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**WARRANTY - LIMITED:
NEPTUNE 2005**

HOLIDAY RAMBLER MOTORHOME LIMITED WARRANTY

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

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

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

Limitations of Implied Warranties

ANY IMPLIED WARRANTIES 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. Also see the section "What the Warranty Does Not Cover" set out below.

What We Will Do to Correct Problems

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

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

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

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

How to Get Service

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

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

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

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

What the Warranty Does Not Cover

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

Events Discharging Warrantor from Obligation Under Warranty

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

Disclaimer of Consequential & Incidental Damages

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

THESE WARRANTIES ARE NOT INTENDED TO "EXTEND TO FUTURE PERFORMANCE." ANY ACTION TO ENFORCE THESE EXPRESS OR ANY IMPLIED WARRANTIES SHALL NOT BE COMMENCED MORE THAN NINETY (90) DAYS AFTER THE EXPIRATION OF THE ONE YEAR WARRANTY COVERAGE PERIOD DESIGNATED ABOVE. IF YOU USE YOUR MOTORHOME FOR COMMERCIAL OR BUSINESS PURPOSES, ANY ACTION TO ENFORCE THESE EXPRESS OR ANY IMPLIED WARRANTIES SHALL NOT BE COMMENCED MORE THAN ONE YEAR AFTER THE EXPIRATION OF THE NINETY (90) WARRANTY COVERAGE PERIOD DESIGNATED ABOVE. THE PERFORMANCE OF REPAIRS SHALL NOT SUSPEND THIS LIMITATIONS PERIOD FROM EXPIRING. THESE TERMS AND ALL EXPRESS AND IMPLIED WARRANTY DISPUTES BETWEEN WARRANTOR AND PURCHASER SHALL BE GOVERNED BY THE SUBSTANTIVE LAWS OF THE STATE OF INDIANA, WITHOUT REGARD TO CONFLICTS OF LAW RULES. Some states do not allow the reduction in the statute of limitations or a choice of law provision, so the above reduction in the statute of limitations and/or choice of law provision may not apply to you.

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

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WARRANTY - LIMITED: 2005 ROADMASTER CHASSIS

ROADMASTER CHASSIS LIMITED WARRANTY

What the Period of Coverage Is:

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

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

Limitations of Implied Warranties

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

What the Warranty Covers

Warrantor's Limited Warranty covers defects in the manufacture of the Roadmaster Chassis and defects in materials used to manufacture the Roadmaster Chassis.

What We Will Do to Correct Problems

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

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

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

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

How to Get Service

For warranty service simply contact one of Warrantor's authorized service centers for an appointment, then deliver your Roadmaster Chassis (at your expense) to the service center. If you need assistance in locating an authorized warranty service facility, contact Warrantor's **Warranty Department (1-877-466-6226)**. The mailing address is:

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

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

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

What the Warranty Does Not Cover

This Limited Warranty does not cover: modifications and alterations to the Roadmaster Chassis by others; the motorhome that is mounted upon the Roadmaster Chassis, including by way of example the motorhome manufacturer's design, manufacture, assembly and/or installation of the side walls, roof, windows, flooring, electrical system, plumbing system, LP-Gas system, appliances and slide outs; items that are working as designed but which you are unhappy with because of the design; normal wear and usage; routine maintenance including by way of example wheel alignments; component parts covered by their own manufacturer's warranty, including by way of example the engine, transmission, tires, tubes, batteries, exhaust system and the emission control systems; and, flaking, peeling rusting and chips or other defects or damage in or to the frame and frame cross members caused by rocks or other road hazards and the environment including airborne pollutants and salt.

Events Discharging Warrantor from Obligation Under Warranty

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

Disclaimer of Consequential & Incidental Damages

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

Legal Remedies

THESE WARRANTIES ARE NOT INTENDED TO "EXTEND TO FUTURE PERFORMANCE." ANY ACTION TO ENFORCE THESE EXPRESS OR ANY IMPLIED WARRANTIES SHALL NOT BE COMMENCED MORE THAN NINETY (90) DAYS AFTER THE EXPIRATION OF THE ONE YEAR WARRANTY COVERAGE PERIOD DESIGNATED ABOVE. IF YOU USE YOUR ROADMASTER CHASSIS FOR COMMERCIAL OR BUSINESS PURPOSES, ANY ACTION TO ENFORCE THESE EXPRESS OR ANY IMPLIED WARRANTIES SHALL NOT BE COMMENCED MORE THAN ONE YEAR AFTER THE EXPIRATION OF THE NINETY (90) DAY WARRANTY COVERAGE PERIOD DESIGNATED ABOVE. THE PERFORMANCE OF REPAIRS SHALL NOT SUSPEND THIS LIMITATIONS PERIOD FROM EXPIRING. THESE TERMS AND ALL EXPRESS AND IMPLIED WARRANTY DISPUTES BETWEEN WARRANTOR AND PURCHASER SHALL BE GOVERNED BY THE SUBSTANTIVE LAWS OF THE STATE OF INDIANA, WITHOUT REGARD TO CONFLICTS OF LAW RULES. Some states do not allow the reduction in the statute of limitations or a choice of law provision, so the above reduction in the statute of limitations and/or choice of law provision may not apply to you.

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

**Roadmaster Chassis Division
Monaco Coach Corporation
91320 Coburg Industrial Way
Coburg, Oregon 97408**

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WARRANTY INFORMATION FILE

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

Additional Information:

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

MANUAL ADDENDUMS

www.monaco-online.com

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

WOOD FINISH

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

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

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

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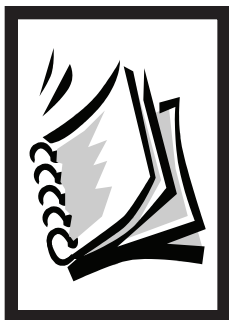
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The information contained in this document is intended to reflect standard and optional equipment included in a typically equipped model at the time of delivery to the initial retail owner. Your actual unit may vary from this document as a result of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

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

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GENERAL INFORMATION

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Safety Terms:

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

WARNING:

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

CAUTION:

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

POISON:

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

NOTE:

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

INSPECTION:

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

LUBE:

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

ASSEMBLE or REPAIR:

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

INFORMATION:

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

TIP:

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

CUSTOMER RELATIONS

Only by ensuring your confidence and satisfaction with our products and services can we have continued success as a manufacturer of motorhomes. We believe a good relationship with our customers is just as important as improving the technical excellence of our products. Your authorized dealer is pleased to help you with instructions about your motorhome and to offer service when you need it. If problems remain after you have consulted your dealer you are invited to contact our Customer Service Department. Please have all pertinent information (serial numbers, model number, etc.) when calling. We will work with the dealer and see that every attempt to resolve the matter is made.

**Customer Service Department
91320 Coburg Industrial Way
Coburg, Oregon 97408
877-466-6226**

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 (MCC). If NHTSA receives similar complaints, it may open an investigation, and if it finds that a safety defect exists in a group of motorhomes, it may order a recall or remedy campaign. However, NHTSA cannot become involved in individual problems between you, your dealer or MCC. To contact NHTSA you may either call the Auto Safety Hot line toll-free at 1-800-424-9393 (or 1-202-366-0123 in the Washington D.C. area) or write to:

**NHTSA
U.S. Department of Transportation
400 7th Street, S.W.
Washington, DC 20590
www.nhtsa.dot.gov**

TAKING DELIVERY *Holiday Rambler Responsibilities*

Your motorhome has been manufactured to the highest quality and standards by factory trained personnel. Quality inspections are performed throughout the manufacturing process of your motorhome. The motorhome has been carefully and almost completely hand assembled in our factory. Prior to the motorhome arriving at the dealership, all systems have been carefully tested and inspected to ensure optimum performance. The necessary forms and required manuals have been placed in the motorhome at the time of shipment to the dealership.

Dealer Responsibilities

The dealer must perform additional pre-delivery inspections and system checks, assist in the customer's understanding of the Limited Warranty and assist in completing any necessary forms. They must do a customer orientation to the motorhome, its systems, components and their operation.

The dealer should also ensure the customer receives a complete Owner's Packet with warranty cards and registrations for the motorhome and for separately warranted products, including detailed operating and maintenance instructions. The dealer is responsible for performing a review of the Limited Warranty provisions with the customer, while stressing the importance of mailing warranty cards and registrations to the manufacturers within the prescribed time limit to avoid loss of warranty coverage. They must assist the customer in completing these forms and locating serial numbers. They should request that the customer reads all warranty information when possible and explain any provision not clearly understood.

The dealer should instruct the customer on how to obtain local and out-of-town service on the motorhome and its various individual warranted components, whether the service is warrantable or out of warranty.

Customer Responsibilities

As a new motorhome owner you are responsible for regular and proper maintenance. This will help you prevent conditions arising from neglect that are not covered by your Limited Warranty. Maintenance services should be performed in accordance with this Owner's Manual, and any other applicable manuals. As the owner, it is your responsibility and obligation to return the motorhome to an authorized dealer for repairs and service (See the Limited Warranty). Since the authorized dealer where you purchased your new motorhome is responsible for its proper servicing before delivery, and has an interest in your continued satisfaction, we recommend that Inspection, Warranty and Maintenance Services be performed by the dealership. We suggest that you take your new motorhome on a weekend shakedown before leaving on an extended trip.

SERVICE SUGGESTIONS

Know when to take your motorhome in for service. Give some thought to the appointment time. There are several things to consider when selecting a time for service. Location of the service center and the time of year can be a major issue. Monday and Friday are busy days for most dealers. Therefore, it makes sense to make a mid-week appointment whenever possible. Ask your dealer if additional time is needed for check in and completion of paperwork.

Prepare for the Appointment

If you're having warranty work done, be sure to have your warranty registration papers with you. All work to be performed may not be covered by the warranty; be sure to discuss additional charges with the service manager. Keep a maintenance log of your motorhome service history. This can often provide a clue to the current problem.

Prepare a List

Make a written list of specific repairs needed. It is important the service manager be aware of all previous work which has been done on your motorhome. For example: if the motorhome has been repaired due to an accident. While this may not seem important, it could have a significant effect on the dealer's diagnosis of a problem.

Be Reasonable With Your Requests

Do not leave a list of 20 items to be serviced and expect to have the motorhome back by 5:00 p.m. If you list a number of items, and must have your motorhome back by the end of the day, discuss the situation with the service manager and list items in order of priority. Some items may not be able to be repaired due to work loads or parts availability. Expect to make a second appointment for work not completed or for the long, drawn-out repair item.

No Looking Over the Technician's Shoulder

Please do not be offended when you are told you cannot watch the work being done. Many service area insurance requirements forbid the admission of customers into the service work area.

Inspect the Work Properly

Check out the service or repair job when you pick up your motorhome and notify the service manager of any dissatisfaction. If circumstances prevent returning for immediate corrective work, make an appointment as soon as possible.

GLOSSARY OF TERMS

AC Electricity - Alternating current also known as household power.

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

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

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 air compressor is building air pressure in an air system.

Compressor Unload Cycle - The time during which the air compressor is idling and is not building air 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 the passenger's side.

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

Current - Alternating (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.

Current - Direct (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.

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

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

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

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.

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

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

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

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

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

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

LED - (Light Emitting Diode) Indicator light.

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

OEM - Term for Original Equipment Manufacturer.

OHM - A unit for measuring electrical resistances.

Ohm's Law - Expresses the relationship between Volts (E) and 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 blast of air from the air tank Auto Purge valve expels moisture from the air tank with every brake application.

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's side.

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

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

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

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

VIM - Vehicle Interface Module. Component used to interface engine and transmission functions with the motorhome chassis operation.

Volt - The unit of measure for electric potential.

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

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

Air Bags

Firestone
317-818-8600
www.bridgestone-firestone.com

Air Conditioner - Dash

SCS/Frigette
800-545-6341
www.scsfrigette.com

Air Conditioner - Roof

Dometic Corp.
219-463-4858
www.dometic.com

Air Filter

Donaldson
800-374-1374
www.donaldson.com

Alternator

Leece-Neville
800-346-8093
www.prestolite.com

Awnings

Carefree
800-621-2617
www.carefreeofcolorado.com

Axle - Front

West Port
216-431-2000
www.westportaxle.com

Axle - Rear

Dana Spicer
800-666-8688
www.dana.com

Batteries

Interstate
800-272-6548
www.interstatebatteries.com

Battery Isolator

Intellitec
800-251-2408
www.intellitecsve.com

Brakes - Anti-Lock Brake System

Meritor Wabco
800-535-5560
www.meritorauto.com

Brakes - Hydraulic

Bosch Braking System Corporation
800-521-5462
www.boschusa.com

Brakes - Auxiliary/Exhaust

Pac Brake
800-663-0096
www.pacbrake.com

Carbon Monoxide Detector

Safe-T-Alert
800-383-0269
www.safe-t-alert.com

Cooktop

Atwood
800-873-4328
www.atwoodmobile.com

Countertops

DuPont Corian®
800-426-7426
www.corian.com

Dumping System (Optional)

RV Sanicon
866-410-1965
www.emptythetanks.com

DVD Player/Home Theater System

RCA
877-266-2728
www.RCA.com

Dash Radio

Magnadyne
800-638-3600
www.magnadyne.com

Energy Management System (Optional)

Intellitec
800-521-2408
www.intellitecsve.com

Engine

Cummins
800-343-7357
www.cummins.com

Entertainment System - Exterior (Optional)

Audiovox
800-229-1235
www.audiovox.com

Entry Step

Coach Step
800-275-7524
www.scsfrigette.com

Fan - Exhaust

Fan-Tastic Vent
800-521-0298
www.fantasticvent.com

Faucet

Price Pfister
800-732-8238
www.pricepfister.com

Filter - Fuel (Primary)

Racor Fluid Filters
800-344-3286
www.parker.com/racor/

Filter - Fuel (Secondary)

Cummins
800-343-7357
www.cummins.com

Filter - Hydraulic

Fleetguard/Nelson
800-223-4583
www.fleetguard.com

Fire Extinguisher

Kidde
800-654-9677
www.kiddesafety.com

Flooring - Carpet

Shaw
888-946-2294
www.shawonline.com

Flooring - Congoleum

Congoleum
800-274-3266
www.congoleum.com

Flooring - Plank

Wilson Art
800-433-3222
www.wilsonart.com

Fuel Sender

Centroid Products
800-423-3574
www.centroidproducts.com

Furnace

Atwood
800-873-4328
www.atwoodmobile.com

Generator

Onan
800-888-6626
www.onan.com

Hitch

All American Fabricating
888-420-7979
www.allamericanfab.com

Home Theater

RCA
877-266-2728
www.rca.com

Inverter

Xantrex Technology
800-446-6180
www.xantrex.com

Leveling System - Hydraulic

RVA
760-746-5732
NO WEBSITE

Liquefied Petroleum Protectors

MTI Industries
800-383-0269
www.mtiindustries.com

LP-Gas Tank

Manchester
800-877-8265
www.mantank.com

Microwave

Sharp Electronics Corp.
800-237-4277
www.sharp-usa.com

Monitor Panel

KIB Enterprises
574-294-1504
www.kibenterprises.com

Outside Mirrors

Ramco Industries, INC.
800-321-4819
www.ramco-eng.com

Power Converter

Progressive Dynamics
616-781-7802
www.progressivedyn.com

Power Sunvisor

Carefree
800-621-2617
www.carefreeofcolorado.com

Rear Vision Camera

Weldex
562-404-8736
www.weldex.com

Refrigerator

Norcold
800-543-1219
www.norcold.com

Shock Absorbors

Monroe
800-880-7580
www.tennecoautomotive.com

Slide-Out Motor

Power Gear
800-334-4712
www.powergearus.com

Smoke Detector

MTI Industries
800-383-0269
www.mtiindustries.com

Steering Gear

Sheppard
717-637-3751
www.rhsheppard.com

Television

RCA
877-266-2728
www.rca.com

Television Antenna

Winegard
800-288-8094
www.winegard.com

Tires

Goodyear Tire & Rubber
800-322-4682
www.goodyear.com

Toilet

Thetford
800-521-3032
www.thetford.com

Transfer Switch

IOTA Engineering
800-866-4682
www.iotaengineering.com

Transmission

Allison Transmission
800-524-2303
www.allisontransmission.com

Transmission Shift Pad

Arens Controls
847-844-4700
www.arencontrols.com

VCR (Optional)

RCA
877-266-2728
www.rca.com

Video Selector Box

Winegard
800-288-8094
www.winegard.com

Washer/Dryer (Optional)

Splendide
800-736-4127
www.splendide.com

Water Heater

Atwood
800-873-4328
www.atwoodmobile.com

Water Filter - Flow Pur

Flowmatic System, Inc.
800-461-4406
www.flowmatic.com

Water Pump

ShurFlo
800-854-3218
www.shurflo.com

Wheels - Simulators

Wheel Masters
800-325-9484
www.wheelmasters.com

Windshield Wipers

AM Equipment
541-327-3362
www.amequipment.com

Limited Warranty Transfer Application/Change of Owner Information

Mail to:

Monaco Coach Corporation
P.O.Box 465
Wakarusa, IN 46573
ATTN: Warranty Registration

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) Prod/Coach # (6 digits)

B. New Owner Information, Transfer Coverage To:

First Name Initial Last Name Phone Number

Street Address Date of Transfer (If Applicable)

City State Zip Odometer Reading at Transfer (If Applicable)

C. Signatures:

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

Terms & Representations

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

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



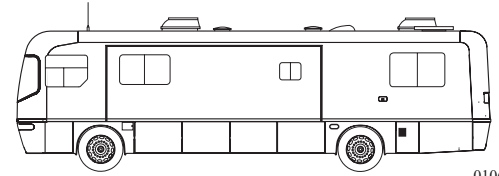


NEPTUNE 2005

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



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NOTE:

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

Inspections

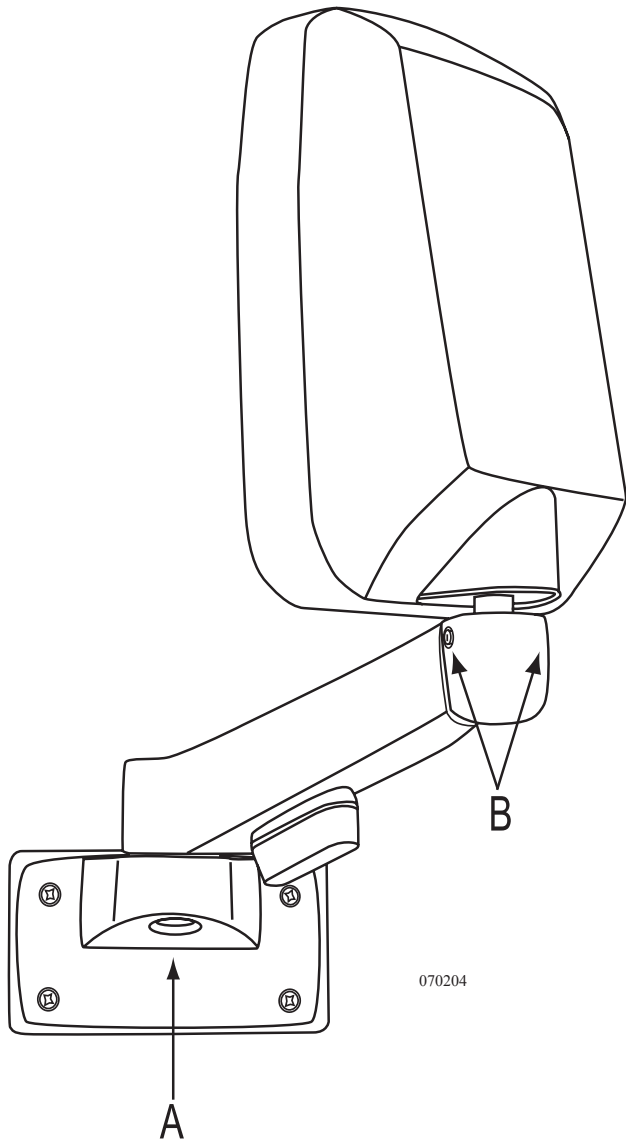
There are significant differences between a passenger automobile and a motorhome. Always be aware of these differences when traveling. The key to safely operating a motorhome is **inspection**. Undetected problems could cause problems on the road and may result in lost time and increased repair costs. **Several states require a special license endorsement and 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**, which includes examining the condition of the motorhome and the surrounding area of the motorhome. Look high and low when walking around the motorhome.

Familiarize Yourself

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

Mirror Adjust (Manual)

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

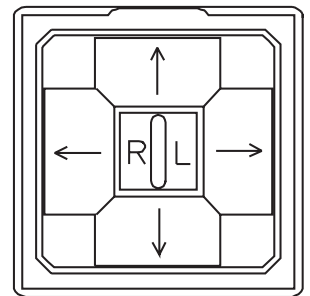


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Mirror Adjusting:

- Tools needed: A 3/16" Allen wrench and a 3/4" socket.
- Adjust the driver seat to travel position.
- Using a 3/4" socket, have the assistant loosen the bolt located at the base of the mirror (see A on illustration).
- Adjust the mirror for a clear side view of the motorhome.
- Tighten the base bolt once proper adjustment is made.
- To adjust the head of the mirror, loosen the Allen screws located at point B. Adjust to the left or the right.
- Ensure Allen set screws and bolt are tight.

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

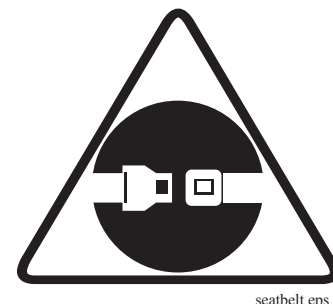


Mirror Adjust Switch

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Safety Seat Belts

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



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

WARNING:

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

Child Safety Seat:

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

WARNING:

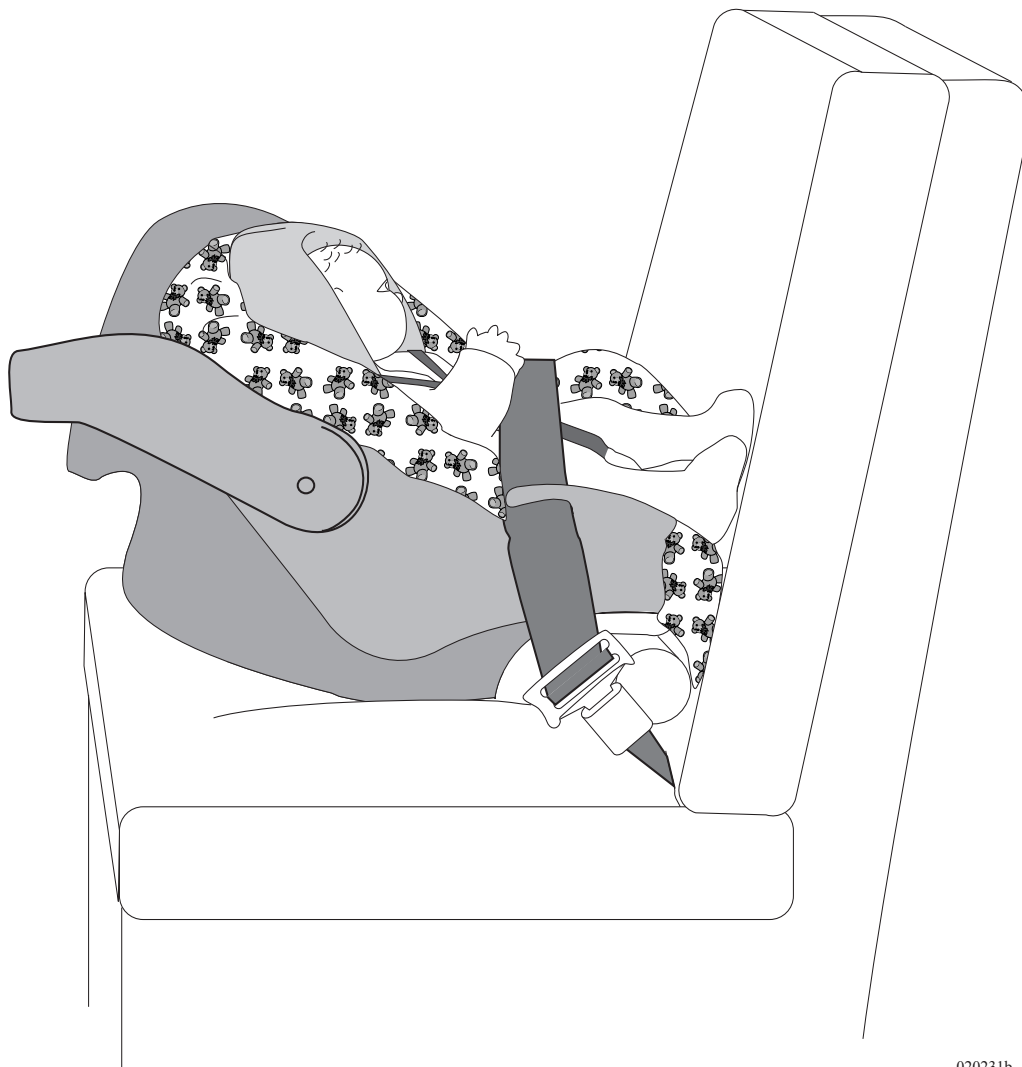
Children must not be transported unrestrained. Infants must be placed in approved safety seats. Small children must be restrained in child safety seats. Do not use a single seat belt on more than one child. Failure to comply with these rules can lead to injury or death.

NOTE:

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

A child safety seat is required for any child:

- **Infants** - from birth to one year, or up to 21 pounds, the child is considered an infant. A (convertible) safety seat for an infant must be secured facing rearward. The top of the head must be below the top of the safety seat. Secure safety seat harness straps at or below the shoulders. (See Example 1).



020231b

Example 1: Convertible Seat Facing to the Rear.

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



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Example 2: High back booster seat facing forward.

WARNING:

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

NOTE:

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

Seat Belt Care:

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

Driving Tips

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



downhill.eps

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 the transmission 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 or engine brake in conjunction with the service brakes to help maintain a safe slow speed of descent. The transmission and engine will help control downhill speed and can extend the service life of the brake lining. The distance required to stop the motorhome is greater than an automobile. The brakes are designed for the (GVWR) Gross Vehicle Weight Rating. Practice stopping away from traffic to get the “feel” of distance required to stop the motorhome.

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

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

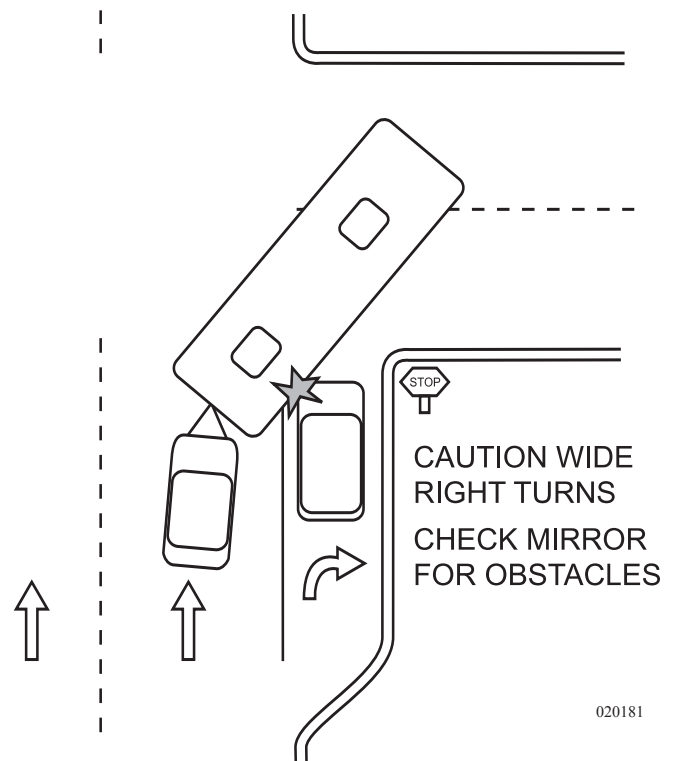
Driving Cautions:

- Avoid getting too close to the edge of the road, a soft shoulder may not support the weight of the motorhome.
- Side spacing is best maintained by keeping the motorhome centered in the driving lane.
- Driving lanes in work zones can be uneven, congested and narrower than usual.
- Be cautious of road debris which can damage the undercarriage of the motorhome or become lodged in the dual tires causing damage to the tires, wheel rims or tow car.
- Keep in consideration that posted speed signs are passenger automobile rated. Therefore, an extra awareness of the driving conditions and appropriate speed for a motorhome are necessary, especially on corners and mountain roads.
- Downgrade speed should be at least 5 mph less than upgrade speed, or downgrade speed should be attainable within three seconds of a brake application.
- Use a four second rule when following other vehicles at speeds under 40 mph. 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 your hips should be parallel to the roadside curb of the corner being turned. This will aid in avoiding a premature turn.
- Make the turn slowly.
- Check mirrors frequently. Stay aware of necessary clearance and space management of the motorhome while negotiating the turn.



Left Turns:

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

Ascending a Grade:

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

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

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

IMPORTANT SAFETY TIP:

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

Descending a Grade:

Prepare to descend a grade at the crest of the hill. Observe 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 the Exhaust Brake switch. When the Exhaust Brake switch is on, the Exhaust Brake will activate 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 service brakes using moderately heavy pressure on the brake pedal to reduce speed and manually downshift to maintain a safe slow speed. Do not "pump" the brakes as this can result in a loss of air pressure. Avoid "riding" the brakes as this can cause the brakes to overheat. Either method can result in loss of brake effectiveness or brake failure.



Night Driving:

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

Extreme Heat and Hot Weather Conditions:

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

Winter and Cold Climate Conditions:

- The motorhome should be prepared for Cold Weather Use.
- Keep speeds slow and steady. Make moves gradually and increase visual distance for a gain in reaction time.
- If road or weather conditions are treacherous find a safe stopping place and wait for conditions to improve.
- Avoid using 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.

Wet Conditions:

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

Fuel Economy:

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

Guidelines to Help Increase Fuel Efficiency:

- When starting out, apply the throttle lightly and accelerate gradually. Avoid using excessive throttle and accelerating quickly.
- Check the tire pressure. A low tire is not only a safety hazard, but also increases rolling resistance to increase fuel consumption.
- While operating the motorhome, keep the engine at a low to mid operating range of 1100 to 1500 RPM. This will use less fuel than operating at higher RPM.
- Avoid using full throttle when ascending a long hill. This wastes fuel and increases engine operating temperature from incomplete combustion. Manually shift to a lower gear and use less throttle. 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 raises. The engine is now ready for travel. Whenever coolant temperature is below 160° F (idling engine) incomplete combustion occurs, causing carbon build-up and raw fuel to wash lubricating oil from the cylinder walls and dilute the crankcase oil.
- Excessive idling (more than 10 or 15 minutes) can clog fuel injectors, 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.
- Follow the maintenance schedule for the engine.

Refueling:

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

WARNING:

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

PRE-TRIP PREPARATIONS - CHECKLIST

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

INFORMATION:

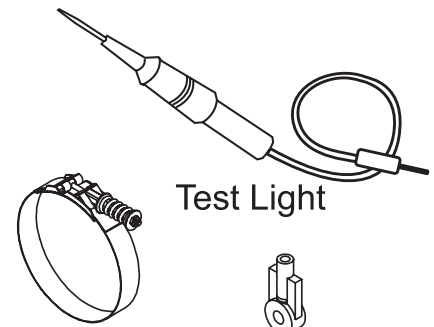
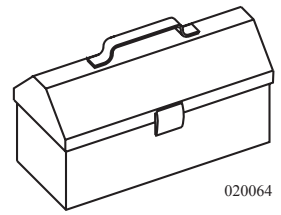
For chassis maintenance details, please refer to the chassis section.

Items To Carry:

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

Interior Items:

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



Test Light

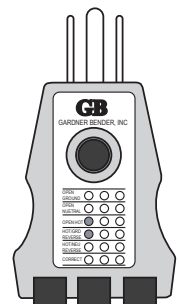


T-Bolt
Clamp



Link

090333b



Polarity Tester

Exterior Items:

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

Engine Checklist:

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

Driving Preparations:

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

Storing Cargo:

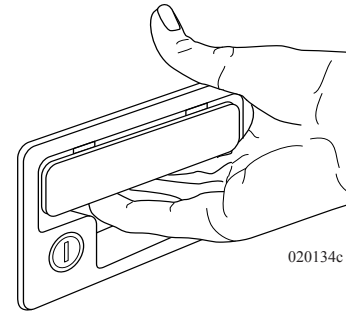
Exercise caution when opening storage bays as cargo may shift during travel. When closing the bay doors, keep fingers clear of openings.

CAUTION:

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

WARNING:

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



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

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

Guidelines for Loading the Motorhome:

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

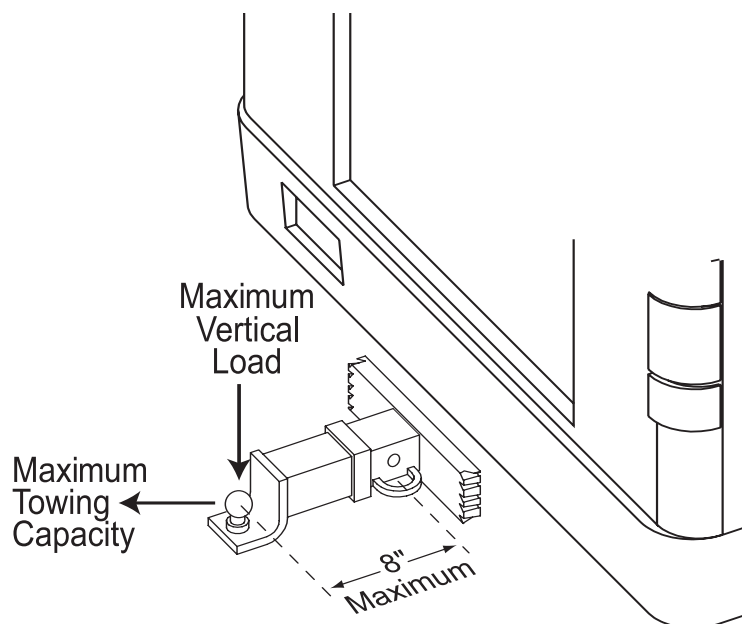
TIPS:

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

HITCH - Using the Rear Receiver

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

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




020065d

WARNING:

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

WARNING:

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

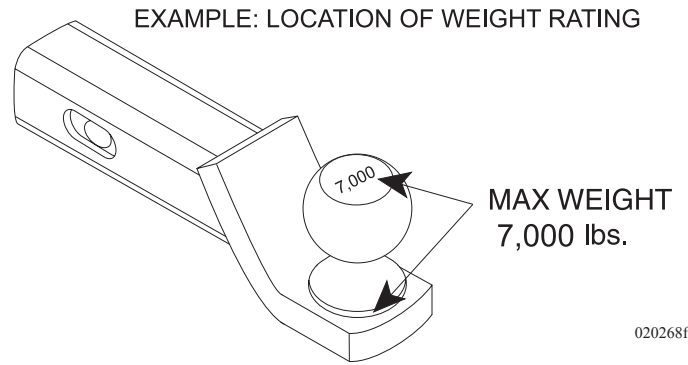
 MONACO COACH CORPORATION	Do Not Cut, Weld or Modify	03213019
	Do Not Exceed Vehicle Ratings	
	Maximum Towing Capacity 7,000Lbs. (3,175Kg.)	
	Maximum Vertical Load 700 Lbs. (317Kg.)	
	Any Towed Vehicle or Trailer Over 1000 lbs (454 kg) Should Have Separate Functioning Brake System.	
	Refer To Owner's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

Coburg, Oregon
Springfield, Oregon
Wakarusa, Indiana
Elkhart, Indiana
Nappanee, Indiana

100200b

Tow Car or Trailer:

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



WARNING:

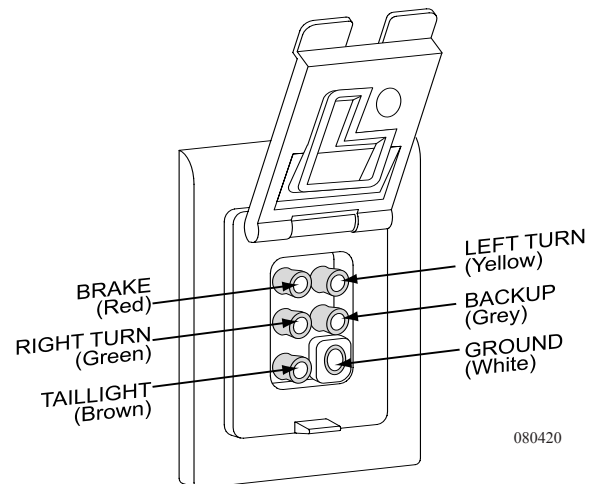
Be sure the weight ratings of the ball mount, tow ball and safety chains are equal to or greater than the load. The use of an extension to the receiver or extended ball mount will significantly reduce hitch receiver weight ratings. Modifications to the hitch receiver, or use of the hitch receiver other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

Tow Plug Connection

The motorhome is prewired with a trailer wire harness. The harness is located on or near the hitch receiver. Convuluted tubing protects the tow harness wires. Current draw should not exceed ten amps for each designated circuit.

NOTE:

When towing a trailer or vehicle with a two-wire system, a turn signal/brake light converter will be needed to adapt the tow plug wiring to the item being towed.



REAR VIEW SYSTEM

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

NOTE:

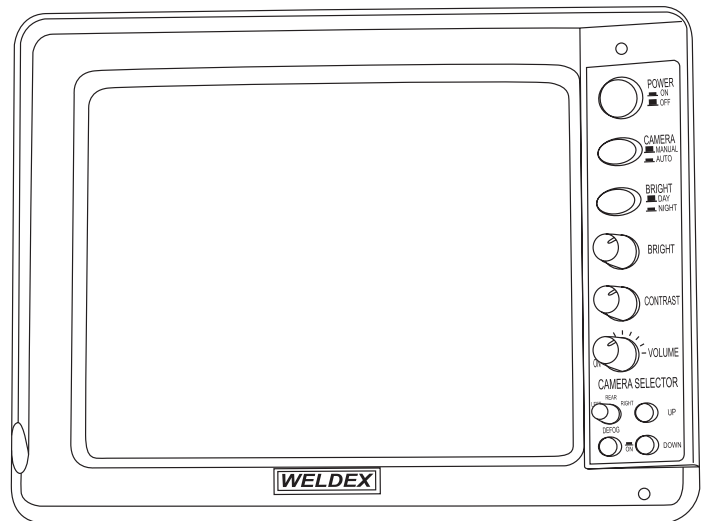
The rear vision system will automatically turn ON when the gear selector is placed in reverse.

Monitor Features:

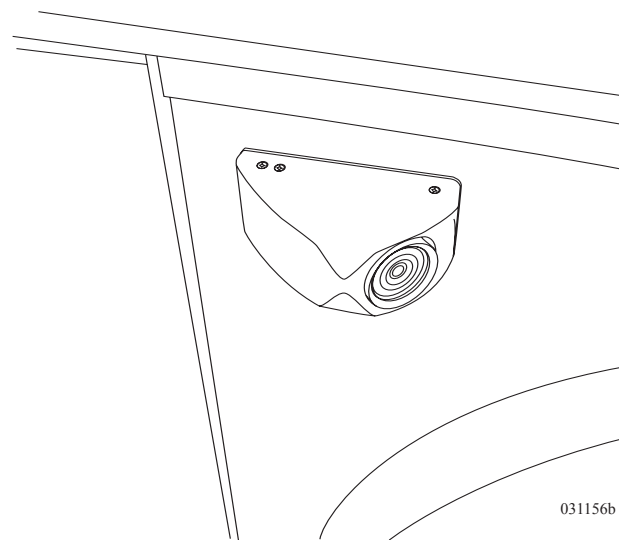
- **Power ON/OFF** button. Turning the main power switch ON will allow continuous operation of the rear vision system while the ignition key is ON.
- **Camera Manual/Auto** button. This is for use with the optional three camera system only. With the button in the **Manual** (out) position, any one of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

INFORMATION:

For more detailed instructions see the manufacturer's manual.



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Side View Camera

BACKING UP A MOTORHOME

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

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

When "pull-through" sites are not available, pick a solid, level site on the left side for a better field of vision using the roadside mirror. If the site is on the right, use the curbside mirror for backing up, but stay aware of blind spots. Prior to backing in a site, get out and walk the area. 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.

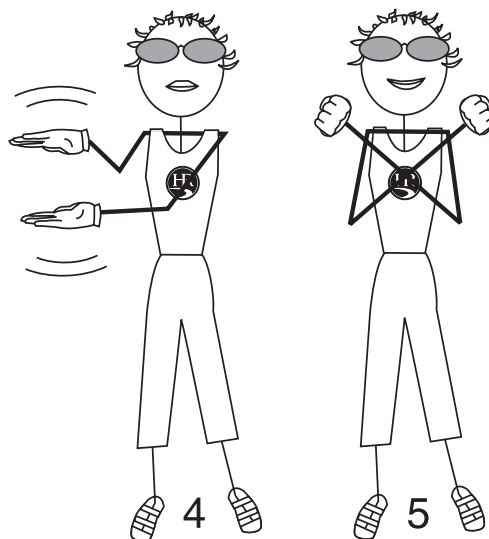
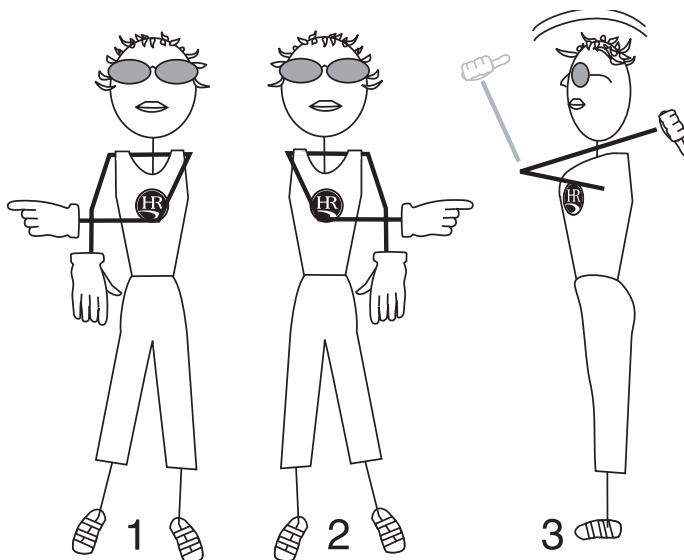
The co-pilot will perform just as important a job as the driver. When guiding the driver, the co-pilot should be located safely at the left rear corner of the motorhome, facing forward, while remaining visible in the roadside mirror at all times. The co-pilot should make a conscious effort to maintain 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, only five clearly defined signals should be used, with only one signal given at a time. Flailing arms with indecisive signals only confuse the driver. Signals should be given with purpose and confidence. Directional signals are directing travel of the rear of the motorhome.

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

The five directional signals are as follows:

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.



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Backing Up Trailers:

Towed vehicles using a tow bar or tow dolly have more than one pivot point and are not suitable for backing. Attempting to back up the motorhome while connected to a tow bar or tow dolly can jack-knife the tow device 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.

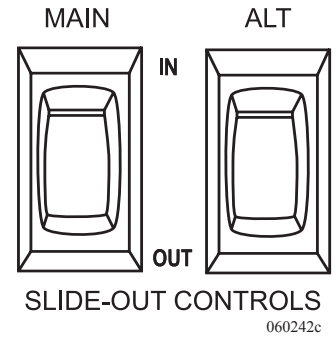
Trailers have one pivot point and may be backed up. The same rules for backing a motorhome can be applied to backing a trailer. When preparing to back the trailer into a space, maneuver the motorhome sweeping wide. Turn back to the opposite direction to maneuver the trailer into the space. Keep the bottom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

CAUTION:

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

SET-UP PROCEDURE CHECKLIST

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



- If applicable, unlock any travel locks which may be securing the slide room. Check for lateral clearance before extending the Slide-out room.

CAUTION:

Check for lateral clearance before extending the slide-out room.

NOTE:

To operate any slide room, turn the ignition switch to OFF, and set the park brake.

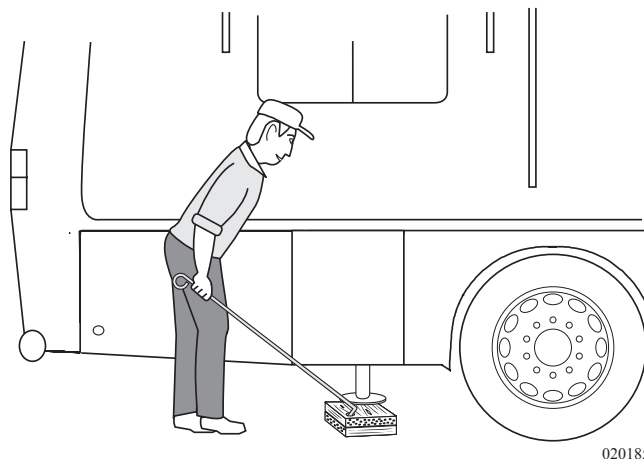
- Follow the procedures and guidelines for “*Leveling the Motorhome*” in **Section 10**. Confirm that the parking surface will accommodate the weight placed on the jacks.

CAUTION:

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

CAUTION:

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



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

When Hooked to 50 Amp:

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

When Hooked to 30 Amp:

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

NOTE:

Wait times are not necessary on motorhomes equipped with a converter.

CAUTION:

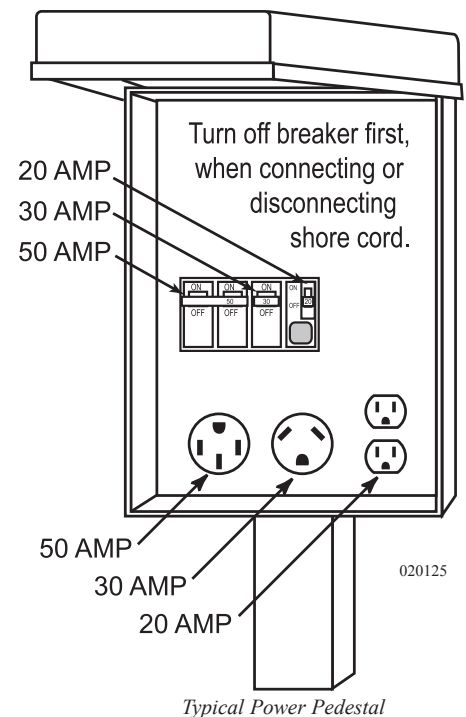
If shore power service is limited to 15 or 20 Amps, use of light duty extension cords and electrical adapters will create a voltage loss through the cord and at each electrical connection. Line voltage loss and the resistance at each electrical connection can be a hazardous combination. Damage to sensitive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

NOTE:

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

CAUTION:

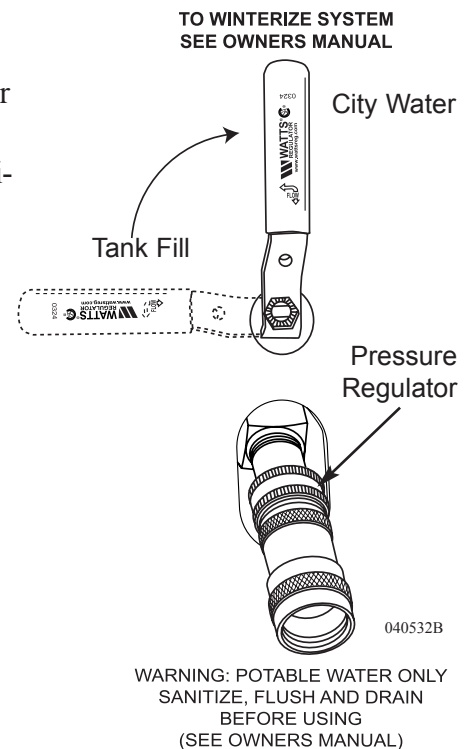
Do not remove cover from shore power supply to troubleshoot electricity to the motorhome. Serious personal injury or death may occur. If there is no power to the motorhome, inform the park manager. It is the park management responsibility to fix problems with the shore hook-up at the site.



- If cable service is provided, hook-up a 75 Ohm RG59 or RG6 cable to the cable connection in the storage bay. If the motorhome has a video selector box press the appropriate viewing button for the item desired.
- A phone connection port is provided in the storage bay. Phone utility outlets are placed throughout the motorhome, including a phone line attached to the satellite receiver for Pay-Per-View movies and events.
- Hook the potable water hose to the city water connection in the service center. Install a water pressure regulator to protect the water hose from excess pressure. Turn the hand valve to **City Water** position.

NOTE:

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



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

DRY CAMPING TIPS

Experience is the best dry camping teacher. Plan ahead and conserve resources.

- Dry camping requires fully charged and properly maintained batteries. Fill batteries with distilled water only. Conserve on battery power whenever possible.
- Fill the hot water tank before topping off the fresh water supply. Confirm waste holding tanks are empty. When the fresh water supply is low, drain waste holding tanks prior to refilling the fresh water tank.
- Solar panels are a valuable addition for battery charging. Additional panels will help charge the batteries during daylight hours. Clean solar panels regularly for optimum performance.
- Confirm the destination can accommodate the size and length of the motorhome. Drive-through sites are preferred for easier access.
- When navigating campgrounds, watch for low hanging limbs, tree trunks and barriers lining the roadway. Have the co-pilot or campground host provide guidance when negotiating tight curves. Position the motorhome to extend slide rooms and awnings. Before lowering the air suspension and leveling the motorhome, check underneath for obstacles that may damage undercarriage components.

Suggestions for Dry Camping:

- Switch refrigerator operation from Auto to LP-Gas.
- Open windows during the day and reduce use of the roof air conditioner.
- Turn off interior 12 Volt DC power whenever possible. The refrigerator is designed to operate with the power off.
- Turn on the water heater about twenty minutes before hot water is needed. Once heated, turn it off. Water will remain hot for several hours.
- Turn off small items that use battery power, such as porch lights, bay lights, engine compartment lights, etc. Turn off the 12 Volt antenna boost when not viewing the television.
- Monitor battery voltage. Do not allow batteries to fully discharge (lights dim) before starting the generator. If possible, run the generator twice a day, morning and afternoon, to charge the batteries.
- Use the inverter for AC power when time does not permit running the generator. Turn off the inverter when not in use.
- Avoid accidents at night when walking outdoors by using a flashlight. Use a flashlight inside the motorhome at night to avoid turning on interior lights. When interior lighting is desired, use one light in a central location, such as the vanity, unscrewing all but one or two bulbs to reduce battery drain.
- Turn on the water pump only when using water.
- Plan what is needed from the refrigerator prior to opening.
- If weather does not permit eating at the picnic table, or no outdoor table is available, eat at the dinette table by candlelight.
- Frequently monitor holding tank levels. Careful management of water is critical when dry camping. Conserve water when showering. Turn water off when soaping then back on to rinse. Take a sponge bath when water conservation is critical. Do not fill the sink full of water to wash only a few dishes. Use disposable dishes when possible. Chances are a campground without hookups will also lack showers or bathrooms and may only be equipped with primitive facilities. However, if it helps to conserve water and holding tank capacity, use them.
- Conserve propane and electricity by cooking dinner over a campfire. Try to operate the microwave with the generator.
- To avoid tracking in dirt, leave shoes outdoors or at the entry step. Get back to nature and still enjoy the comforts of the motorhome. With a little, imagination, there are endless ways to conserve resources while dry camping.

Item	Amp Draw
Interior house power (turned on)	1.5
13" TV	1.7
Rope Lights	1.3
Porch Lights	2.0
Fluorescent dual bulb	2.1
Halogen ceiling light	.09

Typical Current Draw

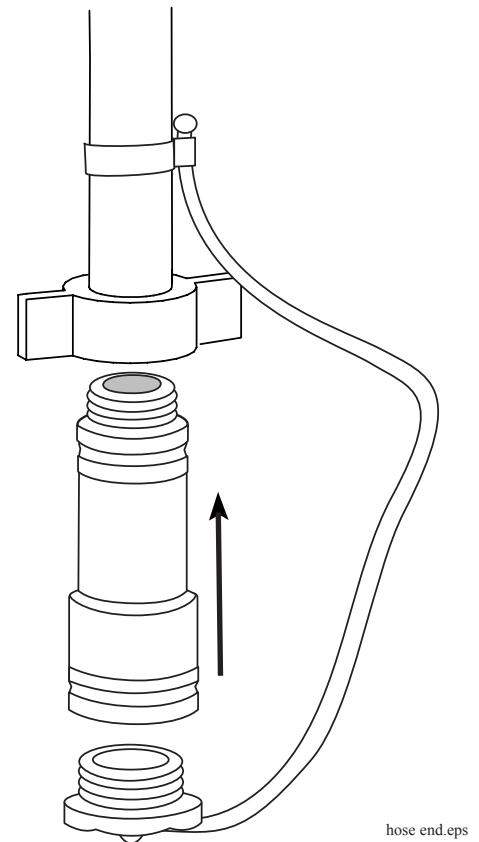
Preparing the motorhome for travel will require several small tasks. Properly securing and storing items will help to prevent them from getting lost or damaged. Below is a checklist guide to reference when preparing to break camp.

Outside Checklist:

- Disconnect the cable TV and lower the satellite dish and/or antenna.
- Disconnect and stow the telephone line.
- Retract awnings and secure them for travel.
- Close the primary LP-Gas tank valve.
- Connect the sewer hose.
- Drain and flush holding tanks.
- Disconnect fresh water hose from the source and store with end cap in place. If applicable, remove the water pressure regulator from the city water faucet.
- Turn shore power breaker off and disconnect the shore line. Wind up and store the shore cord and secure the door.
- **Inspect** fluid level in oil bath hubs (if applicable) and check all tire pressures.
- Secure all compartment doors.
- **Inspect** tires and wheels.
- Check for fluid leaks under and around the motorhome.

