCIDENTAL DAMAGES:

THE ORIGINAL 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 ROADMASTER CHASSIS, INCLUDING BY WAY OF EXAMPLE FUEL AND TRANSPORTATION EXPENSES TO DELIVER THE PRODUCT TO THE SERVICING DEALER, HOTEL ROOMS, LOST WAGES AND WATER DAMAGE. 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:

THIS LIMITED WARRANTY DOES NOT "EXTEND TO FUTURE PERFORMANCE." ANY ACTION TO ENFORCE THIS LIMITED WARRANTY OR ANY IMPLIED WARRANTIES SHALL NOT BE COMMENCED MORE THAN NINETY (90) DAYS AFTER THE EXPIRATION OF THE THIRTY-SIX (36) MONTH WARRANTY COVERAGE PERIOD DESIGNATED ABOVE. IF YOU USE YOUR MOTORHOME FOR COMMERCIAL OR BUSINESS PURPOSES, ANY ACTION TO ENFORCE THIS LIMITED WARRANTY 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. THE PERFORMANCE OF REPAIRS SHALL NOT SUSPEND THIS LIMITATIONS PERIOD FROM EXPIRING. 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.

LARGER PRINT VERSION AVAILABLE WITHIN THE OWNERS MANUAL AND UPON REQUEST ADDRESSED TO YOUR SELLING DEALER OR WARRANTOR'S WARRANTY DEPARTMENT.

012507

2008 CAYMAN

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.

Check online for Addendums or Tech Tips
that may apply to your motorhome.

MANUAL ADDENDUMS & TECH TIPS

www.monaco-online.com

Click on the **Monaco** logo, then click on **SERVICE** link and choose either **MANUAL ADDENDUMS** or **TECH TIPS** from the menu.

WARRANTY INFORMATION FILE

In addition to this Owner's Manual, a Warranty Information File can be found in the motorhome that contains valuable documents about your motorhome systems and equipment. Many of the component manufacturer 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.

REPORTING SAFETY DEFECTS

If you believe that your motorhome has a defect which could cause a crash or could cause injury or death, you should immediately inform the National Highway Traffic Safety Administration (NHTSA) in addition to notifying Monaco Coach Corporation.

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

To contact NHTSA, you may call the Vehicle Safety Hot line toll-free at 1-888-327-4236 (TTY: 1-800-424-9153); go to *http://www.safercar.gov*; or write to: Administrator, NHTSA, 1200 New Jersey Avenue, SE, Washington, DC, 20590. You can also obtain other information about motor vehicle safety from *http://www.safercar.gov.*

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.

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.

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

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 pressure in an air system.

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

Air Governor - Controls the operation of the air compressor by constantly monitoring pressure in the supply tank of the air system. The air governor initiates the unload cycle when the cut-out pressure is reached. The air governor also controls the air dryer by sending signal (at the beginning of the compressor unload cycle) to the control port of the air dryer, initiating the purge cycle. When this air signal is removed by the governor (at the beginning of the compressor load cycle) the purge valve closes and the drying cycle begins.

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 an system.

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

Cut-In Pressure - The pressure level in the air system supply tank which triggers the compressor load cycle.

Cut-Out Pressure - The pressure level in the air system supply tank which triggers the compressor unload cycle.

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. Current only flows one way.

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 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 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 DC lights and accessories inside motorhome.

LED (Light Emitting Diode) - Indicator light.

Liquid Lead Acid Battery (LLA) - 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.

Low Point Drain - The lowest point in the plumbing. 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 - Expresses 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.

Shore Line - This is the electrical cord which runs from the motorhome to the campground 120/240 Volt AC electrical supply.

Stinger - An arm attachment on a tow truck that is used to lift the motorhome slightly for towing.

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 to clean the connections and check the electrolyte level.

Notes

OWNER'S MANUAL SURVEY: 2008 CAYMAN

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 lay-out 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 # _____

TEAR OFF PAGE AND MAIL TO:

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

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.

TEAR OFF PAGE AND MAIL TO:
WARRANTY TRANSFER, MONACO COACH CORPORATION,
91320 COBURG INDUSTRIAL WAY
COBURG, OR 97408

DRIVING & SAFETY

Section Two 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 about 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

Differences between a passenger automobile and a motorhome are significant. 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 motorhome inspection 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**.

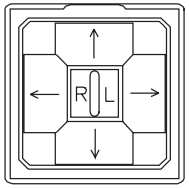
Examine the condition of the motorhome and the surrounding area. Look high and low when walking around the motorhome.

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

Adjust the mirrors prior to starting out. Have an assistant help to simplify the mirror adjustment process.

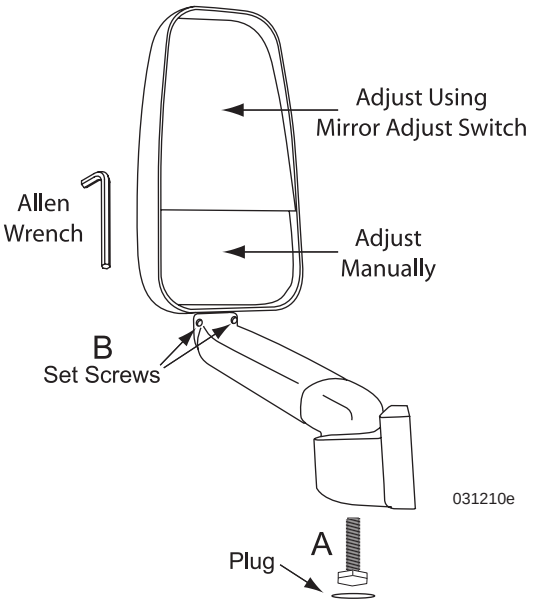


Mirror Adjust Switch on Driver's Console

Mirror Adjusting:

- Tools needed: Allen wrench, flat blade screw driver and socket wrench.
- Adjust the driver seat to the travel position.
- Remove plug at the bottom of the arm.
- Use the socket wrench to loosen the bolt located at the base of the arm (see point **A** on the drawing).
- Adjust the mirror for a clear side view of the motorhome.
- Tighten the bolt once the proper adjustment is made.
- Reinstall the plug.
- To adjust the "head" of the mirror, loosen the set screws located below the mirror shown as point **B**. Adjust the head of the mirror to the left or right.
- Manually adjust the bottom section of the mirror.
- Tighten set screws once the proper adjustment is made.
- Repeat procedure for passenger side mirror.

NOTE:
Use the mirror adjust switch located on the driver's console to fine tune the view.



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; a click will sound when the tab locks into the buckle. Seat belt lengths automatically adjust to your size and sitting position. **DO NOT** route belts over armrest or under arm.

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.

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

General Child Seat Use Information*

Always refer to the child seat and vehicle manufacturers' instructions for proper use and installation instructions.

Age/Weight	Seat Type/Seat Position	Usage Tips
Infants		
Birth to at least 1 year **and** at least 20 lbs.	Infant-Only Seat/rear-facing (or) Convertible Seat/used rear-facing	▪ Never use in a front seat where an air bag is present. ▪ Tightly install child seat in rear seat, facing the rear. ▪ Child seat should recline at approximately a 45° angle. ▪ Harness straps/slots at or below shoulder level (lower set of slots for most convertible child safety seats). ▪ Harness straps snug on child; harness clip at armpit level.
Less than 1 year/20 to 35 lbs.	Convertible Seat/used rear-facing (select one recommended for heavier infants)	
Children may remain in their rear-facing seats as long as they haven't exceeded the height or weight requirements.	*Seats should be secured to the vehicle by the safety belts or by the LATCH system.*	
Preschoolers/Toddlers		
1 to 4 years/at least 20 lbs. to approx. 40 lbs. *Children may remain in their forward-facing seats as long as they haven't exceeded the height or weight requirements.*	Convertible Seat/forward-facing or forward-facing only (or) Combination Seat with Harness *Seats should be secured to the vehicle by the safety belts or by the LATCH system.*	▪ Tightly install child seat, facing forward. ▪ Harness straps/slots at or above child's shoulders (usually top set of slots for convertible child safety seats). ▪ Harness straps snug on child; harness clip at armpit level.
Young Children		
4 to at least 8 years/unless they are 4' 9" (57") tall.	Belt-Positioning Booster No back or High Back Belt-Positioning Booster. *NEVER use with lap-only belts — belt-positioning boosters are always used with lap and shoulder belts.*	▪ Booster used with adult lap and shoulder belt in rear seat. ▪ Shoulder belt should rest snugly across chest, rests on shoulder; and should NEVER be placed under the arm or behind the back. ▪ Lap-belt should rest low, across the lap/upper thigh area - not across the stomach.

Stay informed about child safety seat recalls; be sure to fill out the registration card that comes with new child seats.

** The motorhome manufacturer is not the author of this chart. The information in this chart is reprinted from the National Highway Traffic Safety Administration's web site. Visit NHTSA's website at www.nhtsa.gov for the most recent and up to date information.*

The child safety seat can be positioned in two places in the motorhome: the front passenger (co-pilot) seat and forward facing permanently mounted booth dinette seat.

WARNING:
DO NOT transport children 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 as described in this section. It is your responsibility to know and comply with the laws in the state or province in which you travel.

WARNING:
Because many styles of safety and booster seats are available, refer to the safety seat manufacturer's manual for proper installation and how to properly install and secure the safety or booster seat.

NOTE:
Use of a safety or booster seat in the front seat may be prohibited in some states and Canadian provinces.

Seat Belt Care:

Keep the belt clean and dry. Clean with 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


downhill.eps

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 including 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 including 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 and has a higher center of gravity. These factors affect the reaction time of the motorhome. Swerving and sharp turning, especially 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. When passing another vehicle, allow extra time and space to complete the pass due to the added length of the motorhome.

When descending a long hill, manually shift to a lower gear and begin the descent at a slow speed. Do not allow the motorhome to gain momentum before trying to slow down. Use the exhaust brake in conjunction with the service brakes to help maintain a slow, safe descent. The transmission and engine will help control downhill speed and can extend the service life of the brake lining.

Distance required to stop the motorhome is greater than an automobile. Practice stopping away from traffic to get the feel of distance required to stop 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.

Use the pilot seat controls to comfortably position the seat. Stay seated and adjust the outside mirrors if necessary to gain a clear line of vision down both sides of the motorhome. After the outside mirrors have been adjusted, confirm the rear view camera system is working and clear of any obstruction.

Adjusting to road, weather and terrain conditions is necessary to keep the motorhome under control. Pay attention to road signs that advise of local road hazards and driving conditions. **DO NOT** operate the motorhome when road, weather and terrain conditions seem unsafe.

The cockpit, dash area and windshield are larger than those found on passenger cars and trucks. Keep the windshield clear of humidity in the form of water or ice. Start the motorhome and turn on the dash defrost and the (optional) auxiliary blowers to help remove moisture from inside the windshield. It may be necessary to use a clean cloth to wipe away moisture. **DO NOT** operate the motorhome if the windshield is not clear.

Keep windshield wipers in good working order at all times.

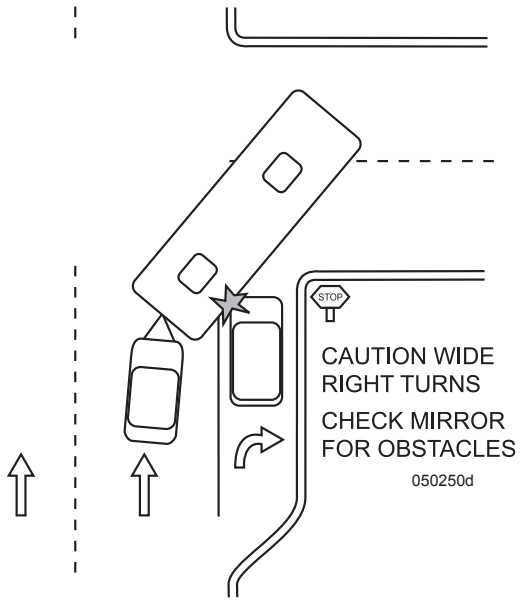
DO NOT operate the motorhome when road, weather and terrain conditions seem unsafe.

Driving Cautions:

- Avoid getting too close to the shoulder of the road, which may be too soft to 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 that can damage the undercarriage of the motorhome or become lodged in the dual tires and cause damage to the tires, wheel rims or tow vehicle.
- On back roads and single divided roads, tree branches and shrubbery can protrude into the roadway. Watch for low hanging branches especially during inclement weather. Rain and snow will cause branches to hang lower than usual.
- Keep in consideration that posted speed signs are usually passenger automobile rated. Be extra aware of driving conditions and use the appropriate speed for a motorhome when 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. Use 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 the driver's hips should be parallel to the roadside curb of the corner being turned to 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** proceed with the turn until the driver's seat is aligned with the center of the intersection. If two lanes are available, take the right hand lane. Vehicles or objects are more easily seen by the driver on the left hand side.

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 operate 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** - The engine, even with the help of a turbo-charger, can only introduce a given volume of air into the combustion chamber. This volume of air can efficiently combine with only so much fuel; so adding more fuel to the engine only wastes fuel.

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

IMPORTANT SAFETY TIP:
Turn on four way flashers if road speed degrades to the point where the motorhome is moving significantly under the posted speed. Use pullouts if traffic is building. Once in a pullout, if there is sufficient clearance for safety, idle the engine for a while to allow the exhaust and the turbo to cool. While these are cooling, the transmission will also cool. Monitor the gauges while waiting.

Descending a Grade:

Prepare to descend a grade at the crest of the hill. Observe any 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 an exhaust brake switch. Turn the exhaust brake switch on to activate the exhaust brake when the throttle is released.

With exhaust brake applied, road speed may increase until the transmission automatically shifts to the next higher gear. Apply the 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. This can result in a loss of air pressure. Riding the brakes can cause the brakes to overheat. Either method can result in brake failure or loss of brake effectiveness.

Night Driving:

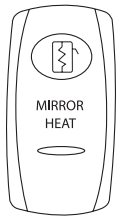
- Be well rested and alert. If necessary, find a safe stopping place to rest until ready to continue.
- Avoid using interior lights that create a glare on the windshield and decrease visibility.
- Dim dash lights to a comfortable level to reduce glare.

Extreme Heat/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 downshifting or using the exhaust brake on wet or slippery surfaces, which 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.



080384e

Located on Driver's Console

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.

Refueling:

- Truck stops are good refueling points for motorhomes.
- Check overhead clearance heights 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:
LP-Gas and gasoline are highly flammable and can ignite, resulting in explosion, fire or death. Ensure all flames are extinguished, all LP-Gas appliances are turned off and the primary LP-Gas valve is off prior to refueling.

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:

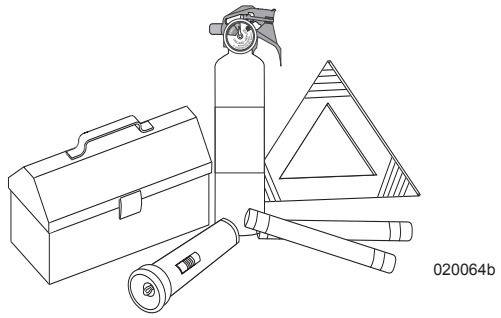
- When starting out, apply the throttle lightly and accelerate gradually. Avoid excess throttle and accelerating quickly.
- Check the tire pressure. A low tire is not only a safety hazard, but also increases rolling resistance and fuel consumption. Keep the engine at a low to mid operating range of 1100 to 1500 RPM, which requires 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. Fuel will burn more efficiently.
- Avoid extended idling to warm-up the engine. Start the engine and wait for normal oil pressure to register. Engage the high idle feature until the engine coolant temperature gauge rises. The engine is now ready for travel. Whenever coolant temperature is below operating temperature (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.
- Excessive idling (more than 10 or 15 minutes) can clog fuel injectors, damage the emission system, and eventually causing piston rings and valves to stick.
- Operate the transmission with the MODE function set to Economy whenever possible; this allows for earlier shifts and enhanced fuel economy. Shift points are also lowered if the cruise power switch is on. Turn off the cruise power and set the transmission to normal mode when in mountainous terrain and congested traffic.
- Follow the maintenance schedule for the engine.

TRIP PREPARATION

The following suggestions are general guidelines to follow when preparing for a trip:

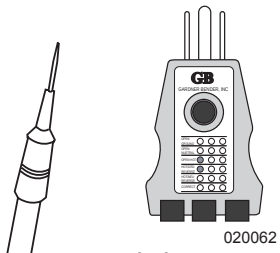
Items to Carry:

- An emergency road kit containing a flashlight, road flares, warning signs and a fire extinguisher.

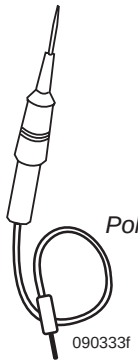


Tool Box & Emergency Road Supplies

- Local, State and National Maps, as well as a 'Motor Carrier' road atlas (for refueling station and truck repair facility locations).
- Hand tools, a 12 Volt DC test light, a 120 Volt AC polarity tester, battery hydrometer, an assortment of blade fuses, mini fuses and alternator belt.
- Potable and non-potable water hoses, a water pressure regulator and various termination connectors for sewage.



Polarity Tester



Test Light

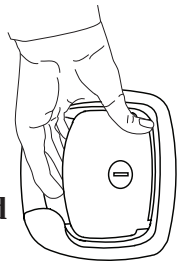
Inspection:

- Ensure all exterior items are stowed or secured (i.e. TV antenna, ceiling vents and windows).
- Check belts, hoses, battery and engine fluid levels. **Inspect** the engine, transmission and generator per the OEM manuals.
- Evenly distribute and secure cargo. Store heavy items near the rear axle and lighter items toward the front to prevent uneven stress and handling problems.
- Check all tires outside the motorhome for accurate pressure and physical condition. Look around, above and under the motorhome for obstruction or leaks. Test all exterior lighting: headlamps, taillights, brake and clearance lights.
- Inside the motorhome store and secure heavier objects in the lower cabinets to maintain a low center of gravity for sway reduction. Secure loose items to prevent weight shifts. Store lighter items in the overhead cabinets. Close and secure all cabinet doors and drawers, shower and pocket doors. Turn off interior lighting. Adjust exterior mirrors and check dash gauges for proper operation.

INFORMATION:
For chassis maintenance details refer to the chassis section.

CAUTION:
Open the bay doors slowly. Cargo may shift 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.

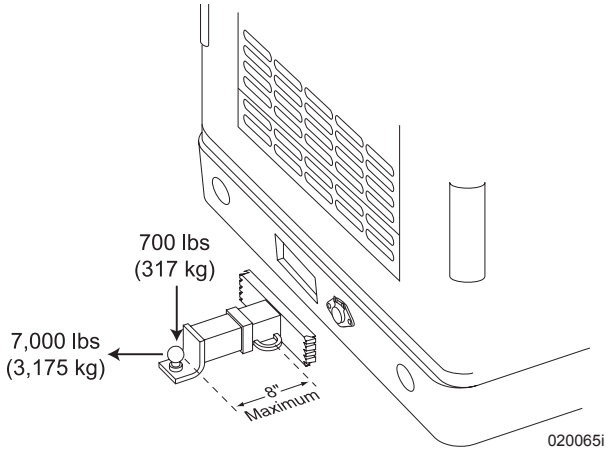


020134i

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

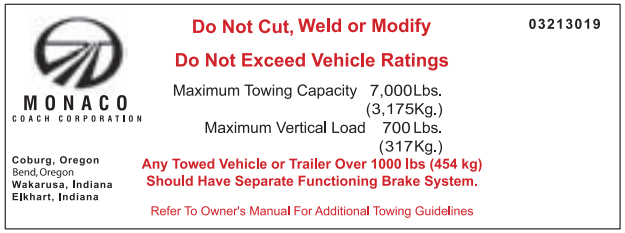
HITCH
Using the Rear Receiver

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 use. Avoid excessive towing loads or other misuse of the receiver. Towing will affect fuel economy.



020065i

Weight pushing down on the rear hitch (tongue weight) must not exceed 10% of maximum tow capacity. It is recommended to weigh the motorhome when fully loaded to ensure proper weight distribution of the GCVW (Gross Combined Vehicle Weight).



100200c

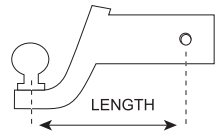
When weighing the motorhome, add all passenger weight to the GCVW total. The motorhome fully loaded, including fresh water, LP-Gas and any vehicle or trailer towed, must not exceed the GCWR (Gross Combined Weight Rating).

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.

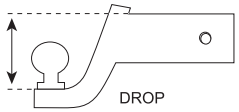
WARNING:
DO NOT tow a trailer or vehicle that exceeds the rated capacity of the hitch receiver. Overloading the hitch receiver can cause unusual handling characteristics and overstress the hitch receiver and chassis. It could also void the warranty. If there are any questions, call customer support.

Ball Mount:

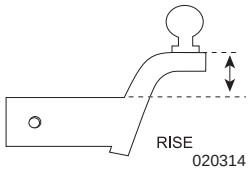
Ball mounts come in various configurations and weight limitations. There are three things to consider when selecting a ball mount: weight rating, pin to ball center length and rise/drop. The weight rating of the ball mount, tongue weight and tow weight must meet or exceed the total load weight.



Distance from the center of the hitch ball hole to the center of the pin hole.



Distance from the shank to the top of the hitch ball platform.



Distance from the top of the shank to the top of the hitch ball platform.

Pin to ball center should not exceed 8". Ball mounts of longer length will significantly reduce the weight rating of the hitch receiver. Observe weight reduction percentages that may be listed on ball mounts longer than 8". Selecting how much rise or drop a ball mount will need is relative to hitch receiver height and height of the towed load with respect to the type of towing equipment between the motorhome and towed load.

Weight Distributing Hitches:

A weight distributing hitch uses spring bars of spring steel to compensate for lack of adequate rear suspension of the tow vehicle. This type of hitch is generally used for towing heavier loads as tongue weight and gross tow weight increases. The spring bars attach to the hitch head assembly and the trailer frame.

Hitch Ball:

The hitch ball is what the trailer attaches to. A hitch ball is available in three common diameters, 1-7/8", 2" and 2-5/16". The larger the diameter of the hitch ball, the higher the weight rating. The diameter of the hitch ball shank also factors into weight rating. Match shank diameter with the hole in the ball mount or weight distributing head. Shank clearance should not exceed 1/16". There should be at least two additional threads extending past the nut when the hitch ball is secure.

Safety Chains:

Safety chains are required by law when towing any load. The chains and any fasteners used to attach the chains to the hitch receiver must be rated for the load being towed. Attach chains so they crisscross under the towing equipment. Allow just enough slack in the chains to make sharp corners. Too much slack will allow the chains to drag on the road surface. If towed load should become uncoupled from the hitch ball, the towing equipment will be cradled by the safety chains. If the towed load does uncouple, do not attempt to make a sudden stop and exacerbate the situation. Apply the brakes with gentle, steady pressure. Pull over to the side of road at a safe location.

Tow Capacity and Class Ratings:

Several components may comprise a tow hitch system. The weight rating of individual components that are part of the towing system must be greater than the gross weight of the load being towed.

Components are classified into weight groups to help define weight capacity of towing equipment. Maximum tow capacity is limited to the component with the lowest weight rating in the tow hitch system. Example: a ball mount may have a weight rating of 5,000 lbs., but the hitch ball is rated 3,500 lbs. Maximum tow capacity is reduced to 3,500 lbs. Many times a component will have a Class weight rating. These groups are shown in chart:

	CLASS I	CLASS II	CLASS III	CLASS IV	CLASS V
Weight Carrying Hitch	TW - Up to 200 lbs.	WC TW - Up to 350 lbs.	TW - Up to 500 lbs.	TW - Up to 750 lbs.	TW - Up to 1,200 lbs.
	GTW - Up to 2,000 lbs.	WC GTW - Up to 3,500 lbs.	GTW - Up to 5,000 lbs.	GTW - Up to 7,500 lbs.	GTW - Up to 12,000 lbs.
Weight Distributing Hitch	---	---	---	TW - Up to 1,200 lbs.	TW - Up to 1,400 lbs.
	---	---	---	GTW - Up to 12,000 lbs.	GTW - Up to 14,000 lbs.

- **GTW** = Gross Trailer Weight. Weight of trailer fully loaded.
- **TW** = Tongue Weight. Weight pushing down on Tow Ball.
- **WC** = Weight Carrying. Weight carrying capacity of the Ball Mount.
- **WD** = Weight Distributing. Weight carrying capacity of a weight distributing hitch.

WARNING:
Be sure the weight ratings of the ball mount, tow ball and safety chains are equal to or greater than the load. 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.

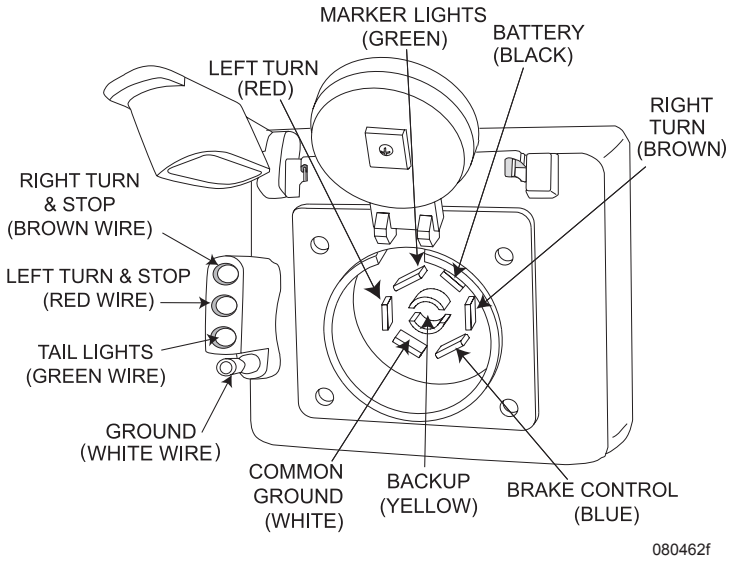
Taillight Configuration:

Taillights come in a 2-wire or 3-wire configuration. A 2-wire configuration has all red lens. A 3-wire configuration usually has red and amber lens. Amber is used for turn signals only and red for taillight and brake light. These systems are electrically different. Whenever hooking a 2-wire system to a 3-wire system, or vice versa, a converter box must be installed for correct taillight function. A taillight converter is available from auto and RV supply stores. **DO NOT** attempt to wire a tow plug connector if unfamiliar with these systems. A trained technician will install the proper converter so the taillights and turn signals work correctly on the motorhome and towed vehicle or trailer when the tow plug connection is made.

Tow Plug Connection

The motorhome is pre-wired from the factory with an electrical connection for towing. The connection is located on the rear cap, near the hitch receiver. Convoluted tubing protects the tow harness wires. Current draw should not exceed 10 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.



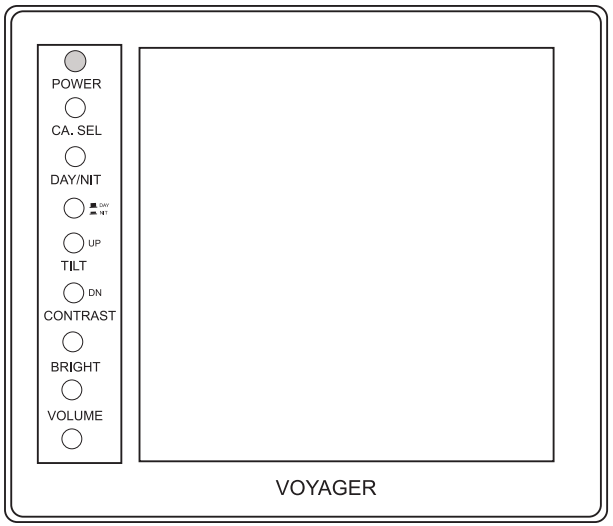
080462f

REAR VISION SYSTEM

The motorhome can be equipped with either a rear camera or optional three camera vision system. The rear vision system consists of a camera and microphone located at the rear of the motorhome. The microphone aids in communication while the camera provides the driver with a rear view. The rear camera is adjustable up and down and is controlled by the driver.

On the optional three camera system, side cameras are located at the front of the motorhome directly above the front wheels and are not adjustable. This system provides the driver with a rear view as well as roadside and curbside views of the motorhome and a microphone for audio communication.

The system may be used while driving in forward, reverse or when parked.



031204c

Features:

- **POWER BUTTON -** Press this button to turn the unit **ON** or **OFF**. Turn the unit **ON** to allow continuous operation of the rear vision system when ignition key is on.

- **CA. SEL. -** Press this button to manually select desired camera (optional three camera system).

- **DAY/NIGHT BUTTON -** Press this button to change setting for daylight (out) or night time (in) driving conditions.

- **TILT UP -** Adjust the rear camera up.

- **TILT DOWN -** Adjust the rear camera down. Optional side cameras are not adjustable.

- **CONTRAST KNOB -** Turn this knob to adjust monitor contrast.

- **BRIGHT KNOB -** Turn this knob to adjust monitor brightness.

- **VOLUME KNOB -** Turn knob to adjust rear microphone volume.

NOTE:
With the engine running, the rear camera will automatically display when the gear selector is placed in reverse.

NOTE:
The optional side cameras will display when a corresponding turn signal is activated. Turning on the hazard lights will display rear camera view.

INFORMATION:
For more detailed instructions, consult the OEM manual or visit the manufacturer's web site at www.asaelectronics.com.

BACKING UP A MOTORHOME

Whether 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, but stay aware of blind spots. Get out and walk the area prior to backing in. 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. Use of walkie-talkies will also aid in guidance.

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 the co-pilot is guiding the driver, five clearly defined signals should be used, with only one signal given at a time. Flailing arms with indecisive signals confuse the driver. Signals should be given with purpose and confidence. Directional signals are directing travel of the rear of the motorhome.

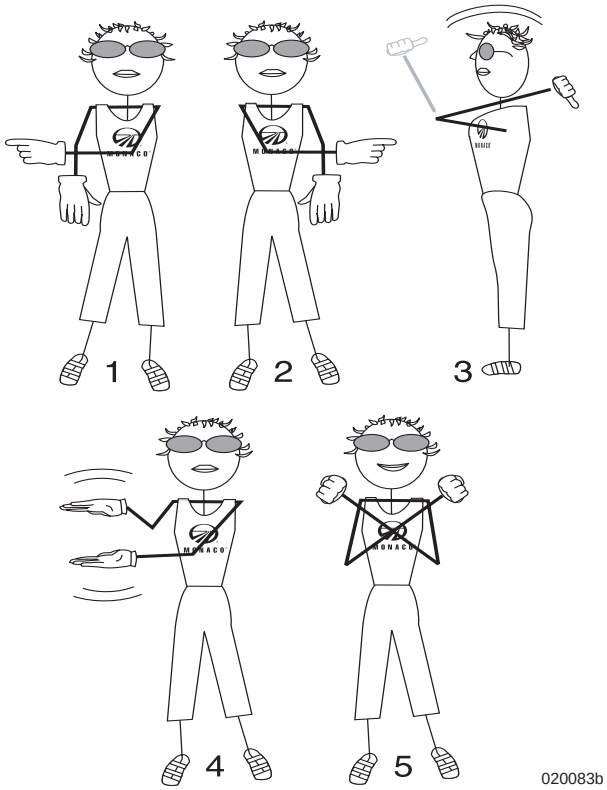
If the desired direction is left, the co-pilot points left. **For example:** The co-pilot will use his/her right arm and forefinger pointing distinctly left with arm and finger held on a horizontal plane, indicating desired direction of travel of the rear of the motorhome. The directional signal given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

Five Directional Signals:

1. Co-pilot uses left hand and arm held horizontal, with forefinger pointing right, to direct rear of motorhome to the right.
2. Co-pilot uses right hand and arm held horizontal, with forefinger pointing left, to direct rear of motorhome to the left.
3. Co-pilot uses 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. Co-pilot holds arms horizontally, hands open with palms facing one another. Start with a wide separation, gradually closing distance of hands in a rate appropriate to vehicle speed to indicate amount of distance to the stop point.
5. Closed fists and crossed arms indicate **STOP**.

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 causing 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, pull 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 PROCEDURES

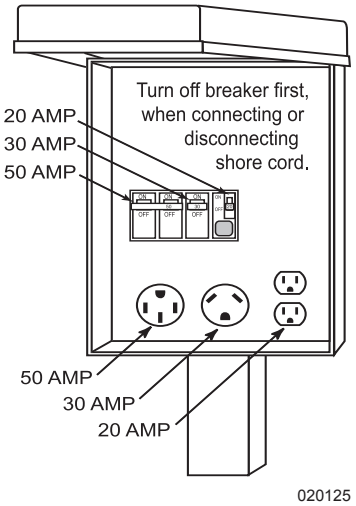
If the site for the motorhome provides full hook-ups, use this quick reference as a guide only. This information is an overview on hooking up the utilities and preparing appliances for use. Specific information on slide room, awning, leveling system, water system, entertainment and LP-Gas operations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

1. Level the motorhome:

- Follow procedures and guidelines for ***“Leveling the Motorhome”*** **in Section 10.** When using the hydraulic jacks confirm that the parking surface will accommodate the weight placed on the jacks.

2. Hook up utilities and prepare appliances for use:

- Open the LP-Gas tank primary valve.
- Prepare the shore cord for connection. Uncoil and **inspect** the cord. 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.
- Begin appliance operation on LP-Gas, if hooked to less than 50 Amp service, for the first 60 minutes. Switch the refrigerator operation to gas, start the water heater and furnace (if needed). This will allow time for the converter or optional inverter to stabilize the battery charging.



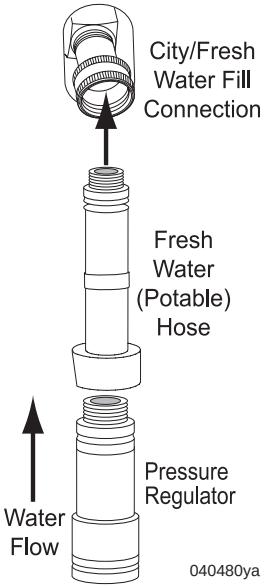
Typical Power Pedestal

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.

CAUTION:
DO NOT remove cover from the 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 any problems with the shore hook-up at the site.

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.

- If cable service is provided, hook-up a 75 Ohm RG59 or RG6 cable to the cable connection in the roadside rear compartment.
- A phone connection port is provided in the roadside rear compartment. Phone utility outlets are placed throughout the motorhome, including a phone line to be attached to a satellite receiver for Pay-Per-View movies and events.
- Hook the potable water hose to the city water connection in the service center.
- 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 (liquid waste drain). The black water valve (solid waste drain) remains closed until the tank is full or until time of departure.



DRY CAMPING

Follow the suggestions below when staying at a location that does not have electrical, water or sewage hook ups. Plan ahead and conserve resources.

Before arriving at the site, ensure batteries are fully charged and properly maintained (**see Section 8 in Batteries - House under "*Battery Maintenance*"**), the fresh water tank and water heater are full and waste holding tanks are empty.

To conserve water and fuel:

- Operate the refrigerator on LP-Gas. Plan what is needed from the refrigerator prior to opening. Conserve LP-Gas by cooking over a campfire.
- Turn the water heater on about twenty minutes prior to use. Once heated, water will remain hot for several hours. Turn the water heater off when not in use.
- Set the thermostat temperature slightly lower than desired to prevent frequent cycling of the heating system.
- Know tank capacities and routinely check fuel levels, especially during cold weather.
- Use ventilation fans to reduce use of the roof air conditioner.
- Frequently monitor water consumption. Limit shower usage; turn water off when soaping down and back on to rinse. When water conservation is critical, take a sponge bath or use campground shower facilities if available. **DO NOT** fill the sink with water to wash only a few dishes. Use disposable dishes when possible.
- Evacuate waste holding tanks prior to filling fresh water tank.

To conserve battery power:

- **DO NOT** allow batteries to fully discharge before operating the generator. If possible, run the generator twice a day, morning and afternoon, to charge the batteries.
- When not using the inverter (optional) for 120 Volts AC, turn it **OFF**.
- Turn **OFF** interior 12 Volt DC power whenever possible. Refrigerator, battery charging and inverter operation will not be affected. Turn **OFF** small battery operated items i.e., porch, bay exterior step, generator and engine compartment lights, etc. Turn **OFF** the antenna boost when not watching TV. One light left on can quickly reduce battery reserves.

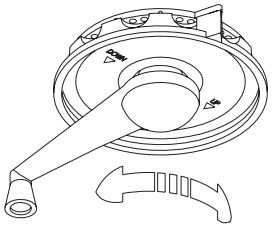
Typical Current Draw	
Battery Cut-out	1.5 Amps
13" TV	1.7 Amps
Rope Light (10 ft.)	1.3 Amps
Porch Light	2.0 Amps
Fluorescent Bulb (1)	2.1 Amps
Halogen Ceiling Light (1)	.09 Amps

- Keep a working flashlight 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.
- Turn on the water pump only when using water.
- If weather does not permit or no outdoor table is available, eat at the dinette table by candlelight.
- Operate the generator when using microwave/convection oven.

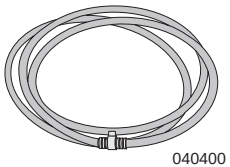
BREAKING CAMP

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 TV antenna.
- Disconnect and stow the telephone line.
- Retract awnings and secure them for travel.
- Close the primary LP-Gas tank valve.
- Connect the sewer hose.
- Drain and flush holding tanks. Start by closing the grey water valve. Run enough cold water down sink and shower drains to fill the grey tank at least 50%. Use caution to avoid overfilling or flooding the grey tank. Open the black tank valve and allow adequate time for black tank to drain. If applicable, connect a non-potable water hose to the "Tank Flush" connection and flush the black tank system. Close black tank valve and open grey water valve. Water from the grey tank will help to flush the drain hose. Once evacuated, close grey water valve. Disconnect the sewer hose and



Screw the ends of the hose together before storage to prevent leakage and to prevent dust and insects from entering the hose.

flush that hose with clean water from a non-potable hose. Store the hose. Replace the sewer cap.
- Fill fresh water tank, then disconnect fresh water hose from the source. Store hose with end cap in place. If applicable, remove the hose protection water pressure regulator from the city water faucet and store.
- Turn shore power breaker off and disconnect shore line. Wind up and store shore cord. Secure door.
- Check all tire pressures.
- Secure all compartment doors.
- **Inspect** tires and wheels.
- Check for fluid leaks under and around the motorhome.

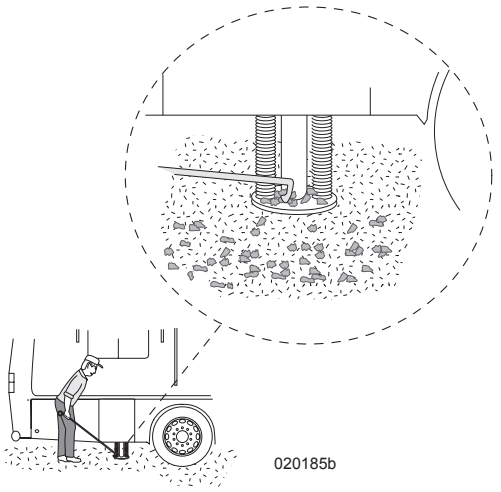
Engine Checklist:
- **Inspect** the engine, transmission and the engine compartment for fluid leaks.
- **Inspect** the area under the motorhome for fluid leaks or puddles.
- **Check all fluid levels:** oil, antifreeze, transmission, hydraulic fluid and washer fluid.
- **Inspect** belts and hoses for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

Interior Checklist:
- If applicable, retract leveling jacks allowing the air suspension to obtain proper ride height.
- Clear the slide room path, clean the floor and move the driver and passenger seats forward. After confirming bay doors are closed, retract the slide room.

NOTE:
To extend/retract the slide-out room, the ignition must be OFF and the park brake set, jacks retracted and the motorhome supported by air suspension. Do not operate the slide out room with the air suspension (air bags) deflated or when supported by hydraulic jacks. Damage to the slide out room, mechanism or seals can occur. Confirm the house batteries are fully charged.

- 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.
- Turn off 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 ensure 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.
- Outside compartment doors should be closed and locked.
- Check operation of all exterior lights, headlamp, taillamp, brake and clearance lights.
- Secure all awning and travel locks.
- Ensure jack pad is clear of debris when retracting hydraulic jacks. Loose rocks, gravel and debris can be thrown from the jack pad and can possibly damage the tow car.



- Secure and lock the entry door for travel.
- Pull forward out of the campsite. Ensure the site is clean and no items are forgotten.

EMERGENCY ROADSIDE PROCEDURES

If an emergency situation occurs use the appropriate braking technique and pull off the roadway a safe distance from traffic (if possible). Set the parking brake and turn on the hazard warning flashers, especially when parked alongside traffic lanes. In the event of an emergency stop due to a mechanical breakdown or other motorhome related problems, contact the manufacturer's customer support or an emergency service provider.

Road flares or reflective warning signs should be displayed if the motorhome is on the side of the road for any length of time. Guidelines for placing warning triangles depend upon the road characteristics and visibility. **For example:** The standard placement is 10, 100 and 200 ft. 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 is required at the front of the motorhome. Roads with curves and hills may require the placement of the last/furthest triangle to be 500 ft. behind the motorhome in order to safely warn approaching traffic.

In Case of Flat Tire


070175

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.

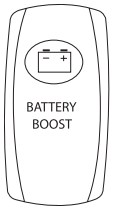
WARNING:
Do not crawl under the motorhome for any reason if a wheel has been removed. Any number of circumstances could cause the motorhome to suddenly fall, resulting in severe injury or death.

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, there are electrical back-up systems in place that may increase chassis battery voltage.

Battery Boost Switch:

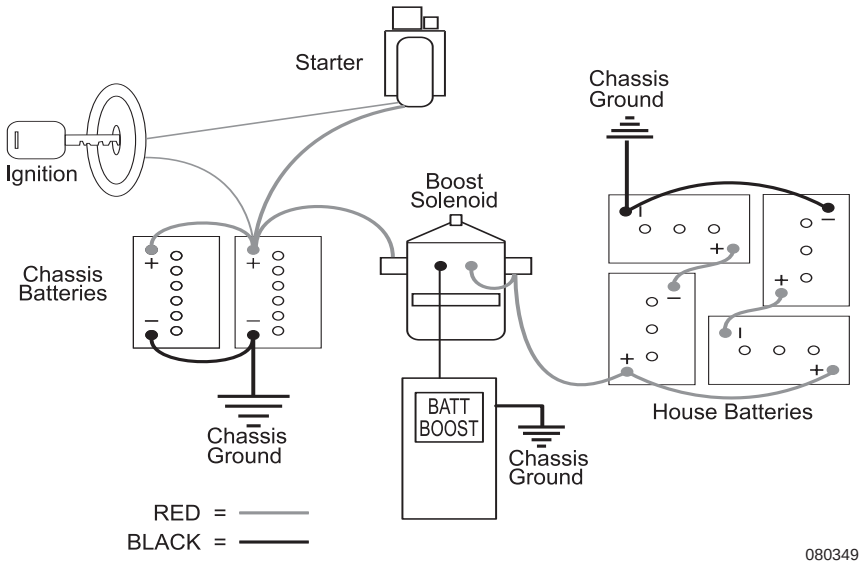
The Battery Boost switch engages a heavy-duty solenoid to electrically connect the house batteries to the engine battery in the event the engine will not crank or cranks slowly. The solenoid is designed for short-term high current intermittent use. Engaging the boost solenoid for an extended period will damage the solenoid.



080384f

Located on Driver Console

EMERGENCY SERVICE PROVIDER		
Equipment	**Provider**	**Emergency Number**
Motorhome: Monaco	Monaco Customer Support	1-877-466-6226
Chassis: Roadmaster	Roadmaster	1-877-466-6226
Engine: Cummins	Cummins Customer Assistance Center	1-800-343-7357
Transmission	Allison Transmission	1-800-524-2303
Towing	Owner's Advantage Program	1-877-882-0614
Tires: Goodyear	Goodyear	1-877-484-7376



080349

Jump Starting Using Battery Boost Switch:

- With 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 ignition.
- 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 engine battery. Once the generator is operating, the electrical combination of the generator and the inverter will charge the batteries.
- Allow the generator to run approximately ½ hour before attempting to start the engine.
- After ½ hour of generator operation, leave the generator on and hold down the Battery Boost switch for one minute. Release the switch for one minute, then press the switch again for one minute. Alternate this cycle three to five 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.

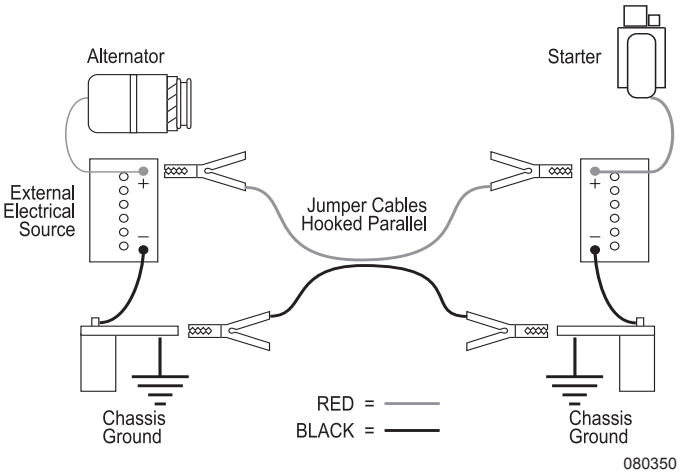
Jump Starting Using an External Source:

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:
Always ventilate the battery compartment prior to any work or service to the batteries. Gas emitted by the batteries can explode when exposed to smoking material, 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. Connect only to the chassis, away from the battery.

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. Wait a sufficient amount of time for a surface charge to build before attempting to start the engine. Voltage fluctuations that occur during a jump-start procedure can damage sensitive electronic equipment and charging systems. 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:
DO NOT use the towed vehicle for jump-starting. The charging system of the towed vehicle does not supply the amperage necessary to jump-start the motorhome. Voltage sensitive equipment on the towed vehicle can be damaged and render the towed vehicle disabled.



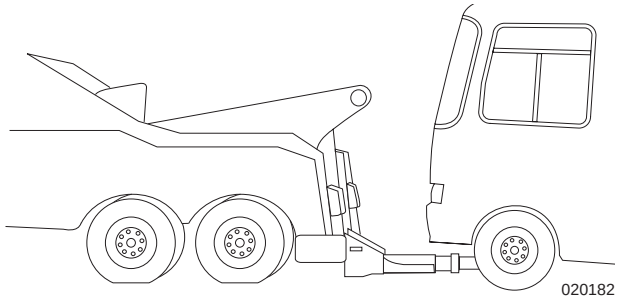
1. When using an external electrical source to connect to the chassis battery, turn the main battery disconnect switches **OFF** prior to hooking up the jumper cables.
2. Hook up the cables then wait several minutes to allow a surface charge to build in the chassis battery before attempting to start 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 starts, 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.

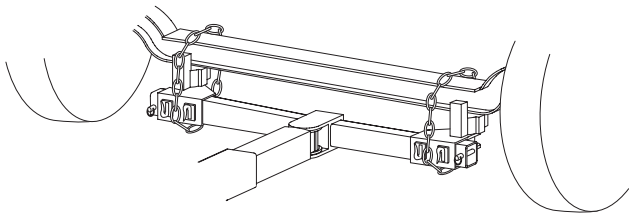
TOWING PROCEDURES

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 to tow the motorhome and to tow a trailer or tow vehicle if it is not operational.

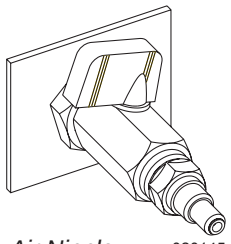


020182



020183

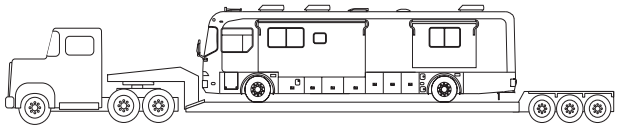
The towing company may need to locate the air nipple to release the air brakes. The air nipple is located in the front generator compartment and should be used by towing personnel only. Generally, if the motorhome ever needs to be towed, use the following instructions.



020145

Air Nipple: Located in the front generator compartment.

- 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.



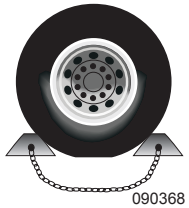
020228b

- 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.
- 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 a towing company.

Disabling Parking Brake

The park/emergency brakes apply to the drive axle only. The brakes can manually release 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.



090368

Example of a properly chocked wheel.

WARNING:
Only trained personnel should perform this procedure. Brake chamber spring is under high pressure. Removal of retaining band could result in serious injury or death.

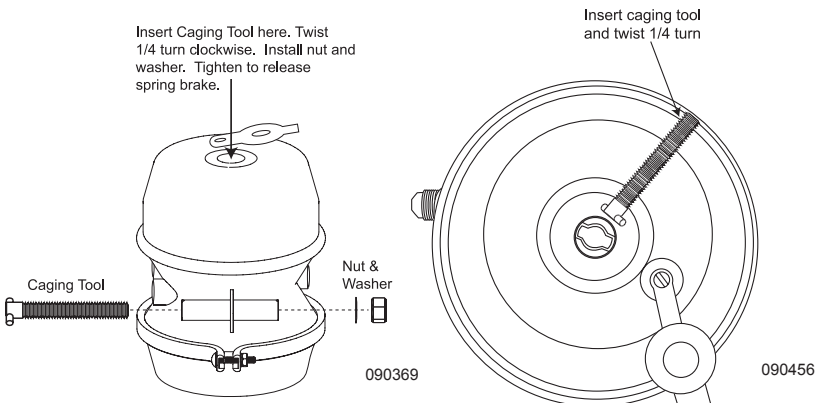
Disabling Brakes:

- 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.

Enabling Brakes:

- 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.

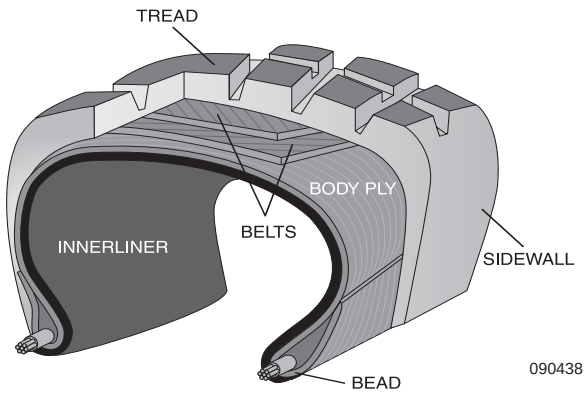
WARNING:
Failure to securely chock the wheels can result in the motorhome rolling when the spring brakes are released. Severe injury or death can occur.



Brake Camber

TIRES

Maintaining proper tire inflation pressure is one of the most critical aspects of travel. Improper pressure will lead to abnormal wear and/or sudden tire failure. All tire positions must be weighed separately with the motorhome fully loaded to determine proper tire inflation pressure. If one tire position on the axle is heavier than the other side, inflate both sides according to the heaviest side. This will provide correct air pressure across the axle while cornering. To obtain the maximum wear and best service from tires, it is helpful to understand their components and functions.



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:** Provides 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 a tire without 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 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 is susceptible 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.

Tires on 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.

NOTE:
The motorhome is equipped with Goodyear 255/70R/22.5 G670 RV Unisteel, Load Range H, radial tires at the time of printing. The motorhome manufacturer will not be responsible for substitution of an incorrect tire size or load range. Verify actual tire brand, size and load range before obtaining replacement tires.

Tire Chart

Understanding the Inflation Table:

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

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

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

WARNING:
DO NOT exceed tire manufacturer's maximum speed rating.

Goodyear Tire Chart

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 D	2410 2350	2540 2460	2680 2610	2835 2755	2955 2865	3075 2975	3195 3085	3305 3195	3415 3305	**3525(F)** **3415(F)**			
225/70R19.5	75	S D		2895 2720	3040 2860	3195 3000	3315 3115	3450 3245	**3640(F)** **3415(F)**	3715 3490	3845 3615	**3970(G)** **3750(G)**			
245/70R19.5	75	S D		3640 3415	3740 3515	3890 3655	**4080(F)** **3970(F)**	4190 4115	4335 4265	**4540(G)** **4410(G)**					
265/70R19.5	75	S D				3970 3750	4180 3930	4355 4095	4540 4300	4685 4405	4850 4560	5070 4805	5170 4860	**5355(G)** **5070(G)**	
9R22.5	75	S D		3370 3270	3560 3410	3730 3550	3890 3690	4080 3860	4235 4005	4390 4150	**4540(F)** **4300(F)**				
10R22.5	65	S D		4080 3860	4280 4045	4480 4230	4675 4410	4850 4585	5025 4760	**5205(F)** **4940(F)**	5360 5075	5515 5210	**5675(G)** **5355(G)**		
11R22.5	75	S D		4530 4380	4770 4580	4990 4760	5220 4950	5510 5205	5730 5415	5950 5625	**6175(G)** **5840(G)**	6320 5895	6465 5950	**6610(H)** **6005(H)**	
12R22.5	75	S D		4940 4780	5200 4990	5450 5190	5690 5390	6005 5675	6205 5785	6405 5895	6610 6005	6870 6265	7130 6525	**7390(H)** **6780(H)**	
245/75R22.5	75	S D		3470 3260	3645 3425	3860 3640	3980 3740	4140 3890	4300 4080	4455 4190	4610 4335	**4675(G)** **4410(G)**			
255/70R22.5	75	S D				4190 3970	4370 4110	4550 4275	4675 4410	4895 4455	5065 4610	5205 4675	5400 4915	**5510(H)** **5070(H)**	
265/75R22.5	75	S D		3875 3870	4070 4040	4255 4205	4440 4370	4620 4525	4800 4685	4975 **4805(G)**	5150	**5205(G)**			
275/70R22.5	75	S D					5170 4770	5400 4980	5630 5180	5850 5390	6070 5590	6290 5800	6510 6000	6730 6200	**6940(H)** **6395(H)**
275/80R22.5	75	S D						5500 5080	5745 5305	5985 5530	6225 5750	6460 5965	6700 6185	6930 6400	**7160(H)** **6610(H)**
295/75R22.5	75	S D			4725 4690	4940 4885	5155 5070	5370 5260	5510 5440	5780 **5675(G)**	5980 5800	**6175(G)** **6005(H)**	6370	**6610(H)**	
295/80R22.5	75	S D				5480 4855	5750 5100	6020 5335	6285 5570	6550 5805	6810 6035	7070 6265	7320 6490	7580 6720	**7830(H)** **6490(H)**
315/80R22.5	75	S D					6415 5840	6670 6070	6940 6395	7190 6540	7440 6770	7610 6940	7920 7210	**8270(J)** **7610(J)**	
11R24.5	75	S D				5310 5070	5550 5260	5840 5510	6095 5675	6350 5840	**6610(G)** **6005(G)**	6790 6205	6970 6405	**7160(H)** **6610(H)**	
285/75R24.5	75	S D			4770 4740	4990 4930	5210 5205	5420 5310	5675 5495	5835 **5675(G)**	6040	**6175(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 is not responsible for the accuracy of the information disclosed or for any errors within the Tire Inflation Chart. ***WARNING: Do not exceed tire manufacturer's maximum speed rating.***

Inspecting & Pressure

Weigh all tire positions seperately and use the tire charts to determine correct tire inflation pressures. 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. Check tire inflation pressure every morning before driving. Use a quality truck tire gauge with an angle airhead to ensure access to 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 good quality reinforced stainless steel braid. Attach hoses securely to the outer wheel.

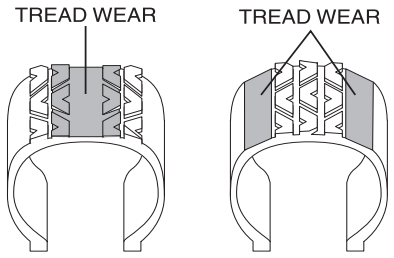
The valve stem cap guarantees the valve core will remain free of dirt and foreign material. Material lodged between the valve core and internal stem can cause slow leaks resulting in tire failure.

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 bind and mechanical damage to the drive train.

CAUTION:
Never let air out of a hot tire.

Over-inflation can cause:
- Hard ride.
- Tire bruising or carcass damage.
- Rapid tread wear in the center of the tire.

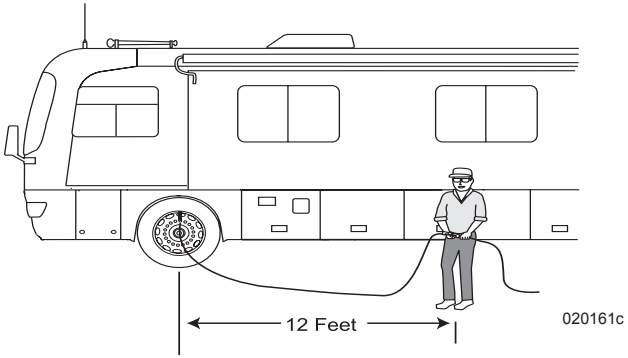
Under-inflation can cause:
- Tire squeal on turns.
- Separations.
- Rapid and uneven wear on the edges of the tread.
- Circumferential breaks.
- Tire container may bruise or rupture.
- Higher risk of road hazard.
- Tire cord breakage.
- Loss of casing durability.
- Excessive tire temperature.
- High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



WARNING:
A slow leak may go unnoticed on one of the dual tires. This can cause the good tire to fail by exceeding the load limit. 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. 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. DO NOT 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. Recheck the pressure with the tire gauge.
6. Replace the valve cap.
7. Repeat with each tire.
8. Visually **inspect** all the tires for nails or other objects that could be embedded or puncture the tire and cause an air leak.
9. Check the sidewalls for gouges, cuts, bulges, or other irregularities.

NOTE:
Air pressure in a tire increases (warm weather) or decreases (cold weather) one to two pounds for every 10° F. of temperature change.

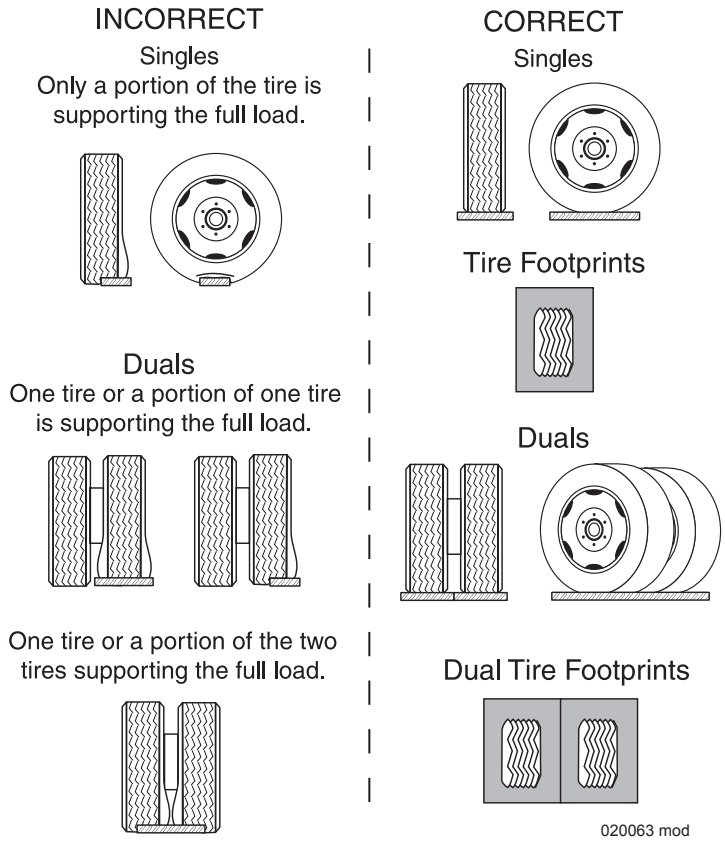
Tire Support When Leveling

Extreme caution must be taken to ensure 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 the tires prevents damage to the sidewall of the tires, but does not prevent tire roll.

Tire "Support" Methods



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 indicators that look like narrow strips of smooth rubber across the tread, appear on the tire when the tread is worn down to 2/32". The tire should be replaced when wear indicators appear.

Visually check tires for signs of uneven wear. Irregular tread wear is 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 determined by age rather than mileage. Tires are subject to weathering. Weathering cracks run in circumference with the tire. Though the sidewall of the tire may look structurally sound, weathering can occur inside the well of the tread. 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.

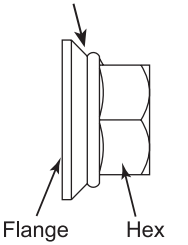
WHEEL MOUNTING

Hub Piloted Mounting:
- 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.

NOTE:
Loosen and tighten lug nuts in sequence (see illustration). Sequence tighten to 50 ft. lbs. first, then sequence tighten to 500 ft. lbs. Over-tightening can cause distortion.

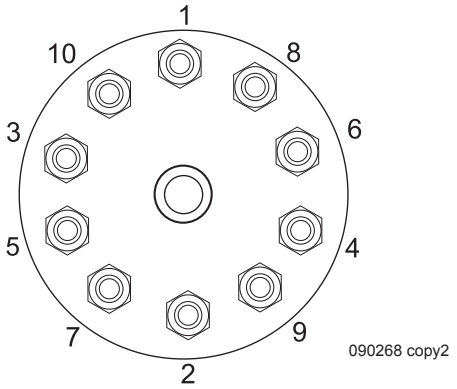
WARNING:
Never use wheels or lug nuts different than the original equipment as this could damage the wheel or the mounting system. Damage to the wheel or mounting system could cause a wheel to come off while the motorhome is in motion.

For used nuts add two drops of oil between flange and hex.



Flange Nut: Front & Side View.

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 500 ft. lbs. in sequence (as in illustration).



Nut Tightening Sequence

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 500 ft. lbs. in sequence (as in illustration).

The hub mount wheels use two-piece flange cap nuts for both front and rear applications. No inner cap nuts are required.

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 mile 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 air wrench output and adjust 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 in this section 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 is 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 weigh 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 weigh the motorhome to calculate **Cargo Carrying Capacity (CCC)** and 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 **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 motorhome, 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** is 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.

Two important factors to consider when loading the motorhome are 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 pounds.

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 weigh 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:
The most accurate method to determine proper tire pressure is to weigh each wheel position independently. Weighing the entire axle will not accurately determine the total weight carried by that wheel position. When calculating the drive axle dual position, divide the total weight by two to determine the weight carried by each tire.

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.

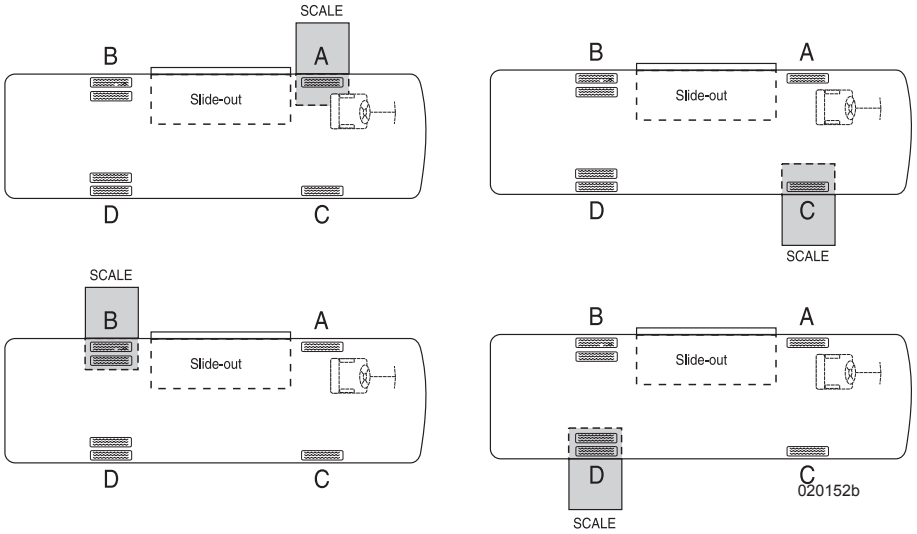
(*1) Towing capacity is limited by GCWR; your vehicle's towing capacity is the difference between the GCWR and the actual vehicle weight; including all water, fuel, passengers, and cargo. Consult your Owner's Manual for further information.
(*2) Your motorhome's fresh water tank and water heater taken together determine the gross fresh water capacity. Your usuable fresh water capacity, however, may be less.
(*3) Dealer installed equipment and towed vehicle tongue weight will reduce CCC.

100179d

Four Corner 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.



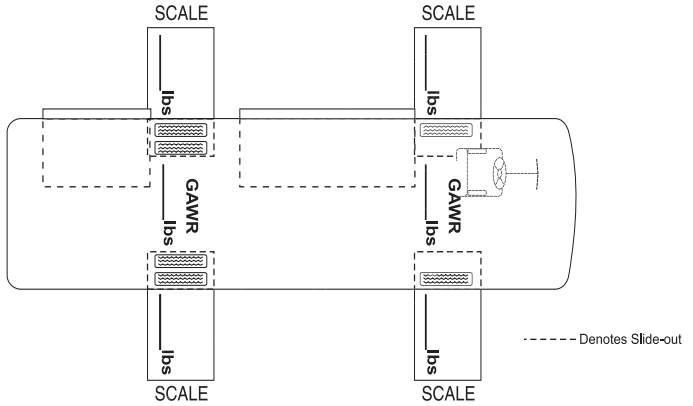
WARNING :
Improperly inflated or overloaded tires can cause a blowout. An overloaded axle can cause a component failure of the suspension system. Tire blowout or broken suspension components can lead to loss of vehicle control resulting in property damage, personal injury or death.

- Take the rear axle **Gross Axle Weight Rating (GAWR)** and divide it by two. Example: Rear axle **GAWR** taken from the motorhome Vehicle Certification Label is 14,500 lbs. Divide the figure by 2, using chart below, record 7,250 lbs. on Scale B and D, line 1.
- Weigh the driver side rear corner (Scale B) and record weight on chart Scale B, line 2. Example: 4,400 lbs.
- Weigh the passenger side rear corner (Scale D) and record weight on chart Scale D, line 2. Example: 4,100 lbs.
- Add chart Scale B and D, lines 1, for **Gross Axle Weight Rating (GAWR)** and record on chart under Totals. Example: 14,500 lbs.
- Add chart Scale B and D, lines 2, for actual **Gross Axle Weight (GAW)** and record on chart under Totals. Example: 8,500 lbs.
- **Actual Gross Axle Weight (GAW)**. Example: 8,500 lbs., is not to exceed **Gross Axle Weight Rating (GAWR)**. Example: 14,500 lbs.
- Refer to the Example Tire Chart (Tire size 255/70R22.5). Use the highest actual weight, Scale B or D, line 2. Example 4,400 lbs. Determine the proper tire pressure for each tire using the Load Inflation chart. Example: 95 psi or stamp on the sidewall of the tire.
- Repeat above procedures to determine front axle Scale A and C, tire pressures.

	ROADSIDE		CURBSIDE		TOTAL AXLE WEIGHT	GROSS AXLE WEIGHT RATING GAWR	GAWR Minus Total Axle Weight
FRONT AXLE	1. 4,000	+	4,000	=	8,000		
	2.(A) 3,000		(C) 2,800		5,800	8,000	2,200
DRIVE AXLE	1. 7,250	+	7,250	=	14,500		
	2.(B) 4,400		(D) 4,100		+ 8,500	+ 14,500	6,000
			Total Axle Weight		= 14,300 UVW	= 22,500 GVWR	= 8,200 CCC

020255b conv

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



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.

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 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**.

GVWR 22,500 - UVW 14,300
= A 8,200

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.

A 8,200 - 581 = B 7,619

B 7,619 - 100.8 = C 7,518.2

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. (70kg) is the average weight established by the U.S. 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 weigh 200, 200, 178 and 138 lbs., totaling 716 lbs., that doesn't mean the sleeping capacity is reduced to three individuals, but rather the CCC is reduced by 100 lbs. due to the actual passenger weight.

C 7,518.2 - SCWR 770 = CCC 6,748.2

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 for weighing 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 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

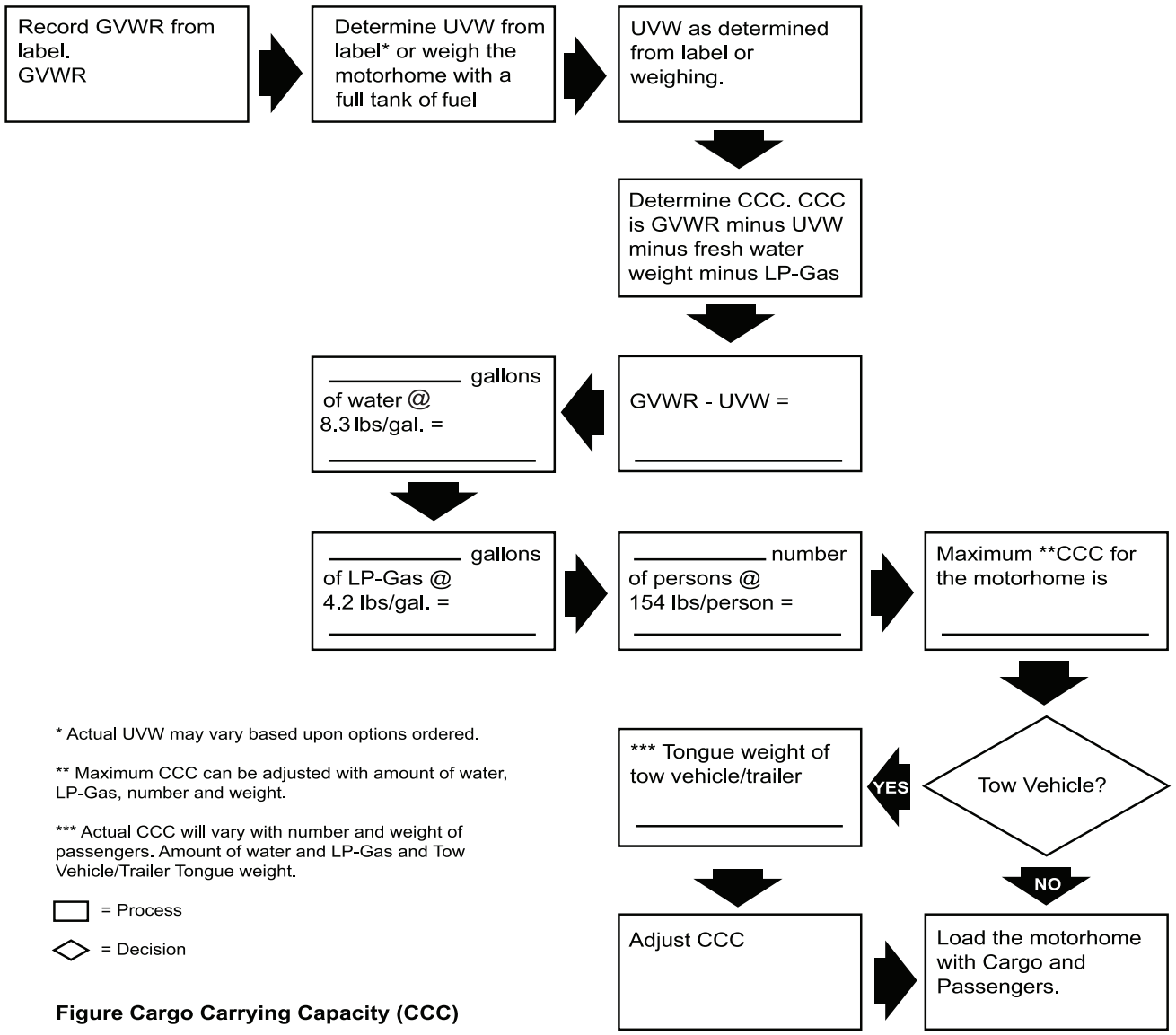


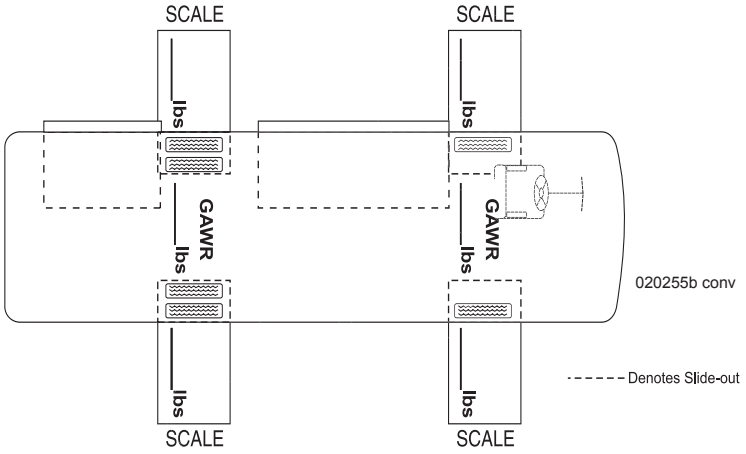
Figure Cargo Carrying Capacity (CCC)

Weighing Procedure Worksheet

Example Worksheet

	ROADSIDE		CURBSIDE		TOTAL AXLE WEIGHT	GROSS AXLE WEIGHT RATING GAWR	GAWR Minus Total Axle Weight
FRONT AXLE	1. 4,000	+	4,000	=	8,000	8,000	2,200
	2.(A) 3,000		(C) 2,800		5,800		
DRIVE AXLE	1. 7,250	+	7,250	=	14,500	+ 14,500	6,000
	2.(B) 4,400		(D) 4,100		+ 8,500		
			Total Axle Weight		= 14,300 UVW	= 22,500 GVWR	= 8,200 CCC

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



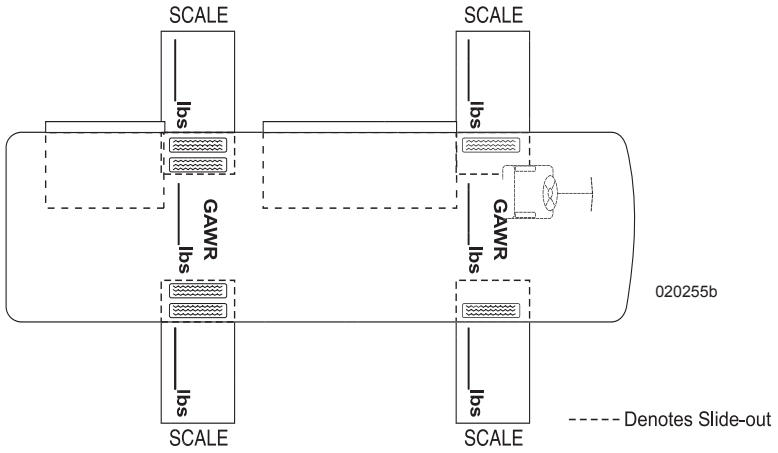
	FORMULA	UVW CAPACITY		CCC
FRESH WATER	Subtract Gallon @ 8.3 lbs/gal	60 X 8.3 = 498	-	7,702
WATER HEATER	Subtract Gallon @ 8.3 lbs/gal	10 X 8.3 = 83	-	7,619
LP-GAS	Subtract Gallon @ 4.2 lbs/gal	24 X 4.2 = 100.8	-	7,518.2
SLEEP CARRYING WEIGHT RATING	Subtract Persons @ 154 lbs/person	5 X 154 = 770	-	6,748.2
		Maximum Cargo Carrying Capacity CCC		6,748.2

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.



	FORMULA	UVW CAPACITY		CCC
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).

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: ____________________

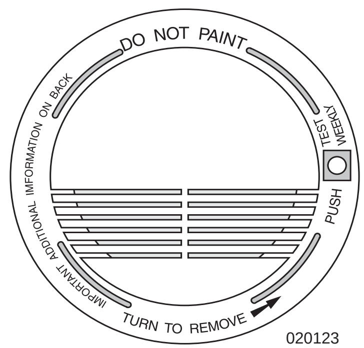
FRONT: ________ + ________ = ________
LEFT RIGHT TOTAL

REAR: ________ + ________ = ________
LEFT RIGHT TOTAL

= ________
TOTAL GROSS VEHICLE WEIGHT

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 automatically returns from alarm to normal state when the reason for activation, 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.



Located on main living area ceiling

<u>WARNING:</u>
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 LED flashes every minute and a loud alarm will sound when a production of combustion is sensed.

<u>NOTE:</u>
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

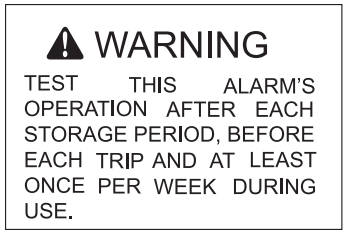
Simply press the test button on the smoke alarm cover for approximately three seconds. The alarm will sound if all electronic circuitry, horn and battery are working properly. The smoke alarm should be tested at least once a week when the motorhome is in use, prior to each trip and when the motorhome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

<u>CAUTION:</u>
Never use an open flame to test the smoke alarm as this may ignite the alarm or surrounding area and set fire to the motorhome.

Maintenance

Maintenance for Proper Operation:

- 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 after the unit has been vacuumed.
- The smoke alarm will beep once a minute when a low battery exists. Replace battery immediately.



020155e

Troubleshooting

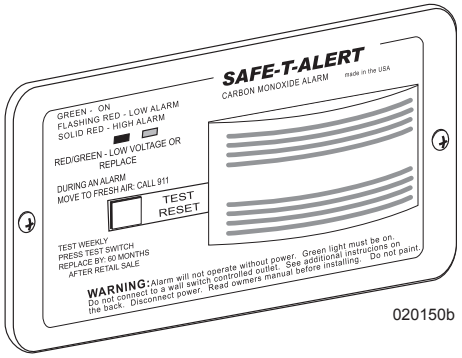
If the alarm does not sound when the test button is pushed, or with a smoke test, try the following:

- **Inspect** alarm 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 RV's 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."*



020150b

Located in bedroom

The motorhome is equipped with 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 Carbon Monoxide is expelled through the lungs. Level of contamination in the body reduces at 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 include the elderly and those 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, produce CO Gas. Consequently, it is uncommon for household smoke from cigarettes or normal cooking to cause the alarm to sound.

CAUTION:
Activation of this device indicates the presence of Carbon Monoxide (CO), which can be fatal. A concentration of above 100 PPM will cause a warning condition. Individuals with medical problems may consider using detection devices with lower Carbon Monoxide alarming capabilities. Prolonged exposure to the horn at a close distance may be harmful to hearing.

WARNING:
Constant beeping and a flashing red light means CO gas has been detected. Shut off appliances, motorhome engine, and water heater. Evacuate the motorhome and call the fire department. Have any problems corrected before restarting any appliances or the coach.

The CO detector is wired to the house batteries. This allows reliable protection by alerting the build up of potentially dangerous levels of Carbon Monoxide. Once powered, the detector will run through a brief warm-up and shelf check prior to monitoring for CO gas.

WARNING:
If the motorhome is unplugged from shore power, the house battery disconnect switch must be ON for the CO detector to operate.

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 will not sound.
- Flashing **red** indicates low CO alarm condition along with **four** beeps then **OFF** for five seconds. The alarm will sound and can be reset by the **TEST/ RESET** button. The CO detector has detected the presence of 60 ppm.
- Steady **red** indicates a **CO ALARM** condition. The detector has sensed the presence of levels over 100 ppm of Carbon Monoxide. The alarm will sound continuously until the **RESET** switch is reset.
- Alternating **red** and **green** indicates a malfunctioning alarm.

Alarm

If 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 in the motorhome:

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

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 by holding the **TEST/RESET** button in until the alarm sounds four beeps and the indicator lamp is steady **red**. Six seconds later the alarm will again beep four times and the indicator light goes steady **green**.

> ⚠ WARNING
> TEST THIS ALARM'S OPERATION AFTER EACH STORAGE PERIOD, BEFORE EACH TRIP AND AT LEAST ONCE PER WEEK DURING USE.

020155e

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 **one 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 recommend that the Carbon Monoxide detector be replaced every five 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**.

INSPECTION:
Test 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 printed on the fire extinguisher. If there is any doubt on how to operate the fire extinguisher practice using it.

Replace or recharge the extinguisher immediately after use. Inspect the fire extinguisher at least once a month. Inspect 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.

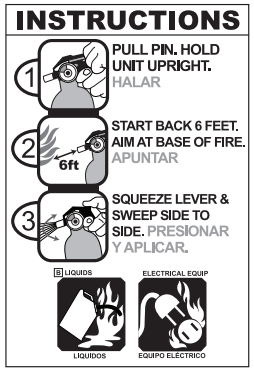
Use the PASS method:

Pull the pin. Hold extinguisher upright.

Aim at the base (bottom) of the fire and stand six feet away.

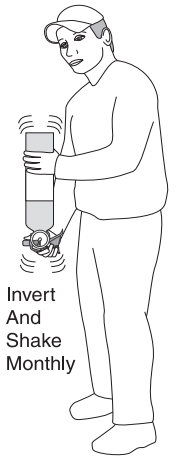
Squeeze the lever to discharge the agent.

Sweep the spray side to side until fire is totally extinguished.



020283b

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



020261

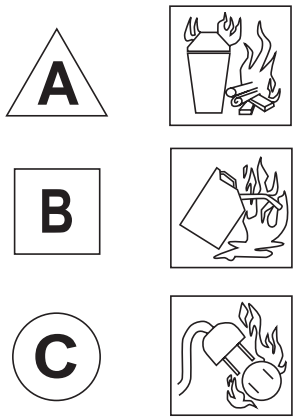
Three classes of fire can occur in a motorhome. Any fire can fall into more than one class; a fire that involves both burning paper and kitchen grease is a Class AB fire.

Classes of Fire:

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

B - Fires 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.

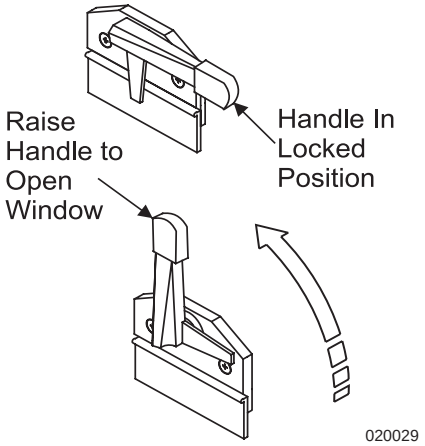


100209

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.



Egress Window Handle

EXTERIOR & INTERIOR CARE - INTRODUCTION

Section 3 covers basic cleaning and care of items and materials found in the motorhome. Due to variations in options and floor plans, some items and materials discussed in this section will not apply to all motorhomes.

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 from corrosive materials collected on 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:
Use 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 (preferred) specifically designed automotive detergents. Avoid 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 brushes as they can scratch the surface and damage the paint. Before washing the motorhome, remove most of the accumulated dirt and road wash 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 working 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, 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

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, 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. They are applied either by hand or by using a polisher with a special pad.

Waxes - Waxes come in many types of chemical make-up. Most contain cleaning agents, lubricants and wax. Cleaning agents remove oxidation and leave a high gloss, and wax leaves a clear film that protects the finish

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

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 types of 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 to check 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 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 color scheme is comprised of specific paint colors, each assigned a code used to achieve a desired color of paint. "Touch-up" paint may be used to repair a small scratch or imperfection in the paint surface. To paint a larger area, it is necessary to obtain the paint code to get the correct color match.

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. This formula can be mixed at a local BASF paint store.

NOTE:
All special paint schemes require contacting Monaco Coach directly for paint codes.

Tire Care

Proper care and methods in cleaning must be used to obtain the maximum service years out of the tires. 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 motorhome 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.

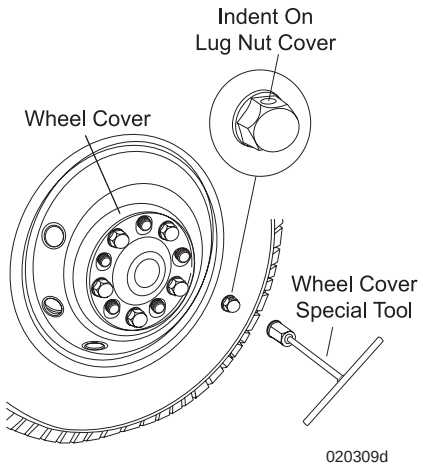
NOTE:
When applying chemicals to remove road tar, use only automotive products that are recommended for painted surfaces and fiberglass. Observe the warning recommendations and directions printed on the container.

Care & Maintenance of Wheel Covers

Clean the wheel covers frequently with high pressure water from a hose using a mild detergent. Do not use harsh alkalis, alcohol or acidic cleansers. A secondary hand washing with a soft cloth may be required to remove stubborn road grime. To remove the wheel covers from the wheel for a thorough cleaning use the special tool that was included with the motorhome. Each wheel cover is secured by lug covers identified by indent or notch markings. When the wheel covers are removed tires and rims can be cleaned and inspected.

Remove dirt, corrosion or any foreign material from the tire side of the rim using a wire brush. Do not use a wire brush or other abrasive substances to remove dirt and corrosion from the wheel covers. To maintain the original appearance of the wheel covers the following procedures are recommended:

1. After reinstalling wheel covers (prior to operating the motorhome) use a sponge, cloth or soft fiber brush to wash the exposed wheel surfaces with a mild detergent/warm water solution.
2. Rinse thoroughly with clean water.
3. Wipe dry to avoid water spots.
4. Use a high quality, non-abrasive polish to remove stubborn road tars, insects or hard to remove deposits.
5. To protect the surface appearance on wheel covers, wax the cleaned surface with a high quality car wax.
6. Clean the wheel covers frequently to maintain their appearance.



EXTERIOR MAINTENANCE

The motorhome is exposed to extreme temperatures, humidity, ultraviolet rays, rain and other 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 not only to keep the exterior looking nice, but also to keep it 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 cloth weave threatens the integrity of the fiberglass. If the exterior exhibits signs of damage, prevent moisture penetration, particularly in freezing climates. Cover the area using plastic sheeting and/or tape, and have the damaged fiberglass repaired as soon as possible.

Roof Care & Seal Inspections

Wherever there is something affixed to the motorhome, such as the “beltline” or vent attached on the roof, there is a seal preventing water intrusion. There are many types of sealants and each has a specific use. While the beltline uses a silicone or urethane base sealant to prevent water intrusion, roof openings use an acrylic based sealant. Moisture intrusion can occur at any time for a number of reasons.

Therefore, regular sealant inspection and maintenance will greatly reduce the likelihood of moisture intrusion and costly repairs.

The motorhome is sealed at the factory. However, extreme weather conditions can shorten the life of the sealant while harsh road conditions can compromise sealant integrity. Maintaining sealant integrity is part of regular motorhome maintenance. Inspect all joints, seams and openings at least once every six months. While sealant integrity may appear fine, a small void under the right conditions can quickly cause major damage. Make a full interior inspection for signs of moisture intrusion every two weeks if the motorhome is in storage.

CAUTION:
Inspect exterior seals, seams and joints for sealant integrity at least twice a year. Make a full interior inspection for water leaks every two weeks while the motorhome is in storage.

WARNING:
Inspecting sealant will require use of a ladder or scaffold assembly. Roof access is also required. Follow proper safety measures accordingly. Exercise extreme care whenever using a ladder/ scaffold assembly. Avoid getting on the roof if it is icy or moisture laden as the surface can be very slick. Use judgment if inspection is considered dangerous. Have the motorhome inspected or sealed (if necessary) by a qualified service technician.

INSPECTION:
Surface must be clean and dry. Inspect seal for voids, cracks, bubbling, peeling or pulling away. Sealant that looks fine without imperfections is acceptable for continued service. Sealant that is old, cracking, flaking or bubbling will allow moisture intrusion and must be repaired.

Sealant Replacement:

Carefully remove sealant that is cracking, flaking, bubbling, peeling or pulling away from the surface. The area under the removed sealant will need to be clean and dry before applying new sealant. Applying new sealant over a dirty or moisture laden surface will not allow proper adhesion. Sealant application may require simple hand tools and paper towels or rags for cleanup. Some sealants may be labeled hazardous or require chemicals for cleanup. Follow all of the manufacturer's warnings and precautions when dealing with these substances.

WARNING:
Some sealants may be labeled hazardous or require use of petroleum distillates for cleanup. Use proper precautions as suggested by the sealant or chemical manufacturer. Use of protective eye wear, gloves, respirator or open ventilation may be required. Use judgment when working with chemicals. If health limits exposure to chemicals or inhibits skills or abilities, employ a qualified service technician to perform the tasks.

Sealant Types

General Maintenance – Roof: Rubber Sealant: Dolphin #7589 UVR Elastiseal

This product is used for large roof openings such as around vents, skylights, any roof mounted antennas and ladder roof mounts. Clean the old sealant that is lifting before applying the new. Make sure the roof is dry and free of dirt. This product is found in a tub container. Care should be used when near an edge, as the product will spread out. Masking tape may be used to mask around area to avoid mishaps.

WARNING:
This product is flammable and if swallowed, can be fatal. Use only in well-ventilated areas. Consult manufacturer data for application and safety instructions.

For small areas of maintenance various rubber sealants are available in a tube. These products are available at RV supply locations.

General Maintenance – Roof Air Conditioner:

Roof air conditioners use a closed cell foam base gasket. No sealants are required. The roof air conditioners should be checked for tightness by the four mounting bolts located in each interior corner of the air conditioner roof opening. Torque specification is 40 to 50 in/lbs. The base gasket should be compressed to about ½".

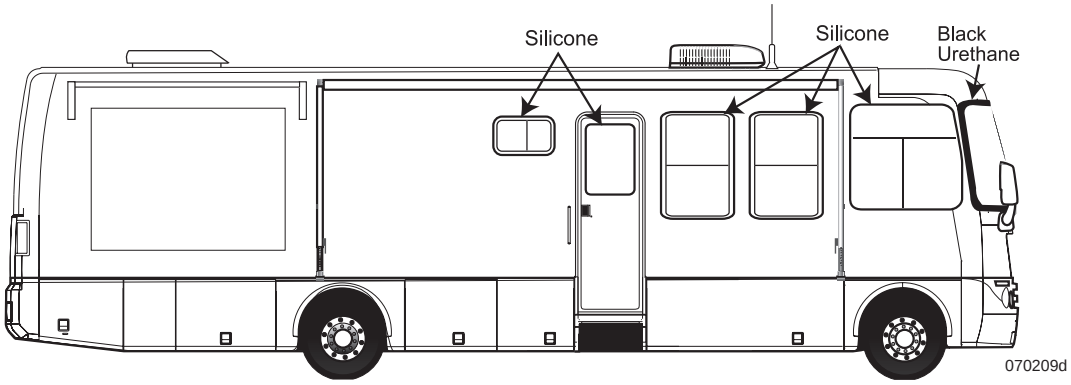
General Maintenance – Windshield: Black Silicone Sealant: Dow Corning #999 - A Black

Used for sealing small areas or imperfections around windshields. The product is available in a tube. Clean up using solvents such as mineral spirits. Consult manufacturer data for application and safety instructions.

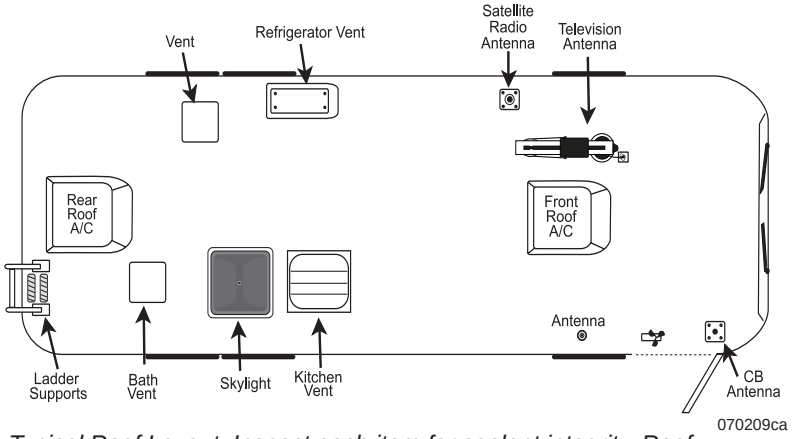
General Maintenance – Exterior Attachments: Dow Corning #999 - A Clear Silicone or Colorimetric High Performance Clear Silicone

Primarily used on the sidewalls around windows, doors, handles, beltline molding, latches and bases of surface mounted items such as clearance lights. Old peeling sealant should be removed with nylon sticks or equivalent. Avoid using metal utensils which can scratch the painted surface. Use nylon sticks or equivalent. Avoid lacquer thinners or ketone based solvents as these chemicals can damage painted surfaces. Confirm that surface is clean and dry before a new application. Cut the tube at an angle with the smallest usable opening. Avoid a heavy bead as a little goes a long way. Use a finger at a 45° angle on the 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 and plan ahead before starting a bead. Look for obstacles that may impede application.

CAUTION:
Avoid eye and skin contact and breathing of vapors. Consult manufacturer data for application and safety instructions.



Typical Side View: Side window seals require silicone. Windshield requires black urethane.



Typical Roof Layout: Inspect each item for sealant integrity. Roof A/C's use a special foam gasket.

General Maintenance – Openings: Spray Foam

This product is used as a sealant where a hole has been made for items such as water lines or wires that are coming through a floor or bulkhead opening. Consult manufacturer data for application and safety instructions.

Windshield Installation – 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 product is considered a hazardous material.

WARNING:
Avoid eye and skin contact and breathing of vapors. Consult manufacturer data for application and safety instructions.

Sealing Under a Painted Surface: Acrylic Sealants: Geocel # 2300

Used where items are sealed under a painted surface such as the metal corners of slide out rooms and roof mounted awning brackets. The material is specially formulated to allow paint adhesion. Consult manufacturer data for application and safety instructions.

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 that will help to brighten the appearance of plastic or Plexiglas instrument panels are Novus Plastic Care®, a three-part system; Meguires® and Johnson Paste Wax®, which will require extensive buffing and rubbing.

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

CAUTION:
DO NOT allow glass cleaners to come in contact with the plastic. Most glass cleaning products are volatile to plastics and will cause it to become brittle or dull the finish.

TIP:
To determine if the lens is glass or plastic, tap the lens with a fingernail. Plastic lens will have a dull hollow sound whereas glass will have a clear ping sound.

FABRICS
General Care & Cleaning

Special care needs to be taken when the motorhome is exposed to a very humid climate for an extended period of time. Protect the fabric from any unnecessary exposure to moisture. Cover all upholstery and make sure window coverings are down to protect fabrics from sun damage. Frequently used items require more attention than those items not regularly used.

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.

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, frequently vacuum or lightly brush 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 a soapy water and diluted bleach solution until 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.

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:
Wipe fresh paint off with a damp cloth. Hot soapy water will normally remove dried latex.

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

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.

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 or dampened with a mild detergent solution. Rinse thoroughly with clean 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.

Blood or Plant Residue:
Rub out spots using a clean cloth, soaked in cool water. For stubborn spots, 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 contaminants 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.

NOTE:
Tears or holes in the vinyl can be temporarily covered with clear 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

Cleaning Suggestions:
Follow cleaning steps in sequence. Each subsequent step is to be used if the previous step was not successful. Clean area with warm water after each process.

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.

WARNING:
Avoid open flames or hot lighting when using an alcohol solution.

CAUTION:
DO NOT use any abrasive cleaner with this material.

NOTE:
A five parts water to one part bleach solution is recommended for disinfecting.

Ultra-Leather

Care Instructions:
- Spot clean with mild soap and water.
- Air dry or dry quickly with warm setting of a hair dryer.
- For stubborn stains, use mild solvent.
- For tougher stains, try Fantastik® brand spray cleaner. Disinfect with a **5:1 NON-CHLORINATED** (only) bleach solution.
- Dry clean using commercial dry cleaning solvents only.
- Use a mild detergent for:
  - Red Wine, Liquor, Coffee, Tea, Cola, Milk
  - Ketchup, Mustard, Mayonnaise, Steak Sauce, Soy Sauce
  - Butter, Salad Oil, Chocolate, Lipstick, Make-up, Face Cream
  - Suntan Oil, Machine Oil, Urine, Blood

Removing ballpoint pen stains:
Wipe the stain off with ethanol (ethyl alcohol). Follow all manufacturer safety instructions when using chemicals.

Use the following procedure if stain the remains:
1. Dilute household bleach (sodium hypochloride) with the same amount of water. (One part to one part solution.)
2. Apply the bleach/water solution to a piece of tissue (do not apply too much). Place the tissue on the stained surface and cover it with polyethylene film to prevent the solution from drying.
3. Periodically remove the tissues to check on the condition of the stain. When the stain is almost gone, remove the tissues completely. **DO NOT** leave on for more than one hour.
4. Wash the stain with sufficient amount of clean water.

CAUTION:
If bleach residue remains on the fabric, the polyurethane resin and back cloth will yellow and deteriorate.

Neutralize bleach by the following method:
- Place a piece of tissue, as in Step 2, and apply hydrogen peroxide solution (15%).
- Leave the solution on for approximately 30 minutes, then remove the tissue.
- Completely remove the residue of hydrogen peroxide on the Ultra-leather with water.

Sodium hypochloride is the only chemical that will remove ballpoint pen stains. However, this chemical may cause polyurethane to yellow or the back cloth to deteriorate. It is recommended to remove ballpoint pen stains as early as possible with ethanol.

For more information, please call:
Ultrafabrics, LLC Customer Service:
1-877-309-6648

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.

Spot Removal Guide

Use the solution specified in order from 1-8 until stain is removed.	A DRY CLEANING FLUID	B NAIL POLISH REMOVER	C DETERGENT SOLUTION	D WARM WATER	E VINEGAR SOLUTION	F AMMONIA SOLUTION	G STAIN REMOVAL KIT	H CALL PROFESSIONAL	I PERMANENT CHANGE
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/Charcoal/Graphite		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/Soft Drinks			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/Stain (Solvent Based)	2	1	3	6	5	4	7	8	*
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/Paint	2	1	3				4	5	*
Oil	1		2	4		3		5	*
Plant Food			1	4	3	2	5	6	*
Rust			2	3	1		4	5	*
Shoe Polish	2	1	3	5		4	6	7	*
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 Floor

Laminate flooring used in the motorhome provides style, durability and ease of maintenance. This high-pressure laminated flooring is designed to be incorporated as a floating floor.

Laminate flooring is constructed of three main material components. The surface, similar to many countertops, contains aluminum oxide particles to form an extremely hard, durable outer layer. The carrier, or core layer, is constructed from high density fiberboard. A tongue and groove design provides a tighter bond. The backer or bottom layer is also made of laminate for strength.

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.

SHOWER

Showers are susceptible to soap build-up. 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

The ceiling of the motorhome can be a variety of materials or fabrics:

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.

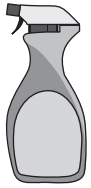
WALL COVERINGS

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.

Before applying a cleaner, test the cleaning agent on a small, inconspicuous portion of the wall covering to ensure the cleaner does not affect the color or gloss of the wall covering.

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. 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.


070200

Care for the Satinesque Wall Covering:

Remove stain 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 wall covering to ensure the cleaner does not affect the color or gloss of the wall covering.

Specific Stain Type Removal Procedures:
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 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. Thoroughly dry to prevent streaking. For stubborn stains, use a clean cloth dampened with a solution of mild non-alkaline soap (dish washing 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 with wood 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 marks 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.

Scratches and Nicks:

"Quick and simple" rarely describes repairs to stained wood finishes; however, a few tricks used by professional woodworkers can be tried to repair nicks and scratches.

Fixing scratches in stained woodwork:

Light scratches will often disappear when carefully rubbed with furniture polish or paste wax. 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. Deeper scratches can be hidden by carefully rubbing with a piece of oily nut meat such as Brazil nut, black walnut or pecan. Be careful to rub the nut meat 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.

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:

The finished surface on the wood is a clear lacquer coating. The lacquer finish can be repaired should the finish become dulled or scratched. Scratches extending into the wood will require wood repair by filling the damaged area. If there is light damage, the wood can be steamed to bring the wood surface level.

Lacquer finish sheen can be restored by carefully using 0000 steel wool or equivalent. Sand damaged lacquer with fine sandpaper. Once the scratched surface is smooth, apply a clear lacquer coating using an aerosol. Lacquer can be applied by cloth or brush, but best results are obtained from an aerosol. If necessary, use 0000 steel wool or equivalent to bring out the luster and smooth overspray.

CAUTION:

Use top coats and finishes in accordance with the manufacture's safety instructions. Use only in well ventilated areas with proper respiratory filters and masks.

Re-staining the wood:

If bare wood is visible at the bottom of the scratch, the wood will need to be re-stained. 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 additional 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. Torn and scratched wood fibers will absorb stain and darken quickly. Start with a stain color that is lighter than the original finish. 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.

COUNTERTOPS

Solid 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 and a grey *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 Liquid Cleanser*® and a grey *Scotchbrite*® pad. Scrub the sink, rinse and towel dry.

Removing Cuts and Scratches:

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

- Sand area starting with 180 grit sandpaper, working your way up to 2000 grit or until blemish is gone and renewed finish is achieved.
- Never sand in one small area. Feather out lightly at each increase in sandpaper grit to blend restoration.

Preventing Heat Damage:

Hot pans and heat-generating appliances, such as frying pans or crock pots, 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 exposing the solid surface to chemicals 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 the cold water faucet to dilute the excess heat.

Laminate

Clean laminate countertops with a damp cloth or sponge. Use a spray cleaner to remove stubborn stains. Avoid using harsh abrasives, scouring powders, peroxides or bleaches as these products may dull or damage the surface. Avoid contact with dyes, bleaches and indelible inks used 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 damage the surface. Use hot pads under pans taken directly from the stovetop.

NOTE:
DO NOT cut directly on the laminate surface.

STAINLESS STEEL SURFACES

Stainless steel can be easily damaged by improper cleaners. For example: many liquid cleansers designed to be gentle on smooth surfaces will damage stainless steel. Only use the methods outlined below, and always follow the directions that come with the cleaner (usually located on the bottle).

General Cleaning:

- Use warm, soapy water and dry with a soft, clean cloth.

For Heavy Soiling:

- Only use a stainless steel cleaner designed specifically for appliances.
- Follow all directions from the manufacturer of the cleaner.

DO NOT USE:

- Abrasive powders or cleaners
- Acidic citrus or vinegar based cleaners
- Ammonia
- Steel wool pads
- Abrasive cloths
- Oven cleaners

NOTE:
Citric acid permanently discolors stainless steel. Immediately remove mustard, tomato juice, marinara or citrus-based sauces or products from stainless steel surfaces.

NOTE:
DO NOT cut directly on the stainless steel surface.

WINDOWS

Water Spots:
Glass will develop water spots when not properly cleaned. Water spots are magnified on 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 develops when water vapor is present in the air. More vapor is added by breathing, bathing, cooking, etc. and collects wherever air space is available. When the temperature reaches dew point, water vapors in the air condense and change to liquid form.

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

- Open roof vents and windows partially to allow outside air to circulate into the interior. Increase ventilation when a large number of people are in the motorhome. Even in damp weather 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. Use of 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. This 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 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 the soft brush attachment of a vacuum cleaner.

Compressed Air or Hair Dryer (non-heat setting):
Blow dust off each slat. Dust is air-borne using this method. 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 that does not 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 may drip.

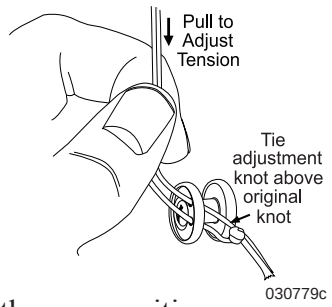
Ultrasonic cleaning:
Professional ultrasonic cleaning may be preferred.

Day/Night Shades

Leave Day-Night shades in the up position when not in use to help the shades hold their shape.

Tension Adjustment:
Tension should be adjusted if the shades are loose or there is excessive vibration. A button is located on the bottom of the shade at each end. Two lines on each side of the shade are threaded through the button and tied off.

- Pull the tied-off lines through the button to increase tension. Leave some slack so the shades are not too tight.



- Tie the lines off at the new position. Adjust each side equally.
- Operate the shades to ensure tension is set correctly and equally on both sides.
- Trim excess line from both sides if desired.

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 use a cleaning solution of ¼ oz. clear liquid soap to 8 oz. 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 and can leave a musty odor, discolor fabrics, stain surfaces and cause considerable damage to the motorhome.

What Does Mold Need to Grow?

Mold requires a food source such as grease or soil. Synthetic fabrics, such as acetate, polyester, acrylic and nylon, are mildew resistant, but soil on the surface of these fabrics are susceptible to mold.

Temperate climate and moisture also 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, including skin irritation, watery eyes, runny noise, 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. Moreover, the Center for Disease Control 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. Currently, there are no EPA regulations or standards 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 should eliminate mold growth in the motorhome. Take the following steps to eliminate mold growth in the motorhome:

1. Carefully examine items for signs of mold before loading them in the motorhome. Potted plants (roots and soil), furnishings, clothing and linens, as well as many other household items, may contain mold.
2. Regular vacuuming and cleaning will help reduce mold levels. Mild bleach solutions and most tile cleaners are effective in eliminating or preventing mold growth.
3. 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.

4. 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.
5. **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.
6. 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. If mold growth is severe, call on the services of a qualified professional cleaner.
7. If mold cannot be removed, throw the item away.

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 DAMAGE 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.

Steps to help control pests:

- Reduce 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.
- 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 motorhomes are well sealed, rodents are capable of chewing through the foam insulation and that area should be routinely inspected.

If signs of rodent infestation exist around the motorhome, place traps or poisons in suspected areas. Keep 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. The National Pest Management Association web site can be useful resource about common pests. Another good source for information are colleges and universities with entomology (study of insects) departments.

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 32º F.

Checklist - Short Term Storage:

- Retract 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.
- Drain the holding tanks. Winterize the fresh water system using FDA RV antifreeze or air pressure to evacuate the plumbing system.
- Retract and secure all awnings.
- Turn **OFF** the interior house power using the battery cut-off switch.
- Store batteries fully charged. Batteries stored in a discharged state will readily freeze and damage the battery.
- If possible, position the motorhome so the batteries are accessible for charging or changing without having to move the motorhome.
- If AC power is not available, turn both the house and chassis battery disconnect switches **OFF**.
- If available, leave the motorhome hooked to shore power. Leave both the house and chassis 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 possible, store the motorhome inside a storage building.
- If stored outside, **inspect** all seams and seals twice a month for possible leakage.
- Store the motorhome with a full fuel tank to minimize moisture condensing at top of fuel tank.
- Close vents and windows to prevent wind driven rain entrance.
- Store tires at maximum inflation pressure.
- Leave cabinet doors and drawers open to facilitate air movement behind those areas.
- Perform a full interior **inspection** for water leaks twice a month. Be sure to check behind all cabinet doors.

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 is vulnerable to the moisture and oxidation processes inherent in the environment.

NOTE:
The natural process of condensation will occur with temperature changes of 30º 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 AC power is not available in storage area:

- Turn **OFF** all appliances.
- Turn **OFF** interior house power using 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 batteries to a full state of charge.
- Turn both the house and chassis battery disconnect switches **OFF**.
- Check battery voltage while the motorhome is in storage if stored outside.
- Preventive measures should be used if the voltage readings are low. It will make it easier to remove the motorhome from storage or move the motorhome in an emergency situation.

NOTE:
Batteries in a low state of charge will readily freeze and damage the battery.

If AC power is available:

The house and chassis battery disconnect switches should remain ON. The converter will charge both the house and chassis battery banks. A 30 Amp shore power service will be more than adequate. If equipped with the optional inverter, the inverter will charge both the house and chassis battery banks.

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!

Surfaces to park/store the motorhome on:

- Avoid parking the motorhome on a grass or gravel surface to prevent moisture accumulation.
- Concrete pads seal the surface and allow 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.

Outdoor Storage Area:

- 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 wash the exterior to help control moss accumulation. Waxing the motorhome twice a year will augment these substances.

Inspect the motorhome:

- Leave cabinet doors and drawers open to facilitate air movement behind those areas.
- 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.
- **Inspect** and clean the roof and sidewall seams 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 fuel tank 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's 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 all engines at least twice a month.

Electric Motors:

Electric motors in the motorhome should be occasionally operated to help lubricate and keep surfaces freely rotating. These items include the roof air conditioners, dash fans, dash blower motor, furnance 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.

NOTE:
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 exterior panels and roof vents. If equipped with an icemaker, drain icemaker and icemaker tray. See the refrigerator OEM manual for more detail.
- **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

Extensive freeze damage or other serious deterioration can occur if the motorhome is not properly winterized. If the motorhome is properly and carefully prepared for storage, removal from storage will not be difficult. The following checklist pertains to items or areas that should be inspected when it is time to take the motorhome out of storage and put back into operation. If you have any questions regarding storage or winterization, consult a qualified service technician.

- 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. Clear the refrigerator openings 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 LLA (Liquid Lead Acid) cells with distilled water only. Charge as necessary. **Inspect** the cable ends and terminals. They should be secure 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 indicate 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 unusual noises, have the system checked by a qualified air conditioner technician.
- Shut the engine down. Adjust or add fluids as necessary. **Inspect** around the engine and 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 contaminates.

- 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 DC 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 OEM 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.

Notes

APPLIANCES - INTRODUCTION

This section covers operation and care of various appliances found in the motorhome: refrigerator, cooktop, 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 OEM manuals.

WARNING:
Before entering any type of refueling station, turn off all LP-Gas operated appliances. Most LP-Gas appliances used in motorhomes 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.

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

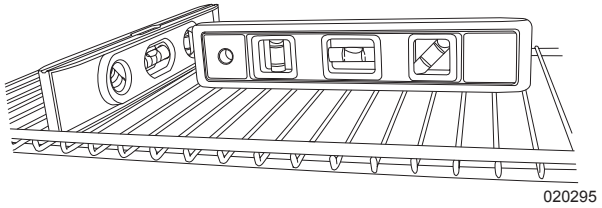
Follow the specific guidelines in the refrigerator manual to ensure longevity and proper operation of the refrigerator. With proper care and maintenance, the refrigerator should provide years of trouble-free service.

NOTE:
The refrigerator may require special winterization procedures. Refer to the refrigerator OEM manual for instructions and recommendations. Also refer to the OEM for detailed operating and maintenance instructions.

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

Operation Specifics

- The refrigerator operates from LP-Gas or 120 Volts AC electric.
- DC Voltage for control pad operation 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.


020295

Important: Operate refrigerator only when level. Level the refrigerator using a torpedo or bulls eye level. Place the levels on the bottom shelf of the refrigerator. The bubble should be at least half-way inside the circles.

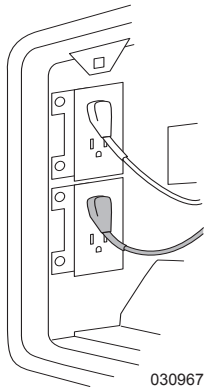
CAUTION:
Operating the refrigerator off-level separates chemicals, causing them to crystallize and block the circulation action of the cooling unit. Damage is cumulative and irreversible.

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.

Refrigerator Operation:

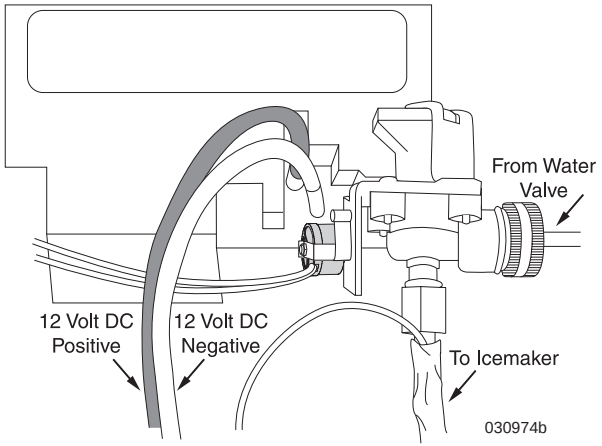
- House batteries must be charged and on.
- The primary LP-Gas valve must be open.
- **Figure A:** The refrigerator 120 Volt AC cord(s) must be plugged in (located outside behind refrigerator access door).

Figure A


030967

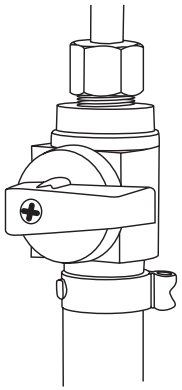
- **Figure B:** If controls do not light up, check house battery charge status or see if the 12 Volt DC wires are plugged into the refrigerator's circuit board (located outside behind refrigerator access door).

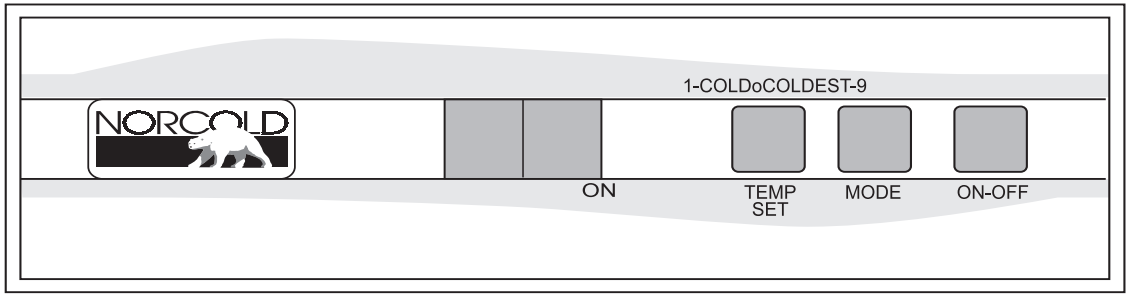
Figure B



- **Figure C:** The water valve is located under the refrigerator or behind the refrigerator access door. On some models (due to floorplan) there are two water valves with the second valve (called the secondary icemaker valve) located in a roadside compartment. The water valve(s) must be open if the refrigerator is equipped with an icemaker.

Figure C





Control Panel - Two Door

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.

TEMP SET Button:
Adjusts the temperature.
- To adjust, push and hold the **SET TEMP** button.
- Number "9" is the coldest setting.

MODE Button:
Controls the operation mode of the refrigerator.
- Press the **MODE** button to select between Automatic **AU**, **AC** or **LP** operation.

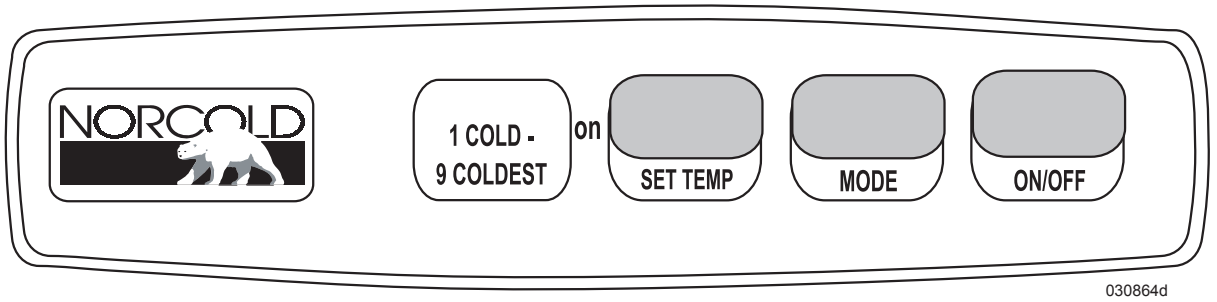
Manual Mode (MAN):
When one of the two manual modes is selected:
1. **AC** = The refrigerator is operating on AC electric.
2. **LP** = The refrigerator is operating on LP-Gas.

Automatic Mode (AU):
This feature selects AC over LP-Gas operation. The controls select the energy source in this sequence.

- When 120 Volts AC is available **"AU AC"** flashes in the display. This indicates the refrigerator is operating on AC electric. After ten seconds, the **"AU AC"** goes off and only a power indicator remains.
- If 120 Volts AC is not available, **"AU LP"** flashes in the display. This means the refrigerator is operating on LP-Gas.
- After the refrigerator is operating, press the **TEMP SET** button and set the desired temperature.

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 an authorized service technician.

Control Panel - Four Door (Optional)



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.
- Press 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.

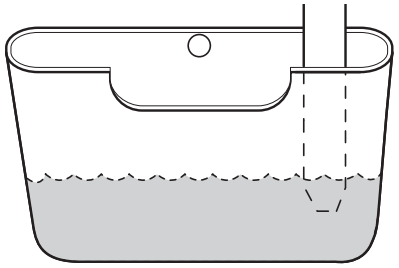
Manual Mode (MAN):
When one of the two manual modes is selected:
1. **AC** = The refrigerator is operating on AC electric.
2. **LP** = The refrigerator is operating on LP-Gas.

Automatic Mode (AU):
This feature selects AC over LP-Gas operation. If AC discontinues, the refrigerator will automatically switch to LP-Gas operation. An alarm will sound and a code will display if the LP-Gas igniter fails to light.

- Press the **MODE** button until **AU** displays. Release the button.
- Press and hold the **SET TEMP** button until the desired temperature displays. Release 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 an authorized service technician.

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.
- Ice build up 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 tube submersed.

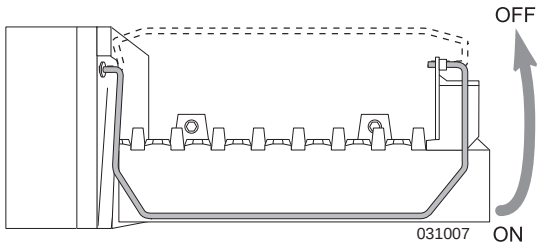


Drip Pan: Located behind the outside access.

Icemaker

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. The water valve is located under the refrigerator or behind the refrigerator access door. On some models (due to floor plan) there are two water valves with the second valve (called secondary icemaker valve) located in a roadside compartment. The water valve(s) must be open if the refrigerator is equipped with an icemaker.

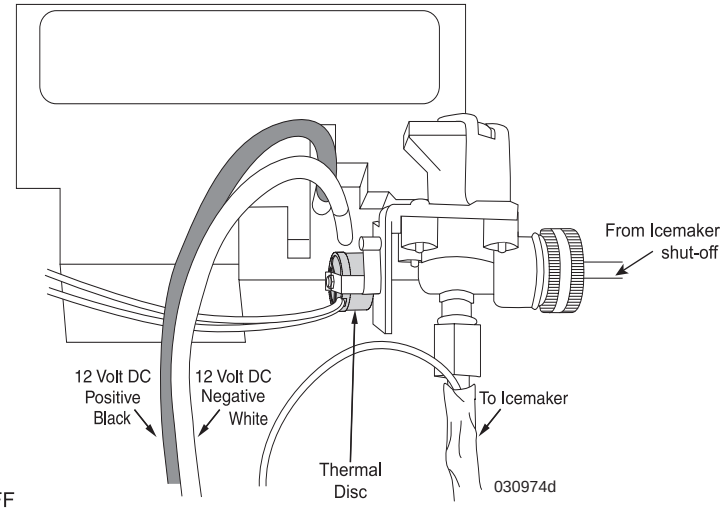
- Pull the metal arm (bail) down to turn the icemaker **ON**.
- Push the arm up to turn the icemaker **OFF**.



NOTE:
Water may spill out of the ice tray if the icemaker is in operation while the motorhome is in transit. DO NOT use the first one or two trays of ice following storage. Operating the icemaker without water pressure supplied to the refrigerator will risk damage to the icemaker assembly.

Water Line Heater:

A thermal disc supplies voltage to heater tape when ambient temperature is less then 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 protected with foam insulation.



Refrigerator Alarm

The refrigerator audible alarm will sound for the following reasons:

1. DC or AC voltage is higher or lower than allowed.
2. The refrigerator fails to light on LP-Gas or fails to light after a period of operation.
3. Refrigerator is set to **Auto**, 120 Volts AC is discontinued and LP-Gas fails to light. **NO AC** will display, followed by **NO FL**, and the alarm will sound. Consult the OEM manual.
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 OEM manual for the list of codes and their meanings.

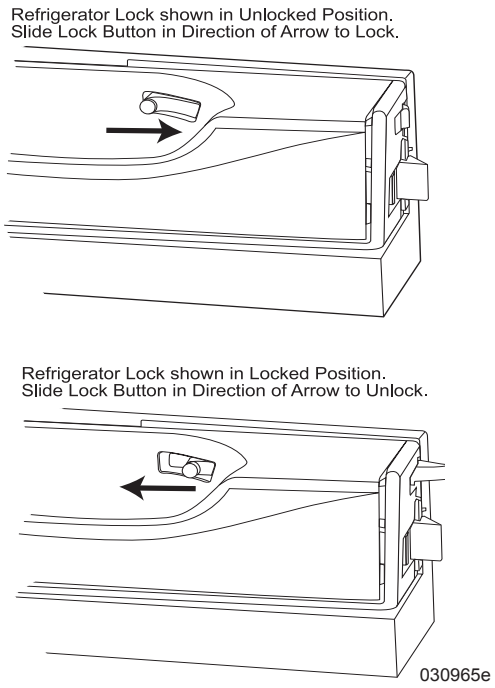
Cooling Unit Fans

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 (four door model) or in the door (two door model). The heating element activates when operating the refrigerator in any mode to help prevent moisture accumulation in high humidity conditions.

Mold and mildew may contaminate a completely sealed refrigerator in storage. The motorhome refrigerator has a storage position to lock the doors partially open and promote airflow that will help prevent mold build up. To use the refrigerator storage position:



1. Completely empty the refrigerator.
2. Disconnect power to the refrigerator.
3. Thoroughly clean the interior box using a soft cloth to remove all stains and spills.
4. Partially open the doors and slide tab into the cut-out of the striker plate.

Storage Procedures

Storage Feature:

- Turn the refrigerator **OFF** and remove all items. Leave the drip tray under the cooling fins.
- **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 that can damage the interior finish.
- Rinse with a solution of baking soda and water. Dry with a clean cloth.
- Lock the doors open.

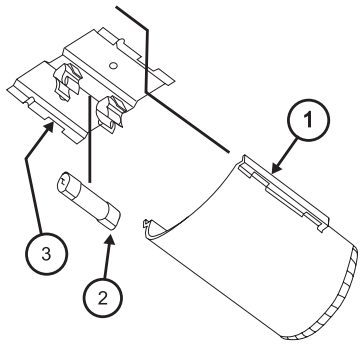
CAUTION:
DO NOT use a hot air blower to defrost. Permanent damage could result to plastic parts. DO NOT use a knife, ice pick or any other sharp instrument to remove ice from the freezer as they can puncture the system.

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 replace the cover.



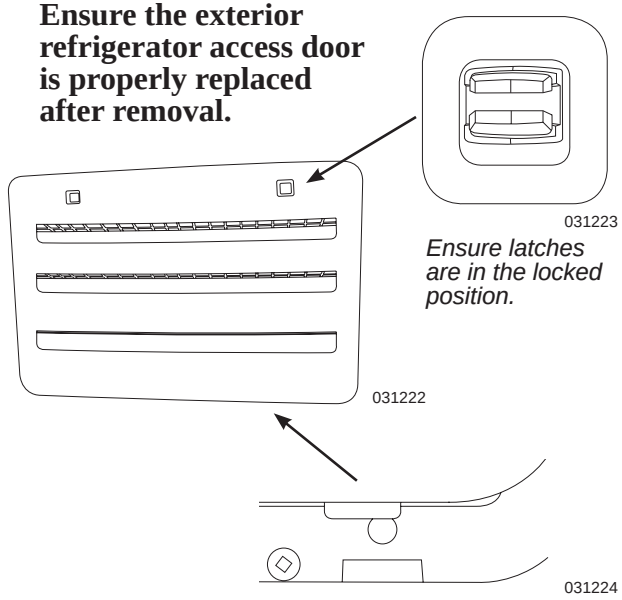
NOTE:
Replacement bulb number is accurate at time of printing. Confirm part number before ordering or obtaining replacement.

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 ft. can affect performance and function. If possible, switch mode operation to AC while at a higher altitude.

Exterior Refrigerator Access Panel

NOTE:
Ensure the exterior refrigerator access door is properly replaced after removal.



Air in LP-Gas Supply Lines

For safety reasons, the refrigerator will attempt to ignite on propane gas within a specified amount of time. When starting the refrigerator for the first time after storage, or after servicing the gas supply system, propane gas supply lines may contain air. Due to the air in the gas supply lines, the refrigerator may not ignite on propane 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 any other necessary 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 **F** or **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 inverter (if equipped).

Operation Tips:

- Ensure cookware being used is microwave safe. 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 steam using a soft cloth.

Microwave/Convection Oven Facts:

One of the most useful documents for the microwave/convection oven is the operations 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. Remember to register the microwave/convection oven with the manufacturer.

CAUTION:
If a fire flares up when using the cooktop, turn OFF the microwave/convection oven ventilation fan as it may spread the flames. The ventilation fan cannot manually turn off when automatically started from a heated cooktop. Turn off the microwave AC breaker to prevent the flames from spreading into the microwave.

NOTE:
When dry camping, minimize using the inverter (if equipped) to operate the microwave/convection oven 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.

NOTE:
For more detailed information and operating instructions, refer to the microwave/convection oven OEM manual.

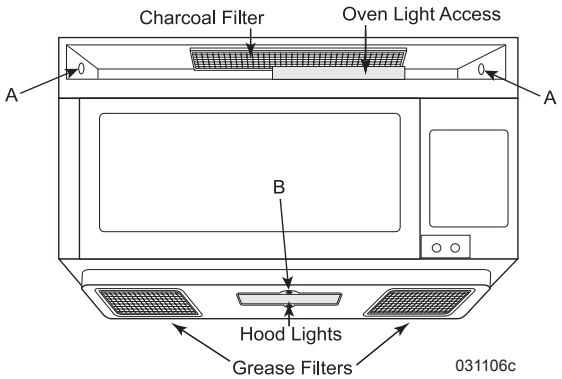
CAUTION:
Long-term use of the inverter (if equipped) to operate the microwave while in transit will damage the alternator. Use the generator to operate the microwave while in transit.

Care & Cleaning

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. Ensure the filter is positioned on the supporting tabs.
5. Replace louver and mounting screws.

Oven Light:

1. Remove the louver as previously indicated.
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 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 once 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:

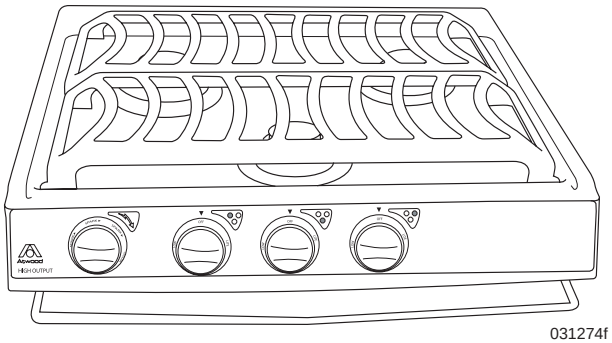
- Turn the oven **OFF** before cleaning.
- Cover food while cooking to keep spattering to a minimum.
- Clean up all spills or spatters before they dry. Wipe up food spatters or spilled liquids with a damp cloth. Mild detergent may be used for stubborn spills. **DO NOT** use harsh detergent or abrasive 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 regularly cleaned 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 abrasive 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.



031274f

The cooktop operates under the following conditions:

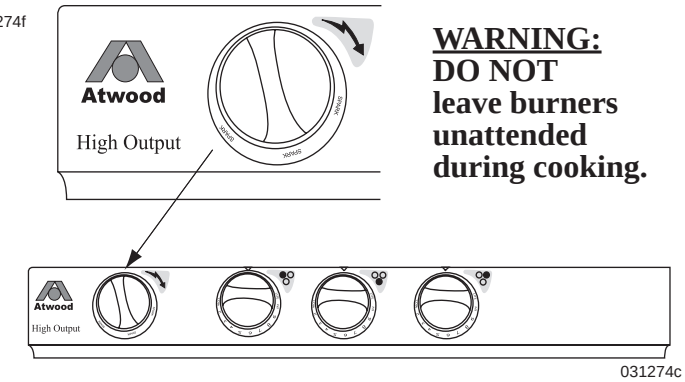
- Primary LP-Gas valve on the LP-Gas tank is open.
- Battery cut-off switch is on.
- House batteries are charged.

Using the Cooktop:

1. Place the cookware on the burner grate over the desired surface burner.
2. Open the burner valve by applying a downward pressure to the knob and rotating clockwise.
3. When the burner lights, rotate knob to the desired flame setting. In the event of a power outage or igniter failure, the cooktop can be manually lit.