Engine Checklist:

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



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

Interior Checklist:

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

NOTE:

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

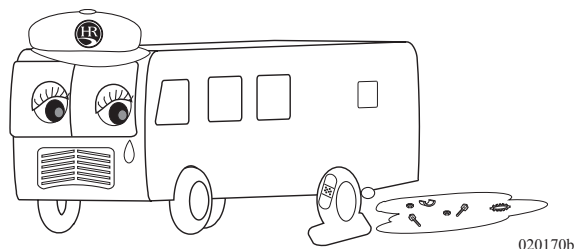
- Secure and fasten the bi-fold and pocket doors. Lock the shower door.
- Close roof vents and windows.
- Secure all loose, heavy or sharp objects in case of a sudden stop.
- Close all cabinet doors and drawers.
- Turn off interior lights.
- Disengage the water pump.
- Check the fuel level gauge and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

Departure Checklist:

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

EMERGENCY ROADSIDE PROCEDURES

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 (1-877-466-6226)** or an emergency service provider.



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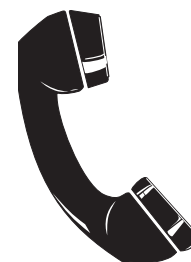
Road flares or reflective warning signs should be displayed if the motorhome is alongside of the road for any length of time. Guidelines for placing the warning triangles depend upon the road characteristics and visibility. For example: The standard placement is 10 feet, 100 feet and 200 feet from the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

INFORMATION:

In the event of a roadside emergency relating to a Cummins engine, contact the nearest Cummins Customer Assistance Center at 1-800-343-7357.

In Case of Flat Tire

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



070175

INFORMATION:

Goodyear emergency service number is 877-484-7376.

Running Out of Fuel

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

CAUTION:

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

To Prime the Fuel System:

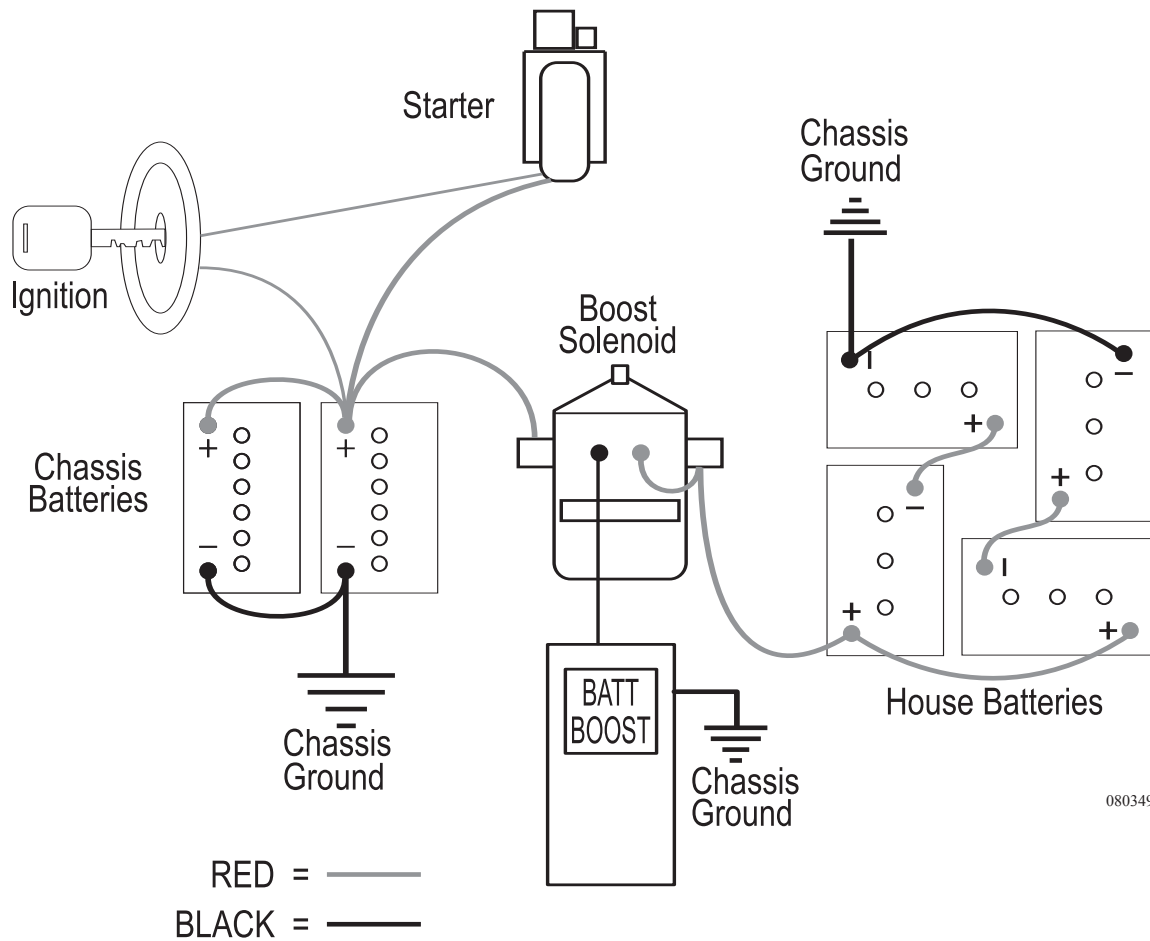
1. Add 30 gallons of fuel to the empty tank, possibly more if the motorhome is parked on an angle.
2. Follow the instructions "To Prime the Fuel System" located in the *Fuel System/Fuel Filters* of *Section 10*.

Dead Chassis Battery

A weak or discharged battery will not supply the amount of CCA (Cold Cranking Amps) necessary to initiate the required voltage to start the engine. If the engine fails to crank, or cranks slowly due to a weak chassis battery, there are electrical back-up systems in place that may increase chassis battery voltage.

Jump Starting Using the Battery Boost Switch:

The Battery Boost switch, located on the driver console, engages a heavy-duty solenoid in the battery compartment 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.

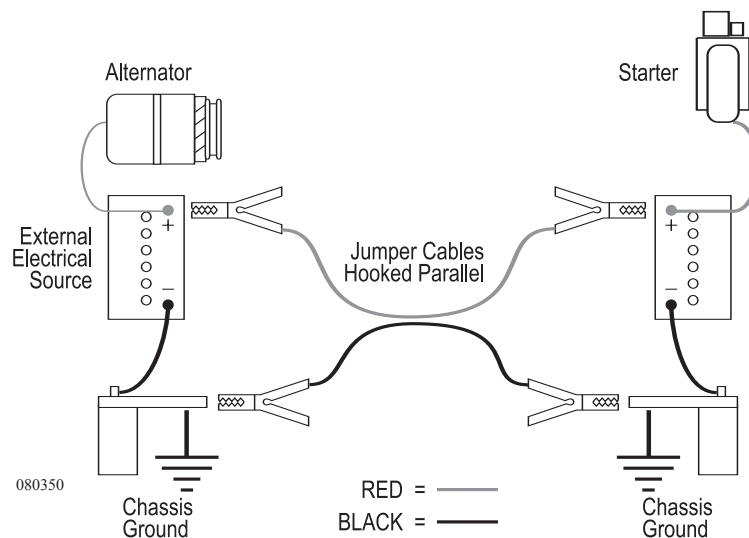


- With the ignition key off, press and hold the Battery Boost switch for ten seconds. After ten seconds, continue to hold the switch down and turn on the ignition. Observe the battery volt gauge on the dash, it should read at least 12 Volts. If voltage is sufficient, try to start the engine.
- If the engine fails to crank, or does not crank fast enough, discontinue the attempt. Continued attempts will only diminish any remaining surface charge in the chassis battery and end future alternative attempts.

- Next, start the generator. This may require using the Battery Boost switch for the generator to start from the engine battery. Once the generator is operating, the electrical combination of the generator, inverter and/or converter 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 to avoid overheating the Boost solenoid.
- Next, hold the switch down and turn the ignition on. The battery voltage gauge on the dash should indicate at least 12 Volts. If voltage is sufficient with the Boost switch held down, try to start the engine.
- If the engine fails to crank, or fails to crank quickly, the chassis battery may be depleted and the motorhome will require jump-starting or an external charger hooked to the chassis battery. When using jumper cables to start the engine, the cables must connect in a parallel configuration. That is positive (+) to positive (+) and negative battery (-) to negative chassis (-). Always connect the positive (+) before connecting the negative (-). To prevent arcing when disconnecting the cables, disconnect the negative (-) before disconnecting the positive (+).

WARNING:

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



Jump Starting using an external source:

1. When using an external electrical source to connect to the chassis battery, turn the main battery disconnect switches **OFF** prior to hooking up the jumper cables.
2. Hook up the cables then wait several minutes to allow a surface charge to build in the chassis battery before attempting to start the engine.
3. Turn **ON** the battery disconnect switches and attempt to start the engine. **DO NOT crank the engine more than a few seconds.**

4. After the engine has started disconnect the cables. Disconnect the negative (-) cables before disconnecting the positive (+) cables to prevent arcing.
5. If the engine does not crank, or cranks slowly, **DO NOT CONTINUE**. Extensive damage, fire or injury can occur. Obtain help from a qualified technician.

WARNING:

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

CAUTION:

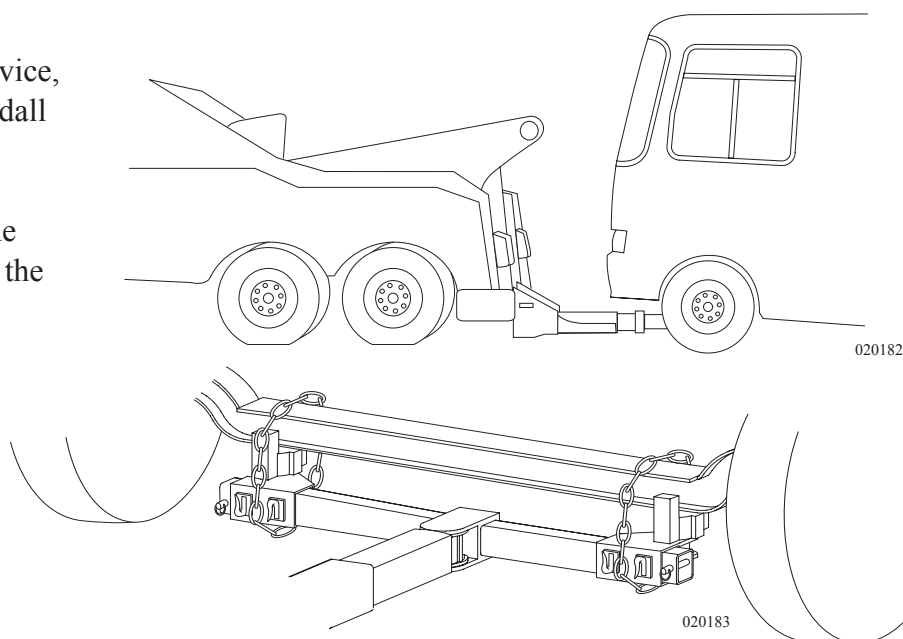
The charging system on the towed vehicle does not supply the amperage necessary to jump-start the motorhome. Voltage sensitive equipment on the towed vehicle can be damaged, leaving the towed vehicle disabled. If a jump-start is necessary, it is recommended to call Roadside Assistance. They will have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

CAUTION:

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

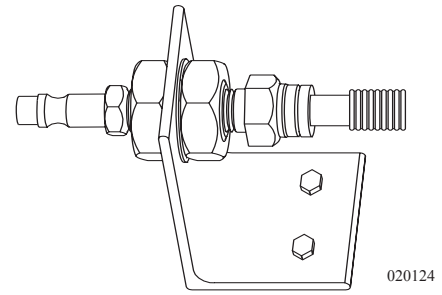
TOWING PROCEDURES

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



If the motorhome needs to be towed, use the following instructions:

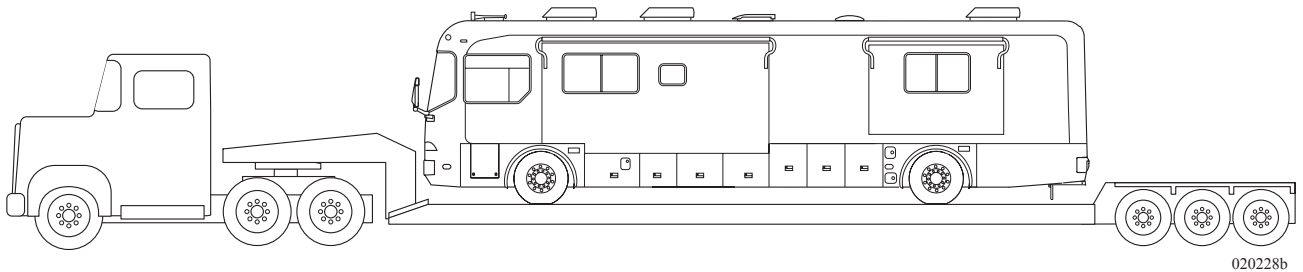
- Secure any loose or protruding parts if the motorhome is damaged.
- **Inspect** the points of attachment on a disabled motorhome. If attachment points are damaged, select other attachment points at a substantial frame structural member.
- Never allow anyone to go under a motorhome while it is being 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.
- 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.



Located in the Generator Compartment

NOTE:

The towing company may need to locate the air nipple to release the emergency brake. The air nipple should be used by towing personnel only.



- **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.

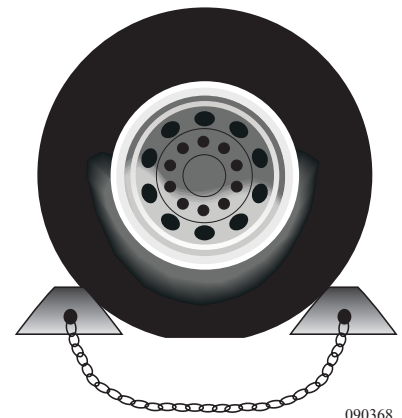
WARNING:

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.

Brake - Disabling Parking Brake

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

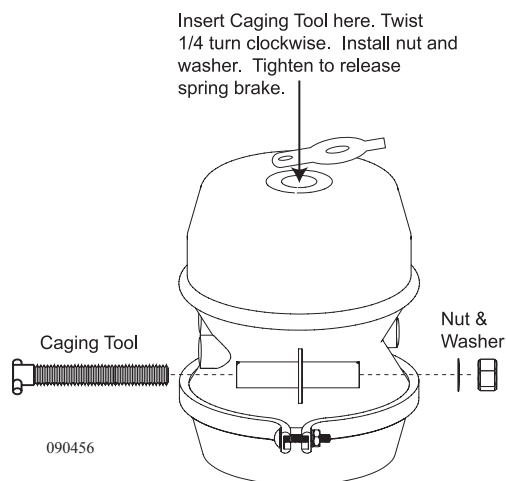
WARNING:
Only trained personnel should perform this procedure.



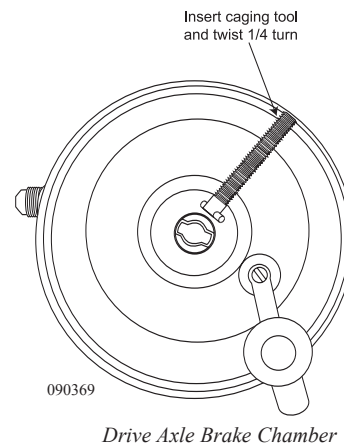
Properly chocked wheel.

- Place wheel chocks firmly against the wheel before performing this procedure.
- Remove the plug from the center of brake chamber.
- 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.
- 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.

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.



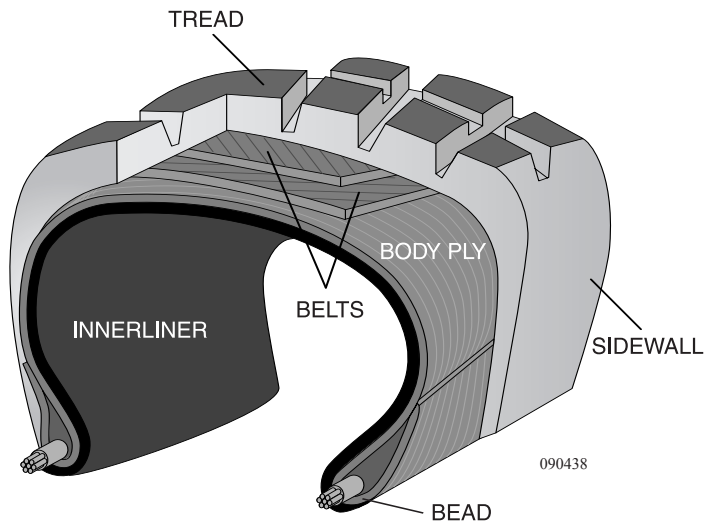
Insert Caging Tool here. Twist 1/4 turn clockwise. Install nut and washer. Tighten to release spring brake.



Insert caging tool and twist 1/4 turn

Drive Axle Brake Chamber

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



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

Tire Components:

- Tread:** Provides traction and cornering grip.
- Belts:** Stabilize and strengthen the tread.
- Sidewall:** Protects the side of the tire from road and curb damage.
- Body Ply:** Gives the tire strength and flexibility.
- Bead:** Assures an air-tight fit with the wheel.
- Inner Liner:** Keeps air inside the tire.

Importance of Air Pressure

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

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

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

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

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

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

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

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

Understanding the Inflation Table:

The tire size is on the left margin of the table. Determine the **Single** inflation reading or **Dual** inflation reading, denoted with a **D** or **S** on the Table. **Single** is for the front axle **Dual** is for the drive axle.

Find the corresponding PSI at the top columns to see the corresponding maximum weight capacity for that PSI.

NOTE:

Every load range has a maximum rating as well as a minimum rating. Do not exceed those ratings.

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

TIRE SIZE	MAX Speed Rating (MPH)	Dual (D) Single (S)	INFLATION PRESSURE PSI														
			65	70	75	80	85	90	95	100	105	110	115	120	125		
8R19.5	75	D S	2350 2410	2460 2540	2570 2680	2680 2800	2780 2930	2880 3060	2980 3170	3070 3280	3160 3400	3375(F) 3500(F)					
225/70R19.5	75	D S		2720 2895	2860 3040	3000 3195	3115 3315	3245 3450	3415(F) 3640(F)								
245/70R19.5	75	D S		3415 3640	3515 3740	3655 3890	3875(F) 4080(F)	3940 4190	4075 4335	4375(G) 4545(G)							
265/70R19.5	75	D S				3750 3970	3930 4180	4095 4355	4300 4540	4405 4685	4560 4850	4805 5070	4860 5170	5070(G) 5355(G)			
9R22.5	65	D S	3120 3190	3270 3370	3410 3560	3550 3730	3690 3890	3820 4050	3950(F) 4210	4350	4500(F)						
10R22.5	65	D S	3690 3770	3870 4000	4040 4210	4200 4410	4375 4610	4520 4790	4670 4970	4875(F) 5150(F)	4970 5320	5110 5490	5250(G) 5680(G)				
11R22.5	75	D S				4760 4990	4950 5220	5120 5430	5300 5640	5470 5840	5750(G) 6175(G)	5800(H) 6240	6430	6610(H)			
12R22.5	65	D S				5190 5450	5390 5690	5590 5920	5780 6140	5960 6370	6150 6590	6320 6790	6500 7010	6750(H) 7390(H)			
245/75R22.5	75	D S				3260 3470	3425 3645	3740 3980	4080 4300	4190 4455	4335 4610	4410(G) 4675(G)					
255/70R22.5	75	D S				3585 3815	3765 4005	3970 4190	4410 4675	4455 4895	4610 5065	4675 5205	5070(H) 5510(H)				
265/75R22.5	75	D S				4040 4070	4370 4440	4525 4620	4685 4800	4805(G) 4975	5150	5205(G)					
275/70R22.5	75	D S					4535 4885	4750 5080	4960 5305	5165 5530	5370 5750	5575 5965	5775 6185	5975 6400	6175(H) 6610(H)		
275/80R22.5	75	D S					4855 5265	5080 5515	5305 5755	5525 6000	5745 6235	5965 6475	6180 6710	6395(H) 6940(H)			
295/75R22.5	75	D S				4690 4725	5070 5155	5260 5370	5440 5510	5675(G) 5780	5800 5980	6005(H) 6175(G)	6370	6610(H)			
295/80R22.5	75	D S				4855 5480	5100 5750	5335 6020	5570 6285	5805 6550	6035 6810	6265 7070	6490 7320	6720 7580	6940(H) 7830(H)		
315/80R22.5	75	D S					5840 6415	6070 6670	6395 6940	6540 7190	6770 7440	6940 7610	7210 7920	7610(J) 8270(J)	7390 8820		
285/75R24.5	75	D S				4740 4770	5205 5210	5310 5420	5495 5675	5675(G) 5835	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.

Check tire pressure regularly. A sharp object can lodge in a tire and create a slow leak. The object will eventually be detected on a front tire, but may go unnoticed on one of the rear duals to result in one tire carrying the weight intended for two. Exceeding weight limits the tire is designed to carry can cause it to fail (in most cases only a few miles) resulting in two flat tires on the same axle and the same side. The flat tire can also generate enough heat by friction for the tire to ignite.

Check the tire pressure every two weeks or at least once a month, and always before a major trip. Check the tire pressure every "drive" morning on both long and short trips (driving a day or less). Check the tire pressure before leaving on a trip and again before starting the trip home. Check the tire pressure before storing the motorhome for any length of time. More importantly, check the tire pressure when removing the motorhome from storage.

Check the tire pressure when the tires are "cold" and have not been driven for more than one mile. The rated load capacity for cold inflation pressure is based on ambient temperature. If you must check the tires when they are warm or hot, allow for a slight increase in air pressure. The pressure should be within a couple of pounds of each other on the same axle. Never let air out of a hot tire.

When checking the inflation pressure, use a high-quality truck tire air gauge with an angle dual head. This type of pressure gauge can check the pressure of the inner dual wheel that has the valve stem pointing outward and the outer wheel that has the valve stem pointing inward. Nothing should restrict the ability to easily check tire air pressure daily when traveling in the motorhome. 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.

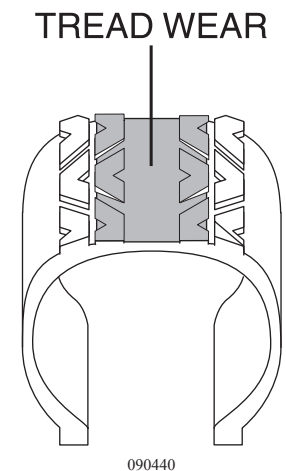
Optimum tire performance is achieved at proper inflation pressure for the load carried. Do not mix tires of different tread patterns on the same axle. The difference in traction could cause rear end gear fight and mechanical damage to the drive train. Never mix tires of a different size or construction on the same axle.

Higher than recommended pressure can cause:

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

WARNING:

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



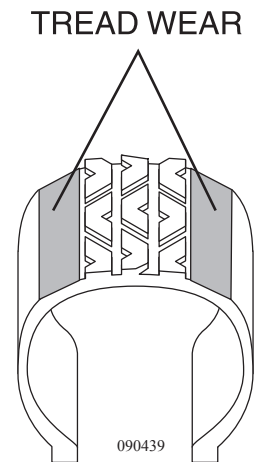
*Example of Overinflation
More wear in center.*

Lower than recommended pressure can cause:

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

WARNING:

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



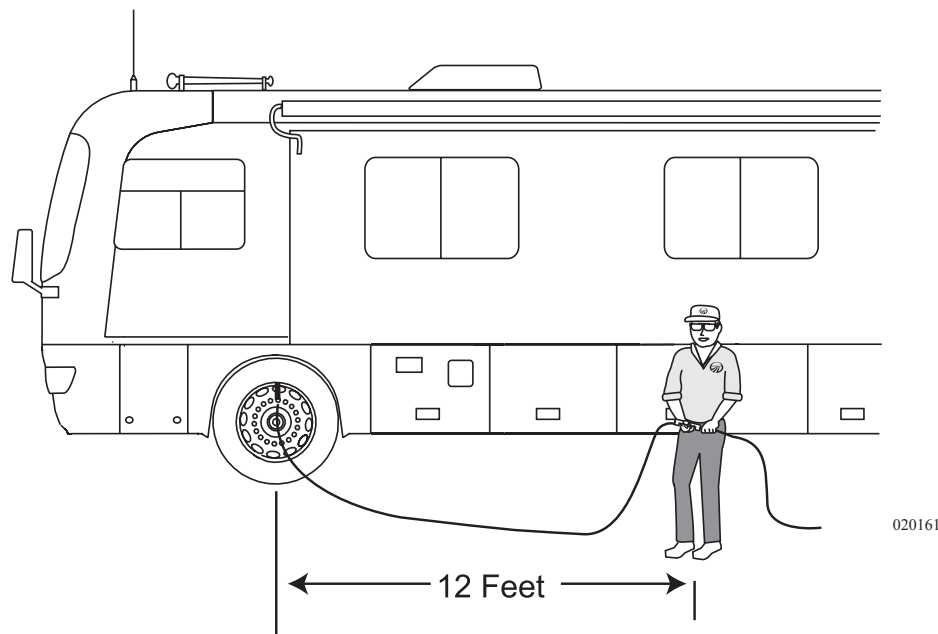
*Example of Underinflation
More wear on edges.*

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.



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

NOTE:

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

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

NOTE:

Air pressure in a tire goes up (in warm weather) or down (in cold weather) 1 to 2 pounds for every 10 degrees of temperature change.

Supporting When Leveling

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

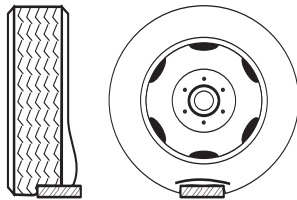
CAUTION:
Supporting the tires prevents damage to the sidewall of the tires and does not prevent tire roll.

Tire "Support" Methods

INCORRECT

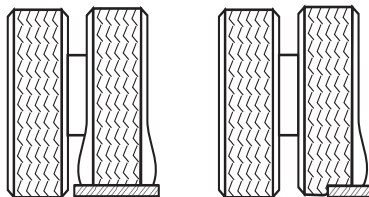
Singles

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

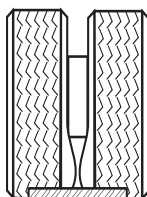


Duals

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

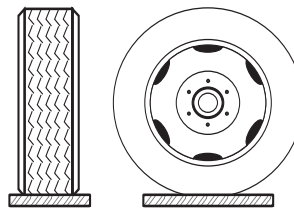


One tire or a portion of the two tires supporting the full load.



CORRECT

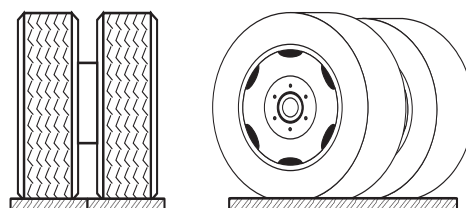
Singles



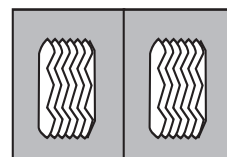
Tire Footprints



Duals



Dual Tire Footprints



020063b modified

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 of an inch on the front, and 2/32 of an inch on the rear. Questions regarding tread wear should be directed to the tire manufacturer.

Built in tread wear indicators, or “wear bars” which look like narrow strips of smooth rubber across the tread, will appear on the tire when the tread is worn down to one-sixteenth of an inch. When “wear bars” are noticed, the tire should be replaced.

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

WARNING:

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

Storage of Tires - Long Term

Rubber tires age faster when not in use. A cool, dry, sealed garage is the preferred method of storage. Tires stored outside in the element may prematurely age. Placing a barrier (i.e. cardboard, plastic or plywood) between the tire and the ground surface will help to protect the tires during outside storage. Outlined below are additional steps that can be taken to reduce the aging effects of tires during long periods of non-use.

NOTE:

If the motorhome is stored with weight on the tires they should be inflated to the maximum inflation pressure as indicated on the Federal Identification Tag.

- Thoroughly clean the tires.
- Unload the motorhome so there is minimum weight on the tires.
- Ensure the surface is reasonably level, firm, clean and has good drainage.
- Move the motorhome every three months to prevent cracking in bulge areas, as well as flat spotting from prolonged sidewall strain and tread deflection.
- Cover the tires to block direct sunlight and ultraviolet rays.

The type of surface the motorhome is parked upon will have an affect on how much moisture accumulation occurs on the chassis and flooring.

- Gravel covered parking areas still allow moisture to evaporate from the ground, through the gravel and to the underside of the motorhome.
- Sealed concrete pads allow better ventilation under the motorhome.
- Storage buildings with sealed concrete floors or heated storage facilities greatly reduce the amount of moisture accumulation and protect the motorhome from moisture damage.
- Wet, oily, or greasy surfaces; highly reflective surfaces, such as sand or snow; and heat absorbent surfaces, such as black asphalt, should be avoided.

Before removing the motorhome from long-term storage thoroughly **inspect** each of the tires. This means a close examination of each tire's tread area and air pressure. If the pressure check indicates the tires have lost air during storage, inflate them to the correct pressure for the current load before putting the motorhome into service.

WHEEL MOUNTING

Hub Piloted Mounting:

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

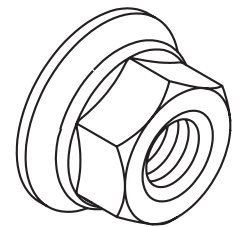
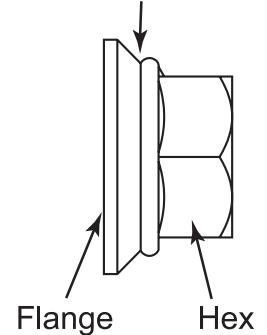
NOTE:

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

WARNING:

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

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



*Flange Nut:
Front and side view.*

090268c

Front Wheels:

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

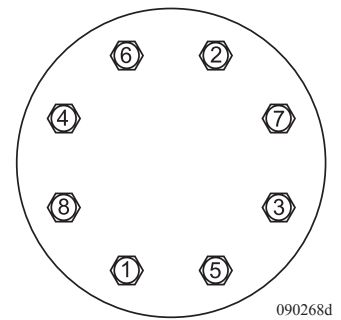
Dual Rear Wheels:

Slide the inner dual wheel over the studs. Use caution to avoid damaging threads. Align the hand-holds for valve access and slide the outer dual wheel over the studs, again using caution to avoid damaging the stud threads. When all nuts are seated, tighten the nuts to 450 ft. lbs. in sequence (as shown in the illustration below).

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

Torque the Nuts Properly:

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



Nut Tightening Sequence

WEIGHING THE MOTORHOME

Proper weight distribution, load management and operating within established limitations will aide in safe and enjoyable travel. This section provides guidelines and worksheets for weighing procedures.

Proper weight distribution and load management is an individual responsibility. In order to correctly manage load and weight distribution, more than one weight measurement will be required. Each wheel position must be weighed to accurately determine the weight placed on each wheel position for proper weight computations. The entire process of 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 understand there are two reasons to weigh the motorhome. One to find out the **Cargo Carrying Capacity (CCC)** and the other to ensure no axle is overloaded.

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

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

NOTE:

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

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

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

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

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

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

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

The following is an explanation of commonly used weight abbreviations:

- **Gross Vehicle Weight Rating (GVWR):** Maximum permissible weight of this motorhome. **GVWR** is equal to or greater than the sum of **UVW** plus **CCC**.
- **Unloaded Vehicle Weight (UVW):** Weight of this motorhome as built at factory with full fuel, engine oil and coolants. **UVW** does not include cargo, fresh water, LP-Gas, occupants or dealer installed accessories.
- **Cargo Carrying Capacity (CCC):** Equal to **GVWR** minus each of the following: **UVW**, full fresh potable water weight (including water heater), full LP-Gas weight, and **SCWR**. Tongue weight of towed vehicle and dealer installed equipment will reduce **CCC**.
- **Gross Combination Weight Rating (GCWR):** The maximum allowable loaded weight of this motorhome and any towed trailer or towed vehicle.
- **Gross Axle Weight Rating (GAWR):** Load-carrying capacity specified by manufacturer of a single axle system, as measured at tire ground interfaces.
- **Sleeping Capacity Weight Rating (SCWR):** The manufacturer's designated number of sleeping positions multiplied by 154 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 weight one axle at a time. A single axle scale weighs one axle at a time. Some scales read only one wheel position at a time due to physical size. Several scale readings may be required to determine the GAW or GVW total. Each wheel position requires weighing, referred to as a four-point weigh, to accurately determine the correct tire inflation pressure.

NOTE:

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

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

Weight Label

MODEL YEAR: _____	MAKE: _____	MODEL: _____	
UNIT NO. _____	CHASSIS VIN: _____		
		<u>LBS.</u>	<u>KGS.</u>
<u>GVWR</u>	(Gross Vehicle Weight Rating) is the maximum permissible weight of this fully loaded motorhome	_____	_____
<u>UVW</u>	(Unloaded Vehicle Weight) is the weight of this Motorhome as manufactured at the factory with full fuel, engine oil and coolants.....	_____	_____
<u>SCWR</u>	(Sleeping Capacity Weight Rating) is the manufacturer's designated number of sleeping positions multiplied by 154 pounds (70 kilograms)	_____	_____
<u>CCC</u>	(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).....	_____	_____
<u>GCWR</u>	(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..	_____	_____
<u>CARGO CARRYING CAPACITY (CCC) COMPUTATION</u>			
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)		_____	_____
<u>WARNING: CONSULT OWNER MANUAL(S) FOR SPECIFIC WEIGHING INSTRUCTIONS AND TOWING GUIDELINES INCLUDING AUXILIARY BRAKE REQUIREMENTS FOR ANY TOWED TRAILER OR TOWED VEHICLE.</u>			
Factory installed options do not include dealer installed after market equipment.			
WARNING: DO NOT EXCEED THE GVWR, GCWR AND/OR GAWR AFTER LOADING YOUR MOTORHOME WITH WATER, FUEL, PASSENGERS AND CARGO. GAWR (Gross Axle Weight Rating) means the maximum permissible load weight a specific axle is designed to carry. See Federal Certification Label for disclosure of The GAWR for each axle.			
(*1) Towing capacity is limited by GCWR; your vehicle's towing capacity is the difference between the GCWR and the actual vehicle weight; including all water, fuel, passengers, and cargo. Consult you Owner's Manual for further towing information.			
(*2) Your motorhome's fresh water tank and water heater taken together determine the gross fresh water capacity. Your usable fresh water capacity, however, may be less.			
(*3) Dealer installed equipment and towed vehicle tongue weight will reduce CCC.			
100179D			

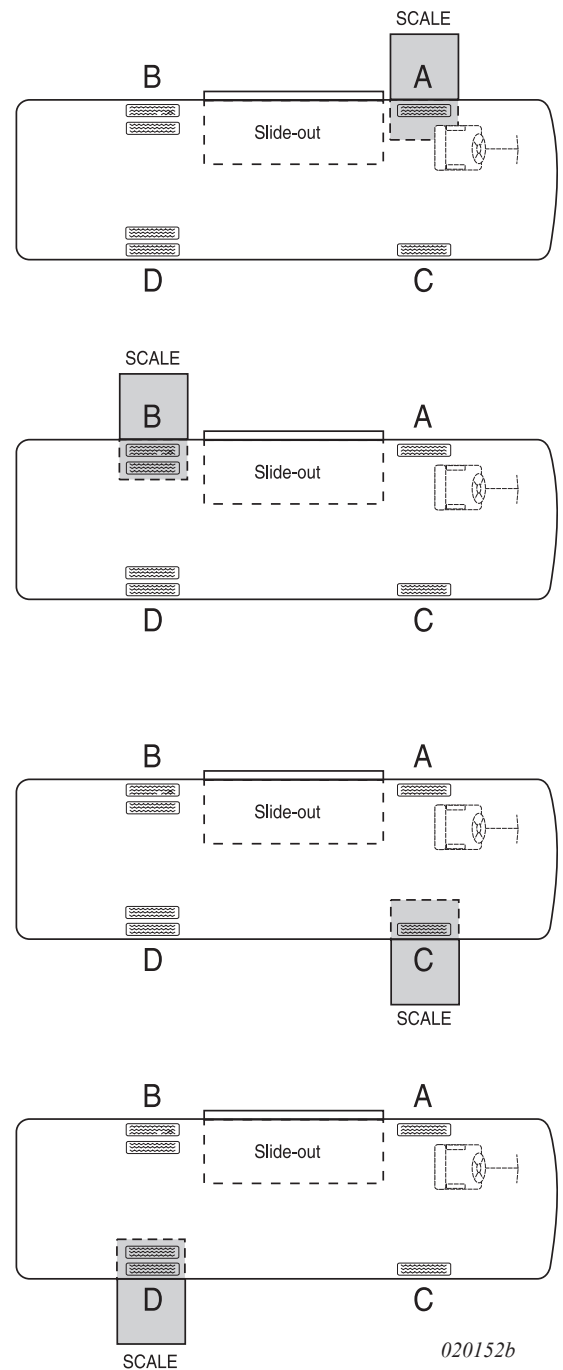
Four Point Weighing (Example)

NOTE:

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

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

1. Take the **FRONT** axle **Gross Axle Weight Rating (GAWR)** and divide it by two. Example: FRONT axle **GAWR** taken from the motorhome Vehicle Certification Label is 13,000 lbs. Divide the figure by 2, using chart , record 6500 lbs. on line 1.
2. Weigh the driver side **FRONT** corner (Scale A) and record weight on chart scale A, line 2. Example: 5000 lbs.
3. Weigh the passengers's side **FRONT** corner (Scale B) and record weight on chart Scale B, line 2. Example: 4000 lbs.
4. Add Roadside and Console side from line 1, for **Gross Axle Weight Rating (GAWR)** and record on chart under Totals. Example: 13000 lbs.
5. Add chart scale A and C, line 2 for actual **Gross Axle Weight (GAW)** and record on chart under Totals. Example: 9000 lbs.
6. Actual **Gross Axle Weight (GAW)**. Example: 9000 lbs is not to exceed Gross Axle Weight Rating (**GAWR**). Example: 13000 lbs.



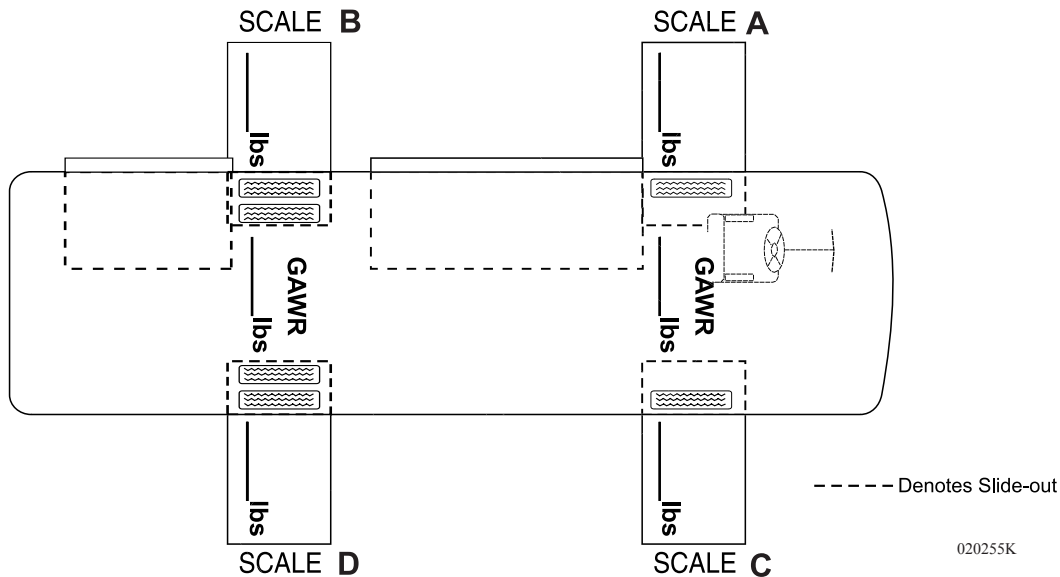
Four Point Weighing Example Chart

- Refer to the Tire Chart (Tire size 295/80R22.5) Use the highest actual weight, Scale A or C, line 2. Example 5000 lbs. Determine the proper tire pressure for each tire using the Load Inflation chart. Example: 80 psi or stamped on the sidewall of the tire.
- Repeat above procedures to determine REAR axle Scale B and D, tire pressures.

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

NOTE:

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



WARNING:

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

CAUTION:

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

Load and Inflation Tables:

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

Cargo Carrying Capacity:

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

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

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

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

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

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

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

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

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 pounds.

$$\begin{array}{rclcl} \text{A} & \underline{15,000} & - 415 & = & \text{B} & \underline{14,585} \\ \text{B} & \underline{14,585} & - 100.8 & = & \text{C} & \underline{14,484.2} \end{array}$$

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

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

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

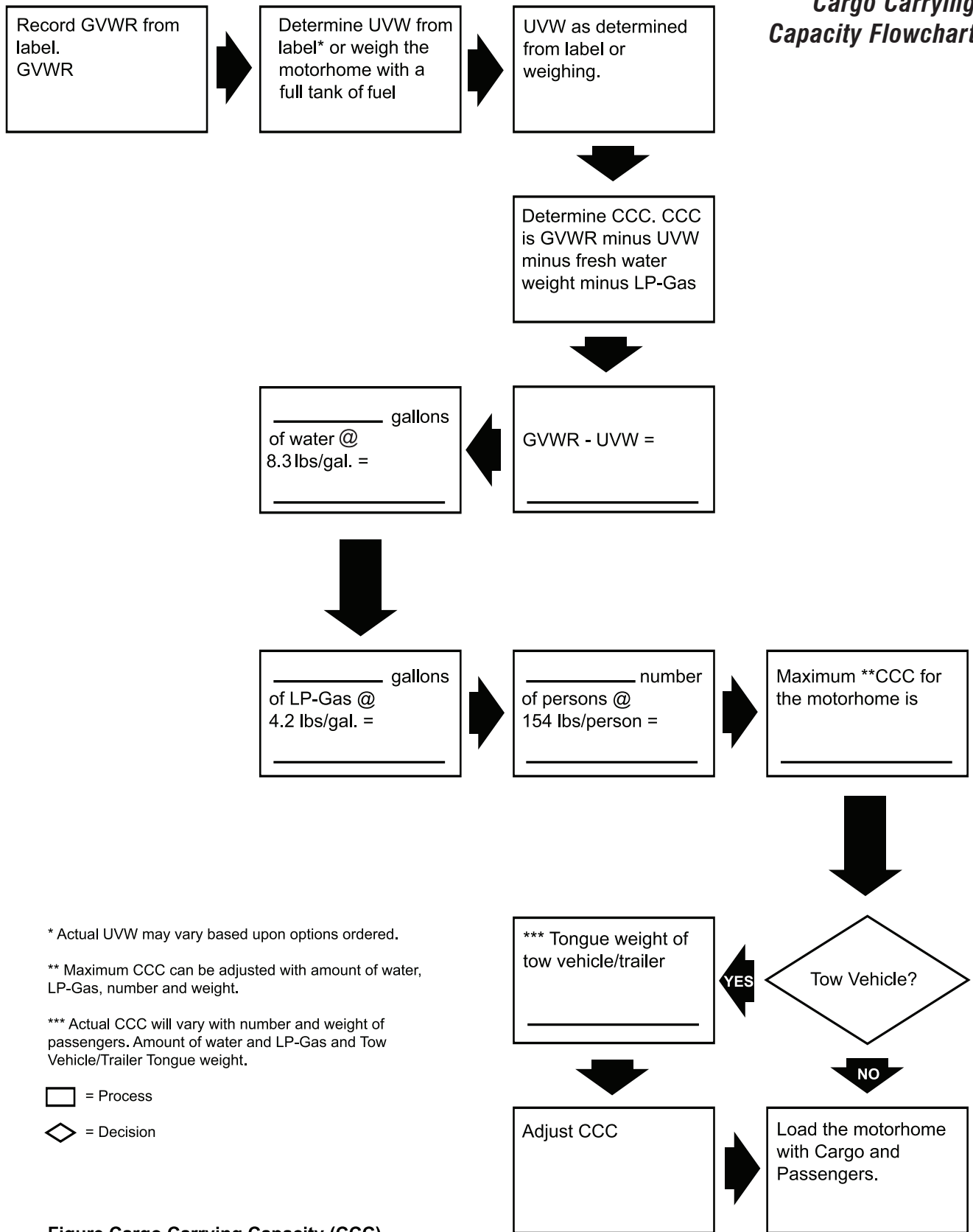
$$C \quad \underline{14,484.2} \quad - \text{SCWR} \quad 716 \quad = \text{CCC} \quad \underline{13,768.2}$$

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

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

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

Cargo Carrying Capacity Flowchart



* Actual UVW may vary based upon options ordered.

** Maximum CCC can be adjusted with amount of water, LP-Gas, number and weight.

*** Actual CCC will vary with number and weight of passengers. Amount of water and LP-Gas and Tow Vehicle/Trailer Tongue weight.

□ = Process

◇ = Decision

Figure Cargo Carrying Capacity (CCC)

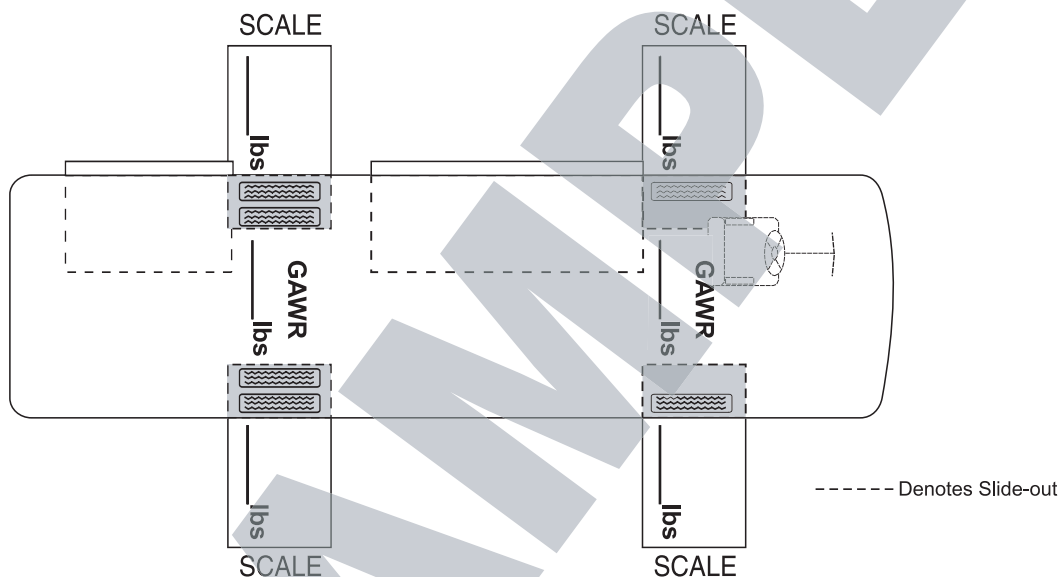
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Weighing the Motorhome Worksheet

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



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



	FORMULA	UVW 23,000 CAPACITY	CCC 10,000
FRESH WATER	Subtract Gallon @ 8.3 lbs/gal	100 x 8.3 = 830	- 9,170
WATER HEATER	Subtract Gallon @ 8.3 lbs/gal	10 x 8.3 = 83	- 9,087
LP-GAS	Subtract Gallon @ 4.2 lbs/gal	40 x 4.2 = 168	- 8,919
SLEEP CARRYING WEIGHT RATING	Subtract Persons @ 154 lbs/person	5 x 154 = 770	- 8,149
		Maximum Cargo Carrying Capacity CCC	8,149

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

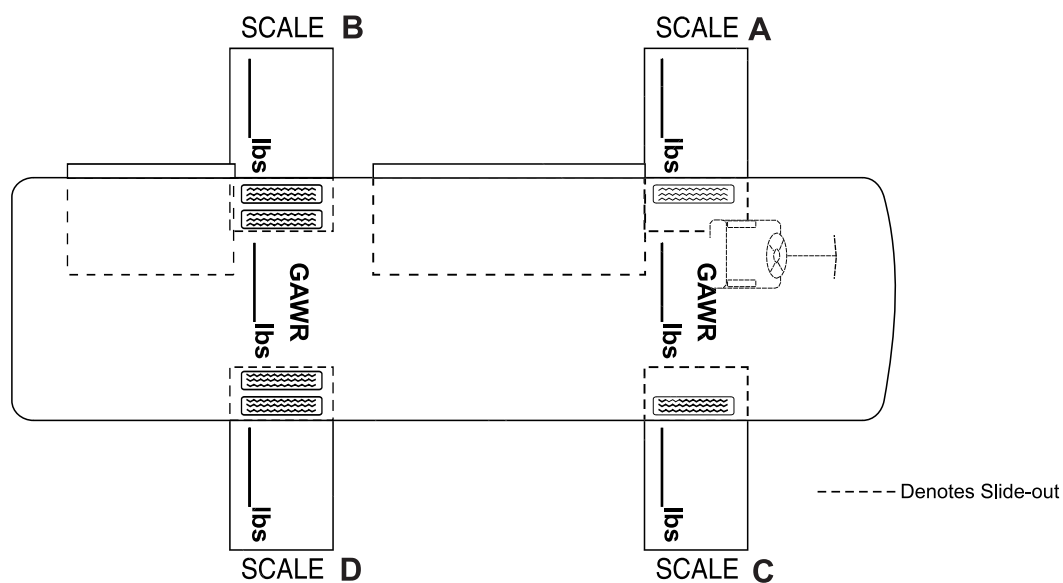
020255b example

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 fuel tank and nobody in the motorhome.