Control Knobs:

- Turn appropriate burner knob counterclockwise to **LITE**. **DO NOT** attempt to light more than one burner at a time.
- Turn the **SPARK** knob clockwise one click. If the burner fails to light, continue turning the **SPARK** knob clockwise until the burner lights.
- Move the burner knob clockwise to **OFF**, to turn the burner off.



031274c

WARNING:
DO NOT leave burners unattended during cooking.

DO NOT leave burner valve(s) open while burner(s) are not lit. LP-Gas is heavier than air and will settle on the floor and "hide" in corners. If you smell gas, extinguish all open flames. Open all windows and doors. DO NOT touch any electrical switches. They may cause a spark that can ignite. Evacuate the motorhome and shut off the primary LP-Gas valve. Liquid propane is highly volatile, highly 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.

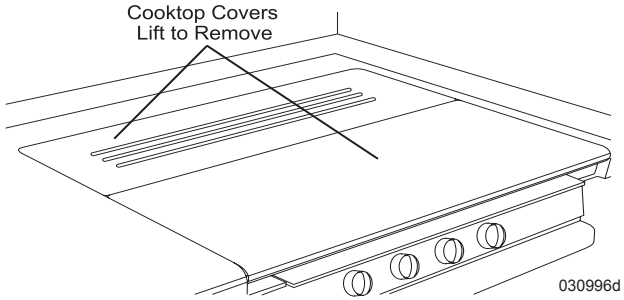
Operation Tips:

- A yellow flame is an indication of incorrect fuel/air ratio. Lowered BTU output and carbon build up can occur.
- When cooking at an altitude above 5,000 ft., the flame may change appearance and the flame BTU output will be lowered. Allow extra time cooking time.
- **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.
- Cooking time can be reduced if the least amount of liquid is used. The choice of cookware selected can make a big difference.
- Additional information can be found in the cooktop OEM manual.

Cooktop Covers

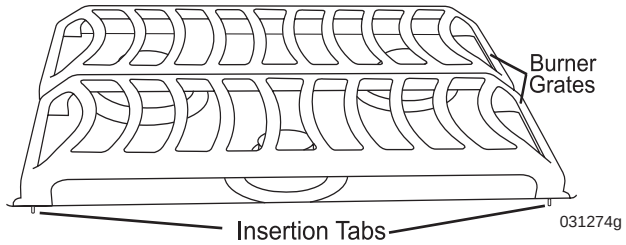
Covers must be removed before cooking on the cooktop.

- DO NOT place the covers on the cooktop while the burners are lit.
- DO NOT use the covers as a griddle.
- The covers must be in place while the motorhome is in transit.



Burner Grate

The two burner grates are attached to the cooktop by four insertion tabs and can be removed for cleaning. Place a cloth down to protect the countertop. To remove a burner grate, pull up on the grate. To re-install a burner grate, align the insertion tabs with the grommets and push down.



NOTE:
For more detailed cooktop information and operating instructions refer the OEM manual.

Care & Cleaning

Regularly wipe down the cooktop with a soft cloth and a warm detergent solution to keep it clean. **DO NOT** clean the cooktop with abrasive or harsh cleaners such as steel wool, bleach, ammonia or oven cleaner.

Use a dry paper towel or cloth to wipe up spatters or spills when the cooktop surface is still slightly warm. To avoid accidental burns, do not clean the cooktop when it is hot to touch. **DO NOT** allow food to bake on. Clean the surface burner grate and caps using the same guidelines as the cooktop surface.

Porcelain Enamel:

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 that can dull the finish of the enamel. To avoid dulling the finish, wipe up the spill before it is baked on. Steel wool and course, gritty cleanser will scratch or mar the surface. Use gentle kitchen cleanser powder or grease cleaner. For further information on care and maintenance of the porcelain, call *Hopes Cultured Marble Polish* at 800-325-4026.

COOKTOP WITH OVEN (Optional)

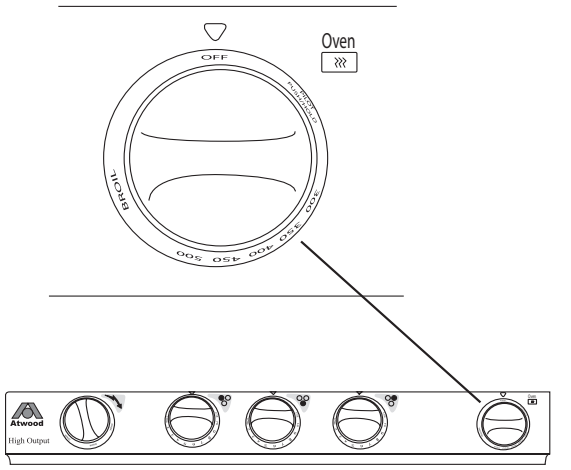
The cooktop range/oven uses only LP-Gas as a fuel source. The burners use a piezo type igniter. The cooktop should be used for cooking purposes only and not as a heating source. When the burner valve is opened the fuel source flows through the valve into the mixture tube. The fuel passes by a hole or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

The cooktop operates under the following conditions:

1. The primary LP-Gas valve on the LP tank is open.
2. The battery cut-out switch is on.
3. House batteries are charged.

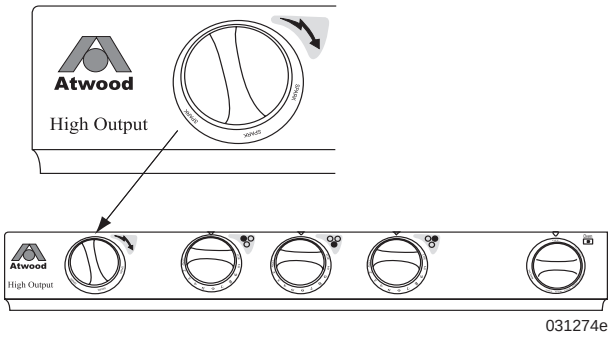
- The oven may be used with the cooktop cover in place.
- Push in the oven control knob and rotate counterclockwise to **PILOT ON**.
- Light the oven pilot located near the back of the oven, under the broiler shelf and to the right of the oven burner.
- Set the oven control knob to **PILOT ON** to maintain the 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**.

WARNING:
Extinguish pilots when refueling or traveling. DO NOT block vents in oven with any objects.



031274d

Lighting the Burners



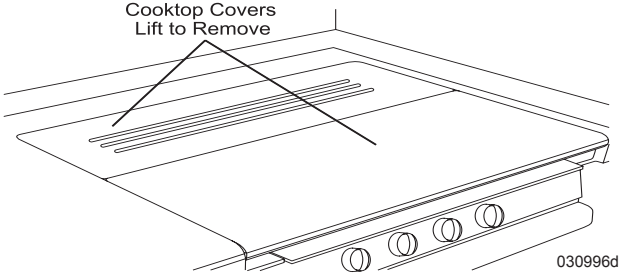
031274e

- Turn the appropriate burner knob counterclockwise to **LITE**. DO NOT attempt to light more than one burner at a time.
- Turn the **SPARK** knob clockwise one click. If the burner fails to light, continue turning the **SPARK** knob clockwise until the burner lights.
- Turn the burner knob clockwise to **OFF**, to disengage the burner.

WARNING:
Top covers must be removed when the cooking surface is in operation.

Cooktop Covers

Remove covers before operating on the cooktop or oven.



030996d

- DO NOT place the covers on the cooktop while the burners are in use.
- DO NOT use the covers as a griddle.
- DO NOT use the oven with covers on the cooktop.
- When the motorhome is in transit, the covers must be in place.

Burner Grate

The two burner grates are attached to the cooktop by insertion tabs and can be removed for cleaning purposes. Place a cloth down to protect the countertop. To remove a burner grate, pull up on the grate. To re-install a burner grate, align the insertion tabs with the grommets and push down.

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.

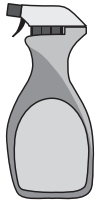
Operation Tips:

- A yellow flame is an indication of incorrect fuel/air ratio. Lowered BTU output and carbon build up can occur.
- Flame appearance may change and BTU output will lower when operating the cooktop at an altitude above 5,000 ft. Allow extra cooking time.
- **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.
- Pre-heat the oven for 10 minutes prior to use.

NOTE:
For more detailed cooktop with oven information and operating instructions refer to OEM manual.

Cleaning Tips:

- Clean all surfaces as soon as possible after boil overs or spill overs.
- 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. Glass cleaner should only be applied to the cooktop surface using a paper towel. DO NOT spray directly on the cooktop 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 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.

The surface is glass and must be given consideration when cleaning. Steel wool and coarse, gritty cleanser will scratch or mar the surface. Any gentle kitchen cleanser powder or grease cleaner will be suitable. For further information on care of the porcelain, call *"Hopes Cultured Marble Polish"* at **1-800-325-4026**.

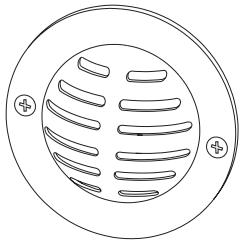
WALL THERMOSTAT

The Comfort Control thermostat controls the **HVAC** (**H**eating, **V**entilation and **A**ir **C**onditioning systems) and is located in the hallway area.

The Comfort Control includes five different functions: OFF, FAN ONLY, COOL, HEAT PUMP and FURNACE which are selected by pressing the MODE button. The FAN controls blower speed of the roof air conditioner. Two speeds are available: Low and High. Selecting Auto adjusts the fan speed automatically based on temperature set point and actual temperature in a selected zone.

The motor home is divided into two operating Zones: Living Room and Bedroom/Bathroom. The comfort control must be in Zone 1 for the furnace to operate unless the motorhome is equipped with two furnaces. For floorplans with two furnaces, **Zone 1** will operate the living room furnace and **Zone 2** will operate the bedroom furnace. Press the Zone button to change zones. The selected zone will flash. The line under the zone indicates that a selected function is operating in that zone. The UP or DOWN buttons control the temperature in any mode.

Remote temperature sensors are located throughout the motorhome to ensure accurate temperature control.


030950

Remote Temperature Sensor

Wall Thermostat Operation Requirements:

- House batteries must be charged.
- House battery disconnect switch must be on.
- Battery cut-off switch must be on.

Living Room = Zone 1
Bedroom/Bathroom = Zone 2

NOTE:
The Comfort Control must be ON to operate any HVAC function. DO NOT select conflicting modes of operation. One zone cannot be on COOL while another zone is set to FURNACE.

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

NOTE:
For more detailed information and operating instructions refer to the OEM manual.

AIR CONDITIONING - ROOF

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

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.

NOTE:
There are ambient air temperature limitations in Heat Pump mode. The roof air conditioner will not operate in Heat Pump mode with ambient temperatures of 30º F. and below.

Operation

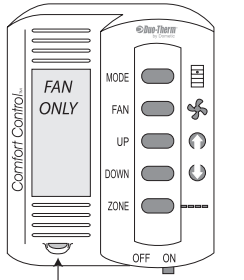
Operation Requirements:

- 120 Volts AC, from either shore power or the generator, is supplied.
- The battery cut-off switch is **ON** and the house batteries are charged.

Fan Only Operation:

Circulates interior air by using the roof air conditioner blower. The fan speed controls the roof air conditioner blower speed in the following modes: **Fan Only**, **Cool** or **Heat Pump**.

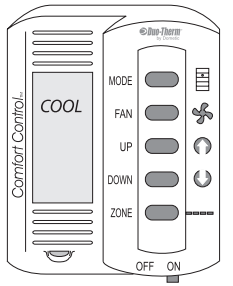
- Press the **MODE** button repeatedly until **Fan Only** is displayed.
- Press the **FAN** button to select the desired fan speed.



050200k

Air Conditioner Operation:

- Press the ZONE button to select Zone.
- Press the **MODE** button repeatedly until **COOL** is displayed.
- Set desired fan speed by pressing the **FAN** button.
- Set desired cooling temperature by pressing the **UP** or **DOWN** buttons.



050200e

NOTE:
The compressor engages approximately two minutes after the blower motor activates to prevent accidental compressor operation against high pressure.

Heat Pump Operation (Optional)

Heat Pump mode offers heat by using the air conditioner as a heat source. The air conditioning principle is reversed, supplying heated air to the ceiling registers instead of refrigerated air. There are ambient temperature limitations in Heat Pump mode.

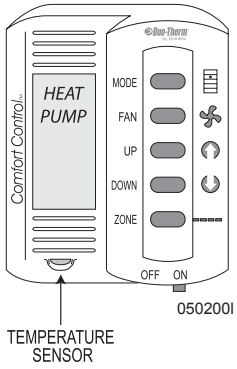
NOTE:
The roof air conditioner will not operate in Heat Pump mode with ambient temperatures at or below 30º F.

Aux Heat Mode:

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

When ambient temperature is between 30 and 42º F., a defrost cycle is initiated approximately every 40 minutes of compressor operation. The blower motor will stop for five minutes and Defrost will be displayed. After the defrost cycle the heat pump operation will resume.

Heat Pump Operation:

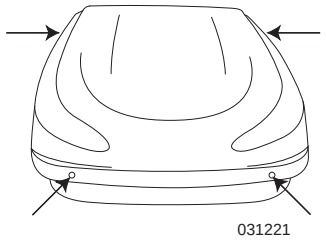


- Turn **ON** the battery cut-off switch.
- Slide the **ON/OFF** switch to the **ON** position.
- Press the **MODE** button repeatedly until **Heat Pump** is displayed.
- Set desired fan speed by pressing the **FAN** button.
- Press the **UP** or **DOWN** buttons to set desired heating temperature.
- Select Zone using the **MODE** button.

Air Conditioner Maintenance

Air Conditioner Cover:

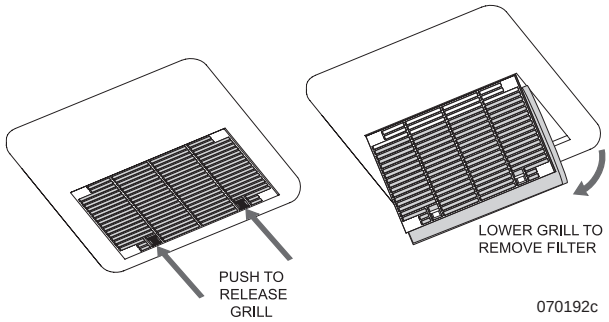
Ensure that the air conditioner cover screws are tight whenever the roof is accessed.



Ensure the A/C cover screws (location as illustrated by arrows) are tight when the roof is accessed.

Return Air Filters

Frequently clean the return air filters. The filter 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 the Return Air Filters:

- 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 intake vent covers.

FURNACE

The furnace and its related components are 12 Volt DC operated, using 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 run throughout the motorhome.

WARNING:
IF YOU SMELL GAS extinguish all open flames and turn off the LP-Gas primary valve. Liquid propane is a highly volatile, extremely dangerous gas. It can explode or ignite, which may result 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. They may spark, which can 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.

CAUTION:
DO NOT store any items/materials in furnace area. Restricted air flow may hamper furnace operation leading to failure and/or fire hazard.

NOTE:
For more detailed information and operating instructions refer to the furnace OEM manual.

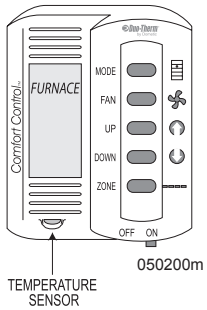
Operation

The furnace operates in the following manner: The wall thermostat sends a signal to the front roof air conditioner circuit board, which closes a relay. Closing a relay sends an electrical signal to the furnace to begin the ignition cycle. There is a small time delay before the blower motor begins. Once the blower motor attains a predetermined speed it will close the sail switch. The sail switch, which is now closed, sends the electrical signal through a high temperature protection switch, then to the automatic ignition circuit board. After the thermostat is satisfied, the gas valve closes and extinguishes the burner. The blower motor stops approximately two or three minutes after cool down.

Furnace Operation Requirements:
- LP-Gas primary valve on the LP-Gas tank is open and the LP-Gas valve at furnace is on.
- House batteries are fully charged and on.
- Battery cut-off switch 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 cycled off.

Using the Furnace



- Slide the ON/OFF switch to the ON position.
- Press the **ZONE** button to select Zone 1 (some floorplans include furnaces in Zone 1 and 2).
- Select the Furnace mode on the Comfort Control using the **MODE** button.
- Select the desired temperature using the **UP** and **DOWN** arrow buttons.

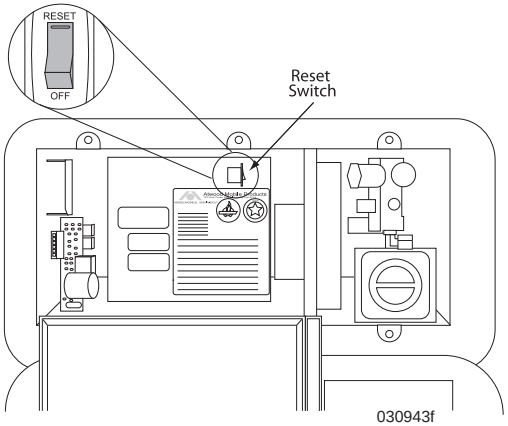
Tips:
- After storage the furnace may produce a musty smell during the first couple of cycles.
- Operating the furnace at an altitude above 5,000 ft. reduces the BTU output due to air/fuel ratio.
- The furnace will periodically need serviced by a qualified technician. If the furnace exhibits unusual symptoms or noises, or has an unusual odor when operating, have the furnace checked or serviced.

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

If the furnace fails to light make sure the LP-Gas primary supply valve is open. 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:
- Hook-up to shore power.
- Start the generator.
- Start the main engine to charge the batteries.



If the blower fails to operate after verifying the batteries are charged and the fuses are good, use a screwdriver to open the outside access door. Push the reset switch to off then to reset.

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: (**1**) 120 Volt AC, supplied either by shore power or the on board generator (**2**) LP-Gas. The 120 Volt AC function is most energy efficient when operated from shore power. The burner for LP-Gas operation is controlled by an automatic ignition circuit board powered by 12 Volt DC. Two thermostats control water temperature, one for 120 Volt AC and the other for LP-Gas. Thermostat temperature is preset by the water heater manufacturer and not adjustable. For ease of winterization, the water heater is equipped with a tank drain plug and bypass valve.

NOTE:
Refer to the Water Heater OEM manual for detailed information and operating instructions.

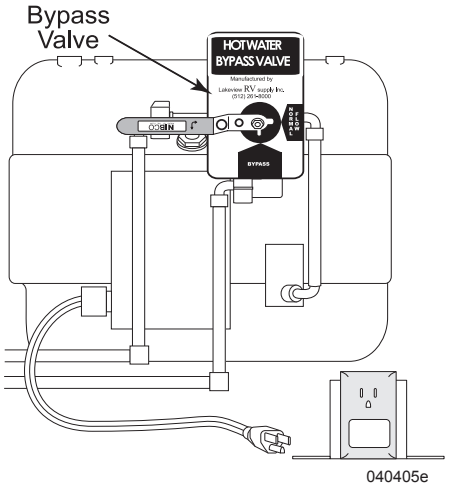
Before Using the Water Heater:

Use water to purge air from the water system and water heater and if necessary, purge FDA approved RV antifreeze from the system.

To Purge Air and Pressurize the System:

- Turn the water heater bypass valve (located on back of water heater) to Normal Flow. If necessary, install the drain plug. Water heater location varies depending upon floor plan, and may either be in the bedroom closet or an outside compartment (typically curbside).

To find the bypass valve, open the compartment next to the water heater. Inside the compartment locate and open the access door to find the bypass valve.



- Fill the fresh water tank or hook to city water.
- Turn on the water pump or city water.
- One at a time, open the hot and cold valves of all faucets until a steady stream of clear water flows with no bubbles or pockets of air. **DO NOT** operate the water heater until the system is purged of air.
- Inspect the water heater and water system for leaks after the water system is purged of air.

CAUTION:
After purging the water lines and water heater, small air pockets or hydrogen gas may be present. After the first heat cycle of the water heater, initially open hot water faucets slowly to minimize potential spattering of hot water.

WARNING:
IF YOU SMELL GAS extinguish all open flame 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 repair LP-Gas leaks before resuming operation.

Water Heater Operation:

- Turn on the battery cut-off switch.
- 120 Volt AC is supplied from shore power (preferred) or the generator.
- The house batteries are charged.
- Open the primary LP-Gas valve on the LP-Gas tank.

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

Heating Water with 120 Volt AC:

- Have either shore power (preferred) or the generator supplying AC voltage.
- Press the water heater 120 Volt switch The indicator lamp will glow.

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

Heating Water with LP-Gas:

- Turn on the LP-Gas.
- Press the water heater 12 Volt switch. The indicator lamp will glow.
- If the DSI fault light illuminates, this indicates a lockout. Press the 12 Volt (gas switch) on and off twice to reset the ignition board. If problem persists consult a qualified technician.

WARNING:
Before beginning any service or work on the water heater, make sure the LP-Gas is turned off and the 120 Volt AC and 12 Volt DC sources have been disconnected. Failure to do so can result in explosion, fire or injury.

CAUTION:
It is recommended not to operate the water heater on LP-Gas while the motorhome is in transit. The water heater must be off before refueling.

NOTE:
LP-Gas and 120 Volt AC functions can be on at the same time. This will speed up the process of heating water for large volume use.

NOTE:
Due to potential air in the LP-Gas lines, the water heater will attempt three ignition cycles. If the burner does not light after the third attempt, the LP-Gas function will "lock-out" and DSI fault light will illuminate. Reasons for lockout may be air in the gas system or burner tube obstructions caused by an insect or spider web. Press the 12 Volt (gas switch) on and off twice to reset the ignition board. If problem persists consult a qualified technician.

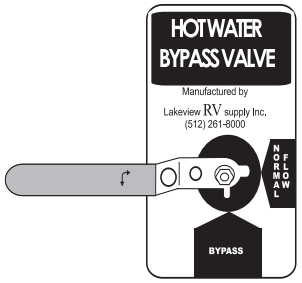
High Temperature Thermostat:

Separate thermostats are used for LP-Gas and AC electric. If a thermostat fails, a high-temperature safety limit switch will open.

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 Valve:

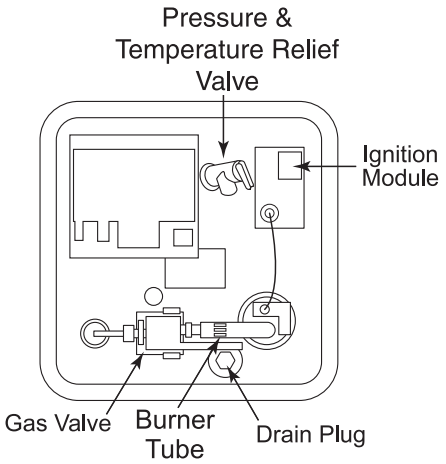
The bypass valve is located at the back of the water heater. Turning the valve to the bypass position prevents water from entering the water heater. Turn the valve to the bypass position when winterizing. For normal operation, turn bypass valve to normal flow.



040405f

Pressure & Temperature Relief Valve:

The water heater is equipped with a Pressure & Temperature (P & T) relief safety valve. The P & T valve is designed to open if water temperature in the tank exceeds 210° F. (98.8° C.) or internal pressure exceeds 150 psi. If water begins to weep from the valve, it may be due to a loss of the air pocket in the tank and not a defective valve. See re-establishing the air pocket.



040424m

Re-establishing the Air Pocket:

Water may weep from the P & T valve under normal operation. This is not necessarily a faulty valve but more likely caused by lack of an air pocket and water expansion. The water heater tank is designed with an internal air pocket. Eventually, the cyclic expansion of water will absorb the air pocket. When weeping from the valve occurs, the air pocket will need to be re-established utilizing the following procedure. If the valve continues to weep after establishing the air pocket, contact a qualified service center to evaluate the valve.

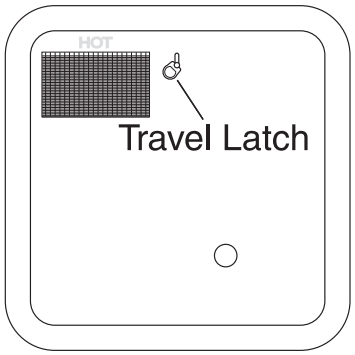
CAUTION:
Ensure the water heater is cool prior to establishing the air pocket.

1. Turn Off the water heater.
2. Turn Off the incoming water supply.
3. Open the hot water faucet closest to the water heater.
4. Open the handle of the P & T valve.
5. Allow excess water to drain from the water heater through the P & T valve. When draining is complete, close the P & T valve by allowing it to snap shut. Close the faucet and turn on the water supply.
6. Turn on the water heater.

Water Heater Compartment:

Periodically inspect the water heater compartment and door screen for foreign material that can prevent the flow of combustion and ventilating air. The water heater drain plug and pressure relief valve are located inside.

CAUTION:
DO NOT block any opening.



010720f

Tips:

- Turn off the water heater when not in use to conserve energy.
- Shut the water off when not rinsing.
- Operate the water heater using LP-Gas when hooked to 30 Amp shore power to reduce the likelihood of tripping the shore power breaker. The water heater element will use approximately 12 Amps at 120 Volts AC. Appliances that operate from 120 Volts AC may need to be operated in sequence to avoid tripping a breaker.

Draining & Storage:

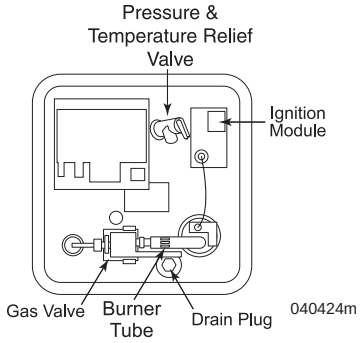
Drain the water heater to prevent freeze damage if the motorhome is to be stored during the winter months.

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 valve to the bypass position.

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

Troubleshooting:

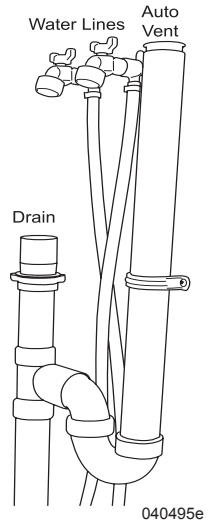
- Insects may make nests in the burner tube. Check the burner tube for obstruction if the water heater fails to light. It is recommended to clean the burner tube with a brush and not compressed air. Compressed air may not fully remove obstructions.
- If the water heater indicator light does not illuminate and the water heater does not ignite, ensure the interior house power is on, shore power is plugged in and working, and the AC breaker is on. Check for a blown fuse in the house distribution panel.
- If the water heater still fails to operate, the high-temperature safety fuse may be blown. Have a qualified technician inspect the water heater.



WASHER-DRYER PREPARED (Optional)

If the motorhome was not ordered with an optional washer-dryer, it will have a washer-dryer preparation package installed from the factory. The washer-dryer "prep" package includes the following items:

- Color coded water supply lines. A red line for hot; a blue line for cold.



- A 1½" water drain line with threaded cap, P-Trap and an automatic vent cap.
- A 120 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 the manufacturer's installation instructions.

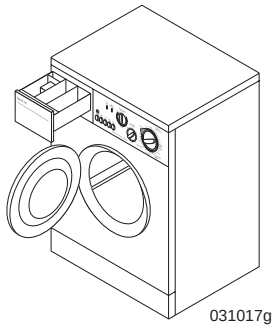
Listed here are further instructions which should be adhered to for safe and reliable operation:

- **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 vents for sufficient circulation of air.

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.

- The washer-dryer operates on 120 Volt AC from shore power or the generator.
- The washer-dryer uses about 12 to 20 gallons of water per wash cycle.


031017g

CAUTION:
It is highly recommended that the motorhome is hooked to shore services when using the washing machine due to limited fresh water supply and limited grey tank capacity. On certain model floor plans and options, the washer may drain into the black tank.

INFORMATION:
Refer to the washer-dryer OEM manual 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 while in the wash cycle, can damage the internal components of the washer-dryer.

Test Procedure:
Before using the washer dryer 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 accumulated dust.

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

Test Procedure Requirements:
- Secure water supply lines and open fresh water valves.
- Hook to city water or turn on the water pump.
- Hook to shore power or start the generator.

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 light flashes fast then slow.

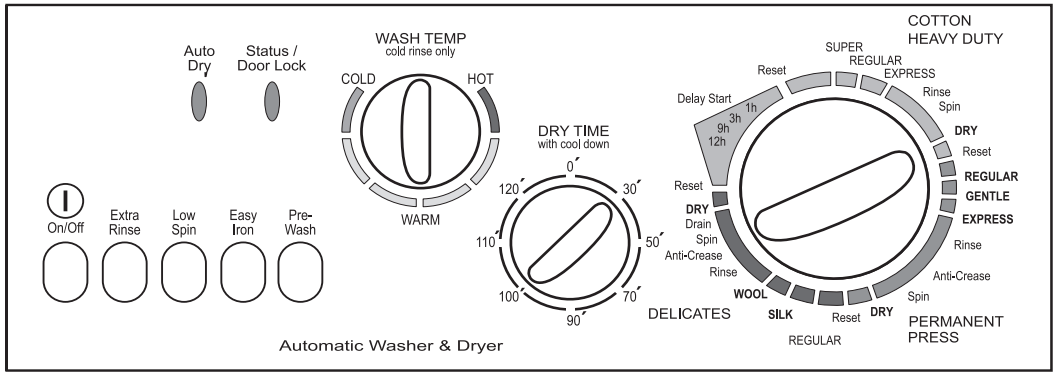
3. Set the selector knob to a wash cycle. Set Wash Temp knob to Warm. Water should be flowing into washer and drum should rotate both directions.
4. Set the selector knob to Reset. Wait five seconds.
5. Set the selector knob to Spin. Water drains and drum rotation increases.
6. Set the selector knob to Reset. Wait five seconds.
7. Set the selector knob to Dry. Dryer fan begins and drum rotates both directions.
8. Set the selector knob to Reset. Wait five seconds.
9. Set the Dry Time knob to zero. The Auto Dry light should go off.
10. The door will unlock in two minutes or less. The Status light flashes fast then slow. The door should now open.
11. Push the On/Off button to Out (**OFF**) position. The Status light should be off.
12. If applicable, close the holding tank drain valve.

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 washer-dryer 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 clothes loosely into the washer. Close the washer door.
- Turn the Wash Temperature knob to the desired temperature setting.
- Choose the desired washing cycle option using the Selector knob.



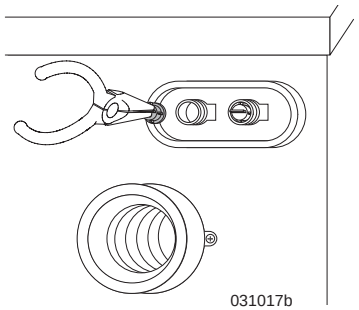
031017e

- Load wash tray with detergent.
- Turn the power **ON**.
- After the cycle is complete, wait two minutes for the door lock to release before attempting to open the door.
- If applicable, turn the power **OFF** and close the holding tank drain valve.

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 immediately next to the door window, to protect the door finish from laundry spills and discoloration.

Reduced water flow to the washer-dryer may indicate the Hot and Cold water inlet screens are clogged. Remove water pressure and undo water lines at the back of the washer-dryer. Use tweezers or pliers to remove screens from fittings.



031017b

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 must be taken as the washer-dryer weighs about 170 lbs. Use proper accommodations to avoid injury or damage to the cabinetry.

Winterizing the Washer-Dryer

Winterize Using Air Pressure:

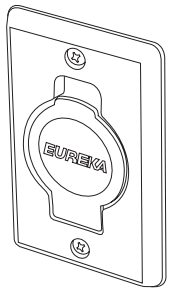
1. Refer to **Section 6 "Winterizing"** and prepare water system for air pressure.
2. Hook an airline (regulated to 45 psi or less) to the water inlet of the motorhome.
3. Rotate the Selector knob to a wash position with the Wash Temp setting on Warm. Press the power button to **ON**. Air pressure clears the Hot and Cold water lines.
4. After water lines are clear, rotate Selector knob to Spin. Allow the pump to drain the drum.
5. Set Selector knob to Reset and Timer to zero. The door unlocks in two minutes or less. Open door and pour in ¼ gallon of non-toxic antifreeze.
6. Set selector knob to Spin. The pump primes with antifreeze. Set selector knob to Reset and turn the power **OFF**.

NOTE:
Some appliances, such as the washer-dryer, may require special winterization instructions. Refer to the washer-dryer OEM manual for details.

CENTRAL VACUUM (Optional)

Operation

- Plug into shore power or start the generator.
- Lift lid on wall receptacle to start vacuum. Insert the hose.
- Connect desired attachment on hose and start vacuuming.



031264f
Inlet located in living room or bathroom area.

NOTE:
Consult vacuum OEM manual for detailed operation and maintenance.

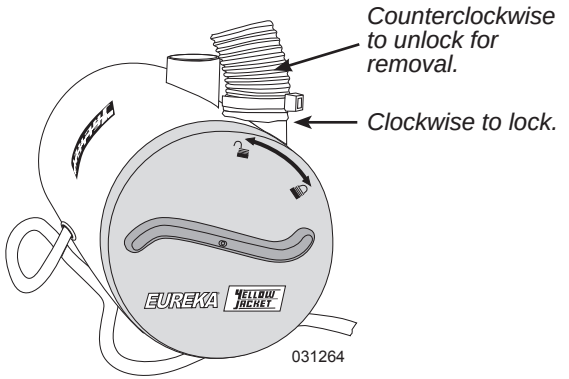
Maintenance

Vacuum has a thermal protector built into the motor to prevent overheating. If motor will not operate, it will automatically reset in about ½ hour. If motor brushes or bearings are worn out, the circuit protector will trip off again after a short period of time. If this happens, contact a qualified service representative. Depending on floor plan, the vacuum is located in either a roadside or curbside compartment.

Changing the Bag:

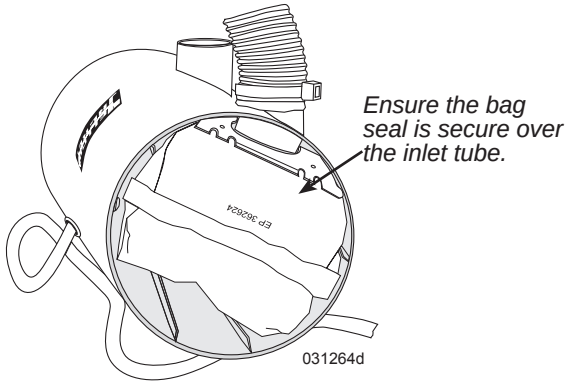
To keep your vacuum at top efficiency, change the filter bag at regular intervals. To maintain cleanability, replace filter bag when it is about ¾ full.

1. Unplug the power unit from grounded outlet.
2. Rotate the bag cover counterclockwise and remove cover.
3. With a finger on each side of the inlet, slide the bag off the inlet tube.



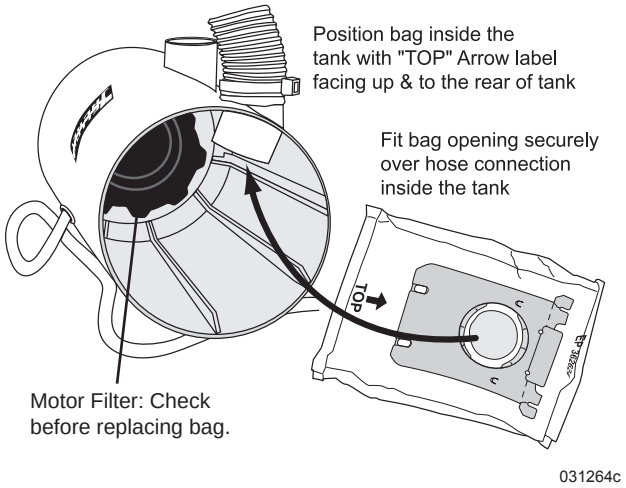
031264

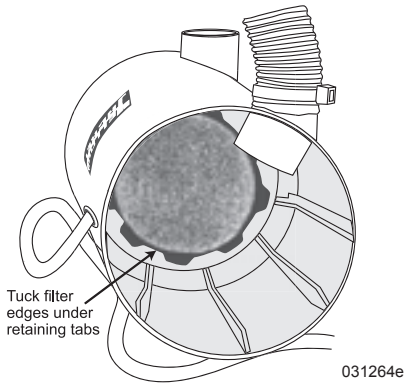
4. Pull the center cardboard tab to automatically seal the bag and prevent dust leakage.



031264d

5. Remove the bag from the vacuum and discard. **DO NOT** reuse.
6. Check support (motor) filter.
7. Unfold the new “OX” bag and insert into the vacuum so the center cardboard seal tab is toward bag cover. The top arrow should point to the bag cover.
8. Hold each of the cardboard tabs and slide the bag on the inlet tube.
9. Line up the mark on the bag cover with the unlock symbol and rotate clockwise to lock symbol.





Replacing & Cleaning the Support (Motor) Filter:

1. Inspect during each bag change. The filter should be cleaned every fifth bag replacement or when excessively dry.
2. Remove dust bag as previously instructed.
3. Locate the support (motor) filter in the bottom of the bag compartment and lift out.
4. Clean by rinsing under warm water and let air dry. If heavily soiled, replace torn or obstructed filters.
5. Reinstall dry motor filter before use. Be sure filter is tucked under retaining tabs.
6. Reinstall bag as previously instructed.

WARNING:
To reduce the risk of fire, electric shock or injury:

- **Unplug and disconnect power before servicing.**
- **Avoid wet surfaces.**
- **Use only manufacturer recommended attachments.**
- **DO NOT use without dustbag and/ or filters in place.**
- **DO NOT pick up anything that is burning or smoking, such as cigarettes, matches, or hot ashes.**
- **Use extra care when cleaning on stairs.**
- **DO NOT use to pick up flammable or combustible liquids such as gasoline or use in areas where they may be present.**

EQUIPMENT - INTRODUCTION

This section covers the basic operation and care of equipment found in the motorhome, most of which are provided for entertainment and comfort. More detailed information about specific equipment may be found in that particular OEM manual. Optional equipment will also be discussed in this section that 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 that specific OEM manual.

ENTRY STEP

Operation

The exterior electric entry step features retractable steps, automatic retraction with the ignition key in the **RUN** position and a last out feature. The bar light indicates the circuit is active when illuminated.

080498z

Located on passenger side.

NOTE:
When dry camping it is important to note that when the switch is illuminated, all step circuits are active and drawing current from the chassis battery.

Operating the Entry Step:

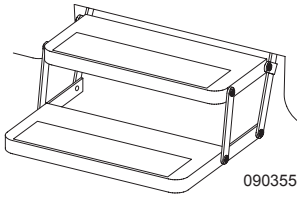
1. Chassis battery disconnect switch must be on.
2. With the entry door open, turn the entry step switch on.
3. Close the door. The step should retract and lock in the **IN** position.
4. Open the door. The step should extend and lock in the **OUT** position. The step will retract when the door is closed.
5. When the switch is turned off, the step should remain in the extended position. Close the door and turn on the ignition switch. The step will retract for travel.
6. With the power switch off, the step extended, the entry door closed and the ignition turned on, the ignition override system will engage to automatically retract the step.
7. Turn the ignition off and open the door. The step will extend and lock in the **OUT** position. This is the "last out" feature. When the ignition is on the step will always activate with door movement, regardless of the power switch position.

WARNING:
Turning the ignition switch to the ON position while the motorhome is parked will cause the entry step to retract. Visually confirm that the entry step is fully extended prior to exiting the motorhome.

CAUTION:
High curbs can impede step operation. Use care when parked on side streets.

NOTE:
The steps are self lubricating and require no maintenance.

If the entry step fails to operate:


090355

- Verify that the entry step switch is ON.
- Check the main power supply for the step: a 25 Amp fuse located in the roadside front electrical 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.

CAUTION:
Keep fingers, clothing and other hardware away from moving components.

NOTE:
Clean and inspect step more frequently in adverse weather conditions. Mud, snow, road salts and sand quickly break down lubricant and corrode painted surfaces.

Step Cover

An electrically operated stepwell cover will extend and retract using the switch on the center console. Power is supplied by a 15 Amp circuit breaker in the roadside front electrical panel.

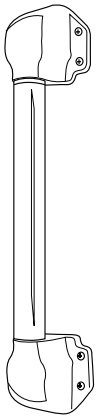
To operate the Stepwell Cover:

- Chassis Battery Disconnect must be on.
- 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.

GRAB HANDLE

The grab handle is used to aid in entering and exiting the motorhome.

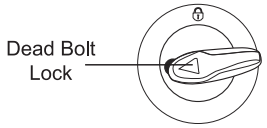

020130d

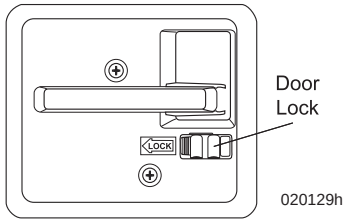
CAUTION:
Clean the acrylic grab handle using mild soap and water only. DO NOT use alcohol-based glass cleaners. Alcohol-based solutions, in combination with heat and light, can adversely affect acrylic material and cause stress cracks that can result in eventual failure of the grab handle.

ENTRY DOOR

The entry door is adjusted at the factory and tested for all operations. The door uses two separate locks for safety and security. One locking system is the door lock and the other is a dead bolt.

The door handle incorporates a primary and secondary latching system used to ensure secure and safe latching. Adjustments can be made to help maintain entry door performance.

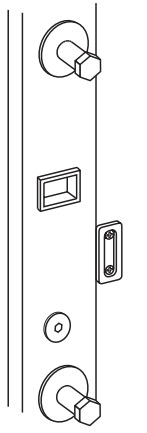




020129h

Adjusting the Entry Door Latch:

- Determine which bolt needs adjustment.
- Slowly close the entry door, observing the latch and strike bolt alignment. **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.
- The entry handle should operate with little effort to open the entry door. Excess pressure indicates the bolts are set too far back.
- With a box wrench or socket, loosen the movable strike bolt. Adjust in small increments. Tighten the bolt firmly after making adjustments.


020131f

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 in use. Use a 1" sponge paint brush, sprayed with silicone for easy application.

CAUTION:
When operating the entry door, ensure the dead bolt latch is fully unlocked prior to closing. Failure to do so can result in damage to the dead bolt and/or entry door.

Changing Screen Door Glass:

- The screen slider is Tuffak®. The slider can be bowed for removal and replacement.
- Replace with new Tuffak and reverse the procedure.

Adjusting the Screen Door:

- Loosen the fasteners on the hinge side of the screen door; two on the top and two on the bottom.
- The steel hinge has slots to allow movement.
- Four Phillips type screws are on the top hinge, and four on the bottom hinge, to adjust the screen door to properly fit to the entry door. The hinge should fit tightly to the trim of the 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, allowing a clear view through the entry door glass while in operation.

- To remove the top half of the screen door for travel, rotate clips 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 room operation uses safety features to prevent mechanical damage or physical harm. Slide-out room(s) will not operate until all safety requirements are met. To prevent damage to cabinet doors or the slide room, secure all cabinet doors in the closed position prior to room activation. Some interior doors may require being fully open or fully closed for the slide room to operate.

Safety Requirements:

- Ignition key must be in the **OFF** position when extending to the **OUT** position.
- Park brake must be applied.

CAUTION:
DO NOT leave the slide room extended during severe weather. Conditions such as high winds or heavy rain may cause damage. Rain water can pool on the slide room awning, adding weight and causing the awning to sag. Retract the room in small increments to allow water run off.

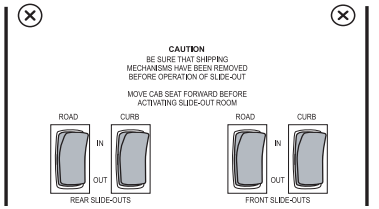
CAUTION:
DO NOT move the motorhome with any slide room extended. Perform slide room operation with air suspension system full.

CAUTION:
Extensive damage could occur to the slide-out room and awning when extending the slide-out room in snow, sleet, ice or freezing rain conditions. 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:
The motorhome must be supported by the air suspension (air bags) whether extending or retracting any slide room. DO NOT operate the slide out room with the air suspension (air bags) deflated or when supported by hydraulic jacks. Damage to the slide out room, mechanism or seals can occur.

Operation Requirements for Slide-out:

- House battery disconnect switch must be on.
- House batteries must be fully charged.



Monitor Panel: Located in hallway area

Guidelines to ensure long life of slide system:

- **Inspect** roof of the slide for debris such as pine needles, dirt, leaves, sticks, etc. 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.
- If the slide room leaks, fully retract the room. If necessary, tape exterior opening closed with duct tape until repairs to the motorhome can be completed.

CAUTION:
Firmly latch all cabinet doors adjacent to the slide before extending or retracting the rooms. Damage to doors or the fascia may occur.

NOTE:
Dirt and grit trapped under the slide room can scratch and damage the floor. Clean the floor before retracting the slide room. Never move the motorhome with the slide room extended.

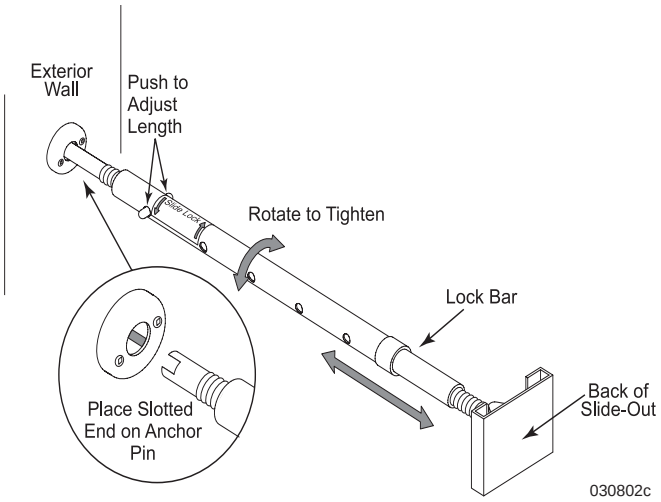
NOTE:
DO NOT use petroleum based products on the slide seal. Petroleum based products can damage the paint and will cause premature aging of the rubber seal.

Extending & Retracting Slide Rooms

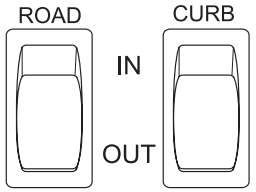
To Extend or Retract Slide Rooms:

- Move the driver or passenger seat forward. Clean the floor of dirt or grit that could result in damage during operation.

- Confirm there is enough clearance inside/outside the motorhome for the room to extend/retract.
- Allow at least five feet of clearance to extend the slide-out.
- Retract hydraulic jacks. Start the engine. Allow time for the air suspension to support the chassis.
- Turn off the engine. Ensure park brake is applied when extending and retracting the slide room.
- Confirm the house batteries are fully charged and operating.
- Open a window or vent to equalize pressure during slide-out operation.
- Ensure people, pets and objects are clear of the slide room path.
- Remove the lock bars when extending.



- Firmly latch all cabinet doors and close drawers. Damage to the doors, drawers and fascia can occur.
- Locate the slide-out room control switch. Press and hold the slide room switch to the desired (**IN** or **OUT**) position.



- Release the switch to stop room movement. The drive motor will not automatically stop; the switch must be released. A change in motor sound indicates full extension/retraction.
- If applicable, install any lock bars for travel.

WARNING:
The outside area must be clear of obstruction that can restrict slide room operation. Ensure there is five or more feet of clear space outside the slide room prior to extending the room or damage to the slide, the motorhome or property can occur. When retracting the slide room, ensure there is sufficient clearance inside the motorhome. Move the driver or passenger seat forward before activating the slide room.

CAUTION:
Remove lock bar prior to extending slide-out.

CAUTION:
Continuous operation of the slide room can drain the batteries and overheat the motor.

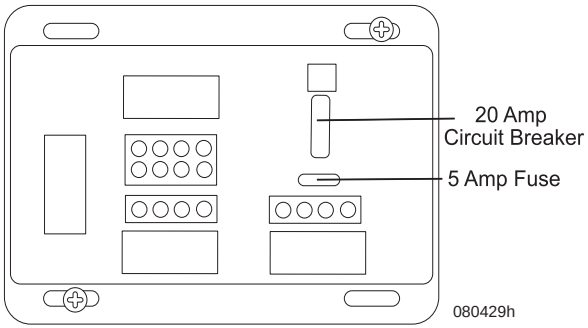
CAUTION:
If a problem with the slide-out occurs, contact a qualified technician.

Troubleshooting

If the slide room does not operate, a safety feature may be engaged to prevent room operation.

If slide room does not respond from switch, check the following safety requirements:
- Ignition key is OFF.
- Park brake is applied.
- Lock bar is removed.
- House battery disconnect switch is ON.
- House batteries are fully charged.

If the slide room does not operate after checking the safety requirements:
- Examine all electrical connections at the slide-out switch.
- Check the 5 Amp fuse and 20 Amp circuit breaker in the black box located in the curbside battery compartment.



Located in curbside battery compartment in black box.

- Check the slide-out relay fuse found in the roadside front electrical panel.

- Check slide-out fuse or fuses (depending on floor plan) located in bedroom distribution panel.
- House batteries are fully charged.
- It may be necessary to contact a repair facility to have the problem diagnosed and repaired.

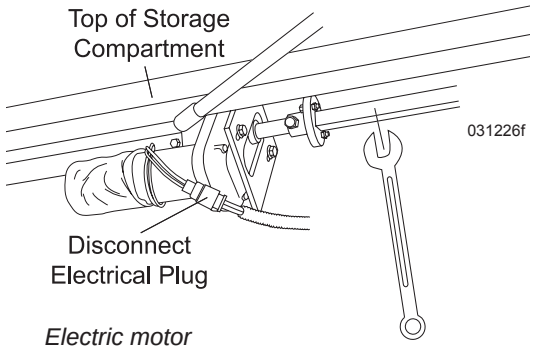
WARNING:
DO NOT work on slide-out system unless the battery is disconnected. Make sure floor is clean before retracting slide-out room.

Manual Override -Main Slide Room

To Move the Main Slide Room (Electric Motor System) Manually:

1. Turn off both house and chassis battery disconnect switches.
2. Access the slide room electric motor. The motor is located in either a curbside or roadside compartment, depending on the floor plan. The motor is at the top of the compartment.
3. Remove 12 Volt DC power from the slide-out motor by disconnecting the electrical plug. The plug can be located by following wires that run from the motor to the plug.
4. Attach a crescent wrench to the electric motor drive shaft. Turn counterclockwise to bring slide room in, turn clockwise to move slide room out.
5. Once the slide room has been manually retracted, apply pressure to the wrench to firmly set the room. This will help prevent room drift.
6. Take the motorhome to an authorized repair center.

CAUTION:
DO NOT continue to turn the motor after the room is fully extended/ retracted. Damage to the slide mechanism can occur.



Electric motor

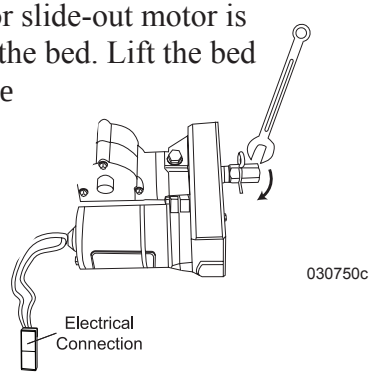
Manual Override - Bedroom

Depending on floorplan the bedroom may have either a cable or an above floor slide-out system. The above floor slide-out is used when the bed moves with the slide out. If the wardrobe closet moves with the slide-out, the system is cable.

Another method of checking for the cable system is with the bedroom slide-out extended a cable is visible by the slide-out.

To Move the Bedroom Slide Room (Above Floor System) Manually:

1. Turn off both the chassis and house battery disconnect switches.
2. The above floor slide-out motor is located under the bed. Lift the bed and remove the access panel.



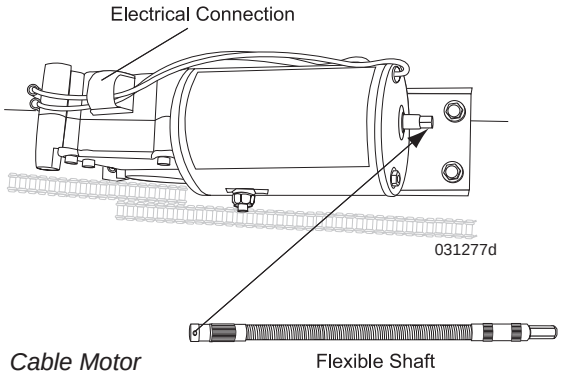
Above floor motor

3. Disconnect the slide-out motor electrical plug to remove 12 Volt DC power from the slide-out motor. The plug can be located by following wires that run from the motor to the plug.
4. Use a wrench to turn drive shaft and retract room. Once the slide room is manually retracted, apply pressure to the wrench to firmly set the room and prevent room drift.
5. Once the slide room is manually retracted, reconnect power supply.
6. Take the motorhome to an authorized repair center.

CAUTION:
Do not continue to turn the motor after the room is fully extended or retracted. Further damage to the slide mechanism can occur.

To Move the Bedroom Slide Room (Cable System) Manually:

1. Turn off both the chassis and house battery disconnect switches.
2. Locate the bedroom slide-out motor. The motor is located near the ceiling of the slide-out. Remove the trim.
3. Disconnect the slide-out motor electrical plug to remove 12 Volt DC power from the slide-out motor. The plug can be located by following wires that run from the motor to the plug.



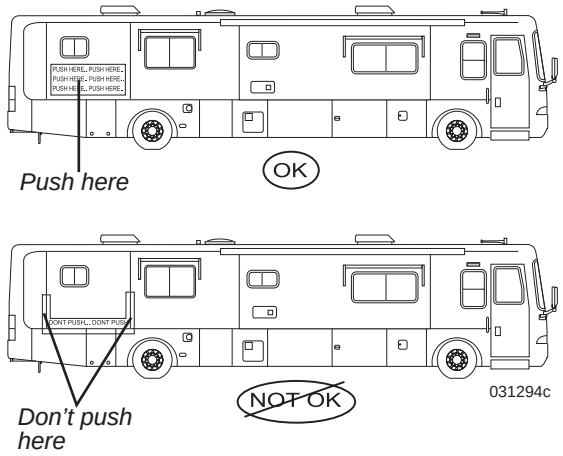
4. Attach the flexible shaft to the fitting on the end of the slide-out motor.
5. Attach a socket and ratchet or drill to the other end of the flexible shaft. Reverse the direction. **DO NOT over-torque as damage can occur.**
6. Turn in proper direction to move the room. If the cables tighten and the motor is difficult to turn, reverse the direction. Over-torquing can cause severe damage.
7. Take the motorhome to an authorized repair center

Broken Cable - Bedroom Slide-Out

If the cable on the bedroom slide-out breaks call an authorized repair center for roadside assistance. If this is not possible then the slide-out must be manually pushed in. When pushing use extreme care and safety. Take extra precautions from getting fingers pinched. Avoid getting fingers near edge of slide wall or around wall edge. Push slide-out from the back. DO NOT wrap hands and fingers around edge of slide-out, see illustration. Keep fingers away from frayed or broken cables. Frayed wire is sharp and can cut. Cables can also jam, then whip free causing serious injury or death.

Manual Procedure:

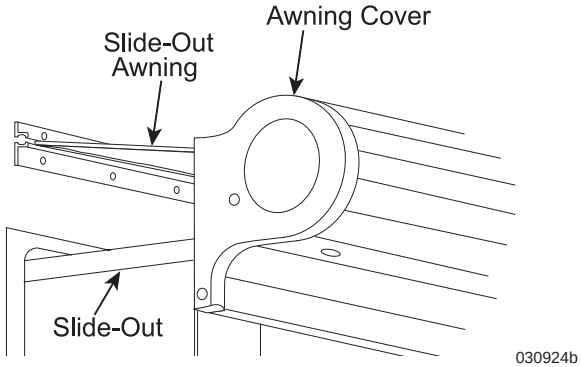
1. Turn off both the battery and house disconnect switches.
2. The bedroom slide-out room is heavy, but not as heavy as the main slide-out. It will require 1-2 people to push the room into position.
3. Once the slide-out is in position, take the motorhome to an authorized repair center.



AWNINGS

Slide-out Cover

The slide-out cover automatically reacts to 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 automatically reaches full extension when the slide-out room is fully extended. The slide-out cover automatically rolls up into the travel position when the slide-out room is fully retracted.



NOTE:
When retracting the slide-out, stop the room approximately halfway. Confirm that the fabric is properly rolling before fully retracting the slide-out.

CAUTION:
The slide room and slide-out awning should be retracted before heavy wind, rain or snow to prevent damage to the awning or motorhome. Wind can drive rain under the slide-out awning and into the motorhome.

CAUTION:
At least five feet of clearance is needed between the side of the motorhome and any objects, such as trees or fences, to allow the slide room and slide-out awning to fully extend.

CAUTION:
Rain water can pool on the slide-out awning. The added weight will cause the awning to sag. Upon retracting the room, material can become caught in between the top of slide room and the opening in the motorhome. It will be necessary to retract the room in small increments and allow the water time to run off.

Front Door Awning

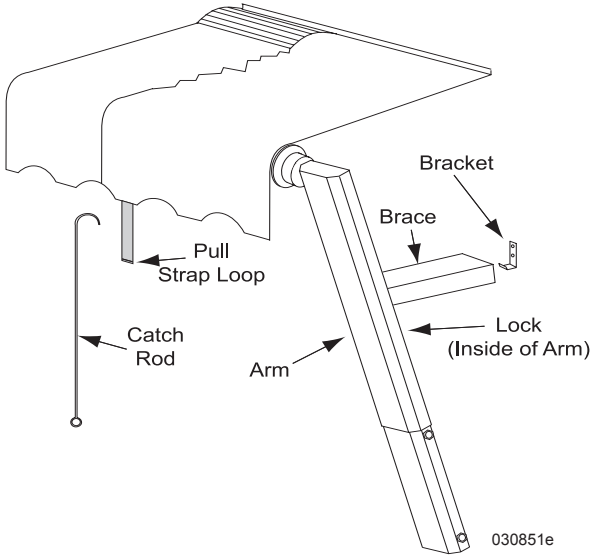
To Extend the Awning:

- Unlock the awning arm. Lock is located inside the right arm. The lock is a metal piece with two holes. Push the lock up to unlock.
- Using the catch rod, hook the pull strap loop.
- Pull downward until awning is at full extension.
- Pull out the brace located in one arm.
- Connect the brace to the bracket on the side of the motorhome.
- Repeat procedure for other arm.
- Store catch rod.

To Retract the Awning:

- Using the catch rod, hook the pull strap loop.
- Pull down slightly to relieve tension on awning.
- Carefully disconnect one brace from the bracket on the side of the motorhome. Store brace by pushing it back into arm.
- Repeat for the other brace.
- Using the catch rod as a guide, carefully allow awning material to wind onto awning roll tube. Hold the catch rod in a neutral position to roll material evenly.
- Lock awning by pulling down on lock until it is securely in place.

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.



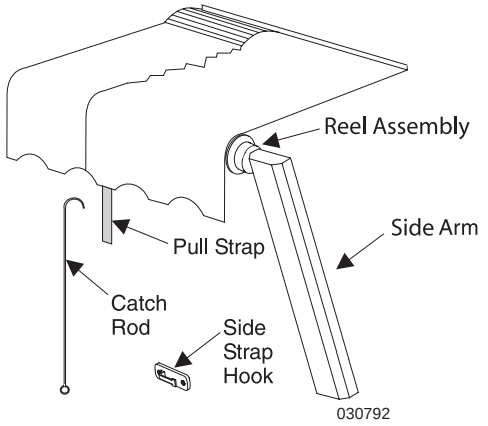
Window Awning (Optional)

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 for future use.

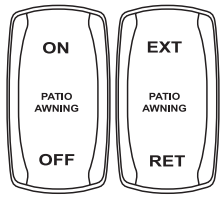


Patio Awning - Eclipse

The Eclipse awning operates on 12 Volt DC by the push of a button. The awning requires 10' of lateral side clearance.

To Operate:

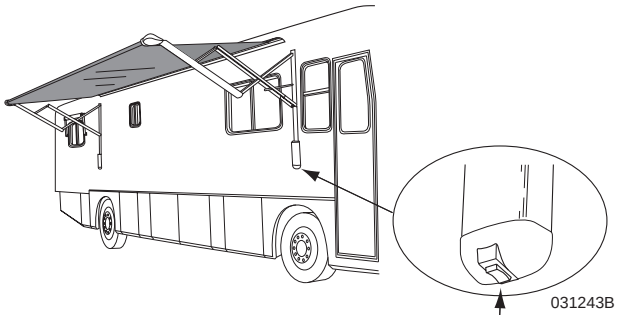
- Turn the ignition switch OFF.
- Check for sufficient clearance before extending the awning.
- Chassis battery disconnect must be ON.
- Turn the Awning Power On/Off button to ON .
- Push and hold the Extend/Retract button to extend the awning. Release the button at any time for partial extension.
- Push the Extend/Retract button and hold to retract awning.



060313g

External Control Switch:

An external control switch is located at the bottom of the front outside arm.



031243B

To Operate:

- Turn the ignition switch OFF.
- Check for sufficient clearance before extending the awning.
- Chassis battery disconnect must be ON.
- Turn the Awning Power On/Off button to ON.
- Push and hold the external control switch to extend and retract the awning. Release the button at any time for partial extension.

If the awning fails to operate:

- Ensure ignition is off.
- Check power at 15 Amp circuit breaker in the roadside front electrical panel.

NOTE:
See awning OEM manual for detailed operation instructions.

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 fabric cleaner may be used to help maintain appearance. Carefully follow the instructions on cleaning products. 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.

Carefree Awnings:

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.

Polyweave and Vinyl Awnings - Mildew will not form on the awning material itself, but 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. A mild soap (i.e. dish soap) and lukewarm water solution can be used. **DO NOT** use detergents. 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*.

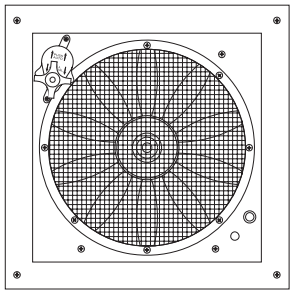
Storm Precautions

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, extend as soon as possible to allow complete drying.

NOTE:
Water weighs 8.33 pounds per gallon. The awning was not designed to withstand the 500 to 700 lbs. of water that can accumulate on the canvas.

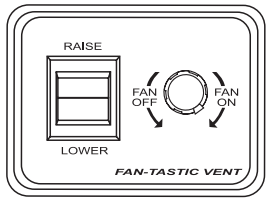
FANS
Automatic

A wall rheostat controls the automatic vent and power of the fan. The system operates from 12 Volt DC power.


030832k

Fan Operation:

- Ensure house batteries are on.
- Turn on the battery cut-off switch.
- Press the vent cover knob into 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.



031205d

- 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 is closed.

WARNING:
DO NOT hold switch after the motor has stopped. This may cause damage to the automatic lift system, resulting in a stuck vent.

NOTE:
The safety switch built into the fan will not allow the fan blade motor to operate unless the vent is open 2" or more.

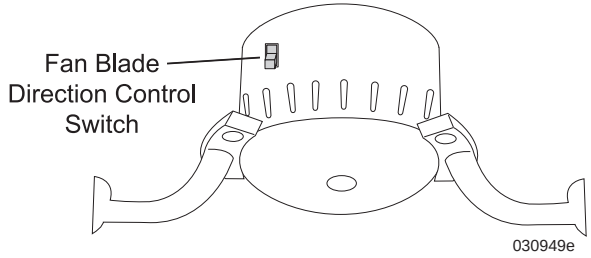
Tips for Fan Operation:

- Operate the fans to keep condensation from accumulating. Condensation occurs naturally from fluctuations in interior and exterior temperatures, humidity and dew point changes, steam from cooking or boiling large amounts of water on the cooktop. Shower use is another source of condensation.
- If the fan fails to operate, check for a blown fuse either in the house distribution fuse panel or the 4 Amp fuse on the fan.
- To remove the screen, loosen the screws holding the screen in place. Use non-abrasive soap and water to clean and reinstall.
- Slightly open windows on the shaded side of the motorhome to create the most airflow, especially on hot, sunny days. Direct airflow by slightly opening selected windows. Maximum airflow is achieved between an open window and the vent.

NOTE:
DO NOT leave the fan switch in the active mode while the motorhome is stored or unattended for extended periods. High winds, unusual conditions or obstructions may prevent the fan cover from fully closing, resulting in leakage and serious damage.

BEDROOM CEILING FAN (Optional)

A bi-directional 12 Volt DC powered ceiling fan is located in the bedroom. Place the switch in the up position to move the blades counterclockwise and push air down (for cooling in summer). Place the switch in the down position to move the blades clockwise and pull air up (for warming in winter). Turn the fan off before reversing fan blade direction.



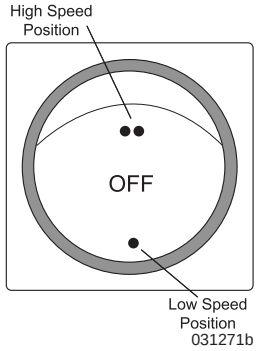
030949e

Fan operation is controlled by a switch next to the bed and has three positions: Off, High Speed, and Low Speed.

Periodic maintenance consists of cleaning the blades with a soft cloth towel or a vacuum to remove dust build up.

Requirement for Ceiling Fan Operation:

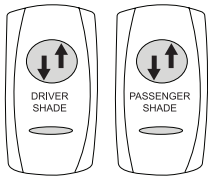
- House battery disconnect switch must be on.
- Turn on battery cut-off switch.

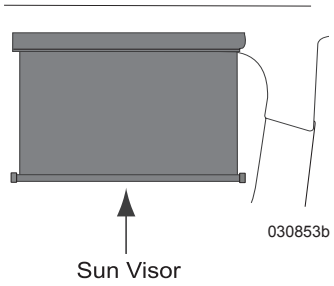


CAUTION:
Use caution not to enter into fan path when on. Serious injury can occur.

POWER SUNVISORS

To extend the sunvisor press and hold the lower portion of the control switch until the desired location is obtained. To retract the sunvisor press and hold the upper portion of the control switch. Clean the sunvisor using a soft clean brush to remove dust.





Requirement for Sunvisor Operation:

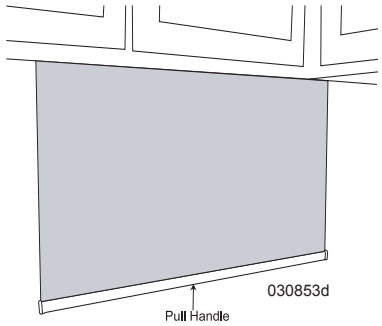
- Chassis battery disconnect switch must be on.
- Chassis batteries must be fully charged.

NOTE:
DO NOT attempt to move or drive the motorhome with any window view obstructed.

SUN SHADES - PULL DOWN

Both the driver and passenger windows have a manual pull down shade to help filter sunlight. To utilize, pull down on the handle.

WARNING:
DO NOT attempt to move or drive the motorhome with any window view obstructed.

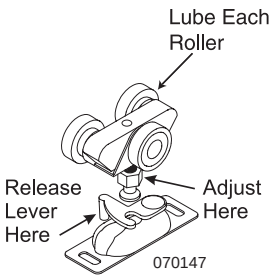


DOOR - SLIDING

The sliding pocket door utilizes two rollers at the top of each door. The sliding door may require adjustment during the life of the motorhome. Locate the small wrench and turn the adjusting screw upward or downward.

To remove the pocket door, locate the portion secured at the top 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 sliding.



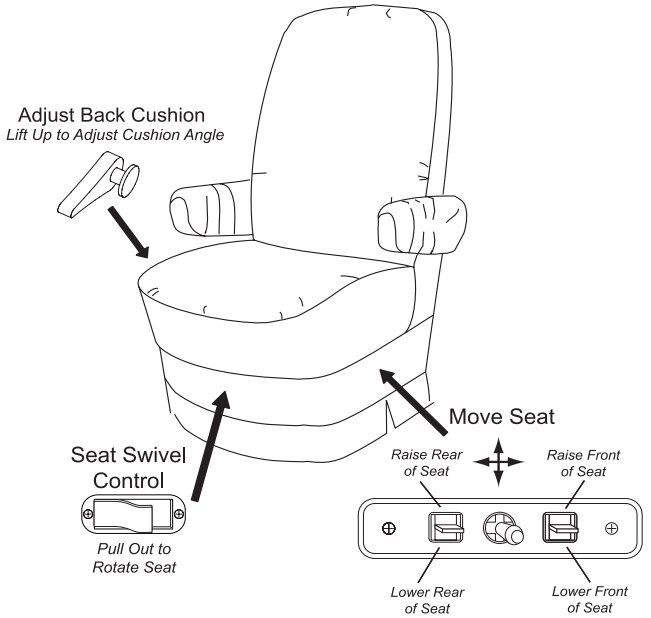
SEAT CONTROLS

The Pilot and Co-Pilot seats are adjustable to provide maximum comfort. Seats must be locked in the forward facing direction while traveling. Co-Pilot power seat controls are optional.

NOTE:
The power seats operate from 12 Volt DC house power. The 15 Amp fuse is located in the roadside front distribution box.

To Operate Seat Power Controls:

- Battery disconnect switch must be on.
- Battery cut-off switch must be on.



Location of seat controls may vary

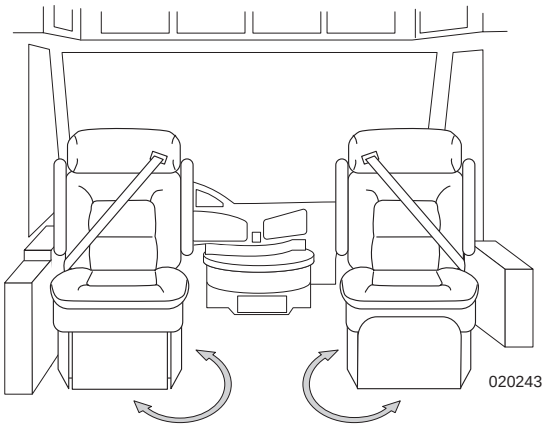
Swivel Seats

Swivel Seat Operation:

- To swivel, pull out on the swivel control lever.
- When rotating the driver seat, put the steering wheel in the upright position.
- Move the seat forward. Pull the swivel lever up and rotate to the desired position.

WARNING:
Seats must be locked in the forward facing position while the motorhome in transit.

NOTE:
If the either power seat is rotated 180°, it must be rotated back in the opposite direction. The 12 Volt wiring in the seat may disconnect if seat if rotated 360°.



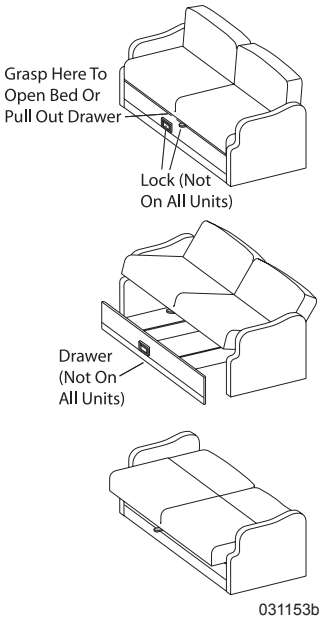
SOFA

Easy Bed Sofa (N/A on All Units)

The sofa coverts into a bed. Clear the area of obstruction and debris.

Sofa to Sleeper:

- If applicable, release lock.
- Raise the sofa seat base until seat base and backrest form a “V” shape by lifting up from the center of sofa just below the seat cushions.
- Push down on seat base until the seat base and backrest are flat.



Sleeper to Sofa:

- Lift the seat base up until seat and back rest are in a “V” shape.
- Push down on seat base.

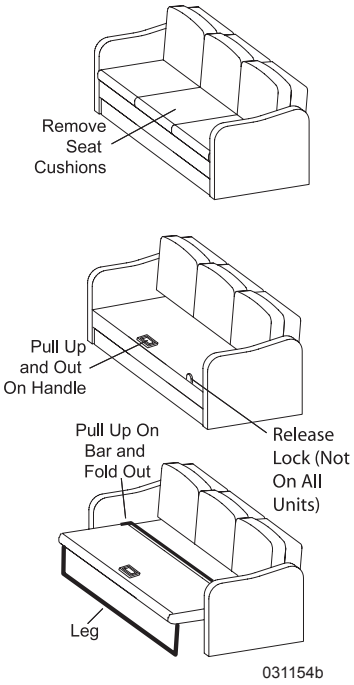
WARNING:
Do not use the sofa for transporting infants or children that require safety seats or booster seats.

Hide-A-Bed (N/A on All Units)

The sofa hide-a-bed will convert into a bed. Clear the area of obstruction and debris.

Sofa to Sleeper:

- Remove the three seat cushions to access the hide-a-bed. The seat cushions should be stored safely until the bed is converted back to a sofa.
- If applicable, release the lock on the right side of metal bar, grasp the front metal bar and lift up pulling out on the bar slightly until the leg of the bed is firmly resting on the floor.

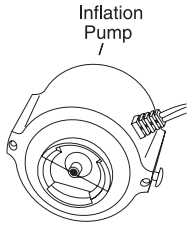


- When the legs of the bed are firmly on the floor there will be another lifting bar exposed to complete the conversion process.
- Grasping and opening the lifting bar will open the bed fully. The bed is now ready for linen.

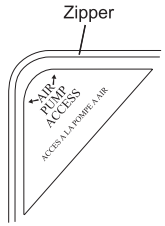
Sleeper to Sofa:
- Remove all bedding from the hide-a-bed.
- Grasp the foot of the hide-a-bed in the center using the metal lifting bar.
- Fold over the bottom portion of the bed that will form the seat.
- Lift the front portion of the lifting bar to raise and lower the hide-a-bed back into the sofa base.
- Replace the seat cushions.

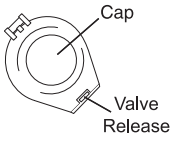
HIDE-A-BED AIR MATTRESS (N/A on All Units)

Use the hand-held electric pump to inflate the mattress. Plug the pump into a 120 Volt AC outlet. For ease of operation, position the sofa so that accessing an electrical outlet is convenient.



To Inflate Mattress:
- Open sofa and allow the mattress to lie flat.
- Unzip the corner of the mattress labeled Air Pump Access.
- Remove valve cap by turning cap counterclockwise.
- After cap is removed, insert pump motor and turn clockwise until pump is engaged.





020260e

- Plug in pump motor and inflate to full, approximately 60 seconds. A motor pitch change occurs when mattress is full.
- Remove pump and reseal valve cap by turning clockwise.
- Zip the "Air Pump Access" cover closed. The bed is now ready for linen.

To Deflate Mattress:
- Remove bed linen.
- Unzip the corner cover of the mattress labeled "Air Pump Access."
- Open deflation valve by lifting valve latch. Allow mattress to deflate.
- Once the mattress is deflated, swing valve to closed position. **DO NOT LOCK VALVE CLOSED** by locking the valve. Trapped air could damage the mattress.
- Zip the "Air Pump Access" cover closed and close the sofa.

NOTE:
DO NOT close deflation valve when closing the sleeper mechanism.

WARNING:
The electric inflation pump is for indoor use only. DO NOT use near or place in water. Keep infants and small children away from pump and product when not fully inflated. Partially inflated product can cause suffocation.

Removing the Mattress Valve:
- Open deflation valve by lifting up on valve tab.
- Remove the old valve by lifting the black plastic on outer edge of the valve toward the center. The valve will then lift out.

Installing New Mattress Valve:
- To install the new valve, first open the replacement.
- Once open, seat the hinge area on to the hinge support, then squeeze the vinyl towards the center of the mattress opening.
- Feed the vinyl through the opening of the new valve.
- Once accomplished, make sure there are no bulges in the vinyl. Use thumb to make sure that it is smooth.
- Next, lock the replacement shut.

AIR MATTRESS - BED (Optional)

The Air Mattress includes two separate air chambers that can be adjusted for comfort and firmness. The air pump is located under the bed.

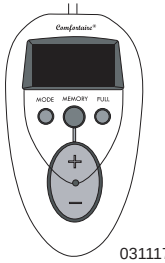
To Operate Air Mattress:

The air mattress requires 120 Volt AC power from shore power or the generator. The optional inverter can be used, however, battery power may be depleted by continued operation.

Ensure the battery-cut out switch is on and the house batteries are charged.

What is a Sleep Number:

- It is a setting between 0 and 100 that represents the ideal combination of mattress comfort, firmness and support for each person's body.
- Use the initial Sleep Number on the remote as a starting point.

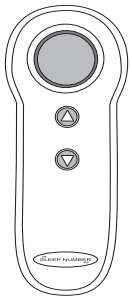


031117

Air Mattress Pump

Setting the Sleep Number:

1. Lie on the bed in a normal sleep position.
2. Press and release any remote button to display the current Sleep Number setting.
3. To change setting, press the firmer or softer buttons until desired comfort setting is achieved.
4. Remain still until the number change is complete.
5. When adjustment is complete, the Sleep Number will stay lit for five seconds and then the display will turn off.



031117c

Air Mattress Remote

NOTE:
Finding the ideal Sleep Number may require experimenting with different settings.

CAUTION:
When retracting or extending the slide-out ensure that the air mattress remote is safely stored and away from the moving slide-out. If not safely stored the air mattress remote could be damaged by the retracting or extending slide-out.

Mattress Care:

The cover may be spot cleaned with carbonated water or mild detergent. **DO NOT** dry clean the mattress cover or put it in a washing machine. **DO NOT** apply a stain-guard, as this may cause yellowing of the fabric.

In rare instances mold or mildew may form inside mattress or bedding. If this occurs call the manufacturer's customer service department at 800-318-2231.

Mountain Traveling:

If traveling into a mountainous region, either (1) temporarily disconnect the mattress from the pump hose to allow air escape or (2) partially deflate the mattress chamber to a Sleep Number of 20.

WARNING:
Rapid changes in altitude will effect the air pressure inside the mattress. The chamber may be damaged when pressure becomes too great.

NOTE:
For more detailed information consult the OEM manual or call 800-318-2231.

DINETTE

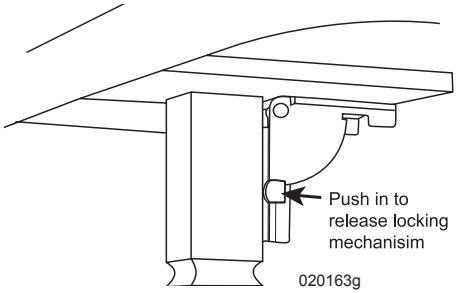
Booth Dinette - Arched Back W/Bed Conversion

For Table:

- Swing table up and attach to wall bracket.
- Unlock leg lock and extend leg into position.
- Place cushions back into seat cushion positions.

Storage:

- Storage is provided under both seats.
- Remove cushions and lift lid to access storage compartments.
- Open front doors to access storage compartments.



020163g

For Bed Conversion:

- Remove the seat cushions. This allows the table to move down into the bed position.
- Under the table locate the button lock found on front bracket. Push button to unlock leg. Swing leg up.
- Tilt table up to release table from wall bracket.
- Pull table out and push down lowering table until it fits between the two seats.
- Use cushions for a mattress.

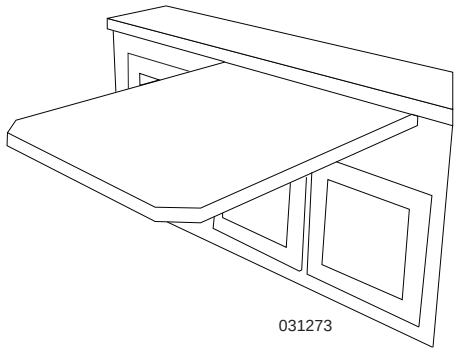
WARNING:
Only forward facing booth dinette seats equipped with seat belts are designed for occupancy while the motorhome is in motion. DO NOT occupy booth dinette (if not equipped with safety belts) or the dining chairs while the motorhome is in motion. To avoid injury in case of a crash or sudden stop, chairs must be stored in an enclosed area or secured with tie down straps while the motorhome is in motion.

Free Standing Dinette (Optional)

The free standing dinette comes with two standing chairs and two folding chairs.

To Extend/Retract Table:

- To extend, pull out on table until it locks.
- To retract, push in on table until it locks.

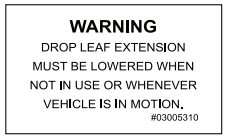


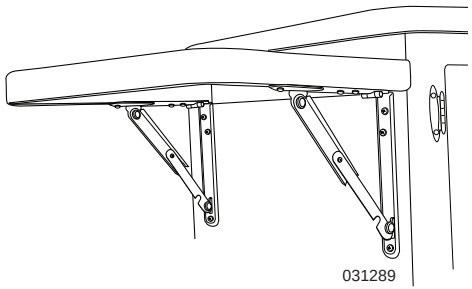
NOTE:
Table does not retract completely.

COUNTERTOP EXTENSION

To Extend Drop Leaf:

- Grasp extension and lift up until it locks into place.





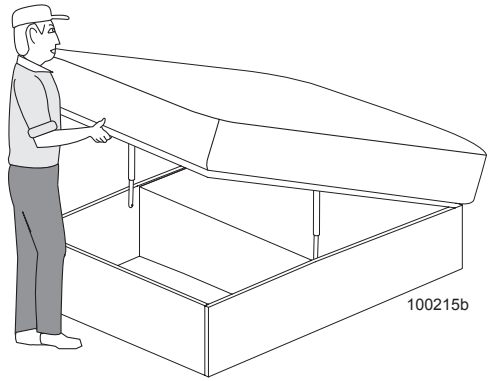
To Close Drop Leaf:

- Grasp extension and lift up.
- Place fingers on both arms, then push in arms to disengage lock.
- Lower extension to the close position.

STORAGE - UNDER BED

To use the storage compartment located under the bed, lift up the bed by the front edge of the mattress platform. Gas struts hold the mattress and platform open.

NOTE:
Overstressing gas struts by rapidly opening or closing the bed access cover can damage the struts or mounts. In extreme cold, struts may not hold the mattress platform open.



LADDER - REAR

The rear ladder allows access to the roof. Use care when climbing the ladder. Access to the roof should be limited to cleaning and sealing purposes only.

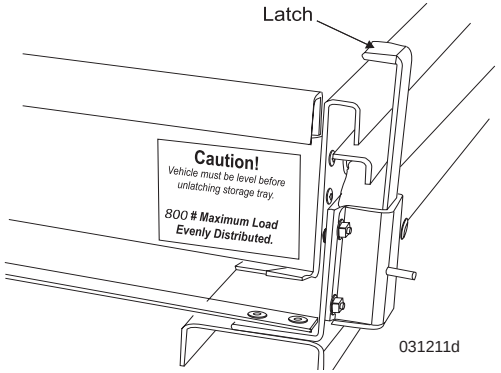
Stow the lower portion of the ladder in the cargo bay during travel.

NOTE:
Maximum weight capacity for the ladder is 300 lbs.

STORAGE BAY SLIDE-OUT TRAY (Optional)

The storage bay slide-out tray is an option available for use in the storage compartment bays of the motorhome. This allows for the payload to slide outward for easier access.

WARNING:
The motorhome must be level when sliding the drawer out of the bay compartment. The drawer can slide out abruptly and cause bodily harm if the motorhome is not level.



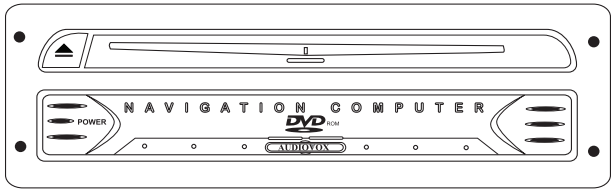
- Ensure the motorhome is level.
- To open, press down on the latch and hold to unlock. The tray can then be pulled out.
- To close, slide the tray in until the latch locks the tray in place.
- DO NOT exceed maximum weight capacity (800 lbs.).

GPS NAVIGATION (Optional)

The GPS Mobile Navigation system provides 2-D and 3-D map views, instant re-routing and turn-by-turn instructions. The system includes a GPS antenna, a DVD ROM player and a DVD to provide map of the US and Canada.

CAUTION:
For safety, only perform GPS operations when motorhome is parked.

INFORMATION:
Complete information and instruction are found in the GPS OEM manual.



Located in the Driver Overhead Compartment 031219c

SATELLITE RADIO (Optional)

The satellite radio option includes a six month prepaid subscription to Sirius satellite service. The deck radio in the motorhome is Sirius ready. Additional hardware will need to be purchased and installed to complete the satellite radio system.

Satellite signals are transmitted from a ground station to satellites orbiting over the continental United States. The satellite then transmits the signal to an antenna in the motorhome. The radio receiver decodes the transmission and plays the selected channel within that transmission. Signals are also transmitted to ground repeaters for listeners in urban areas where the satellite signal can be interrupted.

NOTE:
Components can be obtained by calling National Parts at 1-877-466-6226.

NOTE:
For information regarding subscriptions and service coverage areas, contact the system provider.

Sirius® Radio
1-888-539-7474
www.siriusradio.com

INFORMATION:
For detailed information, account activation and operating instructions on the satellite radio, refer to the manufacturer's manual located in the Owner's Information File box.

TV ENTERTAINMENT COMPONENTS

The following paragraphs will discuss the operations and various components that make up the entertainment center.

INFORMATION:
It is recommended to become familiar with individual components. Refer to the respective component's OEM manual for detailed instructions on operating individual components.

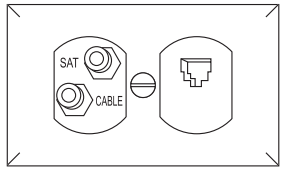
NOTE:
All components of the entertainment system require 120 Volts AC to operate. Hook to shore power, start the generator or turn on the inverter. The satellite system requires 12 Volts DC to operate. Turn on the interior house power using the battery cut-out switch.

Television (Front) Lockout Feature

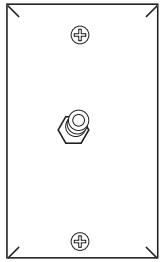
The ignition switch controls the outlet for the front TV, allowing the front TV to operate only while the vehicle is at rest. Viewing time of the front TV from the inverter depends on state of charge of the house batteries and any additional 12 Volt DC lighting used.

Connections - Cable TV, Computer & Phone

The motorhome is equipped with cable TV, satellite, and phone hook-up located in the roadside rear compartment. For convenience, the inside auxiliary outlets are located throughout the motorhome.



Located in roadside rear compartment 060192e



060192bf

Cable Out Connection: Located in curbside compartment

NOTE:
The cable connection in the roadside rear compartment is a CABLE IN that connects, for example, to a campground cable hook-up. A second cable connection is located in a curbside compartment. This is a CABLE OUT that is used to connect to an independent television monitor, for example, a monitor sitting on a picnic table.

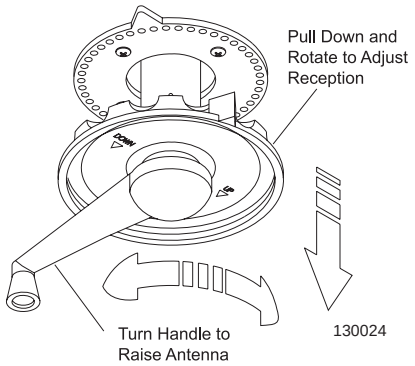
TV Antenna

The television (TV) antenna is a manual crank style antenna with built in electronics that use 12 Volts DC to "boost" signal strength. A weak or fuzzy signal can be amplified by turning on the TV antenna power button on the video selector box. The antenna and booster work together to provide the best possible picture for most situations. Certain conditions may occur that require no amplification, and amplification may actually worsen the reception. In this case, the picture quality may improve by lowering the antenna and providing no amplification.

WARNING:
DO NOT raise the TV antenna near overhead electrical wires. Contact may cause serious injury or death. DO NOT move the motorhome when the TV antenna is up.

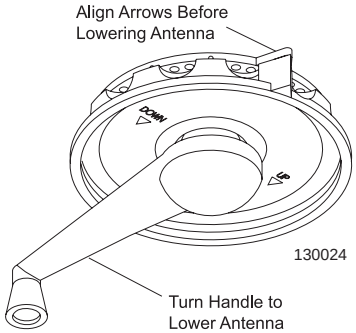
To Raise the Antenna:

- Rotate the crank handle clockwise to raise the antenna (about 14½ 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.
- 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.



CAUTION:
DO NOT move motorhome with antenna in the raised or partially raised position. Worm gear damage or breakage may result from tree limbs or wires.

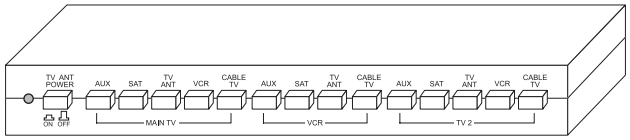
WARNING:
Before raising antenna, make an outside visual inspection for any obstructions or overhead electrical wires. Damage to the antenna, severe shock, personal injury or death can occur from inadequate clearance.

Video Selector Box

The motorhome is equipped with a video selector box with five inputs and three outputs.

Features Include:

- Push button controls allow sending signals from any one of five different inputs to two televisions and VCR.
- Five inputs are Satellite Receiver, TV Antenna, VCR, Cable TV & Auxiliary.
- Three Outputs: Main TV, TV2, and VCR.
- Built-in 12 Volt DC television antenna power supply eliminates need for separate wall mounted television antenna power supply.
- Self-resetting fuses used in antenna power supply prevent failure caused by shorted connections.
- Video switch allows independent viewing of signals on different televisions with a record option from VCR.



Video Select Box 030861b

NOTE:
Two areas will be mainly used on the video selector box. For functions regarding the front television, make selections (TV Ant, Cable, etc.) in the area marked Main TV. For the bedroom television, use the area marked TV 2.

NOTE:
Operation of entertainment components is accurate at the time of printing. Due to changes in the entertainment equipment (manufacturers and models), and possible changes in the electrical systems of the motorhome, operation of various entertainment components may vary from what is printed.

To Watch Main Television from the Antenna:

- On the video selector box press the television antenna POWER button ON. This provides 12 Volt DC power to the television antenna amplifier located inside the antenna housing.
- Press the TV ANT button located in the area marked MAIN TV.
- Turn on TV. Use Input button to select TV.
- For Home Theater sound press Speaker switch to Home Theater. On DVD player press source button to select AUX 1 which will appear in window.
- Select desired channel on TV.
- Use volume control on DVD player to select desired sound level.

To Watch Bedroom Television from the Antenna:

- On the video selector box press the television antenna POWER button ON. This provides 12 Volt DC power to the television antenna amplifier located inside the antenna housing.
- Press the TV ANT button located in the area marked TV2.
- Turn on TV. Use Input button to select MONO or TV (depending on TV model).
- Select desired channel on TV.
- Use volume control on TV to select desired sound level.

INFORMATION:
To receive local channels, the TV must be on the Air setting (also called TV Mono, etc. by some manufacturers) found in the set-up menu.

NOTE:
The picture quality from the outdoor television antenna varies by location of the station in relationship to the antenna. If picture quality is poor and there is no external power supply, try turning the television Antenna Power button located on the control box OFF and ON.

To Watch Main Television from a Cable Signal:

- On the video selector box press the CABLE TV button above the area marked MAIN TV.
- Turn on TV. Use Input button to select TV.
- Access the television main menu and select the Set Up menu. Within the menu select Channel Set Up and select Cable.
- Initiate a channel Search to scan available channels. Exit menu.
- For Home Theater sound press Speaker switch to Home Theater. On DVD player press source button to select AUX 1 which will appear in window.
- Select desired channel on TV.
- Use volume control on DVD player to select desired sound level.

To Watch Bedroom Television from a Cable Signal:

- On the video selector box press the CABLE TV button above the area marked TV2.
- Turn on TV. Use Input button to select TV.
- Access the television main menu and select the Set Up menu. Within the set up menu select Channel Set Up and select Cable.
- Initiate a channel Search to scan available channels. Exit menu.
- Select desired channel on TV.
- Use volume control on TV to select desired sound level.

NOTE:
To view Cable TV signals the motorhome must be connected to a Cable TV. Cable TV inputs are available at many of today's campgrounds.

INFORMATION:
To receive cable channels, the TV must be on the Cable setting (also called CATV by some manufacturers) found in the set-up menu.

NOTE:
A Channel Search must be initiated to scan all available local channels in the area. Channel Search may be called Auto Search, Auto Channel Memory, etc., depending on manufacturer and TV model. Please refer to the TV OEM manual for instructions on how to receive all available over-the-air channels in the area.

To Watch Main Television from Satellite Signal:

- Turn on TV. Use Input button to select INPUT 2.
- Turn ON satellite receiver, then use satellite tracking system to acquire satellite.
- Use satellite remote control to select desired channel.
- For Home Theater sound press Speaker switch to Home Theater. On DVD player press source button to select AUX 1 which will appear in window.
- Use volume control on DVD player to select desired sound level.

To Watch Bedroom Television from Satellite Signal:

- On the video selector box press the SAT button in area marked TV2.
- Turn on TV. Use Input button to select INPUT 2, some television models may require INPUT 3.
- Turn ON satellite receiver, then use satellite tracking system to acquire satellite.
- Use satellite remote control to select desired channel.
- Use volume control on TV to select desired sound level.

NOTE:
If the satellite receiver is in the bedroom, there is no need to press the SAT button in area marked "TV2" on the video selector box. If the satellite receiver is in the front then the video selector box is needed for bedroom reception.

To Watch Main Television from a DVD:

- Turn DVD player on.
- Push source button on DVD player until letters DVD appear in window.
- Open DVD tray by pushing either button 1-5.
- Insert DVD into tray.
- To close tray push same tray button. DVD will load and play automatically.
- Turn TV on. Using Input button select INPUT 1.
- For Home Theater sound press Speaker switch to Home Theater.
- Select volume on DVD player to desired level.

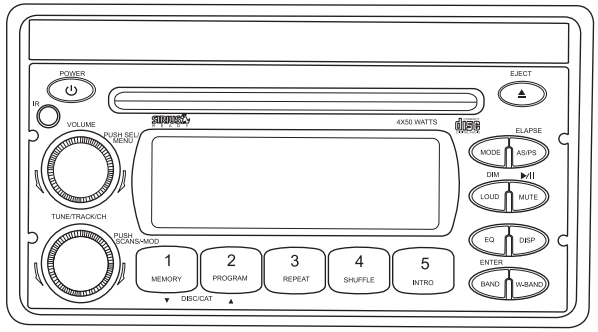
To Play a CD:

- For Home Theater sound press Speaker switch to Home Theater.
- Turn DVD player on.
- Open DVD tray by pushing either button 1-5.
- Insert CD.
- To close tray push same tray button. CD will load and play automatically.
- Adjust volume on DVD player to desired level.
- To view the CD track menu on the TV screen, press the Source button on the DVD player until DVD appears in window.

DASH RADIO

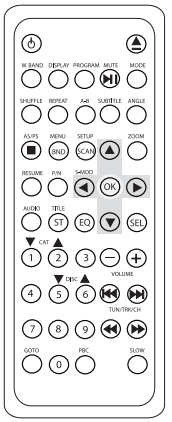
The dash radio is an AM/FM/Weather Band, CD and Sirius ready stereo receiver that holds fifteen FM and ten AM preset stations.

The dash radio is played using speakers throughout the motorhome and is capable of stereo sound.



031220

NOTE:
Refer to the dash radio OEM manual for detailed operating instructions and information.



031278

Dash Radio Remote

Speaker Switch

A speaker switch is located in the compartment above the driver. When activated, sound is played in the motorhome.

- **Dash Radio position:** Sound is heard through front and bedroom speakers.
- **Home Theater position:** Bedroom speakers play only.

031066n

Dash Radio Operation

To Play Radio:

- House battery disconnect switch must be On.
- Ensure that the battery cut-off switch is On.
- Select desired position for Speaker switch.
- Turn on the dash radio.
- Use MODE button to select AM or FM.
- Select station.
- Adjust volume on dash radio.

To Play CD:

- Select desired position for Speaker switch.
- Turn on the dash radio.
- Insert CD (loads and plays automatically).
- Adjust volume on dash radio.

HOME THEATER SURROUND SOUND

The Home Theater Surround Sound System operates on 120 Volt AC powered from shore power, the generator or inverter. Surround Sound Speakers are located throughout the living room area. The sound system operates through the DVD player only and not through the dash radio or bedroom speakers.

Speaker Switch

A speaker switch is located in the overhead compartment above the driver's seat.

- Place switch in Home Theater position for Surround Sound.
- Dash Radio position turns sound off.

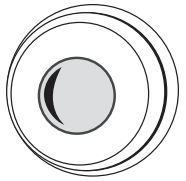
031066n

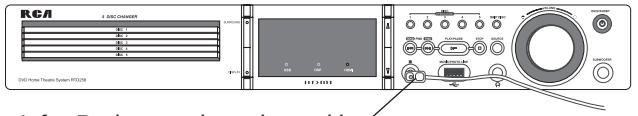
Remote Control

The remote control can be used to perform many entertainment functions.

Requirements for Remote Control Operation:

- Batteries in remote control are operating and charged.
- Infra-Red transmitter must be connected into the Infra-Red input on the DVD player.
- Remote control must be pointed at the Infra-Red eye above the Main TV to perform functions.


031193f
Infra-Red eye by TV


Infra-Red transmitter plugged in
031193e

BEDROOM DVD (Optional)

The bedroom DVD player has many features including multi-format playback for movies, photos and music and progressive scan for enhanced picture quality.

To Play DVD:

- Turn on DVD player.
- Open tray and insert DVD. Close tray. DVD loads and plays automatically.
- Turn on TV.
- Depending on television model, press television or remote control Input button to either Input 2 or Input 3.
- Adjust volume on TV to desired level.

To Play CD:

- Turn on DVD player.
- Open tray and insert CD. Close tray. CD loads and plays automatically.
- Press television or remote control Input button to either Input 2 or Input 3 (depends on television model).
- Adjust volume on TV to desired level.

INFORMATION:
For more detailed operating information refer to the DVD OEM manual.

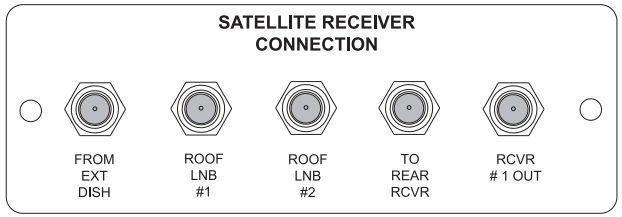
SATELLITE SYSTEM
DSS Prewire

The motorhome is pre-wired with two (2) RG6 cables that route from the satellite prep plate connections ROOF LNB #1 and ROOF LNB #2 to an area above the first ceiling light. The RG6 cable routes to the driver's side rear compartment while another RG6 coax routes to the rear bedroom receiver location.

The motorhome also has telephone lines which route from the driver's side rear compartment to each satellite receiver location: main TV and rear bedroom.

All cables are attached to the satellite prep plate located in the overhead cabinet above the driver. These include ROOF LNB #1 and ROOF LNB #2 to the roof satellite, dish, exterior dish, to the cable plate in the drivers side rear compartment, rear receiver to the rear bedroom interface plate, and receiver #1 out to the switch box as satellite in.

The following corresponds to the connections on the front of the Satellite Receiver Connection.



031070d

FROM EXT DISH: Hook-up to a portable satellite dish. Run a coaxial cable from this connection to Satellite In.

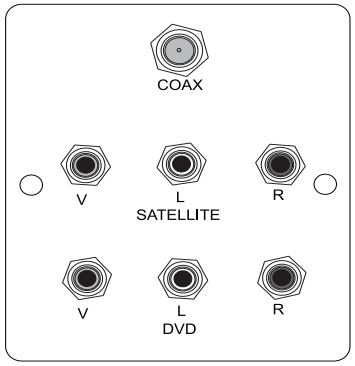
ROOF LNB #1: Hook-up to the roof satellite dish. Run a coaxial cable from this connection to Satellite In.

ROOF LNB #2: Hook-up to the roof satellite dish. Run a coaxial cable from this connection to Satellite In.

TO REAR RCVR: Hook-up to the rear bedroom receiver.

RCVR #1 OUT: Hook-up to the video selector box. Run a coaxial cable from this connection to From Satellite.

The following corresponds to the connections on the front of the Bedroom Satellite Receiver Connection.



031070c

COAX: This connection is used to hook-up Satellite Input to bedroom receiver.

SATELLITE V:
Satellite receiver out to bedroom TV.

SATELLITE L: Hook-up audio.

SATELLITE R: This connection is used to hook-up audio.

DVD V: DVD out to bedroom TV.

DVD L: Hook-up composite AV.

DVD R: Hook-up to composite AV.

SATELLITE
Semi-Automatic Non In-Motion (Optional)

The self-contained stationary, semi-automatic satellite TV system can acquire DirecTV®, DISH Network™ and other satellite provider's satellite signals throughout the continental United States when the motorhome is in a stationary position.

A phone line, located in the compartment above the driver, is provided to be attached to a satellite receiver for Pay-Per-View movies and events.

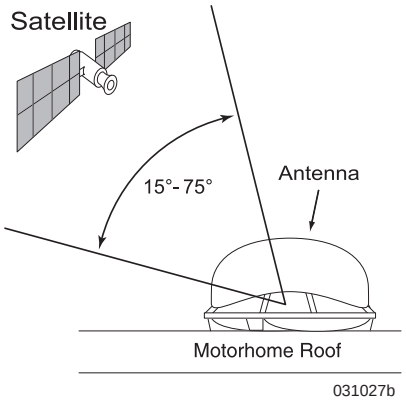
NOTE:
The satellite is a self-acquiring satellite TV antenna for use when the motorhome is stationary. The system is not designed to track the TV satellite when the motorhome is in motion.

NOTE:
Channel availability will vary with satellite system and providers. Consult the OEM manual for providers, coverage areas and channel availability.

Satellite Requirements

The satellite system requires a clear view of the southern sky to receive signal. Ideal antenna site has an unobstructed view of 15º to 75º in the Southern horizon.

If the satellite antenna receives intermittent signals or cannot locate the satellite, check around outside of motorhome for blockage such as trees, building, etc. The satellite antenna must be located in the selected satellite's coverage area in order to receive a signal.



NOTE:
When equipped with a satellite receiver (not provided) the receiver must be turned on for the system to function.

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.

"Instant On" Operation:
As part of operation, the satellite routinely saves its position to memory. When turned on, the system looks at the last saved position. 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.

Maintenance

The 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 full strength liquid dish detergent to the dome surface and allow it to dry. This treatment provides a film on the dome surface that will allow 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:
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.

SYSTEM CONTROL CENTER

The System Control Center is a central location for many of the switches and control monitors used to operate the motorhome.

1. **Comfort Control** - Operates Roof A/C, Furnace and Fan.

2. **System Heat** - Turns on the 12 Volt Bay Heater in the Water Service Center.

3. **Generator** - Starts and stops the generator.

4. **Tank Monitor Panel** - Displays the status of the Black and Grey Holding Tanks, Fresh Water Tank and LP-Gas Tank. Also displays status of House batteries.

5. **Tank Test Switch** - Spring loaded switch displays tank and house battery status on the monitor panel.

6. **Water Pump Switch** - Applies 12 Volt DC power to the water pump if operating from the on-board fresh water tank. The pump status light illuminates when the Water Pump is on.

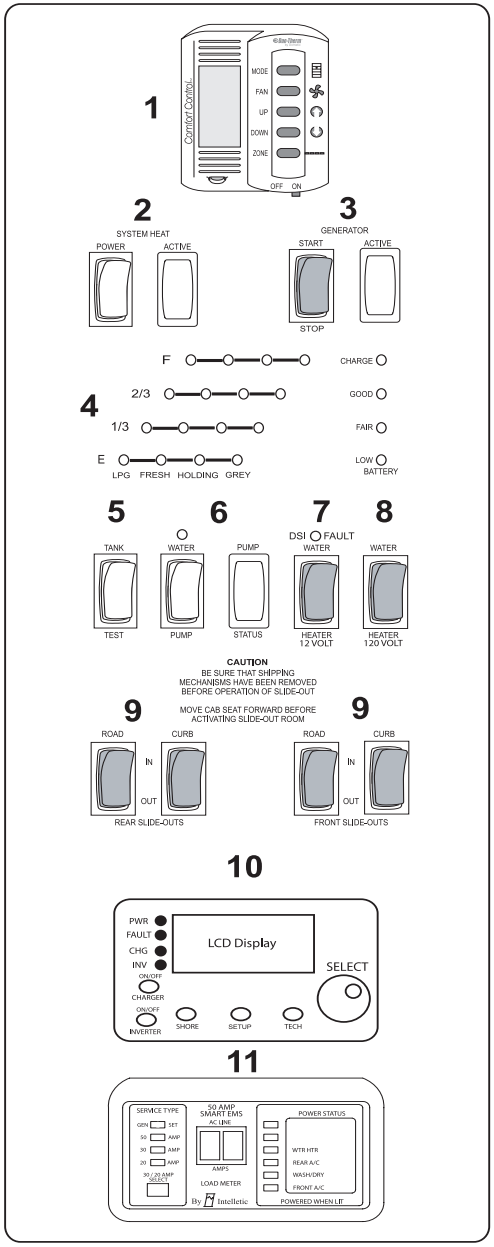
7. **Water Heater 12 Volt** - Applies 12 Volt DC power to ignite the water heater, if preferring to operate the water heater with LP-Gas. If the Water Heater fails to ignite, the DSI FAULT lamp will illuminate. If problem persists consult a qualified technician.

8. **Water Heater 120 Volt** - Applies 120 Volt AC power to the water heater, if preferring to operate the water heater with 120 Volts (electricity).

9. **Slide-Out Room Controls** - Extends and retracts the slide rooms.

10. **Inverter Remote Panel (Optional)** - Turns the optional inverter on or off and monitors battery charging status.

11. **50 Amp Energy Management System** - Provides circuit protection for all 120 Volt AC loads and manages 120 Volt AC distribution.

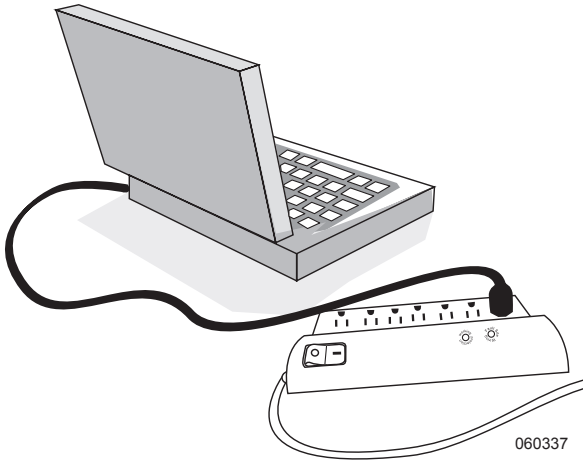


060306w

SURGE PROTECTOR

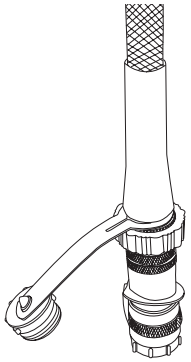
The transfer switch is not a surge protector. Plug sensitive electronic equipment (such as laptops) into a surge protector for protection from power surges.

CAUTION:
The transfer switch does not cut out at high or low voltages.



Use a surge protector for sensitive electronic equipment.

WATER SYSTEMS - INTRODUCTION


040480m

This section contains information about the operation and care of various water system equipment found in the motorhome. Optional water equipment will also be discussed, so not all information may be applicable to each motorhome. More detailed information with **CAUTION** or **WARNING** instructions for various equipment, other than what is found in this section, can be found in the OEM manuals in the owner information box.

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. Plenty of water will be available to meet personal needs once habits are adjusted.

The motorhome plumbing system may be operated with or without shore service. The plumbing system holding tanks include a fresh water tank, a grey water (liquid waste) tank and a black water (solid waste) tank. Sinks and shower drain into the grey tank, and the toilet drains into the black tank. An onboard water pump will supply all faucets and toilets with water from the fresh tank. Close monitoring of the holding tanks is necessary when shore service is not available. A monitor panel is located in the hallway and an optional panel is available in the water service bay.

The motorhome plumbing system can be attached to shore services (city water and sewer) at the roadside water service center. The service center includes the city water/fresh tank fill connection and the grey and black tank valves, drains and tank flush connections. If shore services are available, the shore water supply (city water) can be used to pressurize the water system and the onboard water pump can be turned off. The grey and black tanks share a termination outlet. A sewer hose can be attached from the drain to the shore sewer connection. It is recommended to leave the black tank drain closed and the grey tank drain open when hooked to shore services to avoid a clogged sewer hose. Drain and flush the grey and black tanks after dumping and/or prior to departure.

Fresh Water System:

The fresh water system consists of a fresh water tank, water pump, gravity fill connection, water filter, city/fresh water connection and a water hose for potable use only.


040400

Proper care of the hose is necessary. After each use, drain the water hose and coil the hose neatly. Attach the ends together to keep dirt, debris and insects out of the hose.

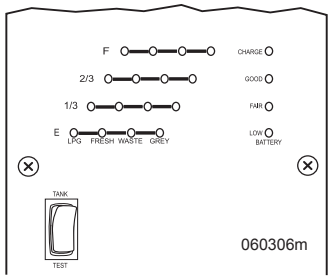
Waste Water System:

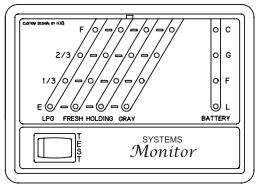
The waste water system consists of a waste holding tank (grey water), sewage holding tank (black water), flush system, toilet, waste hose and drains.

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.

WATER TANKS
Measurements & Calibration

The motorhome is equipped with a monitor panel to aid in managing the storage tanks. The monitor panel is located on the Systems Control Center in the hallway area. A second optional monitor panel is located in the roadside water service center.





030446g

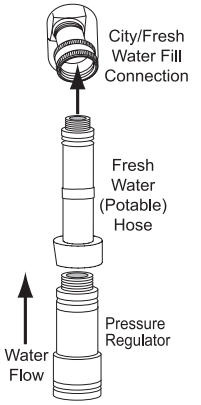
Monitor Panel (Optional) Located in Service Center

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 being monitored. Each scale uses colored lights along with a corresponding scale reading.

LP Tank & Fresh Tank	Holding & Grey Tanks
Red = Empty	Green = Empty
Amber = 1/3 Full	Yellow = 1/3 Full
Yellow = 2/3 Full	Amber = 2/3 Full
Green = Full	Red = Full

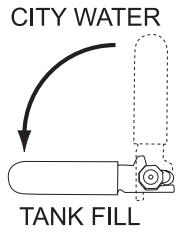
Fresh Water Fill

When connecting the motorhome to fresh water, use a hose manufactured and labeled "for potable water." This ensures that the hose will not flavor the water. It is recommended to install a pressure regulator on the water line to prevent the hose from expanding and bursting due to excessive pressure.



040480ya

1. Connect one end of the pressure regulator to the water source and the other end to the potable hose.
2. Connect potable hose to the City/Fresh Water Fill valve located in the roadside water service center.
3. Close the fresh water tank drain valve. Close all other low point drain valves
4. Open the winterization valve.
5. Turn the water control lever to the "Tank Fill" position.
6. Make sure water pump is off.

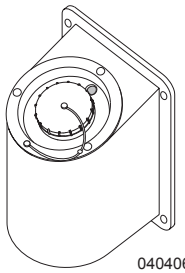


040460o

7. Turn on water at the source. Tank filling is audible.
8. Frequently press the "Test" switch on the monitor panel. Read the scale as the fresh water tank fills. Do not leave the motorhome unattended while filling the fresh water tank.
9. The tank is nearing full when the light marked "F" illuminates. When the tank is completely full, water will flow out an overflow tube under the motorhome.
10. Turn off water supply and return the water control lever to "City Water" position.
11. Disconnect the potable hose. Remove pressure regulator. Store the hose with both ends connected to prevent debris from entering the hose.

WATER TANK - FRESH GRAVITY FILL

The gravity fill inlet allows fluids to be introduced directly into the fresh water tank. Water can be poured directly from a container into the fresh water tank. The gravity fill inlet can be used to pour disinfecting solution into the fresh water tank. Use only potable water sources, solutions and delivery systems when using the gravity fill inlet.


040406

Located in roadside water service center

Filling the Tank:

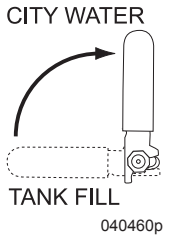
1. Unscrew fill cap taking care to keep cap and inlet clean.
2. Insert potable water hose into inlet.
3. Fill tank until water overflows from inlet.

NOTE:
DO NOT leave the gravity fill inlet unattended when in use.

City Water Hook-up

When connecting the motorhome to fresh water, use a hose manufactured and labeled for potable water to ensure the hose will not flavor the water. It is recommended to install a pressure regulator on the water line to prevent the hose from expanding and bursting due to excessive pressure.

1. Install the pressure regulator on the water source.
2. Connect the pressure regulator to the potable hose and the potable hose to the City/Fresh Water Fill Valve.
3. Water control lever should be in the "City Water" position.
4. Turn on the water at the source.
5. The water pump can either be OFF or ON. It will not affect the water pump to leave it on.
6. Open each faucet, one at a time, to purge air trapped inside the pipes.

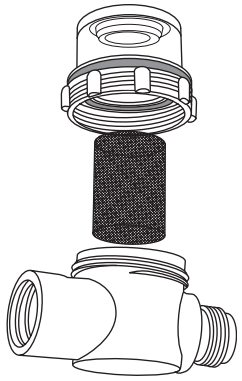


040460p

CAUTION:
Some 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.

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 in the water service center.


040586

Water pump inlet screen: *Located on water pump in water service center. Clean every two months.*

To Operate Water Pump:

- Ensure the house battery disconnect switch is on.
- Battery cut-out switch must be on.

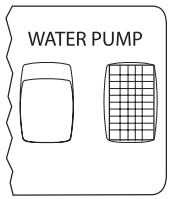
WARNING:
Before leaving the motorhome for extended periods of time (i.e. overnight or longer) the city water supply and water pump must be turned off. The manufacturer is not responsible for damage caused from neglect.

The water pump can be operated from these locations:

- Hallway Systems Control Panel
- Water Service Center

To turn the water pump ON or OFF:

- Momentarily press the water pump switch. The indicator lamp illuminates when the water pump is turned on.



040537c

Service Center Water Pump Switch

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.

To operate the water pump after unhooking from a city water supply or after 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 and the hot water tank to fill.
- Close each faucet when it delivers a steady stream of water (cold water faucets first).

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, fuse or breaker, main switch and ground connection.
- Is voltage present at the pressure switch on the pump? If voltage is present, the pressure switch may be faulty. As a test, temporarily bypass the pressure switch.
- 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 frozen).

Water pump will not prime or sputters (No discharge/motor runs):

- Check the pump inlet strainer for clogs and debris.
- Check the tank for water or air collected in the water heater.
- Check the inlet tubing and plumbing to see if it is 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

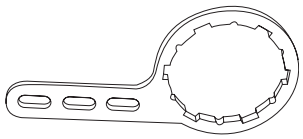
A whole-house water filter is located in the water service bay. Change the water filter after 1,000 gallons of use or sooner if water flow is noticeably reduced.

The maximum pressure for the system is 100 psi and maximum temperature 100º F.

NOTE:
The water filter is located in a roadside compartment next to the water service center.

CAUTION:
Protect filter from freezing or damage to the system could occur.

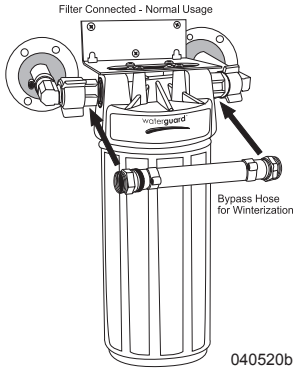
Filter Removal:
- Turn off the water supply and the water pump.
- Open faucets to bleed off pressure.
- Unscrew the filter bowl using the bowl wrench.


040520c
Water Filter Removal Wrench

- Check O-ring for damage and lubricate if necessary. O-ring should be replaced every third cartridge change to ensure proper sealing.
- Remove the old cartridge and discard.
- Empty any remaining water in the bowl.

Filter Installation:
- Insert new cartridge into filter bowl.
- Screw filter bowl back onto head and hand tighten securely.
- Turn on water pump or city water.
- Thoroughly flush and purge air from the system by opening faucets and running the water for approximately 20 minutes.
- Check for leaks.

To Winterize:
- Disconnect the two water line connections (normal usage) on either side of the filter bowl head.
- Connect a bypass hose to the two water lines.
- Unscrew the filter bowl using the bowl wrench.



040520b

- Remove the old cartridge and discard.
- Empty any remaining water in the bowl.
- Store the filter bowl. DO NOT screw filter bowl back onto filter head.
- Winterize the motorhome.

To De-Winterize:
- Disconnect the bypass hose to the two water lines. Store bypass hose.
- Reconnect the two water lines to the filter bowl head.
- Insert new cartridge into filter bowl.
- Screw filter bowl back onto head and hand tighten securely.
- Turn on water pump or city water.
- Thoroughly flush and purge air from the system by opening faucets and running the water for approximately 20 minutes.
- Check for leaks.

NOTE:
Confirm the filter cartridge number before ordering or obtaining a replacement.

CAUTION:
O-ring must be properly seated in the groove of the lower housing or a water leak could occur.

NOTE:
For more information or to order parts, contact Shurflo Customer Service at 1-800-854-3218.

WATER SYSTEMS
Troubleshooting

If the water pump cycles after closing the faucets, drain valves and inlet valves, a leak may be present. At this time check for leaks around fittings, valves, filter and connections of the hot and cold water system. If problems continue, take the motorhome to an authorized dealer for repair.

Disinfecting Fresh Water

Disinfecting the water system with household bleach (superchlorination) protects against bacteriological or viral contamination from common water sources.

Disinfect the fresh water system:

- If the motorhome is new.
- If the motorhome has been in storage.
- Every three months during use.

NOTE:
Use the gravity fill to perform this task. Remove cap from the gravity fill. Add the solution. When finished, secure the gravity fill cap.

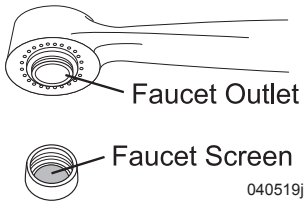
- Remove the water line connections and connect the bypass hose to the water lines on water filter (See"Water Filter).
- Prepare a household chlorine bleach solution of 1 gallon water and ¼ cup of chlorine bleach. Use 1 gallon of solution for every 15 gallons of tank capacity. This mixture puts a 50 ppm (parts per million) residual in the water system, and acts 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.
- Turn the water pump **OFF**.
- Close the water heater bypass valve. The bypass valve is located behind the water heater. This ensures that none of the prepared disinfecting solution enters the water heater. Refer to the water heater OEM instructions on flushing the water heater.
- Drain the fresh water tank. Water tank drain is located in the roadside water service center. Close the drain and pour the solution into the fresh water tank using the gravity fill and a funnel.
- Top off the tank with fresh water.
- Turn the water pump **ON**. Open each faucet, in turn, and run the water until there is a distinct chlorine bleach odor. Do not forget the hot water, tub and shower faucets. Allow the system to stand for four hours.
- Drain the system and flush with fresh water. Water tank and low point drains are located in the roadside water service center. Flush with fresh water repeatedly until the water system no longer smells or tastes like chlorine bleach.
- Remove water filter bypass hose and store. Reconnect water lines to water filter.
- Install the new water filter.

TIP:
Use the same hose labeled for potable water to introduce the chlorine solution into the system. This will disinfect the potable water hose at the same time. Several flushes are required to remove chlorine residue from the potable hose.

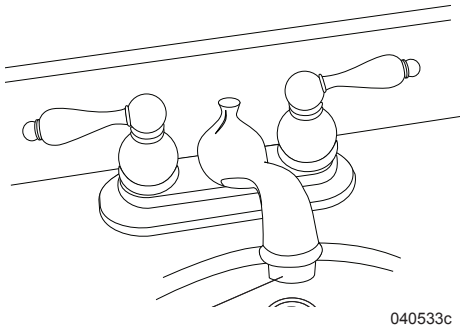
INFORMATION:
Household bleach is 5.25% Sodium Hypochlorite. Higher concentration will increase PPM ratio.

FAUCET SCREENS

Fresh water sources vary by location. Build up of lime deposits, or debris on the faucet screen, will restrict or plug the flow of water coming from the faucets. Should the flow of water reduce, the filter screen in the faucet head may be clogged. All faucet screens should be checked and cleaned every two weeks of use.



Typical Water Faucet



- Faucet screens are normally located on the outlet side of the faucet and held in place with a threaded collar.
- Remove screen from faucet.
- Clean screen using a small soft brush and de-liming solution.
- Reinstall 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 also offer dump facilities at select 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** dispose of table scraps or cooking grease into the tanks. They can clog pipes or damage the termination valve seals.
- Facial tissue is thicker, softer and stronger than a rapidly dissolving tissue. White toilet paper dissolves faster than colored. To test tissue dissolving ability, immerse one tissue square into a jar of water. Shake the jar five times to determine how the tissue disintegrates. **DO NOT** use any type of tissue that remains in one piece. Paper designed specifically for holding tanks is available at most RV supply stores.

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 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.

What to Put in Holding Tanks

Grey Water Tank:
The grey water waste tank stores the sink, shower and clothes washer (if equipped) drain water. A reduced mixture of chemicals may help to control odor in the grey tank.

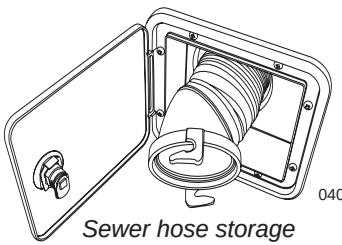
Ensure that there is enough liquid in the holding tanks prior to dumping the waste holding tanks to provide a smooth flow through the valve, drain pipe and drain hose. Empty the waste holding tanks weekly to prevent stagnation and overfilling.

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, add the chemicals, in accordance with the manufacturer instructions. Pour mixture through toilet to the holding tank. Be careful not to spill the chemical on 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 each time the black tank is cycled.

WARNING:
Most chemical mixtures for holding tank odor control are poisonous. Follow the product manufacturer's directions and WARNINGs when using holding tank additive. DO NOT use any products that contain petroleum distillate or ammonia in place of RV odor controlling chemical. Petroleum distillate or ammonia will damage the ABS plastic holding tanks and seals.

Waste Drain Hose

A flexible three-inch sewer hose attaches between the termination drain and the shore facility. Sewer hoses usually come in 10 and 20 foot lengths.



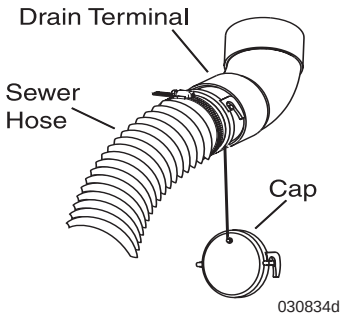
Sewer hose storage

The shore fitting for the sewer hose may be a three or four-inch, male or female thread pipe; or a four-inch pipe with no threads, covered by a metal plate. Different style 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 inline 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 Attach the Hose:

- Remove sewer hose from storage.
- Remove termination cap. Align coupler tangs with termination tabs. Twist coupler clockwise 90º locking coupler to termination outlet.
- Unscrew access port and feed the drain hose through the opening.
- Attach other end of hose to drain service. Restrain hose to prevent movement during use.
- Open the liquid waste drain (grey water) valve.

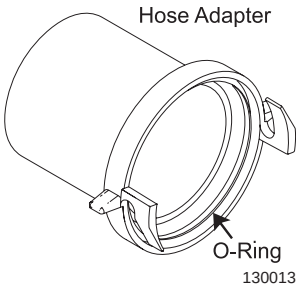


The solid waste drain (black water) valve remains closed until the tank is full or until time of departure to help prevent clogging. Use the outside faucet or shower attachment for washing or rinsing the sewer hose after dumping the black tank.

NOTE:
Use care when connecting the sewer hose adapter to the termination outlet in cold weather.

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.

LUBE:
Periodically lubricate the O-ring on the sewer hose adapter with silicone spray.

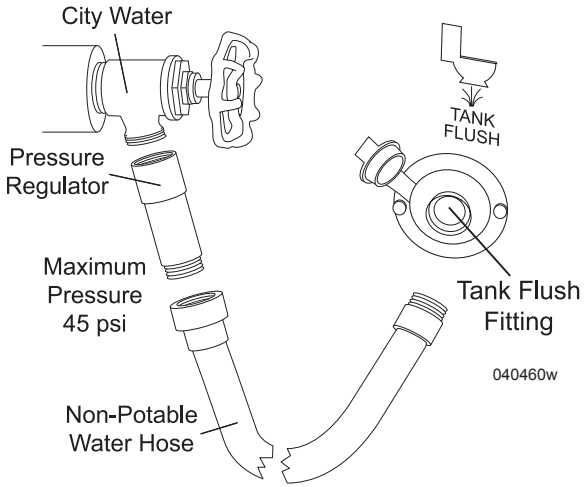


Tank Flush

The motorhome comes equipped with a power flush nozzle, located in the black tank to help reduce solids build-up. Flush the black tank each drain cycle. Failure to thoroughly rinse the black tank may result in accumulated solids and a clogged spray nozzle.

Gravity Drain Hose Dumping:

1. Attach sewer hose to terminal drain and shore facility.
2. Prepare to dump the solid waste (black) tank first. Close the liquid waste drain (grey water) valve.
3. Fill the grey tank to at least 50% by running water in the shower or sinks.
4. Open the solid waste drain (black water) valve. Allow the black tank to drain.



Flush Black Tank

5. Connect one end of the pressure regulator to the water source and the other end to the non-potable water hose. Connect the non-potable hose to the tank flush fitting.
6. Turn on the water source and allow water to rinse the black tank at least three minutes. Never operate the system unattended. Ensure the water flows freely though the drain hose.
7. When completed, turn off the water source and close the black water valve.
8. Open the grey water valve. The water in the grey tank will flush remaining solids from the hose. With the grey water valve open, run two gallons of water down any drain to flush grey tank. The grey valve remains open until the next drain cycle, or time of departure.

WARNING:
Operating the flush system unattended can risk flooding. 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.

9. When preparing for travel, close both dump valves. Undo restraining devices from the hose. Disconnect the hose from the termination outlet by rotating the fitting counterclockwise 90º.
10. Raise the hose and drain using hand over hand method working the hose towards shore fitting. Rinse the hose with outside facility and repeat the hose drain process.
11. Remove the hose from shore fitting. Install hose in carrier and lock door. Secure the termination cap (required by law in some states).
12. 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 (Sani-Con system) is a self-priming impeller pump designed to minimize clogging when draining the tanks. The system includes a 1½" outlet hose and a 13 gpm macerator pump.

Wearing disposable gloves, safety glasses and protective clothing, as necessary, is recommended when operating the Sani-Con. The house battery disconnect switch, located in curbside battery compartment, must be on for the Sani-Con system to operate. The waste pump operates on 12 Volts from the house battery.

NOTE:
For additional information consult the RV Sani-Con manual or go to their website: www.emptythetanks.com

WARNING:
NEVER place in the toilet personal hygiene products, cigarette butts, paper towels, table scraps, grease, any tissue that remains in one piece or any object that can be considered foreign. These objects will damage the Sani-Con system and void manufacturer's warranty.

100220

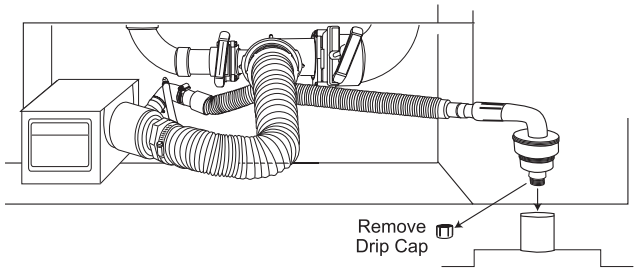
WARNING:
Never leave the Sani-Con pump unattended while in use. DO NOT allow the pump to run dry for any period of time. Damage to the pump impeller and Sani-Con system will result and void manufacturer's warranty.