FORMULA		UVW	CCC
		CAPACITY	
FRESH WATER	Subtract Gallon @ 8.3 lbs/gal	X 8.3 =	-
WATER HEATER	Subtract Gallon @ 8.3 lbs/gal	X 8.3 =	-
LP-GAS	Subtract Gallon @ 4.2 lbs/gal	X 4.2 =	-
SLEEP CARRYING 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

DATE: _____

PLACE: _____

FRONT: _____ + _____ = _____
LEFT RIGHT TOTAL

REAR: _____ + _____ = _____
LEFT RIGHT TOTAL

= _____
TOTAL GROSS
VEHICLE WEIGHT

DATE: _____

PLACE: _____

FRONT: _____ + _____ = _____
LEFT RIGHT TOTAL

REAR: _____ + _____ = _____
LEFT RIGHT TOTAL

= _____
TOTAL GROSS
VEHICLE WEIGHT

DATE: _____

PLACE: _____

FRONT: _____ + _____ = _____
LEFT RIGHT TOTAL

REAR: _____ + _____ = _____
LEFT RIGHT TOTAL

= _____
TOTAL GROSS
VEHICLE WEIGHT

DATE: _____

PLACE: _____

FRONT: _____ + _____ = _____
LEFT RIGHT TOTAL

REAR: _____ + _____ = _____
LEFT RIGHT TOTAL

= _____
TOTAL GROSS
VEHICLE WEIGHT

DATE: _____

PLACE: _____

FRONT: _____ + _____ = _____
LEFT RIGHT TOTAL

REAR: _____ + _____ = _____
LEFT RIGHT TOTAL

= _____
TOTAL GROSS
VEHICLE WEIGHT

DATE: _____

PLACE: _____

FRONT: _____ + _____ = _____
LEFT RIGHT TOTAL

REAR: _____ + _____ = _____
LEFT RIGHT TOTAL

= _____
TOTAL GROSS
VEHICLE WEIGHT

DATE: _____

PLACE: _____

FRONT: _____ + _____ = _____
LEFT RIGHT TOTAL

REAR: _____ + _____ = _____
LEFT RIGHT TOTAL

= _____
TOTAL GROSS
VEHICLE WEIGHT

DATE: _____

PLACE: _____

FRONT: _____ + _____ = _____
LEFT RIGHT TOTAL

REAR: _____ + _____ = _____
LEFT RIGHT TOTAL

= _____
TOTAL GROSS
VEHICLE WEIGHT

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: _____

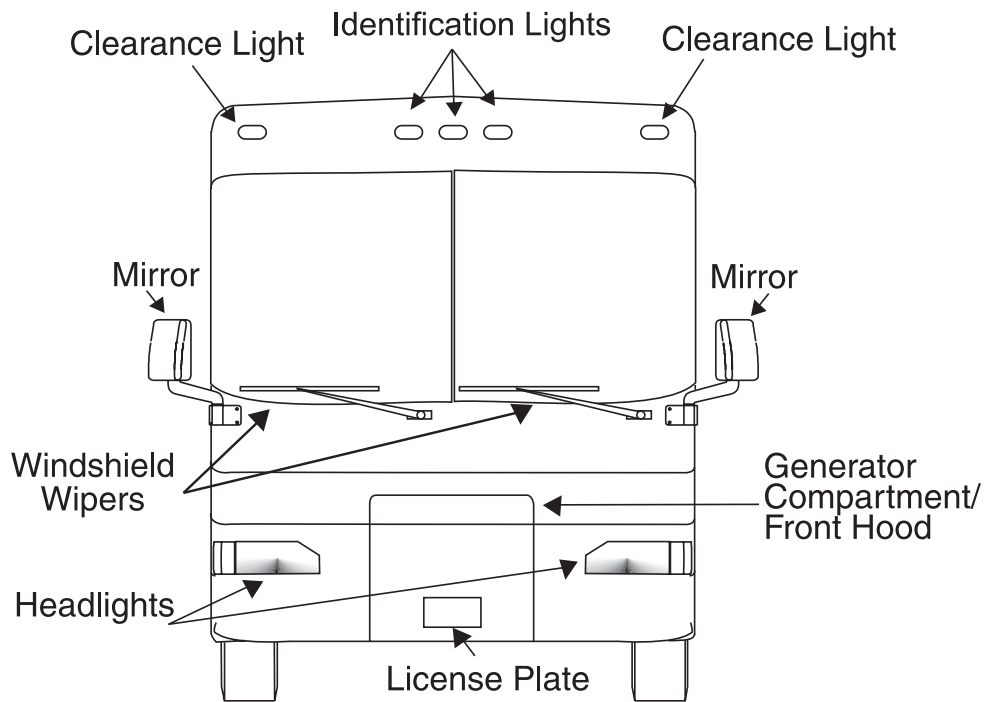
PLACE: _____

FRONT: _____ + _____ = _____
LEFT RIGHT TOTAL

REAR: _____ + _____ = _____
LEFT RIGHT TOTAL

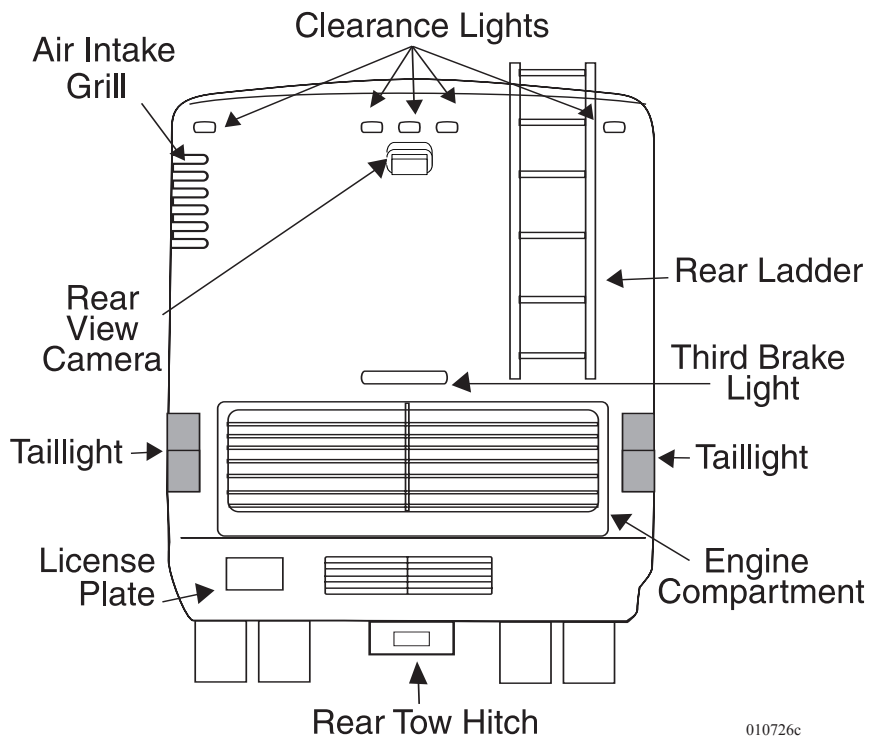
= _____
TOTAL GROSS
VEHICLE WEIGHT

IEWS Front



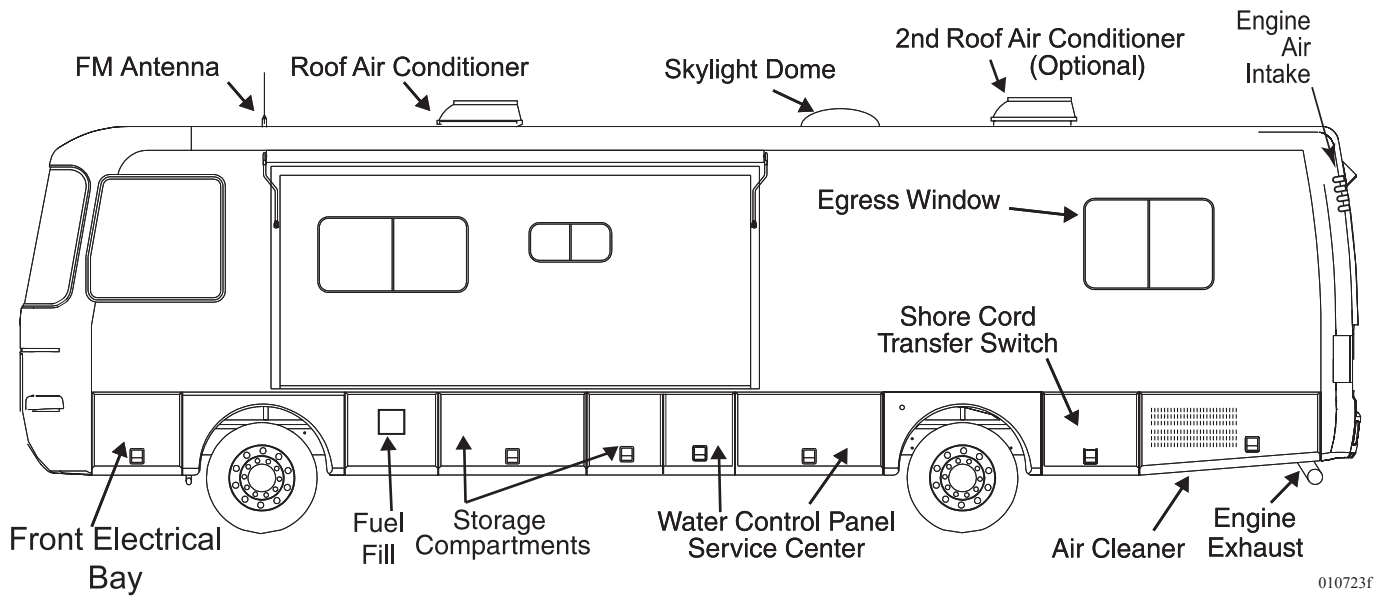
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Rear

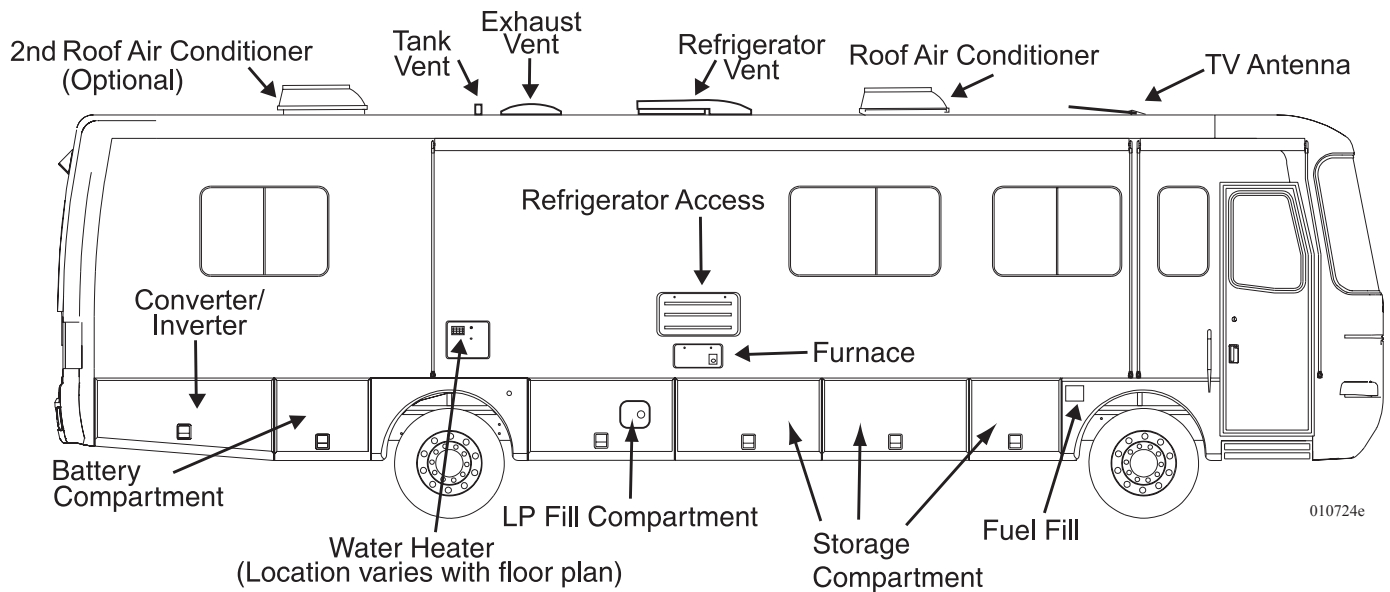


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Roadside

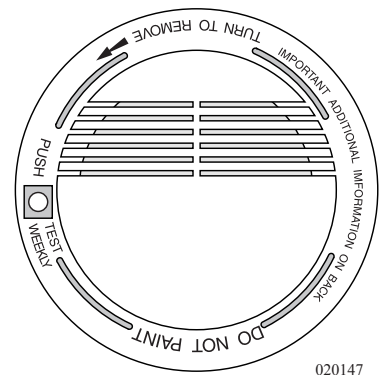


Curbside



SMOKE DETECTOR

Statistics show that most fire casualties are not caused by direct flame, but by less visible smoke (products of combustion). The smoke detector responds to both visible and invisible products of combustion. The smoke detector will automatically return from alarm to normal state when the 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.



WARNING:

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

Operation

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

NOTE:

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

Testing

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

CAUTION:

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

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

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

Troubleshooting

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

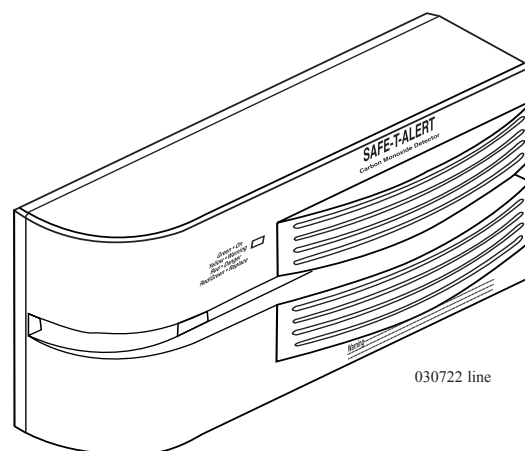
- **Inspect** for obvious damage.
- Check for the recommended battery type.
- Check the battery for proper connection or replace the battery if needed.
- Gently vacuum as recommended.

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

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

The motorhome is equipped with 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.

CARBON MONOXIDE DETECTOR



030722 line

Located in the Bedroom

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 would include the elderly and people with lung or heart disease or anemia.

The CO detector is designed to detect the toxic CO Gas resulting from incomplete combustion of any fuel. This can be gasoline, propane, natural gas, oil, charcoal or wood. Anything that burns fuel such as engines, generators, furnaces, gas stoves or water heaters, 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.

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

WARNING:

If there is constant beeping and the red light is flashing, CO gas has been detected. Shut off appliances, coach engine, and water heater. Evacuate the motorhome and call the fire department. Have any problems corrected before restarting any appliances or the motorhome.

Operation

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

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

Indicator Lights and Sound Patterns:

- **ON** or normal condition is indicated by **green**. The CO detector has power and is sensing air for the presence of CO gas. The alarm horn will not sound.
- Flashing **red** indicates low CO alarm condition along with **four** beeps then **OFF** for 5 seconds. The alarm horn will sound and can be reset by the **TEST/RESET** button. The CO detector has detected the presence of 70 ppm.
- Steady **red** indicates a **CO ALARM** condition. The detector has sensed the presence of levels over 100 ppm of Carbon Monoxide. The alarm horn will sound continuously until the **RESET** switch is reset.
- Alternating **red** and **green** indicates a malfunction alarm.

Alarm

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

Potential Sources of CO when operating the motorhome:

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

Testing

Test Procedures:

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

Peak Level Memory:

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

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

NOTE:

Memory is erased when power is disconnected for 15 seconds.

Cleaning & Maintenance

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

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

INSPECT:

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

FIRE EXTINGUISHER

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

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

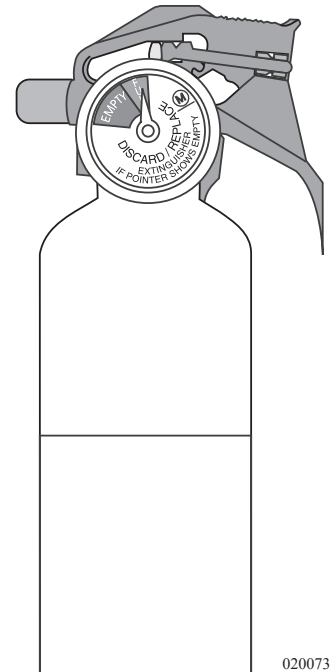
Use the PASS word!

Pull the pin to unlock the extinguisher.

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

Squeeze the lever to discharge the agent.

Sweep the spray from left to right until totally extinguished.



020073

WARNING:

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

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

Classes of Fire:



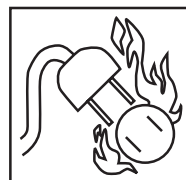
A - Fires that are fueled by materials that leave a residue when they burn: paper, wood, cloth, rubber, and certain plastics.



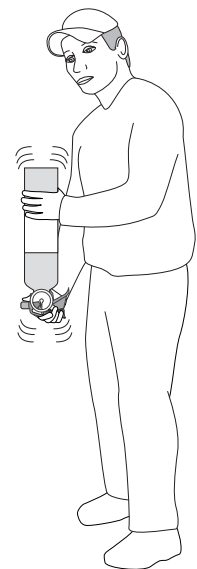
B - Fires that involve flammable liquids and gases: gasoline, paint thinner, kitchen grease, propane and acetylene.



100209



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.



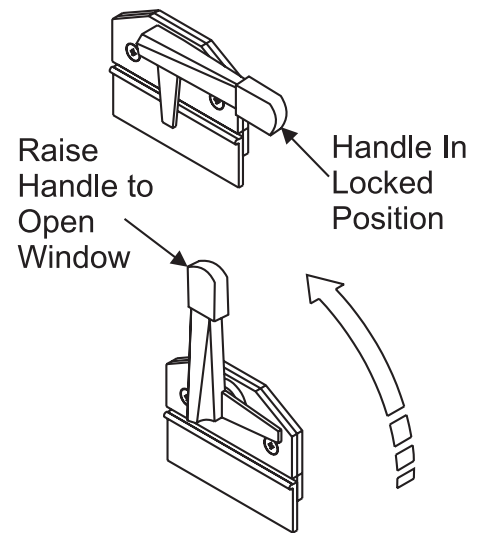
020261

ESCAPE (EGRESS) WINDOW

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

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

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



020029

Egress Window Handle



NEPTUNE 2005

EXTERIOR & INTERIOR CARE SECTION 3

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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 from roadways. If the motorhome is driven in areas where road salts are used it should be washed at least once a week. Otherwise, it is recommended to hose off the undercarriage area at least once a month to help minimize the corrosion process. High pressure washers or steam cleaners are the most effective way of cleaning off the underside and inside wheel openings. **Avoid directly spraying the painted surface with a high-pressure washer.**

CAUTION:

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

Washing

Periodic cleaning will help to preserve the paint finish. The motorhome is painted with a “base coat, clear coat system.” Clear coat is a polyurethane-based material which brings out the shine and luster to the base coat paint. Care should be used when washing the motorhome. Use only mild detergents or preferred specifically designed automotive detergents. Avoid using abrasive cleansers or laundry detergents that will scratch the clear coat and leave a soap film. Use a soft cloth to wash the paint finish. Avoid using brushes as they can scratch the surface and damage the paint. Before washing the motorhome, remove most of the accumulated dirt 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

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

To wax or not to wax? This is a good question. There are many schools of thought on this issue. The two most common thoughts are:

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

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

NOTE:

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

INFORMATION:

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

Types of Products:

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

Waxes - Waxes come in many types of chemical make-up. The popular Carnauba wax is a natural occurring wax from the leaves or fronds of the Carnauba palm tree. Mineral waxes have a paraffin base. There are also other topical application products which contain silicone.

Polishes - Polishes usually contain a combination of wax based substances with an abrasive, getting the two for one idea. 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 checking for hazing or swirl marks. If an abnormal reaction to the finish occurs, discontinue product use and consult the product manufacturer. If the product is a paste, do not allow dried paste to be baked on by the sun. Remove paste shortly after drying. Clean, dry, 100% cotton cloths or cotton baby diapers are best suited for the removal of dried paste. Turn the cloth often. Use a separate clean cloth to buff. The surface should feel “slick” when rubbing the cloth lightly over it. Avoid repeated wax applications which can cause wax to build up. Some very fine scratches or swirl marks may be removed by an application of a glaze. These types of glazes fill the scratches or swirl marks.

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

Paint Codes

Each color scheme is assigned a paint code formula to designate a color of paint. "Touch-up" paint will repair small imperfections in the paint surface. To repair larger areas of pain, it may be necessary to obtain the individual paint codes.

To Obtain the Paint Code:

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

NOTE:

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

Tire Care

Road oil will cause deterioration of the rubber. Dirt build-up can hold chemicals in the air, next to the tire, to also cause deterioration.

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 recreational vehicle tires may last longer due to limited annual mileage and exposure.

Bright Metal

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

NOTE:

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

EXTERIOR MAINTENANCE

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

Fiberglass

Periodically inspect the fiberglass exterior for imperfections in the surface, commonly known as "spider" or hairline cracks, caused by flexing of the material. The integrity of the fiberglass is threatened when a crack opens up and reveals the weave of the cloth. Prevent moisture penetration if the exterior exhibits signs of damage, particularly in freezing climates. Cover the area using plastic sheeting or tape, and have the damaged fiberglass repaired as soon as possible.

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

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

INSPECT:

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

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

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

WARNING:

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

Sealant Types:

Tar Tape:

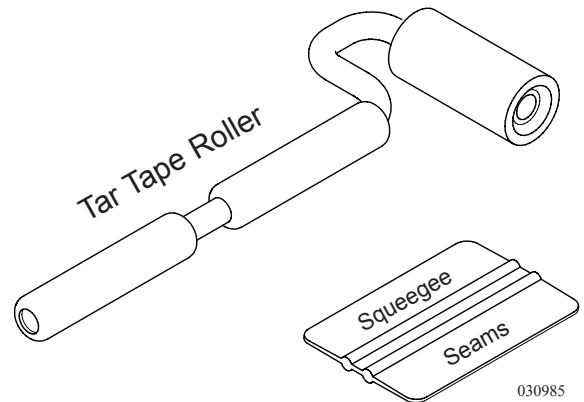
The tar tape is used on aluminum roofs seal seams at the front, rear and down the center. The sealant is available as a peel and stick waterproof membrane that contains UV inhibitors and is temperature resistant providing superior seal protection in all types of weather. Store sealant out of direct sunlight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

To Apply:

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

NOTE:

Check the tar tape at least twice a year for cracks. Removal of the tar tape is done with a plastic putty stick. Thoroughly clean the surface using 3M adhesive cleaner before applying the new tar tape.



Acrylic Foam Tape:

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

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

NOTE:

Use a heat gun to warm the product. When storing the motorhome, store in a warm area if possible.

To install acrylic foam tape, cut the liner for the proper length and then peel back the poly liner from the tape. Apply the tape on the desired line. Continue this process until the project is complete.

Dolphin Sealants (7549): Used where items are sealed under a painted surface such as the metal corners of the slide-out room. The material is specially formulated to allow paint adhesion.

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

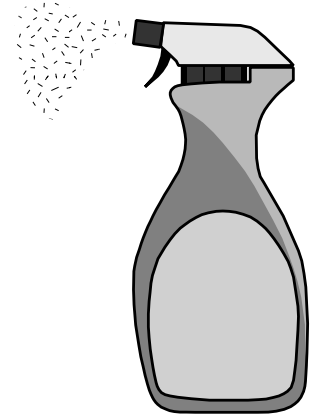
Silicone Sealant: Primarily used on the sidewalls where a hole has been made and an item installed. This includes Windows, Doors, Handles, Beltline Molding, Latches and around bases of items surface mounted such as clearance lights. Old peeling sealant should be removed. Avoid using metal utensils which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

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

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 cleaning on the cloth, not directly onto the lens, to prevent over spray or runoff .



070200

CAUTION:

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

TIP:

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

FABRICS

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

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

Guidelines for Cleaning Upholstery Fabrics:

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

Fabric Cleaning Codes

The codes listed below detail cleaning instructions recommended by the fabric manufacturing industry. Refer to the fabric charts, located on the following pages, for particular fabrics and follow the recommended cleaning code.

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

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

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

CAUTION:

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

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

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

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

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

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

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

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

"Finishing" - If necessary, press as following:

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

Fabric Specifications Charts

COLOR/PATTERN	APPLICATION	CONTENTS	CLEANING CODE
NAVAJO BRICK .65b			
"O" Vinyl Palomino	DR/Pass Chair, Opt. Recliner	100% Vinyl facing 100% Polyester backing	"O" Vinyl
Johnson Cream	Windshield Drape	100% Polyester	Dry Clean
Palomino	Main Dash Vinyl	Vinyl	Vinyl
"O" Vinyl Merlot Embossed 173	Vinyl Inserts for Slide Fascia	100% Vinyl facing 100% Polyester backing	"O" Vinyl
Cressida Curry 18995 C5LU	Sofa, LR Val, Dinette Back	13% Cotton 58% Rayon 1% Nylon 28% Polyester	W
Navajo Spice 39109 A2UU	LR Val, Dinette Cushions, FSD	35% Cotton 17% Olefin 48% Polyester	W
Mirano View Spice	LR Chair, Recliner, LR Pillow	42% Acrylic 30% Polyester 25% Cotton 3% Olefin	W
Elegance DY Cognac	Bedspread, BR Val	52% Cotton 48% Rayon	S-Dry Clean
Dynasty DY Sultan	BR Val, Bedspread Accent, Headboard, BR Pillow	52% Cotton 48% Rayon	S-Dry Clean
Oak Hill FRB-754 B Gold	Decorative Pillow Trim	80% Acrylic, 15% Rayon, 5% Polyester	S
Saville Row .48c			
"O" Vinyl Palomino	DR/Pass Chair, Opt. Recliner	100% Vinyl facing 100% Polyester backing	"O" Vinyl
Johnson Cream	Windshield Drape	100% Polyester	Dry Clean
Palomino	Main Dash Vinyl	Vinyl	Vinyl
"O" Vinyl Merlot Embossed 173	Vinyl Inserts for Slide Fascia	100% Vinyl facing 100% Polyester backing	"O" Vinyl
M-6210 Sandstone	Sofa, LR Val, Dinette Cushions	73% Rayon 27% Polyester	S
M-6285 Cocoa	LR Chair, Recliner, LR Val, LR Pillow	46% Rayon 37% Polyester 17% Cotton	S
Diego BK - Moss	LR Pillow, Dinette Back, FSD	37% Polyester 34% Acrylic 29% Olefin	S/W
Passionata Natural	Bedspread, BR Val	100% Cotton	S
Claiborne Antique	BR Val, Bedspread Accent, Headboard, BR Pillow	100% Polyester	Dry Clean
#20062 Coff / DIJ / Moss Fringe	Decorative Pillow Trim	96% Chenille, 4% Polyester	Vacuum Only
Castle Gate .49c			
"O" Vinyl Papyrus	DR/Pass Chair, Opt. Recliner	100% Vinyl facing 100% Polyester backing	"O" Vinyl
Johnson Cream	Windshield Drape	100% Polyester	Dry Clean
Papyrus	Main Dash Vinyl	Vinyl	Vinyl
"O" Vinyl Merlot Embossed 173	Vinyl Inserts for Slide Fascia	100% Vinyl facing 100% Polyester backing	"O" Vinyl
Warwick Bark	Sofa, LR Val, Dinette Back	62% Acrylic, 38% Polyester	W
Bouvier Moss	LR Chair, Recliner, LR Val, FSD Back, LR Pillow, Dinette Cushions	48% Viscose, 31% Polyester, 21% Cotton	W
Caceres - Ref . 63	LR Pillow, FSD Seat	65% Rayon 30% Polyester 5% Acrylic	S
Monrovia / Paramount Spice	Bedspread, BR Val	100% Cotton	W
Serena Sienna	LR Pillow, BR Val, Bedspread Accent, Headboard	70% Polyester 30% Rayon	Dry Clean
Serena Hazelnut	BR Pillow, BR Welt	70% Polyester 30% Rayon	Dry Clean
FR 215A Hazel Fringe	Decorative Pillow Trim	74% Polyester 26% Cotton	P

SILVER SAGE .66b			
"O" Vinyl Milkweed	DR/Pass Chair, Opt. Recliner	100% Vinyl facing 100% Polyester backing	"O" Vinyl
Johnson Cream	Windshield Drape	100% Polyester	Dry Clean
Milkweed	Main Dash Vinyl	Vinyl	Vinyl
"O" Vinyl Merlot Embossed 173	Vinyl Inserts for Slide Fascia	100% Vinyl facing 100% Polyester backing	"O" Vinyl
Silverfell Seadrift	Sofa, LR Val, Dinette Cushions	46% Rayon 29% Acrylic 25% Polyester	S
Genuine Putty	LR Chair, Recliner, LR Val, LR Pillow	62% Acrylic 32% Polyester 6% Cotton	S
Whitman 812 Camel	FSD	37% Viscose 32% Cotton 31% Polyester	S
Vivace Seadrift	LR Pillow	55% Rayon 45% Polyester	W
Coral Ridge Seadrift (Plaid)	Bedsread	42% Polyester 32% Acrylic 26% Rayon	S
Anjou SD-94 Olive	BR Val, BR Pillow	100% Cotton	Dry Clean
Silkhara 362 Leek	BR Val, Bedsread Accent, Headboard, BR Pillow	68% Rayon 32% Acetate	S
Oak Hill FRB-754 B Olive	Decorative Pillow Trim	80% Acrylic, 15% Rayon, 5% Polyester	S
EBONY VINE .67b			
"O" Vinyl Palomino	DR/Pass Chair, Opt. Recliner	100% Vinyl facing 100% Polyester backing	"O" Vinyl
Johnson Cream	Windshield Drape	100% Polyester	Dry Clean
Palomino	Main Dash Vinyl	Vinyl	Vinyl
"O" Vinyl Merlot Embossed 173	Vinyl Inserts for Slide Fascia	100% Vinyl facing 100% Polyester backing	"O" Vinyl
JST - 412 C Sonic Color 5 Ebony	Sofa	50% Viscose 18% Cotton 32% Polyester	S
Fairlawn 001 MO38464-001-1	FSD, Dinette Cushions, LR Val, LR Pillow	76% Cotton 24% Polyester	S
Breathtaking Taupe 39172 E3GU	LR Chair, Recliner, LR Val, Dinette Back, LR Pillow	17% Cotton 46% Acrylic 37% Polyester	W
Hayfield Flint	Bedsread	65% Polyester 35% Cotton	S
Prince Black	BR Val, BR Pillow	75% Acrylic 25% Polyester	Dry Clean
Shantung SH-66 Black	BR Val, Bedsread Accent, Headboard	57% Cotton 43% Rayon	Dry Clean
Oak Hill FRB-754 B Mocha	Decorative Pillow Trim	80% Acrylic, 15% Rayon, 5% Polyester	S

Vinyl

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

Normal Cleaning:

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

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

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

NOTE:

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

CAUTION:

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

Bird Excreta & Vomit Stains:

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

Urine Stains:

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

Surface Mildew:

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

Ballpoint Ink:

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

Oil-Base Paint:

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

CAUTION:

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

CAUTION:

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

WARNING:

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

Latex Paint:

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

Tar or Asphalt:

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

Crayon, Mustard or Ketchup:

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

Chewing Gum:

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

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

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

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

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

Blood or Plant Residue:

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

TIP:

Vinyl requires periodic cleaning to maintain its appearance and to prevent the buildup of dirt and contaminant that may permanently stain or reduce the life of the vinyl if left untreated. Frequency of cleaning and procedures used depend upon the amount of use and the environmental conditions in which the vinyl is subjected. Tears or holes in the vinyl can be temporarily covered with clear “office” 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.

“O” Vinyl**“O” Vinyl Cleaning Suggestions:**

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

For General Cleaning:

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

For Oil-based Stains:

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

For Marker-type Stains:

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

After each process, clean area with warm water.

WARNING:

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

CAUTION:

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

NOTE:

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

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.

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

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

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.

Vinyl Floor

The vinyl flooring in the motorhome is durable and long lasting when properly taken care of. When a spill occurs, wipe it up with a damp sponge or paper towel. Avoid using cleaners containing abrasives or scouring pads as these may damage the finish of the flooring. Keep the floor clean as dirt, grit and soil can act as abrasives. A 100% latex backed floor mat may help to keep the floor clean. Do not use rubber backed mats or runner casters, as they may stain the flooring. Use large protection pads with felt spots on bases of heavy stationary items to help disperse the weight. Felt spots are non-abrasive. High, stiletto heels may permanently damage the flooring. When moving heavy objects lay a piece of plywood down to prevent accidental galling of the vinyl.

NOTE:

Some dishwashing liquids, oil-based cleaners and one step “polishes” may not be suitable cleaners for the flooring. They can leave an oily residue which attracts soil and reduces gloss.

CAUTION:

Flooring may become extremely slippery when wet. Avoid personal injury by wiping up spills and keeping flooring dry.

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.

- Wipe away stains with a damp cloth.
- Stains caused by inks or paints may require a cloth moistened with acetone (nail polish remover).
- Stains caused by gum or tar should be allowed to harden completely, then gently scraped away.
- Felt protectors on the bottom of furniture and floor mats can preserve the beauty and appearance of the flooring.

CAUTION:

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

NOTE:

Contact Wilsonart at (800) 433-3222 to address any unusual or unique problems concerning the laminate flooring.

SHOWER

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

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

CEILING

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

Time is very important when removing solvent based chemicals or liquids that contain color from wall coverings. Do not use abrasive cleaners containing chlorine bleach or solvents. Fidelity and Jolie brands are recommended. Always begin with a mild detergent or soap and warm water. To remove normal dirt, clean with a soft sponge. Rinse and wipe dry.

Care for the Tower Wall Covering:

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

Care for the Satinesque Wall Covering:

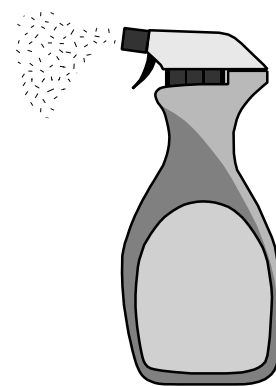
Stains must be removed quickly to minimize the reaction on the wall covering, especially if the stain is solvent-based or pigmented. Examples: nail polish, oil, shampoo, lacquer, enamel, paint, ink and lipstick.

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

Stain Removal Procedures for Specific Stain Types:

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

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



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

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

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

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

WOOD CARE

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

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

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

NOTE:

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

Sanding and Sandpaper:

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

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

Steel Wool:

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

Nail Holes and Small Cracks:

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

TIP:

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

Fixing scratches in stained woodwork:

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

Dents:

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

Restoring the clear finish:

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

Re-staining the wood:

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 several coats. Rub away excess stain with a dry rag. If the wood becomes too dark, use a rag moistened in mineral spirits to lighten the wood. Select a lighter color stain and continue.

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

Scratches and Nicks:

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

Staining the scratch with iodine:

Mahogany - Use new iodine.

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

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

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

COUNTERTOPS - Solid Surface

Guidelines to maintain the countertop surface:

Routine Care:

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

Cleaning the Countertops:

- **Most dirt and stains** - Use soapy water or ammonia-based cleaner.
- **Water marks** - Wipe with damp cloth and towel dry.
- **Difficult stains** - Use soft scrub 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 with 180 grit sandpaper, followed by 320 grit, until the scratch is gone.
- Restore the finish using a Grey *Scotchbrite* pad. Never sand hard in one small area. Feather out lightly to blend restoration.

Preventing Heat Damage:

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

Other Important Tips:

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

NOTE:

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

Laminate

Clean laminate countertops with a damp cloth or sponge. Use a spray cleaner to remove stubborn stains. 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 on food packages. Do not use laminated countertops as a cutting board. Laminated countertops are resistant to minor heat; however, hot pans, irons, and lighted cigarettes will damage the surface. Use hot pads under pans taken directly from the stovetop.

STAINLESS STEEL SURFACE

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

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

Water Spots:

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

Condensation

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

Controlling Moisture Condensation:

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

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

WINDOW TREATMENTS - *Mini Blinds*

Dusting:

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

Vacuuming:

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

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

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

Spot-Cleaning:

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

Ultrasonic cleaning:

Professional ultrasonic cleaning may be preferred.

Day/Night Shades

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

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

Dusting:

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

Cleaning:

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

NOTE:

Do not use colored liquid soap as a stain may appear when fabric dries.

What is Mold?

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

What Does Mold Need to Grow?

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

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

Consequences of Mold:

All mold is not necessarily harmful, but certain strains of mold have been shown to cause, in susceptible persons, allergic reactions, including skin irritation, watery eyes, runny nose, coughing, sneezing, congestion, sore throat and headache. Individuals with suppressed immune systems may risk infections. Some experts contend that mold causes serious symptoms and disease which may even be life threatening. However, experts disagree about the level of mold exposure that may cause health problems, and about the exact nature and extent of the health problems that mold may cause. 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:

There are several steps that can be taken to reduce or eliminate the possibility of mold growth.

Guidelines to Reduce or Eliminate Mold Growth:

- Check for signs of mold prior to bringing items in the motorhome. Potted plants (roots and soil), furnishings, or stored clothing and bedding material, as well as many other household goods, may already contain mold growth.
- Regular vacuuming and cleaning will help reduce mold levels. Mild bleach solutions and most tile cleaners are effective in eliminating or preventing mold growth.
- Indoor humidity can be reduced by 30 to 60% when venting clothes dryers to the outdoors. Ventilate the kitchen and bathroom by opening windows, using exhaust fans or a combination of both. Operating the air conditioning will remove excess moisture in the air, and help facilitate evaporation of water from wet surfaces.
- Promptly clean up spills, condensation and other sources of moisture. Thoroughly dry any wet surfaces or material. Do not let water pool or stand in the motorhome. Promptly replace materials that cannot be thoroughly dried.
- Inspect for leaks on a regular basis. Look for discolorations or wet spots. Repair leaks promptly. Inspect condensation pans (refrigerators and air conditioners) for mold growth. Take notice of musty odors, and any visible signs of mold.
- Should mold develop, thoroughly clean the affected area with a mild solution of bleach. First, test to see if the affected material or surface is color safe. Should mold growth be severe, call on the services of a qualified professional cleaner.
- If mold cannot be removed from an item, properly disposed of it.

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

PEST CONTROL

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

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

Guidelines to help control pests:

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

Rodents:

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

NOTE:

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

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

Insects:

Eliminate insects when signs of infestation appear. If 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. To eliminate all ants, the colony must be destroyed. 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 Pest:

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

Best sources of information about common household pests:

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

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

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

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

STORAGE

Short Term

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

Checklist-Short Term Storage

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

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

NOTE:

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

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

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

NOTE:

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

CAUTION:

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

Type of surface to park and store the motorhome on:

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

If the motorhome is stored outdoors:

- The interior should be heated to help prevent mold and mildew growth. Moisture removing desiccate filter systems are available from hardware and RV supply stores. Place the filter system inside the motorhome to reduce interior moisture condensation or humidity.

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- Proper winterization of the fresh water system will prevent potential damage in extreme cold.
 - Ultraviolet radiation affects soft goods and rubber products such as privacy curtains, window shades and tires. These items should be protected. Store Day/Night Shades in the **Up** position.
 - Cardboard templates can be made for the windows to protect the interior from exposure to direct sunlight.
 - Tire covers are available to protect the sidewall of the tires from cracking. Make sure tires in storage contain the correct air pressure to prevent damaged caused by underinflation.
 - Regularly washing the exterior to help control moss accumulation. Waxing the motorhome twice a year will augment these substances.

Inspect the motorhome:

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

Fuel:

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

Brakes:

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

Engine:

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

Electric Motors:

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

Winter Storage Checklist

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

LUBRICATION:

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

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

Removal from Storage

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

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

NOTE:

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

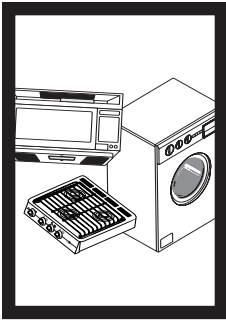
- Open cabinet doors and drawers. Inspect for water leaks at joints or fittings. Repair as necessary.
- Operate all 12 Volt DC lights and accessories. If something does not work there may be a bad 12 Volt circuit breaker or blown fuse.
- Install new batteries in battery operated safety detectors or devices. Test the carbon monoxide, LP-Gas and smoke detectors for proper operation.
- Check that the monitor panel is properly functioning.

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- Inspect the 120 Volt AC electrical system which includes the power cord, inverter/convert-er, all outlets and exposed wiring.

NOTE:

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

- Start and run the generator.
- Confirm that the batteries are charging. Operate the 120 Volt AC appliances and air conditioners. If an electrical item or appliance is not properly functioning, contact the dealer or an authorized service center to have it evaluated.
- Have a qualified technician **inspect** the LP-Gas system and perform an LP-Gas leak test. The leak test should also include an LP-Gas regulator adjustment (if needed). The test can also verify if the regulator is faulty and should be replaced. Have the LP-Gas tank inspect-ed.
- 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.



NEPTUNE 2005

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APPLIANCES - INTRODUCTION

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

INFORMATION:

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

WARNING:

Before entering any type of refueling station turn off all LP-Gas operated appliances. Most LP-Gas appliances used in recreational vehicles are vented to the outside. When parked close to a gasoline pump it is possible for fuel vapors to enter this type of appliance and ignite, resulting in an explosion or fire.

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 - NORCOLD

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

INFORMATION:

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

NOTE:

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

Operation Specifics

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

CAUTION:

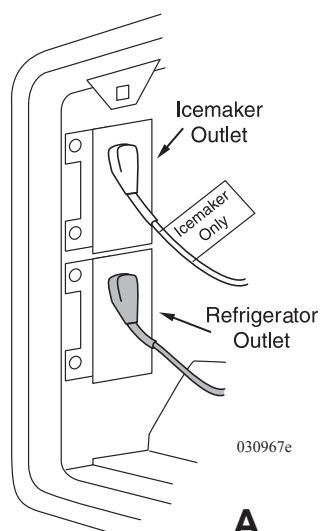
Operate refrigerator only when level. Level the refrigerator, (from front view) within 3° side-to-side and 6° front-to-back, using a torpedo or bulls eye (fence post) level. Place the level on the freezer plate. The level should be within the circle by a half of a bubble. Generally, this is within comfortable living conditions.

NOTE:

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

WARNING:

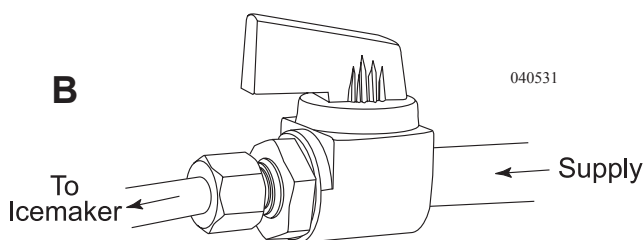
Do not use the refrigerator if there is an ammonia smell inside or outside of the refrigerator, or if a yellowish substance appears inside or at the outside access compartment. This can be an indication of a refrigerant leak. Contact an authorized repair facility.



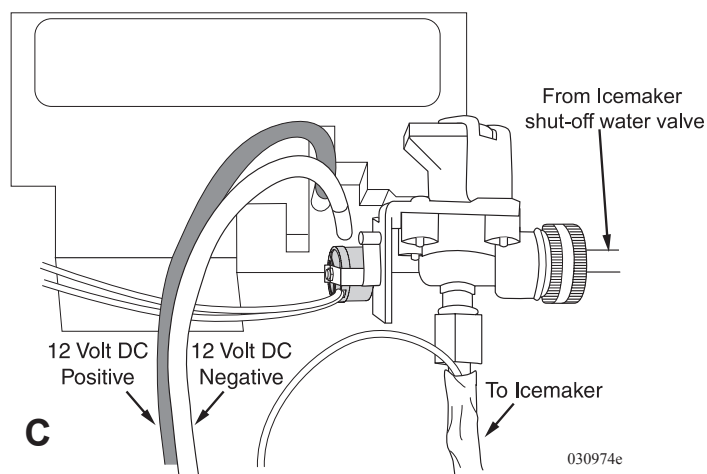
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For the refrigerator to operate:

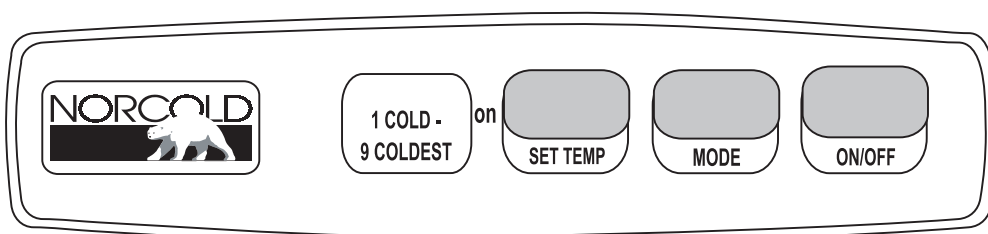
- The house batteries must be fully charged.
- The primary LP-Gas valve and the electric LP-Gas valve must be on, or an AC source must be available.
- **Figure A:** The refrigerator 120 Volt AC cord(s) must be plugged in (located outside behind refrigerator access door).
- **Figure B:** The icemaker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



Valve shown in open position located under refrigerator inside motorhome



C



The Refrigerator Control Panel requires 12 Volt DC to operate.

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

Manual Mode:

When one of the two manual modes is selected:

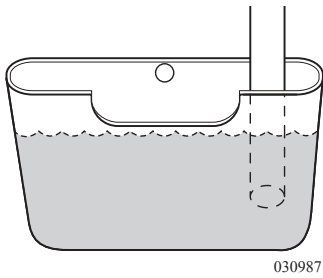
1. **AC** = The refrigerator is operating on AC electric.
2. **LP** = The refrigerator is operating on LP-Gas.

Automatic Mode (AU):

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

- Press and hold the **MODE** button until **AU** displays. Release the button.
- Press and hold the **SET TEMP** button until the desired temperature displays. Release button.
- In **AUTO** mode, AU/AC or AU/LP will alternate 3 times when a mode has changed.

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

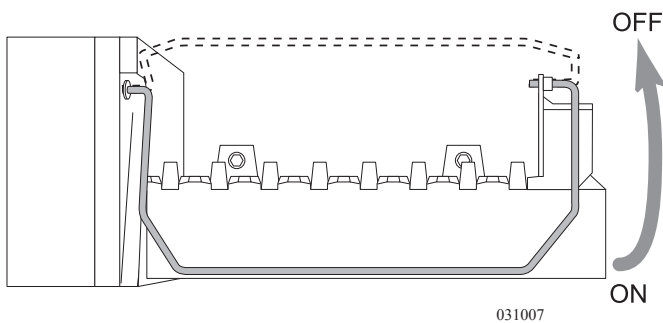


Drip Pan: Located behind the outside access.

Tips:

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

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.

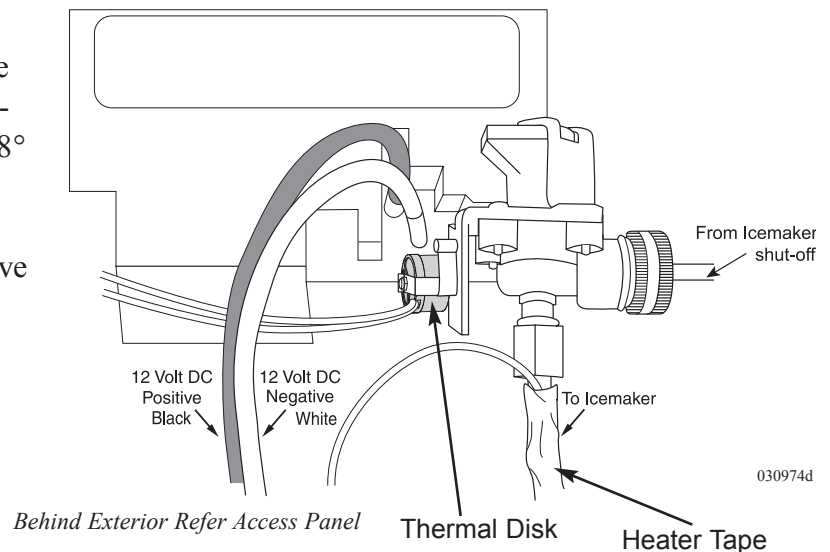
- Pull the metal arm (bail) down to turn the icemaker on.
- Push the arm up to turn the icemaker off.

NOTE:

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

Water Line Heater:

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



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

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

NOTE:

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

INFORMATION:

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

WARNING:

Make sure all flames are extinguished and the primary LP-Gas valve is off before refueling. LP-Gas and gasoline are highly flammable and can ignite, resulting in an explosion, fire or death. Many states have passed laws regarding having the primary LP-Gas valve open while traveling. Know the laws for the particular state in which you are traveling.

Cooling Unit Fans

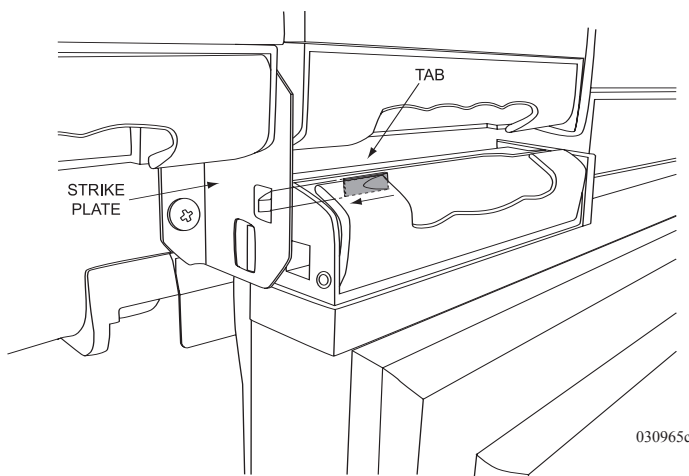
The cooling unit is equipped with a pair of cooling fans that pass air across the cooling unit. These fans start automatically and are audible when in operation.

Doors

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

In storage, a completely sealed refrigerator is a perfect environment for mold and bacteria to grow. When storing the motorhome, reduce risk of mold and bacteria in the refrigerator by using the door storage feature to lock the doors partially open.

To use the storage feature, open doors enough to slide tab into the cut-out of the strike plate.



Storage Feature. Optional 4-door model

Storage Procedures

Storage Feature:

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

CAUTION:

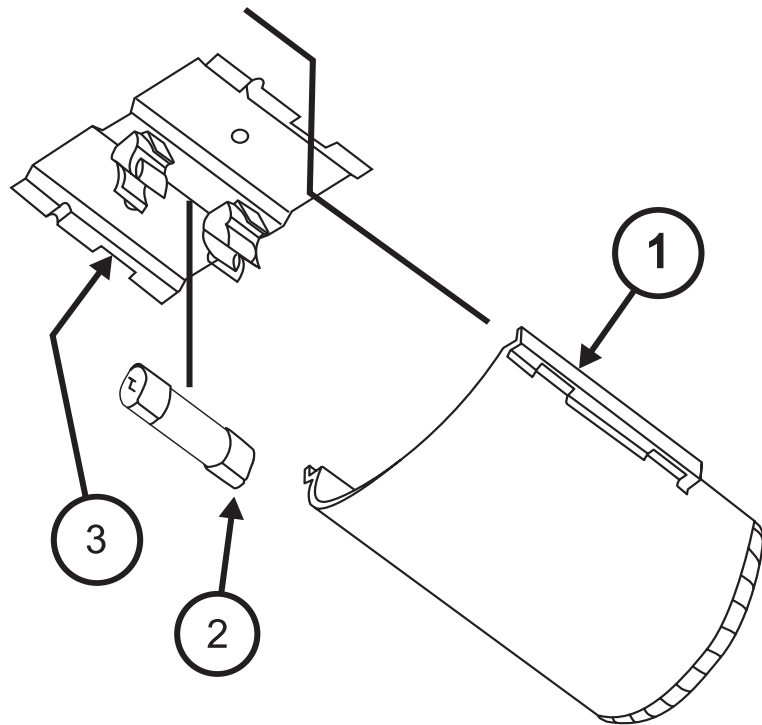
When defrosting, do not use a hot air blower. Permanent damage could result to plastic parts. Do not use a knife, ice pick or any other sharp instrument to remove ice from the freezer as they can puncture the system.

Interior Light

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

Bulb Replacement:

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



Remove light cover to replace refrigerator interior light.

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

Air in LP-Gas Supply Lines

For safety reasons, the refrigerator will attempt to ignite on 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 propane gas supply lines:

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

MICROWAVE/CONVECTION OVEN

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

Operation Tips:

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

Microwave/Convection Oven Facts:

One of the most useful documents for the microwave/convection oven is the 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. Check the microwave/convection oven owner's manual for maintenance tips and other information. Remember to register the microwave/convection oven with the manufacturer.

NOTE:

If the ventilation fan has started automatically from a heated cooktop it can not be manually turned off.

NOTE:

When dry camping, minimize using the inverter 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.

Setting the Clock

To Set Clock:

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

NOTE:

The clock is a 12 hour clock only.

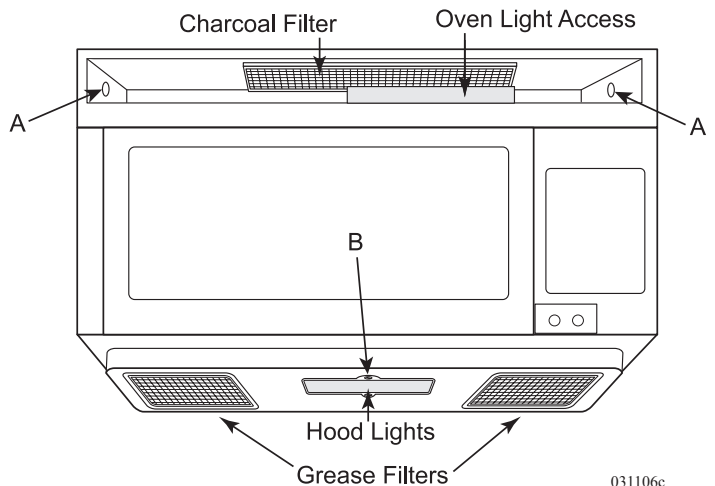
Cleaning the Microwave/Convection Oven

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

Charcoal Filter:

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

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



Oven Light:

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

Hood Light:

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

CAUTION:

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

Grease Filters:

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

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

Cleaning Tips:

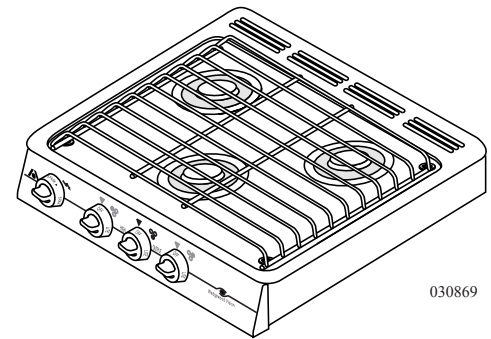
- Turn the oven off before cleaning.
- Cover food while cooking to keep food spattering to a minimum.
- Clean up all spills or spatters before they dry. Wipe up food spatters or spilled liquids with a damp cloth. Mild detergent may be used for stubborn spills. Do not use harsh detergent or abrasive cleaner.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

COOKTOP

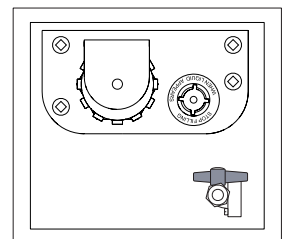
The cooktop uses LP-Gas only as a fuel source. The burners use a piezo type igniter. The cooktop should be used for cooking purposes only and not as a heating source. When the burner valve is opened the fuel source flows through the valve into the mixture tube. The fuel passes by a hole or venturi in 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.

Operation Requirements:

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

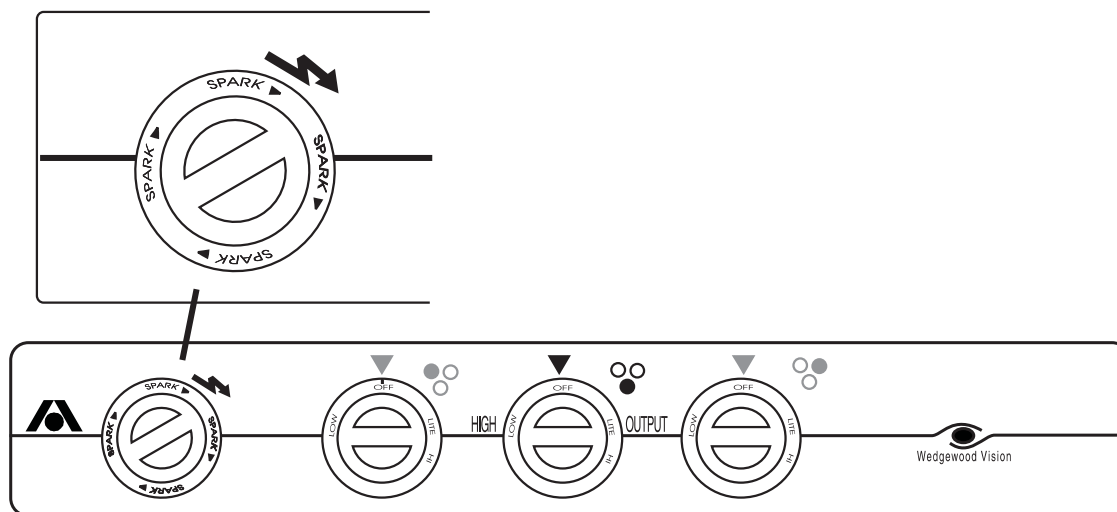


Electric LP-Gas switch located in curbside bay behind front wheel.



Lighting Top Burners

- Turn the appropriate burner knob counterclockwise to LITE. Do not attempt to light more than one burner at a time.
- Turn the SPARK knob located at the left hand side of the cooktop, clockwise one click. If the burner fails to light, continue turning the SPARK knob clockwise until the burner lights.
- Turn the burner knob clockwise to OFF, to turn the burner off.
- Ensure burners are off before installing range covers.