100220b

To Empty the Black Tank (Solid Waste):

- Remove the drip cap at 1½" end of discharge nozzle (see illustration).
- Close the black tank (solid waste) and grey tank (liquid waste) valves.
- Remove the terminal drain outlet cap.
- Secure the flexible sewer hose from the Sani-Con macerator pump to the termination drain outlet by aligning the sewer hose coupler tangs with the terminal tabs. Twist the coupler clockwise to lock it to the terminal outlet.

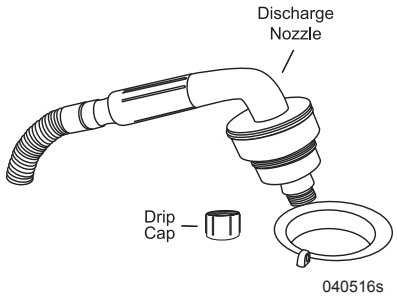
WARNING:
Be sure to remove the drip cap from the Sani-Con hose end (see illustration). Failure to do so will result in damage to the Sani-Con system.



0440223c

CAUTION:
If the pump is activated while the drip cap is on the hose end, switch the pump off (use the Sani-Con On/Off switch) and wait at least 30 seconds to allow pressure to dissipate before removing the drip cap.

- Ensure all hose clamps are secure.
- Install discharge nozzle to the sewer connection (dump station). The discharge nozzle fits a 3" to 4" threaded or non-threaded sewer connections. Ensure the discharge nozzle is installed correctly prior to operation.



- Open the solid waste (black tank) valve by pulling outward.
- Turn on the waste pump using the Sani-Con switch located on Water Service Center panel.
- Push the test switch on the monitor panel to read tank level. Allow the black tank to empty.
- When the black tank is empty, turn off the Sani-Con pump and leave the black tank valve open.
- Store sewer hose and Sani-Con discharge nozzle for travel. Secure termination cap (required by law in some states).
- If desired, add chemicals to the holding tanks to control odor. Follow the chemical manufacturer's directions.

To Empty the Grey Tank (Liquid Waste):

- Remove the drip cap at 1½" end of discharge nozzle (see illustration).
- Secure the flexible sewer hose from the Sani-Con macerator pump to the termination drain outlet.
- Ensure all hose clamps are secure.
- Install discharge nozzle to the sewer connection (dump station). Adapters allow the discharge nozzle to be adapted from 3" to 4" threaded or non-threaded sewer connection. Ensure the discharge nozzle is installed correctly prior to operation.
- If applicable, close the black tank (solid waste water) valve.
- Open the grey tank valve.
- Turn on the Sani-Con pump. Allow the grey tank to empty.
- Push the test switch on the monitor panel to read tank levels.
- If applicable, the black tank (solid waste) can be emptied at this time.
- Turn the Sani-Con pump off.
- Close the grey tank drain valve and, if applicable, the black tank valve.
- Store sewer hose and Sani-Con discharge nozzle for travel. Secure termination cap (required by law in some states).
- If desired, add chemicals to the holding tanks to control odor. Follow the chemical manufacturer's directions.

Using Black Tank Flush:

<u>WARNING:</u>
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.

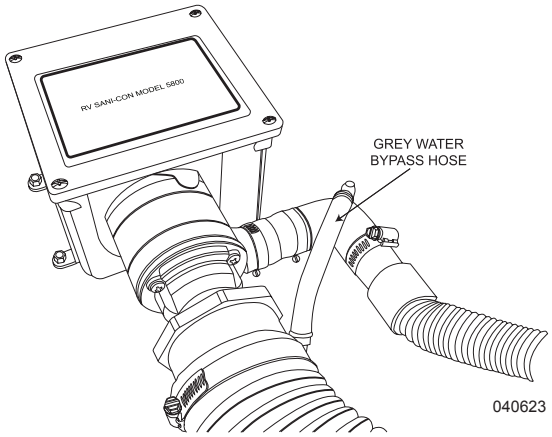
- Remove the drip cap at 1½" end of discharge nozzle (see illustration).
- Secure the flexible sewer hose from the Sani-Con macerator pump to the termination drain outlet.
- Periodically tighten all hose clamps.
- Install discharge nozzle to the sewer connection (dump station).
- Connect a non-potable water hose with pressure regulator to the water source. Connect the other end of the water hose to the Tank Flush fitting.
- Open the solid waste (black tank) valve.
- Turn on the water source and allow the water to rinse the black tank at least three minutes. **DO NOT leave the system unattended during operation.**
- Turn the water off, disconnect the non-potable hose and pressure regulator. Store the hose and regulator for future use.
- Turn the Sani-Con pump on and allow black tank to empty.
- Turn the Sani-Con pump off
- Close black tank drain valve.
- If applicable, the grey tank (liquid waste) can be emptied at this time. Close grey tank valve.
- Store sewer hose and Sani-Con discharge nozzle for travel. Secure termination cap (required by law in some states).
- If desired, add chemicals to the holding tanks to control odor. Follow the chemical manufacturer's directions.

Grey Water Bypass:

The grey water bypass system allows continuous grey water flow. The liquid (grey) waste uses gravity to drain from the tank and bypasses the pump by going through the bypass hose into the sewage service. The bypass hose is the small hose connected at the termination point of the dump valves and "T-s" into the small flexible hose on the outlet side of the macerator pump.

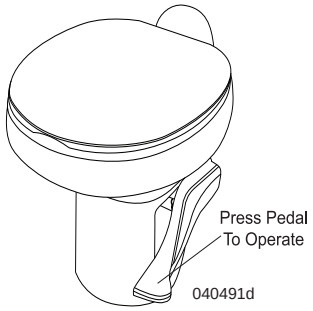
Troubleshooting:

- The house battery disconnect switch must be on.
- 12 Volt DC power for the macerator pump comes from the house batteries and is protected with a 15 Amp mini-breaker. The breaker is located in the curbside electrical battery compartment. Open the black box above the batteries to access the mini-breaker.



TOILET

The toilet uses water from either the fresh water tank or a city water supply. Turn the water pump ON or connect the motorhome to city water. The toilet flushes directly into the sewage holding tank (black water).



CAUTION:
To prevent accumulation of solids below toilet, add several gallons of water to the holding tank before use. Most chemical mixtures for holding tank odor control are poisonous. Follow the product manufacturer's directions and WARNINGs when using any holding tank additive.

NOTE:
Never dispose of sanitary supplies or other non-dissolving items into the toilet. Facial tissue, wet strength tissue, paper towels or an excess toilet tissue can clog the tank or termination valve.

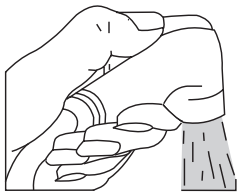
Pedal Flush:

- To add water to the toilet before using, press and hold the pedal halfway until the desired water level is reached. 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.

Water flow pressures vary. Therefore, holding the flush lever down for several seconds may be required. Release the flush lever, allowing it to snap back, permitting positive sealing around the flush ball. A small amount of water should remain in bowl.

Hand Sprayer:

- To operate the hand sprayer, depress the thumb lever. Step on foot pedal. Direct water into the bowl.



Cleaning & Maintenance

The toilet should be cleaned regularly for maximum sanitation and operational efficiency. Clean the toilet bowl with a mild non-abrasive bathroom cleaner with a soft bristle, non-abrasive bowl brush, sponge or soft cloth. DO NOT use scouring powders, acids, concentrated cleaners, chlorine or caustic chemicals, such as drain opening types, as they will damage surfaces, plastic parts and rubber seals.

Clean the toilet system using the tank flush. If additional flushing is desired, flush with several gallons of fresh water and one cup of dry laundry detergent. Add odor control deodorant, in the amount specified for the holding tank capacity, every few days during use.

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.

- **Between Closet Flange and Toilet:** Confirm that flange screws are snug. DO NOT over tighten screws. If leak continues, remove toilet and check flange height. Adjust the flange height to 7/16" above floor, if necessary. Replace flange seal if damaged.

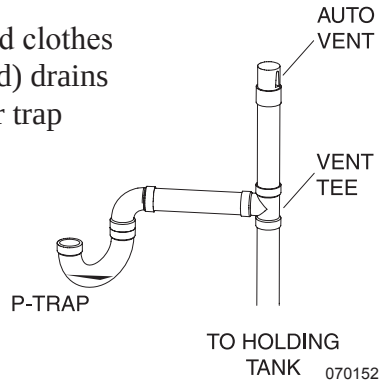
Maintenance - Bowl Problems:

- Poor flush: Flush should be obtained within two to three seconds. If a problem persists, adjust the water level. If problems continue, the water pressure or flow rate may be low. Remove the water supply line and check flow rate. Flow rate should be at least ten quarts (9.5 liters) per minute. Water pressure should not be below 25 psi.
- Bowl will not hold water: Check for and remove any foreign material from valve blade groove in the flush drain. Check blade seal compression with mechanism. If blade seal is worn, replace.

NOTE:
If the motorhome is in storage for six months, spray silicone on the toilet valve and work it back and forth. Perform this maintenance monthly during use (silicone will evaporate in about 30 days). DO NOT use a petroleum-based lubricant, damage to the seals will occur.

DRAIN TRAPS & AUTO VENTS

Sinks, shower and clothes washer (if equipped) drains incorporate a water trap (P-Trap) and auto vents to prevent waste water holding tank odor from entering the motorhome.



Drain Traps:
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 (if equipped) to fill P-Traps.

AutoVents:
The auto vent is designed to assist in the smooth flow of water in the drain without creating a vacuum. If stuck in the open position the auto vent 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.

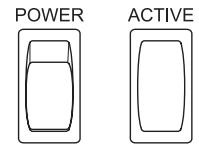
COLD WEATHER CONDITIONS

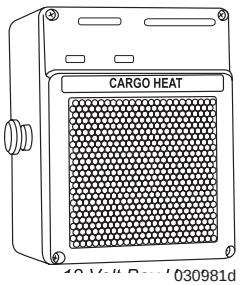
Extended use in below freezing (32° F./0° C.) weather will require operation of the furnace to protect interior water lines, fixtures, water storage tanks and pumps. Exposed drains may freeze quickly. If in doubt about what temperature the motorhome will tolerate, winterize with potable antifreeze. Cold temperature can adversely affect water systems below the floor level because the furnace does not provide heat to these components. A 12 Volt bay heater and thermal snap disc are located in the water service bay. The bay heater reduces the possibility of water lines freezing, and should be turned on when ambient temperature approaches 44º F. (+/- 6º F.) and freezing temperatures may occur. The System Heat switch on the hallway monitor panel operates the bay heater.

System Heat

System Heat Operation:

1. Systems heat switch is turned **ON** to apply power to the snap disc thermostat.
2. When the bay temperature reaches 40º F. (+/-6º F.) the snap disc thermostat closes. The bay heater and systems heat Active light turns on. The heater continues to operate until bay temperature reaches 55º F. (=/-6º F.). The bay heater and Active indicator light will turn **OFF**.





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.

Requirement for Operation:

- House battery disconnect switch must be **ON**.

Cold Weather Storage

If the motorhome is stored where freezing temperatures may occur, drain the domestic fresh water loop. Begin draining the fresh water tank by opening the low point drain for the fresh tank and allowing the water to drain.

NOTE:
Icemakers, water filters, water purifiers and water heaters all use domestic water and should be drained and stored in accordance with the manufacturer's recommendation for winterization.

WINTERIZATION

Water, plumbing and sewer systems require winterization when the motorhome is placed in storage. The recommended method of winterizing the motorhome 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. Air adapters used for winterization are available at RV supply locations. **Air pressure should not exceed 40 PSI. Higher pressure can damage the lines.**

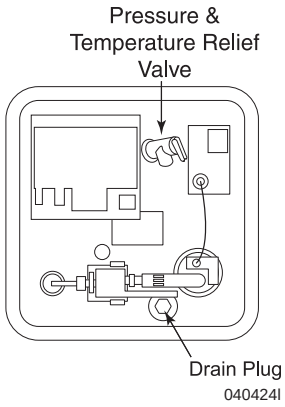
WARNING:
It is recommended that a qualified RV service technician familiar with motorhomes, such as an authorized dealer, perform the winterization procedure.

WARNING:
Freeze damage is not covered under warranty.

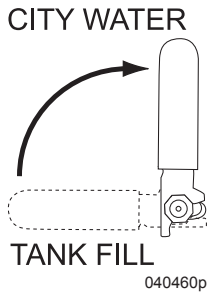
1. Empty and flush the holding tanks.
2. Disconnect the water line connections on either side of the water filter bowl head. Connect the bypass hose to the water lines. Unscrew filter bowl, remove old cartridge and empty any remaining water in the bowl. **DO NOT** screw filter bowl back onto filter head (see "Water Filter").
3. Drain the fresh water tank by opening the fresh water tank drain valve and fresh water tank low point drain valve. Open the winterization valve. All are located in the roadside water service center.
4. Open hot and cold water low-point drains. If equipped, open the secondary ice maker shut-off valve and the secondary ice maker low point drain valve. All are located in the roadside water service center.

CAUTION:
Some appliances such as the washer-dryer, refrigerator and ice maker require special winterizing instructions not covered in this section. Refer to the specific appliance OEM manual for instructions and recommendations.

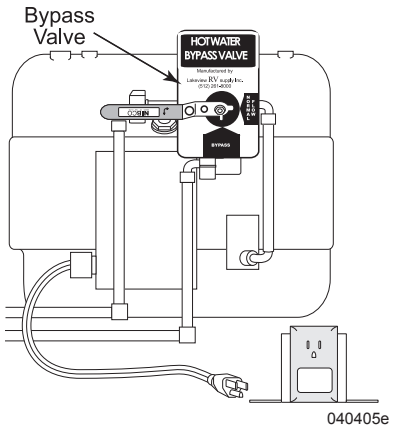
5. Turn the water pump on for 30 to 60 seconds and allow it to run so that all the water is cleared out of the pump and water tank.
6. Turn the water pump off.
7. If applicable, disconnect the water line to the icemaker.
8. Close winterization valve. Leave open fresh water tank drain valve, fresh water tank low point drain valve, hot and cold water low point drain valves, and, if equipped, secondary icemaker low point drain valve.



9. Open the water heater exterior access door. Open the high temperature/pressure relief valve to vent water heater. Remove water heater drain plug to allow water heater to drain.



10. After the water is drained connect an air hose to the City/Fresh Water Fill connection. Position the City/Fresh Water Control lever to the "City Water" position. Turn on air compressor. **Do not exceed 40 PSI in the water lines and faucets.**



11. When no further water can be seen coming out of the drains, move water heater bypass valve to BYPASS position. Bypass valve is located on the back of the water heater.
12. Open and close the faucets one at a time, hot and cold, until only air comes out. **DO NOT** forget outside faucets.
13. Flush toilet until the water has stopped running.
14. Shut off the air compressor and disconnect the air hose.
15. Use one (1) gallon of FDA approved RV antifreeze to protect various water drain lines in the motorhome. Pour 1 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 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. If equipped with a washer-dryer pour the last pint into the washer-dryer drain..
16. Use a soft cloth to wipe out the sinks and shower (after the antifreeze is poured in) to protect the surfaces from stains.
17. Leave open hot and cold low-point drains, fresh water tank drain valve, fresh water tank low point drain valve. Open winterization valve. Also leave open water heater drain.
18. When the motorhome is to be used again, install water heater drain plug, close water heater pressure relief valve. Also close fresh water tank drain valve, fresh water tank low point drain valve, hot and cold water low point drain valves. Winterization valve stays open.

WARNING:
When draining the low water drain lines and the water heater be sure the water is not hot. Hot water from the lines can burn or injure skin.

WARNING:
Clean up antifreeze spills immediately to prevent permanent staining.

Using Non-Toxic Antifreeze

Approximately five to eight gallons of FDA approved antifreeze will be required to winterize the motorhome.

WARNING:
It is recommended that a qualified RV service technician familiar with motorhomes, such as an authorized dealer, do this procedure.

WARNING:
Use only specifically designed, non-toxic, FDA Approved RV antifreeze for potable water systems. DO NOT use automobile engine antifreeze. If ingested, antifreeze can cause serious injury or death.

NOTE:
Freeze damage is not covered under warranty.

1. Empty and flush the holding tanks.
2. Disconnect the water line connections on either side of the water filter bowl head. Connect the bypass hose to the water lines. Unscrew filter bowl, remove old cartridge and empty any remaining water in the bowl. **DO NOT screw filter bowl back onto filter head** (see "Water Filter.").
3. Drain the fresh water tank by opening the fresh water tank drain valve, winterization valve and water tank low point drain. Allow water to drain.

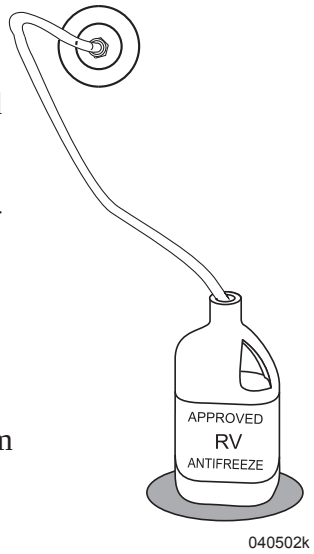
4. Open hot and cold water low-point drain valves and allow water to drain. If equipped, open secondary icemaker low point drain valve and secondary icemaker shut-off valve.

CAUTION:
Some appliances such as washer-dryer, refrigerator and icemaker require special winterizing instructions not covered in this section. Refer to the specific appliance OEM manual for instructions and recommendations.

5. Position the City/Fresh Water Control Lever to the "Tank Fill" position.
6. Turn the water pump on for 30 to 60 seconds and allow it to run so that all the water is cleared out of the pump and fresh water tank. Turn the pump off.
7. Open the water heater exterior access panel. Open the high temperature/ pressure relief valve to vent the water heater. Remove water heater drain plug to allow the water heater to drain.
8. After the water has drained, place the water heater bypass valve to the BYPASS position.
9. Replace the water heater drain plug and close the pressure relief valve.
10. Close the fresh water tank drain valve, fresh water tank low point drain valve, winterization valve, hot and cold low point water drain valves, and, if equipped, secondary icemaker low point drain valve.

CAUTION:
Ensure the fresh water tank is COMPLETELY drained because antifreeze will not enter the fresh water tank.

11. Connect a hose to the Fresh Tank/City Water connection and place the other end into the container of antifreeze.



12. Turn ON the water pump.
13. Turn on all the faucets, one at a time, hot and cold, starting with the faucet farthest from the water pump. When antifreeze is present, pour one cup into the drain to fill traps and turn the faucet off. **DO NOT** all outside faucets.
14. Flush toilet to allow a small amount of antifreeze to run into the holding tanks.
15. Use a soft cloth to wipe out the sinks and shower to protect surface from antifreeze stains.
16. Turn water pump off.
17. Disconnect the power supply line to the water pump.

WARNING:
When draining the low water drain lines and the water heater be sure the water is not hot. Hot water from the lines can burn or injure skin.

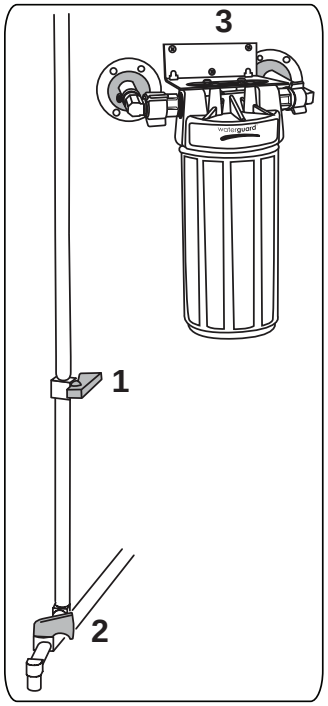
WARNING:
Clean up antifreeze spills immediately to prevent permanent staining.

De-winterization

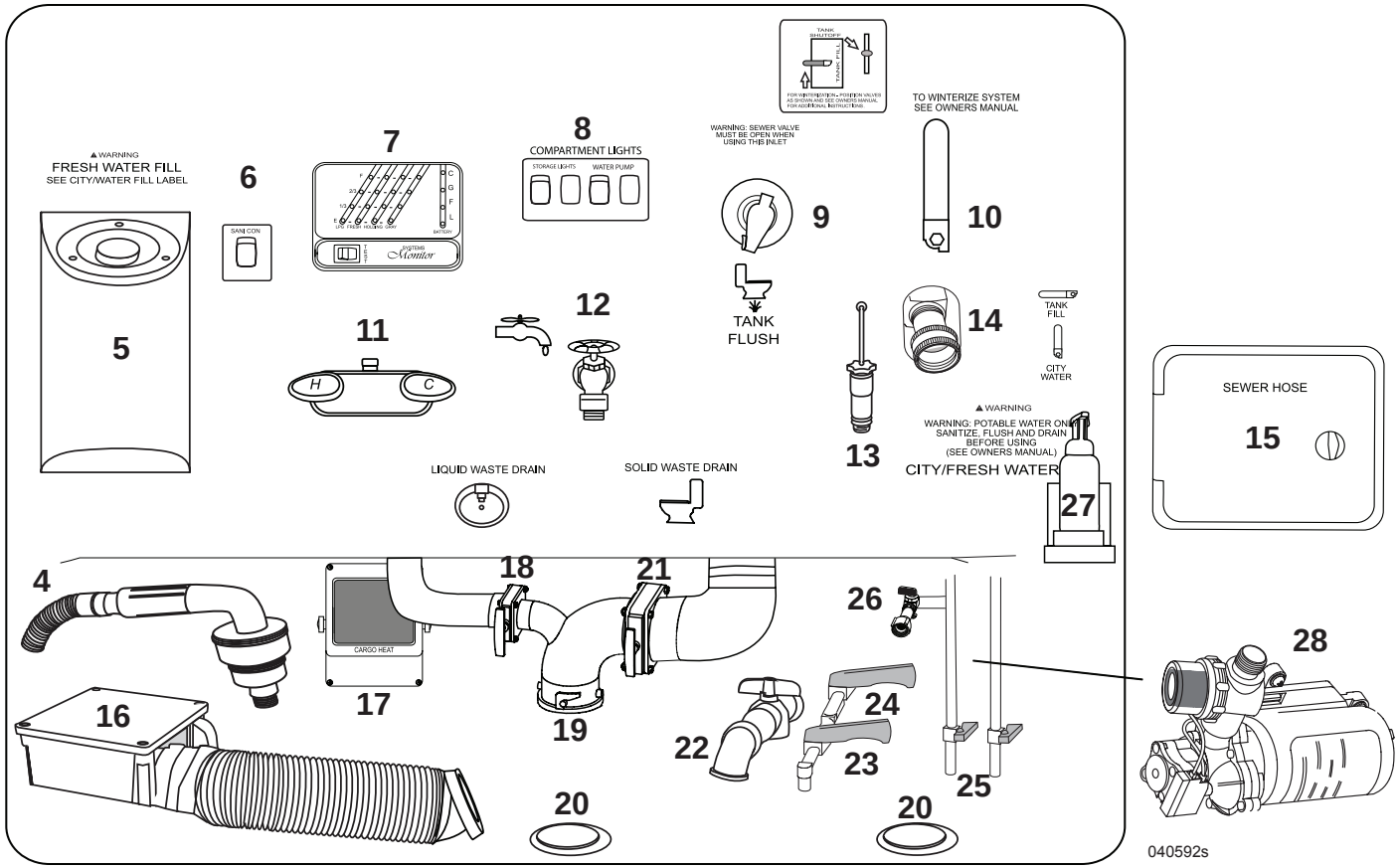
1. Open the winterization valve.
2. Close fresh water tank drain valve, fresh water tank low point drain valve, and hot and cold water low point drains.
3. Fill the fresh water tank with water.
4. Reconnect the power supply line to the water pump.
5. If applicable, connect water line to icemaker.
6. Turn water pump on and operate all faucets, one at a time, until clear water is present.
7. Install new water faucet filter.
8. Fill water heater with water.

CAUTION:
Discard the first two trays of ice from the icemaker. They may contain contaminants.

WATER SERVICE CENTER



Typical Water System



1. Secondary Ice Maker Shut-Off Valve (N/A on all units - depending on floor plan)
2. Secondary Ice Maker Low Point Drain Valve (N/A on all units - depending on floor plan)
3. Water Filter
4. Sani-Con Flush System (Optional)
5. Gravity Fill
6. Sani-Con Power Switch (Optional)
7. Tank Monitor Panel (Optional)
8. Storage Lights/Water Pump Power Switch
9. Black Tank Flush Connection
10. Tank Fill/City Water Lever
11. Exterior Shower
12. Fresh Water Faucet
13. Pressure Regulator
14. City /Fresh Water Connection
15. Sewer Hose Storage
16. Sani-Con Macerator Pump (Optional)
17. 12 Volt Bay Heater
18. Grey Tank Drain Valve
19. Holding Tanks Termination Drain
20. Deck Plates
21. Black Tank Drain Valve
22. Fresh Water Tank Drain Valve
23. Fresh Water Tank Low Point Drain Valve
24. Winterization Valve
25. Hot and Cold Water Low Point Drain Valves
26. Systems Tech Port (For Qualified Technicians Only)
27. Soap Dispenser
28. Water Pump

NOTE:
Layout of Water Service Center and location of components will vary with floor plans, options, and changes to the motorhome.

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 can be found in the OEM manual in the owner's information box.

The LP-Gas tank mounted in the motorhome contains LP-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 ignition problems are commonly caused by air in the manifold system or incorrect gas pressure. **DO NOT** attempt to adjust the regulator. Adjustments must be made by a dealer or authorized service personnel 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 authorized service personnel 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.

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.

Leaks (identified by the odor of rotten eggs or sulfur) can be 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.

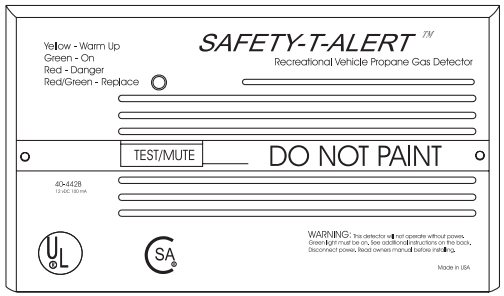
WARNING:
LP-Gas is highly volatile and extremely explosive. DO NOT use matches or a flame to test for leaks. Only approved LP-Gas leak testing solution for leak detection should be used. Unapproved solutions can damage copper tubing and brass fittings. A liquid dish soap solution of 10 parts water may 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 maintenance or repairs to the LP-Gas system.

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) 1192 - Fire & Life Safety, 6.4.8, Propane Detectors** states

"All recreational vehicles equipped with a propane appliance and electrical system shall be equipped with a propane detector listed as suitable for use in recreational vehicles under the requirements of UL 1484 and installed according to the terms of its listing."



030646

LP-Gas is heavier than air and will settle to the lowest point in the motorhome. The LP-Gas detector is also sensitive to other fumes such as hair spray, most of which contain butane as the propellant. Butane, like propane, is heavier than air and will settle to the floor level. Sulfated batteries (rotten egg odor) will also sound the alarm. When this occurs, reset the detector to stop the alert sound.

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. If a burner is left on, the area around the burner, range and adjoining counter space is combustible and can cause injury and damage when ignited. This condition will exist for an extended time period. Eventually, the LP-Gas will reach the detector's location and cause the alarm to sound.

NOTE:
The LP-Gas detector indicates the presence of LP-Gas only at its sensor. Combustible levels of LP-Gas may be present in other areas. The detector is intended for detection of LP-Gas only.

The LP-Gas detector is not designed to detect other types of gas. However, some products may cause the detector to alarm, such as alcohol, liquor, kerosene, gasoline, deodorants, colognes, propellant used in spray cans and cleaning solvents. In some cases, vapors from glue and adhesive used in the manufacturing of the motorhome may also 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. Take precautions to ensure one of these cases has not masked an actual LP-Gas alarm condition.

The LP-Gas detector draws less current than one instrument panel lamp and will operate until the battery is drained down to 7.0 Volts. A voltage higher than 7.0 Volts is needed for the detector to operate properly. If the power source is disconnected, or if the power is otherwise interrupted, the detector will not operate.

The LP-Gas 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.

The LP-Gas detector is wired to the house batteries. This allows reliable protection by alerting the build up of potentially dangerous levels of LP-Gas.

WARNING:
If the motorhome is unplugged from shore power, the house battery disconnect switch must be on for the LP-Gas detector to operate.

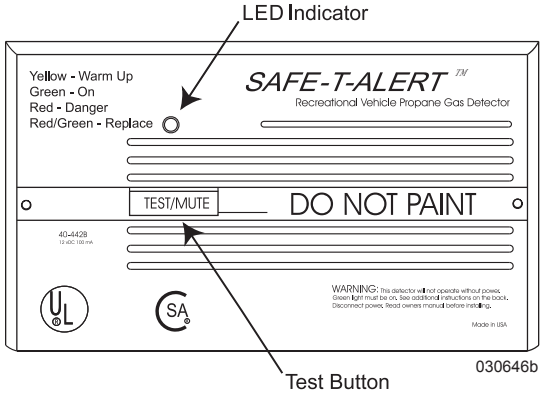
LP-Gas Detector Operation:

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 operates on 12 Volt DC, with a current draw of less than 1/10th of one amp.

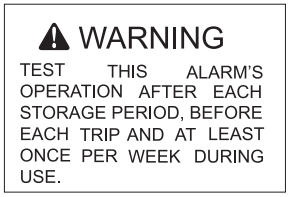
CAUTION:
The detector will not sound an alarm during the three minute warm up cycle.

Testing

Press the TEST switch any time during the warm up cycle or while in normal operation. The LED will turn red and an alarm will sound. Release the switch. This is the only way to test 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.



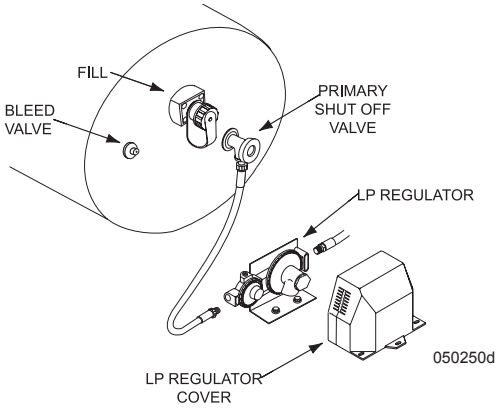
020155e

Alarm

The red LED will flash and the alarm will sound whenever dangerous levels of LP-Gas or natural 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-Gas tank.



Located in roadside bay

Potential Sources of LP-Gas Leaks When Operating the Motorhome	
Cooktop Burners	Defective LP-Gas Connection
Oven	Defective Regulator
Refrigerator	Portable Propane Powered
Water Heater	Appliances/Accessories
	Furnace

3. Determine and repair the source of the leak. If necessary, contact a qualified professional for service.

WARNING:
DO NOT operate any electric switch as they can produce a spark and ignite the gas.

CAUTION:
DO NOT re-enter motorhome until the problem is corrected.

Alarm Mute:

Press the **Test/Mute switch** 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.

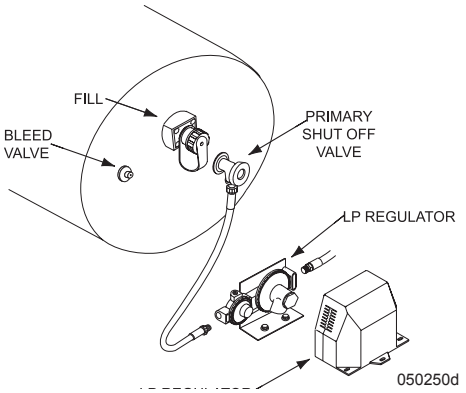
Maintenance

1. Vacuum the dust off the detector cover weekly (more frequently in dusty locations) using the soft brush attachment of a 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) at any time, perform the following steps immediately:

- Shut off LP-Gas appliances.
- Manually turn off the primary shut-off valve at the LP-Gas tank.

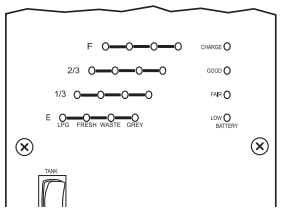


- **DO NOT** operate any electric switch. This can produce a spark and ignite the gas.
- Open windows and doors.
- Evacuate the motorhome. Stay clear of the surrounding area.
- Keep all ignition sources out of the area.
- Contact a qualified service technician to find the source and repair the gas leak.

WARNING:
A fire or explosion from ignited gas or gas fumes can cause serious injury or death.

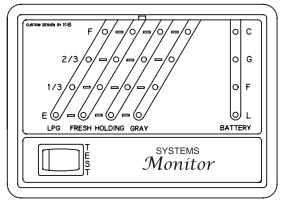
LP-GAS TANK
Measurement

The motorhome is equipped with a monitor panel to aid in managing the LP-Gas tank. The monitor panel is located in the hallway area. A second optional monitor panel is found in the roadside water service center. The switch marked TEST is a momentary switch. Hold the TEST switch down to view the tank staus.



060306m

Monitor Panel: Located in the hallway



030446g

Monitor Panel (Optional): Located in Service Center

LP Tank & Fresh Tank	Holding & Grey Tanks
Red = Empty	Green = Empty
Amber = 1/3 Full	Yellow = 1/3 Full
Yellow = 2/3 Full	Amber = 2/3 Full
Green = Full	Red = Full

Tank Capacity

LP-Gas Tank Capacity
*39 Gallons
**Actual filled LP-Gas capacity is 80% of listing due to safety shut-off required on tank.*

NOTE:
This chart reflects product specifications available at the time of printing.

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. Actual full liquid capacity is 80% of full tank 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.

WARNING:
Extinguish all sources of heat, sparks, flames and smoking materials within a 50' radius during the fueling process.

WARNING:
Before entering a refueling station, turn off all pilot lights and LP-Gas operated appliances. Most LP-Gas appliances used in recreational vehicles are vented to the outside. Fuel vapors can enter an appliance vent on a motorhome that is parked close to a gasoline pump, resulting in an explosion or fire.

The LP-Gas tank fill is located a the roadside compartment. The tank must be filled to the proper level to allow for expansion. An overfilled tank may cause the safety valve to release pressure emitting a strong rotten egg odor near the tank and/or a hissing noise may be detected.

WARNING:
Small amounts of LP-Gas can escape and evaporate during the fueling process. Protect bare skin. Instant freezing will occur if exposed to LP-Gas.

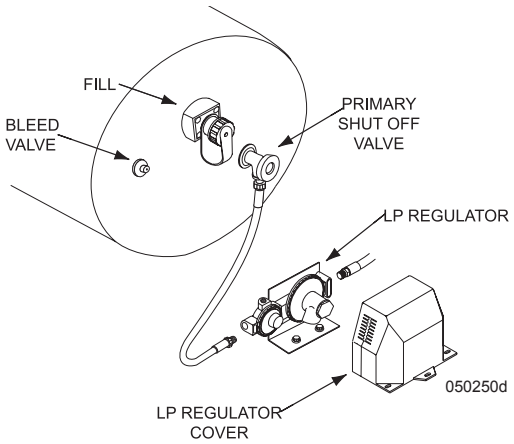
LP-Gas exists in both liquid and vapor form within the tank. A full tank is approximately 80% liquid. The pressure inside the tank varies with the temperature of the liquid. All tanks are required to have a safety pressure relief device to release excess pressure. Actual full liquid capacity is 80% of full tank capacity. The monitor panel is adjusted for this and will indicate "full" at this point.

NOTE:
If the tank is new and being filled for the first time, inform the service technician to purge any air from the tank prior to filling.

Tank Operation

- Open the primary shut-off valve located on the LP-Gas tank.
- Turn off 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. This will over-tighten the valve. The primary valve is designed to be closed by hand. Over-tightening may permanently damage the valve seat.

NOTE:
In some States and Canadian provinces, it may be illegal to drive the motorhome while the primary valve on the LP-Gas tank is open.



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

The above capacities allow for 20% vapor space on each cylinder.
Data taken from the National Fire Prevention Association (NFPA). Pamphlet #58-1998.

CONVERSIONS

Gallons to Liters (1 Gallon = 3.785 Liters)
Fahrenheit to Celsius (F° - 32 ÷ 1.8 = C°)
11 in. Water Column = 6 1/4 ozs. per sq. in. pressure.
27.7 in. Water Column = 1 lb. per sq. in. pressure.

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 ¼ ounces per square inch.
- An inch of Water Column is a measurement of applied pressure to one side of a U-Tube ½ 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 - 44º F., the liquid remains stable with tank pressure, about 0 psi. If liquid temperature is 100º 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 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 oz. 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.

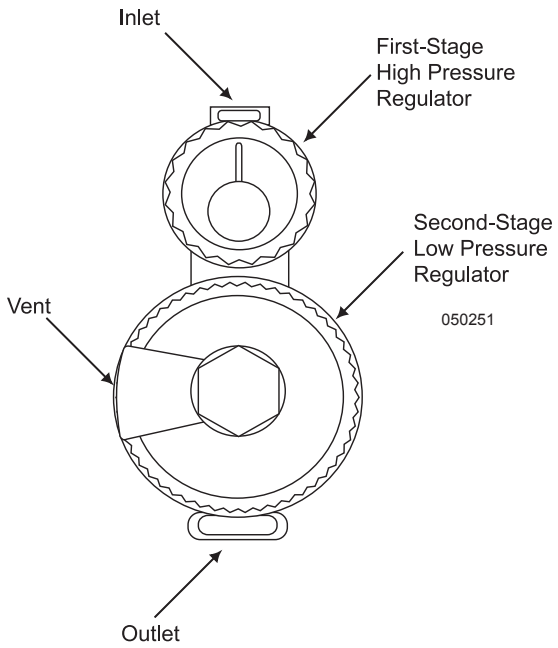
Under normal atmospheric conditions an LP-Gas regulator will not freeze, nor will the LP-Gas. Vapor passing through the regulator will expand and cool, condensing moisture in the gas. The moisture will freeze, build up and block the vent. The possibility of freeze up is greatly reduced with the two-stage regulator.

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.

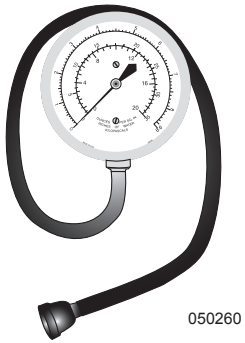


Damage to the regulator can occur when the tank is overfilled. The regulator is designed to work with vapor only. This is why the tank is filled to only 80% of its liquid capacity. The other 20% allows for vaporization of the liquid. The primary vapor valve is located in the vapor section of the tank. In an overfilled tank, liquefied petroleum can fill the regulator. Vaporizing liquid 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.

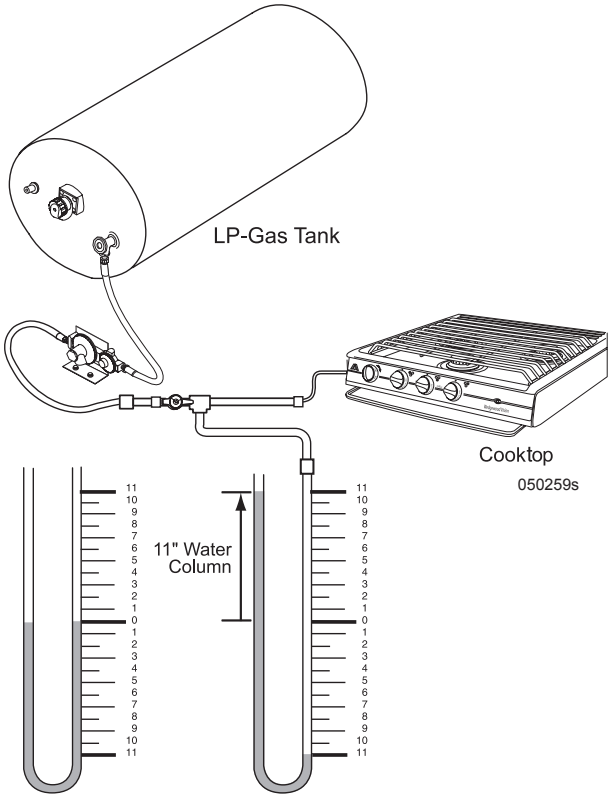
WARNING:
DO NOT attempt to adjust the regulator. Adjustments require special equipment. Failure to follow these instructions may result in a fire or explosion, and can cause severe personal injury or death. DO NOT operate LP-Gas appliances until the LP-Gas pressure is checked and a leak down test is performed!

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 Inches of Water Column.



Manometer Gauge



U-Tube Testing Layout

LP-GAS HOSE INSPECTION

The hose manufacturer suggests that a flexible LP-Gas supply hose undergo regular inspection. As a guideline, it is recommended 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.

Inspection tips:

Hose strength is controlled by the plies of reinforcement. Damage in this area cannot be tolerated. 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. Small cuts, nicks, or gouges that do not go completely through the cover are not cause for replacement of the hose. Inspection should be performed when the hose is not under pressure.

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.

Cause for hose replacement:

- Damage to the textile reinforcement or wire braid
- Wire braid reinforced hose, which has been kinked or flattened so as to permanently deform the wire braid in the un-pressurized state.
- Blistering or loose outer cover.
- Slippage; evident by the misalignment of the hose and coupling and/or the scored or exposed area where slippage has occurred.

NOTE:
Only a qualified RV service technician should complete replacement of LP-Gas components.

Additional suggested maintenance:

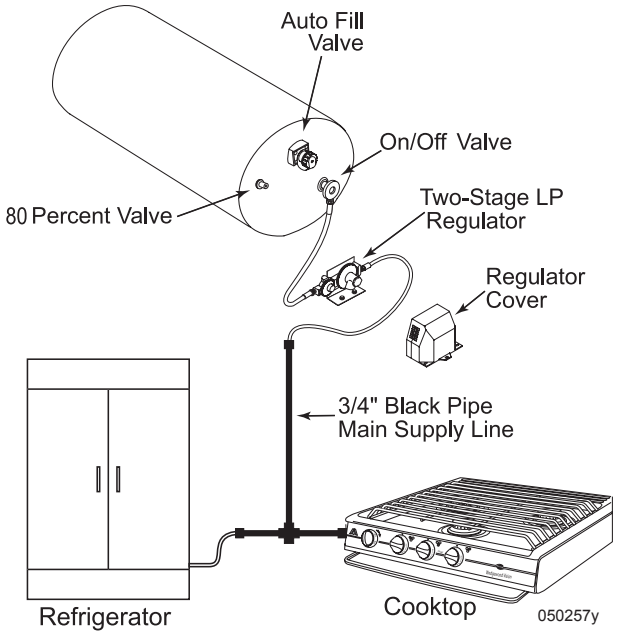
After performing extensive testing the manufacturer of the flexible LP-Gas supply hoses has determined that the hoses be replaced every ten (10) years as the failure rate may increase after this period of time. The motorhome manufacturer recommends following this guideline to assure continued safety 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. It is recommended that gas distribution work be performed by an authorized dealer or an authorized service technician.

INSPECTION:
Inspect the rubber flexible lines twice a year for abrasions, tears, kinks or other signs of damage.

If a gas leak is suspected, have the system inspected and repaired by a qualified service technician as soon as possible.



LP-GAS CONSUMPTION

Each gallon of LP-Gas produces 91,502 BTUs of heat. One 27 gallon tank produces two million BTUs. 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 continuously operate. An example would be the typical cycling of the refrigerator.

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.

Typical Appliance BTU Ratings

Cooktop

Large - 9,500 BTU

Small - 6,500 BTU

Refrigerator (Norcold)

4-door - 2,200 BTU

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 the LP-Gas regulator 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.

LP-GAS SAFETY TIPS

LP-Gas is one of the safest and most reliable fuels available on the market when handled properly, however, LP-Gas does have 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**.

Maintenance and Safety Tips for the LP-Gas Refrigerator and Furnace:

- Have the refrigerator and furnace systems inspected annually by an authorized service center.
- Have the venting system checked for blockage before using the refrigerator or furnace for the first time each season.
- 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 which indicates 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 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.

HOUSE ELECTRICAL - INTRODUCTION

This section contains guidelines, procedures and information on the electrical system and operation of various components. Refer to the OEM manuals included in the Owner's Information File box for respective, in-depth, individual component operating instructions.

General Overview:

The motorhome can utilize various sources of electrical power: shore power connection, generator, inverter, chassis batteries and house batteries. All of these electrical power sources, while independent of each other, can be combined in a variety of ways to provide a highly efficient electrical operating system. Two types of electrical systems are used: 120/240 Volt AC and 12 Volt DC.

The motorhome 120/240 Volt AC system can be operated from three different power sources: shore power, on-board generator or (optional) inverter. Shore power is the most efficient and should be used whenever possible. The generator can be used when shore power is unavailable. The optional inverter supplies silent AC power by using the house batteries of the motorhome, sending AC power to selected appliances and outlets. However, the optional inverter AC power output is limited and should be used sparingly to conserve house battery power. 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.

WARNING:
The electrical system is engineered and tested for safety. Circuit breakers and fuses protect the electrical circuits from overloading. When planning modifications or additions to the electrical system, ensure 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 outlet that may be exposed to a water source. Such use can result in a serious shock causing injury or death.

The motorhome has two 12 Volt DC systems: chassis and house. These two systems, for the most part, are separate from one another. The house system does not operate engine functions; the engine system does not operate house functions. However, within the two systems there are some inner connections. **For example:** While the motorhome is driven the alternator on the engine will charge the house batteries. Likewise, while the motorhome is plugged into shore power, or the generator is running, the chassis batteries are being charged. Each system will supply 12 Volt DC power to the 12 Volt DC distribution panels.

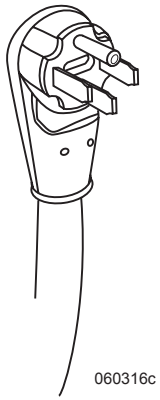
The chassis and house systems have their own sets of batteries. The chassis batteries supply 12 Volt DC power to the front electrical panel, front distribution box and rear distribution box. These panels mostly engine system circuits and wiring such as headlights, taillight, dashboard functions, gauges, etc. The house batteries supply 12 Volt DC power to the distribution panel located in the bedroom. This panel contains fuses for the house, interior lighting and appliances. Become familiar with these panels and the items they operate.

With all the technological advancements taking place in the past several years manufacturers have now incorporated electronics into these systems. It is important to keep the 12 Volt DC systems in good working order. These systems, with their incorporated electronics, are voltage sensitive. Some items can be damaged if the DC voltage is not maintained within the designed specifications.

A majority of the lighting and appliances are designed to operate from 12 Volt DC (direct current) power. This is why the batteries play such an important role in the function of the motorhome. There are exceptions with appliances such as the microwave or television; however, indirectly they still operate from 12 Volt DC power, as they can be operated from the inverter. The chassis functions (engine, transmission, dash air, etc.) are also 12 Volt DC.

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 power cord is 50 Amp 120/240 Volt AC. When this type of power source is not available, electrical adapters will be required to allow a proper and safe connection to the electrical service supply.


060316c

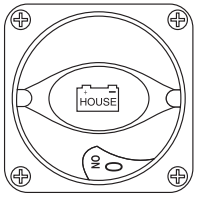
NOTE:
When 50 Amp shore service is not available, care will have to be used when operating the appliances and using the outlets to avoid overloading the shore power service.

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 ft. above sea level. This figure decreases 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 (Optional):
The optional inverter is an auxiliary 120 Volt AC power source that inverts 12 Volt DC house battery power to 120 Volts AC. This device has limited AC power output, measured in watts, and operates only selected appliances and outlets. The optional inverter also converts 120 Volts AC power, supplied from either shore power or the generator, to 12 Volts DC power to recharge the batteries. When dry camping, the optional inverter 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: converter or inverter, house fuse panel in the bedroom and house fuses in the roadside front distribution panel. Turn the house battery disconnect switch off when the motorhome is going to be stored for more than 48 hours or before performing electrical maintenance. If possible, leave the motorhome plugged into an outside electrical service with the house battery disconnect switch on to help prevent the possibility of dead batteries. Use of the house battery disconnect switch 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.

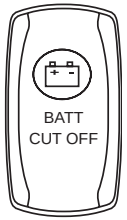


060077b

Located in curbside battery compartment.

BATTERY CUT-OFF SWITCH

The battery cut-off switch is located inside and next to the entry door. This switch controls the 12 Volt DC power to the house fuse panels. When the switch is activated, power is supplied to all the interior DC lighting and DC operated appliances. Some appliances 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 optional inverter operation are unaffected by the operation of this switch. When turned off, this switch will not stop all parasitic loads and therefore is not a substitute for the main battery disconnect switch.



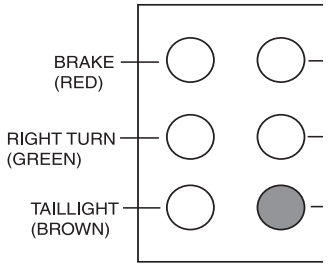
080499b

CAUTION:
Avoid flash damage to electrical contacts. Turn off the interior lighting before activating the battery cut-off switch.

SHORE POWER HOOK-UP

The power requirement for the motorhome is 50 Amp 240 Volt AC single phase. The motorhome can be operated from 30 Amp 120 Volt AC but with limited capacity. If 50 Amp shore power service is available, connect the supplied shore power cord. If less than 50 Amp service is available, electrical adapters are required and power consumption must be reduced to avoid tripping the shore power breaker. The power cord is stored in the rear roadside compartment.

CAUTION:
Avoid flash damage to the electrical system contacts. Before hooking up to shore power, starting the generator or using the optional inverter turn off all of the appliances.



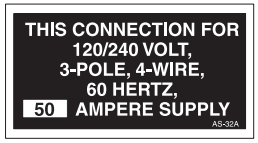
020125

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 an electrical shock, turn the circuit breaker off for the power supply outlet before making the shore power connection.

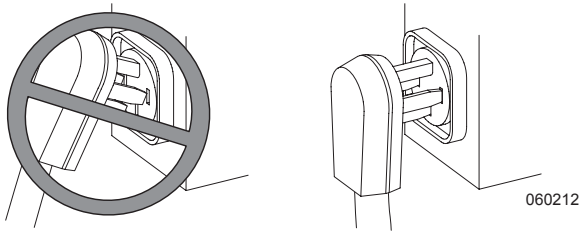
CAUTION:
DO NOT remove cover from shore power supply to troubleshoot electricity to the motorhome. Serious personal injury or death may occur. If there is no power to the motorhome, inform the park manager. It is the park manager's responsibility to fix problems with the park's shore hook-up.

Plugging in the Shore Cord:

- The shore power cord is located in the roadside rear compartment. Unscrew the deck plate and insert the end of the shore cable through the deck. Extend a sufficient amount of cable to reach the power supply.
- All appliances must be off.
- Check the shore power source amperage. When the shore power amperage does not match the shore cord (50 Amp), install the proper adapter on the shore cord.
- Always turn **OFF** the shore power breaker at the power supply before connecting or disconnecting the shore cord. This will prevent an accidental shock or flashing of electrical contacts.
- Align cord end with socket terminals. Push cord all the way into socket until the plug is firmly seated.
- After the connection is made, turn the shore power breaker on. The transfer switch should make an audible click.
- Go inside the motorhome to verify AC power is available. The microwave display should be lit.



060203



060212

Incorrect Method — Correct Method

When Hooked to 50 Amps:

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

When Hooked to 30 Amps:

If 50 Amp service is not available, wait approximately one hour before operating electric appliances. 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.

Disconnecting the Shore Cord:

- Turn off all AC appliances.
- Turn off the shore power breaker. This will prevent accidental shock and flashing of electrical contacts when disconnecting.
- Grasp housing of electrical plug. Without touching electrical contacts, work plug out and away from socket.
- Straighten, clean and store the cord.

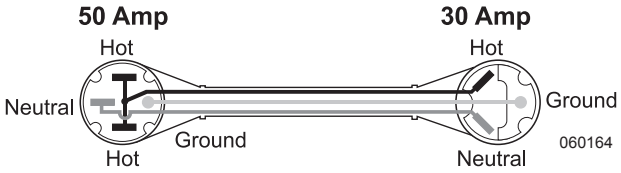
Power Supply:

Amperage supplies vary greatly depending on 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, 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.

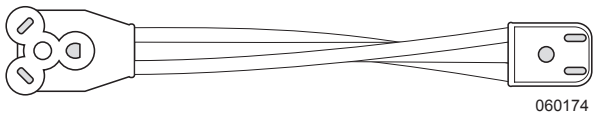
Electrical Adapters:

Different types of electrical adapters are designed to suit a variety of different needs. Only UL approved adapters should be used. The most common adapter is a 50-30 Amp adapter. This type of connector adapts the 50 Amp shore cord to a 30 Amp shore power outlet. Always install the adapter to the cord prior to making the connection to the outlet.



Typical 50 - 30 Amp Adapter

Another common adapter is a 30 to 20 Amp adapter. This type of connector adapts the 30 Amp shore cord to a 20 Amp shore power outlet.



Typical 30 - 20 Amp Adapter: Adapts 30 Amp Shore Cord to 20 Amp Shore Power Outlet

CAUTION:

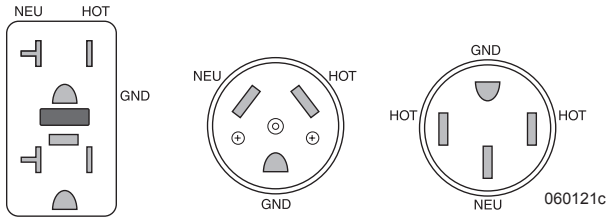
If shore power service is limited to 15 or 20 Amps, use of light duty extension cords and electrical adapters will create a voltage loss through the cord and at each electrical connection. Line voltage loss and the resistance at each electrical connection can be a hazardous combination. Damage to sensitive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

WARNING:

Avoid the risk of electrical shock or component damage by disconnecting from shore power during electrical storm activity. Use the optional inverter or start the generator if AC power is needed.

NOTE:

Three types of shore power outlets most commonly used are shown in the illustration.

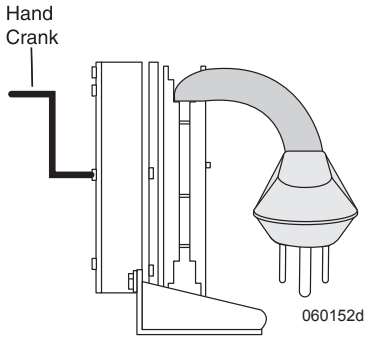


WARNING:

Before working on the electrical system, disconnect from shore power and turn off the optional inverter. Disconnect the negative 12 Volt DC battery cables at the batteries. Remove rings, metal watchbands and other metal jewelry before working around batteries and connectors. Use caution when working with metal tools. If the tool contacts a battery terminal or metal connected to it, a short circuit could occur causing personal injury, explosion or fire.

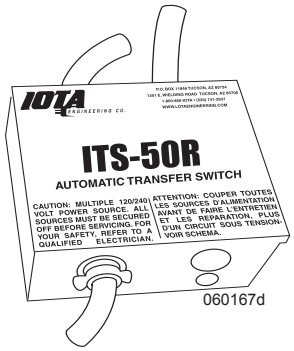
Manual Cord Reel (Optional)

The cord reel coils and stows the shore cord. Use the hand crank to retract the power cord. To extend power cord, pull out. Extend only as much power cord as required to reach the outlet. The cord should not be taut, but slightly slack.



Located in rear roadside compartment

TRANSFER SWITCH



Located in rear roadside compartment

The transfer switch will automatically transfer AC power from the shore power cord or generator through the transfer switch to the 120/240 Volt AC breaker panel.

In the event both shore and generator power are available, generator power will override shore power after a 30 second delay. This allows the generator time to warm up before applying an AC load.

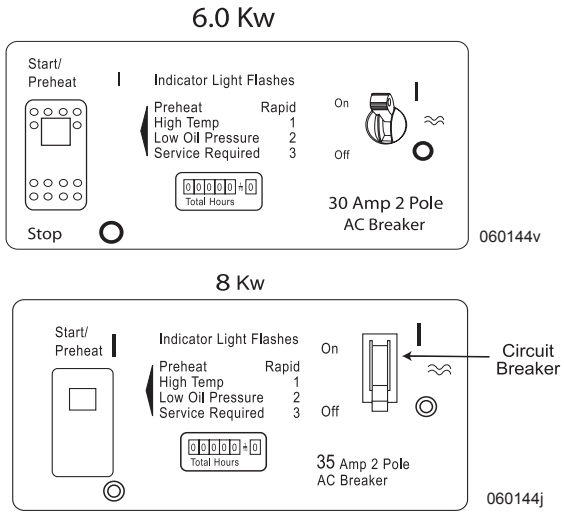
Once the generator is shut down, shore power will be available after a two second delay.

NOTE:
The shore cord is NOT electrically connected to the generator. When the generator is operating, the electrical contacts of the shore cord are not electrically energized.

NOTE:
To prevent damage to transfer switch contacts, discontinue appliance operation and turn off auxiliary electrical loads operated by outlets before connecting/ disconnecting shore power or starting/ stopping the generator.

GENERATOR - 120 VOLT AC

The generator is located in the front compartment of the motorhome. To open the generator, push in on the two locking buttons. Pull the door out and down.



Optional 8 Kw Control Panel

NOTE:
For detailed operating instructions and information refer to the generator OEM manual.

The generator can be started from the following locations:

- Generator remote switch on the dash.
- Generator switch on the generator.
- Generator switch on the hallway systems control panel.

Pre-Start Checks

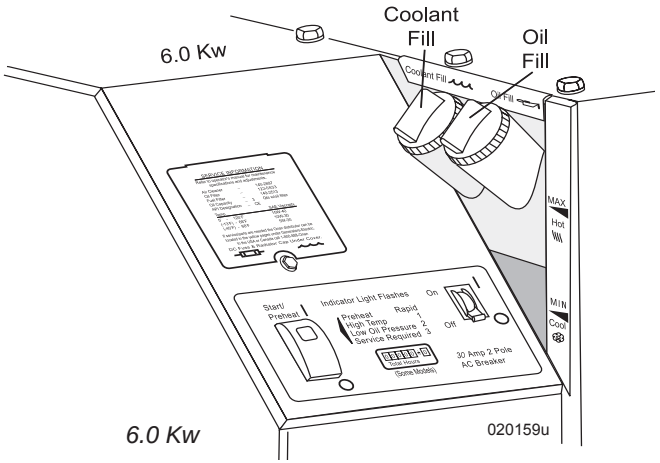
Prior to the first start of the day, perform a general inspection including oil and coolant levels. Keep a maintenance log on number of hours in operation since the last service. Perform any service or maintenance that may be due.

Before Starting the Generator:

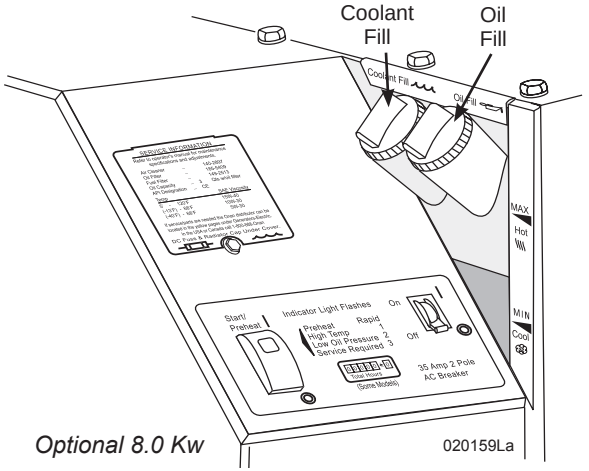
- People and animals must be clear of hazards of electrical shock and moving parts.
- All appliances and other large AC electrical loads must be off.

CAUTION:
Allow the generator to cool before removing the coolant fill cap.

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 so as not to run the main engine out of fuel.



6.0 Kw

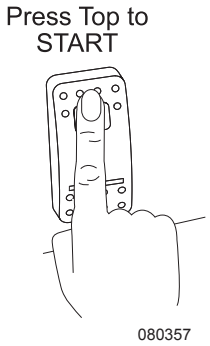


Optional 8.0 Kw

Starting the Generator

Requirement for Generator Operation:

- House battery disconnect switch must be on.



Push and hold the control switch in **START** position until the generator starts. Release switch. On diesel models the control switch may flash up to 15 seconds, indicating engine preheat.

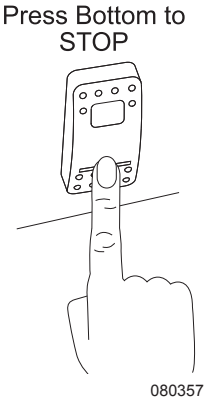
WARNING:
Excessive cranking can overheat and damage the starter motor. DO NOT crank the engine more than 30 seconds at any one time. Wait at least two minutes before resuming. If the generator fails to start refer to the OEM manual.

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. The engine exhaust contains Carbon Monoxide, which is poisonous and can cause unconsciousness and/or death. Inspect the exhaust system before starting the generator. DO NOT block the exhaust pipe or put the motorhome where the exhaust may accumulate outside, underneath, or inside the motorhome or nearby vehicles. Operate the generator only when there is a safe dispersion of exhaust. Monitor outside conditions to ensure the exhaust continues to disperse safely.

WARNING:
When parking near high grass, be sure the hot exhaust does not come into contact with the grass, it could be a fire hazard. Hot exhaust pipe or hot exhaust gases can ignite the grass.

CAUTION:
Exhaust extensions add weight to the generator exhaust system. Exhaust piping or manifold damage can result, allowing Carbon Monoxide to accumulate 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.

NOTE:
The generator requires only a momentary stop signal.

Powering the Equipment

The AC output of the generator powers the motorhome air conditioners, inverter, selected appliances and 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.

NOTE:
The generator may shut down when loaded nearly to full power and an air conditioner (or other large motor load) cycles on. Briefly 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.

Compensation for temperature and elevation may also be necessary. The generator’s maximum output is rated at 500 ft. above sea level. Beyond this point, the generator will lose approximately 3.5% of its rated power for every 1000 ft. gained in elevation. High and low temperatures can also affect generator output. Power decreases 1% for every 10º F. above 85º F. Counteract these effects by operating appliances in sequence rather than at the same time.

INFORMATION:
The generator may shut down for reasons other than an overload. If a blink code appears on the control switch, refer to the OEM manual to obtain an explanation for the code.

Generator Fuel

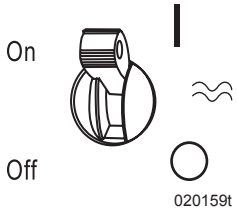
There is always a possibility fuel may be contaminated. Diesel fuel may contain water or a microbe growth (black slime). Any contamination of fuel will greatly reduce the total output of the generator, and may cause erratic AC output.

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 6000 Watts (gal./hrs.)	Diesel 8,000 Watts (gal./hrs.)
No Load	0.13	0.13
Half Load	0.40	0.48
Full Load	0.70	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.



Circuit Breaker on generator

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 reconnecting loads.

NOTE:
An appliance or load may have a short if it causes a circuit breaker to trip after reconnection. DO NOT continue to reset breaker. Have the problem corrected before resuming operation.

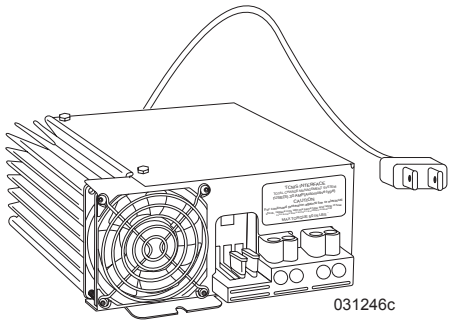
Generator Exercise

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” will help 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 (60 AMP)

The power converter is located in the rear curbside bay. The 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.



Located in rear curbside bay.

- Output on terminals should read 13.6 Volts DC +/- .3 Volts.
- Inspect the converter 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 or around converter.

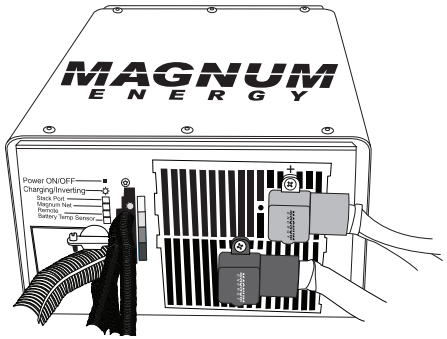
If converter output is correct, but the battery is not charging, there may be a problem with an open wire between the converter and battery. If the fuses are blown, the battery was connected in reverse. It only takes one second of reverse connection to blow the fuse.