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WARNING:

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

WARNING:

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

Operation Tips:

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

Burner Grate

Removing the Burner Grate and Cooktop Cover for cleaning:

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

Cleaning

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

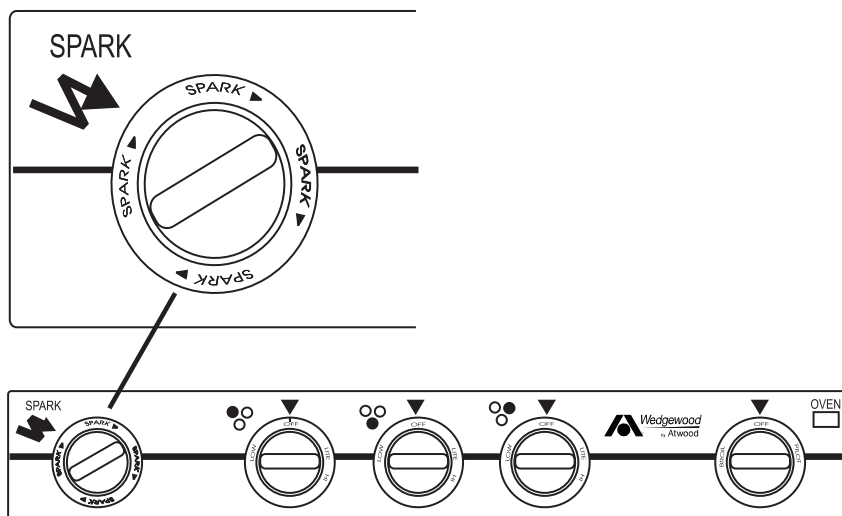
Regular cleaning with a soft cloth and a warm detergent solution is generally enough to keep the cooktop clean. Wash, rinse and dry with a soft cloth. Thoroughly clean the cooktop when it is cool. Use a dry cloth or paper towel while the surface is warm to the touch to clean splatters or spills. Cleaning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

Porcelain Enamel:

Porcelain enamel, a type of glass fused on steel at a very high temperature, is not extremely delicate but must be treated as glass. Sharp blows, radical surface temperature changes, etc., will cause enamel to chip or crack. Some foods such as vinegar, lemon juice, tomatoes and milk contain acids which can dull the finish of the enamel. To avoid dulling the finish, wipe up the spill before it is baked on. 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 800-325-4026.

COOKTOP WITH OVEN (Optional)

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



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- The oven may be used with the cover on. Do not block vent openings on cover.
- Push in the oven control knob and rotate counterclockwise to **PILOT ON**.
- Manually light the oven pilot located near the back of the oven, under the broiler shelf and to the left of the oven burner.
- Set the oven control knob to **PILOT ON** to maintain pilot flame. The oven and broiler are now ready for operation. The oven pilot has been factory set and requires no further adjustment.
- Pre-heat the oven for 10 minutes prior to use.
- To extinguish the oven pilot push in the oven control knob and rotate clockwise to **OFF**.

WARNING:

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

WALL THERMOSTAT

The wall thermostat operates the HVAC (Heating, Ventilating and Air Conditioning) system. The thermostat requires 12 Volts DC to operate. The thermostat operates the roof air conditioner functions as well as the LP-Gas furnace.

Fan Operation:

- Move the Fan switch to the On position.
- Set the thermostat to the desired temperature.
- Use the Hi/Low switch to select the fan speed.

Air Conditioner Operation:

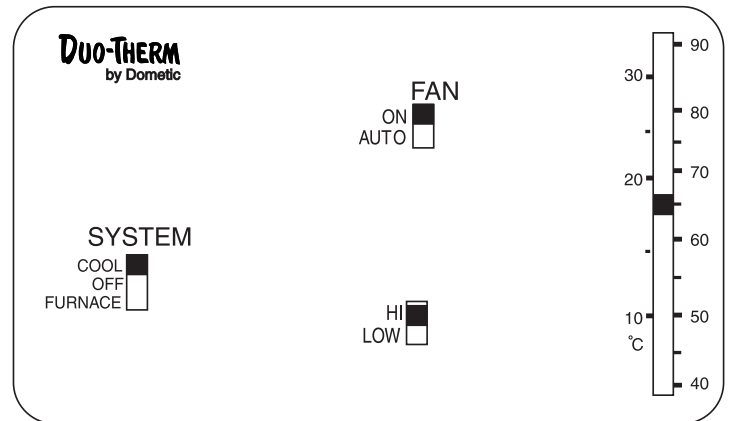
- Move the System switch to Cool and the Fan switch to On.
- Set the thermostat to the desired temperature.
- Use the Hi/Low switch to select the fan speed.

NOTE:

The thermostat in the bedroom performs the same function as the living room thermostat. The Furnace position on the bedroom thermostat is nonfunctional.

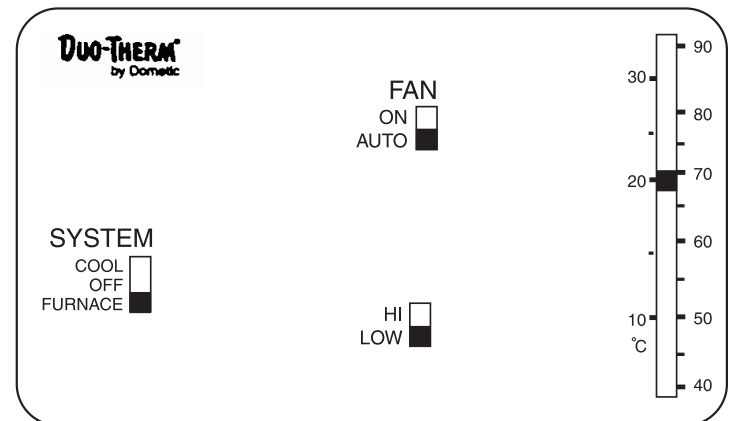
Furnace Operation:

- Set the Fan switch to Auto to turn off AC fan.
- Set the thermostat to the desired temperature.
- Set the System switch to Furnace.



Standard Wall Thermostat

050235b



Wall Thermostat w/ Furnace Selected

050235 Furnace

Comfort Control (Optional)

The comfort control operates the HVAC (Heating, Ventilating and Air Conditioning) system. The comfort control is located in the hallway on the monitor panel. The comfort control will operate both roof air conditioners and the LP-Gas furnace. The comfort control uses a liquid crystal display to show the current mode status.

There are five different modes of the Comfort Control system:

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

The motorhome is divided into two operating Zones, the living room and the bedroom. The living room is Zone One. The bedroom is Zone Two. The comfort control must be in Zone 1 for the furnace to operate. Press the Zone button to change zones. The Up and Down buttons control the temperature in any mode.

NOTE:

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

NOTE:

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

NOTE:

Conflicting modes cannot be selected. One zone cannot be set to Heat mode while another zone is set to Cool mode.

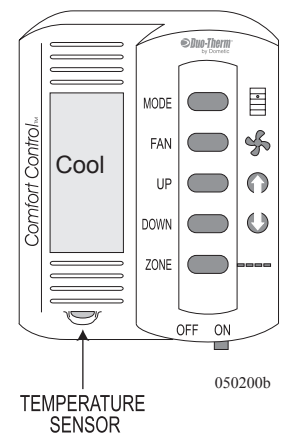
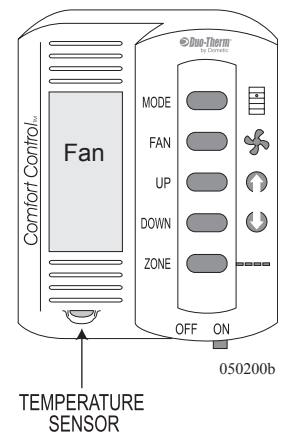
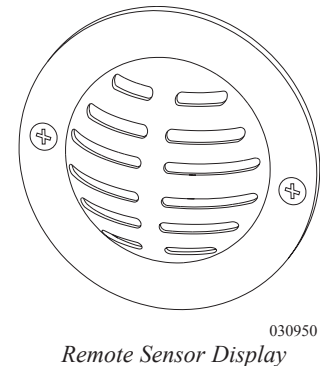
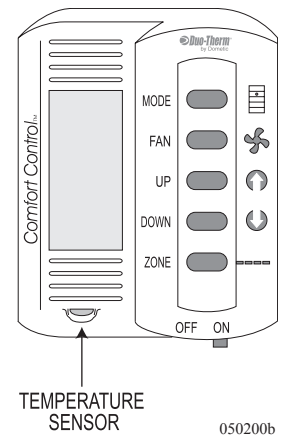
Fan Operation:

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

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

Air Conditioner Operation:

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

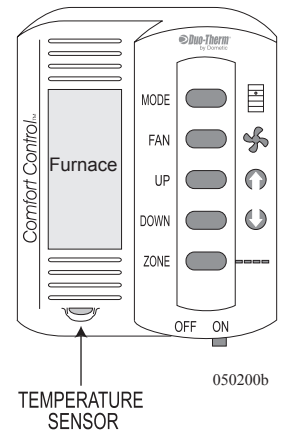


Furnace Operation:

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

NOTE:

The Zone 2 function does not operate the furnace.



Heat Pump (Optional - N/A w/ Standard Thermostat)

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

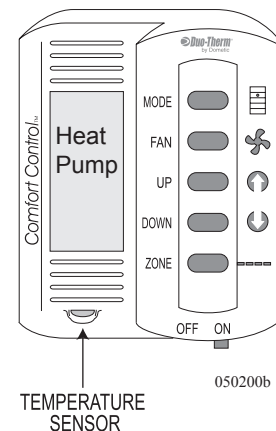
NOTE:

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

Heat Pump Operation:

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

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



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

AIR CONDITIONER - ROOF

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

NOTE:

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

Operation

Roof Air Conditioner Operation Requirements:

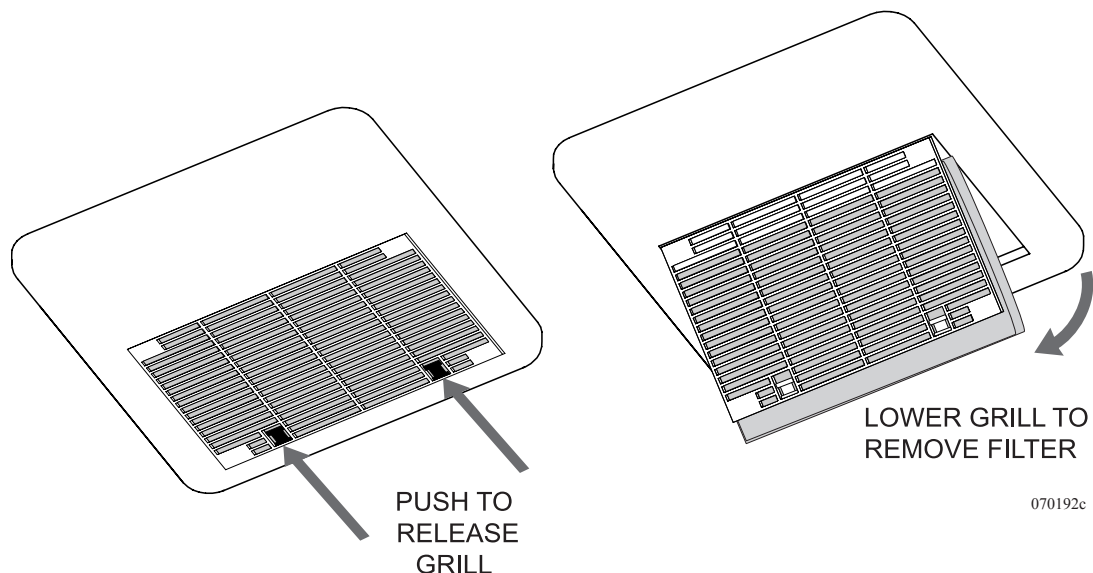
- 120 Volts AC, from either shore power or the generator, is supplied.
- The interior house power is on and house batteries are charged.

Return Air Filters

Clean the return air filters frequently. They are located inside the motorhome behind the intake vent covers. Firmly grasp the leading edge and push back on both tabs. Never run the air conditioner without the return air filters in place. Dust and other particles will plug the evaporator core and substantially reduce the performance of the air conditioners.

To Clean:

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



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 can be run throughout the motorhome.

CAUTION:

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

WARNING:

IF YOU SMELL GAS extinguish all open flames and turn off the main gas supply. Liquid propane is a highly volatile, extremely dangerous gas. It can explode or ignite, 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.

Operating Instructions

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

Furnace Operation Requirements:

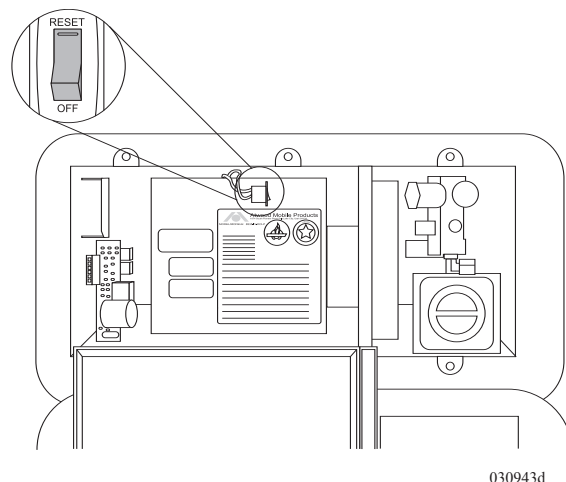
1. The LP-Gas primary valve on the LP tank and the electric LP-Gas valve at the remote fill are open.
2. The house batteries in the motorhome are fully charged and the interior house power is on.

NOTE:

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

Tips:

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

**CAUTION:**

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

NOTE:

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

If the Furnace Fails to Light

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

To Charge the House Batteries, either:

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

WARNING:

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

WATER HEATER

The water heater uses two different methods to heat water: (1) 120 Volt AC, supplied either by shore power or the on board generator (2) LP-Gas. The 120 Volt AC uses a heating element similar to the type used in a house water heater. The 120 Volt AC method is efficient if shore power is available. An automatic ignition circuit board, operated by 12 Volt DC, controls the LP-Gas. Two thermostats control water temperature: One for the 120 Volt and the other for the LP-Gas. The thermostat temperatures are preset by the water heater manufacturer and are not adjustable.

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

NOTE:

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

NOTE:

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

Before Using the Water Heater

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

To Purge the Air and Pressurize the System:

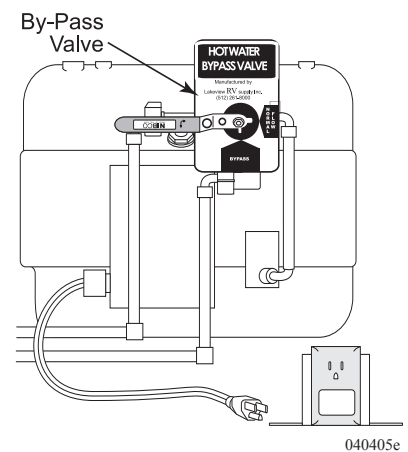
- Remove the interior access panel to the back of the water heater.
- Turn the water heater Bypass Valve (located at the back of the water heater) to Normal Flow. If necessary replace drain plug.
- Fill the fresh water tank or hook to city water.
- Turn on the water pump or city water.
- Turn on the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

CAUTION:

After purging the water lines and water heater, air may still be present. Use caution upon opening a hot water faucet after the first heat cycle of the water heater.

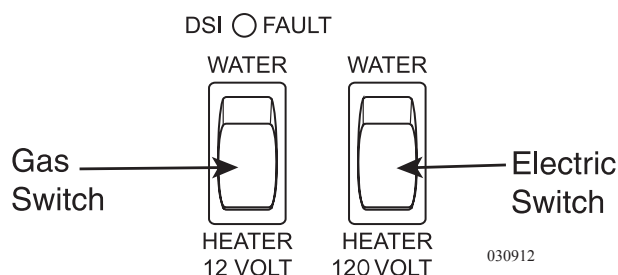
WARNING:

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



Heating Water with 120 Volt AC:

- Have either shore power or the generator supplying AC voltage.
- Turn on the electric water heater switch (120 volt).
- Both gas and electric functions may be on at the same time. This will speed up the process of heating water for large volume use.



Heating Water with LP-Gas:

- Make sure the LP-Gas is turned on.
- Turn on the LP-Gas water heater switch (12 volt). The water heater will make an audible "roar" from the burner when ignited.
- The indicator light on the switch will illuminate briefly, then go out when the water heater is lit. The indicator light will glow steady when the ignition cycle has gone into "lock-out."

CAUTION:

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

NOTE:

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

Ignition Module:

The LP-Gas On/Off switch controls the ignition circuit to the water heater.

The indicator lamp illuminates under the following conditions:

- Upon initial start-up the lamp illuminates briefly, ignition occurs, and the lamp goes out.
- If the burner does not light within 6 to 9 seconds, the ignition board will lock out and the indicator lamp will glow steady.

Thermostats

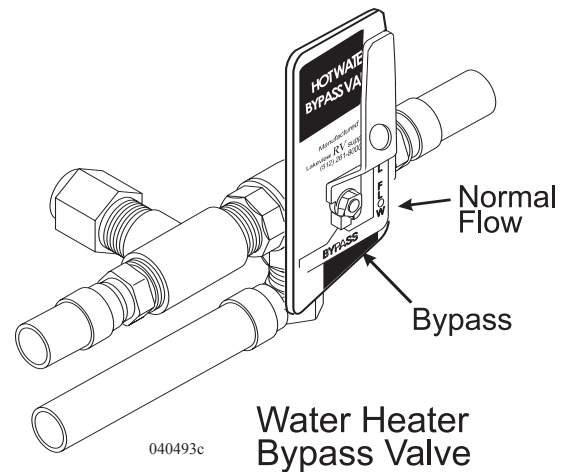
Separate thermostats are used for LP-Gas and AC electric. The thermostat controls the power to the module board. At 130° F, the thermostat will open, extinguishing the burner. If the thermostat fails, a High Temperature safety limit switch will open. The safety switch will require manual reset.

CAUTION:

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

Water Heater Bypass

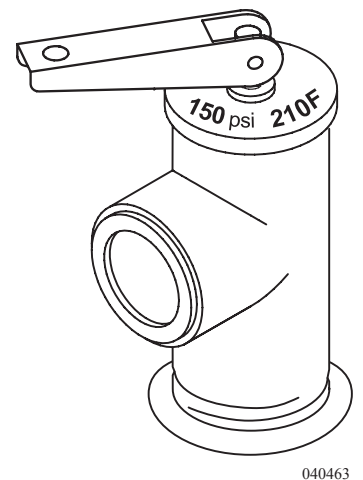
The bypass valve is located at the back of the water heater. Turning the valve to **BYPASS** stops water from entering the cold water inlet of the water heater. Turn the valve to **BYPASS** when winterizing. For normal operation, turn valve so that handle points to **NORMAL FLOW**.



Pressure-Temperature Relief Valve

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

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



CAUTION:

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

Re-establishing the Air Pocket:

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

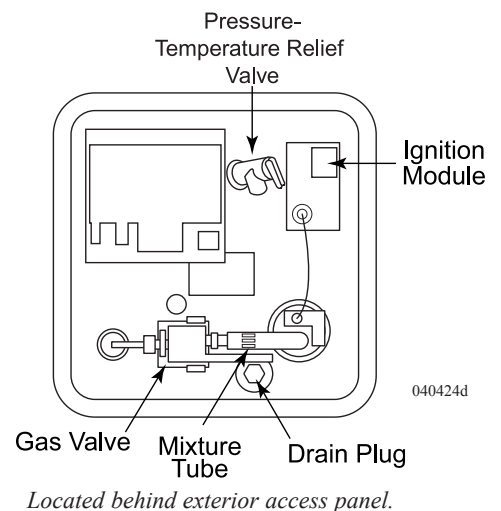
Step 2: Turn **OFF** the incoming water supply.

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

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

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

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

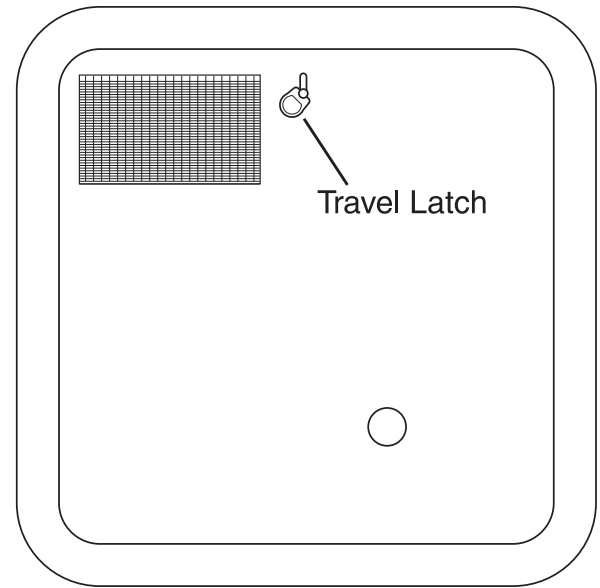


The air pocket is re-established and the process does not need to be repeated until the next discharge of water from the P & T valve. If the discharge does not stop, contact a qualified service center to evaluate the valve and make any required repairs.

Burner Compartment

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

NOTE:
Do not block any opening.



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Tips

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

Draining & Storage

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

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

NOTE:

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

Troubleshooting

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

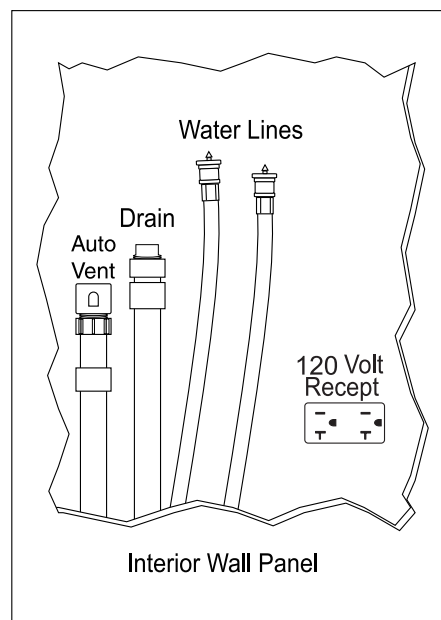
WASHER-DRYER PREPARED (*Optional*)

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

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

NOTE:

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



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

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

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

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

INFORMATION:

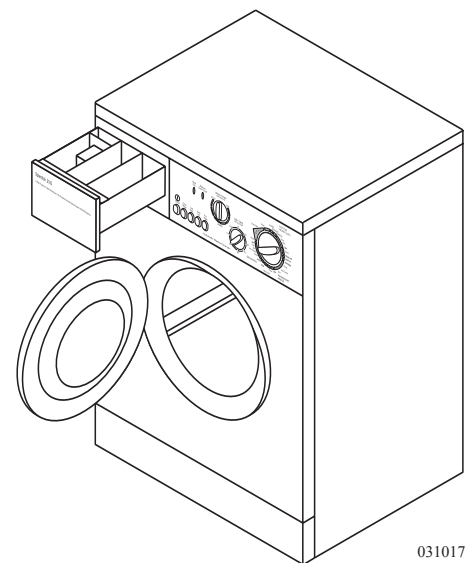
The washer-dryer has many features. Refer to the manufacturer's manual in the owner's information file for detailed operating instructions.

WARNING:

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

CAUTION:

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



Test Procedure

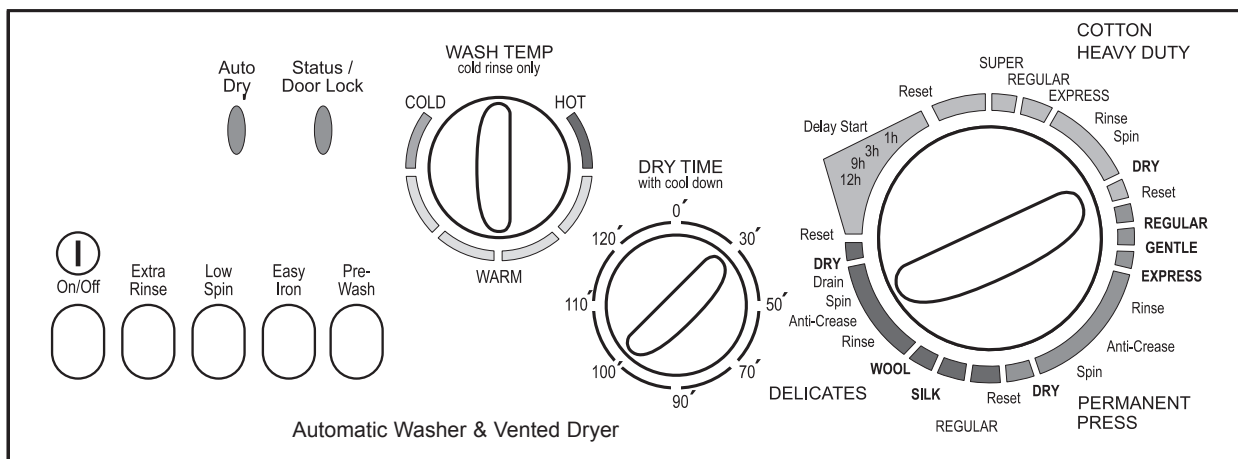
Before using the washer for the first time, after winter storage or a long period of non-use, conduct a simple test procedure to verify that all the hardware and electronic components are functioning. Wipe the interior and exterior of the washer-dryer with a damp cloth to remove dust that has accumulated.

NOTE:

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

Test Procedure Requirements:

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



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To Conduct the Test Procedure:

1. Set the selector knob to **Reset**.
2. Set the **Dry Timer** knob to 30 minutes. Push the **On/Off** button to **On**. Wait five seconds. The **Auto Dry** light should be on and the **Status** light flashes fast then slow.
3. Set the selector knob to a wash cycle. Set **Wash Temp** knob to **Warm**. Water should flow into washer and the drum should rotate both directions.
4. Set the selector knob to **Reset**. Wait five seconds.
5. Set the selector knob to **Spin**. Water should drain and the drum rotation should speed up.
6. Set the selector knob to **Reset**. Wait five seconds.
7. Set the selector knob to **Dry**. Dryer fan should begin and the drum should rotate both directions.
8. Set the selector knob to **Reset**. Wait five seconds.
9. Set the **Dry Time** knob to 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.

WARNING:

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

CAUTION:

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

To begin a wash load:

- Sort and pre-treat clothes.
- Add the measured amount of detergent suggested by the package directions (maximum two tablespoons).
- Load the laundry loosely into the washer. Close the washer door.
- Turn the Wash Temperature knob to the desired temperature setting.
- Choose the desired washing cycle option using the Selector knob.
- 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.

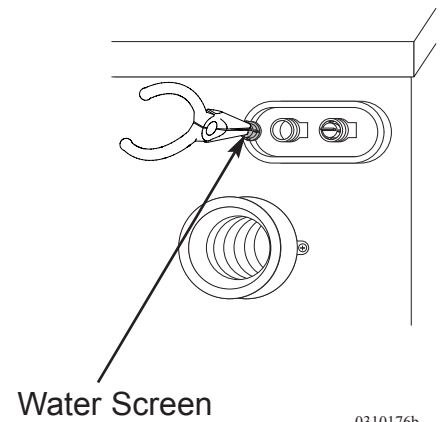
Washer-Dryer Maintenance

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

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

NOTE:

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



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Winterizing the Washer-Dryer

To Winterize the Washer Dryer with Air Pressure:

1. Hook an airline (regulated to 45 psi or less) to the water inlet of the motorhome.
2. Rotate Selector knob to a wash position with the Wash Temp setting on Warm. Press the power button to On. Air pressure will clear the Hot and Cold water lines.
3. After water lines are clear, rotate Selector knob to Spin. Allow the pump to drain the drum.
4. Set Selector knob to Reset and Timer to zero. The door will unlock in two minutes or less. Open door and pour in $\frac{1}{4}$ gallon of RV antifreeze.
5. Set Selector knob to Spin. The pump will prime with antifreeze. Set selector knob to Reset and turn the power off.

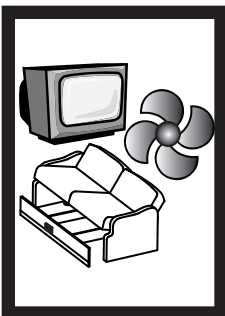
To Winterize the Washer Dryer Using RV Antifreeze:

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

1. Turn on the Water Pump. Rotate Selector knob to a wash position with the Wash Temp setting on Warm. Press the power button to On. Allow antifreeze to enter the drum.
2. After water lines are filled with antifreeze, rotate Selector knob to Spin. Allow the pump to drain the drum.
3. Set Selector knob to reset and Timer to zero. The door will unlock in two minutes or less. Turn the power off.
4. Any remaining liquid should contain a sufficient amount of antifreeze to be protected from freezing.

NOTE:

After winter, perform a Test Procedure before washing or drying any laundry to make sure all antifreeze has purged.



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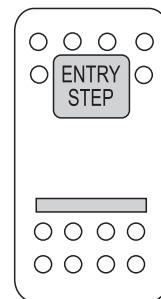
This section covers the basic operation and care of equipment found in the motorhome, most of which provides for entertainment and comfort. More detailed information about specific equipment may be found in that particular manufacturer's manual. Optional equipment will also be discussed in this section which may not apply to all motorhomes.

INFORMATION:

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

ENTRY STEP Operation

The entry step is made up of two parts: the exterior retractable entry step and the interior stepwell area. The exterior electric entry step features retractable steps, amber lighting under the step, automatic retraction with the ignition key in the RUN position and a "last out" feature. The step switch (located to the right on the dash just inside the entry door) has a bar light indicator which, when illuminated, indicates the circuit is active.



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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. With the entrance door open, turn the **ENTRY STEP** switch on.
2. Close the door. The step should retract and lock in the **IN** position.
3. Open the door. The step should extend and lock in the **OUT** position. The step will retract when the door is closed.
4. When the entry step switch is turned off, the step should remain in the extended position with the door closed and the under step light off. Close the door and turn on the ignition switch. The step will retract for travel.
5. With the power switch off, the step extended, the entrance door closed and the ignition turned on, the ignition override system will engage to automatically retract the step.
6. 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.

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 step fails to operate:

- Verify that the step switch is ON.
- Check the main power supply for the step: a 25 Amp fuse located in the front distribution panel.
- A magnetic door jam switch is used to control step operation. Use a separate magnet to apply a “trigger” to the door jam switch. Rotate test magnet to align polarity field.

Warning:

If the motorhome is driven with the step in the extended position, there is the possibility of causing major damage to both the step and the motorhome.

Stepwell

The stepwell incorporates two small lamps for lighting, a storage compartment and a sliding stepwell cover. The upper step of the stepwell has a compartment to store frequently used items such as, gloves (for refueling), tire pressure gauge, flashlight or outside slippers.

Cover:

An electrically operated stepwell cover will extend and retract using the switch on the curbside armrest. Power is supplied by a 15 Amp fuse in the roadside front electrical bay.

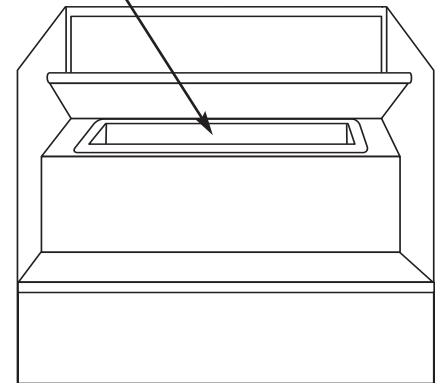
To operate the Stepwell Cover:

1. Turn on the Battery Cut-Off switch.
2. Press and hold the **Step cover** switch to the desired direction. Release the switch to stop movement.

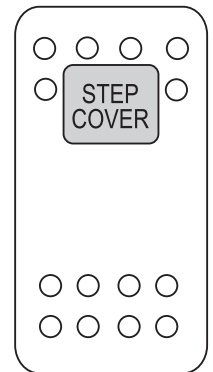
CAUTION:

When operating the stepwell cover, make sure there are no pets, shoes or other obstructions in the stepwell area. Do not operate the stepwell cover while standing in the stepwell area.

Storage Compartment



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The entry door is adjusted at the factory and tested for all operations. The door incorporates three separate seals to eliminate wind noise during travel. The door uses two separate locks for safety and security. One locking system is the door handle and the other is a dead bolt. The door handle incorporates a primary and secondary latching system. This is used to ensure secure and safe latching. There are adjustments which can be made to help maintain entry door performance.

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 of the door.
- The entry handle should operate with little effort to open the entry door. Excessive pressure indicates the bolts are set too far back.
- With a 5/8" inch box wrench or socket, loosen the movable strike bolt. Make all adjustments in small increments. Tighten the bolt firmly after making adjustments. The bolts should have slight up and down movement for vibration control in travel.
- Test the operation of the dead bolt lock to ensure proper functions.
- Apply silicone weekly to the entry door rubber gaskets to prevent squeaking while the motorhome is traveling. Use a one inch sponge paint brush, sprayed with silicone for easy application.

CAUTION:

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

Screen Door Maintenance**Changing Screen Door Glass:**

- The screen slider is *Lexan*, the slider can be bowed for removal and replacement.
- Replace with new *Lexan* and reverse the procedure.

Adjusting the Screen Door:

- Loosen the bolts on the hinge side of the screen door; two on the top and two on the bottom.
- The hinge has slots to allow in and out movement to properly adjust the screen. The hinge should fit tightly to the trim of the entry door when the screen door is latched to the door and the door is open.

Removable Screen:

- The top half of the screen door is removable. This allows clear viewing through the entry door glass while traveling.
- To remove the top half of the screen door for travel, rotate clips 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

The main slide-out room operates by an electric switch that controls an electric motor. Slide-out room operation uses many safety features that prevent mechanical damage or physical harm. The slide-out room(s) will not operate until all safety requirements are met.

The design of the slide-out system requires very little maintenance. To ensure long life of the slide-out system, follow these simple guidelines:

- **Inspect** the roof of the slide-out for debris such as pine needles, dirt, leaves, sticks, etc. Any debris left on the top may cause damage to the seals when being retracted. If debris is present wash with soap and water, then rinse.
- When the room is out visually **inspect** the wipe seal. The seal should be clean and free of dirt or other foreign material. **Inspect** the seal for tears.
- In the event the slide-out room leaks, fully retract it. If necessary, tape the exterior opening closed with duct tape until repairs to the motorhome can be completed.
- Open a window or a vent to equalize pressure during slide-out operation.

NOTE:

Do not use any petroleum-based products on the slide-out seal. Petroleum based products can damage the paint and will cause premature aging of the rubber seal.

WARNING:

Move the driver's seat forward before activating the slide-out room. Damage to the upholstery can occur. The outside area must be clear of any obstructions restricting slide-out room operation. Ensure there is five or more feet of clear space outside the slide-out room prior to extending or damage can occur. When retracting the slide-out room, ensure there is sufficient clearance inside the motorhome. Never move the motorhome with any slide-out room extended.

CAUTION:

Continuous operation of the slide-out room can drain the batteries and damage the motor from overheating.

Main Room Slide-out

To Extend the Main Slide-out Room:

- Move the driver seat forward.
- Confirm that there is at least five feet of clearance outside the motorhome for the slide-out room to extend.
- Ensure the ignition key is in the **OFF** position.
- The park brake must be applied.
- The house batteries are fully charged.
- Be sure all people, pets and objects are clear of slide-out room path.
- Remove the lock bar.
- The slide-out room control switch is on the system monitor panel.

- Press and hold the front slide-out room switch in the **OUT** position. The slide-out room will slowly move to the **OUT** position. Release the switch to stop room movement. To continue the room movement, push and hold the switch in.
- Release the slide-out switch when the room is fully extended (a change in motor sound indicates extension). The slide-out drive motor will not stop automatically; the switch must be released.
- If equipped, extend additional slide-out rooms.
- Level the motorhome with the leveling system.

NOTE:

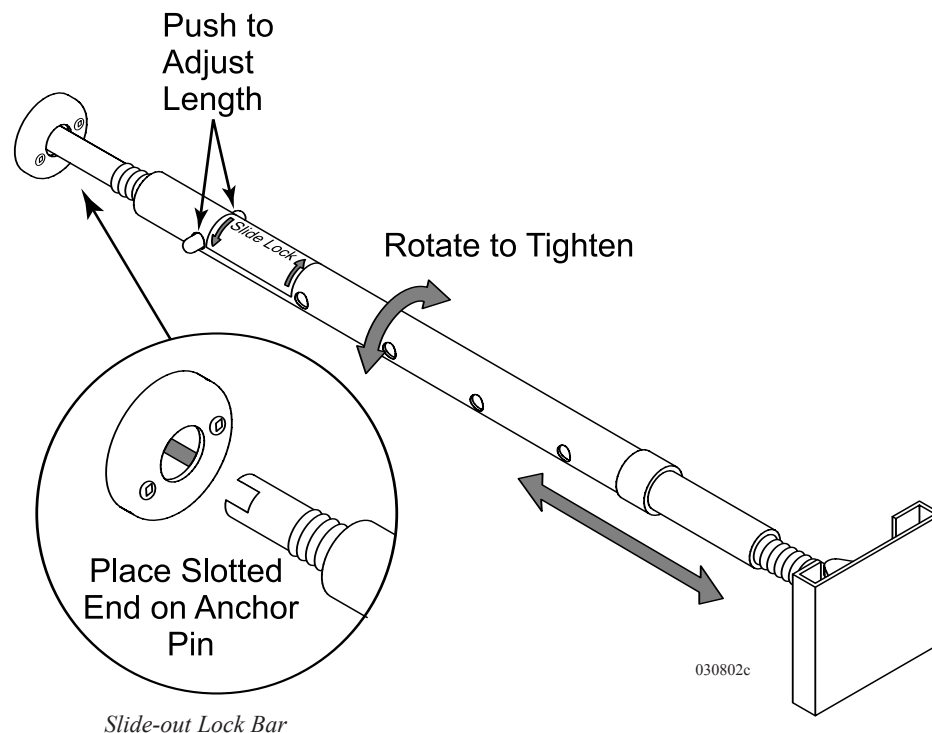
Perform the slide-out room operation with the air suspension system full. Extensive damage could occur to the slide-out room and awning when extending the slide-out room in snow, sleet, ice or freezing rain. In such conditions, if the slide-out room is extended, clear the awning and ensure free movement prior to operating the slide-out room.

CAUTION:

Dirt and grit trapped under the slide-out room could result in damage to the floor. Continuous operation of the slide-out could cause a drain on the house batteries and damage to the slide-out motor from overheating.

CAUTION:

Remove lock bar prior to extending slide-out.



To Retract the Main Slide-out Room:

- Check for sufficient clearance inside the motorhome before retracting the slide-out room.
- Clean the floor, if applicable, to ensure there is no dirt or grit that could result in floor damage during operation.
- Move the driver's seat forward.
- Inspect the exterior to ensure there are no sags in the awning material.
- Remove any debris from the top of the slide-out room.
- Prior to retracting the slide-out room, start the motorhome. Allow the air bags to fully inflate to normal travel height.
- Retract the leveling jacks prior to operating the slide-out.
- Turn the ignition switch **OFF**. The slide-out room will not operate with the engine running.
- The house batteries should be fully charged.
- The park brake must be applied.
- Ensure all people, pets and objects are clear of slide-out room path.
- Press and hold the switch in the **IN** position. The slide-out room will move slowly in. To stop the slide-out room, release the switch. To continue the room movement, push and hold the switch in.
- Rain water can pool on the slide-out awning. Added weight will cause the awning to sag. Upon retracting the room, the material can catch between the top of the slide room and the opening in the the motorhome. It will be necessary to retract the room in small increments, allowing the water time to run off.
- Release the switch.
- Install lock bar for travel.

CAUTION:

Check for sufficient clearance on the inside of the motorhome (driver's seat, etc.) before retracting the slide-out room. Never move the motorhome with the slide-out room extended.

CAUTION:

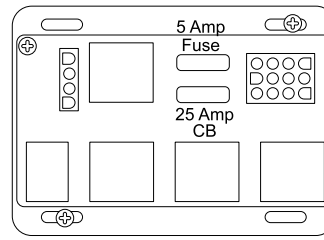
Rain water can pool on the slide-out awning. The added weight will cause the awning to sag. Upon retracting the room, material can become caught in between the top of slide room and the opening in the motorhome. It will be necessary to retract the room in small increments allowing the water time to run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

NOTE:

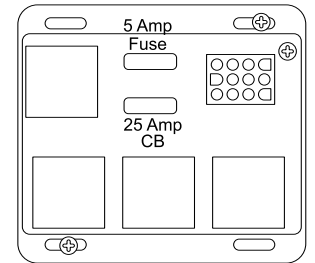
Ensure the floor is clean before retracting the slide-out room. Trapped dirt or grit under the slide-out room can scratch the floor surface.

If the Slide Room Fails to Operate:

Check the fuse and auto-reset circuit breaker on the slide-out relay module located adjacent to the inverter. If the fuses and circuit breakers test okay, it will be necessary to call and obtain mechanical assistance to correct the problem.



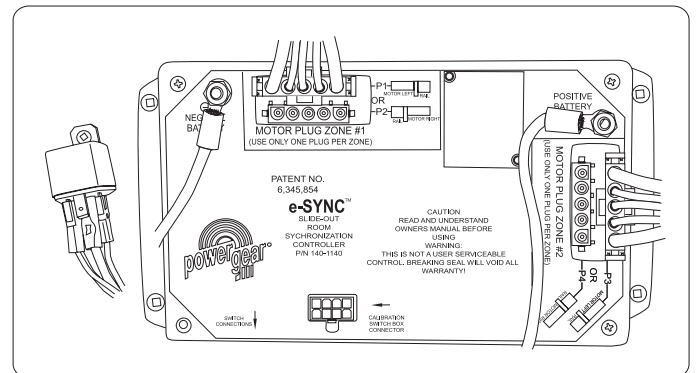
Triple Slide Relay Module



Double Slide Relay Module

To Extend the Bedroom Slide-out:

- Confirm that there is at least five feet of clearance outside the motorhome for the slide-out room to extend.
- Ensure the ignition key is in the **OFF** position.
- The house batteries are fully charged.
- The battery cut-off switch must be in the **ON** position. The switch is on the monitor panel.
- Ensure all people, pets and objects are clear of the slide-out room path.
- Press and hold the rear slide-out room switch in the **OUT** position. The slide-out room will slowly move to the **OUT** position. Release the switch to stop room movement. To continue the room movement, push and hold the switch in.
- Release the slide-out switch when the room is fully extended (a change in motor sound indicates extension). The slide-out drive motor will stop automatically.
- Level the motorhome with the leveling system.



Synchronizer for dual motor slide-outs.

080473

WARNING:

Firmly latch all cabinet doors adjacent to the bedroom slide-out before extending or retracting the room. Damage to doors or fascia can occur.

CAUTION:

Dirt and grit trapped under the slide could result in damage to the floor. Continuous operation of the slide-out could cause a drain on the house batteries and damage to the motor from overheating.

NOTE:

Do not leave the slide-out extended during severe weather. Conditions such as high winds or heavy rain may cause damage.

NOTE:

Perform the slide-out room operation with the air suspension system full. Extensive damage could occur to the slide-out room and awning when extending the slide-out room in snow, sleet, ice or freezing rain 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.

To Retract the Bedroom Slide-out:

- Check for sufficient clearance inside the motorhome before retracting the slide-out room.
- Clean the floor, if applicable, to ensure there is no dirt or grit that could result in floor damage during slide-out retraction.
- Remove any debris from the top of the slide-out room.
- Prior to retracting the slide-out room, start the motorhome. Allow the air bags to fully inflate to normal travel height.
- Retract the leveling system or prepare the air leveling system for travel prior to operating the slide-out.
- Turn the ignition switch **OFF**. **The slide-out room will not operate with the engine running.**
- The house batteries are fully charged.
- The battery cut-off switch must be in the **ON** position.
- Locate the control switch for the slide-out, usually located on the monitor panel, or on the bedroom wall.
- Clear all people, pets and objects from the slide-out room path.
- Press and hold the switch in the **IN** position. The slide-out room will move slowly **IN**. To stop the slide-out room movement, release the switch. To resume the room movement, push and hold the switch in. The motor will change sound when the slide-out room is fully retracted.
- Release the switch.
- Rain water can pool on the slide-out awning. Added weight will cause the awning to sag. Upon retracting the room, the material can catch between the top of the slide room and the opening in the motorhome. It will be necessary to retract the room in small increments, allowing the water time to run off.

CAUTION:

Continuous operation of the slide-out room can drain the battery and damage the slide-out motor from overheating. Never move the motorhome without having the slide-out room retracted.

Manual Override - Bedroom Slide-out

If the slide-out room does not respond from the switch, check that all the safety features are in place.

- The ignition key is **OFF**.
- The battery cut-off switch is **ON**.
- The house batteries are fully charged.

If the Slide Room Fails to Operate:

Check the fuse and auto-reset circuit breaker on the slide-out relay module located adjacent to the inverter.

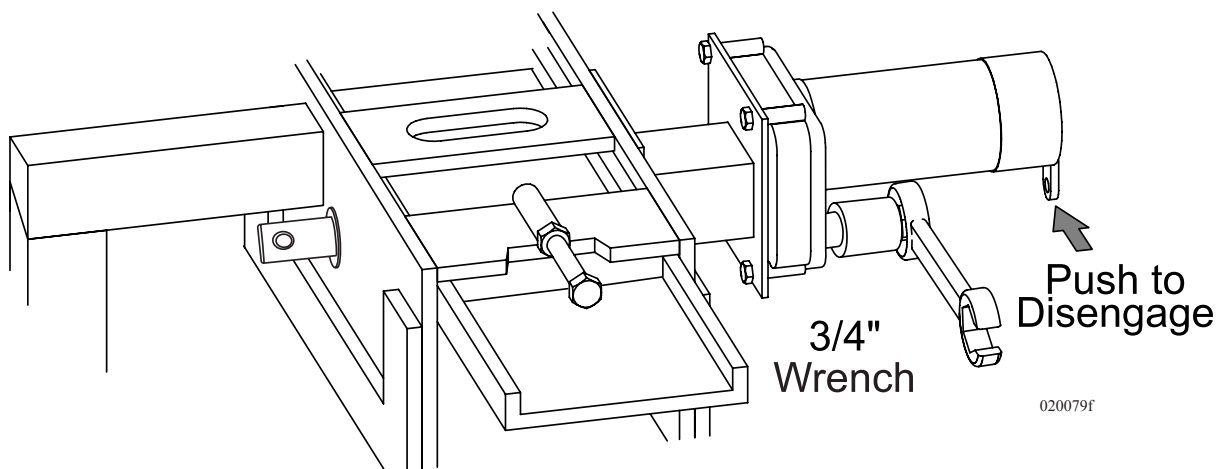
If the fuses and circuit breakers test okay, it will be necessary to manually override the slide-out mechanism. Following the steps below to manually override the slide-out room:

WARNING:

Do not work on the slide-out system unless the battery is disconnected. Make sure the floor is clean before retracting the slide-out room.

Manual Override for Bedroom Slide-out:

1. Lift up the mattress and unscrew baseboard to gain access to the slide-out cover board and mechanism.
2. Remove 12 Volt DC from the motor by disconnecting the plug from the slide-out motor to the power supply.
3. Push the brake lever to disengage the drive motor.
4. Turn the large hexnut, using a 3/4" wrench, to bring the slide out in.
5. Once the slide room has been manually retracted, return the brake level to its original position to lock the room in place.
6. Take the motorhome to an authorized repair center.



AWNINGS

Slide-out Cover

The slide-out cover is automatic. When the slide-out moves in or out, the cover reacts to the slide-out direction. A fixed edge of the slide-out cover is installed into an awning rail, mounted just above the slide-out. A spring-loaded roller with special brackets mounts to the slide-out. In a hard rain, the cover helps prevent water from penetrating the seal of the slide-out.

The slide-out cover will extend automatically attaining full coverage when the slide-out achieves maximum extension.

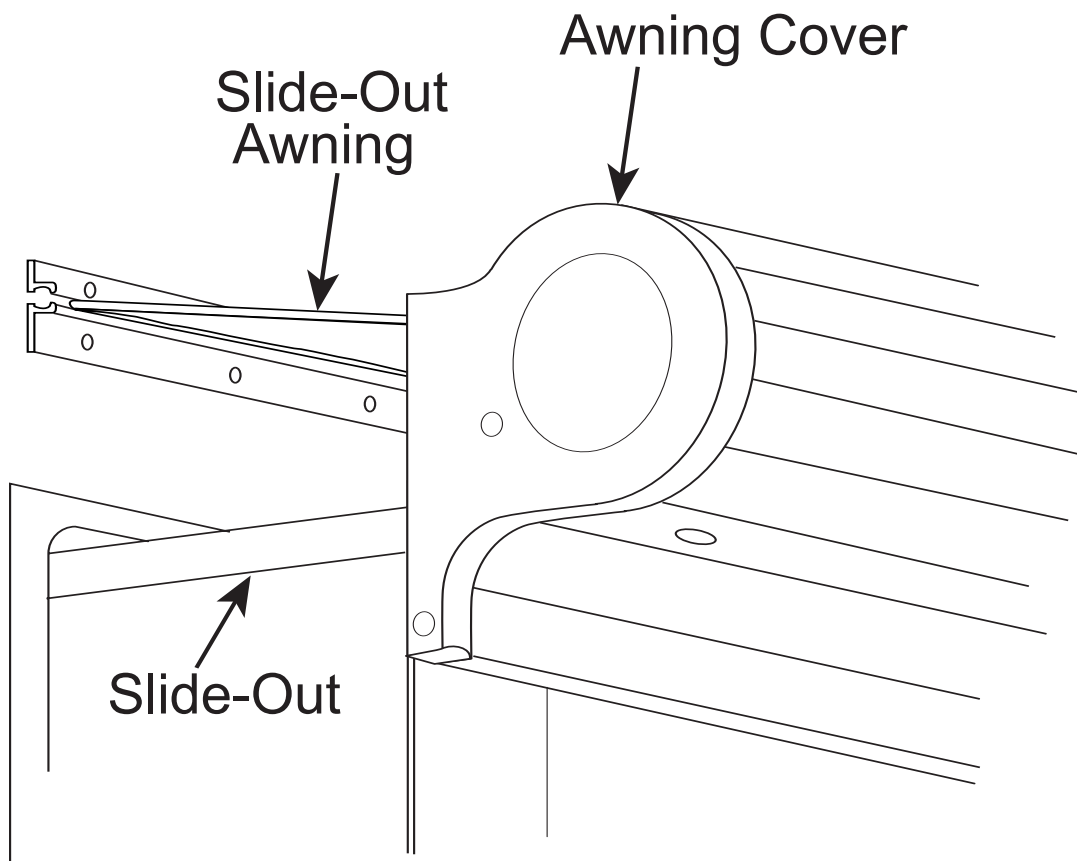
NOTE:

Water may pool on top of the extended cover. As the slide-out is retracted, the water is removed when the cover retracts. Retract room slowly. Pause three or four times to allow any accumulated water a chance to run off.

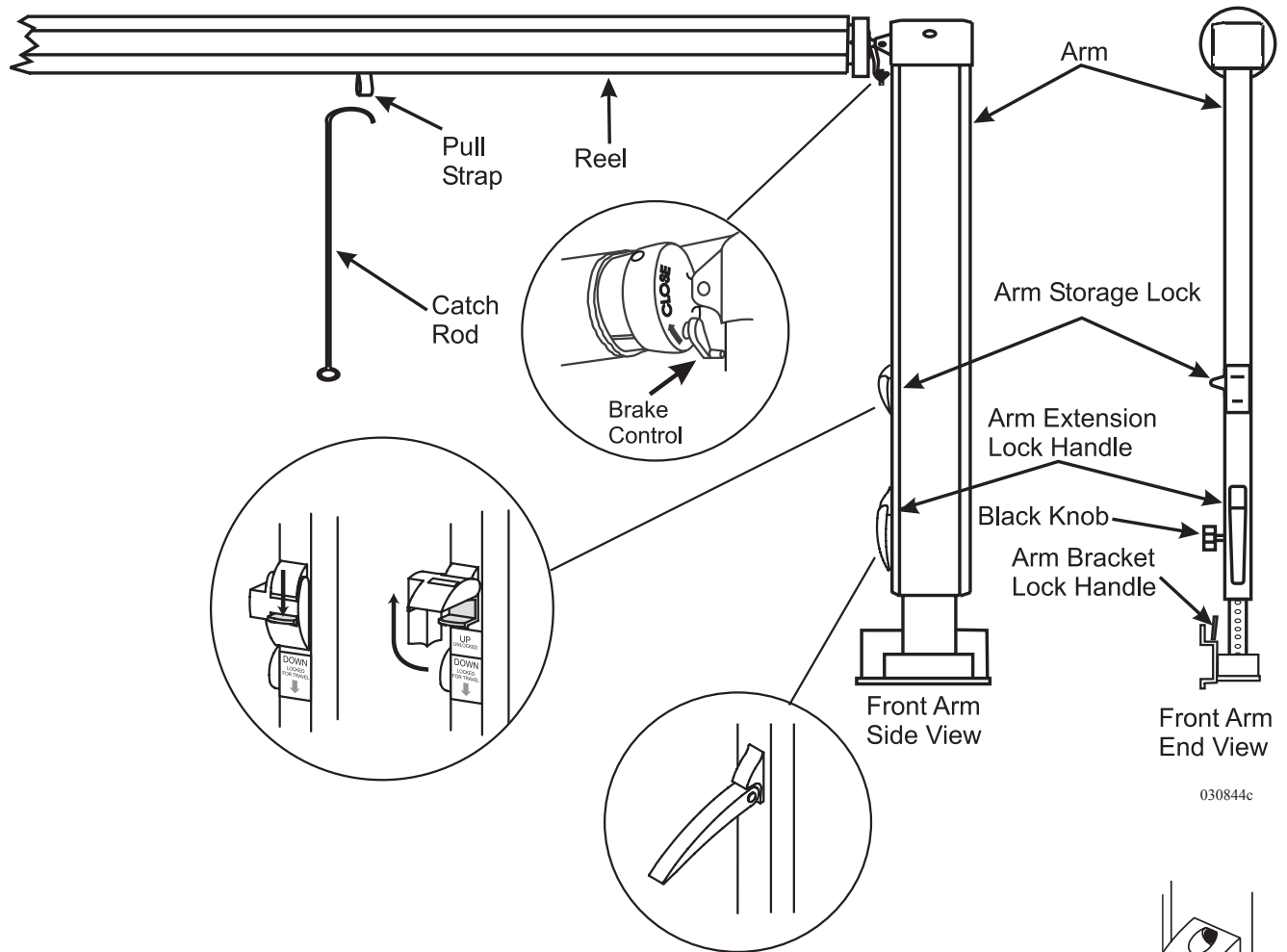
The slide-out cover retracts automatically and rolls up to the travel position when the slide-out is completely closed.