If the power requirement for the converter is met, the fuses are good. If there is no output from the converter, the converter may need to be replaced.

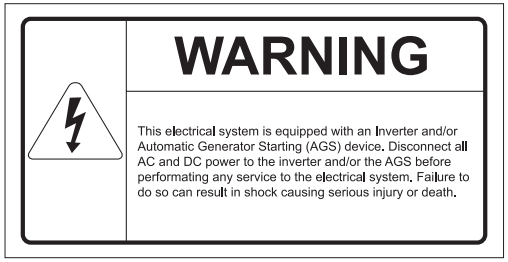
CAUTION:
DO NOT store objects close to the converter. This may disrupt the air flow to and from the converter, possibly causing damage due to overheating.

INVERTER (Optional)

The inverter changes DC battery power to AC electrical power, and also charges the house and chassis 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. 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 panel is used to change the variable settings.



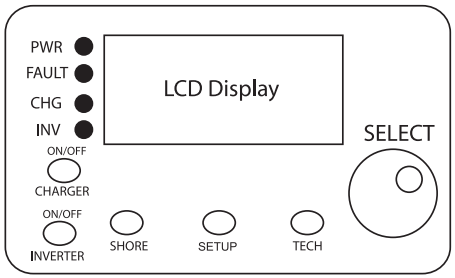
060157f



100218

Providing AC Power with Inverter

To turn the inverter on:
Press the **INVERTER ON/OFF** switch at the remote panel. If the inverter doesn't 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.



060254b
Remote Panel

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.

Shore Setting:
The Shore setting in the remote panel adjusts the amount of AC current the battery charger can use. If hooked to less than 50 Amp service, select the proper Shore setting to help prevent combined AC loads such as the roof air conditioner and the charger from overloading limited shore power service.

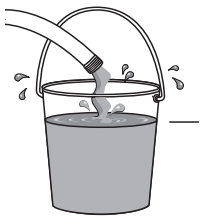
To Adjust Shore Power Setting:
- Press the Shore button on the inverter remote.
- Turn the knob on the inverter remote left or right to scroll through shore setting options.
- Press the knob to select. An arrow will appear next to the selected setting.

Shore Setting	AC Power
50 Amp	When hooked to 50 Amp shore service.
30 Amp	When hooked to 30 Amp shore service.
20 Amp	When hooked to 20 Amp shore service.
10 Amp	Used when shore service is severly limited or experiencing shore power overload.
5 Amp	Minimum charge capacity setting. Used when shore service is severly limited or experiencing shore power overload.
Contrast	75 %

NOTE:
Settings 20 Amp and below limits battery charge capacity and may hamper ability to efficiently operate DC electrical loads. Reset to higher amperage when available.

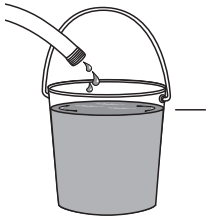
Inverter three-stage charging cycle:

- **Bulk Charge Cycle:** Brings the DC voltage up high, initially between 14.2 - 14.6 Volts DC. The length of time the inverter is in Bulk Charge depends the state of charge of the batteries.



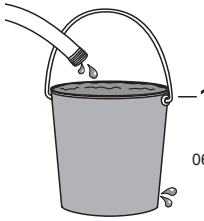
Bulk Charge
Water (charger) on full until bucket (battery) is 80% full.

- **Absorb Cycle:** Absorb Cycle battery voltage is the same as the Bulk Charge Cycle, between 14.2 - 14.6 Volts DC. Length of the Absorb Cycle is a timed event determined by the inverter.



Absorb Charge
Water (charger) slows until bucket (battery) is 90% full.

- **Float Charge Cycle:** Charge voltage is generally around 13.3 - 13.7 Volts DC. Approximately 80% of the charging cycle has been completed by this time.



Float Charge
Water (charger) slowly trickles into bucket (battery) until 100% full. Water (charger) will adjust flow to maintain level.

Hose = Inverter in Charge Mode
Bucket = Battery

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 %

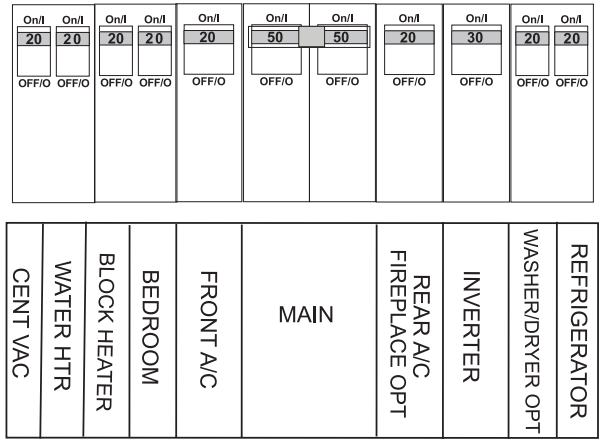
NOTE:
The Inverter will charge the batteries with AC power applied regardless of remote status.

Battery Temperature Sensor

A **Battery Temperature Sensor (BTS)** is affixed to one of the house battery terminals to measure battery temperature and send that information to the inverter. When battery temperature rises, the inverter will decrease charge voltage to prevent boiling the batteries. When battery temperature cools, the inverter will raise charge voltage. Voltage compensation with temperature variation is necessary to keep charge voltage at optimum values. If the BTS cord is unplugged from the inverter, the inverter will use a temperature default setting of 77º F./25º C. as a reference point.

DISTRIBUTION PANEL (50 AMP)
House 120/240 Volt AC Panel

The AC distribution panel is located in the bedroom. The main AC 120/240 Volt panel receives power from the transfer switch, which is powered by either shore power or the generator. The AC power is introduced into the panel by 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.



060286Q

NOTE:
This panel will change with options or changes to the motorhome.

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, the generator is off and the inverter is in the off position. Certain testing procedures can require the AC power to be on. Only qualified personnel or personnel with electrical backgrounds should attempt any testing procedures.

Energy Management System

The 50 Amp Smart EMS consists of two elements: the display panel and the bedroom distribution panel.

The distribution panel, located in the bedroom, is 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.

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, must be a 50 Amp unit 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 120 Volt AC - 30 Amp shore power source, 50 Amp shore power source or generator source. Depending upon available power, the EMS controls the operation of six possible loads as indicated on the distribution panel. These may be any type load, but are typically heavier loads; those whose use can be “postponed until a time when current is available for use. If the available power source is 120 Volt AC - 30 Amp 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 feature is intended to prevent 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.

If the generator is running, 120 Volt AC will be present at the distribution panel L1 and L2 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.

If 120 Volt AC is present at the distribution panel L1 and L2 inputs the system will assume that 120 Volt AC, 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. 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, turning the loads off and calculating the amount of current that was removed, which is the value for that load. 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, which is the value of that load, in memory. The system continues to turn off loads until the total current falls below the service limit or all of the six controlled loads have been shed. Through this process the system has "learned" the amount of current 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 turned off or "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:
A minimum two minute delay period occurs after a load is shed before the load is turned on again to prevent air conditioners from turning on with a head pressure.

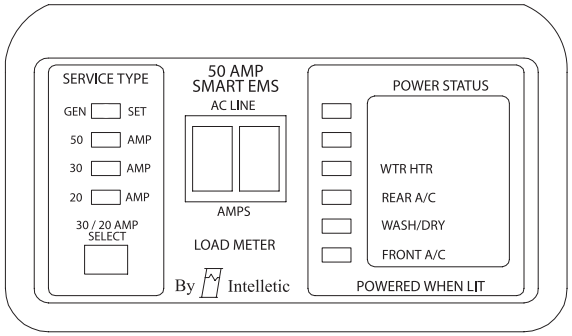
Three Hour Averaging:

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 three 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 translates to 16 Amps. Because the EMS calculates a running three hour average, if the average load current drops below the limit the system restores power to loads based on their impact on the limit. If the system is in the averaging mode the decimal point at the lower right corner of the load meter display on the display panel illuminates.

Display Panel:

The display panel connects to the distribution panel located in the bedroom. Six power status LED's indicate power is applied to those loads. These LED's 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.



060303b

Four service type LED's indicate the source for 120/240 Volt AC power. Three of these sources are automatically detected and indicated by the EMS, namely: 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.

Circuit Breaker

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.

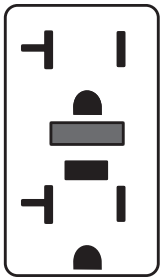
For example: A breaker with a 20 Amp rating will operate a continuous 16 Amp load. This design leaves a small amount of working capacity within the breaker. When an inductive load is applied, such as when an electric motor turns on, the motor starts to spin and current consumption may momentarily exceed 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. For example: The electrical item is rated at 1370 watts. Divide that by the operating voltage of 115 Volts AC which equals 11.913 Amps. Use this formula to calculate the amount of load and compare to the available power supply.

GFCI Breakers & Outlets

A ground fault circuit interrupter "GFCI" can be found in two different types of applications. One type is incorporated in a breaker used in 120 Volt AC breaker panels, the other is incorporated in an outlet.


060072

The GFCI, whether it is a breaker or an outlet, offer two types of protection. One type of protection is from over-current or shorts. It also provides protection for persons against hazardous ground fault currents which can result in injury or death. Ground fault currents are currents that flow from the "HOT" or 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. If the device has been properly installed it 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 or breaker uses sensitive electronics inside the outlet or breaker to detect a ground fault problem. The electronics monitor the normal current of power, flowing to the "hot" or black wire through the load (e.g. 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 breaker or 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 or breaker manufacturers (about 30 mils or less).

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 shock, can still be seriously injured. A GFCI outlet or breaker 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.

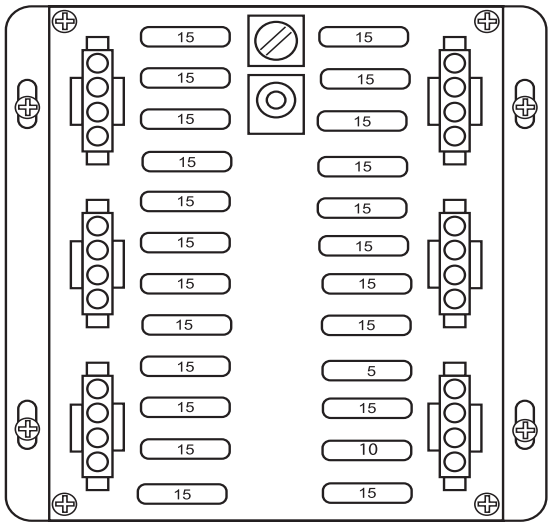
WARNING:
If a breaker or outlet continually trips DO NOT continue to reset breaker or outlet until the problem has been identified and corrected.

NOTE:
The ground fault outlet or breaker should be tested once a month to insure it is properly working. Use the "TEST" button on the outlet or breaker. It should trip with an audible "click." The breaker or outlet will not trip if no AC power is present to the device. If power is present and the device will not "trip," replace it before using that circuit.

NOTE:
One mil is 1/1000 of one amp.

DISTRIBUTION PANEL
House 12 Volt DC

The 12 Volt DC house distribution panel contains fuses (located in the bedroom) that protect the electrical circuits. These fuses are the standard automotive type.



060165p

Typical arrangement of fuses. Actual fuse arrangement will change with options and changes to the motorhome

FUSE	CIRCUIT	AMP	COLOR	GA
F1	CENTER LITS OR PASS BATH	15	BLU	14
F2	PORCH, CURB VAL/OH LTS	15	YEL	14
F3	BEDROOM	15	GRN	14
F4	FRONT FANS, ROAD VAL/OH LTS	15	VIO	14
F5	CEILING LTS. FRONT	15	RED	10
F6	REAR CEILING FANS	15	VIO/BLK	14
F7	ACC LITS HUTCH/CEILING LTS GAL	15	BROWN	14
F8	REAR RADIO (OPT.)	15	GRY/BLK	14
F9	CENTER LTS OR DR BATH	15	ORG	14
F10	GALLEY LIGHTS/CEILING LTS	15	RED/BLK	14
F11	CENTER LTS OR REAR BATH (OPT)	15	BLU/BLK	14
F12	REAR LIGHTING (OPT)	15	GRN/BLK	14
F13	FURNACE/ROOF A/C	15	GRY	14
F14	MONITOR PANEL/WATER PUMP	10	RED	12
F15	OPEN	15		14
F16	DASH RADIO SWITCH (OPT.)	5	GRY	16
F17	AUTO GEN START (OPT.)	15	ORG	14
F18	EMS (OPT)	15	BRN	14
F19	REAR S/O BED/SOFA	15	GRN	14
F20	REAR S/O WARDROBE	15	BLK	14
F21	EXT RADIO (OPT.)	15	VIO/BLK	14
F22	110V WTR HTR SYSTEMS PANEL	15	BLK	14
F23	KITCHEN FURNACE (OPT.)	15	GRY/BLK	14
F24	OPEN			

Note: Fuses will change with options or changes to the motorhome.

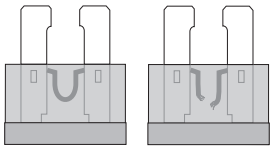
060286n

Fuses

The 12 Volt DC fuses, located in the distribution panel, service the interior house functions. A blown fuse is evident by the broken metal strip located in the center of the fuse. Replacement fuses should be of the same amperage. A higher rated fuse 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 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, as 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.



060086b

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

Fuse color represents amperage

BATTERIES - HOUSE

House batteries are designed for use with 12 Volt DC operated lights, appliances and inverters.

Types of House Batteries:

- Liquid Lead Acid (LLA)

Deep Cycle Batteries:

Deep cycle batteries are a type of Liquid Lead Acid (LLA) battery. Deep cycle batteries are best suited for use with 12 Volt operated lights, appliances and inverter/converters. Deep cycle batteries are designed to have a majority of their capacity used before being recharged.

NOTE:
Tap water contains minerals which can alter battery chemistry and ruin the battery. Use only distilled water when refilling the LLA battery.

IMPORTANT!

IMPORTANT!
This motorhome is equipped with Non-sealed Liquid Lead Acid (LLA) house batteries which require regular maintenance. Lack of maintenance will result in a shortened battery life.

NOTE:
Read your owners manual for storage, dry camping and battery maintenance.

MONACO CUSTOMER SERVICE: 1-877-4-MONACO

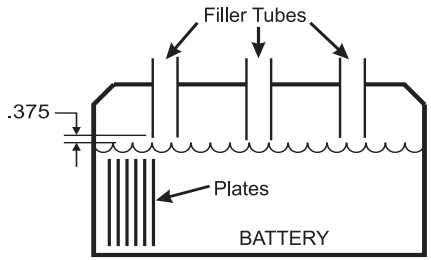
060331

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.



Battery State of Charge	Spec. Gravity	Voltage
100%	1.265	12.7
75%	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.

020034

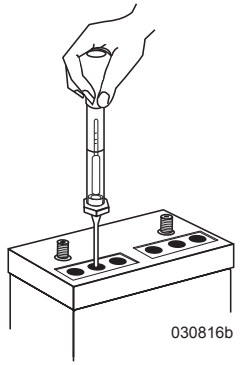
WARNING:
Liquid lead acid batteries produce hydrogen gas while being charged. This is highly explosive. DO NOT smoke around batteries and keep all sources of ignition or flames away from batteries. The hydrogen gas may explode resulting in fire, personal injury, property damage or death.

Testing the Battery

A battery can be tested and monitored several ways. The monitor panel on the hallway Systems Control Center or the (optional) monitor in water service center show voltage of the house batteries. Press the Test switch to check battery status.

Checking the Electrolyte Solution:

The most efficient way of testing the batteries is to check the electrolyte solution. The only way to test a battery's electrolyte solution is with a hydrometer. Many styles are available, from types with cylinder graduation (shown here) to types with floating balls. Hydrometers can be purchased from most auto parts stores.

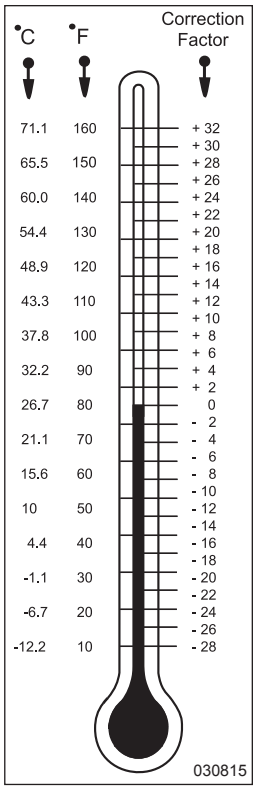


Hydrometer (cylinder type) shown testing LLA type battery.

The hydrometer tests the battery's electrolyte solution which is 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 80° F. chart. Readings between cells should not vary more than 50 points.



Temperature Correction Chart

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.

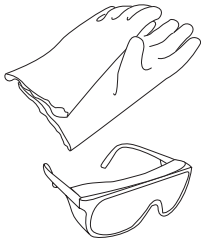
If the low cell does not come up after charging, this battery can damage the rest of the battery bank and should be replaced. An accurate digital Volt meter + - .5% will also give an indicator of the battery's state of charge.

Placing a Load on the Battery:

Another test that can be performed 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 batteries 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.

Battery Charge Time & Consumption Rate

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 80º 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 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

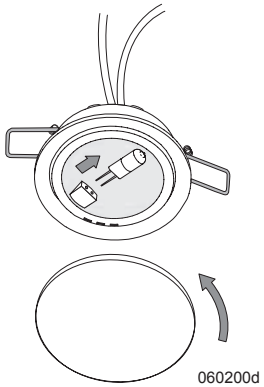
Light fixtures and styles found in the motorhome vary depending on floor plans. The articles that follow reflect an overview of some of the more common fixture types. Actual styles and types may differ.

Interior Halogen

Changing the Bulb:

Removal:

1. Grasp light fixture and pull down slightly then tilt fixture to one side. This will allow one spring clip to come out.



CAUTION:

Push spring clip inward with a finger as clip is being eased out. If this is not done spring clip can snap back on fingers.

2. Tilt fixture to other side and ease the other spring clip out.
3. Unscrew the light lens counterclockwise and remove.
4. Carefully grasp bulb and pull from socket. Replace with the same type of bulb.
5. 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 result in immediate bulb failure.
6. Align contacts of bulb with terminals in fixture base. Insert bulb until contacts are firmly seated.

Reinstall:

1. Align tabs on light lens with slots in fixture base. Rotate lens clockwise until light lens locks into place.
2. Fold up both spring clips and insert light fixture into opening. Once in opening the spring clips will expand and lock light fixture 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, allow it to cool and clean the bulb with alcohol.

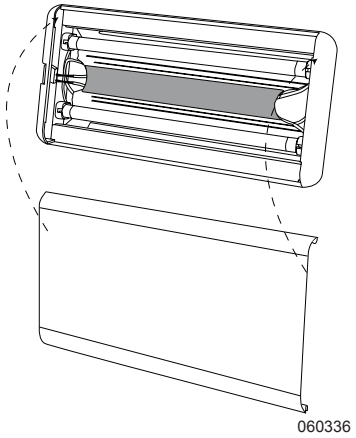
Fluorescent Light

Operation: Turn the fixture On/Off by pressing the power switch on the side.

To Remove a Fluorescent Tube:

1. The light fixture must be OFF.
2. Carefully squeeze both sides of the lens cover. The cover has a groove on each side that fits into a guide rail. Remove the lens cover.
3. Grasp the fluorescent tube with both hands and rotate it so the prongs are facing straight up in the socket slot.
4. Carefully remove tube.
5. Replace with Philips TL 8W/33T fluorescent tube

NOTE:
Replacement tube number is accurate at the time of printing. Confirm replacement tube number before ordering or obtaining replacement.



To Replace a Fluorescent Tube:

1. Align the prongs on the fluorescent tube with socket slot.
2. Insert tube and using both hands rotate to seat.

WARNING:
Fluorescent tube must be fully seated for proper operation.

3. Insert one groove on the lens cover into the guide rail.
4. Carefully squeeze lens cover to insert other groove into guide rail.

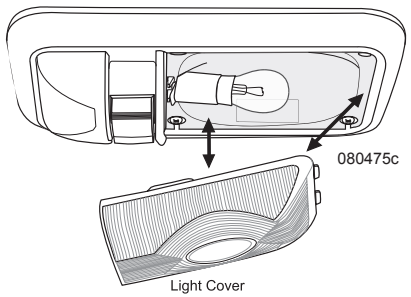
CAUTION:
DO NOT touch fluorescent tubes while they are on. Ensure tubes are cool before handling.

Incandescent Light

Incandescent lights, such as in the exterior compartment and interior of the motorhome, come in different styles or variations. The bulbs in the 12 Volt incandescent light fixtures are replaceable.

To Replace a Bulb:

1. Carefully squeeze the lens cover then gently pull the cover out. The cover has tabs that lock the cover in place
2. Using a clean cloth or piece of tissue carefully grasp the bulb and rotate to the unlock position.
3. Remove bulb from the socket.
4. The bulb replacement is 1141 12V 21CP.



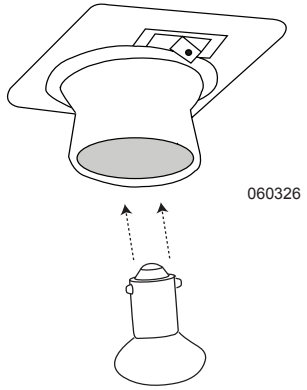
NOTE:
Replacement bulb number is accurate at time of printing. Confirm replacement bulb number before ordering or obtaining a replacement.

5. Using a clean cloth or piece of tissue grasp the new bulb and align the prongs on the bulb with the slot on light socket.
6. Push bulb in and rotate to lock position.
7. Gently squeeze lens cover and insert tabs on cover into fixture.

CAUTION:
DO NOT touch the incandescent bulbs while it is on. The bulb can be hot and cause a burn. Allow the bulb to cool down before replacing.

Swivel Light

Operation: Turn the map light on by pressing the On/Off switch on the map light. The map light pivots left and right to allow illumination of different areas.



In addition a wall switch is located next to the bed which also turns the map light on/off. For the light to operater from the wall switch, the On/Off switch on the map light must be on.

To Replace a Bulb:

1. Carefully push in on the bulb and turn counterclockwise.
2. Pull bulb from the socket.
3. Replace bulb. To re-install align the two pins on the bulb with the two channels on the socket. Insert the bulb and turn clockwise.

If Map Lights Fail to Operate:

- Ensure the battery cut-off switch is turned on.
- Check the bedroom fuse panel and map light fuse in roadside front electrical bay.

NOTE:
Confirm bulb number before ordering or obtaining a replacement.

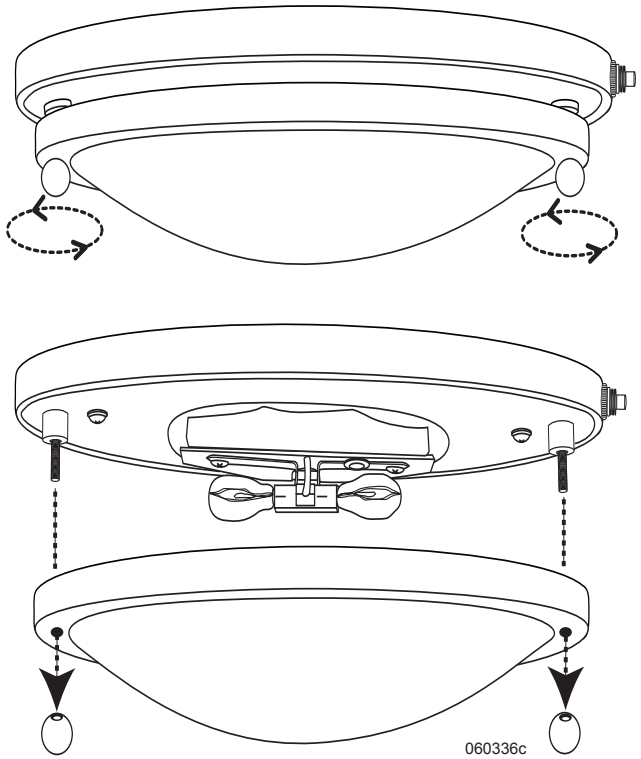
Decorative Incandescent Light

To Replace a Bulb:

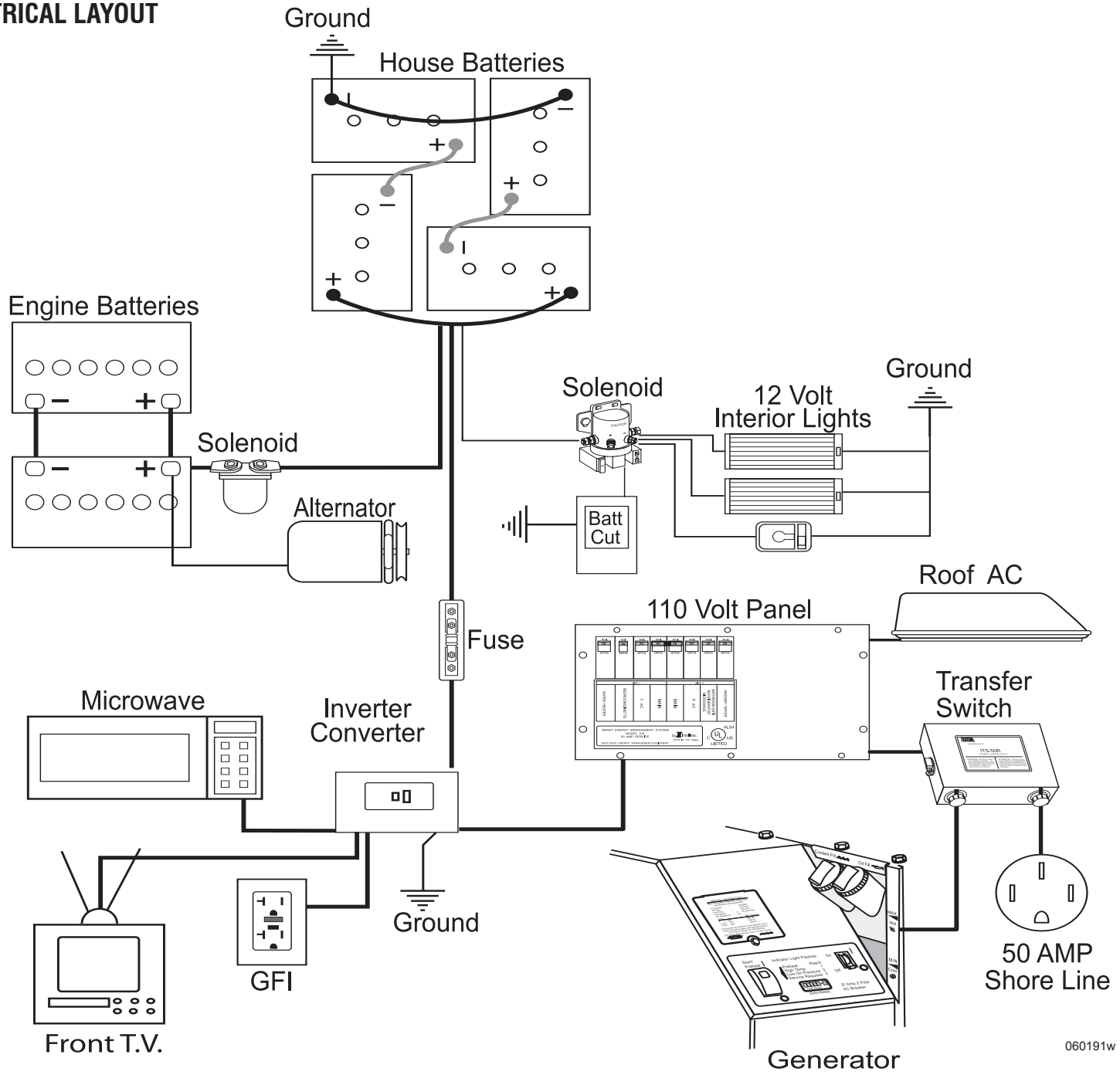
1. Unscrew two side round bolts.
2. Carefully remove glass dome and frame from side screws.
3. Carefully grasp bulb and pull from socket.
4. Replace with the same type of bulb. Bulb replacement is **Type #921.**
5. Carefully push bulb into light socket. Ensure bulb is firmly seated.
6. Insert frame and glass dome into side screws.
7. Holding glass dome, screw two round bolts into side screws.

CAUTION:
Do not touch the incandescent bulbs while on. Allow bulbs to cool down before replacing to avoid being burned.

NOTE:
Replacement bulb number is accurate at time of printing. Confirm replacement bulb number before ordering or obtaining a replacement.



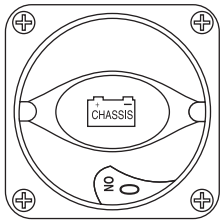
TYPICAL ELECTRICAL LAYOUT



CHASSIS ELECTRICAL - INTRODUCTION

This section contains guidelines, procedures and information that will assist in understanding the chassis electrical system and the operation of various components. Refer to the OEM manuals included in the Owner's Information File box for their respective, in-depth, individual component operating instructions.

BATTERY DISCONNECT
Chassis



060077c

Located in curbside battery compartment

The chassis battery disconnect is located in the curbside battery compartment. The switch controls the DC power to the front electrical panel and front and rear distribution boxes. 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 engaged.

Turn the chassis battery disconnect switch off when the motorhome is going to be stored or when performing electrical maintenance. If possible, leave the motorhome plugged into an AC source with the chassis battery disconnect switch on to help prevent the possibility of dead batteries.

If an AC source is not available, and the motorhome is going to be stored more than 48 hours, it is recommended to turn the chassis battery disconnect switch off.

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.

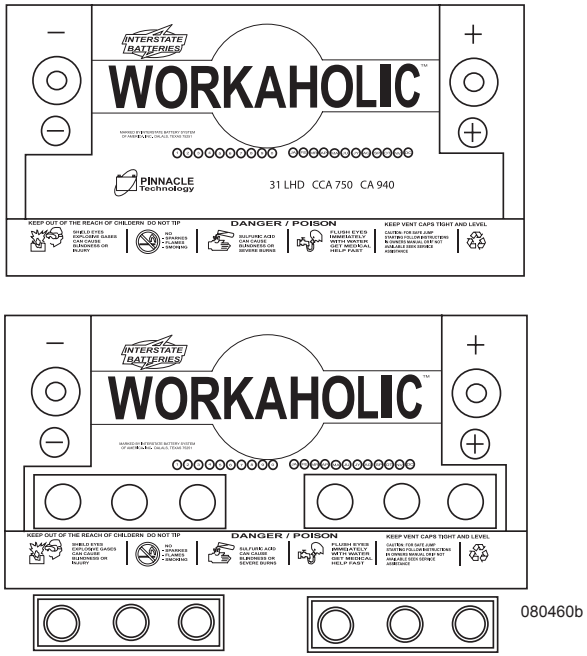
DANGER: Due to the sensitive nature of the electronics on the chassis, the following precautions are required to protect electrical components in the motorhome chassis:

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 curbside of the engine block.**
4. **Disconnect all the plugs from the transmission Electronic Control Unit located in the rear curbside compartment.**
5. **DO NOT connect welding cables to electronic control components.**
6. **Attach the welding ground cable no more than two feet from the part to be welded.**

BATTERY - CHASSIS

The chassis battery is designed to produce high amperage necessary to start the engine. Maintain the chassis battery through regular electrolyte level inspections and hydrometer readings. High electrolyte consumption, or inconsistent hydrometer cell readings, may indicate a charging system problem. Perform a charging system and current draw check if the battery is exhibiting abnormal hydrometer readings.

NOTE:
Replacement batteries should have the same Cold Cranking Amp (CCA) rating.



080460b

Battery with cover removed. Cut plastic to remove cover.

FUSE & CIRCUITS

The motorhome relies on three electrical panels to control chassis functions and some house operated items.

The front electrical panel (also called the front run box) is located in the outside roadside front compartment and contains fuses, self resetting manual reset supply circuit breakers, solenoid and relays for many chassis and house related functions. The front distribution box, located under the front electrical panel, controls front chassis functions only. A rear distribution box, located in a curbside rear compartment, controls rear chassis functions only.

The fuses are standard plug-in type (ATM). 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 rating will defeat the circuit protection provided by the fuse, which could result in damage to the motorhome electrical system. A fuse that has been replaced and continues to blow may indicate 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 door.

- For the front electrical panel remove 3 wing nuts to view label.
- For front and rear distribution boxes turn handle to unlock box and view label.

FUSE NO.	DESCRIPTION	MAX FUSE SIZE
C401(F)	CHASSIS	
4-1	STEP MOTOR	25
5-2	STEP SWITCH	7.5
6-3	SPARE	25
3-4	SPARE	7.5
2-5	LEVELING AIR/HYD.	15
1-6	AIR LEV COMPRESSOR	15
C402(D)		
4-7	NAVIGATION	15
5-8	STEP COVER	CB-15
6-9	SUNVISOR	5
3-10	CB RADIO PREP	5
2-11	KEYLESS	15
1-12	ALADDIN MAIN PWR	15
C403(D)	IGN#1	
4-13	DASH A/C	20
5-14	JACK/ANT WARNING	5
6-15	TV/LEVEL LOCKOUT	7.5
3-16	MIRROR HEAT	15
2-17	MIRROR MOTORS	2
1-18	SIDE DOCKING LIGHTS	20
C415(F)	RELAY FUSE	
1-59	PATIO AWNING	CB-15
2-60	ENTRY DOOR AWNING	CB-15
3-61	SIDE DOCK LT REALAY	15
6-62	N/A	15
5-63	N/A	15
4-64	N/A	15
65	MARKER LIGHTS	10

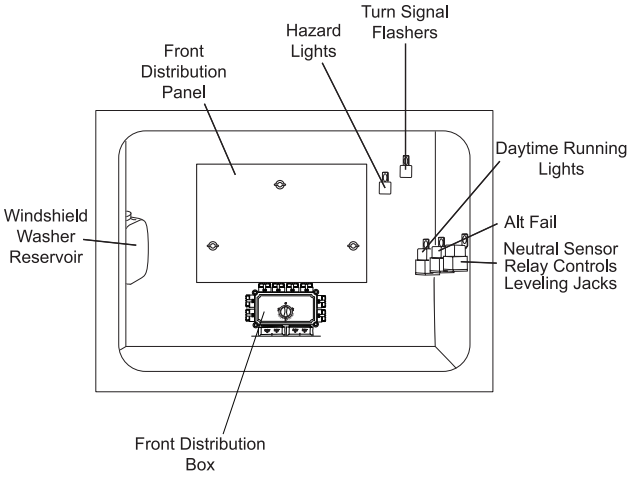
FUSE NO.	DESCRIPTION	MAX FUSE SIZE
C404(F)	IGN#2	
4-19	STEP/ISO SENSE	7.5
5-20	LEVELING JACKS	15
6-21	SPARE	3
3-22	SLIDE-OUT RELAY	15
2-23	SPARE	15
1-24	SPARE	15
C405(D)	ACC#1	
2-25	REAR VISION	5
1-26	ALADDIN IGN FEED	5
4-27	ADJUSTABLE PEDALS	10
7-28	OVER HEAD DEFROST	15
8-29	ACCESSORY	15
9-30	AIR DUMP	CB-15
6-31	AIR LEVELING	15
3-32	FOG LAMPS	15
C 412 (F)	NON SWITCHED HOUSE 12V	
4-66	RADIO MEMORY	10
5-67	REFER	10
6-68	AIR LEVELING	15
3-69	LP/CO DETECTOR	3
2-70	SYST. HEAT/SNAP DISC	5
1-71	HOUSE READ OUT	3
	CIRCUIT BREAKERS	
	INTERIOR FUSE PANEL	80

FUSE NO.	DESCRIPTION	MAX FUSE SIZE
C406(F)	SWITCHED HOUSE 12V	
4-33	DRV POWER SEAT	CB-15
5-34	PASS POWER SEAT	CB-15
6-35	STORAGE LIGHTS	15
3-36	SERVICE LIGHT	7.5
2-37	POWER CORD REEL	CB-15
1-38	POWER HOSE REEL	CB-15
C407(F)	DRIVER FRONT SLD 40 PDQ	CB-20
2-39	BAY 12V/CPTR RECEP.	15
1-40	SPARE	5
4-41	SPARE	15
7-42	SPARE	3
8-43	SPARE	15
9-44	SPARE	15
6-45	STEP WELL LIGHTS	15
3-46	SPARE	
C408(F)		
4-47	SPARE	3
5-48	SPARE	15
6-49	DRVRS S/O PWR #1	15
3-50	PASS S/O PWR	15
2-51	DRVRS S/O PWR #2	15
1-52	PASS S/O PWR BED/LAV	15
C409(D)		
4-53	MAP LIGHT	7.5
5-54	12V COMUTER RECEPT.	15
6-55	SPARE	5
3-56	BATT. BOOST/TV BOOST	15
2-57	HOME THEATER AMP	15
1-58	SERV. LT/AUX 12V PWR	15

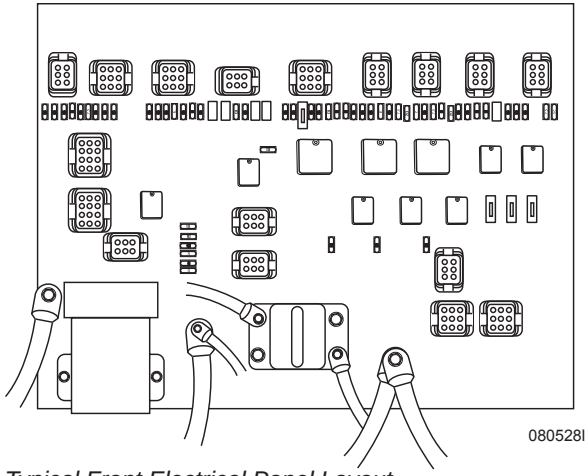
03213970 rev.F

Front Electrical Panel Label

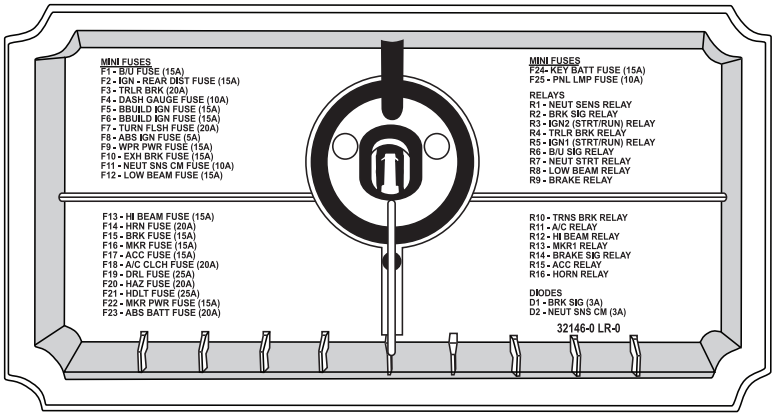
Note: Fuse panel will change with options or changes to the motorhome.



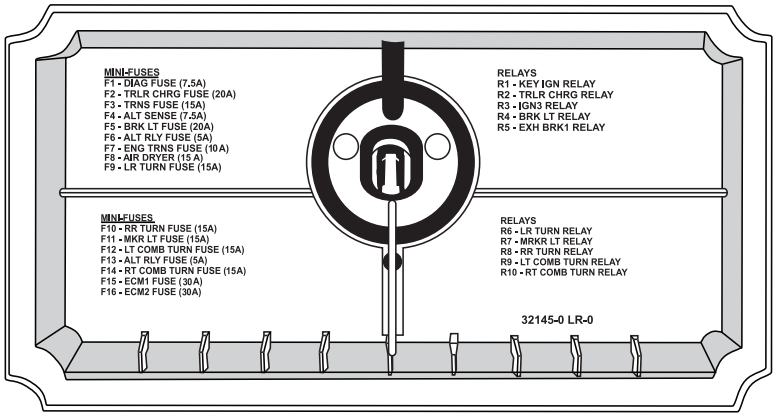
Front Electrical Panel



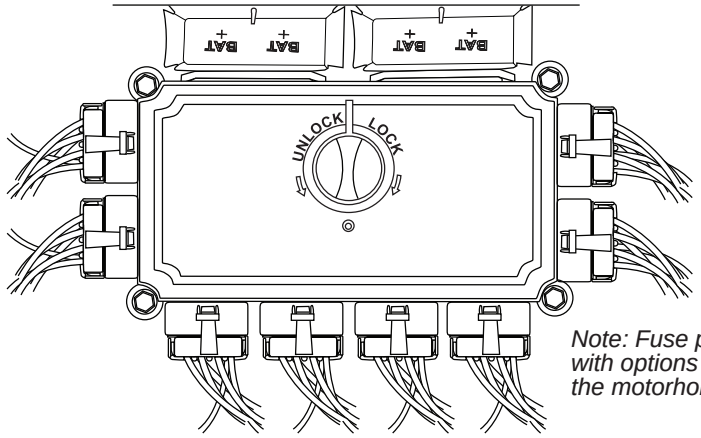
Typical Front Electrical Panel Layout



080522f

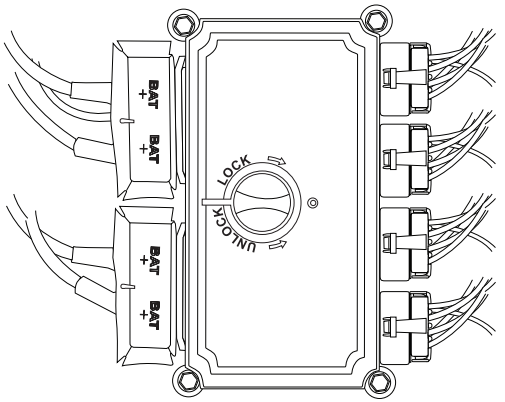


Rear Distribution Box Label 080522i

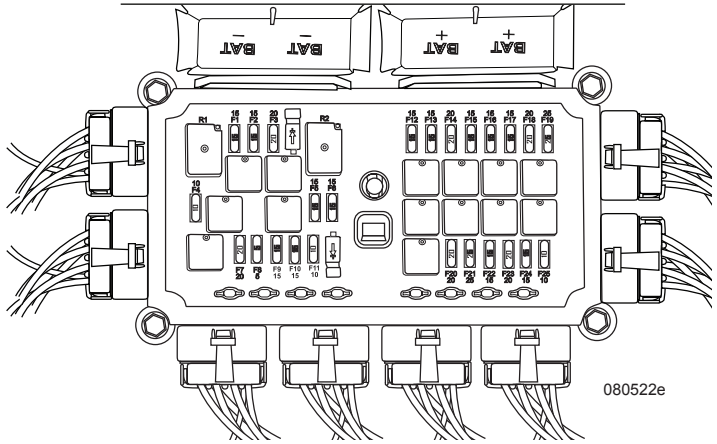


Note: Fuse panel will change with options or changes to the motorhome.

Front Distribution Box 080522d

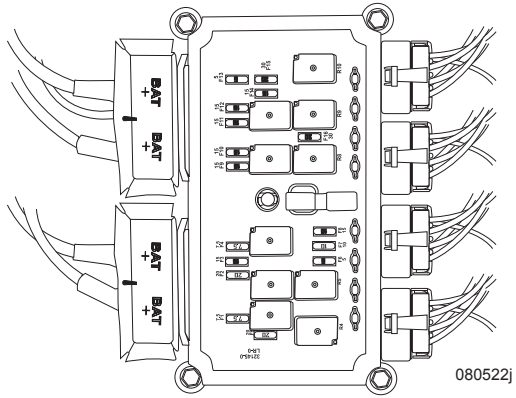


Rear Distribution Box 080522



080522e

Typical Front Distribution Box Layout



080522j

Typical Rear Distribution Box Layout

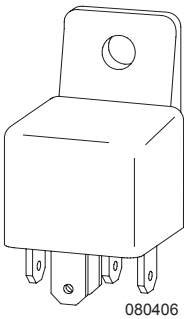
BATTERY MAINTAINER

The Battery Maintainer (Bi-Directional Isolator Relay Delay) constantly senses voltage of the house and chassis batteries.

With the engine running, the alternator on the engine will maintain chassis and house battery voltage. When the motorhome is plugged into shore power or operating from the generator, both the house and chassis batteries are charged from the inverter or converter. If neither battery is being charged, the batteries are fully isolated.

The battery maintainer also senses heavy loads on either battery to prevent the wrong battery from being inadvertently discharged.

Relays


080406

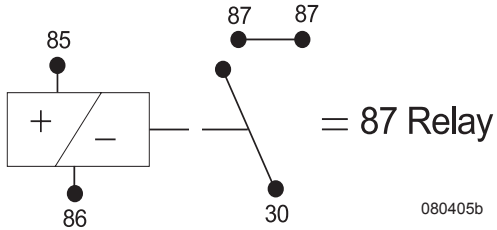
The motorhome uses various relays to operate electrical equipment, such as lights and motors. If a relay needs to be replaced, carefully record the location of each wire and all markings or labels.

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.

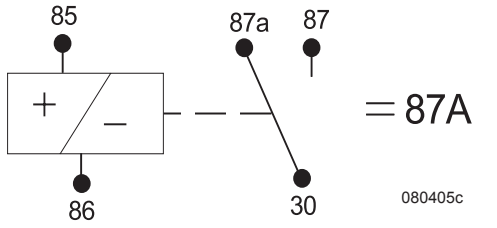
Another indicator to the type of relay is the post or legs. Turn the relay over and look at the post.

Note differences between 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.

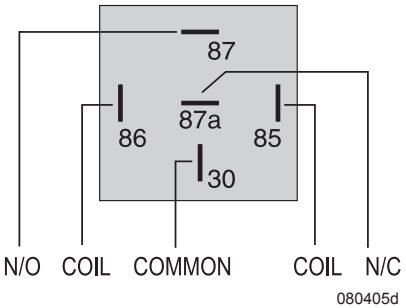


080405b



080405c

NOTE:
Fuse panels, components and location of components will change with options or changes to the motorhome.



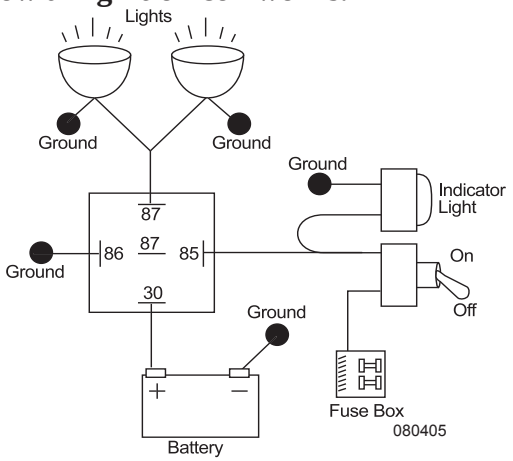
080405d

Single Pole Single Throw 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.

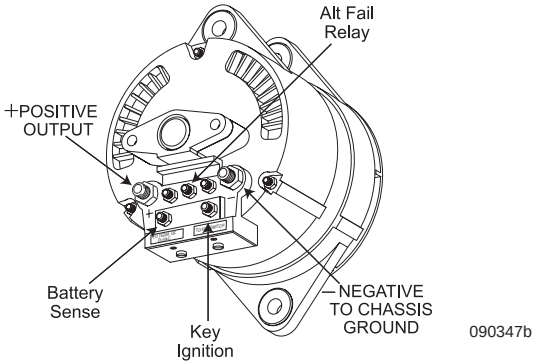
NOTE:
When power is applied to the coil, the coil sets up a magnetic field in the windings. When the power is removed, the field collapses. A momentary high voltage discharge will occur. This is how an ignition coil works.



080405

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.

NOTE:
The alternator is not designed to charge the house batteries from a complete discharge to a full state of charge. The alternator will maintain the battery charge during travel, supplying the DC current necessary to operate running lights or other DC loads.

If the house batteries are in a low state of charge, it is recommended to charge the house batteries with the converter/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.
- Alternator ground to chassis frame.
- Motor block ground to chassis frame.
- Chassis battery ground to chassis frame.
- Alternator positive output to isolator relay terminal.
- **Inspect** the alternator for damage.
- 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 ft. lbs.
- 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.
- The 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 the battery state/rate of charge.

CAUTION:
The alternator is not a battery charger. The alternator 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

Horn:

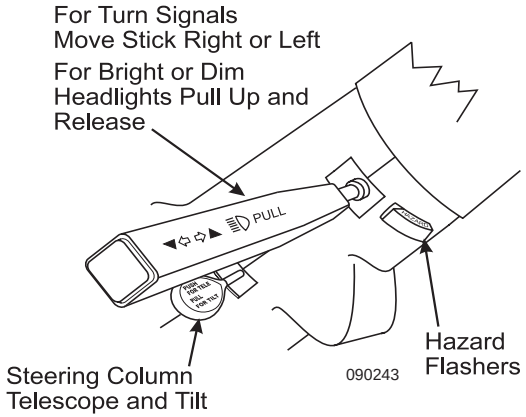
Press the horn bar on the steering wheel to activate the horns.

Tilt & Telescope

The Tilt and Telescope steering wheel control lever is located on the steering column.

- **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.

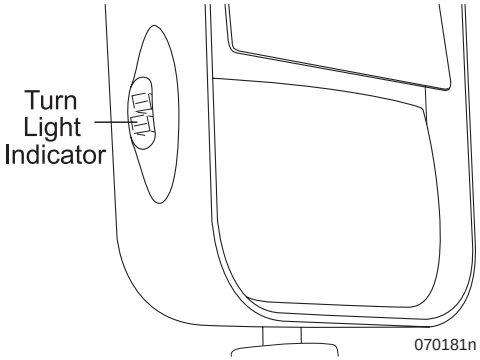


The turn indicator and headlight high/low dimmer control lever is located on the steering column.

- **Right Turn Indicator:** Push the lever forward to activate right turn indicator circuits when the ignition is on.
- **Left Turn Indicator:** Pull the lever down to activate the left turn indicator circuits when the ignition is on.
- **High/Low Beam Headlights:** Push the lever up to select high/low beam circuits when the headlights are **ON**.

NOTE:
An audible sound is heard when turn signals are activated. Applying the foot brake cancels the turn signal sound, releasing the foot brake activates the audible turn signal sound.

Turn Signal on Mirror: A turn signal indicator is located on the bottom or on the side of each mirror arm. Upon activation of a turn signal the indicator will blink.



Hazard Flashers:
The hazard flasher button is located on the steering column.

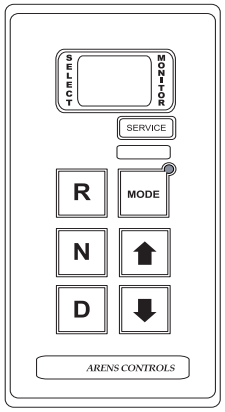
- Pull out on flasher button to turn four way flasher on.
- Push button inward to shut off flasher.
- Pulling out hazard flasher activates the rear view camera when the engine is running.

CONSOLE

NOTE:
Switch and component placement on panels may vary.

Transmission Shift Selector

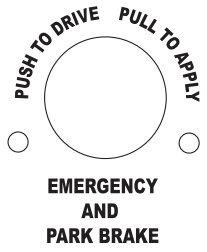
The keypads on the shift control are **R** (Reverse), **N** (Neutral), **D** (Drive) and Up and Down arrow. A digital display window shows gear selection.



090386c

Parking Brake

The parking brake system is activated by pulling the push-pull control knob located on the driver's left console panel. When the knob is pushed, the brake is released. Prior to driving, allow the air system to fully pressurize as indicated by the purge cycle of the air dryer.



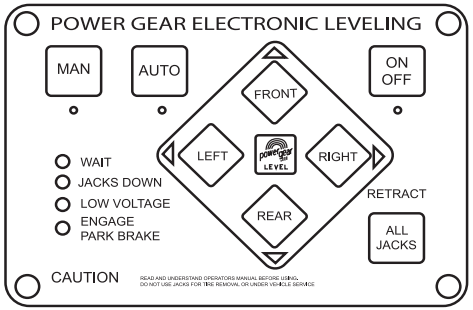
020039f

WARNING:
It is possible for the parking brake to accidentally release if the air system is charged. It is advised to fabricate a device to place under the parking brake handle to prevent children or pets from releasing the brake when parked. A wooden clothespin, clasped to the shaft, is suitable.

Leveling Controls

Hydraulic System:

The three-point hydraulic leveling system is operated from the control module to manually or automatically level the motorhome. The control features a multiple warning system with flashing lights and an alarm to alert of a jack down.

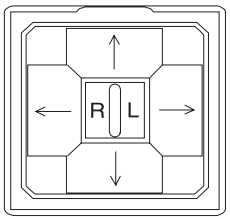


020039f

Power Gear Hydraulic Level

Mirror Adjust

To adjust the rear view mirror 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 of the mirror position.



060097

The outside mirrors can be adjusted with an Allen wrench. After taking delivery of the new motorhome it will be necessary adjust both the driver and the passenger side mirrors.

DASH

Instrument Panel

NOTE:
Layouts may vary with difference in models or options.

1. AIR PRESSURE GAUGES: One gauge is for the front air tank and the other is for the rear air tank. The normal air system operating pressures are 115 to 145 psi. Air pressures are preset at the factory. If a problem occurs with either air system not maintaining 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 an authorized service technician immediately.

2. TACHOMETER: Displays engine speed in revolutions per minute (RPM).

3. OIL PRESSURE: Indicates oil pressure oil, not the amount of oil in the engine. Refer to the OEM instructions for specific pressure recommendations

WARNING:
If oil pressure drops and the WARNING lamp illuminates, stop the engine and check oil level.

NOTE:
When operating the engine cold, the pressure will be considerably higher due to increased viscosity (thickness) of the oil.

4. SPEEDOMETER: Indicates the speed of the motorhome. The gauge indicates MPH and KPH.

5. ODOMETER/TRIP METER: Records the mileage driven as well as total mileage on a trip and transmission temperature.

6. MILEAGE/TRIP RESET BUTTON: Used to toggle between the odometer, Trip 1, Trip 2 and the transmission temperature. Holding the button down for two seconds resets the trip meter.

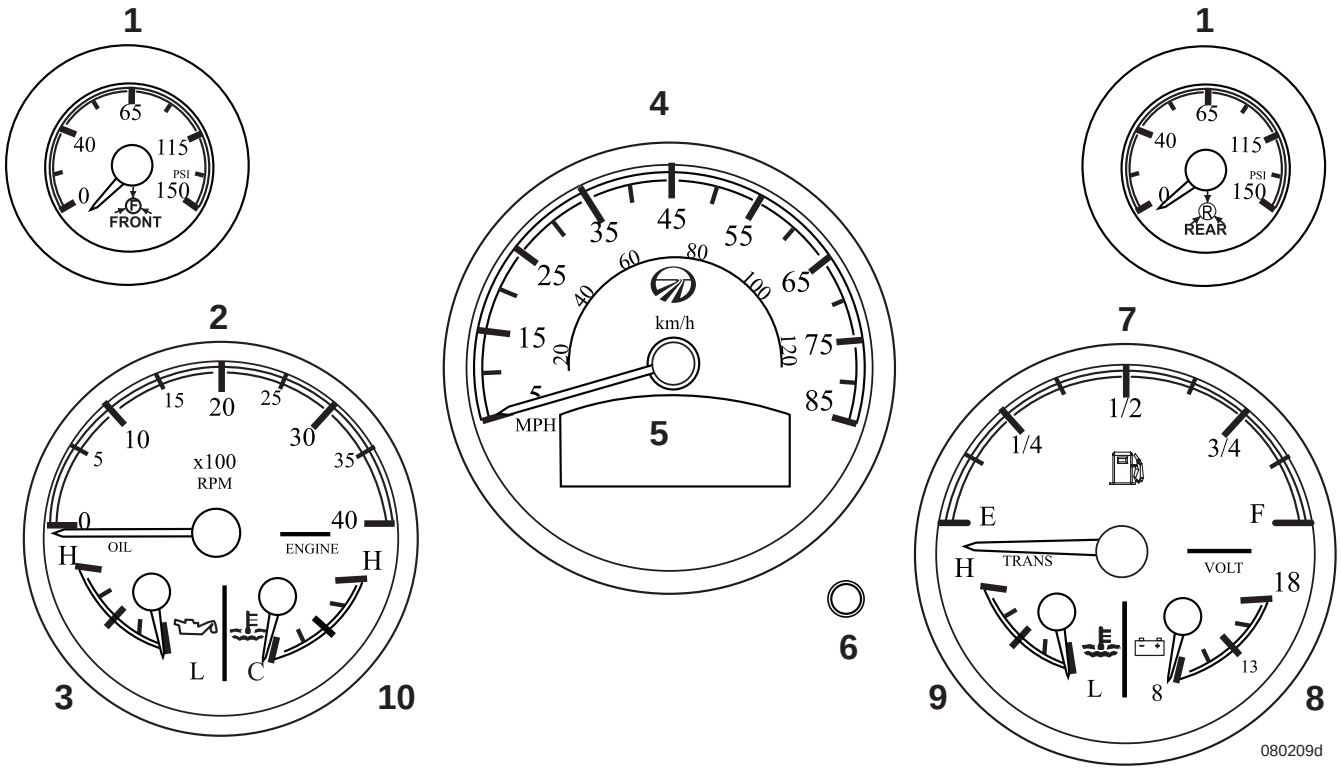
7. FUEL: Fuel gauge registers approximate fuel tank level when ignition switch is in the run position.

NOTE:
Fuel mileage varies with driving style and road conditions. Always average more than one tankful to obtain a more accurate figure. The diesel Generator uses fuel from main tank and will affect fuel mileage figures. Diesel generators will not operate below ¼ tank to ensure there is enough fuel to run main engine.

8. VOLTMETER: Shows the charge condition in the chassis battery. The normal voltage with the ignition switch **ON** and the engine **OFF** varies between 12.0 and 13 Volts. Battery charging voltage is about 14.0 Volts when the engine is operating under a normal load. Battery readings of less than 10.5, or more than 15 Volts, usually indicate a battery or electrical system problem.

9. TRANS TEMP: Shows approximate normal operating temperature of the transmission fluid. Do not let the transmission oil temperature exceed OEM specifications. Refer to the readout on the odometer (toggle the mileage/trip reset button) if the needle indicates an out of range condition. Stop the motorhome and shift into neutral if excessive temperature is indicated. Idle the engine at 1200 to 1500 RPM and allow transmission fluid temperature to return to normal.

10. COOLANT TEMP: Indicates an approximate normal operating range. Monitor this gauge frequently when CLIMBING HILLS, TOWING or in HIGH AMBIENT TEMPERATURES. If the needle indicates an out of range condition. IMMEDIATE ACTION should be taken to avoid engine damage. Refer to the OEM instructions for specific temperature recommendations.



Indicator Lights

1. Left Arrow - Audible Turn Indicators: Audible indicator cancels when brake is applied.

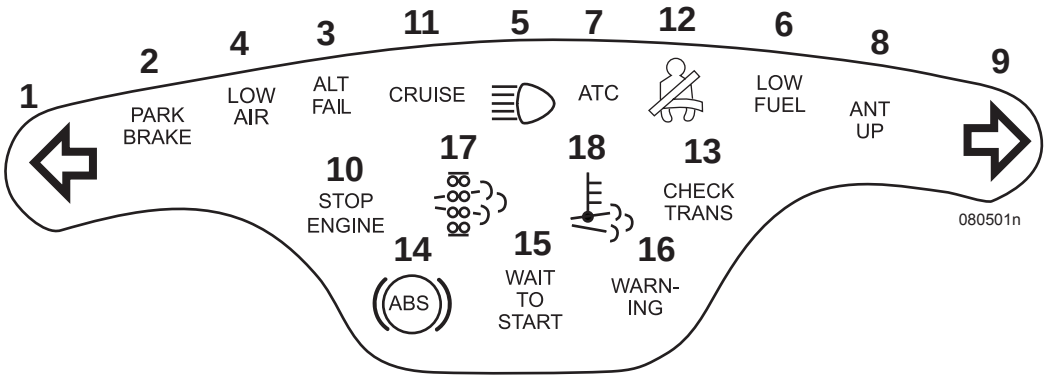
2. PARK BRAKE: Parking/emergency brake is applied.

3. ALT FAIL: Failure within the alternator charging system.

4. LOW AIR: Air tank pressures are out of operating range. Check air pressure gauges.

5. High Beam: Turns on when high beams are activated.

6. LOW FUEL: Fuel level is becoming low.



7. ATC (Automatic Traction Control): The ATC indicator light illuminates steady when the ignition key is turned ON. The light remains illuminated until the first brake application. The indicator illuminates when the ATC switch is pressed. See Section 10 for more information.

8. ANT UP (Antenna Up): Illuminates when the TV antenna is raised. Lower the antenna before moving the motorhome.

9. Right Arrow- Audible Turn Indicators: Audible indicator cancels when brake is applied.

10. STOP ENGINE: Alerts of severe out of range condition within the engine protection circuits. Pull over and stop as soon as possible. Shut-off engine to avoid damage to the engine or related systems.

11. CRUISE: Indicates when cruise control is activated.

12. Seat Belt Light: A warning light that indicates seat belts are not fastened.

13. CHECK TRANS: Alerts of problems related to the Allison Transmission. The light should momentarily illuminate when the ignition is switched on. When starting, the lamp will extinguish indicating the circuits are working properly. If the lamp fails to illuminate or remains on, the transmission needs to be checked immediately. Contact the nearest Allison dealer.

14. ABS Brake: Indicates possible fault in the ABS Brake system.

15. WAIT TO START: Monitors the air intake heater at engine start up. Wait for lamp to cycle off before cranking engine.

16. WARNING: Out of range condition exists within the engine protection circuits. Have the motorhome serviced as soon as possible.

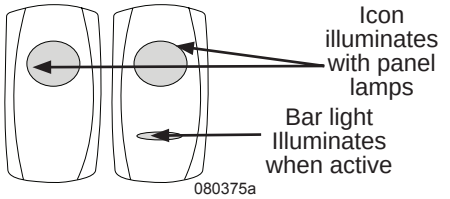
17. DPF: The DPF (Diesel Particulate Filter) light turns on when an active regeneration cycle is necessary and has not been able to initiate. See Section 10 for more information.

18. HEST: The HEST (High Exhaust System Temperature) light turns on when exhaust temperatures reach 1450º F. This indicates that an active regeneration cycle is underway. No fault exists as long as there are no other active warning lights. See Section 10 for more information.

Switches

Dash switches come either with or without a Bar Light. The Bar Light indicates the item/function is active. Icon lighting for both switch types illuminate with panel lamps. Dash switches can be illuminated and dimmed by turning the headlight switch counter-clockwise. Rotating clockwise dims and turns off the switch light.

Two types of switches are used: lighted and non-lighted. Each switch has the function control printed on the switch. Press the top of the switch to start the function and press the bottom to stop the function.



Typical switch configuration.

The following information is a list of switches used and their functions.

Driver's Console:

ICC: Flashes all exterior lights at once.

ATC: The ATC system improves traction on slippery or unstable surfaces by preventing excessive wheel slip. (See Section 10 for detailed information). An indicator light on the dash turns on with the switch.

CRUISE ON/OFF: Turns cruise control power On or Off. Dash Icon will illuminate indicating cruise control power is enabled.

CRUISE SET/RES:

- **Cruise SET -** Sets and maintains cruise speed as determined by the operator.
- **Cruise RES -** Returns vehicle speed to previously set cruise speed after a brake application or cruise cancel is pressed.

WARNING:
For safety purposes Do Not engage 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 engaged. Engine speed may dramatically increase until cruise control is cancelled or turned off.

WARNING:
Cruise control is not to be used as an aid to maintain driver attentiveness. While cruise control can be used as an aid in driving, it is not a substitute for safe driving practices and driver alertness and awareness.

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 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.

FOG LIGHT: Activates fog lights (headlights must be on).

BATTERY BOOST: This switch connects the house batteries to the chassis batteries to assist in starting the engine in the event that the motorhome chassis battery has been drained and cannot start the engine.

DRIVER SHADE: Operates the driver shade.

PASSENGER SHADE: Operates the passenger shade.

MIRROR HEAT: The switch turns on the heaters in outside rearview mirrors. Mirror heaters should be used when defogging or de-icing is needed.

Driver Dash:

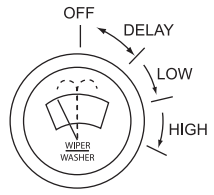
HEADLIGHT: Pull one click to operate the parking lights. Pull two clicks to operate the headlights. Rotating the headlight switch counterclockwise illuminates the dash lights. Rotating the switch clockwise dims the dash lights.