NOTE:

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



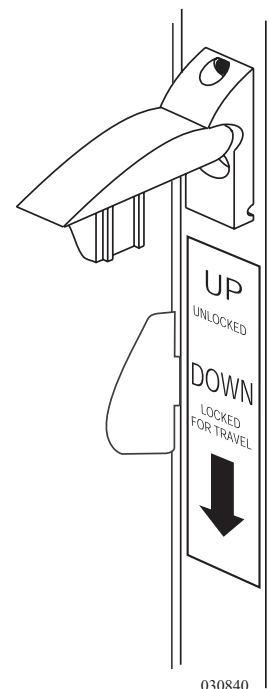
030924b



To Unlock the Awning:

Start with either awning leg. Repeat the following steps for each leg.

1. Loosen the black locking knob located on the backside of the awning leg (only about six turns are needed). This will allow the support brace to move freely.
2. Unlock the travel lock by using one hand to squeeze inner and outer arm to remove tension from storage lock. Push up on tab and swing lock away.
3. Move the brake control (front leg only), to the up/unlock position.



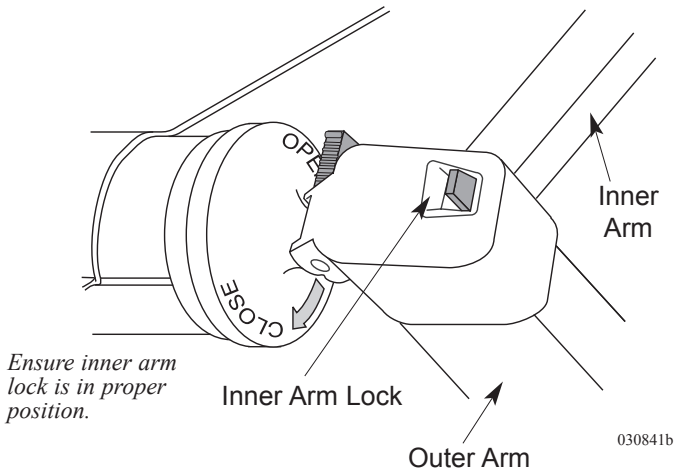
Lower Brake Control

To Extend the Patio Awning:

1. Locate the awning pull rod.
2. Locate the loop of the pull strap and hook it with the awning pull rod. Draw the awning away from the motorhome to the desired extension.

WARNING:

Always use the pull strap for extending and retracting awning. Never retract awning while holding onto the awning arm. Hands or fingers caught between the awning arm channel and brace channel during awning retraction may result in serious injury.

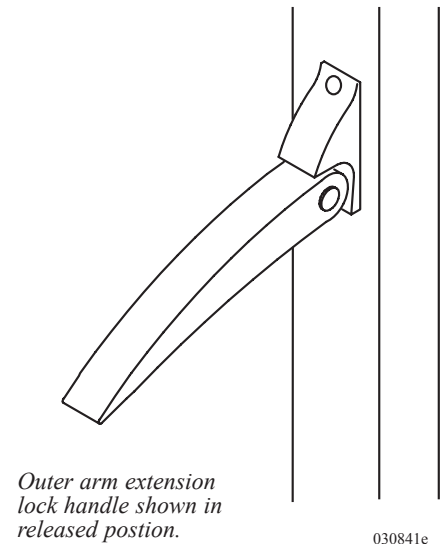


3. Slide the inner bracing rafters to the top of each arm ensuring the bracing is locked in place. Tighten the black locking knob.

NOTE:

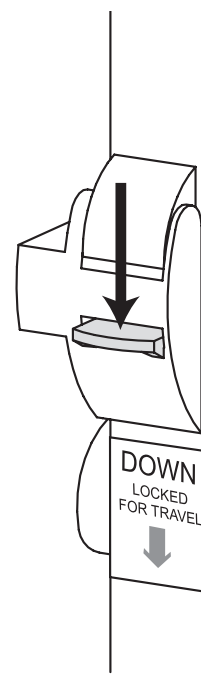
Ensure the locking tab on the support brace is latched through the hole in the end cap.

4. If equipped with Canopy Clamps, fasten the clamps at this time.
5. Release the outer arm extension lock handle to slide outer arm upward for additional clearance. Lift front of awning to the desired height. Support the weight of the awning with one hand while relaxing release lever and allow the engaging pin to set into a hole in the lower arm. Go to the other awning arm and do the same. Ensure the awning is straight.
6. Slide the center pull strap to one end of the awning and store it by wrapping the strap around the awning leg.



To Retract the Patio Awning:

1. Loosen the strap from the awning leg if it has been stored there.
2. Support the weight of the awning with one hand while opening the extension lock handle and lower the awning until the arms rest on the lower stop bolt. Loosen the two black locking knobs enough to allow the support brace to travel freely.
3. If equipped with Canopy Clamps, remove and store the clamps at this time.
4. Release the locking tab on the end cap of the awning leg and slide the inner support brace to down the awning leg to the stop bolt. Repeat for opposite side.
5. While pulling down slightly on the pull strap, slide the brake control down located on the front awning leg.
6. Keeping downward pressure applied, slide the pull strap to the center of the awning while holding on to the strap.
7. Place the hook end of awning rod into pull strap loop to assist in retracting the awning. Make sure pull wand does not slip out of pull strap loop. Allow the awning to roll up to the stored position.
8. Store the awning rod until it is needed again.
9. Verify that the brake control is in the locked or closed position. Snap the arm storage locks into the down position and tighten black locking knobs.



020219

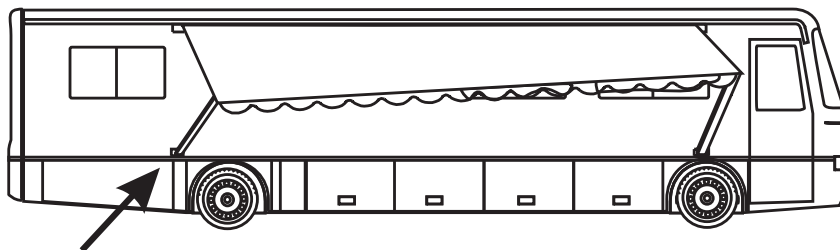
Rain Release Setting (Manual Awning Only):

After the awning has been extended, choose the rain release position to prevent water build up on the awning. To position the awning in the rain release setting, lower one arm of the awning and leave the other arm in the normal position. This will create enough of a slope for adequate water run off.

Caution:

Water can quickly accumulate on the canvas during storm activity and damage the awning or motorhome. Storm related damage is not covered under warranty.

Rain Release Setting



One arm should be set lower than the other for proper water run-off.

020031

Using the Carport Feature:

(Not available with Carefree Eclipse Awnings.)

1. Unlock and extend the awning as described under "To Unlock the Awning" and under "To Extend Awning."
2. Unlatch the bottom of the rear arm by pushing in on the lock handle on the arm bracket. Swing the arm away from the motorhome to an upright position.
3. Drive the stakes through the bottom holes in the arm.
4. Raise the rear arm extension lock handle all the way up or to the desired height and lower the lock handle to lock the arms in place.
5. Repeat instructions 2 through 4 for the front arm.

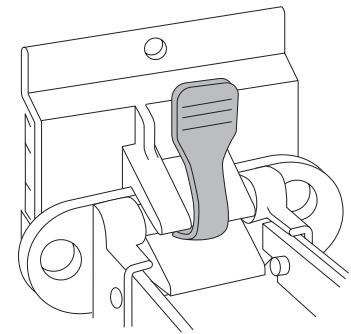
NOTE:

To move the awning out of the carport position reverse the above steps.

Securing the Awning for Travel:

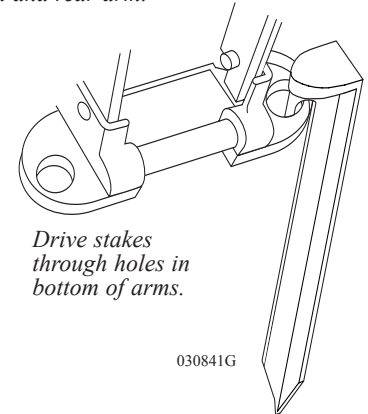
Before traveling, check the following:

1. The awning is fully retracted against the sides of the motorhome.
2. The black locking knobs are tightened.
3. The brake control is in the full down (locked) position, and no red warning is showing.
4. The storage locks are down and in the locked position.
5. The bottom of the front and rear arms is latched properly into the bottom brackets.
6. The awning pull rod is stored away.



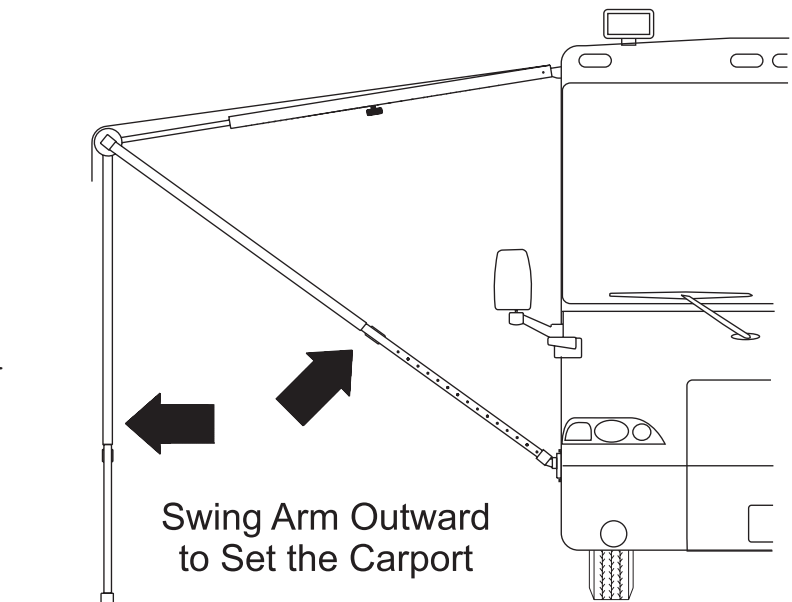
Unlatch the bottom of the front and rear arm.

030841D



Drive stakes through holes in bottom of arms.

030841G



030841H

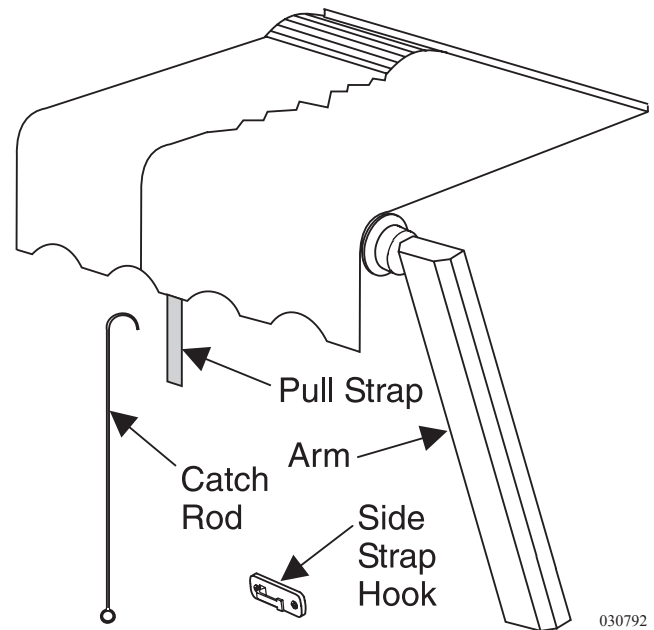
Window Awning (Optional)

To Extend the 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 Awning:

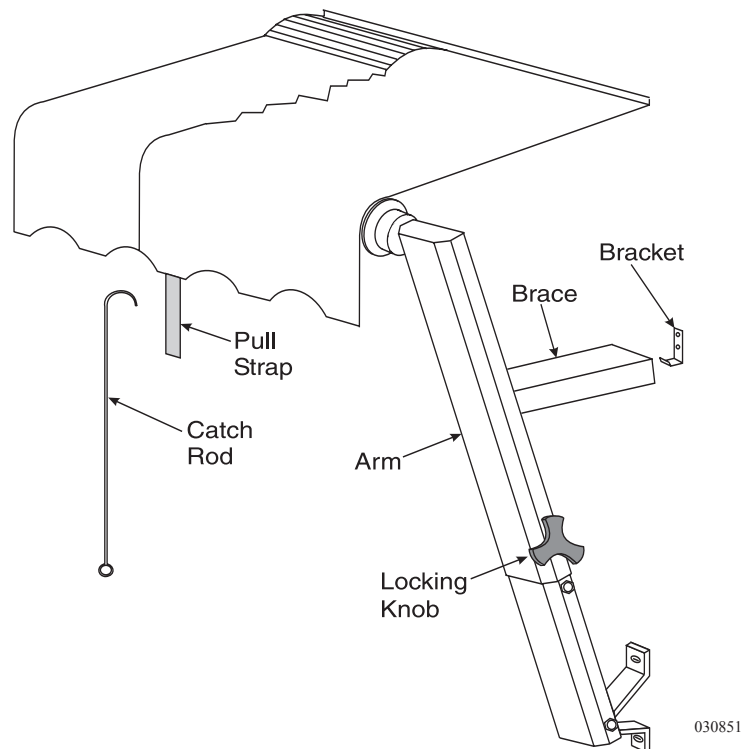
- Hook catch rod on pull strap, remove pull strap from side strap hook and slowly allow awning to retract.
- Remove catch rod from pull strap and store.



Front Door Awning (Optional)

To Extend the Awning:

- Hook the pull strap loop with awning pull rod.
- Pull strap until awning is at full extension. With free hand, lever out inner arms.
- Mate the slot of inner arm with hook on side of the motorhome. Repeat procedure for other arm.
- Release strap slowly ensuring inner arms are secure. Slide the strap to rear of awning roll tube and tie to rear arm.
- Loosen locking knobs for both arms and extend arms so the canvas will clear door in the open position.

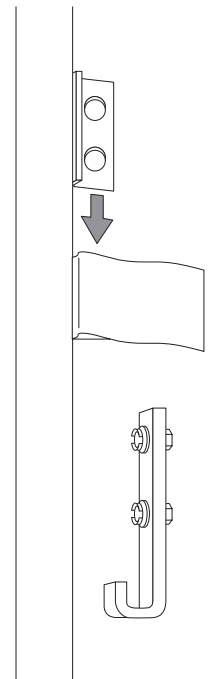


To Retract the Awning:

- Loosen locking knobs for both arms. Lower arms to stop bolts. Tighten knobs.
- Untie the pull strap and slide strap to center of awning roll tube.
- Pull down on pull strap with a firm grip until tension is off the inner arms. Fold inner arms and attach them to the velcro.
- Carefully allow material to wind onto awning roll tube while holding strap in a neutral position. This will allow material to roll up evenly.
- Awning end caps should be against the rubber bumpers. If one end cap is off, pull down on awning pull strap while holding strap slightly to opposite side, allowing awning to roll back up into position.

CAUTION:

When the awning is at full extension do not allow the awning to snap back into the retracted position. Personal injury or damage to the awning or motorhome may occur.



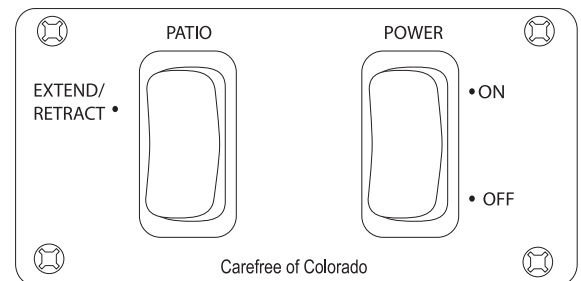
010743

Patio Awning - Eclipse (Optional)

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

To Operate Awning:

- Push and hold switch to extend the awning. Release the switch at any time for partial extension.
- Push and hold the switch to retract awning.
- The interior awning power switch needs to be on to operate both interior and exterior awning switches.



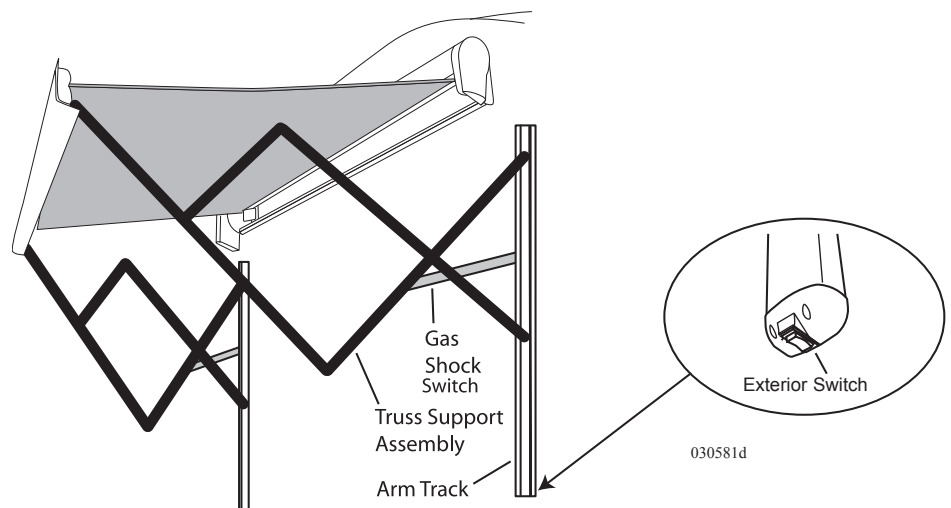
Before travel, slide travel lock into position.

Interior Switch

030851d

If the awning fails to operate:

- Ensure ignition is off.
- Check power at 15 Amp mini breaker in front electrical bay on the roadside.



030581d

Care of Awning Vinyl Fabric:

Mildew will not form on the awning material itself, but it may form on the dust accumulated on the canopy. A quality vinyl cleaner, such as Carefree Awning Magic, will help keep your awning looking new. Be sure to follow the instructions on the container.

NOTE:

Allow the awning material to thoroughly dry before rolling the awning up. Metal surfaces should be cleaned with soapy water and thoroughly rinsed.

Care of Awning Acrylic Fabric:

The acrylic fabric should be cleaned regularly before substances such as dirt, leaves, etc., are allowed to accumulate on, and become embedded in, the fabric. The fabric can be cleaned without being removed from the awning. Simply brush off any loose dirt, leaves, etc. Hose down and clean with a cloth and mild soap. Do not use detergents. Allow to air dry, preferably on a warm sunny day. Should you have to retract the awning when the fabric is wet, it should be extended at the first opportunity to finish air-drying.

Cleaning and Maintenance:

- **Washing:** 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 hose. This process can be made easier with awning maintenance products. Saturate the fabric with the solution and leave it on for 15-20 minutes. Wash both sides of the awning using an awning brush. If necessary, reapply the solution to keep fabric saturated. Rinse the awning thoroughly. Repeat, if necessary, until most of the stains disappear.
- **Water Leaks:** If leaking occurs after washing, it generally results from insufficient rinse water removal. 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.

It is normal for slight leakage to occur through the fabric where water is allowed to accumulate or pocket on the fabric. See "Storm Precautions" for information on the awning settings for proper water drainage. Sometimes soap or chemical residue, such as from active agents in insect fog or sprays, 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 repeating the washing and thoroughly rinsing, please contact Carefree of Colorado concerning further maintenance.

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. Avoid leaving the awning partially extended during rainy conditions. The awning is at the strongest setting when the awning is fully extended. If you are leaving or retiring for the night, close the awning. This takes only a few seconds and it gives the best protection for the awning. If unable to close the awning, lower both ends of it as far as you can. This will create a sufficient slope for water run-off. One end may be lowered to sufficiently divert the water, if the awning is being monitored.

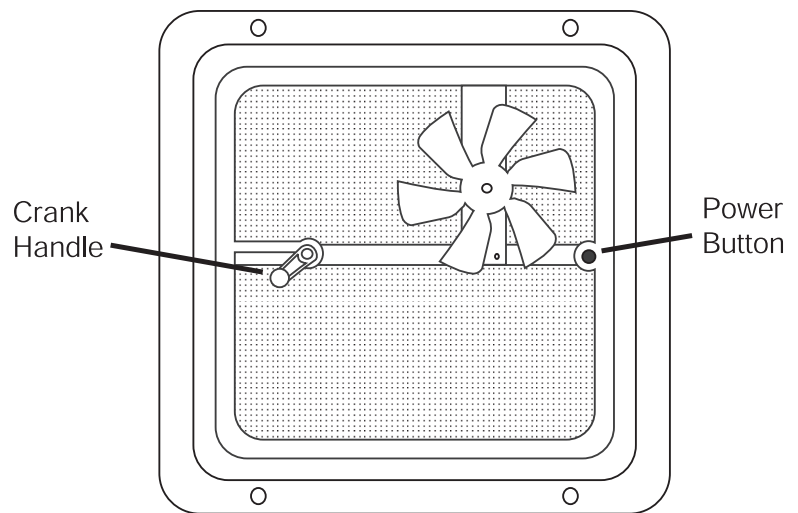
Water weighs 8.33 pounds per gallon. The awning was not designed to withstand the 500 to 700 pounds of water that could accumulate. It is best not to subject the awning and the motorhome to the needless strain.

FANS

Bathroom Fan

The motorhome is equipped with roof air vents which are manually operated. The vent is opened or closed by simply turning the crank handle in the desired direction. The fan is for ventilation only as it will not help cool the motorhome. The fan is operated by pushing the small power button. The vent must be opened before using the power fan.

To close the power air vent, push in the power button to stop the fan and close the vent.



030842

Exhaust Fan - Automatic (Optional)

The fan is a three speed fan with a 0 or **OFF** position. The fan extracts air from the motorhome. There are three controls located on the ceiling vent fan. The knurled knob is used to open the vent cover. The rotary knob selects the operating speed of the fan. The **ON/OFF** switch turns the power on or off to the fan and vent motor.

When the vent cover is open approximately two inches, the fan motor will operate. Press the vent cover knob **IN** for Automatic operation. Pull the knob **OUT** for manual operation. In the Automatic position the dome will open and close and the fan will turn on or off with the wall thermostat. With the vent cover knob in the manual position turn the knob counterclockwise to open or clockwise to close the vent cover.

To operate the fan in the Manual mode:

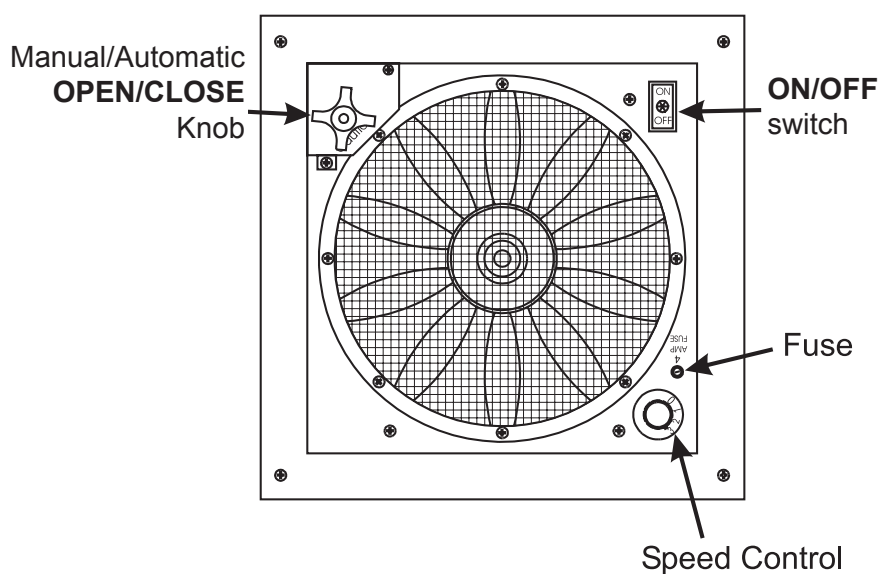
- Pull vent cover knob to the Out/Manual position.
- Turn knob counterclockwise to open vent cover to desired position.
- Turn fan switch to the **ON** position.
- Select desired fan speed on the Speed Control dial.

To operate the fan in the Automatic mode:

- Ensure the vent cover knob is pressed **IN** to the Automatic position.
- Ensure the **ON/OFF** switch is **ON**.
- Select the temperature setting on the wall thermostat. The vent cover will automatically raise and the fan motor will turn on.
- Select desired fan speed on the Speed Control Dial.

NOTE:

The dome will not cycle down and up as the interior temperature increases or decreases. Only the fan will turn on or off.



Tips for Using the Fan:

- To keep condensation from accumulating open the vent fan lids slightly to help the air circulate. 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 usage also produces condensation.
- If the fan fails to operate, check for a blown fuse either in the domestic fuse panel or the 4 Amp fuse on the fan.
- To clean the screen remove the eight screws holding it in place. Wash the screen using a non-abrasive soap and water. Re-install the screen and tighten the screws.
- Keep all the vents closed when using the Fantastic Fan Vent. Direct the airflow by slightly opening the window(s) on the shaded side of the motorhome to obtain the maximum air flow especially on hot, sunny days. Close all the roof vents. The area between the open window(s) and the Fantastic Vent supplies the maximum air flow and providing the most comfort.

NOTE:

Do not leave the vent cover open while the motorhome is stored or unattended for extended periods of time. High winds or other unusual conditions or obstructions may prevent the vent cover from closing. Leakage could result causing serious damage.

POWER SUNVISOR *(Optional)*

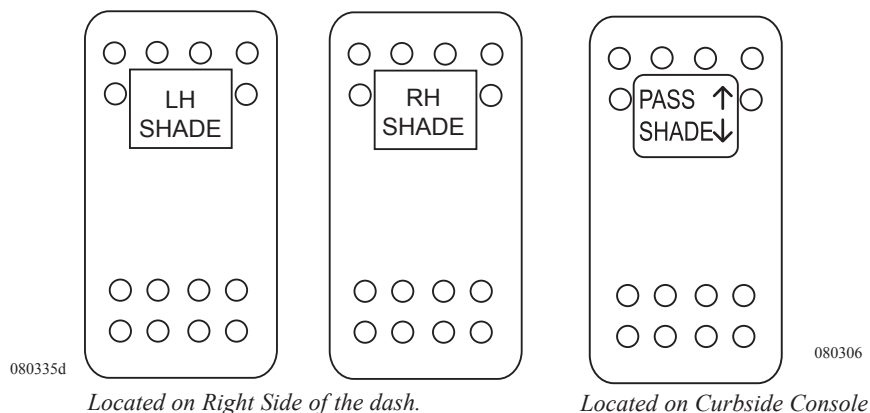
The cockpit blinds are 12 Volt DC operating from the Chassis batteries. Power is supplied by a 5 amp fuse located in the Roadside front electrical bay. One blind assembly is used for each window located in the cockpit area.

To Operate the Blind:

- Push the switch down to lower the desired blind.
- Push the switch up to raise any blind.

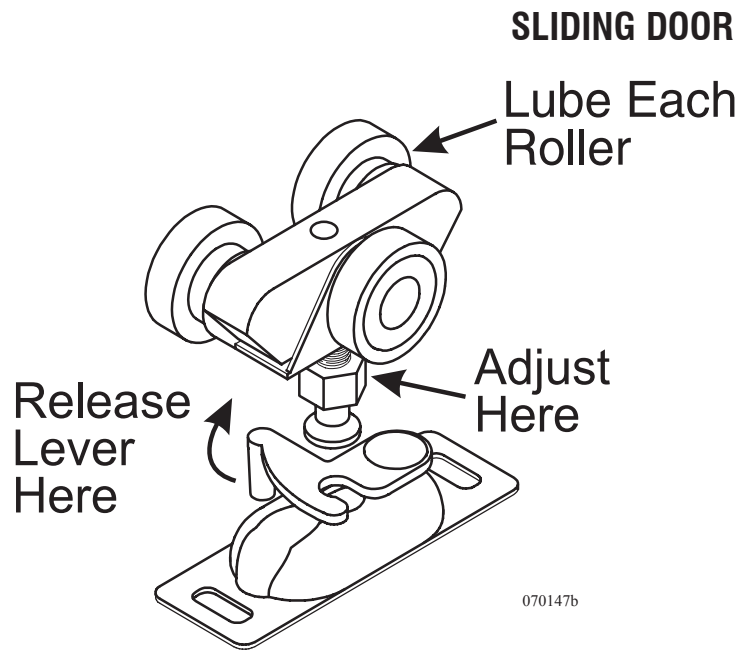
NOTE:

Do not attempt to move or drive the motorhome with any blind in the lowered position.



The sliding pocket door uses two rollers at the top of each door. During the life of the motorhome the sliding door may need adjusting. The sliding pocket door can be adjusted to close tight against the wall. Use a small wrench and turn the adjusting screw upward or downward.

If, for any reason, the pocket door needs to be removed, locate the portion that is secured to the top of the pocket door and rotate the small lever outward to release the latches.



LUBE:

The pocket door rollers should be lubed with just a small drop of oil once a year to help increase the life of the rollers and improve the sliding of the door.

REAR LADDER (Optional)

The rear ladder allows access to the roof. Care should be used when climbing the ladder. Access to the roof should be limited to cleaning and sealing purposes only. The lower portion of the ladder is removable and stored in the cargo bay.

NOTE:

Maximum weight is 300 lbs.

SEAT CONTROLS

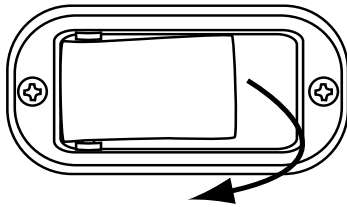
The Pilot and Co-Pilot seats are adjustable to provide maximum comfort. Seats must be locked in the forward facing direction while traveling. The battery cut-off switch must be on for the power pilot seat to operate.

NOTE:

The pilot seat operates from 12 Volt DC house power. The 15 Amp Fuse is located in the roadside front electrical bay.

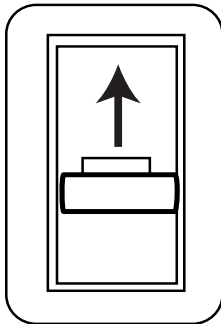
Pilot Seat

Swivel

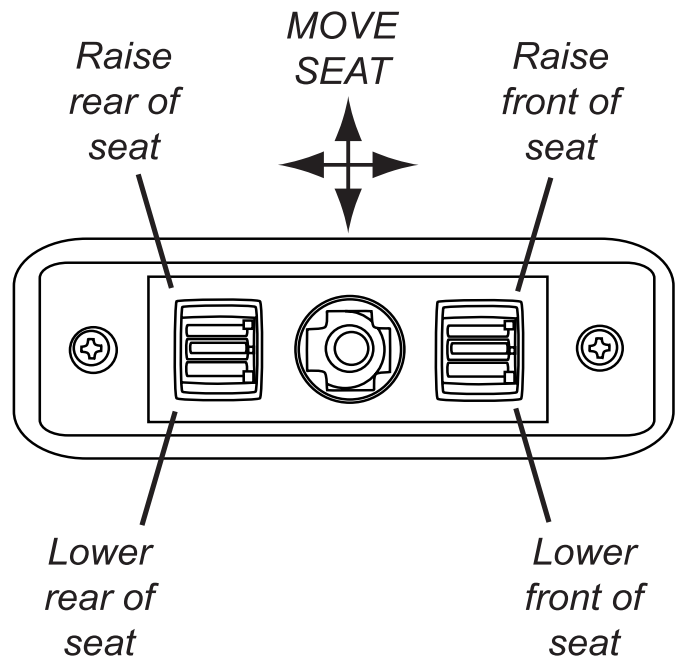


Pull out to Rotate

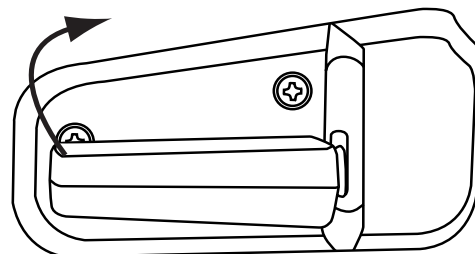
Armrest Lock



Lift up to unlock armrest



Co-Pilot Seat



Lift up to adjust seat back

060257

Swivel Seat

Swivel Seat Operation:

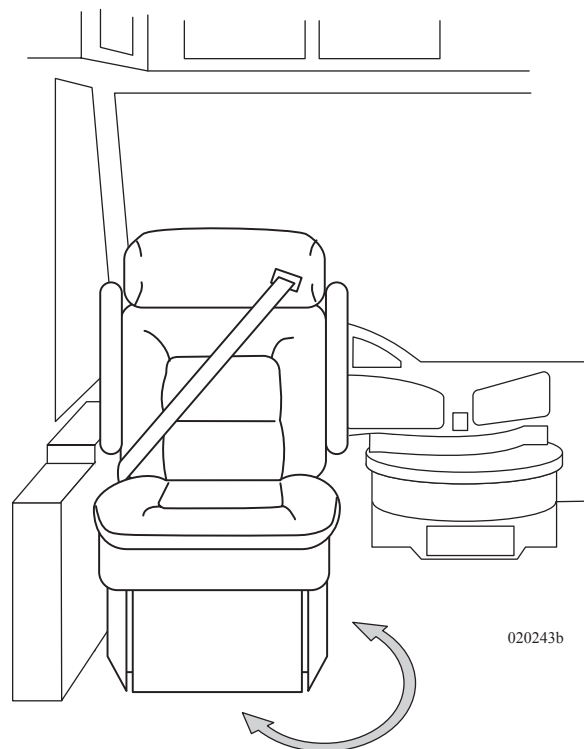
- When swiveling the seat, lift up on the swivel lever and rotate to the desired position.
- When rotating the seat, put the steering wheel in the upright position.
- Move the seat forward, then pull the swivel lever up and rotate around to the desired position.

WARNING:

Seat must be locked in the forward facing position while the motorhome in transit.

NOTE:

After the seat is rotated 180°, it must be rotated back in the opposite direction rotation originated from. The 12 Volt DC wiring in the seat may disconnect if rotated 360°.



SOFA BED

There are several sofa variations that can be installed in the motorhome. The standard sofa is commonly referred to as a “jackknife” sofa. This style sofa has storage space below the seat and a removable front pane. The sofa will pull up and out, at the front of the seat then lay flat to form the bed/sleeper area. Cushions are not removable.

NOTE:

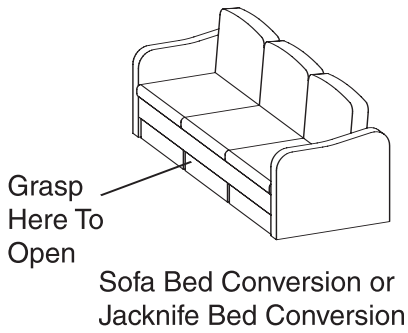
All Flexsteel sofas will have a locking mechanism that must be released to convert the sofa to a bed.

Several optional sofas that can be installed:

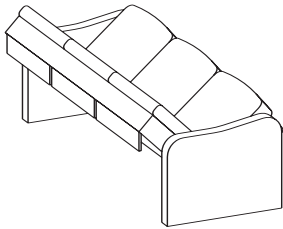
- Sofa Bed
- Convertible Sofa
- Electric Bed
- Air Coil Mattress

Convertible Sofa:

This sofa is most commonly called the “Hide-A-Bed.” This bed is similar to the ones found in many home guest rooms. The conventional sofa has a spring mattress. The newest addition to this style of hide-a-bed is the Air Coil Mattress.



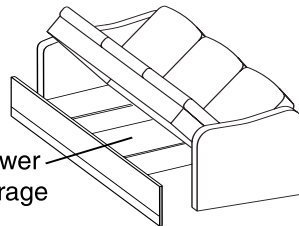
Sofa Bed Conversion or Jackknife Bed Conversion



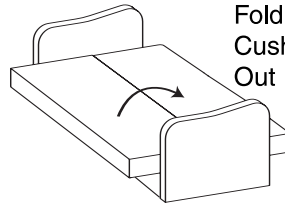
Sofa Wonder Bed

Grasp Here To Open Bed Or Pull Out Drawer

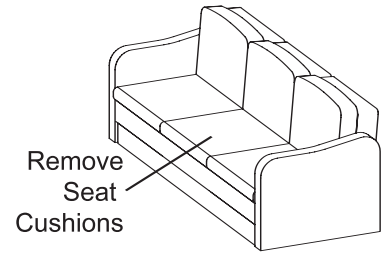
Drawer Storage



Fold Seat Cushion Out

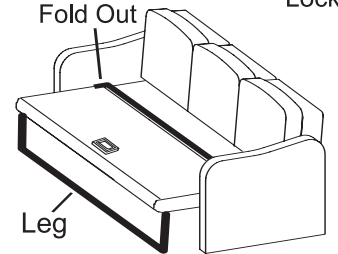
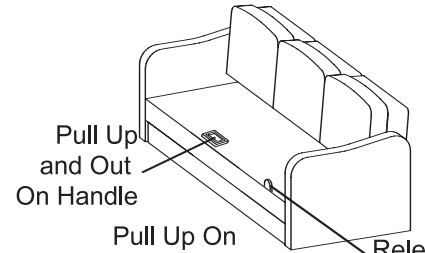


Magic Bed



Pull Up and Out On Handle

Pull Up On Bar and Fold Out Release Lock



Hide-A-Bed

020222m

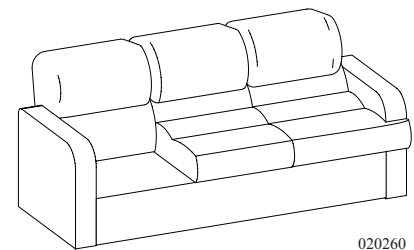
Standard Sofa Bed

Air Coil Mattress:

The Air Coil Mattress inflates and deflates in a matter of seconds. Use the hand-held electric pump to inflate the mattress. The pump operates from any 120 Volt AC outlet.

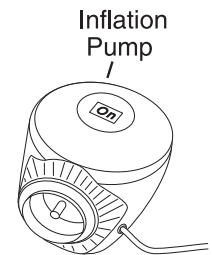
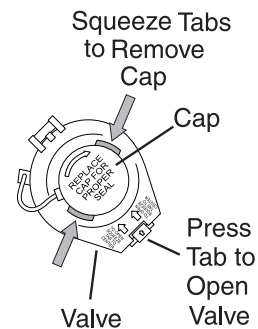
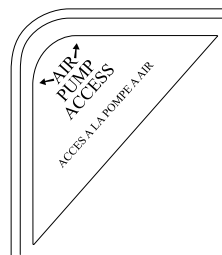
To Inflate the Mattress:

1. Remove and store the seat cushions.
2. Open the Convertible Sofa and allow the mattress to lie flat.
3. Unzip the corner of the mattress labeled Air Valve Access.
4. Ensure the valve is locked firmly in place.
5. Open the cap on the valve.
6. Place the pump on the valve and turn $\frac{1}{4}$ turn locking the pump in the valve.
7. Plug in the pump motor to inflate to a desired firmness.
8. Remove the handheld pump, replace the valve cap and zip the mattress cover.
9. Place bedding items on the mattress.



Convertible Sofa

020260



020260b

To Deflate the Mattress:

1. Remove bedding items.
2. Unzip the corner of the mattress where the air valve is located.
3. Lift the valve release.
4. Once deflated, close the valve release, zip the mattress cover and close the convertible sofa.

Electric Bed:

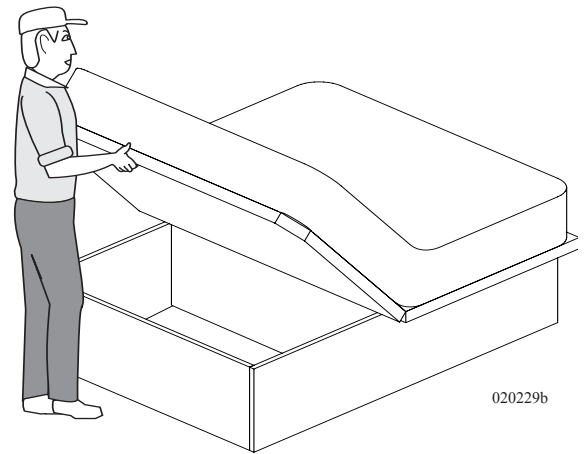
The newest generation of sofa sleeper is the electric bed. This sofa uses 12 Volt DC to operate the slide mechanism.

STORAGE - UNDER BED

To use the storage compartment located under the bed, locate and unlock the bed deck latches. Lift up the bed by the front edge of the mattress platform. Gas struts hold the mattress and platform open.

NOTE:

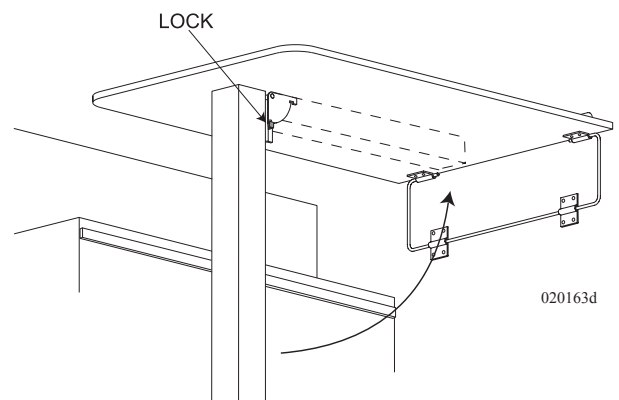
Do not over stress gas struts by rapidly opening or losing the bed access cover, as this action can damage the struts or mounts. In extreme cold, gas struts may not hold the mattress platform in the open position.



DINETTE BED CONVERSION (Optional)

To Convert Booth Dinette into a Bed:

- Lift seat cushions to an angled vertical position.
- With a firm grip, lift front edge of the table approximately six inches and push table leg lock to side.
- Swing the table leg up and lock into a horizontal position.
- Continue lifting table until table stays are clear of retainers. Pull outward and lower table down.
- Use both seat cushions and one back cushion for a mattress. Leave one back cushion in a vertical position.



WARNING:

Do not occupy the booth dinette, if not equipped with safety belts, or the dining chairs while the motorhome is in motion. To avoid personal injury to occupants 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.

RADIO - Dash

Magnadyne CD Player

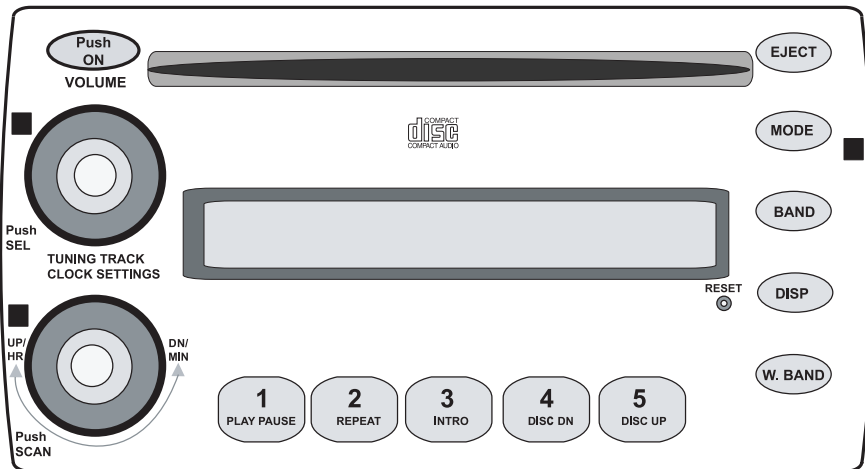
The dash radio will control the multi-functions for the dash audio. There are many features associated with the dash radio. The tuner will hold pre-set AM and FM stations. Turn the radio power off at the dash.

Operation:

- Turn **ON** the house power disconnect switch.
- Turn **ON** house battery cut-off switch, located at the entry door.
- Turn **ON** the radio power switch at the dash panel.
- To turn the radio **ON**, press the **Push ON** button.
- To turn the radio **OFF**, press the **Push ON** button.

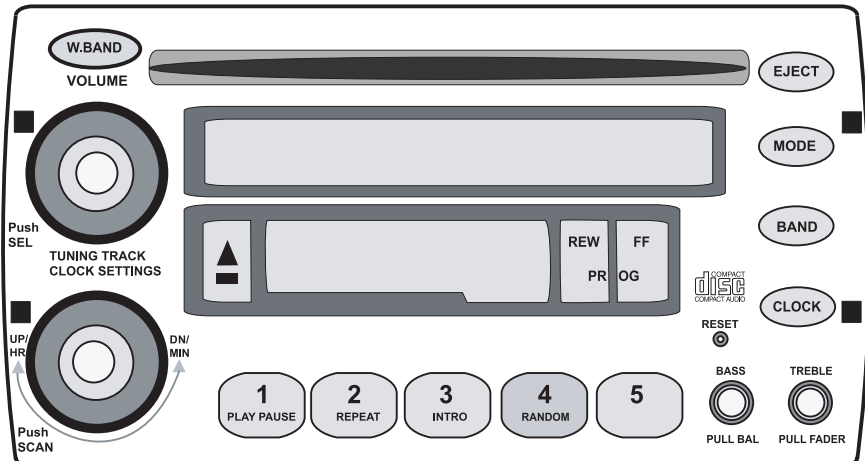
Clock Adjust:

- Press and hold the menu button until clock adjust is displayed.
- Press the left and right buttons until the desired time is displayed.
- Press the menu button once the correct time is displayed.



Standard CD player

031088



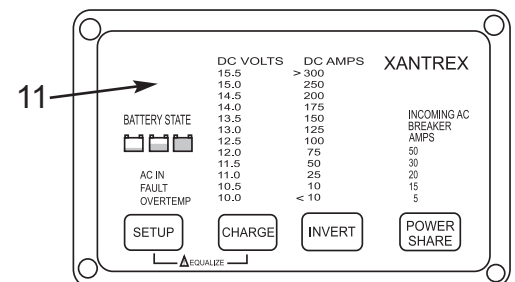
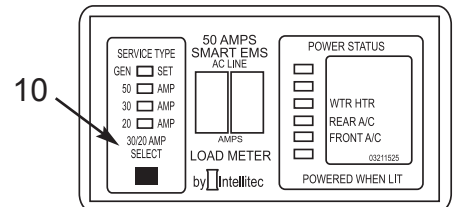
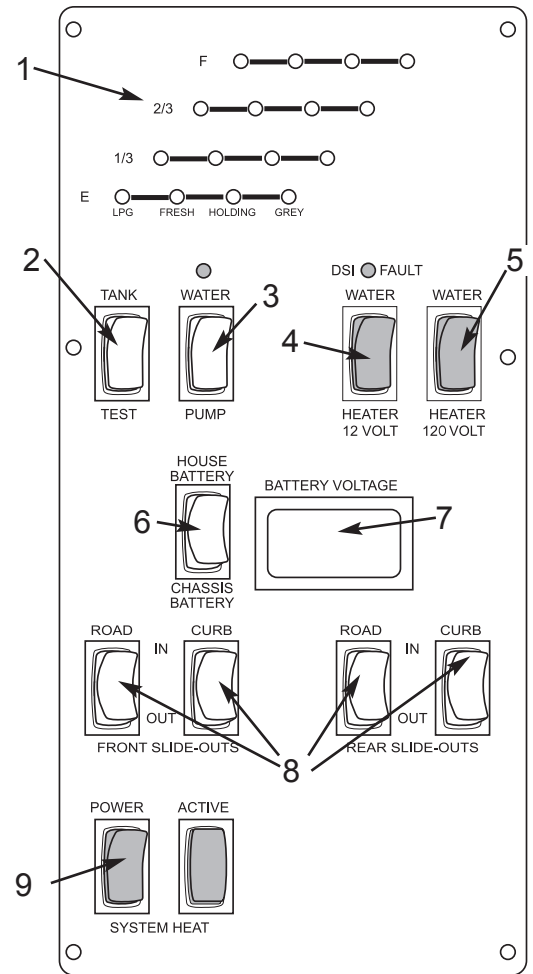
Optional Cd player w/Cassette Player

031088b

SYSTEMS CONTROL CENTER

The System Control Center enables a central location for many of the switches and control monitors use to operate the motorhome. This panel is a flush wall-mounted unit.

1. **Tank Monitor Panel** - Displays the status of the holding tanks, fresh tank and LP tank. Holding Tank 1 is the black tank and Holding Tank 2 is the grey tank.
2. **Tank Test Switch** - Spring loaded switch used to display tank status on the monitoring panel.
3. **Water Pump Switch** - Applies 12 Volt DC power to operate the Water Pump if operating from the on-board fresh water supply.
4. **Water Heater Switch** - 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.
5. **Water Heater Switch** - Applies 120 Volt AC power to the Water Heater if preferring to operate the Water Heater with 120 Volts.
6. **Battery Test Switch** - A two-position test switch used to provide a quick reference test of the battery voltage.
7. **Battery Voltage Meter** - A LCD Display.
8. **Slide-out Room Controls** - Provides power to operate the slide rooms.
9. **System Heater** - Basement Heater.
10. **50 Amp Smart Energy Management System (Optional)** - Provides circuit protection for all 120 Volt AC loads and manages 120 Volt AC distribution.
11. **Inverter Remote Panel (Optional)** - This panel controls the functions of the Heart Inverter.



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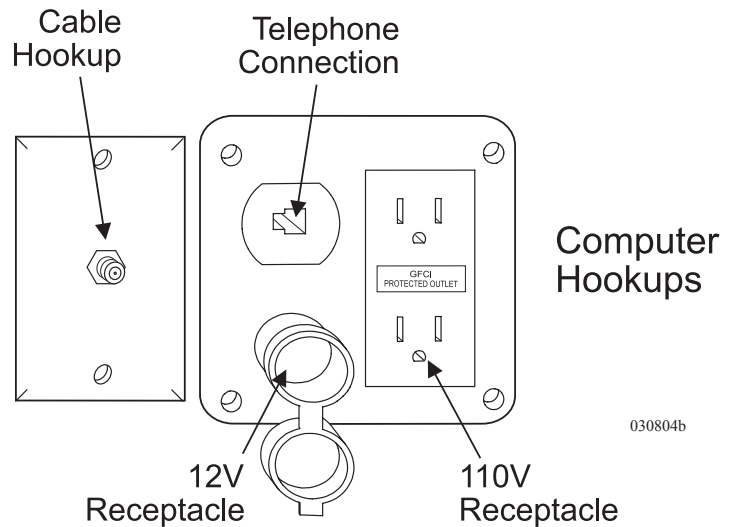
TV & ENTERTAINMENT COMPONENTS

The components used to make up the entertainment center are carefully selected to provide the highest quality in audio and visual enjoyment. There are several pieces of equipment, that encompass the entertainment center. The following paragraphs will discuss the operations and various components. Use the instructions given in the Video Selector Box section to use these components.

Connections - TV Cable, Computer & Telephone

The motorhome is equipped with cable TV and telephone hook-ups, located in the electrical service center. For convenience, there are auxiliary outlets located at the co-pilot seat and on the optional computer desk. This connection is set up for a telephone or laptop computer.

Entertainment connections are provided for convenience in the passenger bay. These include telephone jack, cable TV hook-up, and a 120 Volt AC electrical outlet.



Television (Front) Lock-out Feature

The ignition switch controls the outlet for the front TV. Only with the ignition OFF will the front TV operate. The TV operates on 120 Volt AC power only. This power can be provided by shore power, the generator or the inverter. Viewing time of the TV from the inverter depends on the state of charge of the house batteries and any additional 12 Volt DC circuitry which is being operated.

The television antenna is a manual crank up style antenna with built in electronics that use 12 Volts DC to "boost" signal strength. Signals that are weak or fuzzy can be amplified by pressing the **POWER** switch on the Video Selector Box. The antenna and booster work together to provide the best possible picture for most situations. Certain conditions occur when no amplification is needed, and in fact may make the picture worse. The television station will send the initial signal that resembles the waves or rings of water from a rock thrown into a still pond. The radiating television signal can hit an object such as a mountain and come back. The antenna will receive a signal from the initial pass, and then receive an additional signal from the rebound resulting in a split or double image. In this case, the picture may be improved by no amplification or even lowering the antenna.

NOTE:

Do not move the motorhome with antenna in the raised position, it can be damaged by tree limbs or wires.

WARNING:

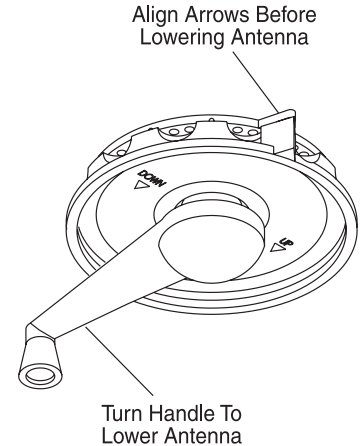
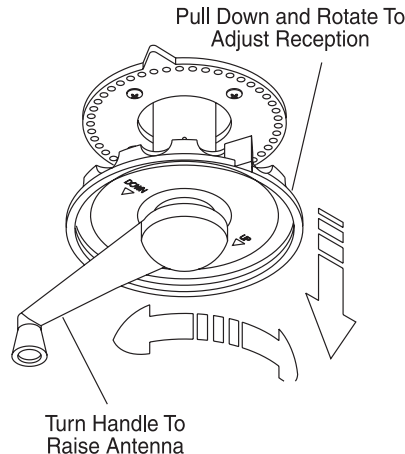
Before raising antenna make an outside, visual inspection for any obstructions or overhead electrical wires. Damage to the antenna, severe shock, personal injury or death can occur from inadequate clearance.

To Raise the Antenna:

- Rotate the crank handle clockwise until handle stops.
- Pull down on the outside directional wheel and rotate the antenna until the best picture is obtained. The directional wheel is spring loaded.

WARNING:

Do not raise a TV antenna near overhead electrical wires as contact may cause serious injury or death. The motorhome must not be driven with the antenna in a raised or partially raised position. Worm breakage may result.