080332

NOTE:
If the headlights are left ON and the ignition turned OFF a warning bell sounds alerting the driver that headlights are still ON.

DRIVER MAP LIGHT: Above the driver is a map light. To turn on, rotate headlight switch counter-clockwise. To turn off, rotate switch clockwise. The battery cut-off switch must be on for the map light to operate. The map light cannot be dimmed.

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 (ranging from 45 seconds to two seconds) will occur. The amount of delay time changes as knob is rotated. A continuous low or high speed can be obtained by rotating the knob to the appropriate position. The wipers will turn **OFF** with the switch in the **OFF** position.



Wiper Control
080339b

When the end of the knob is pushed in, washer fluid will dispense from the system and the wipers will turn on momentarily.

Center Console:

AUXILIARY BLOWER (Optional): This three-way switch activates the auxiliary blower. The middle position is off, top position is high fan speed, and bottom position is low fan speed. Use the auxiliary blower in conjunction with the dash HVAC system to help defrost the windshield.

NOTE:
Extreme weather conditions combined with elevated interior humidity levels may require additional manual assistance to clear the windshield for safety. It is not safe to drive with obscured vision due to moisture or snow accumulating on the windshield.

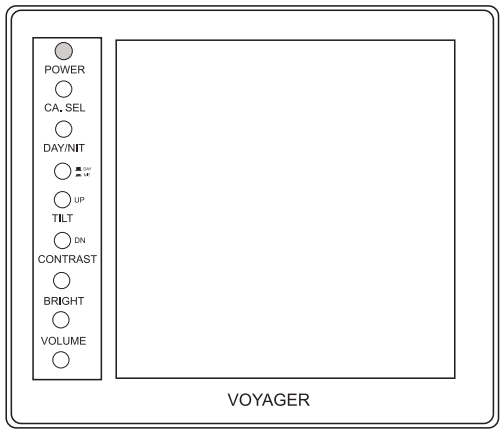
STEP COVER: Extends and retracts the step cover.

AIR DUMP: Dumps air from the air bags, which may aid in leveling the motorhome with the hydraulic levelers. 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:
DO NOT drive the motorhome with the air bags deflated. This can damage the motorhome.

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 rapidly flashing. Depending on ambient temperature, preheat cycle may last up to 10 seconds.

BACK UP MONITOR: Used with the back up camera to display the rear view of the motorhome.



031204c

Passenger Console:

STEP COVER: Extends and retracts the step cover.

STEP LIGHT: Turns step lights on and off.

MAP LIGHT: Turns on and off map light. Battery cut-off switch must be on for map light to operate.

PASS SHADE: Operates the passenger side power sun visor.

At Entry Door:

BATTERY CUT-OFF: Turns house battery power **ON** and **OFF** to interior 12 Volt panel.

ENTRY STEP: Provides power to the entry step.

PORCH LIGHT: Turns the outside porch light on and off.

CEILING LIGHT: Turns the front overhead lights on and off.

STORAGE LIGHT: Turns lights on and off in basement storage bays.

PATIO AWNING ON/OFF: Turns power on and off to the patio awning.

PATIO AWNING EXTEND/RETRACT: Extends and retracts the patio awning.

AIR CONDITIONER & HEATER CONTROLS

Designed to 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:
Controls the four speeds of the blower motor. This is one of the most effective ways of controlling temperature. The blower will not activate until the Mode Control Switch is set to any position other than Off.

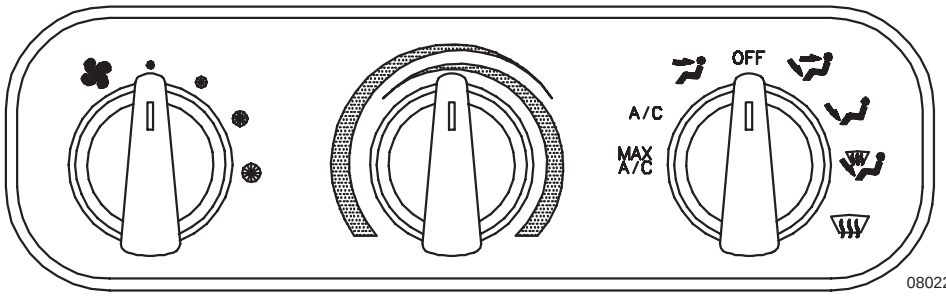
Temperature Control Switch:

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.

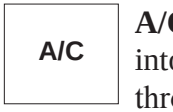
NOTE:
The air conditioner compressor is activated when using MAX A/C, A/C, MIX or DEFROST.



080221

Blower Speed Control Temperature Control Mode Control Switch

MAX A/C - Recirculated air is drawn from the passenger area and discharged through the dash louvers.



A/C - Fresh air is drawn from outside into the system and discharged through the dash louvers.

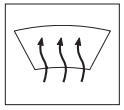
VENT - Fresh air is drawn in and discharged throughout the dash louvers.

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 louvers.

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.



090273 - 277

DEFROST - Fresh air is drawn in and discharged through the defrost louvers. The A/C compressor operates to dehumidify the discharged air.

A/C Operation:

When the Mode Control Knob is positioned in the A/C mode, fresh air is drawn through the front air intake of the unit through the A/C coil. The Mode Control Knob in the MAX A/C position closes off a damper door to outside air and recirculates air from inside the motorhome. Select this position when maximum cold air is desired or to keep outside air from entering the motorhome.

NOTE:
Activate the A/C system monthly to keep internal components of the compressor lubricated.

Heat and Defrost Operation:

- Set the Mode Control Switch to the desired position.
- Set the Temperature Control Switch to the red zone.

Operating Tips & Hints

Air intake and discharge temperatures are greatly affected by ambient temperatures and relative humidity. A large amount of cooling capacity is used to dehumidify as well as cool air. After three to five minutes of A/C operations, discharged air temperature should be approximately 20º to 30º F. cooler than the fresh or recirculated air entering the A/C system.

At the beginning of the day, activate the compressor with the engine at idle. This will avoid sudden high speed activation resulting in possible damage from lack of internal compressor lubrication.

Winter Use:

- De-ice the windshield using the **DEFROST** mode.
- Air will heat up faster with a slower blower speed until normal operating temperature ranges are reached.

Summer Use:

- Close all windows and vents to hot, humid outside air.
- MAX A/C and HI blower provides quick cool down.
- Use a lower blower speed to produce cooler air.
- Temperature Control switch must be set to the blue zone for cool air.

Heater:

The heater warms the air in the dash area. Much like the refrigeration side of the system, a liquid will be used in the process. This liquid is the engine coolant. The coolant is passed from the radiator to an electronic water valve. When open, the water valve will allow the coolant to flow through the heater core. The heater core is a small radiator. 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. When the temperature control is in the WARM position coolant flows through the heater core. When the temperature is in the COOL position coolant flow bypasses the heater core. In either position, the airflow is felt at the discharge vents.

Electric Water Valve:

The water valve controls water flow to the heater core. A control module compares the output voltage from the thermostat to the feedback for the stepper motor of the water valve. The control module then drives the motor to within one-half volt of the control thermostat voltage.

Functional Test:

- Start and operate the engine until the water reaches normal operating temperature.
- Set the HVAC temperature control to the full hot position.
- The discharge air outlets should have hot air.
- Rotate the temperature control to full cold position.
- Allow 10 minutes for the temperature to stabilize.
- The discharge air outlets should have cold air.

System Components

Compressor - The compressor is belt driven from the engine through the compressor and electronic clutch pulley. The compressor will pump freon from a low-pressure gas into a high-pressure, high-temperature gas. This is the start of the refrigeration process.

Condenser - The condenser is made of coils and fins which provide rapid transfer of heat from the refrigerant as external air passes over the coils. The high-pressure gas is changed to a high-pressure liquid.

Condenser Fan - A steady flow of cooling air is maintained across the condenser during system operations.

Receiver-Drier - Freon leaves the condenser, enters the receiver-drier and is stored until needed. The drier filters out moisture in the system. It only takes one drop of moisture to cause a malfunction in the cooling unit.

Expansion Valve - The expansion valve suppresses the refrigerant into the evaporator according to the cooling requirements. The pressure is reduced in the restrictive effort of the expansion valve. A part of the valve is the capillary tube assembly. The capillary tube is the sensing bulb at the outlet of the evaporator.

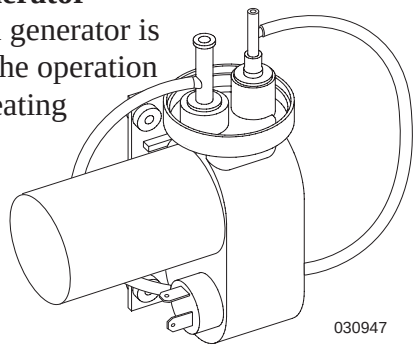
Evaporator - A tube core and fins are used in the evaporator similar to the condenser. Air is blown through the fins to allow the evaporator to cool and reduce pressure.

Blower and Motor - The evaporator has a fan called the blower. The blower will draw air from the cab area and force the air over the evaporator coils and fins. This forced air will ensure continuous vaporizing of the R134a.

Relays and Switches - Both electronic and vacuum switches are used in the control and operations of the system.

Vacuum Generator

- The vacuum generator is important to the operation of the dash heating and A/C systems. This provides the vacuum to open and close the vacuum switches. The vacuum generator creates 15 inches of vacuum that is passed to a reservoir ball. Most dash heater and A/C systems will only require 10 inches of vacuum to operate the switches. The output from the reservoir is sent to the vent control knob. The control knob will then direct the vacuum operation to the appropriate vacuum switch to open or close vents and switches. When the ignition is on and the A/C is operating, the vacuum generator will operate.



Vacuum Generator: Located at front firewall.

Troubleshooting

The dash A/C and Heat system uses a combination of compressed air (developed by the chassis system), vacuum air (developed by the vacuum generator) and electric relays and vacuum switches. Therefore, any repair can be classified in one of five categories:

- Electrical Vacuum
- Air Conditioner
- Heater
- Defroster

No Cooling:

1. Check that the blower is operating, A/C switch is in **A/C** or **MAX A/C** position, temperature control is turned to **MAX** cooling (blue area).
2. System fuses are not blown.
3. Condenser fan is operating.
4. Check power supply to unit and grounding of system.
5. Check wiring.
6. Coolant valve is leaking.
7. Drive belt is loose or broken.
8. Compressor Clutch is inoperative, will not engage.
9. Expansion Valve is faulty or frozen.
10. Thermostat control is faulty.
11. Mode control switch is faulty.
12. Compressor is faulty.
13. Loss of refrigerant.

NOTE:
An Ultraviolet or UV Blue Light cube is used for leak detection when dye is introduced to the A/C System.

Reduced Cooling:

1. Coolant valve not operating correctly.
2. Air passages are obstructed.
3. Loose or worn drive belt.
4. Check blower and select switch.
5. Thermostat control valve is faulty.
6. Expansion valve is faulty.
7. Compressor is faulty.
8. Low refrigerant charge.

No Heating:

1. A/C switch is turned off.
2. Blower switch is turned off.
3. Verify the proper engine coolant level.
4. Verify that the engine is reaching operating temperature.
5. Verify engine coolant is reaching water valve attached to unit.
6. Verify operation of water valve to permit engine coolant to pass through valve to heater core.
7. Check unit fuses.
8. Check power supply to water valve and grounding.
9. Check wiring.
10. Engine thermostat faulty.

Blower Does Not Operate or Runs Slow:

1. Check fuses.
2. Check for loose or corroded connection.

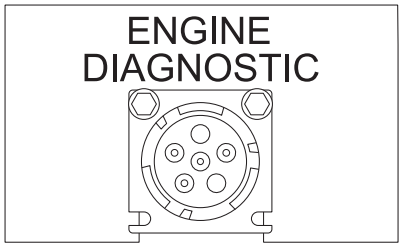
3. Check wiring.
4. Check to ensure ignition switch is on.
5. Check blower and select switch.
6. Motor shaft has seized.
7. Blower wheel is out of alignment.

Damper Doors DO NOT Operate:

1. Does the motorhome air tank have pressure?
2. Is the vacuum generator being powered and producing a vacuum?
3. Check the vacuum line entering the unit for vacuum.
4. Check that the vacuum solenoid mounted on unit is receiving power from the mode switch. The vacuum solenoid should feel hot when current is engaging the solenoid.
5. Check the mode switch.
6. Check wiring.
7. Check for a pinch in the vacuum line leading to the vacuum motor that operates the damper door in question.

DIAGNOSTIC PLUG LOCATION

A combined engine/transmission diagnostic plug (J1939 and J1587) is located under the dash on the left side of the steering column. A Cummins diagnostic plug (J1939) is found on the engine curbside.

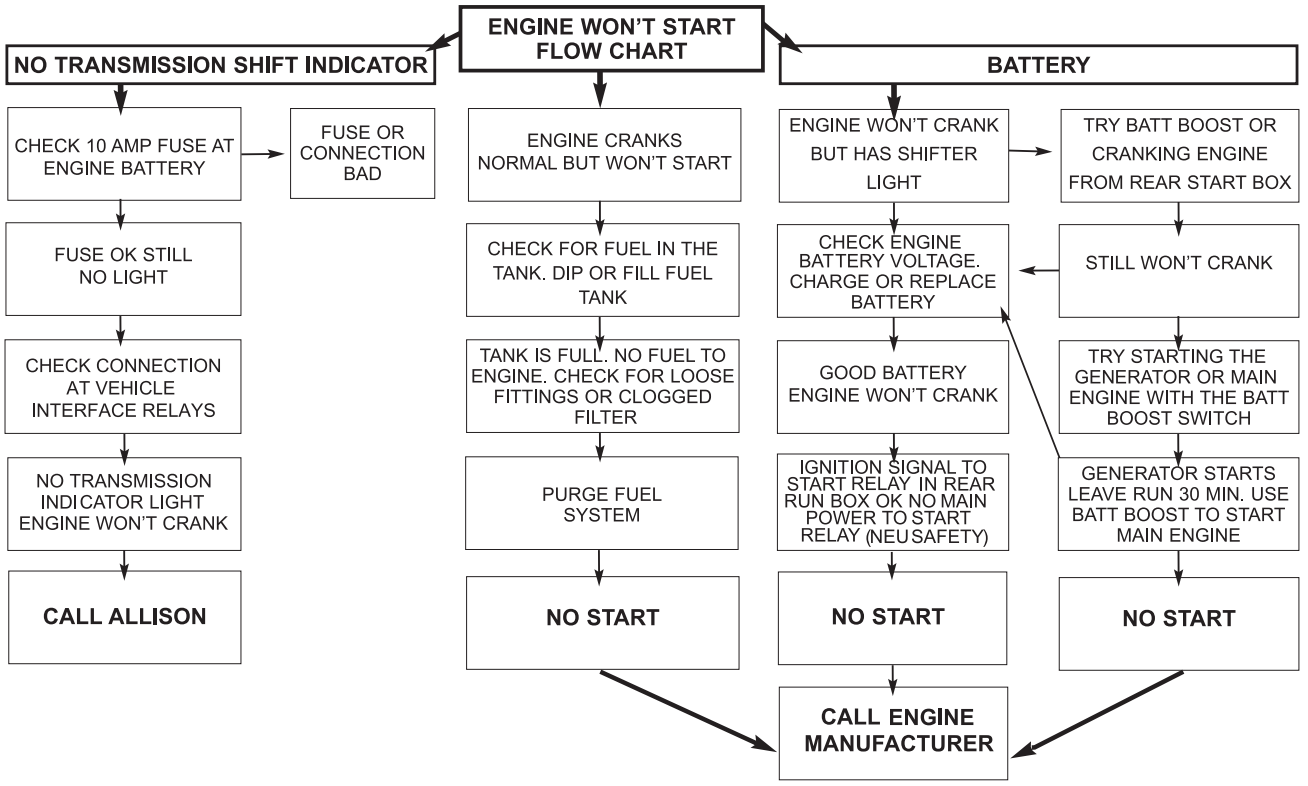


090280e

Engine Diagnostics:

The engine diagnostics will notify the operator of deviations from the programmed limits of the engine through the “Warning” light in the dashboard. Should a system component with the engine develop a deviation, the “Warning” light will illuminate and a diagnostic code will be logged and stored in the system memory. These codes are accessed by a service technician using special equipment.

ENGINE “NO START” FLOW CHART



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 the engine and transmission are located in their respective OEM 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.

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 curbside of the engine block.**
4. **Disconnect all the plugs from the transmission Electronic Control Module located in the rear curbside compartment.**
5. **Disconnect 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 using four air bags and 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 incorporated in the construction of the frame is rated at 7,000 lbs. towing and 700 lbs. tongue weight.

100168c

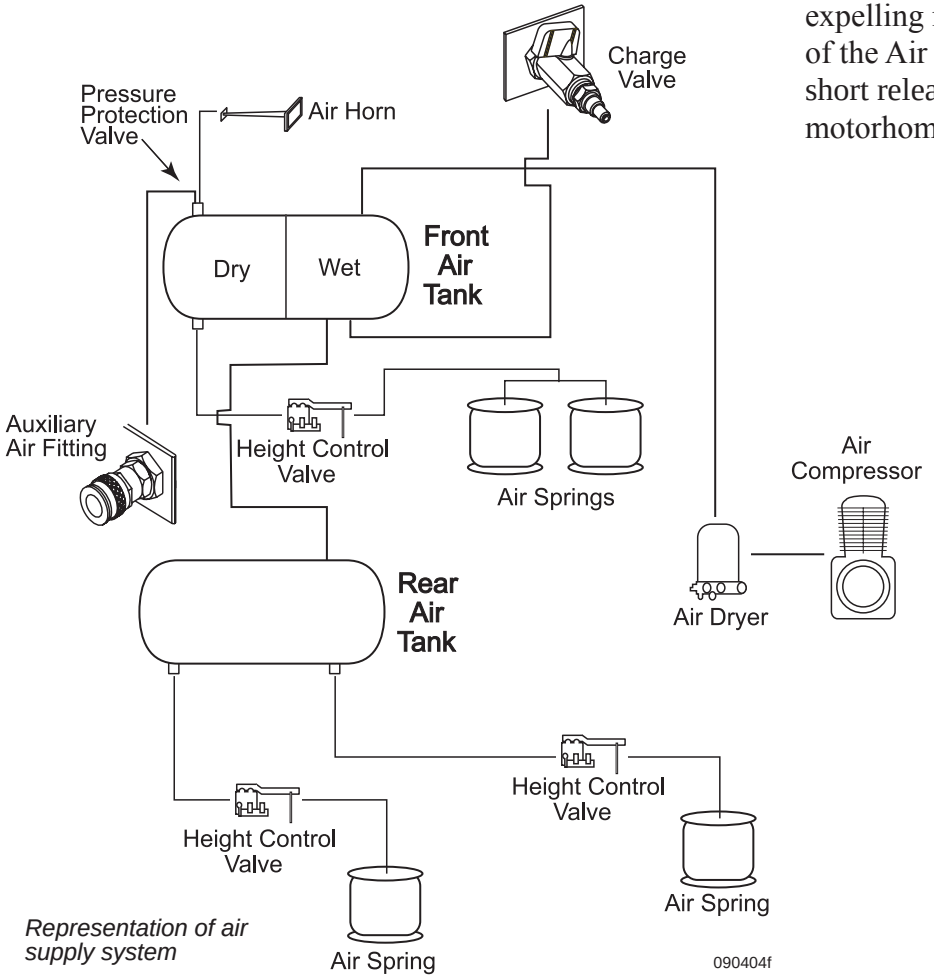
The Roadmaster's exclusive raised-rail chassis with air suspension consists of front and rear axles, with trailing links. A Panhard bar on each axle controls side motion. Each axle mounts to the trailing links that are connected to the chassis. The raised rail design of main chassis offers increased bay storage space. The suspension control arms attach to the frame through bushings, which require no 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 consists of: air compressor, air governor, air dryer, front air tank and rear air tank. The compressed air system operates several items, such as brakes, suspension, air horns and air gauges. The air system is charged by a gear driven air compressor mounted on the engine. As engine speed increases, compressed air output increases. When air is compressed, heat is generated. Heat dissipates as air is discharged from the compressor. Moisture condenses in the compressed air as it cools. The moisture laden air then enters an air dryer where the air is filtered. The filtered air charges the front air tank. The front air tank is divided in two halves: a wet side and a 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 back flow of compressed air.

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 air horns, receive air through pressure protection valves (PPV). The PPV will not allow compressed air flow until about 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.

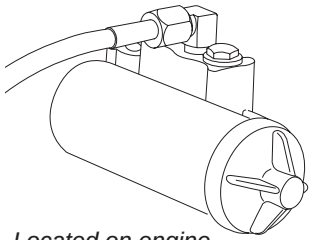


Representation of air supply system

Air Governor

The air governor, located in the engine compartment, regulates the air compressor to cut-in and cut-out, keeping the air system in the specified operating range of 115 to 145 psi, then sends an air "purge" signal to the Air Dryer.

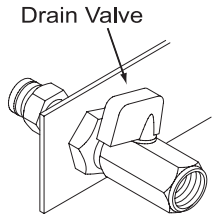
When cut-out pressure is reached, the governor will send an air purge signal to the Air Dryer. This opens the purge port of the Air Dryer, expelling moisture. The purge action of the Air Dryer is identified by the short release of air at the rear of the motorhome.



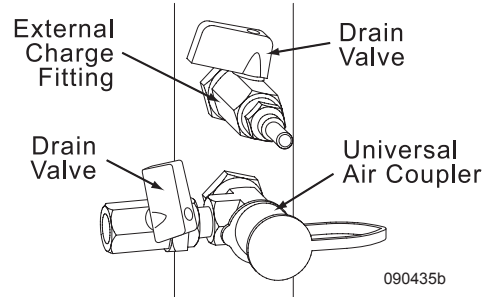
Located on engine

Air Storage Tanks

Manually drain the front and rear air tanks once a month, or more, depending on operating conditions where humidity is high.



Rear tank drain: located next to rear hitch



Front Tank Drain: located in generator compartment

Air Drains:

Air system tank drains are located in the generator compartment and in the rear engine compartment. The air tanks should be drained at least once a month or more often in areas of high humidity and where temperature fluctuates 40º F. or more daily.

To Drain the Tanks:

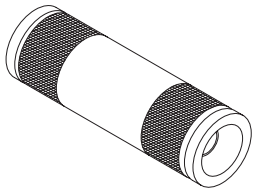
- Slowly open the drain valves. Moisture will be expelled under pressure. After all moisture and air is purged from the tanks, the valves should remain open an additional five minutes to allow any moisture remaining a chance to drain.
- Close valves and start engine. Check valves for leaks.

WARNING:
Wear safety glasses to prevent eye injury from expelled moisture. Open drain valves slowly as moisture will be expelled under high-pressure.

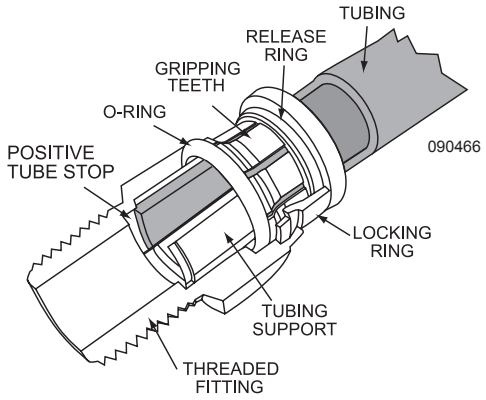
NOTE:
Both air tanks have a pressure relief valve which is set to release at about 130 psi.

Air Fittings

Push-in fittings are used to connect air hoses between pneumatically operated items. Fittings, sizes and types vary for different applications. Threaded fittings adapt the push-in fittings to connect pneumatically operated items. Parts include the release ring, locking ring, solid brass body and special rubber compound O-ring. Damaged hoses can be repaired by splicing.



Splice fitting for repairs



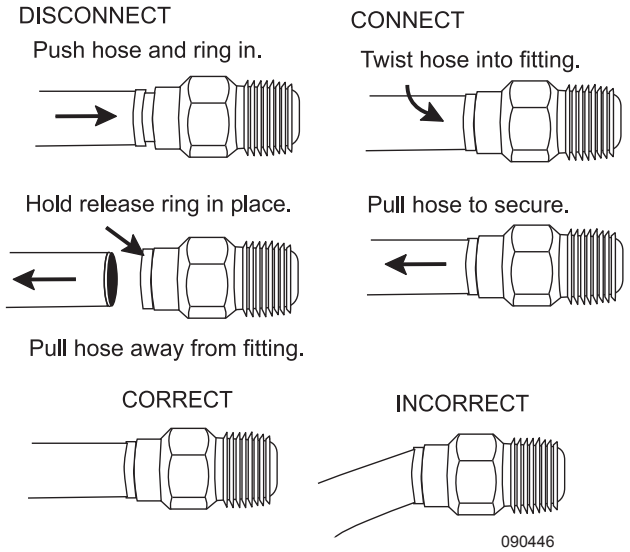
Cut-away of push-in fitting.

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. Use 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.



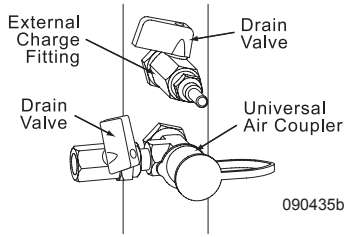
NOTE:
When putting air hose back into fitting, be sure that hose is cut as squarely as possible for an even seal in the fitting. The cavity of the positive tubing stop provides support to prevent leakage.

WARNING:
DO NOT remove air hoses from fittings while system is pressurized. Serious injury may occur.

WARNING:
Never place yourself under motorhome without first properly blocking frame (jackstands) from coming down in case of rapid deflation of air system.

Air System Charging (External)

The air system on the motorhome can be charged from an external air supply source. Located in the front generator compartment is a type C automotive male fitting (also used as the front tank wet side drain). 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 from this fitting is not filtered by the air dryer. The auxiliary air charge fitting will charge the front and rear air tanks. A shut-off valve is installed to prevent air from escaping.

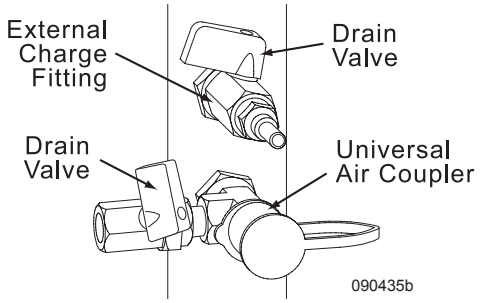


Located in generator compartment

CAUTION:
The external air supply source should be regulated to charge the air system on the motorhome no higher than 120 psi. Damage to the air system or pneumatically operated items may occur.

Air Coupler

A remote air supply coupler is located in the generator compartment. This female fitting will accept type C automotive connectors. This auxiliary air fitting may be used to inflate tires, air mattresses or other pneumatic items. This fitting 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.



Located in generator compartment

To use this feature:

- Slide the locking collar back. Using a firm grip, fully insert the air fitting into the auxiliary air supply. Release the locking collar to retain the air fitting after 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.

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 about 95 to 105 psi with 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.

Air System Test

Air system integrity is tested at the factory. The air system is equipped with several safety features. Periodically test these safety features for function as well as checking the air system for possible leaks.

NOTE:
The tests can also be found in the Department of Motor Vehicle (DMV) air brake certification requirement. Some tests require precautions for safety purposes.

Inflation Rate Test:

This will test how long it takes the air system to achieve a specific pressure in a timed event when starting at a lower pressure. This test will verify the minimum acceptable volume of compressed air created by the air system.

1. Start engine. Increase engine speed to 1000 RPM.
2. Beginning time for the test will commence when air system pressure obtains 85 psi.
3. End time when system pressure obtains 100 psi.

Elapsed time must not exceed 45 seconds.

Air Governor Cutout Test:

The air governor controls action of the air system pump. This will test the air governor cutout pressure setting, which indicates system pressure has achieved maximum set psi.

1. Start engine.
2. Run engine until a chuff (air release) is heard from the air dryer.

Maximum cutout pressure must not exceed 155 psi. Air system pressure will stabilize between 135 to 145 psi.

Unapplied Pressure Loss Test:

This test will verify maximum acceptable air system pressure loss rate without use of any pneumatically operated devices. This test requires a flat, level surface as the park brake will be released with the engine off. Chock wheels to prevent vehicle movement.

1. Start engine.
2. Run engine until a chuff (air release) is heard from the air dryer.
3. Shut engine off.
4. Release the park brake.

Note system pressure after air system stabilizes from release of park brake. Air system pressure must not lose more than 2 psi per minute.

Applied Pressure Loss Test:

This test will verify the rate of maximum acceptable air system pressure loss with only the service brakes applied. Do not use other pneumatically operated devices during this test. This test requires a flat, level surface as the park brake will be released with the engine off. Chock wheels to prevent vehicle movement.

1. Start engine.
2. Run engine until a chuff (air release) is heard from the air dryer.
3. Shut engine off.
4. Release the park brake.
5. Apply and hold service brake pedal.

Note system pressure after air system pressure stabilizes. Air system pressure must not lose more than 3 psi per minute.

Low Air Warning Test:

This test will verify low air warning buzzer/lamp activation. A Low Air warning buzzer or lamp will sound/illuminate should air system pressure fall to 60 or 65 psi.

1. Start engine.
2. Run engine until low air warning indicators are inactive.
3. Shut engine off then turn key to ignition on.
4. Fan (apply/release in quick succession) service brake pedal.

Low air warning indicator will sound no lower than 60 psi.

Park Brake Apply Test:

The park brake will automatically apply if low air warning indicator(s) are ignored and system pressure falls well below safe operating levels. A flat, level surface is required as the park brake will be released with the engine off. Chock wheels to prevent vehicle movement.

1. Start engine.
2. Run engine until low air warning indicators are inactive.
3. Shut engine off.
4. Release park brake.
5. Fan (apply/release in quick succession) service brake pedal.

The park brake will automatically apply between 20 to 40 psi.

Park Brake Hold Test:

This test will verify engagement of the park brake. A flat, level surface is required. While the test is performed with the park brake applied, use precautions in case of vehicle movement. This test only verifies the park brake is engaged. It is not intended to verify the maximum amount of braking force created by the park brake.

1. Start engine.
2. Place transmission into gear. Do not release park brake.
3. Apply light throttle, not to exceed 1,000 RPM.

Test confirms that the park brake is engaged and holding.

Air Governor Cut-in Test:

The air governor controls action of the air system pump. This will confirm the air governor cut-in pressure setting.

1. Start engine.
2. Run engine until a chuff (air release) is heard from the air dryer.
3. Fan (apply/release in quick succession) service brake pedal until system pressure is between 110 and 115 psi.

Air governor cut-in pressure is approximately 115 psi.

Brake Grab Test:

This test will verify brake friction torque between the front wheels. This test requires a rapid and full pressure application of service brake pedal. Use proper precautions to prevent movement of cargo or other items that are not secured. This is a single vehicle test. Select deserted and level road surface (preferably a large and empty parking lot). Road crown, depending on severity, may affect test results.

1. Start engine.
2. Run engine until a chuff (air release) is heard from the air dryer.
3. Release park brake.
4. Accelerate to approximately 5 mph.
5. Rapidly and firmly apply service brake pedal to bring vehicle to an abrupt stop.

The steering wheel will not pull to the left or right if front wheel braking torque is symmetrical.

AIR DRYER

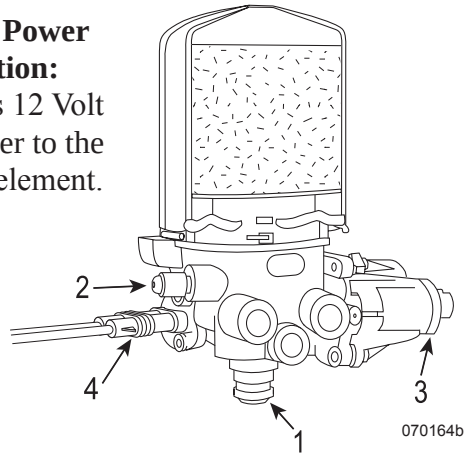
The air dryer, located between the frame rails next to the transmission, removes moisture from the compressed air system to prevent freezing of brakes or other pneumatically operated items. The three functions of the air dryer are cooling, filtering and drying the system air. This prevents valve and seal damage or wash away of lubricants as well as freeze damage to the system components.

Air Dryer Cycle:

The governor turns the compressor on when the supply tank pressure drops below cut-in pressure. Compressed air then passes into the air dryer at the inlet port. Moisture-laden air and contaminants pass through the desiccant. Moisture is retained by the desiccant and collects in the base of the dryer. When the compressor reaches cut-out pressure (approximately 130 psi) the purge valve opens and the dryer purges and expels water collected in the dryer base. The regeneration valve opens sending a small charge of dry system air from the front air tank back through the dryer. The backflow dries the desiccant, preparing it for the next cycle.

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 Connection:** Provides 12 Volt DC power to the heating element.



070164b

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 15 amp fuse for heater is located in the rear distribution box found in the rear curbside compartment.

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

Warm, humid air from the compressor condenses into either water or water vapor. A desiccant-type air dryer protects the air brake system by drying moisture-laden air before it passes through the air reservoirs and into the brake system. The replacement kit contains one cartridge and one O-ring.

070165

To Replace the Cartridge:

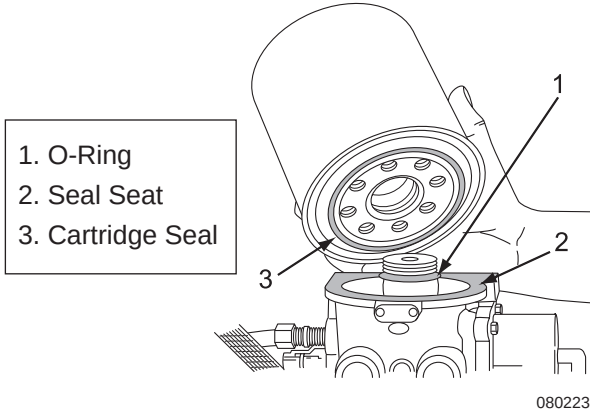
1. Loosen and remove the old cartridge. Use a strap wrench, if necessary.
2. Remove and discard the O-ring from the dryer base.
3. **Inspect** and clean the seal seat. Repair any minor damage.

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**.

NOTE:
If an excess amount of water is present when performing the monthly air tank drain service, the filter for the air dryer may need to be changed.

REPLACEMENT REQUIREMENTS		
Components	**When to replace?**	**Why?**
Desiccant Cartridge	• Every two to three years. • When compressor is replaced. • Water in supply tank.	• Preventive maintenance. • Contaminated cartridge. • Saturated or contaminated cartridge, high duty cycle (wrong application of air dryer).



NOTE:
At the time of printing replacement cartridge is R950011. Confirm cartridge number before ordering or obtaining a replacement.

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. The governor turns the compressor off when the system reaches cutout pressure (approximately 135 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

Items listed below should 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** air lines to ensure contact does not exist between air line and OD of the air springs. Air lines can rub a hole in an air spring very quickly.
- Ensure 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 inch. 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 axle H-frame assembly and the two main frame rails. Air spring support plates mount to the main frame and the H-frame. 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.

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.

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. Air disc brakes follow much the same principle, with the exception of the threaded rod directly activating calipers.

Consideration needs to be given to stopping distances and air system pressures. The motorhome requires longer stopping distances. 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 exhaust 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 a low air pressure warning system safety feature. Should a low air condition arise while the vehicle 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.

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 vehicle 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 and prevent the air pressure from building, it may become necessary to "cage" the spring brakes (***"cage" procedure in* Section 2 Towing Procedures - *Disabling Parking Brake***). This is an emergency procedure only. Caging the rear air brake chambers manually overrides the spring brakes and allows the vehicle 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 with the air tank not depleted, there is 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.

Automatic Slack Adjuster

The braking system 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. Automatic slack adjusters and the connecting S-cam shaft require periodic lubrication and inspection.

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.

WARNING:
Automatic slack adjusters are not designed to manually adjust. DO NOT manually adjust the slack adjusters. 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.

NOTE:
Replacement parts should be of the same original equipment size and type. Mixing brake components may result in unequal braking action. Brake maintenance is not covered by the manufacturer.

Brake Systems - Backup

The motorhome air braking system is equipped with 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 light will flash. 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 backup system acts as an automatic emergency brake system.

Another backup safety 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; 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.

The rear air tank also has a safety backup - 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 backup system implements use of all the brakes, allowing the operator to bring the motorhome a safe stop. In case of all compressed air charge escaping from the front air tank, the operator will still have full use of the rear brakes.

ABS/ATC SYSTEM (ANTI-LOCK BRAKES)

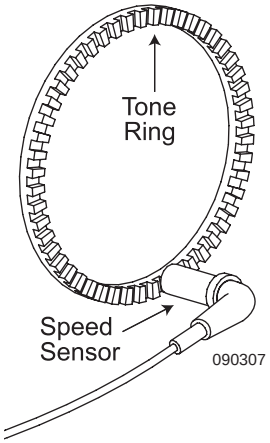
The motorhome is equipped with an anti-lock braking system (ABS) and automatic traction control system (ATC). The ABS system monitors wheel rotation speeds by using a 100-tooth magnetic tone ring mounted to the hub. Revolving with the wheel, the magnetic tone ring is polarized giving positive and negative pulsations. A stationary sensor is mounted adjacent to the tone ring to monitor magnetic pulses. The pulses are monitored by the ABS electronic control unit (ECU).

The ECU monitors all 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 to limit wheel lock and decrease stopping distance. Cautious driving practices and maintaining adequate safe distance when following vehicles is the key to safe vehicle 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.
- The ECU receives the speed sensor signal pulses to calculate 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 are operated in the Air, Release or Hold modes to regulate air pressure to the brake chambers.
- Braking force is applied at a level which minimizes the stopping distance while maintaining as much lateral stability as possible.

ABS Warning Light:
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 (three seconds) verifying the self-diagnostic test. If the ABS indicator light remains on, or illuminates while the motorhome is being operated, this indicates a fault in the anti-lock brake system. This fault will not affect normal service braking. The motorhome will need to go to a service center to repair the problem.

INFORMATION:
If a fault code occurs, call a Bendix service locator at 1-800-247-2725 and take the motorhome to the nearest repair facility.

ABS Diagnostic

If the ABS light on the dash comes on it indicates that a fault has occurred with the Anti-lock Brake System only. Normal braking is not affected but the motorhome will need to go to a service center. The service center can retrieve ABS diagnostic fault codes.

Retrieving Codes Using ECU:
System configuration codes and fault codes are displayed through the dash ABS warning light as a series of blinked sequences. The fault codes can be accessed by properly grounding Terminal 18 in the X1 connector found on the ABS ECU module. The Bendix ABS ECU module is located under the shift selector panel. On the back of the ECU locate the black X1 connector, pin 18. Ground pin 18 as described by inserting a wire at the rear of the connector. Pin 18 is located in the bottom right corner (labeled ABS Warning).

NOTE:
System configuration codes are sequences of six blinked digits while fault codes are sequences of two blinked digits. Refer to an authorized Bendix service center for a list of blink code sequences. If grounding out is not done correctly for a specific readout, stop then start the procedure again.

NOTE:
All blink codes are displayed by the ABS warning light only.

The system is capable of performing several diagnostic mode functions. After Ignition On, a two second delay must be observed prior to grounding.

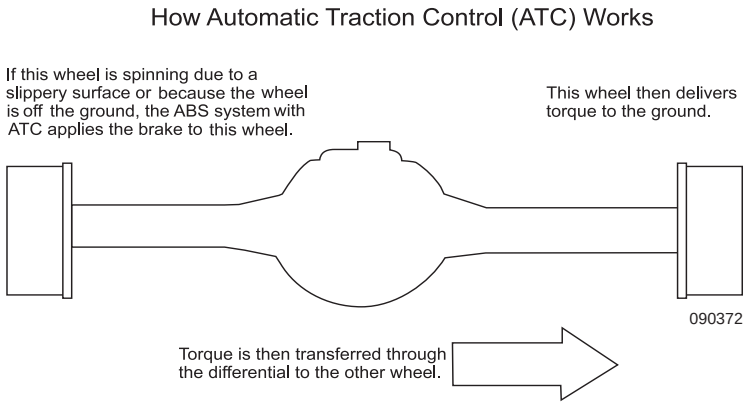
- **Press once for Active Code retrieval**.
- **Press twice for Inactive Code retrieval**.
- **Press three times for clearing Active codes**.
- **Press four times for System Configuration check.**
- **Press five times for Dynamometer Test Mode**.
- **Press seven times for Reconfigure ECU**.

NOTE:
Reconfigure Mode is entered by holding the switch in prior to "ignition on." Once ignition is on, release the switch and press seven times.

ATC System:
The ATC system improves traction on slippery or unstable road surfaces by limiting excessive drive wheel slip. This is accomplished two ways, limiting engine torque to the drive wheel or engaging a brake to the spinning drive wheel. During normal operation engine torque is unaffected. The ATC system works in conjunction with the ABS Electronic Control Unit. The ECU monitors tone ring speed of the drive wheel in relation to the other wheels. If a speed differential occurs in the drive wheel, the ECU enters Automatic Traction Control mode.
During an ATC event, the ECU will automatically react to optimize traction and safety if the motorhome encounters a slippery road surface. Engine torque is normally reduced to limit drive wheel slip.

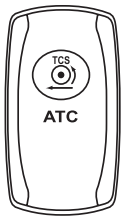
NOTE:
The ATC system is always active.

ATC reacts to drive wheel slip by:
- Reducing engine torque to the drive wheel if road speed is above 25 mph.
- Reducing engine torque and activating drive axle brake controls if road speed is below 25 mph. If the brake control activates, it remains active regardless of road speed.



ATC Switch:

Activating the ATC switch reduces ECU control over engine torque. Momentarily pressing the ATC switch allows the ECU to increase the amount of engine torque applied to the drive wheel in an ATC event.



080498y

Located on driver console

The amount of engine torque applied to the drive wheel will vary with the amount of drive wheel slip versus road speed. In an ATC event, the ECU remains active regardless of road speed or switch position. The light flashes slowly when the ATC switch is activated.

ATC Indicator Light:

During normal operation, the ATC indicator light on the dash will illuminate steady when the ignition key is turned **ON**. If an ATC event occurs, the indicator light will flash quickly. The indicator light will flash slowly if the ATC switch is activated.

CAUTION:

Normally the switch should remain inactive. During an ATC event (drive wheel slip) the ECU will automatically optimize drive wheel traction in most situations. Activating the switch during periods of wheel slip can increase torque to the spinning drive wheel. Drive train damage can occur if the spinning drive wheel should suddenly regain traction. If the motorhome is stuck it is advised to call a professional towing company to limit the possibility of body and drive train damage.

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 surfaces may cause a “clunking” noise to emanate from the steering column, but if noise is heard on smooth surfaces while sharply turning back and forth, the noise should be inspected and repaired as necessary.

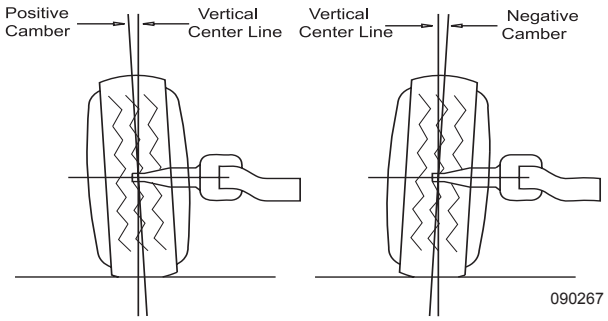
Shimmy and looseness should be checked and corrected as soon as possible. If looseness is felt in the steering, the steering linkages can be observed while someone turns the steering wheel left and right. Watch the linkages for evident play or uneven interaction between components to help pinpoint a 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 intermediate steering 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.

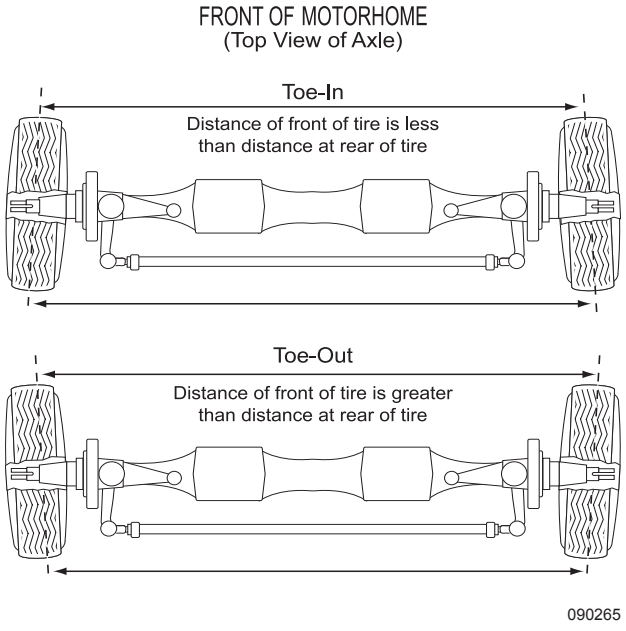
Alignment

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.

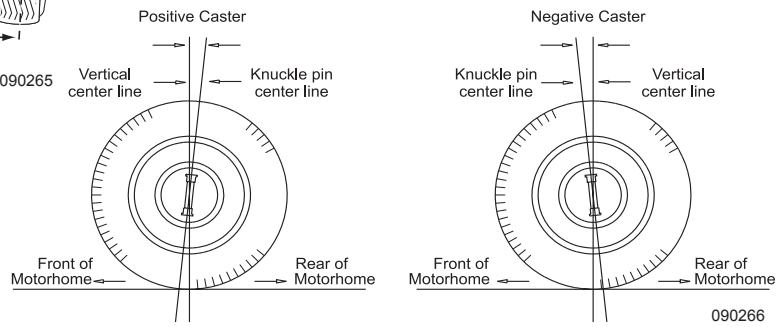
Wheels are generally set with initial toe-in. As the motorhome operates tires tend toward a toe-out condition. By starting with an initial toe-in setting, a desirable "near zero toe-in" can be achieved when the motorhome is in motion. Incorrect toe settings, where toed-in or toed-out, can have a significant 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.



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.

	Left	Right
Camber	1/8 º +/- 7/16 º	-1/8 º +/- 7/16 º
Caster*	4 º +/- 1 º	4 º +/- 1 º
Total Toe	1/16″ (0.08 º)	

** Right must exceed Left at least 1.5 º, but less than 2.5 º.*
NOTE: Motorhome must be at ride height for proper alignment.

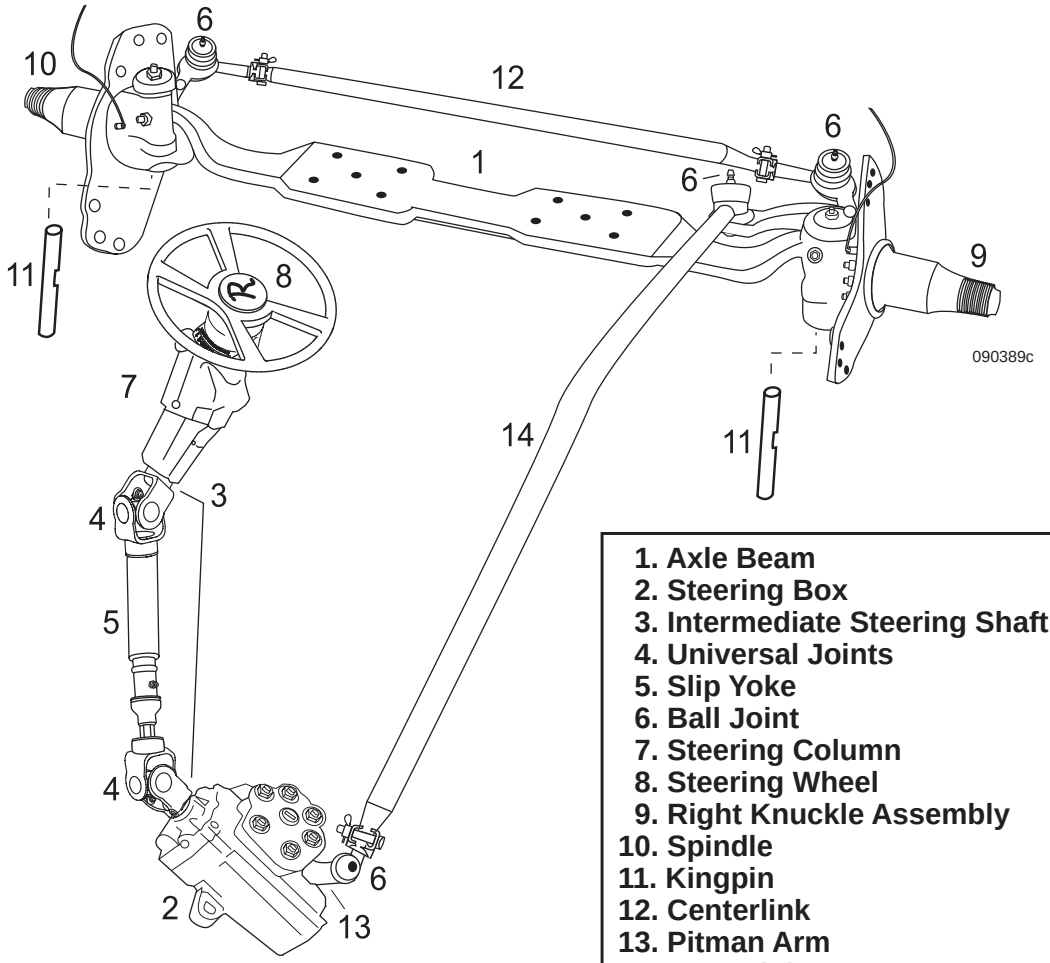
Lubrication Maintenance Safety

The front axle components require periodic lubrication maintenance. Chock wheels for safety prior to accessing components underneath the motorhome.

WARNING:
Never place yourself under motorhome without first properly blocking frame (jackstands) from coming down in case of rapid deflation of air system.

NOTE:
Suspension and steering components are lubricated at factory using a NLGI 2 Lithium Soap based grease.

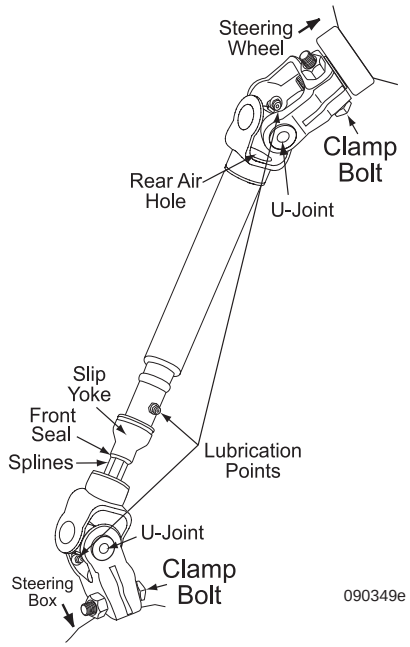
Steering Components



Typical Steering Components

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

WARNING:
DO NOT place yourself under motorhome without first properly blocking frame (jackstands) from coming down in case of rapid deflation of air system.



Intermediate Steering Shaft: Torque clamp bolt 48 ft. lb for 3/8", 75 ft. lb for 7/16"

Greasing the Intermediate Steering Shaft Universal Joints:

1. Check the shaft for looseness. Repair if loose or worn. Check clamp bolt and torque as specified.

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.

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.

Check torque on clamp bolts at least once every five years or 50,000 miles. Remove the steering column cover to access the upper universal joint and slip yoke lubrication points. The lower universal joint is accessed from underneath in the generator compartment behind the front electrical box.

Greasing the Intermediate Steering Shaft Slip Yoke and Splines:

1. Check the shaft for looseness. Repair if loose or worn.

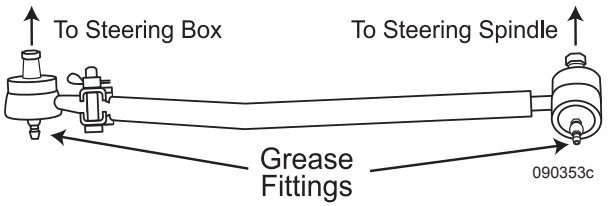
2. With finger, cover the rear air hole so grease flows to the front seal. Apply the specified grease at the grease fitting on the slip yoke. Apply until new grease purges and forces finger away from the air hole in the end of the slip yoke. Greasing interval is yearly or every 30,000 miles.

NOTE:
Universal joints may have two grease fittings each depending upon application. It is necessary to apply grease to each fitting to properly lube the universal joint.

Drag Link

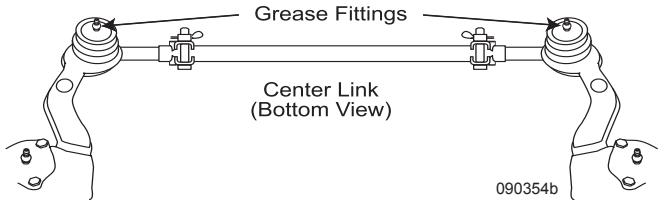
The drag link connects the steering box pitman arm to the steer axle. The movable joint (ball joint) uses sealed boots to prevent water intrusion. **DO NOT** rupture the boot when applying grease. Grease interval is six months or every 5,000 miles.

NOTE:
It will be necessary to start the motorhome and turn the steering wheel to access fitting(s).



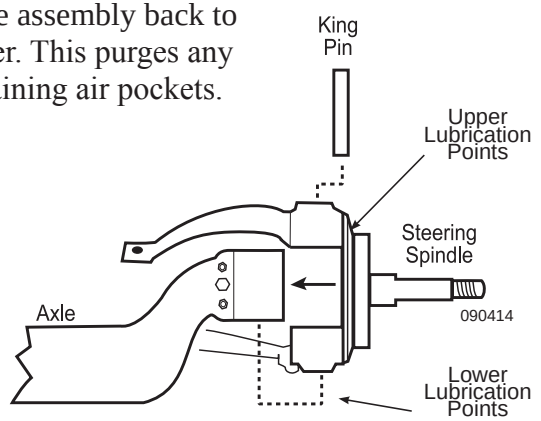
Center Link

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. The kingpin has upper and lower lubrication points. 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 any remaining air pockets.



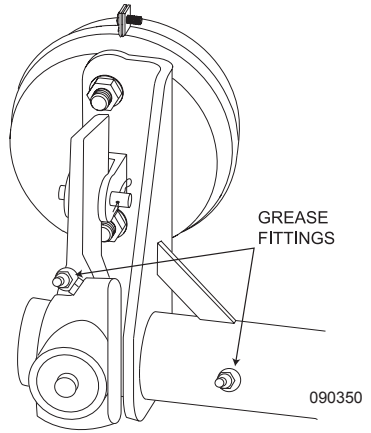
Continue lubricating the kingpins until new grease purges with no air pockets. Greasing interval is every six months or 5,000 miles.

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.

Front Brakes

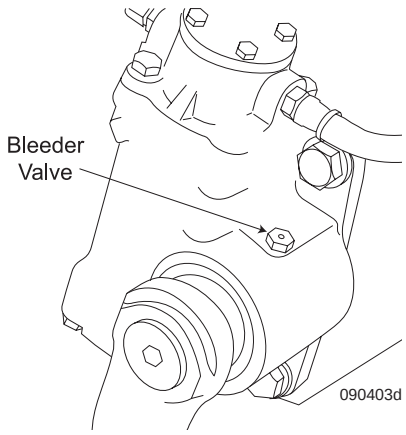
The slack adjuster and camshaft need to be lubed periodically to ensure proper brake operation. Lubricate every 10,000 miles or three months using NLGI #2 Lithium soap-based lubricant.



Typical Air Drum Brakes: Lubricate until new grease appears at exit points.

STEERING GEAR

The steering gear has been designed to provide long service life and simple service repair. The rack and sector shaft does not require center point adjustment. The clearance between the cylinder bore and the piston is closely controlled and a pistion ring was added to better use the hydraulic oil supplied. With reasonable care and limited maintenance the steering gear will provide many miles of reliable performance. The bleeder valve is used on intitial installation and replacement.



Power steering is provided by using hydraulic pressure to assist rotating the output shaft of the steering gear. A poppet valve and worm drive are located at the end of the input shaft of the steering gear. The poppet valve directs the hydraulic fluid pressure to a type of spool. The 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.

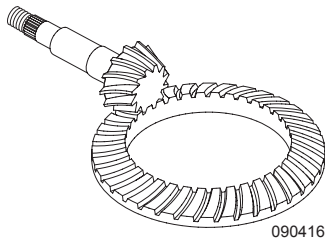
NOTE:
Inspect for signs of leakage when performing fluid level checks.

Changing the hydraulic filter in the engine compartment at regular intervals will help ensure trouble-free operation.

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.



Ring and Pinion Gears

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.

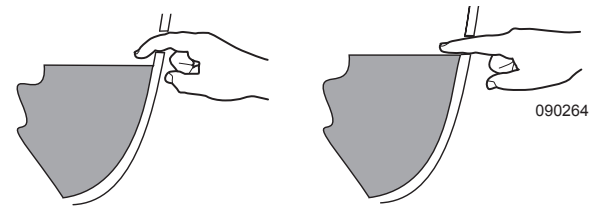
The level of lubricant in the rear axle should be checked every 30,000 miles or 6 months, whichever occurs first. This will ensure adequate lubricant in the axle for proper operation. Regular inspection of the drive axle lube levels is an essential maintenance procedure.

WARNING:
DO NOT place yourself under motorhome without first properly blocking frame (jackstands) from coming down in case of rapid deflation of air system.

Proper Drive Axle Lubricant Level:

- 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.



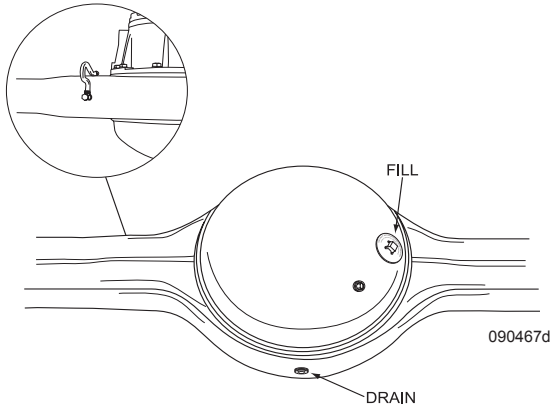
To Drain and Replace Lubricant:

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.

Fill Plug

WARNING:
When checking or changing the lubricant, always ensure that the axle is not hot. Oil temperature 90º F. or hotter can easily cause severe burns.

NOTE:
When checking the lube level also check the housing breathers on top of axle housing. Clean breathers if dirty or replace if damaged.



Drive Shaft:

The drive shaft transfers the power produced by the engine to the drive axle. A worn or out of balance drive shaft causes chassis vibration that generally increases in intensity with road speed.

Lubrication Maintenance:

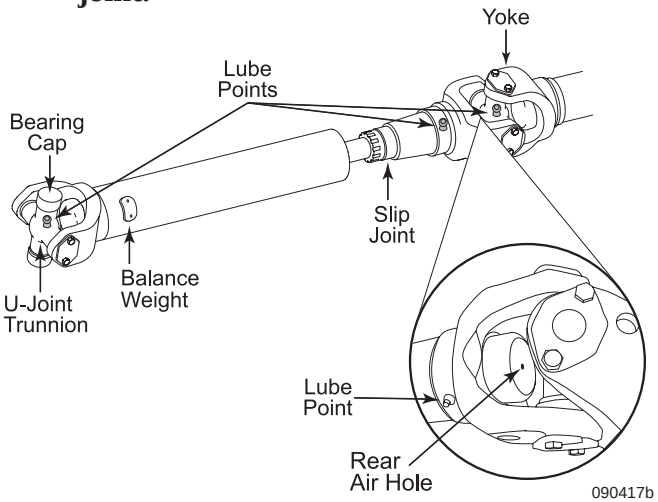
The drive shaft requires periodic lubrication maintenance. Lubricate the slip joint and universal joints every 5,000 miles or 6 months, whichever occurs first. Use NLGI #2 chassis lubricant.

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:

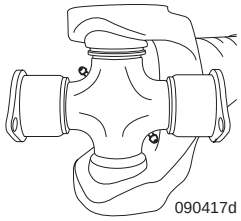
1. Check the drive shaft for looseness. Repair if loose or worn.
2. Apply the specified grease at the grease fitting on the universal joint. Apply until new grease purges from all the seals.
3. If new grease does not purge at the seals, loosen the bearing cap bolts and re-grease until all four caps purge. If new grease still does not purge, disassemble and clean or replace the universal joint.

NOTE:
Depending upon application universal joints may have two grease fittings each. It is necessary to apply grease to each fitting to properly lube the universal joint.



Greasing the Drive Shaft Slip Yoke and Splines:

1. Check the drive shaft for looseness. Repair if loose or worn.


090417d

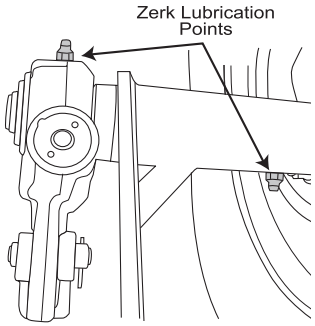
Dual Zerk U-Joint

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.

WARNING:
Rotating shafts can be dangerous as they can snag clothes, skin, hair, hands, etc. resulting in serious injury or death. DO NOT work on or near a shaft with or without a guard when the engine is running.

Rear Brakes

The drive and "S" cam shaft need to be periodically lubed to ensure proper brake operation. Lubricate every 10,000 miles or three months using a NLGI #2 Lithium soap-base lubricant.



Rear Brakes 090472b

SHOCK ABSORBER


090315

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 shock in the design of the exclusive air glide 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.

A self lubricating seal is used, which is designed to 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 is 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 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. Since the only moving part is the piston rod, there are no springs, hinges or pins to wear out, get weak or deteriorate.

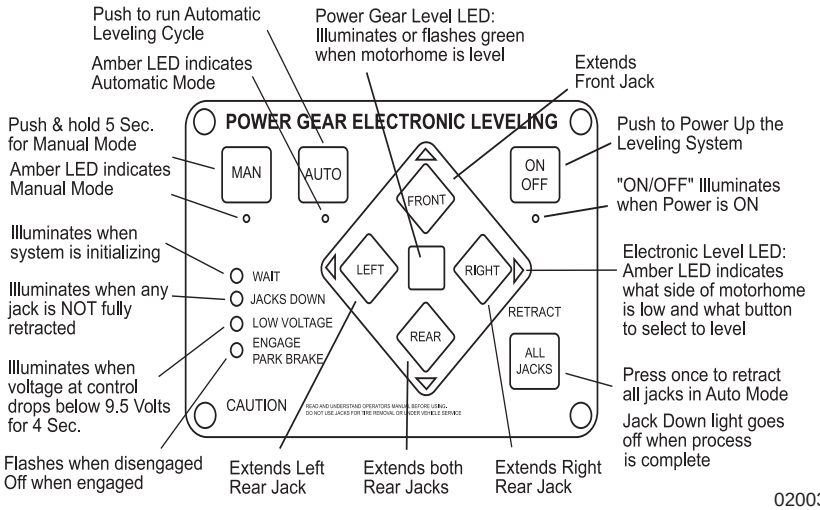
LEVELING - HYDRAULIC

The leveling system is designed to reduce sight selection problems and stabilize the motorhome when parked. The leveling system features a remote control panel (located near the pilot seat). The multiple warning system that consists of a Jacks Down LED and warning alarm if a jack is down and the transmission is placed in gear or the park brake is released. The leveling system can be operated in manual or automatic modes.

Safety Features:

The leveling system has safety features to prevent a jack from extending during travel. The control panel will not activate until the following safety features are in place.

- Transmission is in Neutral.
- Parking brake is applied.
- Ignition switch is in the ON position.



020039e

Control Panel:

The control panel includes four switches that operate the jacks: an Auto switch, a **MAN** (manual) switch, a retract All Jacks switch and a power **ON/OFF** switch. A LED light next to a directional button indicates that position is low.