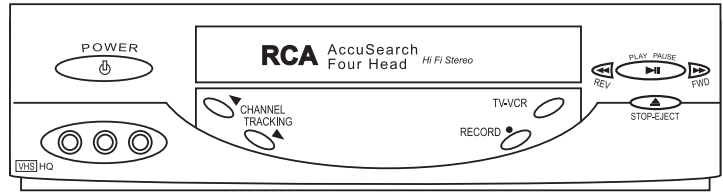
130024

To Lower the Antenna:

- Pull down on the directional wheel and align arrows together.
- Rotate the crank handle counterclockwise to lower the antenna fully into the cradle. Make an outside visual inspection to ensure the antenna is properly stowed.

Video Cassette Recorder (Optional)

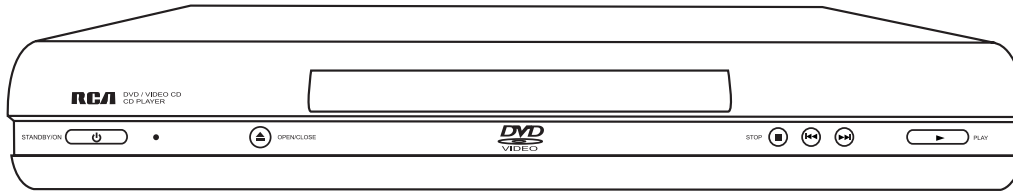
The videocassette recorder is the same one found in most homes. The VHS compatibility allows recording and playing back programs on standard VHS tapes. The Audio/Video Input Jacks in the front allows for quick, easy connections of additional video equipment.



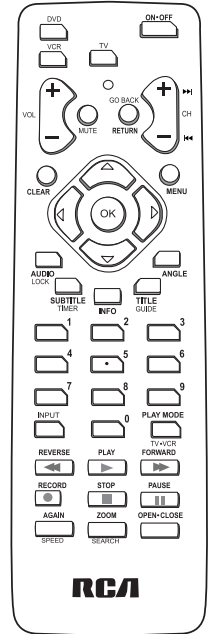
030977

DVD Player (Optional)

The DVD player is a multi-function component. It plays Digital Video Discs, and has a built in radio and amplifier. The power button on the DVD player must be pushed on to place the system in Stand-by mode. The DVD player will then respond manually or when using the remote control.



031157

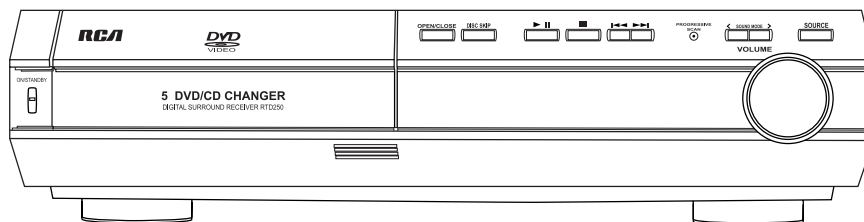


031157b

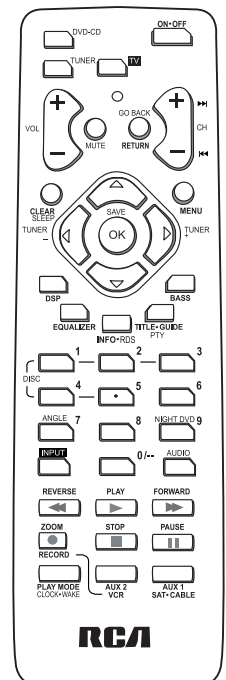
Home Theater System (Optional)

The remote for the Home Theater system is the most versatile of all the items of equipment. The programmable remote can control the television if the manufacturer's codes are programmed. A complete listing of the manufacturer's codes is located in the A/V System Guide supplied in the warranty information file. The Home Theater System can be used as a tuner for radio listening.

A built in DVD player enables DVD, CD and Video CD to play through the television.



031158

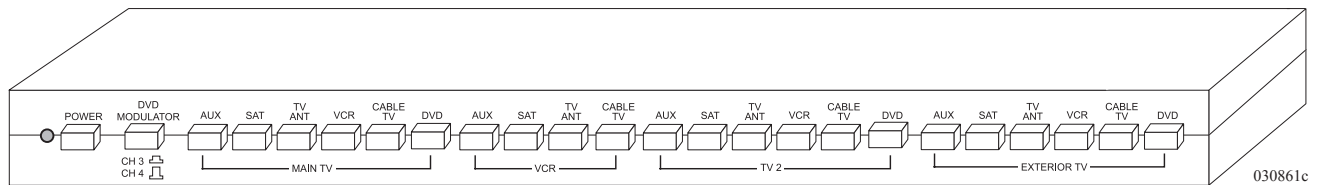


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The motorhome is equipped with a video selector box that has five inputs and four outputs. The video selector box interfaces the different input signals from the various components to the televisions and VCR.

Features Include:

- Five Inputs: **Satellite Receiver (N/A), TV Antenna, VCR, Cable TV** and **Auxiliary**.
- Four Outputs: **MAIN TV, TV2 (Bedroom TV), VCR, EXTERIOR TV**.
- Built-in 12 Volt TV antenna amplifier.
- Independent viewing of signals at different televisions, with a record option from the VCR.



Operating the Components

To Watch TV Using the Antenna:

Press the **TV ANT** button located above the section marked **MAIN TV** on the switchbox. Turn **TV ON** and select channel. Fringe area reception can be improved by pressing the **POWER** button on the switchbox. Follow the same procedure for TV 2 (Bedroom TV).

NOTE:

The picture quality from the outdoor TV antenna varies depending on the location of the TV station in relationship to the location of the TV antenna. If picture quality is poor, turn the POWER button on the Video Selector Box. Turn off when not viewing from the antenna.

To Watch TV Using the Shore Cable Signal:

Press the **CABLE TV** button above the section marked **MAIN TV**. Turn the **TV ON** and select channel.

NOTE:

To view Cable TV signals, hook a 75-Ohm cable from the supplied service to the Cable TV input in the Water Service Compartment. Cable TV inputs are available at many of today's campgrounds.

To Play or Record using the VCR:

Press the **VCR** button above the section marked **MAIN TV**. Turn the **TV ON** and select channel **3**. Turn the **VCR ON** and insert videotape. To record, select the component to be recorded from in the VCR section of the switchbox. Follow the same procedure for TV2 (Bedroom).

To Play a DVD:

Press the **POWER** button on the DVD player. Select DVD on the DVD remote. Turn **ON** the TV and select channel 3. Press **DVD** on the Video Selector Box in the section marked main T.V. Open the tray and place the disc on the tray label side up. Press **PLAY** on the DVD remote. Adjust the volume using the TV remote.

To Play a DVD on the Surround Sound System:

Turn on the TV and Surround Sound System. Select Channel 3 on the TV and press **DVD** on the Video Selector Box in the section marked **MAIN TV**. Press the **SOURCE** button on the Surround Sound remote until DVD displays. Place a DVD on the tray, label side up and press **PLAY** on the Surround Sound remote. For full surround effect reduce TV volume to zero using the TV remote and adjust the surround volume using the Surround Sound remote.

DIGITAL SATELLITE PREP

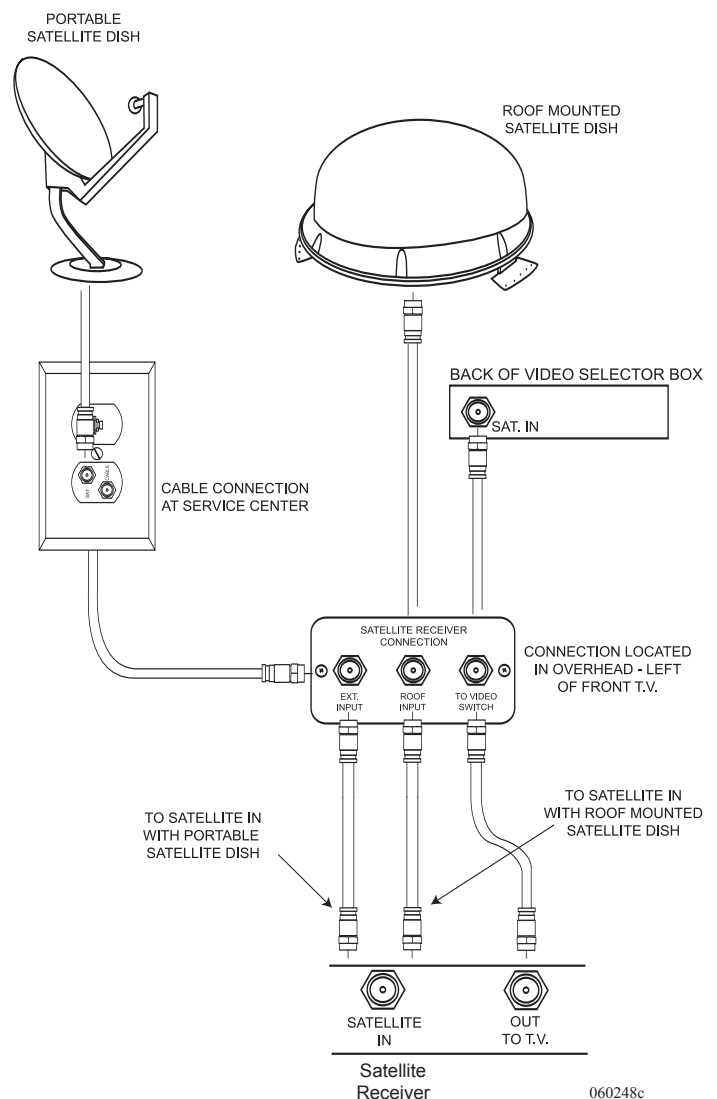
The motorhome is pre-wired for a roof-mounted or a portable Digital Satellite System. The pre-wire consists of a Satellite Receiver Connection, coax, a wire for the Antenna Up indicator on the dash, a 12 Volt DC power connection and a phone cable for Pay-Per-View programming.

Installing the satellite dish:

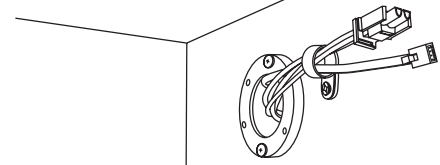
The coax and wire for the Antenna Up indicator are located in the ceiling behind the first ceiling light in the living room. The satellite dish should be mounted just forward of the ceiling light to secure the mounting base of the satellite to the backing plate that is built into the roof. Install satellite according to installation instructions provided with the satellite dish.

Connecting the satellite receiver (IRD):

- Connect a coax from the Roof Input on the Satellite Receiver Connection in the overhead cabinet above the pilot seat to the Satellite In connection on the back of the receiver.
- When using a portable satellite dish connect a coax from the Exterior Input on the Satellite Receiver Connection to the Satellite In on the back of the satellite receiver.
- Connect a coax from Satellite Out on the back of the satellite receiver to To Video Switch on the Satellite Receiver Connection.



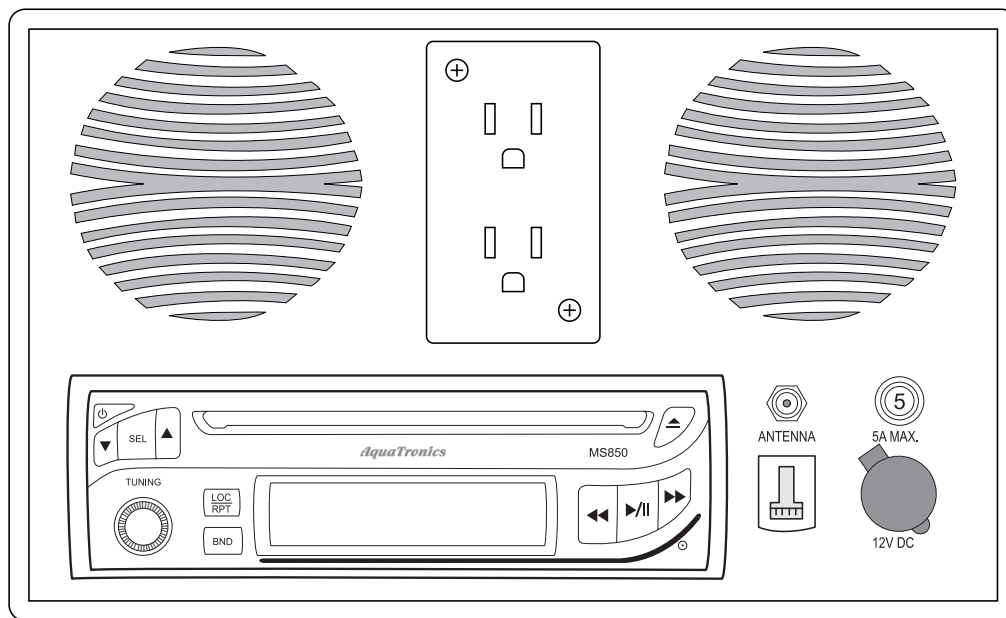
- Connect the provided phone cable to Tel Line on the back of the satellite receiver.
- A 12 Volt DC power connection is provided for use with satellite systems that require 12 Volt DC power to control satellite dish movement. Power comes from the front electrical box on the road side.



060248

12 Volt DC Power and Phone Connection

ENTERTAINMENT CENTER - EXTERIOR (Optional)



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Functions:

- **ON/OFF POWER BUTTON** - Press this button to turn the unit on or off.
- **VOLUME/LEVEL CONTROL** - To increase the volume level, press the up arrow button. To decrease the volume level, press the down arrow button.
- **SELECT BUTTON** - This button is used to select the audio function (volume, treble, bass, balance or fade) to be adjusted using the Level Control.
- **AM/FM BAND SELECTOR** - During radio operation each momentary press of this button will change the radio band.
- **TUNER** - To manually tune in a station turn knob to appropriate direction until the desired frequency is reached.

- **DISC SLOT** - With the label surface facing up, gently insert the disc into the slot until the soft-loading mechanism engages and disc play begins.
- **TRACK SELECT** - These buttons are used to quickly select the beginning of a particular track. With each momentary tap of the Forward Track Select button (right arrows) the next higher track number will be selected as shown on the display panel. Similarly, with each momentary tap the Backward Track Select button (left arrows) the next lower track number will be selected.
- **CD PLAY/PAUSE DESELECTOR** - During disc play, press this button to temporarily stop play of the disc. Press the button again to resume play of the disc from the point at which it was stopped.
- **REPEAT PLAY SELECTOR** - During disc play, press this button to repeat the play of the selected track ("RPT" will appear on the display panel). Play of the track will continue to repeat until the button is pressed again.
- **DISC EJECT** - Disc play is stopped, the disc is ejected and the unit will change to radio operation by pressing this button.

BEDROOM TV SWIVEL

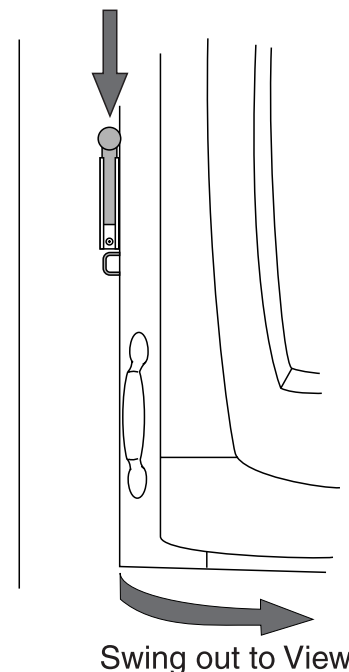
Bedroom TV Swivel (Certain Models):

- Unlock the TV when parked. Pivot the TV outward to desired angle.
- Stow the TV into the cabinet when preparing for travel. Lock the TV into position.

CAUTION:

Failure to lock TV in travel position can result in damage to the TV and cabinetry.

Secure for Travel



020257



NEPTUNE 2005

WATER SYSTEMS SECTION 6

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WATER SYSTEMS - INTRODUCTION

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

It is hard to imagine how much water is used by the average person. Newcomers to a self-contained motorhome soon discover water does not last long unless consumption is drastically reduced. For example, less water can be used for showering if the shower is turned off while soaping down, then turned back on to rinse. This way a good shower uses a couple gallons of water or less. There is plenty of water to meet personal needs once habits are adjusted.

Fresh Water System:

The fresh water system consists of the fresh water tank, water pump, water filter, a city/fresh water connection, and a water hose (not supplied) for potable water use only. Proper care of fresh water connections is a must. After each use, drain the water hose and screw the ends together. A pressure regulator is attached to the city water/tank fill connection. After each use, attach the end cap to keep out debris and insects.

Waste Water System:

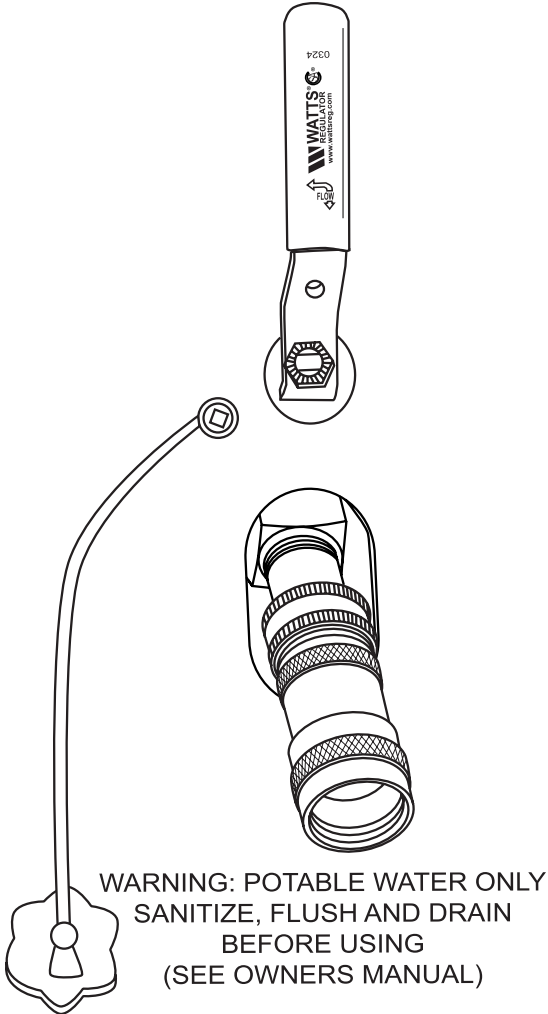
The waste water system consists of a waste holding tank (grey water), a sewage holding tank (black water), flush system, toilet and drains.

WARNING:

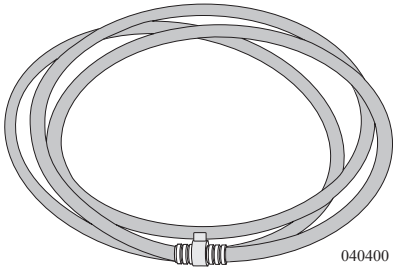
Water is electrically conductive. Do not use any electrically powered item or electrical outlet that may be exposed to a water source. Such use can result in a serious shock causing injury or death.

*Water Hose (Not Supplied):
Screw ends of hose together before storage to prevent leakage and to prevent dust and insects from entering hose.*

**TO WINTERIZE SYSTEM
SEE OWNERS MANUAL**



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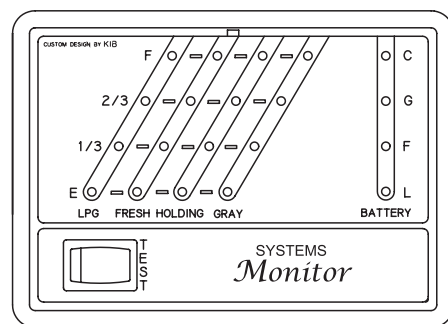


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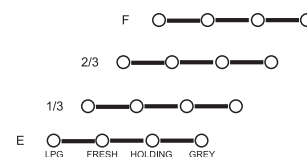
WATER TANKS - *Measurements & Calibration*

The motorhome is equipped with a monitor panel to aid in managing the storage tanks. The monitor panel will be located in a main Status Monitor Panel in the hallway area. A second monitor can be found in the roadside 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 to be monitored. Each scale uses colored lights along with a corresponding scale reading. The lights and scale indications are as follows:

- **Green** lamps indicate good or normal ranges.
- **Amber** lamps indicate fair or partial ranges.
- **Red** lamps indicate full or empty ranges (depending on the scale), which are in the critical range.



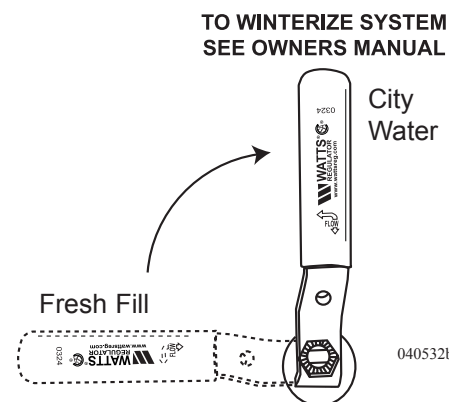
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WATER - POTABLE *City Hook-Up*

- Connect a potable water hose to the city/fresh water hook-up located in the service center on the roadside of motorhome.
- The city water hook-up in the service center has a built in pressure regulator and one-way check valve. The pressure regulator limits the water pressure to approximately 45 PSI.
- An additional pressure regulator can be connected to the city water faucet to regulate the pressure to the potable water hose.
- Turn the city water/tank fill valve to the city water position (as shown).
- Turn on the water supply.
- The water pump can be either off or on. It will not affect the water pump to leave it on.



Valve shown in the City Water Position

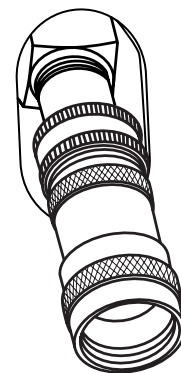
040532b

NOTE:

When connecting the motorhome to fresh water be sure to use a hose manufactured and labeled for potable water to ensure that the hose will not flavor the water.

CAUTION:

Some outside water sources develop high water pressure, particularly in mountainous regions. High water pressure is anything over 55 psi (pounds per square inch). Excessive water pressure may cause leaks in water lines and/or damage the water heater. (An additional pressure regulator can be connected to the city water faucet to regulate the pressure to the potable water hose.) Excess pressure on a hot day can cause the water hose to swell and burst.



040532e

Water Pressure Regulator.

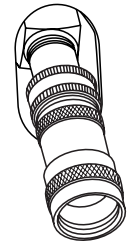
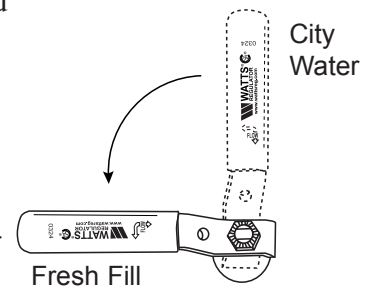
Fresh Tank Fill

- Make sure the water pump is off.
- Connect a potable water hose to the city/fresh water hook-up located in the service center on the roadside of the motorhome.
- Turn the city water/tank fill valve to the Fresh Water Fill position.
- Turn on the water supply.
- The system monitor in the service center or in the hallway area may be used to observe the fresh water tank level.
- After the system monitor shows the tank approaching full, watch for water to come out of the overflow pipe.
- The water tank is full when water come out of the tank overflow pipe. Shut the water off as soon as possible.

NOTE:

When filling the fresh water tank, do not leave the hose unattended. Turn water off before a full black of water come out of the overflow pipe.

TO WINTERIZE SYSTEM
SEE OWNERS MANUAL



040532

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

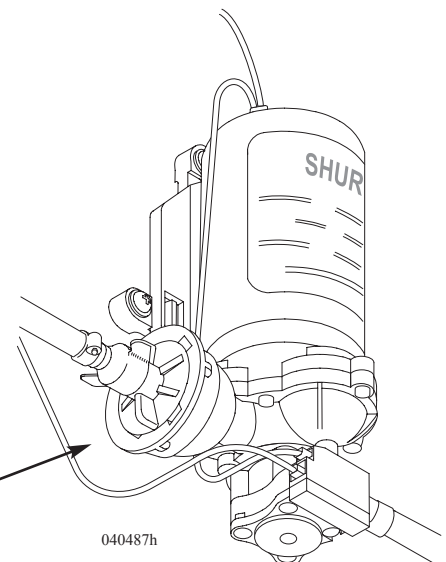
Valve Shown in the tank fill position.

The water pump pressurizes the fresh water system when not connected to city water. When turned on, the water pump is automatic and self-priming, operating on demand as water is used. The water pump is located behind the plumbing service center.

WARNING:

Before leaving the motorhome for extended periods of time (i.e. overnight or longer) be sure that the city water and the water pump have been turned off. Damage from neglect will be the responsibility of the owner, not the manufacturer.

Inlet Strainer
(Clean Twice
Monthly)



Water Pump Located in Plumbing Service Center

To turn the water pump on or off:

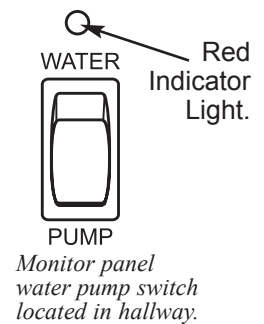
- Momentarily press the water pump switch. The indicator lamp will illuminate when the water pump is turned on.

CAUTION:

Do not continue water pump operation if the fresh water holding tank is empty. Damage to the water pump or electrical supply system may result.

Using the water pump to pressurize the fresh water system after removal from storage:

- Close all drain valves and low point drains.
- Fill the fresh water tank.
- Open the hot and cold water valves of each faucet.
- Turn the water pump on. Wait for the water lines to fill.
- Close each faucet when it delivers a steady stream of water.



Water Pump Troubleshooting

Vibration induced by road conditions can cause the plumbing or pump hardware to loosen. Check the water pump system for components that are loose. Many symptoms can be resolved by tightening the hardware. Check the following items:

Water pump will not start or blows the fuse:

- Check the electrical connections at the water pump, located in the Roadside water bay, fuse or breaker, water pump switch and ground connection.
- Is voltage present at the pump? If voltage is present, the pressure switch may be faulty.
- Check the charging system for correct voltage and good ground.
- Check for an open or grounded circuit or motor.
- Check for a seized or locked diaphragm assembly (water pump frozen).

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

- Is the pump inlet strainer clogged with debris?
- Is there water in the tank, or has air collected in the water heater?
- Is the inlet tubing and plumbing sucking in air at plumbing connections (vacuum leak)?
- Check for proper voltage with the pump operating.
- Check the pump housing for cracks or loose drive assembly screws.

Water pump will not shut-off or continues to run when the faucet is closed:

- Check to see if the fresh water/tank fill valve is completely closed.
- Check the output (pressure) side plumbing for leaks and inspect for a leaky toilet or valves.
- Look for a loose drive assembly or pump head screws.

Water pump is noisy or rough in operation:

- Check for plumbing that may have vibrated loose.
- Does the mounting surface multiply noise (flexible)?
- Check for mounting feet that are loose or compressed too tight.
- Look for loose pump head to motor screws.

Water pump is rapid cycling:

- Look for restrictive water flow in the faucets or shower heads.

The motorhome is equipped with a filtered water dispenser at the galley sink. A diverter hose is installed at the factory and the water filter is secured on a clip next to the diverter hose. The water filter will need to be installed by the motorhome owner.

Replacing/Installing Water Filter or Diverter Hose:

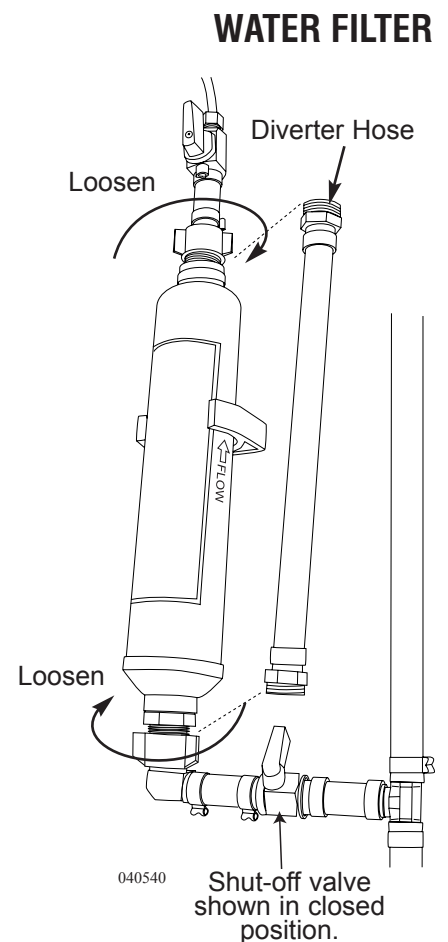
- Close the shut-off valve on the inlet side of the water filter.
- Turn the faucet on to relieve pressure in the line.
- Remove the water filter/diverter hose by unscrewing the fittings at the top and bottom.
- Install filter according to label, or install diverter hose.
- Open the valve and check for leaks.

NOTE:

Check the filter or diverter hose for leaks after installation to prevent damage to the motorhome.

NOTE:

Replace the water filter every six months. Remove the water filter and install the diverter hose when winterizing the motorhome.



WATER SYSTEMS - *Troubleshooting*

Water system problems are generally caused by improper use or lack of attention. Improper winterizing, poor maintenance, road vibration and campsite water pressure variations are common culprits of water system failure.

Check all plumbing connections for leaks at least once a year. If the water pump runs when a faucet is not open, check for a water leak. Close drain valves. If the pump continues to run, take the motorhome to an authorized dealer for service.

Disinfecting Fresh Water

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

When to disinfect the fresh water system:

- If the motorhome is new.
- If the motorhome has not been used in a long time.
- Every three months.

NOTE:

An independently operated water pump with garden hose connections and a container to hold the prepared solution may be used to perform this task.

To Disinfect the Water System:

- Remove water filter in galley and install diverter hose.
- Prepare a chlorine bleach solution using one gallon of water and $\frac{1}{4}$ cup of chlorine bleach. Use 1 gallon of solution for every 15 gallons of tank capacity. For example: Add $2\frac{2}{3}$ gallons solution to a 40 gallon tank. Add $4\frac{2}{3}$ gallons solution to a 70 gallon tank. Add $6\frac{2}{3}$ gallons to 100 gallon tank. This mixture puts a 50 PPM (parts per million) disinfecting solution in the water system that will act as a quick-kill dosage for harmful bacteria, viruses and slime-forming organisms. Concentrations higher than 50 PPM may damage the water lines and/or tanks.
- Another method of calculating the amount of chlorine bleach to be used is to multiply the number of gallons by 0.13. The result is the amount in ounces of chlorine to introduce into the fresh tank with water.
- Drain the fresh water tank. Close the drain and prepare to add the solution to the fresh water tank. The method of introduction is up to the owner.

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 will be required to remove any chlorine residue. Flush the system several times to remove chlorine residue.

- Turn on the water pump in the motorhome.
- Open each faucet and run the water until you smell a distinct chlorine bleach odor.
- Turn off all faucets allowing the system to stand for four hours.
- Drain the fresh water tank of the mixed solution.
- Fill the water tank with fresh water. Thoroughly flush hot and cold lines with fresh water. Repeat this process until the chlorine bleach smell is no longer detectable in the water system.
- Install new water filter.

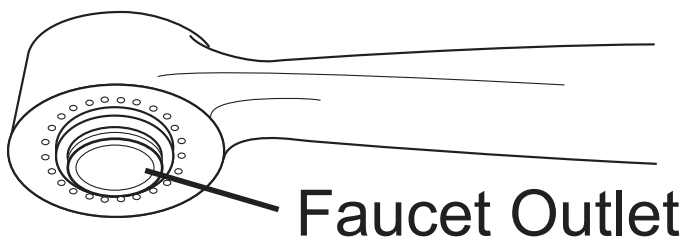
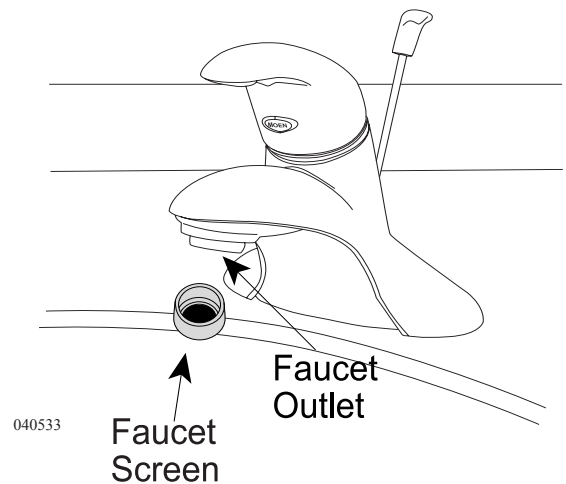
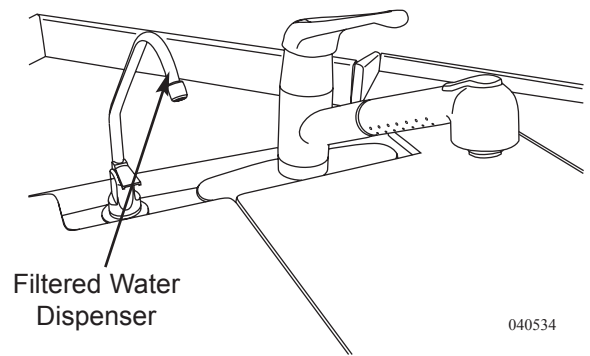
FAUCETS

The kitchen faucet head has a flexible hose allowing the faucet head to extend from the base. O-rings seal the faucet head to the base preventing water from dripping into the cabinet. The faucet can be set to stream or spray.

Fresh water may contain lime deposit or debris that will attach to the faucet screen and restrict or plug the flow of water. All faucet screens should be checked and cleaned every two weeks of use.

To clean faucet screens:

- Unscrew kitchen-screen retainer from faucet head.
- Lavatory/vanity - remove threaded collar from faucet outlet.
- Clean screen using a small soft brush, if necessary, and a de-liming solution.
- Install screen and check water flow.



WASTE WATER SYSTEMS

Proper Waste Disposal

Dumping raw sewage from toilet holding tanks, except at authorized dumping stations, is universally prohibited. Most National, State and private parks have either a central dump facility or campsite hook-up for sewage. Many modern rest areas along the interstate now have dump stations available. Woodall's Campground Directory, Trailer Life's RV Campgrounds and Services Directory, Rand McNally's Campground and Trailer Park Guide, Good Sam Park Director (Good Sam Club), and other similar publications list dumping stations. Some major oil companies offer dump facilities at selected stations.

What Not to Put in Waste Holding Tanks

- Do not use strong or full strength detergents to deodorize and disinfect. Use odor control chemicals made especially for holding tanks.
- Automotive antifreeze, ammonia, alcohol or acetone in holding tanks will dissolve plastic.
- Do not put large table scraps in the tanks. They could stick in or damage the valve seals.
- Facial tissue is thicker, softer and stronger than a rapidly dissolving tissue. White toilet paper dissolves faster than colored. Paper designed specifically for holding tanks is available at most RV supply stores.

TIP:

To test tissue dissolving ability, immerse one tissue square into a jar of water. Shake the jar five times to determine if the tissue disintegrates into pieces or remains in one piece. Do not use any type of tissue that remains in one piece.

NOTE:

Never dispose of sanitary supplies or other non-dissolving items into the system. Facial tissue, wet strength tissue, paper towels or an excessive amount of toilet tissue can create clogging in the holding tank system.

CAUTION:

Do not use 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 - Black Water Tank

Before initially operating the toilet, treat the sewage holding tank with a pre-charge of water and an odor-control chemical (available at most RV supply stores). First, add approximately three gallons of water to the holding tank. Next, mix the chemicals, in accordance with the manufacturer instructions, with approximately one gallon of water. Pour mixture through toilet to the holding tank. Be careful not to spill the chemical on your hands, clothing, toilet bowl or carpet. Hot weather conditions may require adjusting the amount of chemical used to control odor. Repeat the chemical pre-charge to the holding tank each time the tank is cycled.

WARNING:

Most chemical mixtures for holding tank odor control are poisonous. Follow the product manufacturer's directions and warnings when using 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.

What to Put in Holding Tanks - Grey Water Tank

The grey water waste tank stores the sink, shower and clothes washer drain water. A reduced mixture of chemicals may help to control odor in the grey tank.

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

Waste Drain & Sewage Tanks

The waste drain system provides adequate and safe storage and/or discharge of waste materials. The drain system uses ABS plastic piping and fittings connected to sinks, shower, toilet and holding tanks draining to an outside termination. The motorhome should be reasonably level for optimum operation of the waste systems. The wastewater holding system consists of a grey water tank that stores the sink, shower and laundry washer drain water, and a black holding tank that stores waste from the toilet.

Drain valves and a tank flush system dispose waste through a common termination. Each holding tank has a separate drain valve dumping the waste water (grey water) and sewage (black water) through a common single discharge outlet. The tank drain valves are located in the roadside service center. Use service bay monitor or systems control center to monitor tank levels. When ready to drain the tanks, drain the sewage tank first. Next, flush the black tank with the flush system. Close black tank valve after flushing tank. Drain the grey water tank. Using this sequence helps to flush solids from the sewer hose. When traveling, it is recommend both holding tanks be empty or less than half full.

Waste Drain Hose - Standard

A flexible three-inch sewer hose attaches between the termination drain and the shore facility. The termination drain is adjustable and should be periodically exercised. Sewer hoses usually come in 10 or 20 foot lengths. The sewer hose is stored in a tube accessed through a door in the roadside service center. 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 adapters are available to fit most configurations. Hose ladders may also be purchased to support the hose.

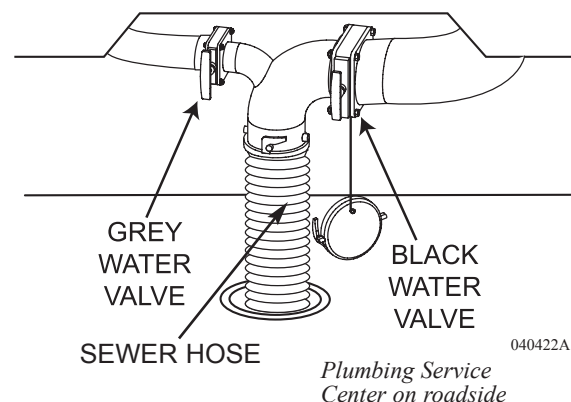
It is important that the hose remains secure. **Always tighten clamps and restraining devices before use.** Lay the hose inline between the termination outlet and the shore fitting. Restrain the hose to prevent movement during use. Wear protective and/or disposable gloves when handling the sewer hose.

To Exercise the Termination Drain:

- Grasp the drain firmly on both sides of the drainpipe.
- Swivel the pipe up and down several inches to exercise the internal O-rings.
- The drainpipe may be left in the upward position to prevent residual material from leaking out.

To Attach the Hose:

- Remove sewer hose from carrier.
- Remove termination cap. Align coupler tangs with termination tabs. Twist coupler clockwise 90° locking coupler to termination outlet.
- Unscrew the access deck plate and feed the drain hose through the opening.
- Rotate the drainpipe downward for maximum flow.



- Attach the other end of the hose to the drain service. Restrain hose to prevent movement during use.
- Open the (small) grey water valve.

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

LUBE:

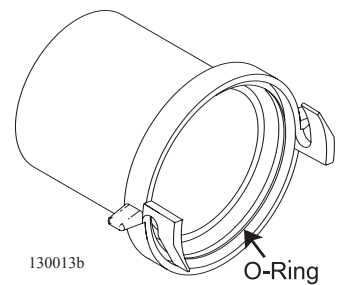
Lubricate the O-ring on the sewer hose adapter periodically with silicone spray.

NOTE:

Close the grey water valve 24 hours prior to departing to allow the tank to fill with liquid to help in the dumping process.

NOTE:

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

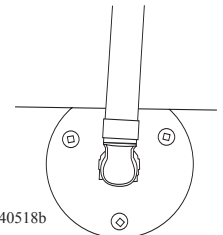


Hose adapter clamped to end of sewer hose.

Black Tank Flush

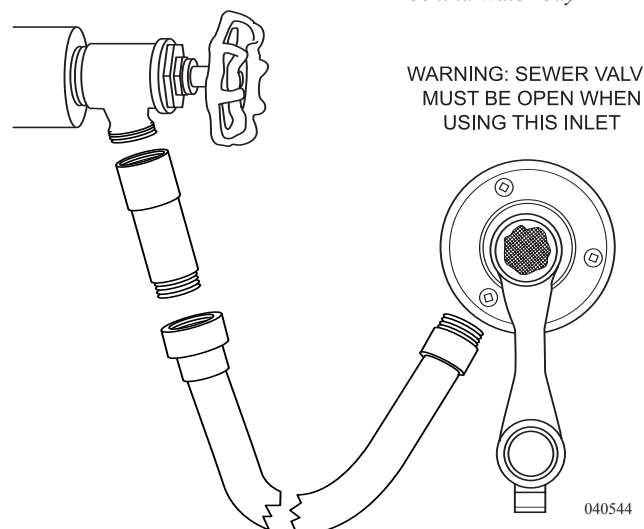
The black tank comes equipped with a flush nozzle, located on the curbside, to help reduce solid build up. Flush the tank each drain cycle. Failure to thoroughly flush the tank may result in accumulated solids and a clogged spray nozzle.

1. Close the grey water valve and fill the grey tank to at least 50% by running water in the shower or sinks. Use the Systems Control Center to observe tank fluid levels. When the grey tank is 50% full, stop filling the tank.
2. Open the black water valve. Allow the black tank to drain.
3. Connect a non-potable water hose, with pressure regulator, to the flush system fitting located in the service center. Turn on the faucet and allow water to rinse the black tank for at least three minutes. Never operate the system unattended. Ensure the water flows freely through the sewer hose. When completed, turn off the faucet and close the black water valve.



Black Tank Flush nozzle in curbside compartment behind water bay

WARNING: SEWER VALVE MUST BE OPEN WHEN USING THIS INLET



4. Open the grey water valve. The water in the grey tank will flush remaining solids from the sewer hose. The grey valve remains open until the next drain cycle, or time of departure.

WARNING:

Never operate the flush system unattended. Flooding may occur. Use the tank flush system each time the holding tanks are cycled. Failure to routinely use the flush system will result in a clogged spray nozzle. Turn off the water supply when finished flushing the tank.

When preparing for travel:

1. Close black and grey valves. Undo restraining devices from the sewer hose. Disconnect the sewer hose from the termination outlet by rotating the fitting counterclockwise 90°.
2. Drain the sewer hose using a hand over hand method while working the sewer hose towards shore fitting. Rinse the sewer hose with outside facility and repeat the hose drain process.
3. Remove the sewer hose from shore fitting. Install sewer hose in carrier and lock door. Secure the termination cap (required by law in some states).
4. If desired, add chemicals to the tanks to control odor. Follow the directions given by the manufacturer of the chemical.

NOTE:

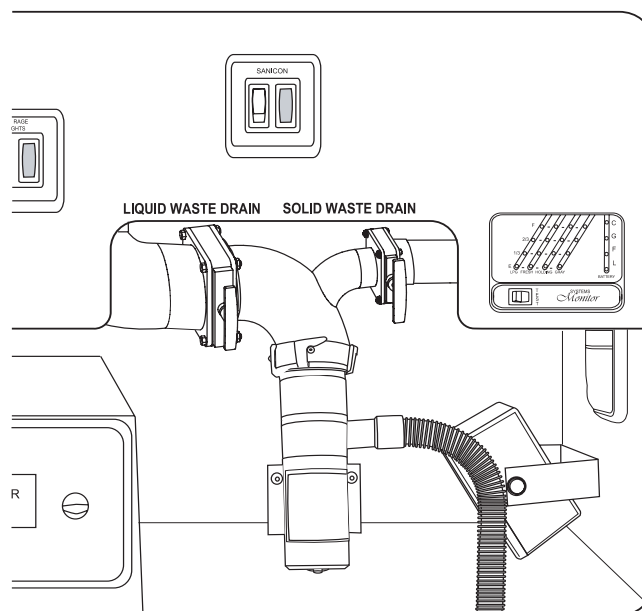
Dump the black tank before driving.

Waste Pump (Optional)

The waste pump is a self-priming impeller pump designed to minimize clogging when draining the tanks. The system comes with a 1-1/2" outlet hose with sewer pipe adapter and a 13 gallon per minute macerator pump.

To Empty the Black Tank:

- Ensure the connector on the macerator pump to the termination point on the dump connection is secure. Ensure waste pump outlet hose is secure.
- Remove the drip cap at the bottom of the sewer pipe adapter.
- Insert the adapter into the sewer connection.
- Open the solid (black) waste drain valve at the plumbing service center.
- Turn on the macerator pump using the switch on the service center panel.
- When the black tank is empty, turn off the pump and leave the solid waste drain valve open.

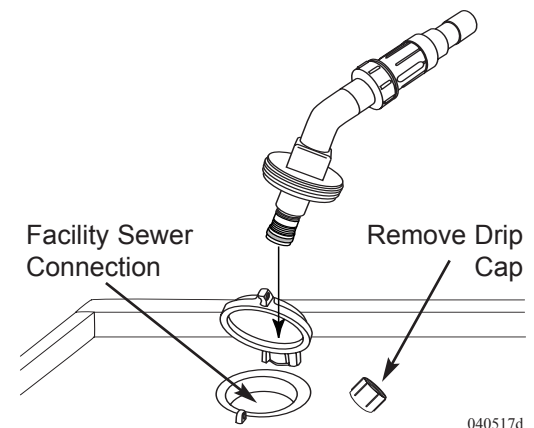


To Rinse the Black Tank:

- With the solid waste drain valve left in the open position, open the liquid (grey) waste drain valve. Gravity will equalize the volume of the black and grey tanks.
- Close the liquid waste drain valve and turn the pump back on to rinse the black tank. This process may be repeated to rinse the tank again.

To Flush the Black Tank:

- Ensure the sewer pipe adapter is inserted in the facility sewer connection.
- Ensure the solid waste drain valve is open, the liquid waste drain valve is closed and the grey tank is at least 50% full.
- Connect a non-potable water hose with pressure regulator to the flush system fitting in the plumbing service center. Turn on the water supply and waste pump. Allow the water to rinse the black tank for at least three minutes. Never operate the system unattended. Ensure the water flows freely through the waste pump outlet hose.
- When completed turn off the faucet.
- Close the solid waste drain valve and open the liquid waste drain valve. Turn on the waste pump. The water in the grey tank will flush the remaining solids from the sewer hose. The liquid waste drain valve remains open until the next drain cycle or time of departure.



When Preparing for Travel:

- Empty the tanks and close both the solid and liquid waste drain valves. Undo restraining devices from the waste pump outlet hose. Drain the hose using a hand over hand method while working the hose toward the shore connection. Remove sewer pipe adapter from shore fitting and install drip cap. Coil and store hose in water bay.
- If desired, add chemical to the tanks to control odor. Follow the directions given by the manufacturer of the chemical.

NOTE:

Drain both waste tanks before traveling.

Troubleshooting:

- The house battery disconnect switch in the battery compartment needs to be on for the macerator pump to operate.
- 12 Volt DC power for the macerator pump is supplied by the house batteries and is protected with a 20 Amp mini breaker located in the battery bay in the electrical enclosure.

TOILET - *Operating Instructions*

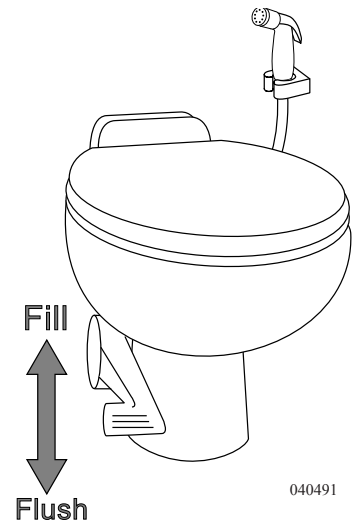
The toilet operates from either the fresh water tank or city water supply. The water pump must be turned on or the city water connected. The toilet flushes directly into a sewage holding tank (black water).

NOTE:

To prevent accumulation of solids below toilet, add several gallons of water to the holding tank before use.

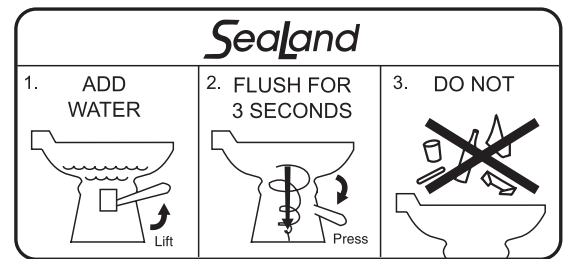
CAUTION:

Most chemical mixtures for holding tank odor control are poisonous. Follow the product manufacturer's directions and warnings when using any holding tank additive.



Toilet Operation:

- Using a foot, lift up the flush lever to add water to the bowl. Generally, more water is required only when flushing solids.
- To flush the toilet, push the lever all the way down until the sewage leaves the toilet.



Water flow pressures vary at different locations; therefore, holding the flush lever down for several seconds may be required. Release the flush lever by allowing it to snap back, which permits positive sealing around the flush ball. A small amount of water should remain in bowl.

NOTE:

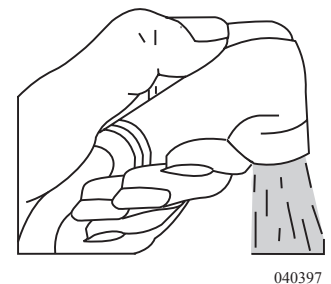
Holding flush lever down longer than necessary results in excessive water usage.

Cleaning & Maintenance

Cleaning the Toilet:

The toilet should be cleaned regularly for maximum sanitation and operational efficiency. Clean the toilet bowl with a mild bathroom cleaner. Do not use chlorine or caustic chemicals, such as drain opening types, as they will damage the seals.

Clean out the system by flushing several gallons of fresh water through with one cup of dry laundry detergent. Add odor control deodorant, in the amount specified for your holding tank capacity, after cleaning and 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.

NOTE:

If the motorhome is in storage for six months it is a good idea to spray silicone on the toilet valve and work it back and forth. Perform this maintenance monthly (silicone will evaporate in about 30 days).

Troubleshooting:

• Leaks:

- Back of toilet: check water supply line connection.
- Between closet flange and toilet: Check the screws for tightness. If the leak continues, remove the toilet and check flange height. Adjust the height, if necessary, to 7/16" above floor. Replace the flange seal if it is damaged.

• Poor flush:

A good flush should be obtained within two to three seconds. If the problem persists, remove the water supply line and check the flow rate. The flow rate should be at least ten quarts (9.5 liters) per minute.

• Bowl will not hold water:

Check for foreign material in the valve blade groove in the flush drain.

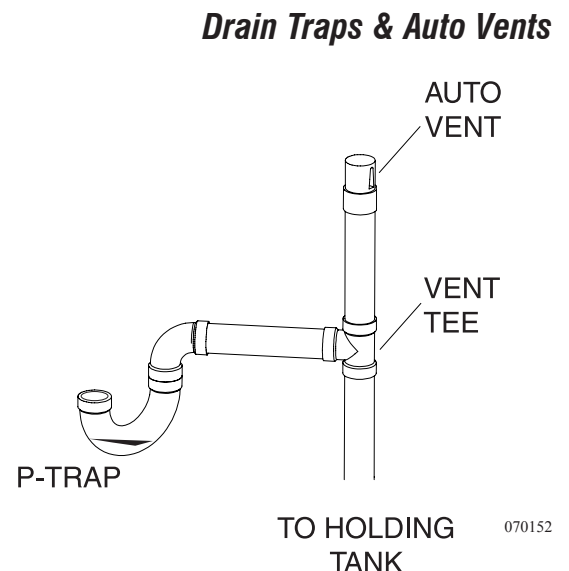
NOTE:

Most chemical mixtures for holding tank odor control are poisonous. Follow the product manufacturer's directions and warnings when using any holding tank additive.

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

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 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.

The auto vent, if stuck in the open position, can allow grey tank 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

The motorhome is not designed for extended use in below freezing (32°F/0°C) weather. There are precautionary measures that can be taken for extended cold weather use.

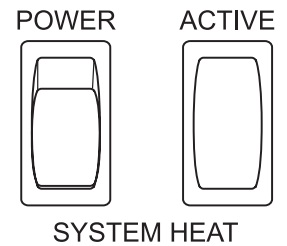
Interior water lines, fixtures, and drains above the floor are normally protected from moderate freezing temperatures as long as the furnace is operating. Cold temperatures can adversely affect water systems below the floor level because the LP-Gas furnace heat does not provide heat to these components. A supplemental 12 Volt bay heater and thermal snap disc are located in the water service bay. The System Heat switch on the monitor panel operates the plumbing service center bay heater to prevent waterlines from freezing and should be turned on when ambient temperature approaches 44°F (+/- 6°F) and freezing temperatures may occur.

System Heat Operation:

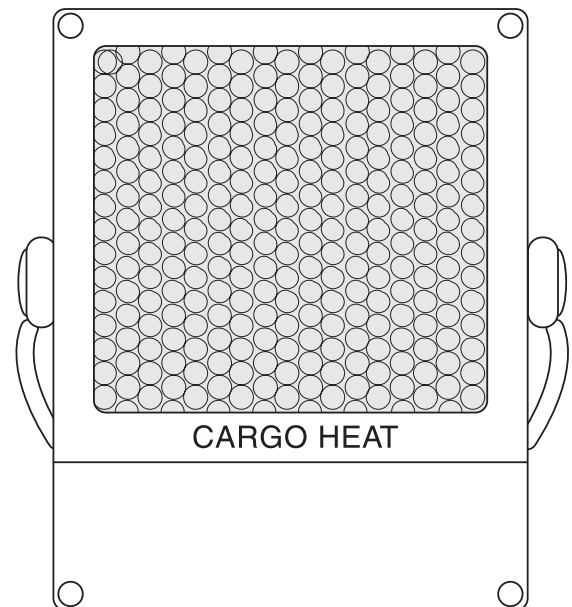
1. Turn the Systems Heat switch ON to supply power to the snap disc thermostat.
2. When the bay temperature reaches 40°F (+/- 6°F), the snap disc thermostat will close. The bay heater and the systems heat Active light will turn on. The heater will continue to operate until bay temperature reaches 55°F (+/- 6°F). The bay heater and Active indicator light will turn OFF.

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.



040437



12 Volt DC Bay Heater

030981

Cold Weather Storage

If the motorhome is stored where freezing temperatures may occur, drain the domestic fresh water loop. Drain the fresh water tank by opening the fresh tank drain valve in the storage bay.

NOTE:

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

WINTERIZATION

The fresh and waste water systems require winterization when the motorhome is placed in storage. To winterize, use compressed air to evacuate all liquids and/or antifreeze to replace all liquids.

The recommended method of winterizing is using air pressure to remove liquids that may freeze and cause damage to the various systems and appliances. The lines can then be left empty, or filled with an FDA approved RV antifreeze. When plumbing lines are drained, antifreeze is not necessary, and the decision to use antifreeze is left to the motorhome operator.

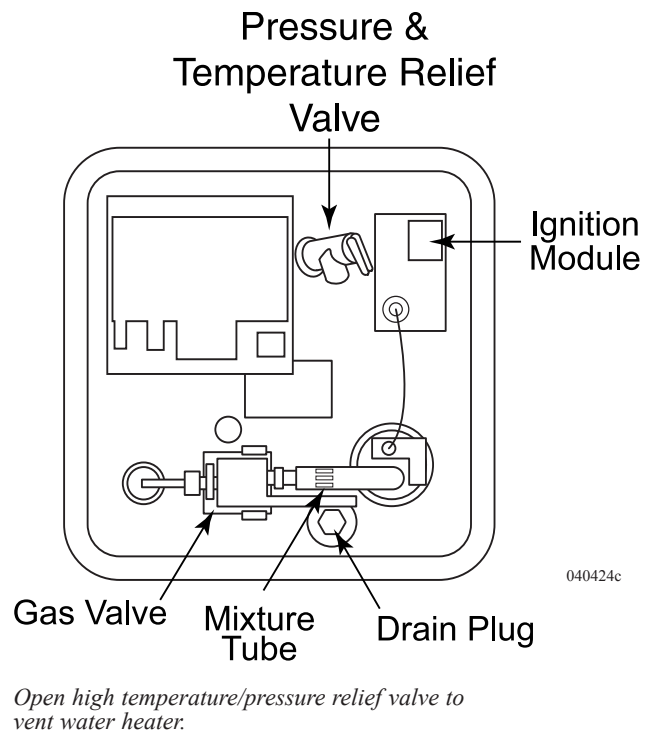
NOTE:

ONLY FDA approved RV antifreeze should be used to winterize the water systems in the motorhome.

Using Air Pressure

Access to an air compressor, and an adapter to connect the air line regulator to the water system, will be necessary. The Air Coupler in the engine compartment, which is part of the Chassis Air System, may also be used. Air adapters used for winterizing are available at RV supply locations. When attached to the water lines, air pressure should not exceed 40 PSI. Higher pressure can damage the lines.

1. Empty and flush the holding tanks.
2. Drain the fresh water tank by opening the drain valve located in the bay next to the service center.
3. Open all low-point drain valves and allow the water to drain.
4. Remove water heater exterior access panel. Open the high temperature/pressure relief valve to vent water heater. Remove drain plug to allow tank to drain. Replace plug.
5. Go to the interior hot water tank access point. Place the water heater bypass valve in bypass position.
6. Remove water filter under galley sink and install diverter hose.
7. Connect an air hose with regulator to the city/fresh water fill connection, with valve positioned for city water. Set regulator for 40 psi and turn on air. (Air adapters for winterizing are available at RV supply locations.)
8. When water stops flowing from the drain valves, open and close the faucets one at a time, hot and cold, until only air comes out. Do not forget any outside faucets.
9. Hold the toilet flush mechanism open until the water has stopped running.
10. Disconnect the air hose with adapter.
11. Close all valves and faucets.



12. One gallon of FDA approved RV antifreeze is needed to protect various water drain lines in the motorhome. Pour one pint into both the kitchen and bath shower drains. Pour two pints into the bath sink drain. This will protect the P-traps, with some of the antifreeze going into the grey tank to protect the drain valve. Open the valve on the toilet. Pour another three pints into the toilet, letting the antifreeze run into the black tank to protect the drain valve. Use a soft cloth to wipe out the sinks, shower and toilet (after the antifreeze is poured in) to protect the surfaces from stains. Pour the last pint into the washer/dryer drain.

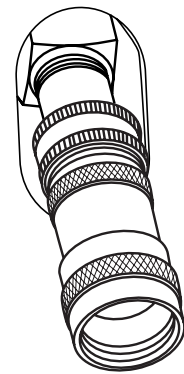
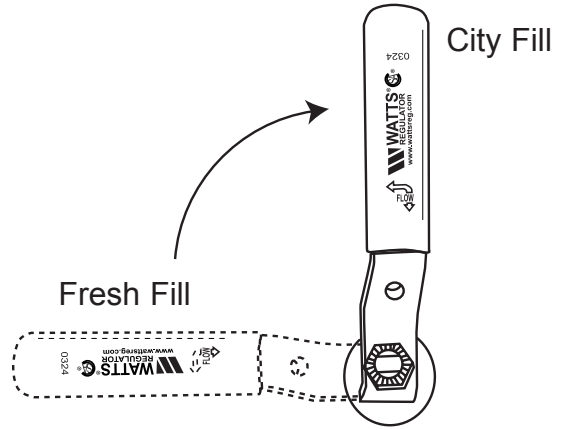
WARNING:

Ensure the water is not hot when draining the low-point drain lines. Hot water from the lines can cause burn injuries.

NOTE:

Some items require special winterizing instructions, which can be found in the specific owner’s manuals.

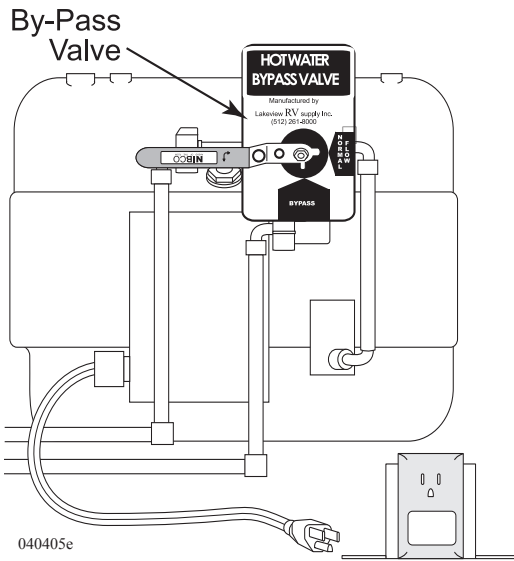
**TO WINTERIZE SYSTEM
SEE OWNERS MANUAL**



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**WARNING: POTABLE WATER ONLY
SANITIZE, FLUSH AND DRAIN
BEFORE USING
(SEE OWNERS MANUAL)**

*Standard City/Fresh Water Fill Connection.
Valve shown in City Water Position.*



Place valve in bypass position. Valve above shown in normal flow position.

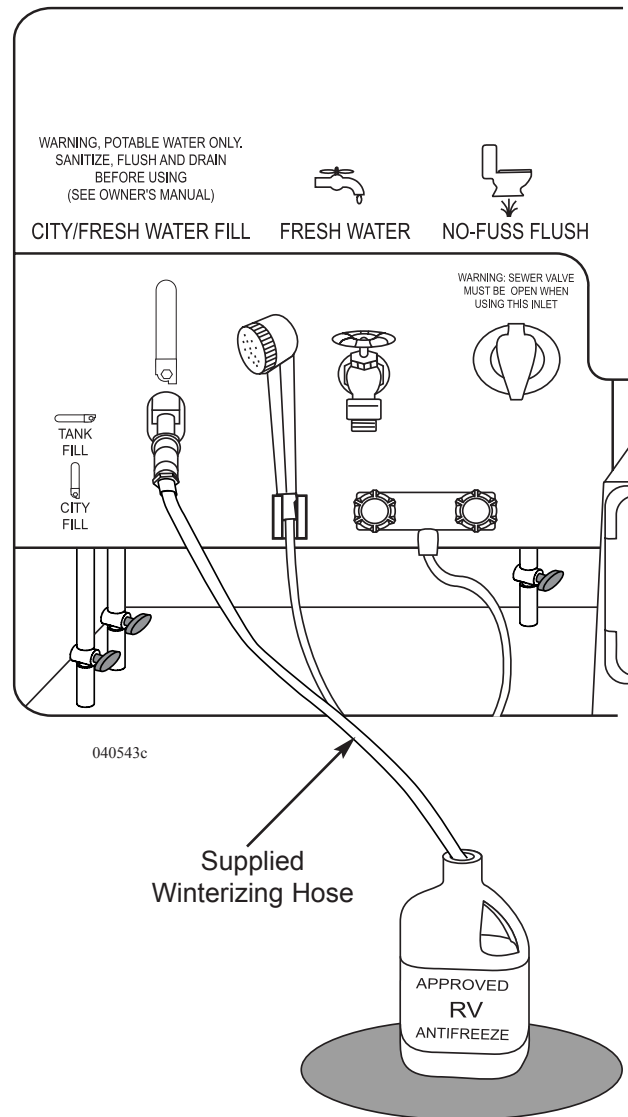
Using Nontoxic Antifreeze

Approximately three gallons of FDA approved RV antifreeze will be required to winterize the motorhome.

CAUTION:

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

1. Empty and flush the holding tanks.
2. Remove water filter under galley sink and replace with diverter hose.
3. Close all faucets, drain valves and low point drains.
4. Turn water heater bypass valve to bypass position. Remove drain plug and drain water heater.
5. Connect the supplied winterizing hose to the Fresh Tank Fill/ City Water connection at the service center.
6. Turn the Fresh Tank Fill/ City Water Valve to the Tank Fill position.
7. Close the winterization valve located between the water pump and fresh water tank.
8. Insert winterizing hose into the container of antifreeze.



-
-
9. Turn on the pump.
 10. Open all faucets, one at a time, hot and cold starting with the faucet farthest from the pump. Turn the faucet off when you see antifreeze. Hold the toilet flush mechanism open until antifreeze appears.
 11. Use a soft cloth to wipe out the sinks and shower to protect surfaces from antifreeze stains.
 12. One gallon of FDA approved RV antifreeze is needed to protect various water drain lines in the motorhome. Pour one pint into both the kitchen and bath shower drains. Pour two pints into the bath sink drain. This will protect the P-traps, with some of the antifreeze going into the grey tank to protect the drain valve. Open the valve on the toilet. Pour another three pints into the toilet, letting the antifreeze run into the black tank to protect the drain valve. Use a soft cloth to wipe out the sinks, shower and toilet (after the antifreeze is poured in) to protect the surfaces from stains. Pour the last pint into the washer/dryer drain.
 13. Disconnect power to Water Pump.

NOTE:

Clean up antifreeze spills immediately to prevent permanent staining.

NOTE:

Ensure the water is not hot when draining the low-point drain lines. Hot water from the lines can cause burn injuries.

NOTE:

Some items require special winterizing instructions, which can be found in the specific owner's manuals.

De-Winterization

To dewinterize drain and fill the fresh tank with water, connect the power to the water pump. Operate all faucets, one at a time, until clear water is present.

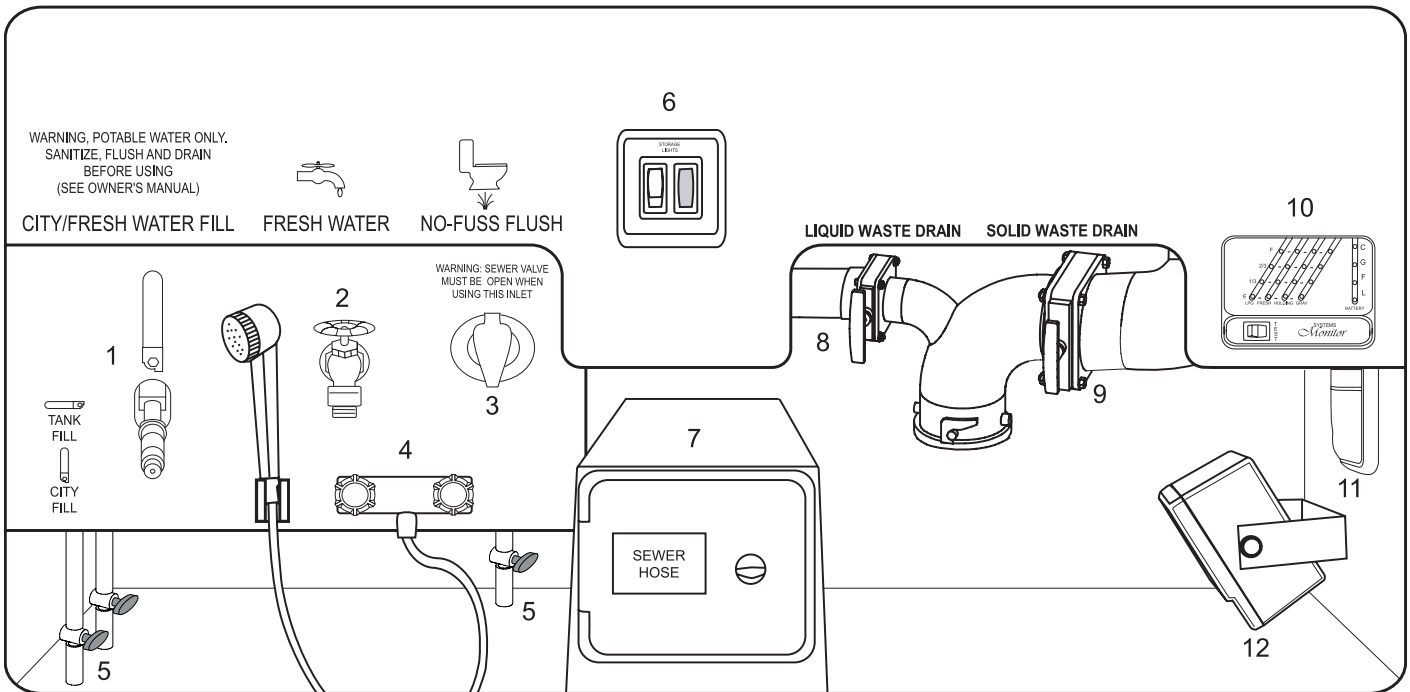
NOTE:

Depending on length of storage, the fresh water tank may need to be sanitized.

CAUTION:

The first two trays of ice from the icemaker may contain contaminants. Discard and replenish the icemaker as necessary.

SERVICE CENTER



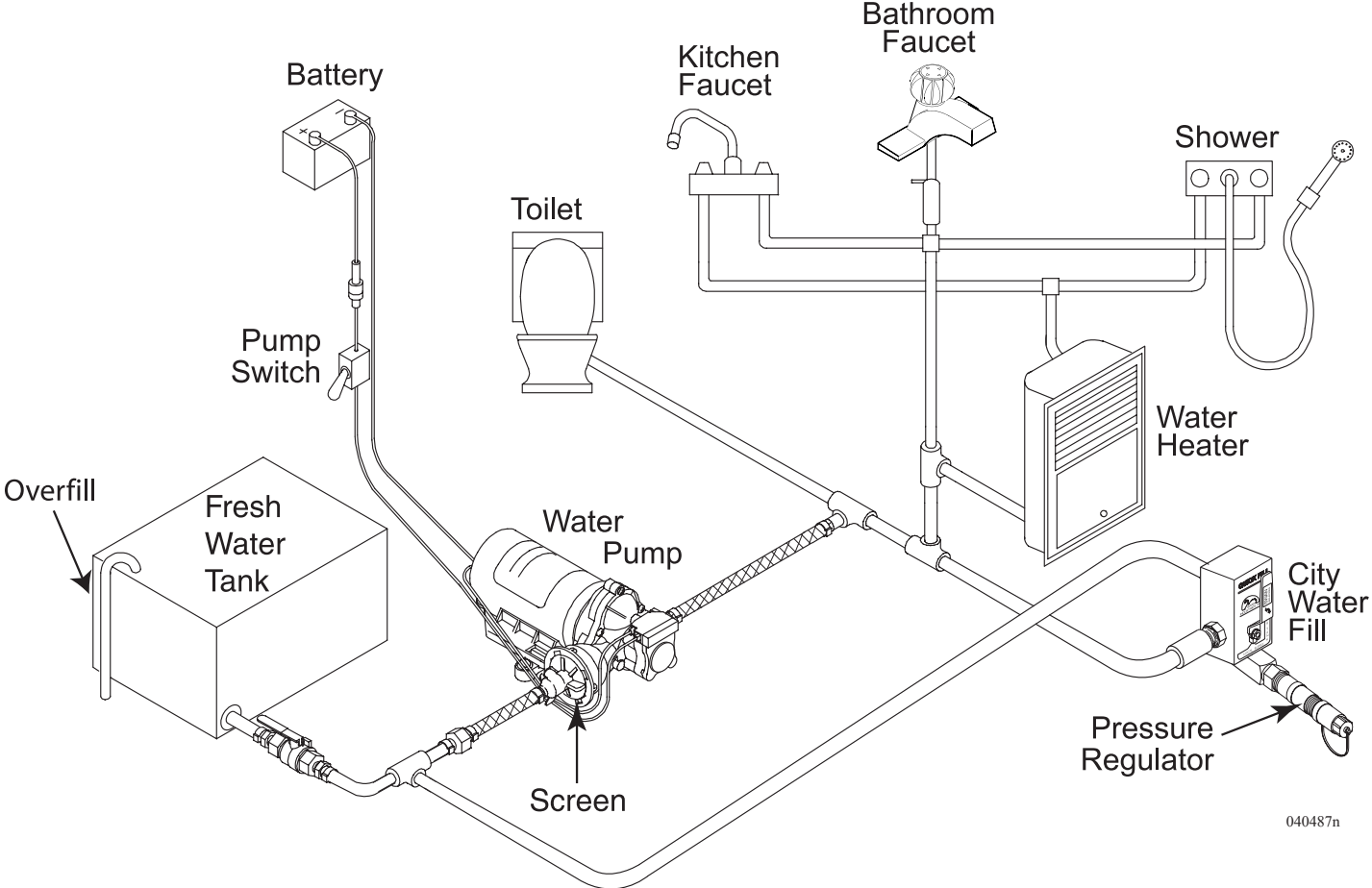
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NOTE:

Layout of Service Center and location of components may vary with floor plans.

- | | |
|--------------------------------------|--------------------------|
| 1. City Water/Fresh Water Fill Valve | 9. Black Tank Dump Valve |
| 2. Fresh Water Valve | 10. Grey Tank Dump Valve |
| 3. Black Tank Flush Connection | 11. System Monitor |
| 4. Outdoor Shower Assembly | 12. Bay Light |
| 5. Low Point Drains | 13. Bay Heater |
| 6. Storage Light | |
| 7. Sewer Hose Storage | |
| 8. Water Pump Switch | |

WATER SYSTEM DIAGRAM



Typical Layout

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NEPTUNE 2005

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LP-GAS SYSTEMS

This section contains safety information and operating instructions of the Liquefied Petroleum Gas (LP-Gas) system and related equipment in the motorhome. Some items discussed may not be applicable to all motorhomes. More detailed information with **CAUTION** or **WARNING** instructions for various equipment other than what is found in this section, can be found in the equipment manufacturer's manual in the owner's information box.

The LP-Gas tank mounted in the motorhome contains liquid petroleum gas that is under high pressure. As fuel is used, the liquid vaporizes and passes through the primary tank valve to a regulator that reduces pressure. Low-pressure gas is then distributed to components through a pipe manifold system.

Component lighting problems are commonly caused by air in the manifold system or incorrect gas pressure. Do not attempt to adjust the regulator. Adjustments need to be made by a dealer or an authorized service person with the proper equipment.

In higher elevations or extreme cold weather (10° F/-12° C or lower) a shortage of LP-Gas may be experienced. If LP-Gas is going to be used in higher elevations or cold climates for a long period of time, have an authorized service person adjust the LP-Gas regulator for these conditions.

Have the LP-Gas system tested by an authorized dealer or service center at least once a year and before every extended trip. The test will include having the system checked for leaks and the regulator pressure checked and tested for functionality. Although the manufacturer and the dealer test the system carefully for leakage, travel vibrations can loosen fittings.

Leaks (identified by the odor of rotten eggs or sulfur) can be easily found by applying a leak detector solution on all connections. Never light a match, have an open flame or use any spark producing equipment or appliance to test for leaks.

Leaks can usually be repaired by tightening the fittings. If not, shut off the primary gas valve at the tank. Hand-tighten the primary valve only. Do not use a wrench or pliers as over tightening may damage valve seats and cause leaks. If a leak is suspected, immediately see an authorized dealer or service center for repairs.

WARNING:

LP-Gas is highly volatile and extremely explosive. DO NOT use matches or a flame to test for leaks. Only approved LP-Gas leak testing solution 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 any maintenance or repair to the LP-Gas system.

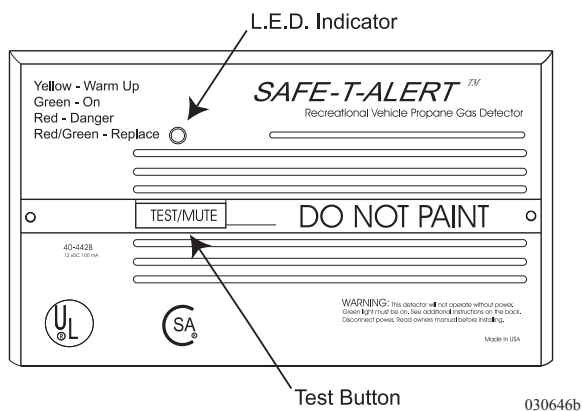
WARNING:

When storing portable LP-Gas tanks that are not connected to an LP-Gas system, install an approved plug in the tank outlet hole to prevent leaks. Do not store or transport empty LP-Gas tanks, portable tanks, gasoline or other flammable liquids in the interior area of the motorhome. Keep open flame and park producing materials away from the LP-Gas area. Shut off all appliances and the primary LP-Gas tank valve when the motorhome is in storage. If this warning is ignored, a fire or explosion could result.

NOTE:

It may be illegal to travel in some states and Canadian provinces with the primary LP-Gas valve open. Failure to comply with these State and Canadian province requirements may result in fines and/or pose a safety hazard.

LP-GAS DETECTOR



The LP-Gas detector is required safety equipment in RVs. **American National Standards Institute (ANSI) A119.2 - Fire & Life Safety 3-4.8 LP Gas Detectors** states " *A LP-Gas detector must be installed in any RV that contains an LP-Gas appliance and an electrical system. The LP-Gas detector must be listed as suitable for use in recreational vehicles under the requirement of UL 1484 Residential Gas Detectors, and installed according to the terms of its listing.* "

The detector senses both LP-Gas and methane gas. Liquefied Petroleum (LP) Gas is heavier than air; methane gas is lighter than air. LP-Gas will settle to the lowest point, generally the floor of the motorhome. Methane gas will rise. The gas detector is also sensitive to other fumes such as hair spray, of which most 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 gas leak versus gas escaping from an unlit, open burner. Pure propane vapors from a leaking pipe or gas fitting are heavier than air and will build up heaviest concentration at the leak and float down to mix with air. Gas from open burners is intentionally mixed with air to induce burning and dissipate into the air. When mixed with air, gas becomes only marginally heavier and will expand outward. If a gas burner is left on, the area around the burner, range, and adjoining counter space will be combustible and can cause injury and damage if ignited. This condition will exist for an extended time period. Eventually, the gas will reach the detector's location and cause the alarm to sound.

NOTE:

The LP-Gas detector only indicates the presence of propane gas at its sensor. Combustible levels of LP-Gas may be present in other areas. This detector is intended for the detection of LP-Gas ONLY.

The LP-Gas detector is not designed to detect other types of gas. However, other volatile gases (nuisance gases), most of them flammable in various concentration, may cause the detector to alarm. Some products that may cause the detector to alarm are alcohol, liquor, kerosene, gasoline, deodorants, colognes, propellant used in spray cans and cleaning solvents. 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 nuisances has not masked an actual gas alarm condition. The detector draws less current than one instrument panel lamp and will operate to detect gas until the battery is drained down to 7.0 Volts. The detector must be supplied with a voltage higher than 7.0 Volts, for it to operate properly. If the power source is disconnected, or if the power is otherwise interrupted, the detector will not operate.

The LP-Gas leak detector has a self-check circuit running at all times while the detector is powered. In the event that the circuitry fails, a failure alarm will sound and the operating indicator will cease to light.

LP-Gas Detector Operation:

Upon first application of power, the LED will flash yellow for three minutes while the detector is stabilizing. At the end of the start cycle the LED will turn Green, indicating full operation. If the detector senses unsafe levels of gas it will immediately sound an alarm. The LP-Gas detector draws power from the chassis batteries, with a current draw of less than 1/10th of one amp.

CAUTION:

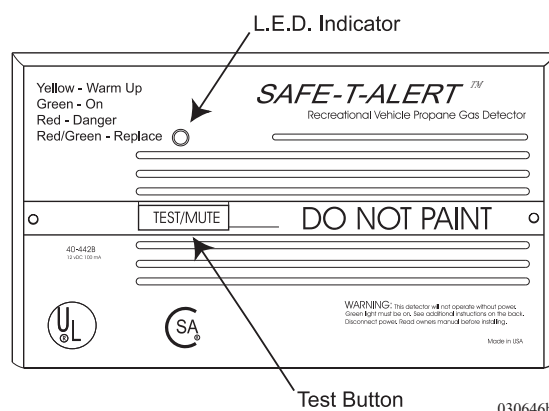
The detector will not alarm during the three minute warm up cycle.

Testing

Press the **TEST** switch any time during the warm up cycle, or while in normal operation. The LED should flash red and the alarm should sound. Release the switch. This is the only way the detector should be tested. The test feature checks full operation of the detector.

WARNING:

Test the operation of this detector after the motorhome has been in storage, before each trip and at least once per week during use.

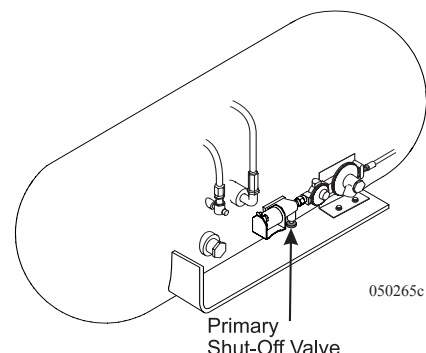


Alarm

The **red** LED will flash and the alarm will sound whenever dangerous levels of propane or methane 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 gas appliances (stove, water heater, furnace, refrigerator), extinguish all flames and smoking material. Evacuate, leave doors and windows open.
2. Turn off primary valve on the LP tank (located under motorhome).
3. Determine and repair the source of the leak. If necessary, contact a qualified professional for service.



WARNING:

Do not operate any electric switch. This can produce a spark and ignite the gas.

Warning:

Do not operate the remote LP-Gas disconnect switch during an alarm. This may cause a spark that can ignite the fuel. Turn off the primary LP-Gas valve on the LP-Gas tank.

CAUTION:

Do Not re-enter until the problem is corrected.

Potential Sources of LP Gas Leaks When Operating the Motorhome:

- | | |
|--|---|
| <ul style="list-style-type: none">• Cooktop Burners• Oven• Refrigerator Equipment• Water Heater | <ul style="list-style-type: none">• Defective LP-Gas Connection• Defective Regulator• Portable Propane Powered Appliances/Accessories• Furnace |
|--|---|

Alarm Mute:

Press the **Test-Mute** button when the detector is in alarm.

1. The **red** LED will continue to flash and the alarm will beep every 30 seconds until the gas level has dropped to a safe level.
2. The LED will flash **green** until the end of the **Mute** cycle.
3. If dangerous gas levels return before the end of the **Mute** cycle, the alarm will beep four times and return to phase 1.
4. After two minutes the detector will return to normal operation (solid **green**) or resound the alarm if dangerous levels of gas remain in the area.

Fault Alarm:

Should the microprocessor sense a fault in the gas detector, a fault alarm will sound twice every 15 seconds. The LED will alternately flash **red to green** and the **MUTE** switch will not respond to any command. The gas detector must be repaired or replaced.

1. Vacuum the dust off the detector cover weekly (more frequently in dusty locations) using the soft brush attachment of the vacuum.
2. Do not spray cleaning agents or waxes directly onto the front panel. This action may damage the sensor, cause an alarm or cause a detector malfunction.

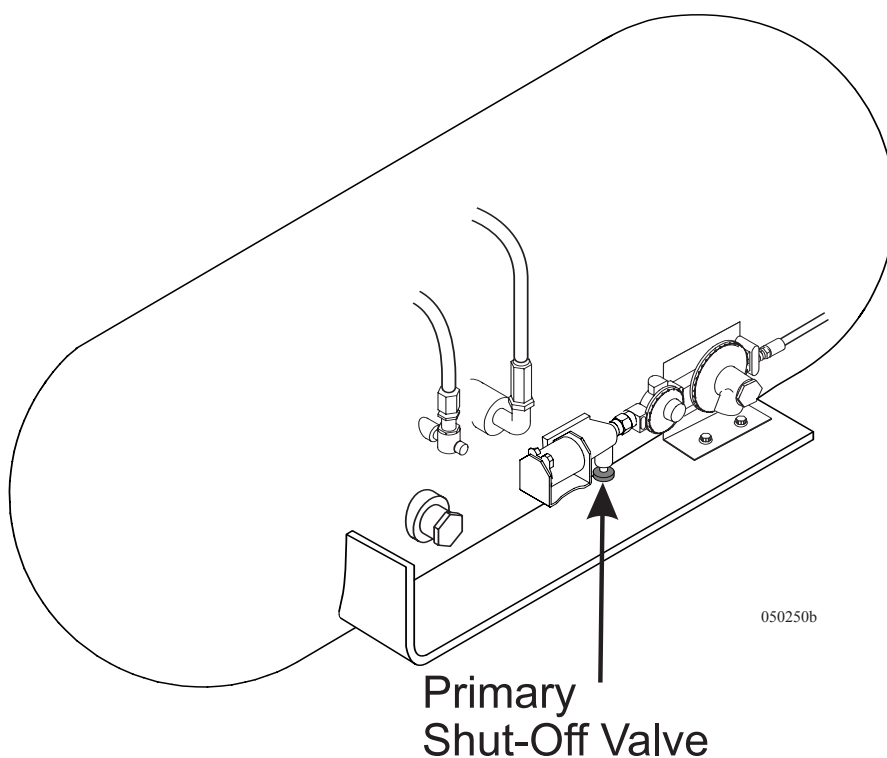
LP-GAS EMERGENCY PROCEDURES - CHECKLIST

If you smell gas (a rotten egg or sulfur smell) at any time, perform the following steps immediately:

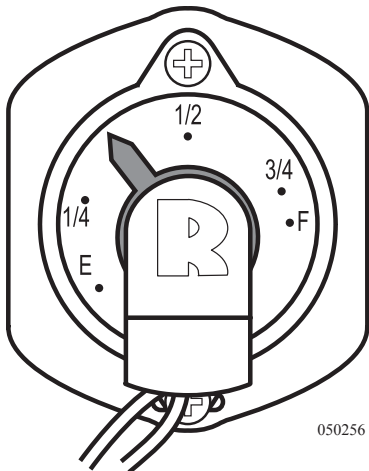
- Shut off gas appliances.
- Manually turn off the primary shut-off valve at the LP-Gas tank.
- **Do not operate any electric switch.** This can produce a spark and ignite the gas.
- Open windows and doors.
- Evacuate the motorhome. Stay clear of the surrounding area.
- Keep all sources of ignition out of the area.
- Contact a qualified service technician to find the source and repair the gas leak.

WARNING:

A fire or explosion from ignited gas or gas fumes can cause serious injury or death.



LP-GAS TANK - Measurement



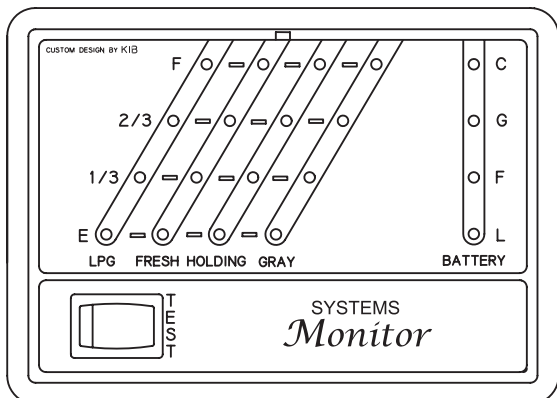
Sensor mounted on LP-Gas Tank

Tank Measurement:

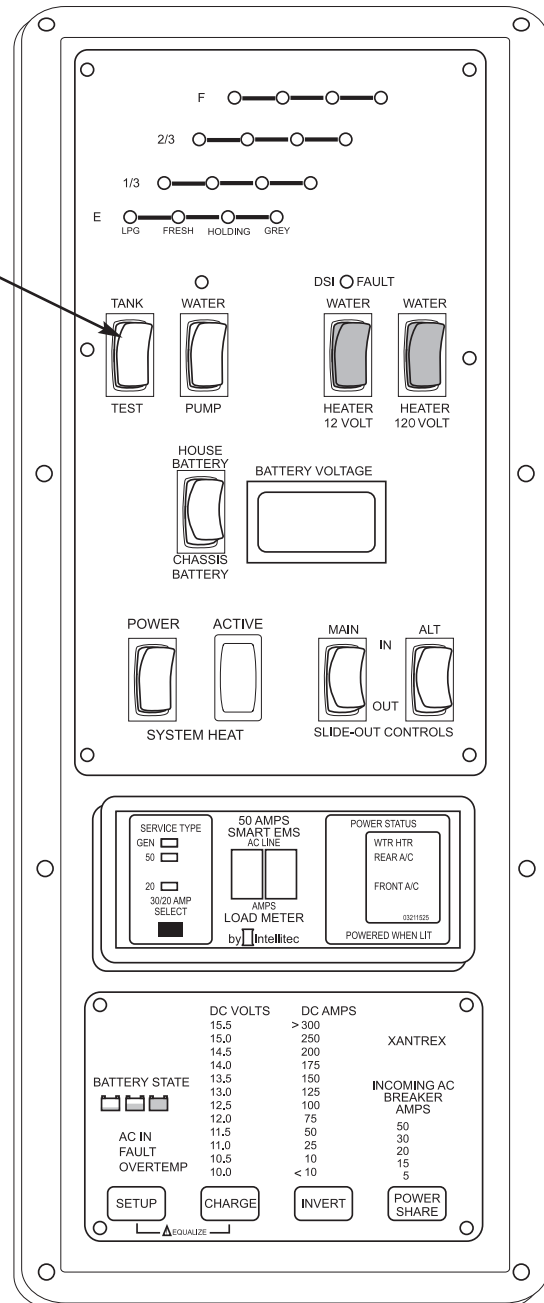
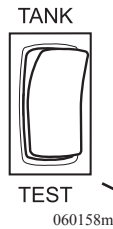
To measure level of a tank, press the Tank Test switch on display panel. Observe the indicator lamps corresponding to the tank of interest.

NOTE:

Calibration of the LP-Gas gauge is preset and not adjustable.



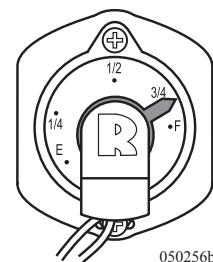
Systems Monitor Located in Plumbing Service Center



Systems Monitor Panel in Hallway.

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 the electric valve at the LP-Tank fill port, pilot lights, appliances and igniters to prevent a fire or explosion. Have a trained service person fill the LP-Gas tank.



*LP Tank Gauge
Located on tank.*

NOTE:

If the tank is new and being filled for the first time, inform the service technician to purge any air from the tank before filling.

The LP-Gas tank fill is located in the curbside compartment. When the tank is filled to the proper level, there is space available for the conversion of liquid into gas. If a tank is over-filled, it may cause the safety valve to release pressure. When this happens, a strong rotten egg odor near the tank and/or a hissing noise may be detected.

LP-Gas exists in both liquid and vapor form within the tank. A "Full" tank is approximately 80% liquid. The pressure inside the tank varies with the temperature of the liquid. All tanks are required to be equipped with a safety pressure relief device. The purpose of the safety valve is to release excess pressure. When the tank is full, the gauge on the tank will only read $\frac{3}{4}$ full. The monitor panel is adjusted to indicate "full" at this point.

NOTE:

Turn off the electric valve at the LP-Tank fill port, pilot lights and appliances while filling the LP-Gas tank to prevent a fire or explosion.

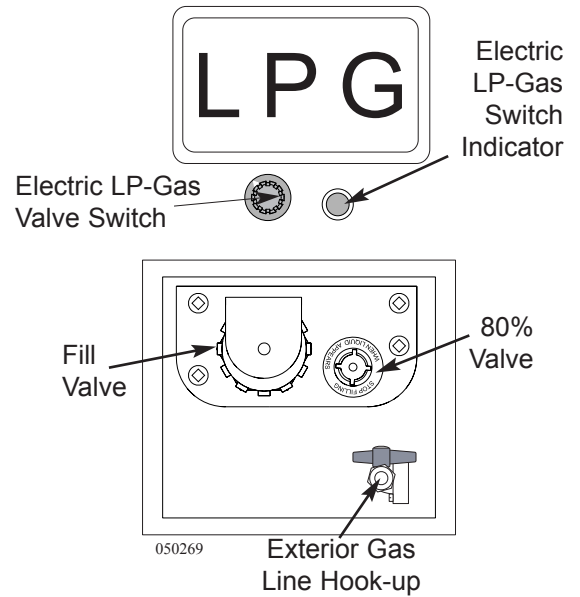
NOTE:

Actual full liquid capacity is 80% of full tank capacity.

WARNING:

Extinguish all sources of heat, sparks, flames and smoking materials within a 50' radius during the refueling process.

1. Turn off pilot lights, all appliances and the engine. Close all vents, doors and windows to prevent vapors from entering the motorhome. Turn off Electric Valve.
2. Remove dust cover. Screw LP nozzle to fill valve.
3. Turn on dispensing pump, then open 80% bleed valve.
4. Open valve on fill nozzle and dispense liquid into the tank.
5. Close valve on fill nozzle as liquid just begins to expel from 80% bleed valve. The overfill protection valve prevents filling the tank to more than 80% of the rated capacity.
6. Close 80% valve and shut off dispensing pump.
7. Open high-pressure bleed valve on fill nozzle to remove pressure between dispensing pump and fill nozzle. Remove nozzle from the fill valve.
8. Install the dust cover.
9. LP-Gas appliances (especially the refrigerator) may have difficulty starting after a period of non-use. To speed the process of supplying fresh fuel to the appliances, light the stove first.

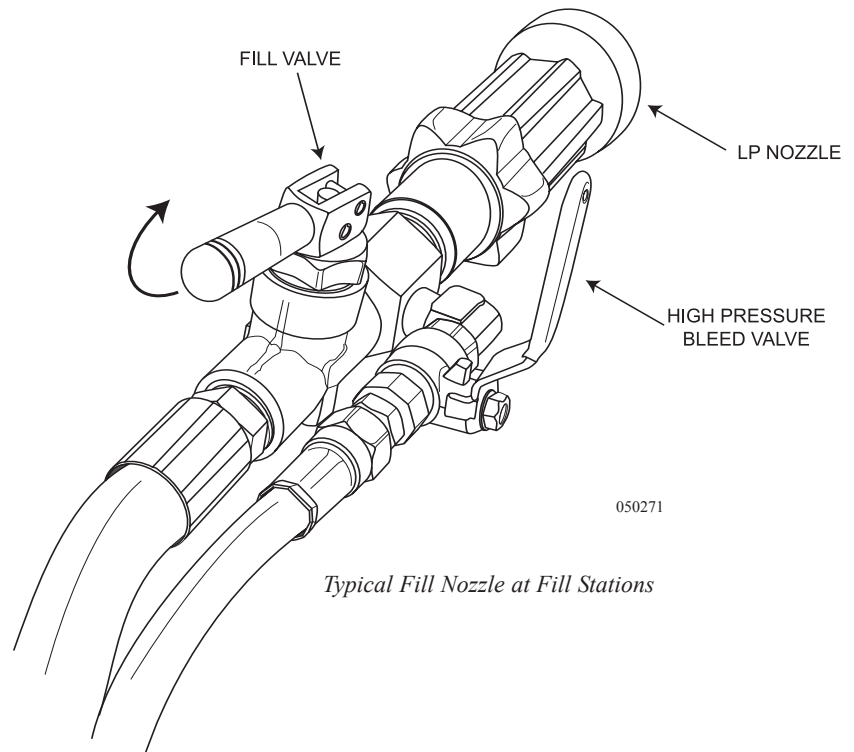


WARNING:

It is common for small amounts of liquid propane to escape and evaporate during the refueling process. Protect bare skin. Instant freezing will occur if exposed to LP-Gas.

CAUTION:

Pressure inside LP-Gas tanks can reach over 200 psi when exposed to direct sunlight. A high-pressure safety relief valve will purge excess high pressure, if necessary. LP-Gas will stop vaporizing as the LP-Gas tank temperature approaches -44° F.

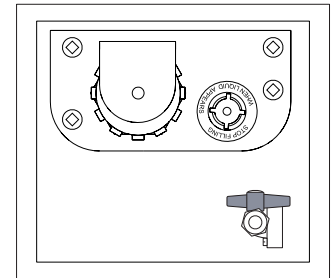


Typical Fill Nozzle at Fill Stations

- Manually open the primary shut-off valve located on the LP-Gas tank.
- Turn on the electric LP-Gas valve to allow gas to flow to the appliances.
- Turn off the electric valve and primary valve on the LP-Gas tank when the tank is being filled, when driving, in between trips and when in storage.
- Hand-tighten the primary valve only. Do not use a wrench or pliers, as this will over-tighten the valve.
- The primary valve is designed to be closed by hand, over-tightening may permanently damage the valve seat.

NOTE:

In some states and Canadian provinces, it may be illegal to drive the motorhome while primary valve on the LP tank is open.



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Exterior Gas Line Hook-Up Prep:

An auxiliary remote LP-Gas hook-up is for external LP-Gas accessories and is to be used for external components only. For safety, only approved LP-Gas quick disconnect fittings and flexible hose should be used to connect external accessories to the remote hook-up. A LP-Gas Quick Disconnect fitting should be installed by a qualified agency as defined in the Nation Fire Protection Associates NFPA (Fire) 54-02 code.

NOTE:

Every time the remote hook-up is used, check for gas leaks on all connections. If a leak is detected, turn off the primary valve at the main LP-Gas tank. Contact a qualified service center for the necessary repairs.



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QUICK DISCONNECT FITTING

NOTE:
COUPLING TO BE INSTALLED BY A QUALIFIED AGENCY AS DEFINED IN THE NATIONAL FUEL GAS CODE (NFPA 54)

INSTALLATION INSTRUCTIONS

- 1) INSTALL SOCKET WITH SHUT-OFF VALVE ON THE GAS SUPPLY SIDE
- 2) INSTALL PLUG ON THE ACCESSORY SIDE
- 3) LEAK TEST USING SOAP WATER SOLUTION

OPERATING INSTRUCTIONS

TO CONNECT:

- 1) CLOSE SHUT-OFF VALVE
- 2) PULL SOCKET SLEEVE BACK
- 3) INSERT PLUG; RELEASE SLEEVE
- 4) PUSH PLUG INTO SOCKET UNTIL SLEEVE SNAPS FORWARD
- 5) OPEN SHUT-OFF
- 6) LEAK TEST USING SOAPY WATER SOLUTION

TO DISCONNECT:

- 1) CLOSE SHUT-OFF VALVE
- 2) TO RELEASE PLUG, PULL SLEEVE BACK AWAY FROM PLUG; PULL OUT PLUG
- 3) INSERT PLUG; RELEASE SLEEVE
- 4) LEAK TEST USING SOAPY WATER SOLUTION

LP-GAS FUNDAMENTALS

# Capacity	Gallon Capacity	BTU Capacity
5	1.18	107,909
10	2.36	215,807
11	2.59	237,387
20	4.72	431,613
30	7.08	647,420
40	9.43	863,226

CONVERSIONS

Gallons to Liters (1 Gallon = 3.785 Liters)
 Fahrenheit to Celsius ($F^{\circ} - 32 \div 1.8 = C^{\circ}$)
 11 in. Water Column = 6 1/4 ozs. per sq. in. pressure.
 27.7 in. Water Column = 1 lb. per sq. in. pressure.

The above capacities allow for 20% vapor space on each cylinder.

Data taken from the National Fire Prevention Association (NFPA). Pamphlet #58-1998.

LP-Gas Statistics:

Pounds Per Gallon	4.24
Specific Gravity of Gas	1.50
Specific Gravity of Liquid	.504
Cubic Feet Gas Per Gallon of Liquid	36.38
Cubic Feet Gas Per Pound	8.66
BTU Per Gallon	91,502
BTU 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 BTU (British Thermal Units).
- Temperature affects pressure of LP-Gas. Internal tank pressure can exceed 200 psi.
- Tanks or valves contain pressure relief valves. The relief valve opens at 125% above tank rating.
- LP-Gas stops vaporizing at -44° F.
- Standard LP-Gas operating pressure is 11" of Water Column or approximately 6 1/4 ounces per square inch.
- An inch of Water Column is a measurement of applied pressure to one side of a U-Tube 1/2 filled with water at sea level. The amount of pressure required to raise the water level 11", represents 11" of Water Column.

NOTE:

The above information is not a complete guide for the use of LP-Gas tanks or appliances. In cold climates keep fuel levels above 50% in order to keep vaporization of LP-Gas at the highest level.

LP-GAS REGULATOR

LP-Gas is compressed into liquid form in the tank. Only the vapor is used during combustion by an appliance. As vapor is removed from the tank, the remaining liquid will vaporize to maintain pressure that is removed during consumption. This process will continue until there is no liquid remaining in the tank.

Temperature affects the vaporizing action of the liquid. If temperature of the liquid is -44° F, the liquid remains stable with tank pressure, about 0 psi. If liquid temperature is 100° F, the liquid quickly vaporizes with tank pressure, about 200 psi. Vapor pressure must remain relatively consistent, regardless of temperature, for the appliance heat output to remain stable. Vapor pressure regulation is performed by the regulator.

The motorhome two-stage regulator reduces vapor pressure so that it is safe for use. The first stage of the regulator reduces tank pressure to a range of 10 to 13 psig (pounds per square inch gauge). The second stage further reduces pressure to a working pressure of 0.4 psig (11 Inches of Water Column or about 6¼ ounces psi.). A vent is installed to allow the internal diaphragm to move with atmospheric pressure change. It is important to keep the vent clean and clear of obstruction or corrosion. If the vent becomes clogged, pressure from LP tank may cause erratic pressure regulation. If there is any corrosion, contact a qualified LP-Gas service technician. The regulator is mounted so that the vent faces downward. If the vent becomes clogged, clean it with a toothbrush.

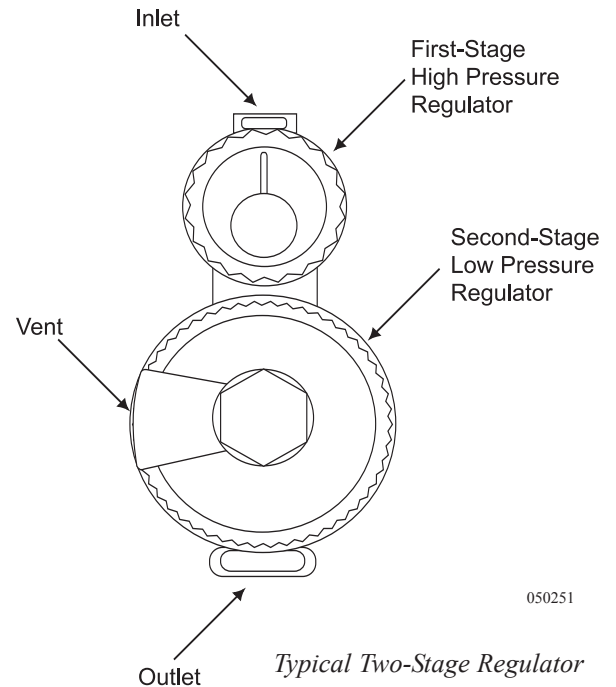
Under normal atmospheric conditions an LP-Gas regulator will not freeze, nor will the LP-Gas. Vapor passing through the regulator will expand and cool, condensing moisture in the gas. The moisture will freeze, build up and block the vent. The possibility of freeze up is greatly reduced with the two-stage regulator.

To Prevent Freeze Up:

- Ensure the LP-Gas tank is totally free of moisture prior to filling.
- Ensure the tank is not overfilled.
- Keep the valve closed when the tank is empty.

If A Freeze Up Occurs:

- Have an LP-Gas distributor purge the tank.
- Have the LP-Gas distributor inject methyl alcohol in the tank.



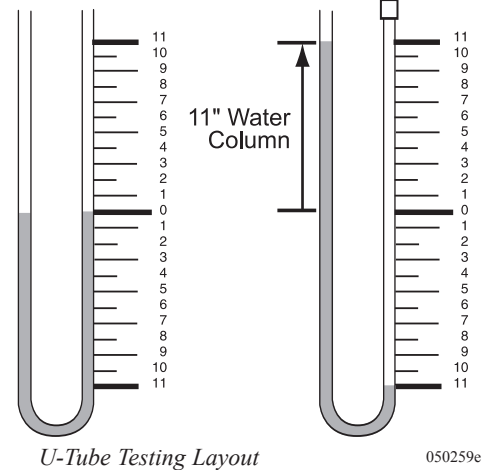
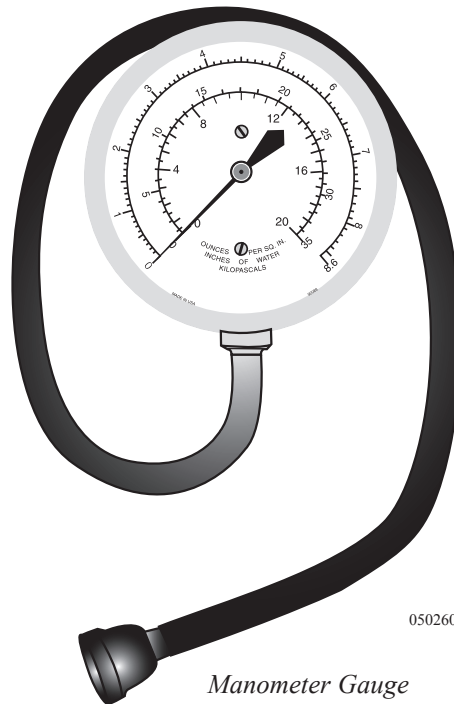
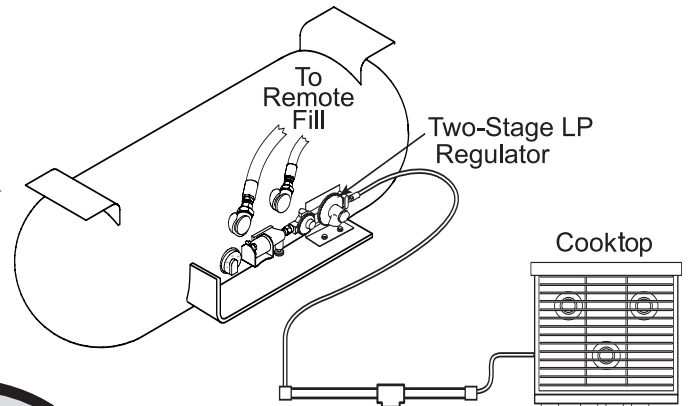
Damage to the regulator can occur when the tank is overfilled. The regulator is designed to work with vapor only. This is why the tank is filled to only 80% of its liquid capacity. The other 20% allows for vaporization of the liquid. The primary vapor valve is located in the vapor section of the tank. In an overfilled tank, liquefied petroleum can fill the regulator. As the liquid vaporizes, it can freeze the diaphragm. High tank pressure on a frozen diaphragm can cause a rupture and result in erratic pressure regulation. This is why it is important to have the LP-Gas pressure checked for proper pressure and accurate regulation during appliance operation. Erratic pressure regulation dramatically affects refrigerator operation on LP-Gas.

Manometers:

The manometer is the best way to accurately determine LP-Gas pressure. There are two different styles of manometers: Gauge and U-tube. Gas pressure is measured in Inches of Water Column. This is the amount of pressure applied to one side of a U-shaped tube half filled with water. The amount of pressure needed to raise the column of water 11" represents **11 Inches of Water Column**.

WARNING:

Do not attempt to adjust the regulator. Adjustments require special equipment. Failure to follow these instructions may result in a fire or explosion, and can cause severe personal injury or death. Do not operate LP-Gas appliances until the LP-Gas pressure is checked and a leak down test is performed!



It is suggested by the hose manufacturer that the LP-Gas supply hoses used on the motorhome undergo regular inspection. As a guideline, we suggest that all flexible LP-Gas lines connecting the slide-out, appliances and tanks be inspected in the spring and fall of each year by a qualified RV technician.

According to the manufacturer, inspection should consist of the following procedures, and performed when the hose is not under pressure:

1. **INSPECTION:** Inspect the outside cover of the hose for blistering, abrasion or cuts and coupling slippage. Cuts in the hose cover that expose or damage the reinforcement are cause for replacement. Hose strength is controlled by the plies of reinforcement and damage in this area cannot be tolerated. Small cuts, nicks, or gouges that do not go completely through the cover are not cause for replacement of the hose.

NOTE:

Pricking of the cover in the manufacture of this type of hose is common and necessary for satisfactory hose performance. Consequently, the uniformly pricked cover should not be viewed with alarm.

2. Damage to the textile reinforcement or wire braid is cause for hose replacement. Wire braid reinforced hose, which has been kinked or flattened so as to permanently deform the wire braid in the unpressurized state, shall be removed from service.
3. Blistering or loose outer cover is cause for hose replacement.
4. Examine couplings for slippage. Slippage is evidenced by the misalignment of the hose and coupling and/or the scored or exposed area where slippage has occurred. Any evidence of slippage is cause for hose replacement.
5. It is important that if a damaged LP-Gas hose is found, the source of the damage be determined and corrected prior to the replacement of the LP-Gas hose.

NOTE:

Only a qualified RV technician should complete replacement of LP-Gas components.