Indicator Lamps:

- **MAN** – Indicates system is in manual level mode.
- **AUTO** – Initiates Automatic level mode.
- **ON/OFF** – Turns the leveling system on or off.
- **WAIT -** Indicates system is initializing
- **JACKS DOWN** – Indicates one or more jack is extended.
- **LOW VOLTAGE** – Indicates chassis voltage is low.
- **ENGAGE PARK BRAKE** – Indicates the Park Brake is disengaged.
- The LED adjacent to any extend switch indicates that position is low.

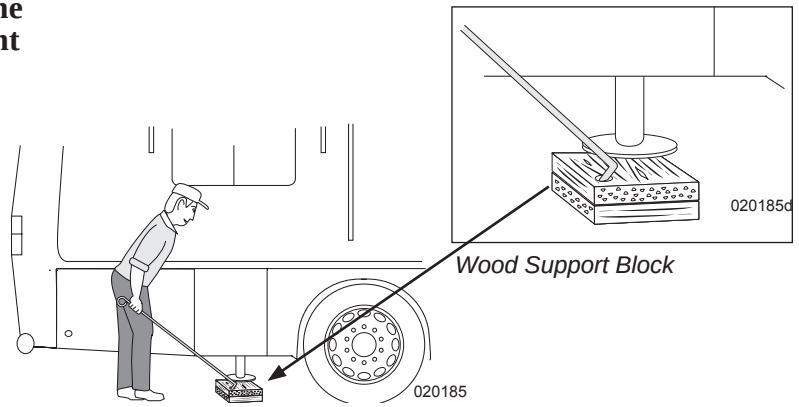
CAUTION:
The leveling jacks are not designed for changing tires. Using the jacks to elevate any wheel position off the ground will cause problems with the suspension system, frame alignment and damage to the windshield.

CAUTION:
DO NOT move the motorhome while the jacks are still in contact with the ground or extended. Damage to the jacks can occur.

Prior to Leveling

- Chassis battery voltage must be at least 12 Volts DC.
- Select a level site if possible, or park the motorhome with the front facing downhill.
- Apply the parking brake. Place the transmission in Neutral.
- Lower the air suspension by stepping on the brake several times until system air pressure is below 60 psi. With the ignition on, push and hold the Air Dump switch to lower the suspension. This reduces the amount the jack will need to extend before making contact with the surface.

CAUTION:
Survey the area around and under the motorhome for obstructions that can damage the motorhome or undercarriage components before lowering the air suspension. Damage to the mud flap may occur if it is located over a raised area.



CAUTION:
Ensure potential jack contact points are clear of obstruction or depression before operation. Keep all people clear of the motorhome during the leveling system operations. 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.

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.

NOTE:
If additional height or surface support is needed, construct a 1' x 1' wooden block made from two pieces of ¾" plywood for a total thickness of 1½". Drill hole in corner and use awning wand to slide wooden block under jack pad.

Manual Leveling

The manual leveling mode can be used for leveling or stabilization preference. An indicator lamp adjacent to an extend switch indicates that jack position(s) is low.

Manual Leveling Operation:

- Follow the instructions in *Prior to Leveling*.
- Turn the ignition switch to On position.
- Press the **ON/OFF** button to turn the system on.
- Press and hold the MAN (manual) button for five seconds. Once the indicator lamp below the MAN button illuminates, the system is ready.

CAUTION:
Prior to leveling the motorhome it is important that all jacks be in contact with the ground to stabilize and support the frame. No single jack should be solely used to level the motorhome. Applying an improper leveling process can cause excess torsion stress and/or twisting of the chassis, frame and body, resulting in damage to the windshield or an entry door malfunction.

- Extend the front jack until contact with the surface is made. Extend an additional ½". This allows the front jack to act as a pivot point.
- Extend the jack position according to the indicator lamp. Example: If the indicator lamp is lit under Jack Extend Switch - Rear, the rear of the motorhome is low. Press and hold the Rear button. Both rear jacks will extend. Once level, the system will automatically stop. The Power Gear Level Light will illuminate. Release the switch. Pressing Right or Left will extend a single rear jack accordingly.
- Turn off the remote panel.
- Turn off the Ignition switch.

Automatic Leveling

The automatic function of the leveling system should only engage when the site is relatively level and solid to prevent excessive twist/stress to the frame. It is essential that there is no movement in the motorhome prior to and during the automatic leveling process.

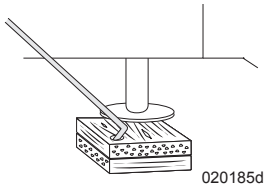
Automatic Leveling Operation:

- Follow the instructions in *Prior to Leveling*.
- Turn the ignition switch to the On position.
- Press the **ON/OFF** button to turn the system on.
- Press the Auto switch. The pump motor activates and the appropriate jacks automatically extend and level the motorhome.

NOTE:
A Jacks Down warning light will illuminate when the jacks are extended. The alarm will sound if the jacks are down and the park brake is released or transmission placed in gear.

- The motorhome is level when the LED's next to Jack Extend switches are off and the green Power Gear Level light is illuminated.
- Turn off the remote panel.
- Turn off the ignition switch.

NOTE:
If additional height or surface support is needed, construct a 1' x 1' wooden block made from two pieces of ¾" plywood for a total thickness of 1½". Drill a hole in one corner and use the awning wand to slide the wooden block under the jack pad.

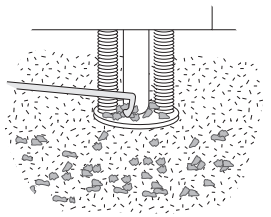

020185d

Wood Support Block

Retracting Leveling Jacks

- Turn the ignition switch to the On position.
- Apply the parking brake.
- Turn On the remote panel.
- Momentarily press the All Jacks Retract button. If retracting in manual mode, the All Jacks button must be held until the Jacks Down LED goes out.
- Once the Jacks Down LED goes out, the jacks should be fully retracted. Make a visual inspection to ensure that all jacks have fully retracted before moving the motorhome.

INSPECTION:
Before moving the motorhome always perform a visual inspection to be sure that all jacks have fully retracted. Remove any debris that may be on the jack pad.


020185b

If the jacks fail to extend or retract:

- Apply the park brake, turn the ignition to the On position and place the transmission in Park.
- If jacks still do not operate, check the leveling system fuse in the front distribution box.

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.

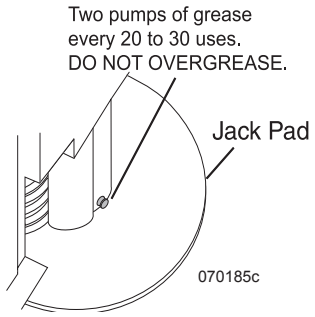
Drive-away Protection:

With the jacks extended and the park brake is released or transmission placed in gear, a warning alarm will sound and all LEDs will illuminate. The jacks will automatically retract. A full visual inspection is required to confirm full retraction of jacks before moving motorhome.

Maintenance:

At weekly intervals, use 100% silicone spray on the jack rod. This will help prevent moisture damage to surface of the jack rod. If parked near coastal areas, apply more frequently. Occasional oil or grease on the extended jack rod is normal.

- Remove dirt and road debris from the jacks as needed.
- Check fluid level every month 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.

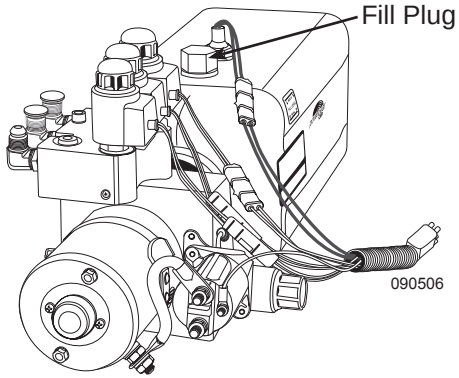


- Fluid change interval is 36 months.

Adding Fluid:

If the leveling system makes unusual noise or the alarm sounds when driving around corners or over bumpy roads, this indicates a low fluid level.

1. Chock all wheels for safety.
2. Ensure all jacks are retracted.
3. Unscrew the fill plug from the top of the pump. Slowly fill the reservoir with *Dexron 3 Mercon ATF* hydraulic fluid until ¼" from the fill plug.
4. Replace fill plug.



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.

INFORMATION:
The equipment owner and operator is responsible for safe operation of engine. Consult your engine manufacturer's owner's manual or authorized repair location for more information.

STARTING PROCEDURE

Normal Starting

CAUTION:
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.

WARNING:
Never attempt to start the engine by "jumping" relays or any means other than using the ignition start switch. DO NOT attempt to start the engine unless all persons are clear of the engine before starting.

The engine is equipped with an intake air heater. The intake air heater helps engine starting in cold weather. Intake manifold air temperature is monitored by the Electronic Control Module on the engine. Grid heater activation is indicated by the **WAIT TO START** indicator lamp.

WARNING:
Use of ether starting fluids may cause an explosion upon air inlet heater activation.

To Start the Engine:

With the throttle in idle position, turn ignition to **ON**. Allow the **WAIT TO START** lamp to extinguish. Turn key to the start position. When the engine starts the grid heater will again energize for a time period determined by the Electronic Control Module. Allow the engine to idle with no load for three to five minutes. The engine coolant temperature should be up to normal operating range (140º F./60º C. to 212º F./100º C.) before operating the engine under full throttle.

CAUTION:
DO NOT depress accelerator pedal when starting engine. To start engine turn ignition key ONLY.

NOTE:
DO NOT idle the engine for long periods of time. Consistent periods of long idle wastes fuel and may cause engine damage.

Cold Weather

CAUTION:
Refer to engine OEM manual for information on proper fuels, lubricants and coolants for cold weather operation.

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.

Depending on ambient temperature it may be necessary to pre-heat the engine. Located in the coolant passage in the engine is a heating unit that operates from 120 Volt AC. If it is necessary to pre-heat the engine due to ambient temperature, it is recommended to activate the block heater the night before, allowing several hours for the block heater to warm 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. Cold weather operation can be defined in two categories: Winter and Arctic.

WINTER (32º to -25º F.) (0º to -32º C.):
Use a 50% antifreeze to 50% water coolant mixture, use multi-viscosity oil meeting manufacturers specifications and fuel to have maximum cloud pour points 10º F. (6º C.) lower than the ambient temperature in which the motorhome operates.

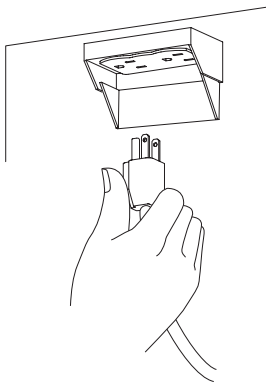
ARCTIC (-25º to -65º F.) (-32º to -52º C.): Use a 60% antifreeze to 40% water coolant mixture. Use oil meeting manufacturers specifications and fuel to have maximum cloud pour points 10º F. (6º C.) lower than the ambient temperature in which the motorhome operates.

NOTE:
The engine is filled with 15-40w multi-viscosity oil from the factory. Generally this will start the engine in temperature down to 15º F. If the engine has normalized to a temperature below 15º F. it will be necessary to pre-heat the engine before starting.

CAUTION:
Upon cranking an engine in cold temperature, the starter may rapidly engage and disengage. If this occurs STOP attempting to crank the engine to prevent starter damage. Pre-heat the engine before making further attempts to start.

Block Heat:

The block heater is rated between 850 and 1500 watts, depending on engine size. For efficiency, hook to shore power or plug the block heater cord into a separate power cord rated for 15 Amps and a GFCI protected outlet rated at 20 Amps. The engine may require several hours of pre-heating before starting.



090397

Located in roadside rear compartment

It is recommended to start preheating the engine the night before departure.

To Use the Block Heater:

- Hook to shore power and plug the block heater cord into the block heater receptacle (both are located in the roadside rear compartment).

Tips:

1. When operating below 32° F., the block heater preheat can enhance engine starting by easing cranking and helping to prevent engine misfire and white smoke during starting.
2. Always follow the 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 warm for operation. Utilize the fast idle feature to quicken the process. Wait at least three minutes to operate the motorhome or until the coolant temperature begins to rise.
4. Check air inlet and filter daily, or as necessary, when driving in snow conditions.
5. The demand on batteries increases during winter. Check and service the batteries frequently to help ensure trouble-free starts.
6. Start out slowly with the motorhome 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 additives to start the engine as damage may occur.

ENGINE OIL

Cummins Engine Requirements:

Maintenance guidelines and requirements are located in the Cummins Operation & Maintenance Manual. These recommendations for the engine will extend 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 American Petroleum Institute (API) specification **CJ-4/SL** and **Cummins Engineering Standard (CES) 20081** is recommended. 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.

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.

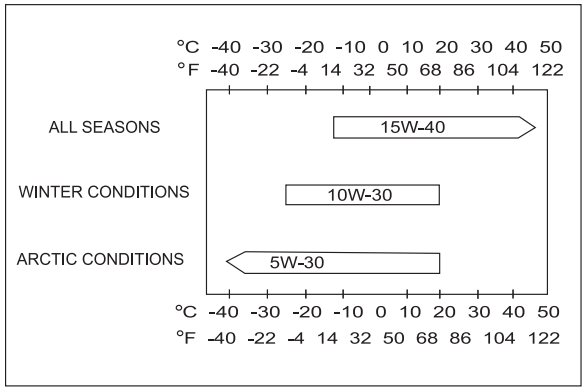
Synthetic oils API category III specifications are recommended for extreme cold temperatures only. Low viscosity oils used for winter operations will aid in starting. Synthetic oils, or oil with adequate low temperature properties used for Arctic operations where the engine cannot be kept warm when shut 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.

NOTE:
The engine is filled with SAE 15W-40 multi-viscosity oil from the factory.



070201

Lubricating oil recommendations and specifications.

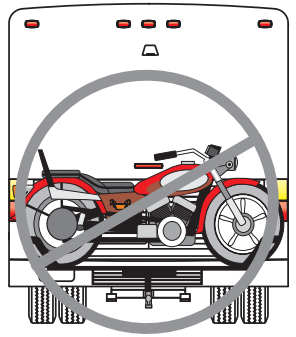
ENGINE SHUTDOWN

Allow the engine to idle three to five minutes after a full load operation. This allows 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 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's 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



080208d

The system uses a fully formulated coolant. The difference between fully formatted antifreeze and fully formulated coolant is the percentage of water. Antifreeze must meet ethylene glycol or propylene glycol recommendations.

Fully formulated antifreeze **must** be mixed with good-quality water at a 50/50 ratio (40 to 60% working range). A 50/50 mixture of antifreeze and water gives a -33º F. freezing point and a 226º F. boiling point. The actual lowest freezing point of ethylene glycol antifreeze is at 68%. Using higher concentrations of antifreeze will raise the freezing point of the solution and **increase the possibility of a silica gel problem**.

The 50/50 mix ratio must be premixed prior to being put in the system. Placing antifreeze and water in the cooling system is not recommended. Consult the manufacturer's OEM for more details.

Good-Quality Water:

Good quality water is important for cooling system performance. Excessive levels of calcium and magnesium contribute to scaling problems, and excessive levels of chlorides and sulfates cause cooling system corrosion.

Testing the Coolant:

A refractometer **must** be used to measure the freezing point of the coolant **accurately**. **DO NOT** use a floating ball hydrometer. Using floating ball hydrometers can give an incorrect reading.

Coolant System Sealing Additives:

DO NOT use sealing additives in the cooling system. Use of sealing additives will:

- Build up in coolant low-flow areas.
- Plug the radiator and oil cooler.
- Possibly damage the water pump seal.

Cooling System Soluble Oils:

DO NOT use soluble oils in the cooling system. Use of soluble oils will:

- Corrode brass and copper.
- Damage heat transfer surfaces.
- Damage seals and hoses.

CAUTION:
An over-concentration of antifreeze will reduce freeze protection. Use of high silicate antifreeze can damage the cooling system and engine.

WARNING:
DO NOT continue engine operation if engine temperature rises and the Warning light on the dash illuminates. The engine protection software will begin to decrease fuel (derate) to the engine regardless of throttle position. Continued operation will result in severe engine damage.

Check the coolant level before each trip, refueling, and when checking the oil level. Coolant freeze point is checked at every oil change interval or as specified by the engine manufacture. Coolant drain and flush intervals are specified by the engine manufacturer. Refer to the OEM engine manual for more information on service maintenance intervals.

INFORMATION:
Refer to the engine OEM manual for details on engine coolant maintenance.

Coolant Types:

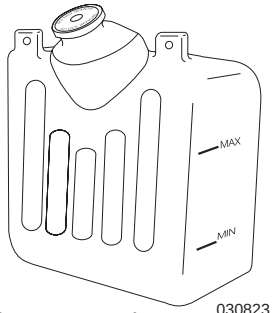
- Use a low-silicate antifreeze that meets ASTM4985 (GM6038M specification) criteria.
- Recommendations include using either a 50/50 mixture of good quality water and fully formulated antifreeze or fully formulated coolant.

CAUTION:
Use of supplemental coolant additives are NOT required.

Engine Coolant Reservoir:

The engine coolant reservoir is connected to the radiator by a hose. Coolant heats and expands as the motorhome is driven. Coolant displaced by expansion overflows from the radiator into the reservoir. Coolant contracts as it cools and is drawn back in the radiator by a vacuum. Thus, the radiator is filled to capacity with coolant 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.

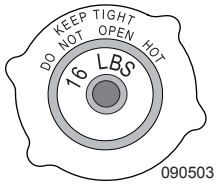
The reservoir is marked **MIN** (cold check)/**MAX** (hot check), or the reservoir has upper (hot check) and lower (cold check) sight windows. Maintain coolant between the appropriate reservoir indicators.



Coolant Reservoir

CAUTION:
DO NOT remove the reservoir cap while the engine is running or if the engine is hot. Cap removal can result in severe burns and damage to the engine cooling system.

NOTE:
Be sure to replace cap after adding fluid.



Coolant reservoir cap is rated at 16 lbs.

- Check coolant level before each trip, when refueling, and when checking the oil level.
- A low coolant alarm will sound and a low coolant indication will appear on the instrument panel if coolant level drops below acceptable levels in the reservoir. Stop the motorhome and inspect the coolant level before continued operation.
- Coolant level should remain between the MIN and MAX indicators on the reservoir when the cooling system is properly filled.

Cooling System Maintenance:

Refer to the engine OEM manual for detailed information regarding cooling system service and maintenance intervals. Services include draining and replacing the coolant, flushing the cooling system, inspecting the water pump and standpipe and replacing the thermostat, gasket or seal.

Coolant Overheated:

The engine can overheat for a number of reasons. Before engine temperature reaches a critical point, it is preceded by illumination of dash indicator lamps as well as above normal temperature gauge readings. It is best to adhere to these indicators and take corrective action before the engine is subjected to extreme heat and potential engine damage.

If the engine should begin to severely overheat, engine protection software will begin to decrease fuel regardless of throttle position (derate) to reduce heat created by combustion. Damage to the engine will occur if engine operation continues and cause of the overheat condition is not immediately corrected. At this point it is best to shut off the engine as soon as possible to avoid further engine damage.

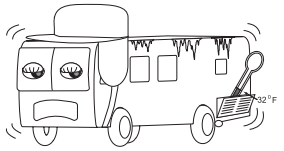
WARNING:
It is advised to shut off the engine should the engine overheat. It may take several hours before engine temperature has lowered to a safe operating range. Do not remove the coolant reservoir cap as severe burns may result. Never add cold water to an overheated engine as this will cause uneven rapid cooling and possibly result in further engine damage.

Freeze Protection:

Coolant freeze protection is checked using a refractometer for accuracy. This meter checks at what point the coolant begins to freeze. Refer to the engine OEM manual for test procedures.

Coolant System - Thawing:

If the coolant system becomes frozen, the motorhome must be towed. Place the motorhome in a warm area until completely thawed.



020165h

If the engine is operated when the cooling system is frozen, the engine may overheat due to insufficient coolant circulation. Once thawed, check the engine, radiator and related components for damage caused by expansion of frozen coolant.

Coolant Hoses:

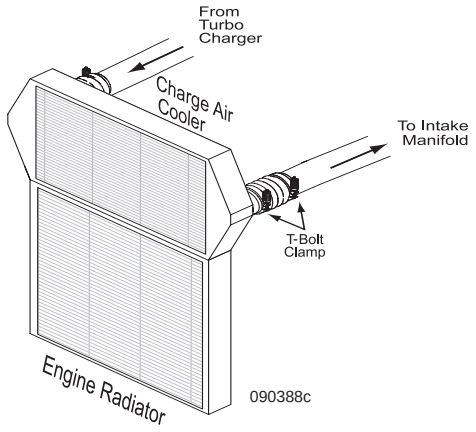
Inspect coolant hoses and connections when checking engine or transmission fluids. Look for any signs of chaffing at hose restraints or sharp edges. Indications that hoses have reached the end of service life include cracking or swelling around clamps and connections. Oil leaks can also deteriorate hoses.

Overheating can be caused by a collapsed hose. Old hoses can also deteriorate on the inside causing partial clogs reducing cooling efficiency. Replace any hose found to be cracked, swollen or damaged. Periodically check hose clamp torque.

INSPECTION:
Every 12 months - Inspect all hoses, clamps, and fittings for leaks due to cracking, softness and loose clamps/ fittings. Look for signs of fluid leaks, damaged end fittings or ballooning; chafed, kinked, or crushed hoses; and loose clamps and fittings. Correct any deficiencies found.

Radiator/Charge Air Cooler

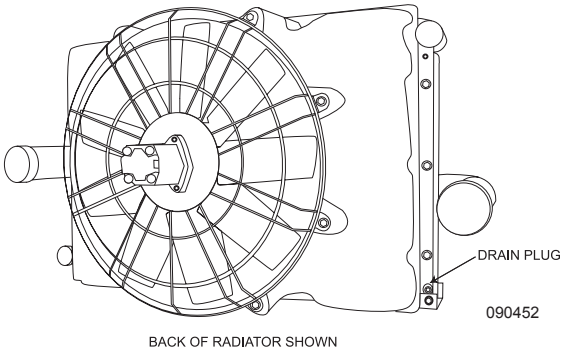
The diesel engine uses compression to ignite the fuel/air charge. To increase compression inside the combustion chamber (resulting in increased power output) a turbocharger is added to the engine. The turbocharger is a paired housing assembly with impellers inside each housing connected by a common shaft. 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.



090388c

This process works well, however, the intake air charge is heated two different ways: through convection by the exhaust gases driving the turbocharger and when air is compressed. This negative effect inside the combustion chamber results in lost power potential. Therefore, a Charge Air Cooler (CAC) is installed to cool the intake air before it enters the engine. 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 300º to 375º 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.

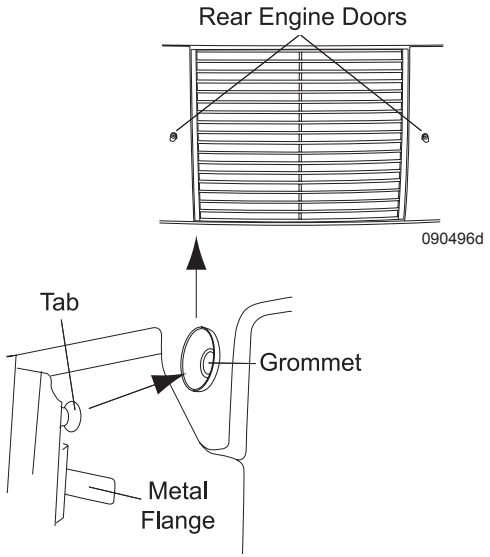


Rear Grill

The rear grill pulls out for access to the radiator compartment. The grill is attached by four tabs that insert into four grommets, one on each corner.

To detach, place both hands evenly spaced on the grill and gently ease the grill out. To reinstall, align the tabs with the grommets and push in.

WARNING:
When reinstalling it is IMPORTANT that the four corners of the grill are securely attached to the four grommets. Failure to do so may result in the grill jarring loose with travel.



EXHAUST BRAKE

The exhaust brake switch (located on the driver's console) activates the auxiliary brake integrated in the variable geometry turbocharger. The dash mounted switch will operate the auxiliary brake when the dash switch is ON and the throttle is released. The auxiliary brake is not designed to bring the motorhome to a complete stop; however, it can assist in controlling the speed of the motorhome. Use of the auxiliary braking system can extend the life of pads, shoes, rotors and drums, saving on costly service brake repairs.

How It Operates

When the auxiliary brake is activated, exhaust pressure increases within the engine. Increased exhaust back pressure slows the engine speed, resulting in engine braking action. The amount of engine braking power developed is related to engine speed (RPM).

When To Use It

Use the exhaust brake when traveling down a hill, on the freeway or exiting the off ramp. When activated, the exhaust brake 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 exhaust brake effect.

Cruise Control

Turning on the exhaust brake switch DOES NOT cancel cruise control. If cruise control is on, tap the service brake pedal to disable cruise control. Then turn the exhaust brake switch on and the exhaust brake will activate.

Another way to disable cruise control is to turn the cruise control power switch off. Then the exhaust brake switch can be turned on to activate the exhaust brake.

WARNING:
The exhaust brake is designed to assist the service brakes, but WILL NOT bring the motorhome to a stop. Refer to the engine OEM manual for more information.

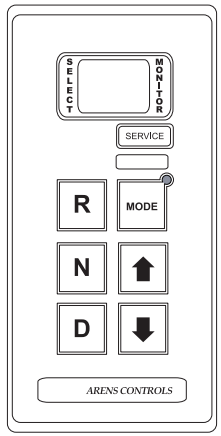
NOTE:
Use of the exhaust brake can help increase the service life of the service brakes.

TRANSMISSION

The Allison World transmission incorporates the **World Transmission Electronic Control (WTEC)** system. The system is compromised of five major components connected by a wiring harness: the Electronic Control Unit (ECU), engine throttle position sensor, three speed sensors, remote shift selector (keypad) and the control module. The ECU processes information received from the throttle position sensor, speed sensor, pressure switch and shift selector to provide optimum shift quality. This is accomplished by matching transmission and engine RPM during a shift to establish a desired shift profile within the ECU. Another feature of the transmission is the ability to "learn" or "adapt." The electronic control system optimizes shift quality by using "Adaptive Shifting." A wide variety of varied shift conditions is required before optimizing shift quality. Generally, five typical shifts of a consistent shift type are needed to optimize shift quality.

Shift Selector

The keypads on the shift control are **R** (Reverse), **N** (Neutral), **D** (Drive), Arrow Up or Down and Mode. A digital display window shows gear selection. Keypads have a split screen displaying two number sets while in drive. The left number displays the highest forward range available. The right number is the range that the transmission is currently in. **NN** (Neutral) will appear in the display window when the ignition is turned On. This indicates the transmission is in neutral and it is safe to start the crank. If the **NN** does not display when the ignition is turned on, there is no power to the shift selector and the transmission will not allow the engine to start. No display is an indicator of electrical problems with the engine batteries, ECU or the shift selector.



080386c

Keypad Functions:

- Select the Reverse gear by pressing **R**. RR will display.
- Select Neutral by pressing **N**. The area around the **N** button has a raised ridge so the driver can orient his hand to the push buttons by touch without looking at the display.
- Select Drive range by pressing **D**. The highest forward gear (6th gear) appears in the display and the transmission will shift to first gear indicated as 6 1.
- Up and Down arrow buttons are used to select a higher (if not in "6") or lower (if not in "1") forward range. These buttons are not functional in Neutral or Reverse.
- When in Drive, one press changes the gear range selected by one. If the button is held continuously, the selected range will continue to change up or down until the button is released or until the highest/lowest possible range of gears is selected.

- The Mode button enables a secondary shift point to be selected. This is commonly referred to as Economy mode. Economy mode affects the upshift schedule 3-4, 4-5, 5-6 and downshift schedule 6-5, 5-4, 4-3. During highway driving, with the cruise control set between 55 and 65 m.p.h., setting the transmission to economy mode will eliminate about 99% of transmission downshifts from sixth to fifth when incurring a slight incline or overpass.

CAUTION:
DO NOT use Economy Mode in heavy stop and go traffic or mountainous terrains. Frequent shifting while using heavy throttle occurs in Economy Mode and increases transmission fluid temperature. Exit Economy Mode until road conditions improve.

CAUTION:
Engine temperature may rise when ascending long grades using full throttle. Towing a load will increase the demand on the engine. If this occurs, manually shift the transmission to the next lower gear and use less throttle. The engine will use less fuel and RPM should increase.

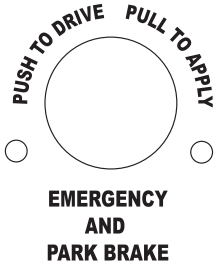
NOTE:
The transmission will not accept a manually selected gear change to occur if the gear selected is out of the specified operating range.

NOTE:
The transmission will not shift into gear from Neutral if the engine RPM is at or above 900. The display will flash "66" indicating the engine RPM is excessive. Select "N" and lower engine RPM.

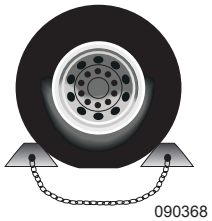
NOTE:
Cruise control power switch enabled alerts the shift schedule. Turn off the cruise power switch in congested traffic and mountainous terrain.

Parking the Motorhome:

- Bring the motorhome to a complete stop using the service brakes and hold the service brake pedal down.
- Allow the engine to come to a low idle (500 to 800 rpm).
- With a foot still on the service brake, apply the Park/Emergency brake by pulling up on the knob.
- Once the Park/Emergency brake is set, then move the shifter to the N (NEUTRAL) position.
- After this is accomplished release the service brake pedal.



CAUTION:
Chock all the wheels securely if the motorhome is left unattended.



Check Trans Indicator (On Dash)

The electronic control system of the transmission is programmed to inform the operator of a problem with the transmission system and reacts automatically to protect the operator, motorhome and transmission. When the Electronic Control Unit (ECU) detects a DO NOT SHIFT (DNS) condition the ECU restricts shifting, turns on the CHECK TRANS light in the instrument panel and registers a fault code.

NOTE:
For some problems, fault codes may be registered without the ECU activating the CHECK TRANS light. An Allison Transmission authorized service outlet should be consulted whenever there is a transmission related concern. They have the equipment to check diagnostic codes and correct problems which may arise.

Each time the engine is started the CHECK TRANS icon will light, then turn off after a few seconds. This momentary lighting is to indicate that the status light circuit is properly working. If the CHECK TRANS light does not illuminate during start up, or if the light remains on after start up, the transmission system should be immediately checked. Continued illumination of the CHECK TRANS light during vehicle operation (other than start up) indicates that the ECU has signaled a diagnostic code. Illumination of the CHECK TRANS light is accompanied by a flashing display from the shift selector. The shift selector display will show actual range attained and the transmission will not respond to shift selector requests.

Indications from the shift selector are provided to inform the operator that the transmission is not performing as designed and is operating at reduced capabilities. Before turning the ignition off, the transmission may operate for a short time in the selected range in order to "limp home" for service assistance. Service should be performed immediately in order to minimize potential damage to the transmission.

When the Check Trans icon illuminates, the keypad will not respond to command and the transmission generally will downshift to 4th gear. The torque converter will not "lock-up" and engine speed is automatically reduced. Direction changes (i.e. forward to reverse) is not allowed. Locate a safe secure place to park the motorhome. If the engine is shut off, then engaged after a Check Trans indication, the transmission remains in Neutral until the fault causing the Check Trans light is corrected.

NOTE:
Contact an authorized Allison Transmission service center whenever a transmission related concern arises. For some problems, fault codes may be registered without the ECU activating the Check Trans indicator. An authorized Allison Transmission Service center will have the equipment to check diagnostic codes and correct problems that may arise.

Periodic Inspections

The MH Series requires very little maintenance. Careful attention to the fluid level, electrical connections and hydraulic hoses is very important.

The transmission should be kept clean for easy inspection. Make periodic checks for loose bolts and leaking fluid. Check the condition of the electrical harnesses regularly. Check the engine cooling system occasionally for evidence of transmission fluid that would indicate a faulty oil cooler. Report any abnormal condition to an Allison Service Center.

Prevent Major Problems:

Help the control system oversee the operation of the transmission. Minor problems can be kept from becoming major problems if an Allison Transmission Service center is notified when one of these conditions occur:

1. Shifting feels odd.
2. Transmission leaks fluid.
3. Unusual transmission-related sounds (sound made by normal engine thermostatic fan cycling when climbing a long grade with a heavy load are often mistaken for transmission-related sounds).
4. The Check Trans indicator frequently comes on.

TRANSMISSION FLUID & FILTERS

A small tag is attached to the dipstick identifying that the transmission is filled with TranSynd™ synthetic transmission fluid. A remote check/fill is located at the back of the engine.

Fluid and Filter Change Interval:

The transmission has a spin-on filter located on the transmission bell housing.

Motorhome owners must use genuine Allison TranSynd oil and genuine filters for the duration of the five year period for warranty coverage.

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.

Proper Fluid Levels:

Transmission fluid cools, lubricates and transmits hydraulic power. Proper fluid levels must be maintained at all times. If fluid level is too low, the converter and clutches do not receive an adequate supply of fluid. If fluid level is too high, the fluid can aerate. Aerated fluid can cause the transmission to shift erratically or overheat.

An **Oil Level Sensor (OLS)** is built into the transmission. The fluid level can be checked easily and cleanly using the shift selector. Check the transmission fluid level before each trip and after removing the motorhome from storage.

Cold Check - Manual Check Procedures:
The concept of a cold check is to determine adequate fluid level for safe operating such as after a fluid and filter change. A cold check should be performed after transmission maintenance or service until a hot fluid level check or fluid level check from the shift selector can be performed.

To Check the Fluid When Cold:
- Park the motorhome on a level surface. Set the parking brake.
- Chock the wheels to prevent the motorhome from moving.
- Start the engine.
- 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. Shift the transmission to **N (Neutral)** and release the service brakes. Allow the engine to idle at 500 to 800 RPM.
- Remove the dipstick and wipe clean. Reinsert the dipstick fully into the tube, then remove to check fluid level. Repeat to verify reading, if needed.
- Safe operating level is anywhere within the Cold Check band on the dipstick. This allows safe operation of the transmission until a Hot Check or fluid level check from the shift selector 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 a fluid level check from the shift selector or a Hot Check at the first opportunity when normal operating temperatures are reached.

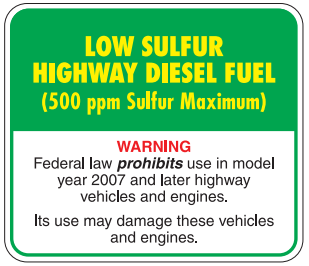
CAUTION:
Low or high fluid level can cause overheating and irregular shift patterns. These conditions can damage the transmission if not corrected.

Fluid Levels - Hot Check
Fluid level rises as temperature increases. Fluid must be hot to ensure an accurate check. Be sure fluid has reached normal operating temperature. If a transmission temperature gauge is not present, check the fluid level when the engine water temperature gauge has stabilized and the motorhome has been driven for at least one hour.

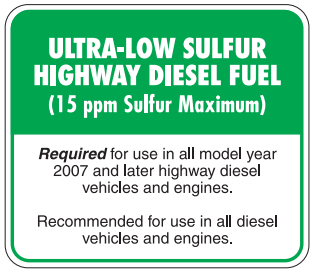
- Park the motorhome on a level surface and shift to **N (Neutral)**. Apply the parking brake and allow the engine to idle (500 to 800 RPM).
- After wiping the dipstick clean, check the fluid level. Safe operating level is anywhere within the Hot Run band on the dipstick.
- The width of the Hot Run band 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.
- Ensure that fluid level checks are consistent. Check the level more than once. If readings are not consistent, ensure the transmission breather is clean and not clogged. If readings are still not consistent, contact the nearest Allison Service Center.

FUEL SYSTEM
Fuel Requirements

Diesel fuel classified as # 2 is used in moderate and temperate climates. A winter blend of #1 and #2 diesel fuels is available during the winter months in cooler climates (or possibly year-round in extremely cold or arctic areas). The dispensing pump may not indicate winter blend.



100217



100217

LSD (Low Sulfur Diesel) and ULSD (Ultra Low Sulfur Diesel):

Beginning June 1, 2006, 80% of available diesel fuel in the United States will have less sulfur. Beginning October 15, 2006, additional labeling on diesel fuel dispensing pumps will reflect the reduction in sulfur to include Ultra Low Sulfur Diesel (ULSD) and Low Sulfur Diesel (LSD). ULSD fuel contains a maximum sulfur content of 15 ppm (parts per million) while LSD fuel contains a maximum sulfur content of 500 ppm. 2007 and later model year engines and emission systems are designed to use ULSD fuel. Refer to the OEM engine manual for which type of fuel is acceptable for use.

WARNING:
Use of LSD fuel in ULSD engines will damage emission control systems and is subject to fine.

CAUTION:
Engines designed for ULSD fuel require specially formulated motor oil classified by the API (American Petroleum Institute) as category CJ-4.

NOTE:
Some states (including California) have prohibited the sale of Low Sulfur Diesel.

Biodiesel:

Biodiesel is a synthetic fuel made from plant oil or recycled cooking oil. Biodiesel is often sold as a biodiesel/petrodiesel blend with an alphanumeric designation that indicates biodiesel content. For example: B5 is 5% biodiesel and 95% petrodiesel while B100 is 100% biodiesel. Due to variances in biodiesel, its use is restricted by the engine manufacturer. Refer to the OEM engine manual for acceptable biodiesel tolerances.

Tips:

Try to obtain fuel from sources that are serviced often such as large truck service facilities. Fuel supply is fresh and the possibility of introducing contaminants or water into the fuel system is reduced. If the engine runs out of fuel, the fuel system will need to be thoroughly primed before the engine will start and run properly.

WARNING:
DO NOT mix gasoline, alcohol or gasohol with diesel fuel. This mixture can cause an explosion.

NOTE:
Due to the precise tolerances of diesel injection systems, it is extremely important that fuel be kept clean and free of dirt and water. Contaminants in the system can cause severe damage to both the fuel pump and 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 prevent gelling during cold weather. Before adding any type of fuel additive or extender, consult the Manufacturer's Owner's Manual.

Fuel Tank

Pick-up and return lines are placed at opposite ends of the tank to inhibit fuel aeration. The engine pickup tube is cut at a 45° angle to allow optimum flow to the engine. The generator intake tube is set to approximately ¼ of a tank. This will prevent depleting the fuel supply while dry camping.

Internal baffles are installed to 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

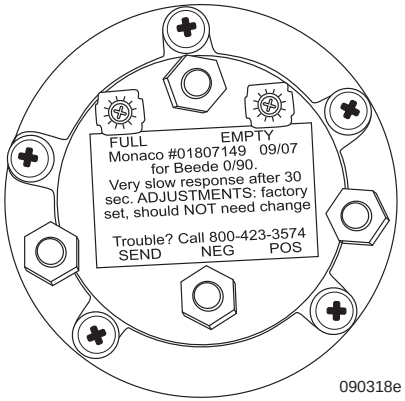
The fuel sender is preset at the Centroid factory. The Centroid fuel sender has no moving parts and works by measuring electrical property between inner and outer tubes in the tank. The more fuel between the tubes the higher the reading. Electronics in the head of the sender convert the capacitance to current to drive the fuel gauge.

Connections:
The Centroid sender has four connections:

1 & 2 - Positive (POS) & 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 the fuel gauge is reading about 1/8 tank). This turns on the fuel indicator on the liquid crystal display on the speedometer and is not adjustable.



090318e

Adjustments:
The Centroid sender has two adjustments:
1 - EMPTY: Adjusts for length of sender. It is set at the factory, covered with a sealant and should not be changed.

2 - FULL (Full Adjustment): The full adjustment can be used to correct for slight differences between fuel meters. During installation it was factory calibrated and does 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.

NOTE:
The adjustment must be made within 30 seconds of turning on power. If not finished, turn the power off and back on to get another 30 seconds of adjustment time. The sender responds too slowly after 30 seconds to changes to allow calibration (damped output).

Troubleshooting:
A. Electronic Output: The sender has a transistorized output to prevent an ohmmeter from getting a correct reading of output resistance.

B. Fuel Only: The sender will not work correctly in conducting fluids such as water (it will read empty all the time in water). One possibility is that when a constant empty reading occurs 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 hoses for leaks daily as part of the pre-start inspection. Check all fittings, clamps and ties. Ensure the hoses are not touching shafts, couplings or heated surfaces, including exhaust manifolds, sharp edges or other obvious hazardous areas. 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

Two filters are used for the engine: a primary and secondary filter. The primary filter is located roadside behind the air conditioner condenser; the secondary filter is found on the engine, curbside.

NOTE:
It is recommended to wear gloves and old clothing when working with diesel fuel. Avoid getting fuel in the interior of the motorhome.

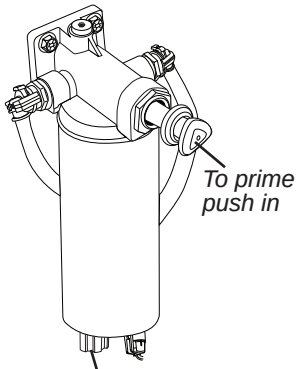
Filter Maintenance Intervals:
- Drain the primary fuel filter daily before travel.
- Change the primary fuel/water separator filter every six months or every 15,000 miles or at the first indication of power loss.
- Refer to the engine OEM manual for service intervals of the secondary fuel filter.

Water in Fuel:
If water in fuel is found in the primary filter, DO NOT continue engine operation. Fuel contaminated with water can damage fuel injectors. Water is heavier than fuel and will collect in the primary filter bowl. Drain primary filter bowl using the valve on the bottom of the filter bowl.

NOTE:
Always carry an extra filter as one tank full of excessively contaminated diesel fuel can plug a filter.

To Drain the Filter:
- Wear safety goggles.
- Shut off the engine.
- Open the drain valve, by hand, counterclockwise approximately 1 1/2 to 2 turns until draining occurs. Drain water/fuel into a container and dispose of in accordance with local environmental regulations.
- Close the drain valve by turning clockwise when clear fuel is visible.

Priming the Engine:
- Fill tank with 30 gallons of fuel or more if parked on a slant.
- Unscrew knob on filter to the out position.
- To prime, push in on knob repeatedly until resistance is met.



- Go inside motorhome and turn ignition key to on for approximately 30 seconds and then off again. This may need to be repeated several times before the system is purged of air.
- Attempt to start the engine.

NOTE:
This procedure may have to be performed a few times.

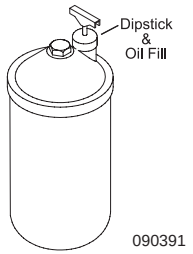
- If unable to start the engine, contact nearest Cummins Center or phone 1-800-343-7357 for Cummins Customer Assistance Center.

HYDRAULIC SYSTEM

On a walk-around and pre-check of the motorhome, look for oil leaks under the motorhome and around hose fittings. 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

The hydraulic filter assembly, located inside the reservoir, is rated at ten micron*. The reservoir is filled with 15W-40 motor oil from the factory.



Located in the rear engine compartment

Filter assembly: Nelson 91085G
Filter number: 84365A (ten micron*)

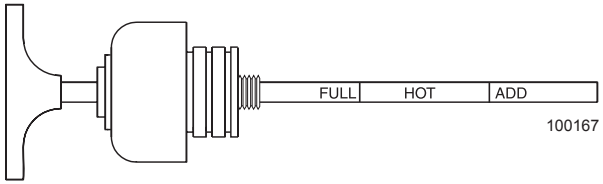
NOTE:
Filter is accurate at time of printing. Confirm part number before ordering or obtaining replacement.

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 dipstick and oil fill are 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. Use only 15W-40 motor oil when adding fluid.

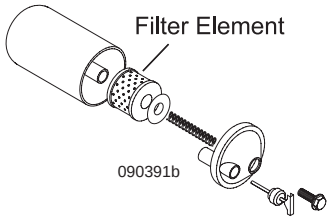
Checking the Fluid Level:

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. Rotate the easy grip handle 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 for the dipstick. **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.



Hydraulic Filter (Power Steering)

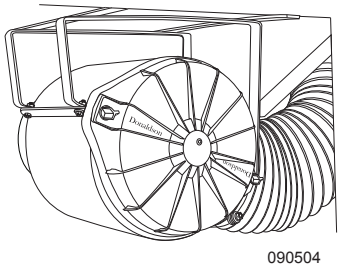
Change the hydraulic oil filter every 15,000 miles (once a year, for cellulose element).

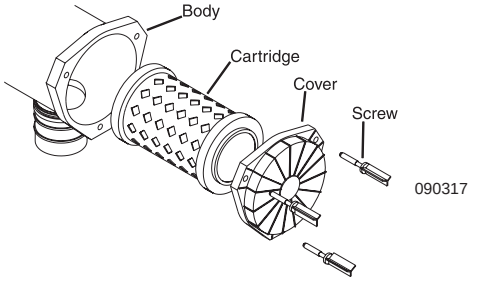


1. Use a 15/16" wrench to loosen the center cover bolt.
2. Remove the bolt and cover plate to access the spring and filter.
3. Remove the spring and washer to remove the filter assembly.
4. After replacing the filter assembly, reverse the process to re-assemble the reservoir.

AIR FILTER

The air filter is located in the roadside rear compartment. 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.





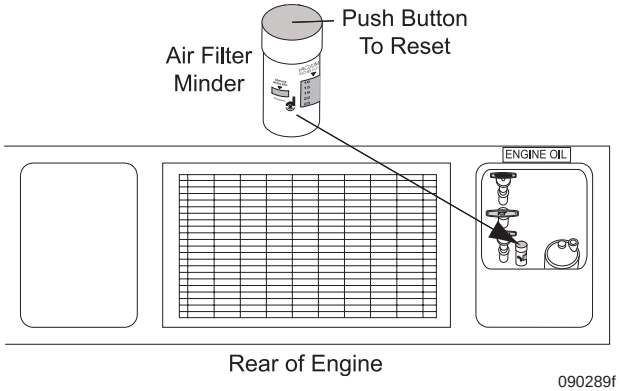
Located in rear roadside compartment

NOTE:
Air Filter Number: Donaldson P533930
Filter is accurate at time of printing. Confirm part number before ordering or obtaining replacement.

WARNING:
DO NOT start the engine with the air cleaner removed and DO NOT remove it while the engine is running.

Air Filter Restriction Indicator

The air filter restriction indicator improves engine efficiency by telling the amount of restriction present in the air intake system, thus indicating when the air filter needs changing. A visual inspection of the air filter is not adequate and should never dictate service life. The air filter restriction indicator is located in the rear engine compartment.



Located in the rear compartment of the motorhome.

What Indicator Does:
- Continuously shows how much life is left in engine air filter (window).
- Continuously reads air flow restrictions in increments (scale).

When To Monitor:
- Inspect indicator before each trip.

When To Change Air Filter:
- When the yellow indicator approaches the red (top) area it is signaling that the air filter is becoming excessively dirty. Service the air filter when the red indicator stays in the window with the engine off.

How To Reset Indicator:
- Push button on top to reset.

NOTE:
If the air filter restriction indicator should become faulty, replace entire unit.

DIESEL PARTICULATE FILTER

The exhaust system is equipped with a DPF (Diesel Particulate Filter) to lower particulate emissions. The DPF traps particulate matter. Naturally occurring exhaust heat oxidizes built up particulate and regenerates the filter. This is called passive regeneration. If passive regeneration is not sufficient, an active regeneration cycle will automatically initiate at speeds greater than 20 mph. Both passive and active regeneration cycles initiate automatically.

WARNING:
Use Ultra Low Sulfur Diesel (ULSD) only. Do not use Low Sulfur Diesel (LSD) with a DPF equipped engine. LSD will damage the DPF, which may cause the Stop Engine light to illuminate and cause the engine to severely derate.

Passive Regeneration:
Passive regeneration uses heat from naturally occurring exhaust gasses to oxidize built-up particulate.

Active Regeneration:
An active regeneration cycle will be initiated if exhaust temperatures are not high enough to regenerate the filter. The motorhome must be traveling in excess of 20 mph for an active regeneration cycle to initiate.


090502

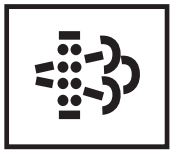
HEST Dash Light

During an active regeneration cycle, diesel fuel is introduced into the exhaust system upstream of the DPF. The fuel will ignite and super-heat the DPF to oxidize particulate matter. The HEST (High Exhaust System Temperature) dash light will illuminate when exhaust temperatures reach 1450º F., indicating that an active regeneration is underway and exhaust system temperatures are elevated above normal levels. These temperature levels may occur for up to 40 minutes. The HEST light will remain on until the exhaust temperature cools to 650º F., which may not be until the engine is turned off and the exhaust system cools before restarting. The HEST light does not indicate a fault as long as there are no other active warning lights.

CAUTION:
Use extreme caution if parking the motorhome while the HEST light is on. The exhaust system and exhaust gas will be extremely hot to the point of fire hazard. Do not park the motorhome on or around anything combustible.

NOTE:
If the engine is turned off during an active regeneration cycle, the cycle will automatically begin again (if necessary) when the motorhome is operated at speeds above 20 mph.

DPF Dash Light:


090502

DPF Dash Light

A DPF (Diesel Particulate Filter) indicator light on the dash illuminates when an active regeneration cycle is necessary and has not been able to initiate. Driving the motorhome above speeds of 20 mph will allow an active regeneration cycle to initiate. The HEST light will turn on when exhaust temperatures reach 1450º F, indicating an active regeneration cycle is underway. Once the DPF is clear of particulate matter the DPF light will turn off.

DPF Light Warning System:

If the DPF remains clogged, there are four stages of the DPF light warning system. The HEST light may illuminate during this sequence, which indicates that an active regeneration cycle is underway. This should successfully regenerate the filter. The only indication that the DPF is clear and in good working order is the DPF light turning back off.

- **Stage One:** The DPF light glows steady. This means that an active regeneration cycle is necessary but has not been able to initiate.
- **Stage Two:** The DPF light flashes. The DPF filter is clogged to the point that the engine will slightly derate (lose power).
- **Stage Three:** The DPF light flashes and the Check engine light turns on. The DPF is clogged to the point that service is required immediately. The engine will severely derate at this point.
- **Stage Four:** The DPF light and Check Engine lights extinguish and the Stop Engine light turns on. Turn off the engine as soon as possible to avoid severe engine and/or system component damage. Do not drive the motorhome in this condition. The DPF will need to be removed for repair.

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, properly recycle or disposed of all waste fluids and filters. Package used oils, antifreeze and other fluids in sealed containers. Waste fluids should not be left in open containers. Used oil may be accepted, free of charge, at most county disposal sites.

Waste fluids are toxic to pets and other animals. Antifreeze has a sweet odor and is attractive to pets, however, it is extremely 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 and 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, 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.

WARNING:
Never place yourself under motorhome without first properly blocking frame (jackstands) from coming down in case of rapid deflation of air system.

Brake actuating components require lubrication to keep the actuating components freely operating. Avoid contaminating brake linings with lubricant. Particular care and attention to detail should be taken when lubricating brake actuating components. Wheel removal may be necessary to gain access the grease fittings.

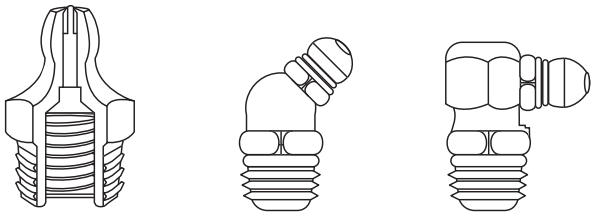
NOTE:
Suspension, steering, brake and drivetrain components are lubricated at factory using NLGI 2 Lithium Soap based grease.

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 remain in 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.

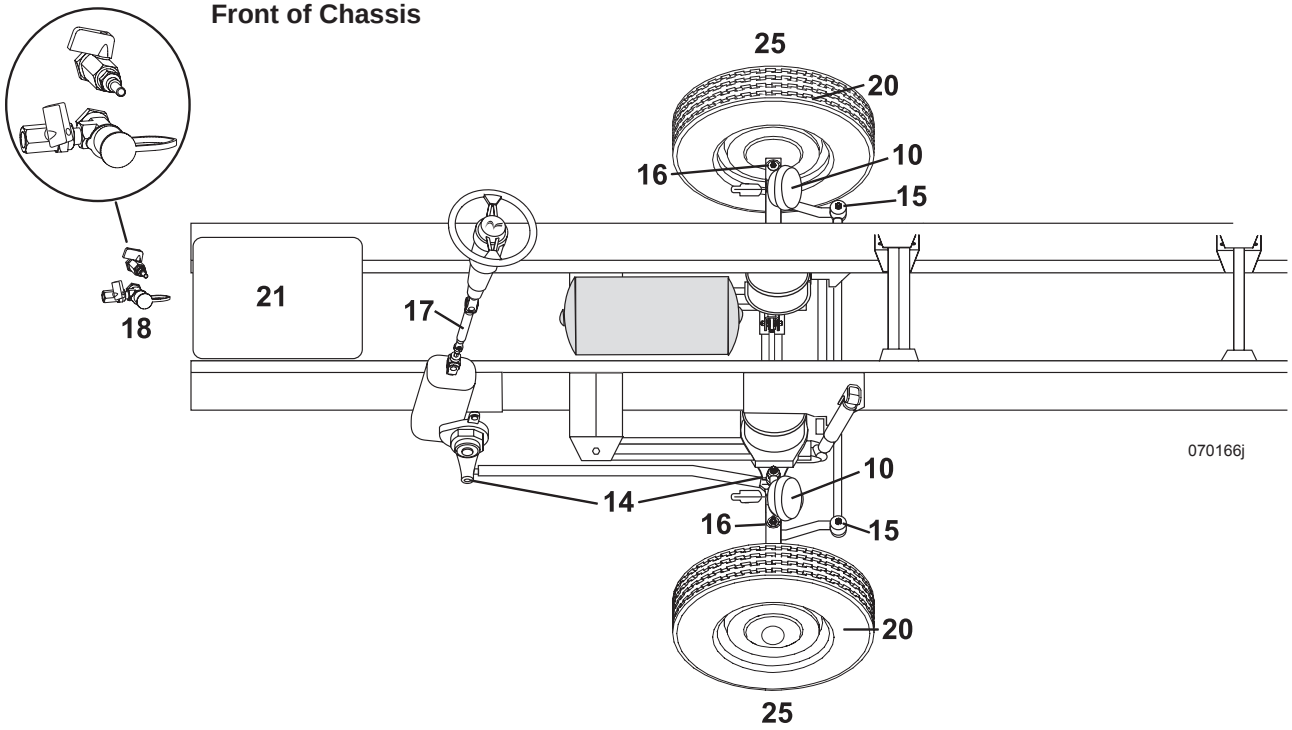
If the component does not accept grease the Zerk fitting may be plugged or damaged. Zerk fittings are replaceable and generally available at most auto supply stores. Zerk fittings come in a variety of angles depending on the application. Every effort should be made to lubricate the component, as neglect will only result in premature component failure.

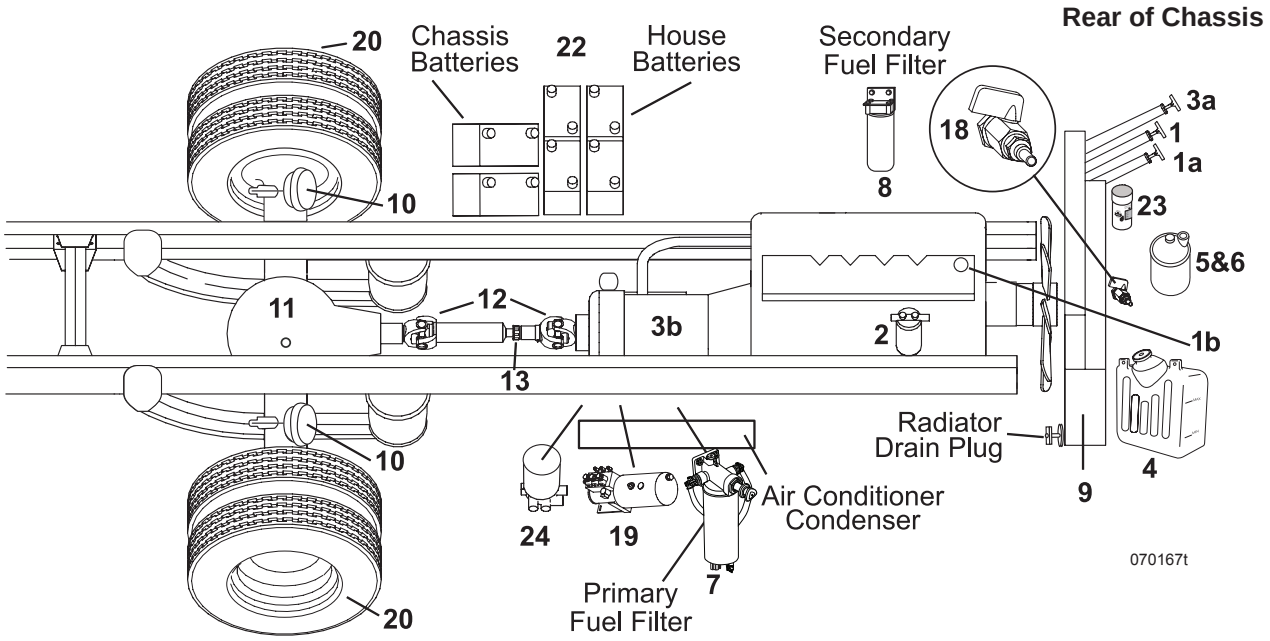
NOTE:
Some grease fittings may not be accessible until the steering wheel is turned or the motorhome is moved slightly.



Typical Zerk Fitting

LUBRICATION CHARTS





	Component:	Action:	When:	Code
1.	Engine Oil Dipstick	Keep to Full Mark	Before Each Trip + Daily Enroute	EO
1a./1b.	Engine Oil Fill	Keep to Full Mark	Before Each Trip + Daily Enroute	EO
2.	Engine Oil Filter	Replace Filter	At Oil Change	OEM
3a.	Transmission Remote Fill	Keep to Full Mark	Refer to OEM Manual	TS
3b.	Transmission Filter	Replace	Refer to OEM Manual	OEM
4.	Engine Coolant Reservoir	Maintain Level	Before Each Trip + Daily Enroute	AF
5.	Hydraulic Fluid Reservoir	Maintain Level	Before Each Trip + Daily Enroute	EO2
6.	Hydraulic Filter	Replace Filter	15,000 or Annually	EO2
7.	Filter Fuel/Water Separator (Primary)	Inspect/Replace	Before Each Trip + Daily Enroute/15,000 or 6 Months	FF
8.	Filter Fuel (Secondary)	Replace	Refer to OEM Manual	OEM
9.	Radiator/Charge Air Cooler	Inspect	Weekly	OEM
10.	Slack Adjuster/Cam Shaft	Grease-2 Fittings ea.	10,000 or 3 Months	CL
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.	Intermediate Steering Shaft	Grease-3 Fittings	30,000 or Annually	CL-4
18.	Air Tank Drains	Drains	Monthly	-
19.	Power Gear Hydraulic 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.	Air Dryer Filter	Replace	2 to 3 Years	--
25.	Wheel Bearings	Re-pack	30,000 Miles or Annually	HT

Lubrication Code Chart:	
*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 - Penzoil Gear Plus Super-ew 75w-90, Synthetic.
*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	Dexron 3 Mecron ATF hydraulic fluid
*AF	Antifreeze as recommended by the engine manufacture.
FF	Fuel Filter
HT	High Temperature Bearing Grease
*TS	TranSynd™
DW	Distilled Water
P	Petroleum Jelly
EO2	15W-40 Engine Oil
CL-4	U-Joints located inside the motorhome under the steering cover use chassis lubricant.

**Fluids initially filled at factory.*

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 Owner's Manual for the generator service interval.

SPECIFICATIONS CHARTS

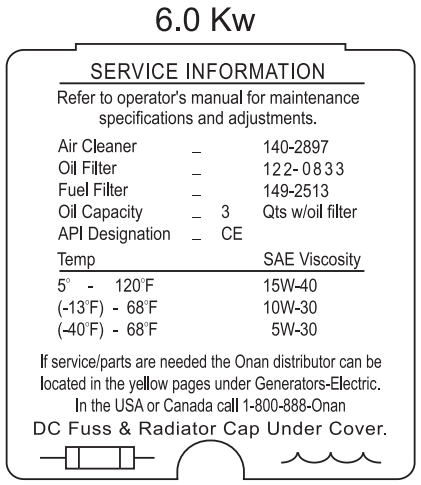
Engine Specifications

ENGINE SPECIFICATIONS	ISB 340HP
Cubic Inch Displacement	6.7L/409 CI
Engine HP	340 HP @ 2800 RPM
Engine Torque	660 lbs./ft. @ 1600 RPM
Governed Speed	2800 RPM
Firing Order	153624
Rear Axle Ratio	4.78:1
Alternator Amp Size	160 Amp
Idle Speed	750 RPM

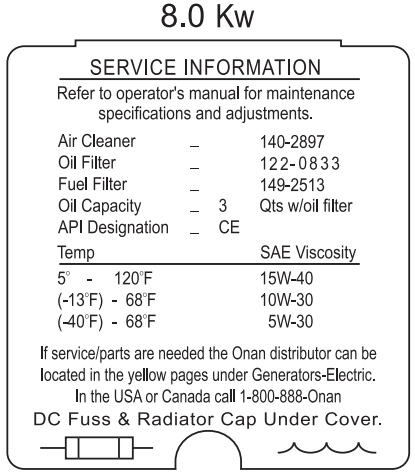
Chassis Fluid Capacities

CHASSIS LIQUID CAPACITIES	ISB 340HP
Engine Oil	17 Qts. Approx.
Transmission Oil (initial amount)	14.8 Qts.
Transmission Oil (w/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	15 Qts. Approx.

Generator Specifications



Generator Specifications label. 020159V



Generator Specifications label (optional). 020159o

NOTE:
Generator specification label is accurate at the time of printing. The generator manufacturer reserves the right to make changes. Confirm filter numbers before ordering or obtaining replacement.

Tank Capacities

Tank Capacities (Approx. Gallons) All Models	
Water Heater	10 gallons
Grey Water	55 gallons
Black Water	39 gallons
Fresh Water	95 gallons
Diesel Fuel	75 gallons
LP-Gas*	39 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:
The charts reflects product specifications available at the time of printing. Therefore any floor plans introduced thereafter may not be reflected in the charts. All other information contained throughout the manual will still apply.

Belts & Filters

Filters & Belts	Manufacturer	Number
Oil Filter	Fleetguard	LF 3970
Fuel Filter (Primary)	Fleetguard	FS 1065
Fuel Filter (Secondary)	Fleetguard	FF 5632
Air Filter	Donaldson	P533930
Alternator Belt	Cummins	3289963
Power Steering Filter	Nelson	84365A

NOTE:
Filters and belt numbers are accurate at the time of printing. Confirm part numbers before ordering or obtaining replacement. The manufacturer will not responsible for incorrect filter or belt usage. Please refer to engine manufacturer's operating instructions for specific maintenance information.

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 (optional) 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 (optional) 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.

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											
7											
8											
9											
10											
11											
12											
13											
14											
15											
16											
17											
18											
19											
20											
21											
22											
23											
24											
25											
26											
27											
28											
29											
30											

BATTERY RECORD						
MAKE	TYPE	DATE INSTALLED	REPAIRS	DATE REPLACED	SERVICE	
					MONTHS	MILES

TIRE RECORD							
MAKE	TYPE	PLY	DATE INSTALLED	REPAIRS	DATE REPLACED	SERVICE	
						MONTHS	MILES

TECHNICAL PUBLICATIONS

MANAGER:
Vance Buell

OPERATIONS
Technical Writers
William Birch - OR
Nate Bondurant - OR
Thomas Joachim - IN
Claudia Price - IN

Creative Designers
Kelly Stroble - OR
Aaron Graham - OR
Julie Karnes - IN

ILLUSTRATIONS:
Kelly Stroble, Aaron Graham,
Dustin Hutchcraft

PRINTING
Holiday Graphics - IN

ONLINE
Corporate Site: www.monaco-online.com

ONLINE TOURS
www.monaco-online.com/tours/

2008 CAYMAN OWNER'S MANUAL

Technical Writer:
Thomas Joachim

Manual Layout & Cover Design:
Kelly Stroble

A

B

C

D

E

F

G

H

I, J, K

L

M, N

O

P, Q

R

S

T, U, V

W, X, Y, Z

Notes