It is also suggested, that the flexible LP-Gas supply lines on your recreational vehicle be replaced every ten (10) years. The manufacturer of the LP-Gas supply lines recommended this schedule after performing extended testing and determining that the failure rate may increase after this period of time. The motorhome manufacturer recommends following these guidelines to assure continued safety and dependable use.

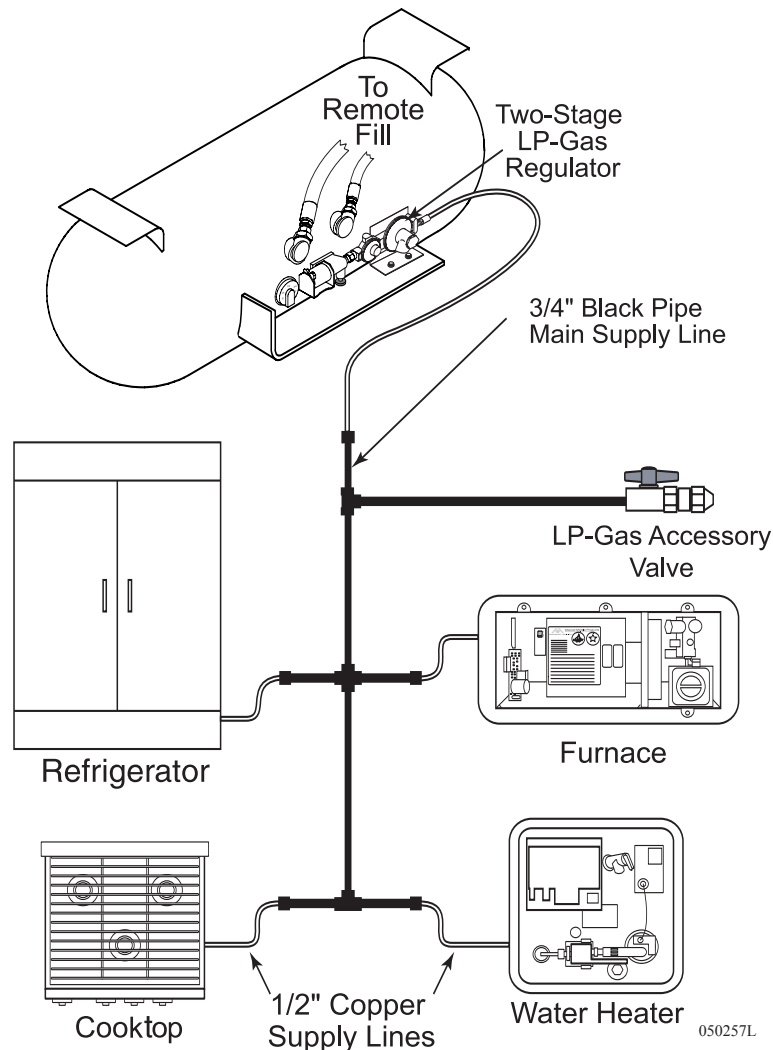
LP-GAS DISTRIBUTION LINES

A primary manifold black steel pipe running throughout the motorhome distributes LP-Gas to secondary lines. All secondary lines leading to gas appliances are made of copper tubing with flared fittings. If any lines rupture do not attempt to splice them. Always run a new line. It is recommended that gas distribution work be performed by an authorized dealer or an authorized service technician. When removing or servicing any gas appliance, manually close the primary valve located on the end of the LP-Gas tank. This will prevent dangerous gas leakage that could result in an explosion and possible serious injury.

INSPECTION:

Inspect the rubber flexible lines, twice a year, for abrasions, tears, kinks or other signs of damage.

If a gas leak is suspected, get the system inspected and repaired by a qualified service technician as soon as possible.



Typical LP-Gas System Layout

LP-GAS CONSUMPTION

Each gallon of LP-Gas produces 91,502 BTUs of heat. One 27 gallon tank produces two million BTU's. Total consumption depends on the rate of usage by each appliance and the operating time. The stove typically uses the most gas.

Determine Fuel Consumption:

To determine approximately how many hours an LP-Gas appliance will operate on one gallon of LP-Gas, use the following formula:

- LP-Gas appliances are rated in Input BTU (British Thermal Units). The rating is usually stamped or printed on a tag affixed to the appliance. For example: the Input rating of the appliance is 10,000 BTUs.
- One gallon of LP-Gas produces 91,502 BTUs.
- Divide the amount of BTUs of one gallon of LP-Gas (91,502) by the rating on the appliance in this example 10,000. Net continuous operation time for one gallon of LP-Gas for this appliance would be approximately 9.2 hours.

The above formula can be useful when trying to determine the approximate length of time a tank of LP-Gas will last. Generally, LP-Gas appliances do not operate continuously. An example would be the typical cycling of the furnace or water heater.

Determining how long a tank of LP-Gas will last:

- Combine the BTU input totals of all appliances, and the approximate length of time these appliances operate per day.
- Multiply the number of liquid gallons in the LP-Gas tank by 91,502.
- Divide the total of BTUs of the LP-Gas tank by the total number of BTUs the appliances consume, equals the approximate number of hours of operation before refueling.

Typical Appliance BTU Ratings
Water Heater (Atwood) 10 gallon - 12,000 BTU
Furnace (Atwood) 35,000 BTU 40,000 BTU 50,000 BTU (2x25 BTU)
Cooktop 9,000 BTU - Front 6,500 BTU - Rear 7,100 BTU -Oven
Refrigerator (Norcold) 2-door 1500 BTU 4-door 2200 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 LP-Gas regulators without the use of proper equipment. Improper LP-Gas regulator adjustment will affect the performance of LP-Gas operated appliances. Incorrect flame or explosion can occur. Only qualified personnel should perform any maintenance or repair to the LP-Gas system.

LP-GAS SAFETY TIPS

Liquid Propane gas is one of the safest and most reliable fuels available on the market when handled properly. LP-Gas, however, does have a great explosive “potential” if handled improperly. Danger is minimized by becoming familiar with and following a few safety precautions, and by learning how to properly operate LP-Gas appliances. Use of LP-Gas requires the responsibility to enforce extra safety measures.

The motorhome is equipped with many LP-Gas operated appliances because it is a convenient and efficient source of fuel. LP-Gas appliances must be operated and maintained in accordance with the product manufacturer’s instructions.

The National Propane Gas Association (NPGA) has a special service program offered called GAS[®] (Gas Appliance System) Check. The GAS[®] Check program is aimed at educating users about the convenience of propane with safety and peace of mind. For information on the **NPGA Gas[®] Check program**, call (202) 466-7200 or visit www.npga.org.

LP-Gas Tanks and Cylinders:

Tanks are built to American Society of Mechanical Engineers (ASME) Code. The cylinders are built to DOT (Department of Transportation) Code. The major difference between cylinders and tanks is in required testing and inspection procedures, and in construction of the containers. Both tanks and cylinders are required to undergo pressure testing and inspection; however, the procedures for how they are tested and inspected differ.

The difference between the two codes are that the valves, fittings and brackets are located only on the ends of the DOT cylinders; however, on the ASME tanks they may be located on ends, as well as the sides. There is also a difference in how the tanks are rated. Required tank ratings are in gallons (ASME ratings) or pounds (DOT) water capacity. The Federal DOT (Department of Transportation) regulations require periodic inspections and re-qualifications of cylinders.

American Society of Mechanical Engineers (ASME) tanks or bulk containers are generally used in motorhomes, and are permanently mounted on to the unit.

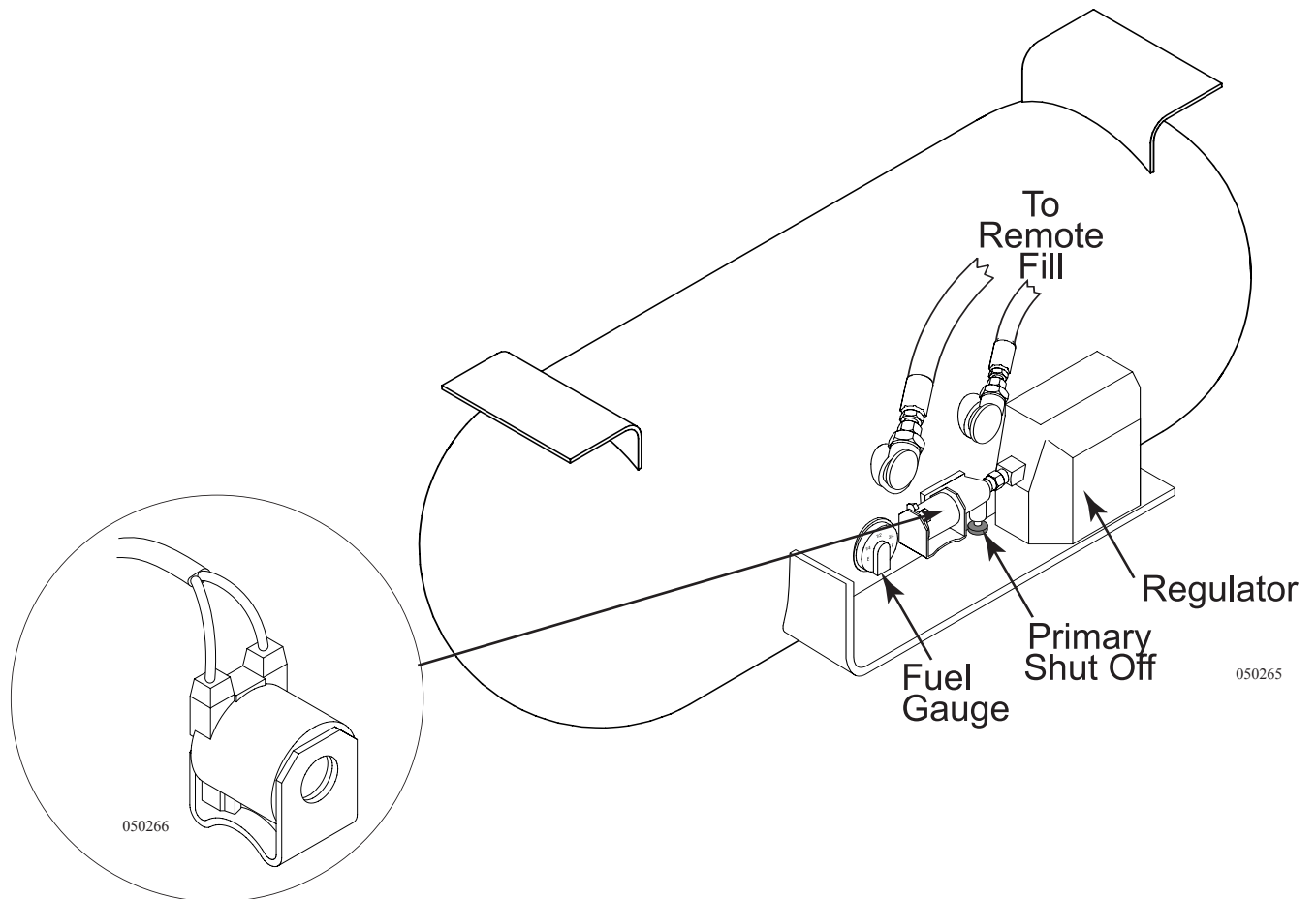
An alloy steel two-piece welded and brazed tank is used on all towable products. The marking on the collar, DOT 4BA240, identifies the DOT specifications and service pressure. Other pertinent information included on the collar is the water capacity (WC) and the tare weight (TW), both which are measured in pounds, and the manufacture date (one of the most important items). There is a required 12 year re-qualification. The final piece of information is Dip Tube (DT) length. This is part of the overfill protection and maximum liquid allowance in the cylinder.

Maintenance and Safety Tips for the LP-Gas Refrigerator:

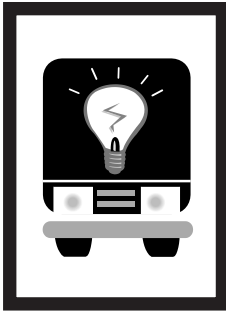
- It is recommended to have the venting system checked for blockage by an authorized service center before firing up the refrigerator for the first time each season and annually. Insects may have built nests that will obstruct flow.
- Have the refrigerator venting **inspected** annually by an authorized service center.
- Before firing up the refrigerator for the first time each season, have the venting system checked for blockage. Insects may have built nests that will obstruct flow.
- At the first indication of incomplete combustion (yellow flame instead of a blue flame or soot is present) contact a service technician immediately. Improper combustion can cause carbon monoxide buildup, which is potentially fatal!

Maintenance and Safety Tips for the LP-Gas Range:

- Burner flame should be a blue color, indicating complete combustion. If not, have the unit serviced by a qualified technician.
- Do not cover the oven bottom with foil. Air circulation will be restricted.
- Never use 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.



While dry camping, this solenoid will draw .66 Amps. .66x24 hrs. per day = 55.84 Amps each day.



NEPTUNE 2005

ELECTRICAL SYSTEMS - HOUSE **SECTION 8**

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HOUSE ELECTRICAL - INTRODUCTION

The motorhome 120/240 Volt AC system can be supplied by three different power sources: shore power, the on-board generator or the optional inverter/charger. Shore power is the most efficient and should be used whenever possible. The generator can be used when shore power is unavailable. The inverter/charger supplies silent AC power using the house batteries of the motorhome. The AC power output is limited and should be used sparingly.

Two different sources supply the main AC circuit breaker panel with power: the 50 Amp shore power cord or the on-board generator. The power source used is automatically selected by a switching device known as a transfer switch. The inverter supplies AC power to the sub-panel.

WARNING:

The electrical system is engineered and tested for complete safety. Circuit breakers and fuses protect the electrical circuits from overloading. When planning modifications or additions to the electrical system, we strongly recommend consulting the dealer for assistance to ensure continued integrity and safety of the electrical system. Please note that any modifications may void the warranty.

WARNING:

Water is electrically conductive. Do not use any electrically powered item or electrical outlet that may be exposed to a water source. Such use can result in a serious shock causing injury or death.

Shore Power:

The motorhome is equipped with a shore power cord to connect to outside electrical services. Shore power service is the most efficient source of electrical power. The plug end of the shore power cord is 50 Amp, 240 Volt. When this type of power service is not available, electrical adapters will be required to allow a proper and safe connection to the electrical service supply.

NOTE:

When 50 Amp shore service is not available, care will have to be used when operating the appliances and using the outlets to avoid overloading the shore power service.

Generator:

The generator can be selected for use when shore power is unavailable. The maximum amount of generator output power, measured in watts, is calculated at an elevation of 500 feet above sea level. This figure will decrease slightly at higher altitude. Ambient temperature also effects total maximum output. The amount of AC electrical load applied to the generator determines fuel consumption.

Converter:

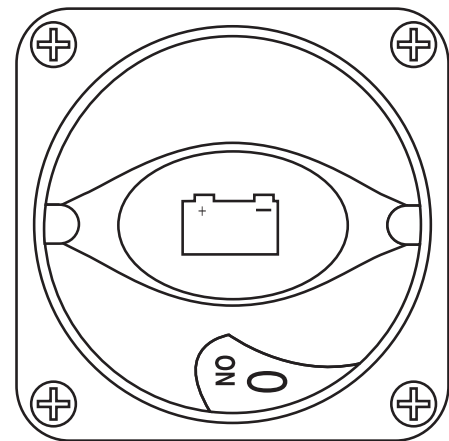
The power converter provides filtered 12 Volt DC power to the lighting and appliance circuits, and also recharges and maintains the units batteries. The power converter is virtually maintenance free.

Inverter/Charger (Optional):

The Inverter/Charger provides silent AC power when shore power is unavailable, and the generator is not selected as a secondary power source. This device has limited AC power output, measured in watts, and operates only selected appliances and outlets. The Inverter/Charger is an auxiliary 120 Volt AC power source that inverts 12 Volt DC house battery power to 120 Volts AC. The Inverter/Charger also converts 120 Volts AC power, supplied from either shore power or the generator, to 12 Volts DC power, to recharge the batteries. When dry camping, the Inverter/Charger may be used to supply power to selected outlets.

BATTERY DISCONNECT - HOUSE

The main house battery disconnect switch turns the house battery power supply on or off by disconnecting 12 Volt DC power to the following items: inverter, domestic fuse panel in the bedroom, domestic fuse panel in the front roadside electrical bay. Turn the house battery disconnect switch off when the motorhome is going to be stored, or before performing electrical maintenance. If possible, leave the motorhome plugged into an AC source with the battery disconnect switch on to help prevent the possibility of dead batteries. Turning off the **BATTERY CUT-OFF** switch at the entry door will not turn off all DC electrical items or other parasitic loads present on the house battery. Some are federal mandate items such as the LP-Gas detector. If an AC power source is not available, and the motorhome is going to be stored for more than 48 hours, it is recommended to turn the house battery disconnect switch off.

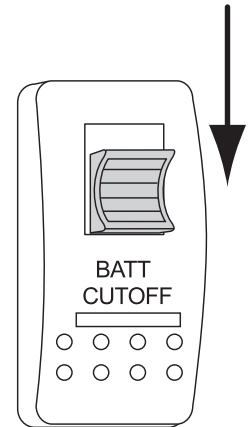


Located in the battery compartment.

060077

BATTERY CUT-OFF SWITCH

The battery cut-off switch is located inside next to the entry door. This switch controls the 12 Volt DC power to the domestic fuse panel. The switch locks into the center position to prevent interior DC power from being accidentally turned on or off. When the switch is activated, power is supplied to all interior DC lighting and DC operated appliances. Some appliances will require both DC and AC power to operate, such as the roof air conditioner. This switch is helpful when dry camping to conserve house battery power. Refrigerator and inverter operation are unaffected by the operation of this switch. When the interior house power is off, there are still parasitic loads on the house batteries, and therefore is not a substitute for the main battery disconnect switch.



080375d

**Release
Lock**

To Turn the Interior Power On or Off:

- Simultaneously push the spring-loaded lock down and push the switch.

CAUTION:

To avoid flash damage to electrical contacts, turn off the interior lighting before activating or deactivating the battery cut-off switch.

SHORE POWER HOOK-UP

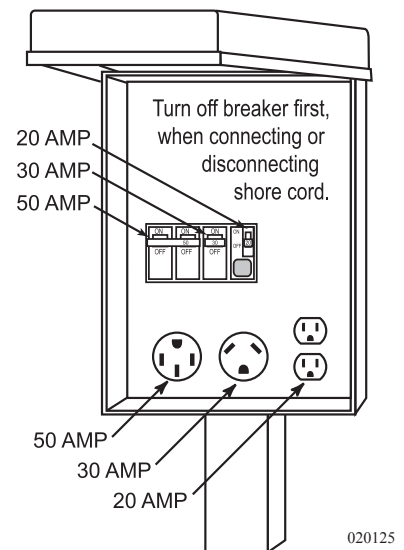
The power requirement for the motorhome is 50 Amp 120/240 Volt AC single phase. The shore cord is stored in the rear roadside compartment. If 50 Amp shore power service is available, connect the supplied shore power cord. If less than 50 Amp service is available, electrical adapters will be required.

CAUTION:

Avoid flash damage to the electrical system contacts. Before plugging the motorhome into shore power, starting the generator or using the inverter make sure all the appliances are off.

WARNING:

Keep fingers away from metal contacts of the shore plug end. Do Not stand in water when making electrical connections. Serious electrical shock and personal injury can occur. To avoid the risk of electrical shock, turn the circuit breaker off at the power supply outlet before making the shore power connection.



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Typical Power Pedestal

CAUTION:

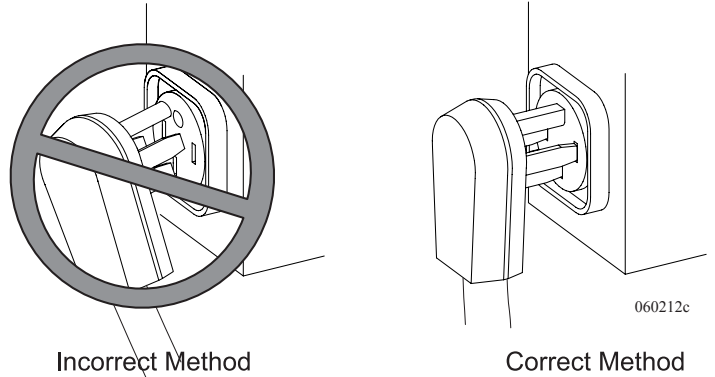
Do not remove cover from shore power supply to troubleshoot electricity to the motorhome. Serious personal injury or death may occur. If there is no power to the motorhome inform the park manager. It is the park manager's responsibility to fix problems with the shore power hook-up.

Plugging in the Shore Cord:

- Located in the roadside compartment is the shore power cord.
- Unscrew the deck plate and insert the end of the shore cable through the deck plate.
- If 50 Amp service is not available, install the proper electrical adapter(s) to the opposite end of the cord.
- Always turn off the shore power breaker to the power supply outlet before connecting or disconnecting the shore cord. This will prevent an accidental shock and flashing of electrical contacts.
- Make the connection to the outlet and turn the shore power breaker on. The transfer switch should make an audible click.
- Ensure **AC In** is lit on the inverter remote panel inside the motorhome.

**THIS CONNECTION FOR
120/240 VOLT,
3-POLE, 4-WIRE,
60 HERTZ,
50 AMPERE SUPPLY**
AS-32A

060203

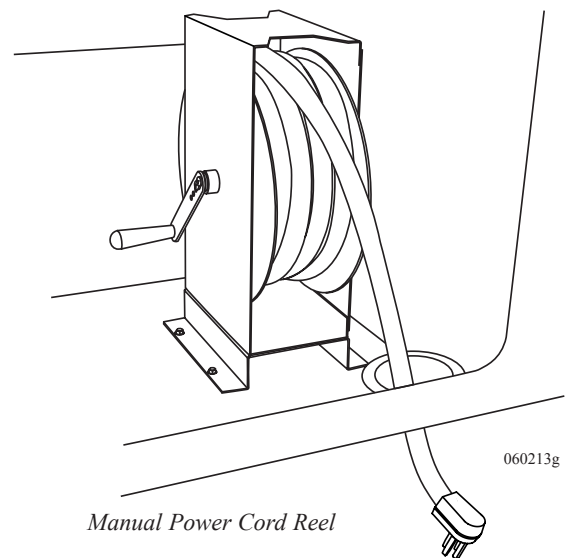


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Plugging in the Shore Cord with Cord Reel

Option:

- Located in the roadside compartment is the shore power cord.
- Extend the cable by extending a sufficient amount of cable to reach the power supply. If 50 Amp service is not available, install the proper electrical adapter(s) to the cord.
- Always turn off the shore power breaker to the power supply before connecting or disconnecting the shore cord. This will prevent an accidental shock and flashing of electrical contacts.
- After the connection is made, turn the shore power breaker on. The transfer switch should make an audible click.
- Ensure **AC In** is lit on the inverter remote panel inside the motorhome.



060213g

Disconnecting the Shore Cord:

- Turn off all AC appliances. This will prevent accidental shock and flashing of electrical contact when disconnecting.
- Turn off the shore power breaker.
- Grasp housing of electrical cord. Without touching electrical contacts, work cord out and away from socket.
- Straighten and clean cord.
- Stow in Compartment.

When Hooked to 50 Amp:

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

When Hooked to 30 Amp:

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

NOTE:

No wait period is necessary on motorhomes equipped with a converter.

CAUTION:

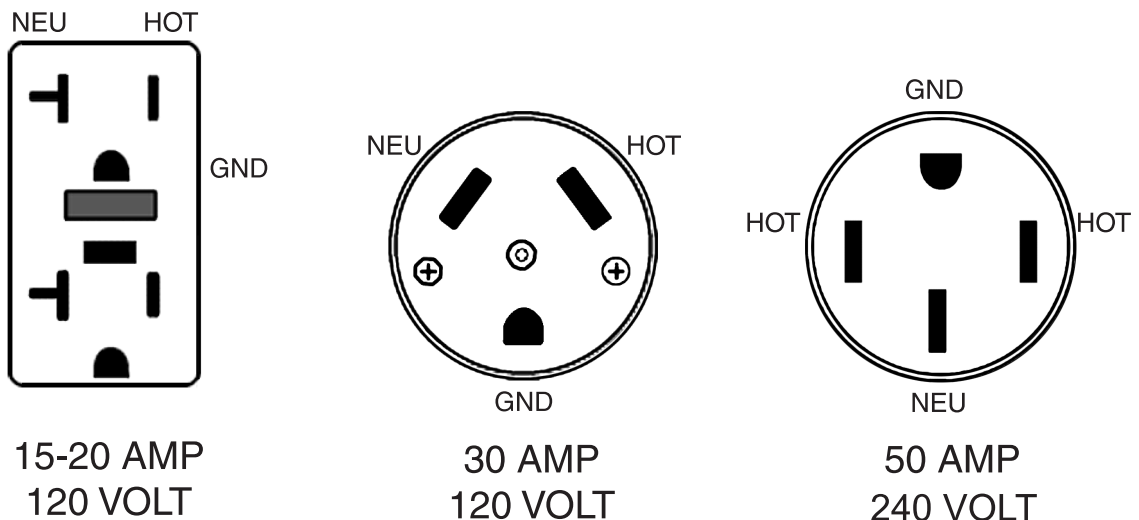
If shore power service is limited to 15 or 20 Amps, use of light duty extension cords and electrical adapters will create voltage loss through the cord and at each electrical connection. Line voltage loss and the resistance at each electrical connection, can be a hazardous combination. Damage to sensitive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

WARNING:

Avoid the risk of electrical shock or component damage by disconnecting from shore power during electrical storm activity. Use the Inverter/Charger or start the generator, if AC power is needed.

NOTE:

Three types of shore power outlets most commonly used are shown in the illustration.



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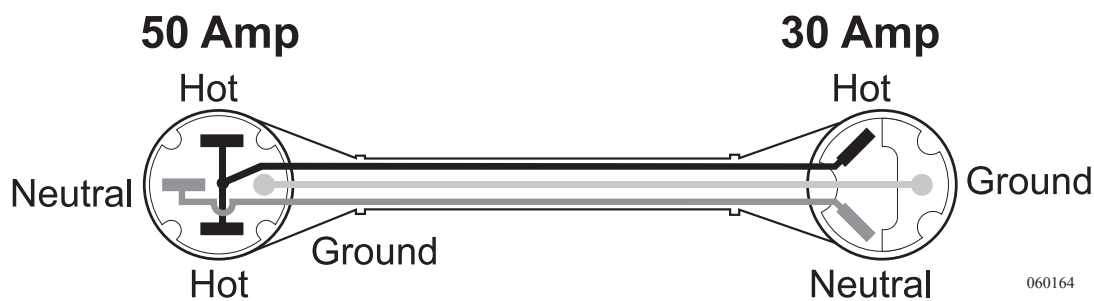
Power Supply:

Different amperage supplies vary greatly in the amount of available current.

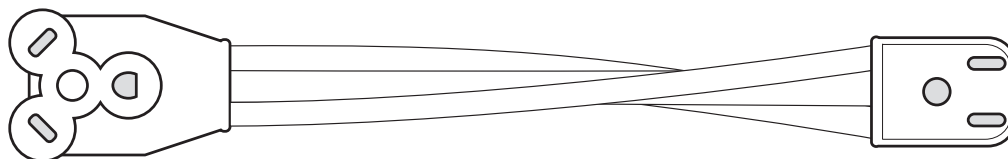
- The continuous amount of current through a breaker or fuse is only 80% of its rated capacity.
- 50 Amp 240 Volt AC shore power service consists of two power supply conductors (120 Volts AC each), a neutral and a safety ground. The 50 Amp breaker simultaneously limits each power supply conductor to no more than a short-term maximum of 50 Amps for each conductor. The 50 Amp 240 Volt service actually provides 80 continuous amps.
- Use care when hooked to anything less than 50 Amp shore service. Shore power service less than 50 Amps consists of one power supply conductor, a neutral and a safety ground; 30 Amp shore service is limited to 24 continuous Amps; 20 Amp shore service is limited to 16 continuous Amps.

Electrical Adapters:

There are many different electrical adapters to suit a variety of needs. Only UL approved adapters should be used. The most common adapter is a 50-30 Amp adapter. The type of connector adapts the 50 Amp shore cord to a 30 Amp shore power outlet. Another common adapter is the 30-20 Amp adapter. Always install the adapter to the cord prior to making the connection to the outlet.



Typical 50-30 Amp Adapter.



30-20 Amp adapter. Adapts the 30 Amp shore cord to a 20 Amp shore power outlet.

TRANSFER SWITCH

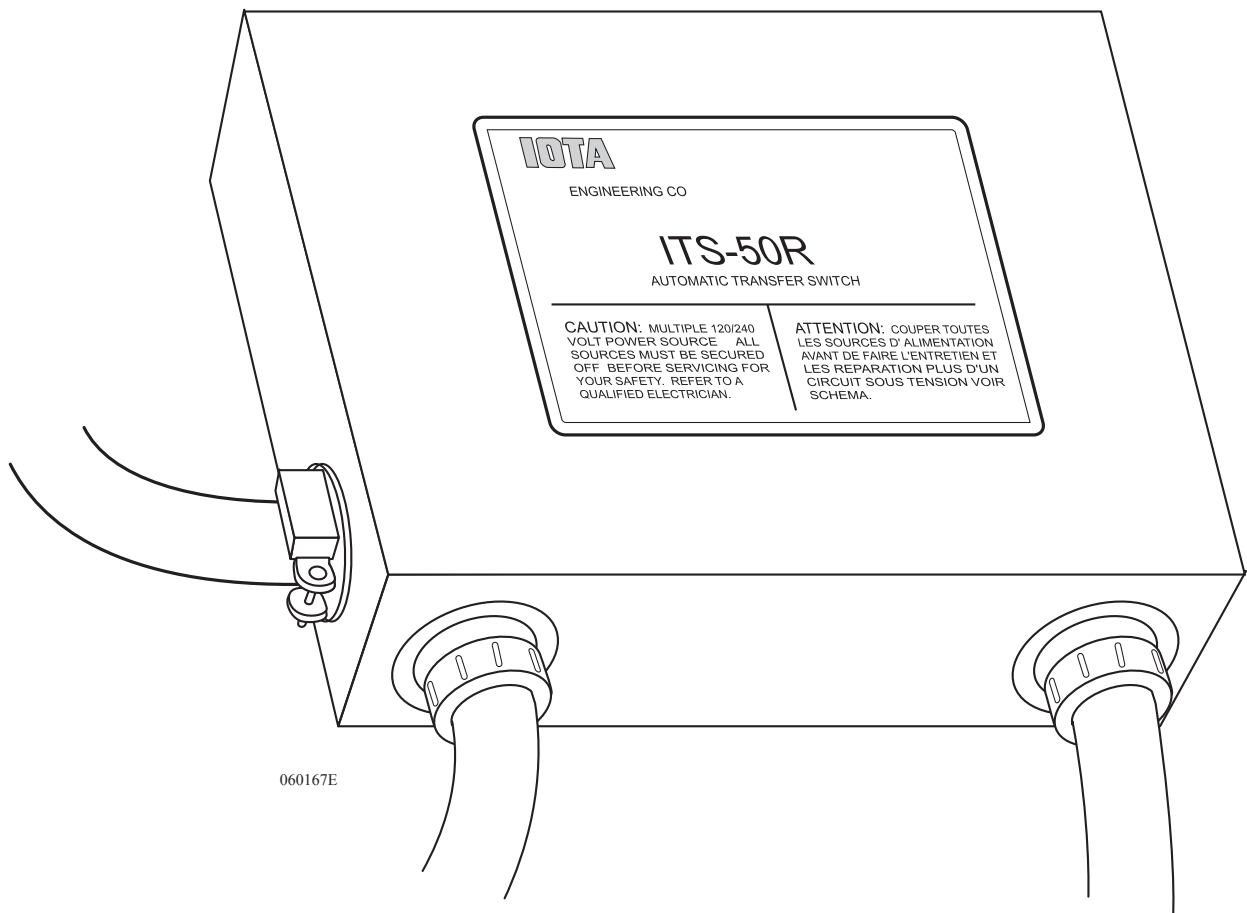
The transfer switch automatically transfers AC power from the shore power cord or generator through the transfer switch to the 120/240 Volt AC breaker panel. When using the generator as the power source, the transfer switch has a time delay built into it before transferring power to the AC breaker panel. This allows the generator time to warm up before applying an AC load. When operating the generator while hooked to shore power, the transfer switch automatically selects generator power as priority over shore power.

NOTE:

The shore cord is NOT electrically connected to the generator. When the generator is operating, the electrical contacts of the unplugged shore cord are not electrically energized.

NOTE:

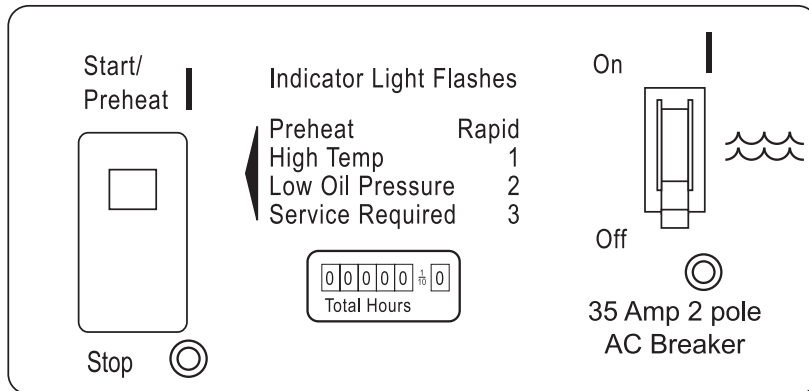
Do not have appliances on or AC loads plugged into outlets when hooking up to shore power or starting the generator to prevent damage to the transfer switch contacts. The transfer switch will begin to disengage at approximately 90 Volts AC. Operation at this voltage may damage the transfer switch, appliances or other items plugged into outlets. Start the generator and disconnect from shore service until the shore service supply voltage stabilizes.



GENERATOR - 120 VOLT AC

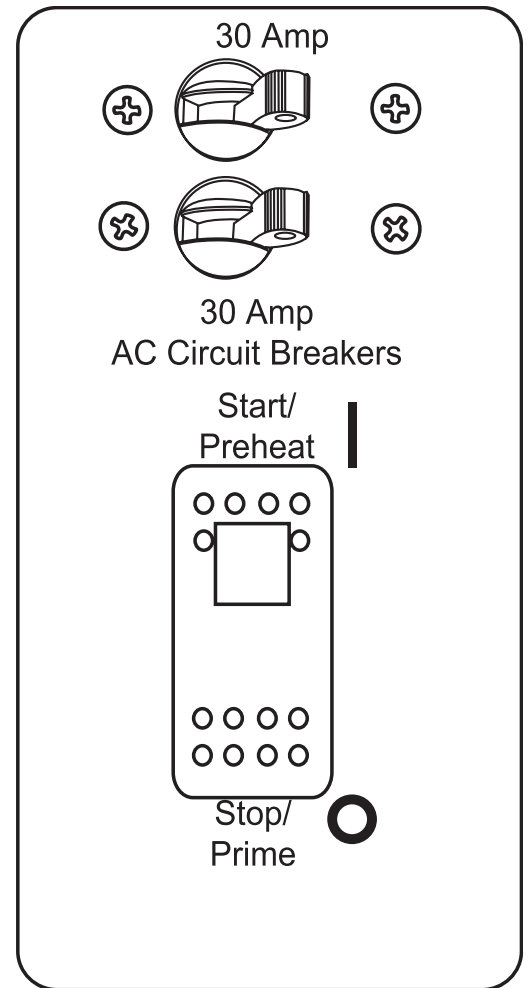
The generator is located in the front compartment of the motorhome. The generator can be started from the following locations:

- Generator remote switch on the dash.
- Generator control panel located on the generator.



Optional 8 Kw Control Panel

060144k



Standard 5.5 Kw Control Panel

020159i

Pre-Start Checks

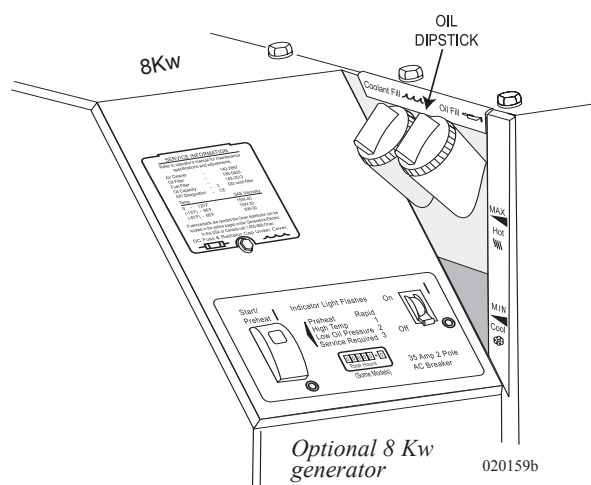
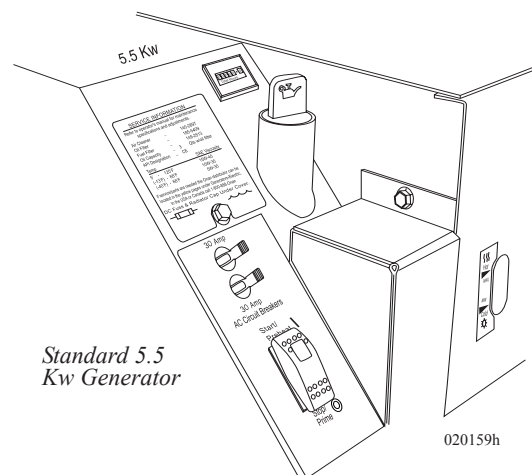
Prior to the first start of the day perform a general **inspection** including oil and coolant levels. Keep a maintenance log on number of hours in operation since the last service. Perform any service or maintenance that may be due.

Before Starting the Generator:

- Clear people and animals from hazards of electrical shock and moving parts.
- All appliances and other large AC electrical loads must be off.

NOTE:

The generator may require priming. To prime hold control switch in the **OFF** position. Repeat if necessary. The diesel generator fuel pick-up tube is cut to approximately 1/4 tank so as not to run the main engine out of fuel.



Starting the Generator

Push and hold the control switch in **START** position until the generator starts. Release switch. The control switch may flash up to 15 seconds, indicating engine preheat.

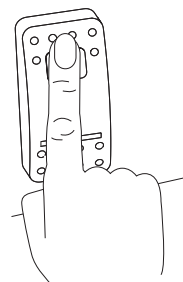
WARNING:

Excessive cranking can overheat and damage the starter motor. Do not crank the engine for more than 30 seconds at a time, in two minute intervals. If the generator fails to start, refer to the manufacturer's manual.

WARNING:

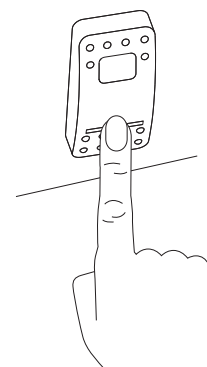
When the motorhome is parked, position the dash air conditioner vent control in the **OFF** position to prevent exhaust gases from entering the motorhome during generator operation.

Press Top to
START



080357b

Press Bottom to
STOP or PRIME



Engine exhaust contains Carbon Monoxide, an odorless and colorless gas. Carbon Monoxide is poisonous and can cause unconsciousness and/or death. Inspect the exhaust system thoroughly before starting the generator. Do not block the exhaust pipe, or situate the motorhome where the exhaust may accumulate around the motorhome or nearby vehicles. Operate the generator only when safe dispersion of exhaust can be assured. Monitor outside conditions to ensure the exhaust continues to safely disperse.

WARNING:

When parking near high grass, be sure that the hot exhaust gases or the exhaust pipe does not contact the grass and ignite, resulting in a fire.

CAUTION:

An exhaust extension adds weight and stresses the generator exhaust system. Damage to the exhaust piping or exhaust manifold can result, allowing Carbon Monoxide gases to accumulate under or leak into the motorhome.

Stopping the Generator

Turn off the appliances and disconnect other AC loads being used. Allow the generator to run unloaded for at least one minute before shutdown to allow the engine to cool. Momentarily push the control switch to the **STOP** position. Release the switch.

Powering the Equipment

The AC output of the generator powers the motorhome air conditioners, the optional AC Inverter/Charger, all appliances and items plugged into the electrical outlets of the motorhome. The number of electrical appliances that can be operated at any given time depends upon how much power is available from the generator. If the generator is “overloaded” or a short circuit causes “over current,” either the generator will shut down or the circuit breaker will trip. If power consumption, in total, exceeds the generator power output, compensation for temperature and elevation may be necessary. Operate appliances in sequence, rather than all at the same time.

NOTE:

The generator may shut down when loaded nearly to full power and an air conditioner (or other large motor load) cycles on. For a brief moment during start up an electric motor can draw up to three times the rated power. For this reason it may be necessary to operate some appliances in sequence when air conditioners or other large motor loads are on.

Air density decreases as altitude increases. Power decreases at approximately 3% of the rated power each 1,000 feet (305M) of increase in elevation above sea level. It may be necessary to operate fewer appliances at the same time when the camping location is at a higher elevation. For example: 7500 watt generator at 5,000 ft. = 6375 watts net. Temperature also affects maximum output power. For example: at 120° a 7500 watt generator produces 6000 watts net.

INFORMATION:

The generator may shut down for reasons other than an overload. If a blink code appears on the control switch, refer to the manufacturer’s manual to obtain an explanation for the code.

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	5500 Watts (gal./hr.)	8000 Watts (gal./hr.)
No Load	.25	0.13
Half Load	.41	0.49
Full Load	.66	1.02

Resetting the Circuit Breaker

If a circuit breaker trips in the main AC breaker panel, or on the generator control panel, there may be a short circuit or too much load.

NOTE:

The generator will continue to run after a circuit breaker trips.

If a circuit breaker trips, disconnect or turn off as many loads as possible. To reset the circuit breaker, switch the circuit breaker to **OFF**; then switch back to **ON** to reconnect the circuit. If the circuit breaker immediately trips, the electrical distribution system has a short or the circuit breaker is faulty. Call a qualified electrician. If the circuit breaker does not trip, reconnect a combination of loads that will not overload the generator or cause the circuit breaker to trip again. Remember to compensate for elevation and temperature changes when re-connecting loads.

NOTE:

An appliance or load may have a short if it causes a circuit breaker to trip after re-connecting. 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

Tests can be performed to ensure the power converter is functioning properly.

- Units with converters require only two house batteries.
- Output on terminals should read 13.6 Volts DC +/- .3 Volts.
- Inspect the fuses to ensure they are not blown.
- The power requirement for the converter is 120 Volts AC.
- Good air flow required. Do not store anything on converter.

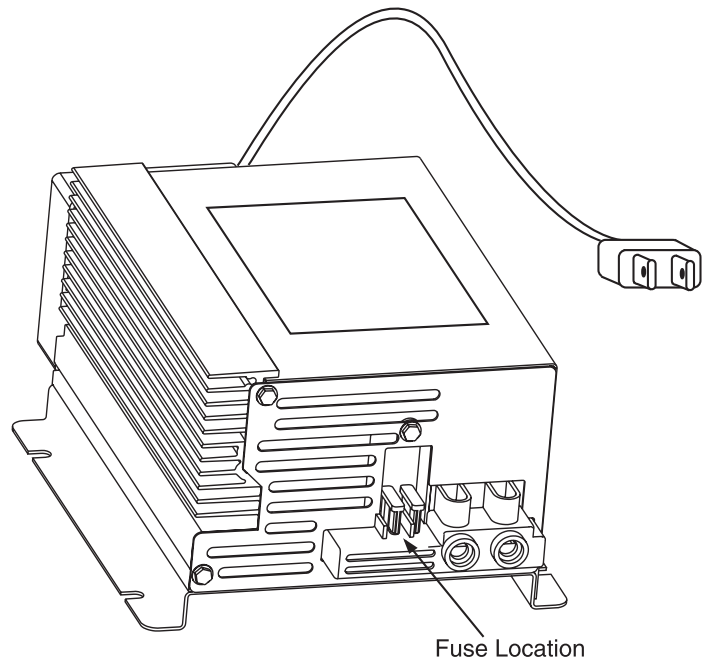
If converter output is correct, but the battery is not charging, there may be a problem with an open wire between the converter and battery.

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, and there is no output from the converter, the converter is bad and will need to be replaced.

NOTE:

Do not store objects close to the converter. This may disrupt the air flow to and from the converter, possibly causing damage due to overheating.



Typical View of Converter

060087

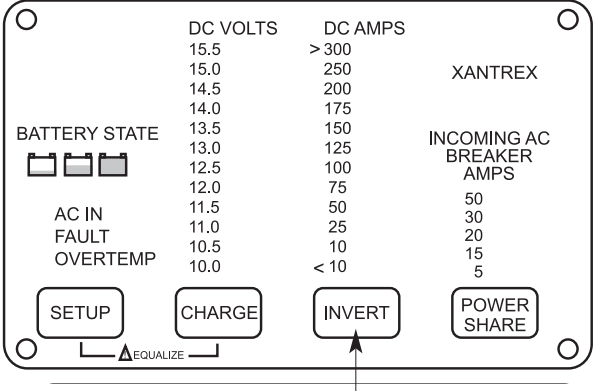
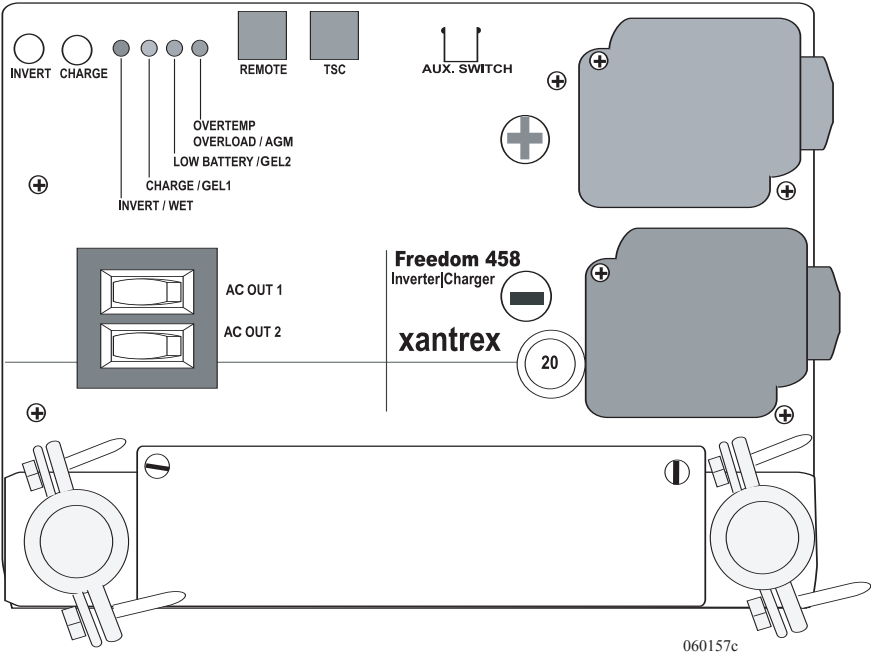
INVERTER (Optional)

The inverter performs two functions, first it changes DC battery power to AC electrical power. Second, it charges the batteries when hooked to shore power or operating from the generator. Use the inverter to supply AC power when shore power is not available and the generator is not going to be used as a secondary AC power source. The inverter supplies AC power to most receptacles, the television and microwave. It is important to remember that using the inverter quickly consumes house battery power. Turn off the inverter when not in use to conserve house battery power. The remote control is used to change the variable settings.

To Turn Inverter On:

- Press the switch marked **INVERT** on the remote panel.

NOTE:
The inverter option will replace the 60 Amp Converter.



Press to Turn Inverter On

Battery Charging w/ the Inverter

The inverter will automatically begin charging when AC power is supplied from shore service or the generator. The charger uses a three-stage cycle to charge the batteries. If desired the charger may be turned off.

To Turn the Charger OFF or Back ON:

- Press the switch marked **CHARGE** on the remote panel.

INFORMATION:

Complete instructions and guidance can be found in the Owner's Information File Box. Please refer to the information booklet provided from the manufacturer.

Remote Panel

The remote panel monitors the inverter status and is used to change variable settings. The panel uses LED lights to monitor values when hooked to shore power, inverting or in the set-up mode.

LED Indications When Hooked to Shore

Power:

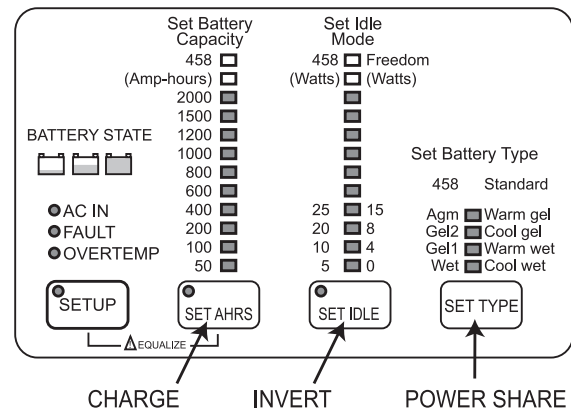
- DC Volts represents DC output voltage at the inverter.
- DC Amps represents the amount of DC charge current.

LED Indications When Inverting:

- DC Volts represents DC battery voltage at the inverter.
- DC Amps represents the amount of DC discharge current.

LED Indications When in Set-up Mode: (Press and hold SET-UP for five seconds):

- DC Volts represents the amount of Amp Hours of the battery bank.
- DC Amps represents the amount of load (measured in watts) needed to activate the inverter.
- Incoming AC Breaker Amps represent battery type and operating temperature.



Remote panel in set-up mode.

060169

Battery State Indicator

The battery state indicator performs two functions. When not hooked to shore power the Battery State indicator displays the approximate state of charge of the house batteries. When connected to shore power or operating from the generator, the lamps indicate what part of the charge cycle the inverter is in.



• **Red = Bulk Charge**



• **Yellow = Accept Charge**



• **Green = Float Charge**

Circuit Breakers

Battery Charger Circuit Breaker:

The circuit breaker for the charger is located on the front of the inverter. The breaker is a re-settable breaker in case an over current or short circuit condition occurs within the Battery Charger circuitry.

AC Out Circuit Breakers:

Two branch circuit breakers are located on the front of the inverter. One of the branch circuit breakers supplies AC power to various receptacles. The other breaker supplies AC power to the microwave.

Stand-by Mode

The inverter may be placed in "STAND-BY" when hooked to shore power or operating from the generator. If AC power discontinues, the inverter activates automatically. When AC power resumes, the inverter will go back to **STAND-BY** mode. **STAND-BY** mode is indicated by the **INVERT** status light flashing once every two seconds when hooked to shore power or operating from the generator.

To Enable or Disable this Feature:

- Press the **INVERT** button.

NOTE:

Remember to disable stand-by mode when not in use. It may run down the house batteries.

Power Share

Setting the Power Share amps can limit the amount of AC power available to the internal charger. Battery charger draw can exceed 20 AC Amps. When hooked to anything less than 50 Amp service it may be necessary, depending on other AC loads, to adjust the Power Share amps to avoid overloading the shore power breaker.

NOTE:

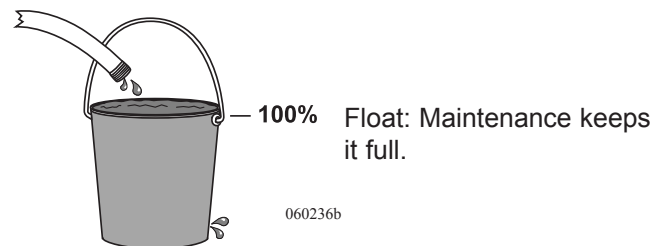
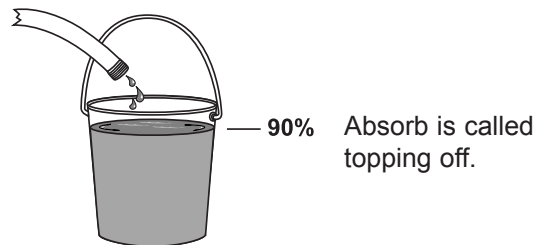
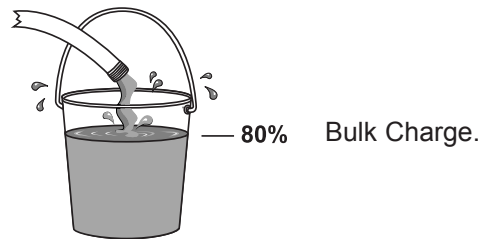
Limiting the amount of useable current for the charger increases the amount of time necessary to charge the batteries.

Charge Cycles

The time it takes to fully charge the batteries varies greatly. It can take several hours or even days, depending on the inverter's settings and state of charge of the batteries. The charge cycle is done in three steps:

Inverter three-stage charging cycle:

- **Bulk Charge Cycle:** Brings the DC voltage up high, initially between 14.2 - 14.6 Volts. The length of time the inverter is in Bulk Charge depends the state of charge of the batteries.
- **Absorb Cycle:** Absorb Cycle battery voltage is the same as the Bulk Charge Cycle, between 14.2 - 14.6 Volts. Length of the Absorb Cycle is a timed event determined by the inverter.
- **Float Charge Cycle:** Charge voltage is generally around 13.3 - 13.7 Volts. Approximately 80% of the charging cycle has been completed by this time.



NOTE:

The Inverter/Charger will charge the batteries with AC power applied regardless of remote status.

Pass-Through Relay

A double pole "pass-through" relay trips when AC power is supplied to the input terminals to transfer AC power through the inverter to the two circuit breakers located on the front of the inverter. The two breakers supply AC power to various outlets and the microwave. When AC power is supplied to the inverter, the internal battery charger will "ramp up" battery charge voltage. A 20 second time delay allows charge stabilization before pass through AC power is supplied to the breakers.

Temperature Sensitive Charging

The inverter uses a battery temperature sensor to adjust charge voltage. When the battery temperature rises the sensor sends this information to the inverter to decrease charge voltage. Voltage compensation with temperature variation is necessary to keep charge voltage at optimum values. The sensor is secured to the terminal of the battery.

Programming the Inverter

Battery Capacity and Idle Mode are adjustable. The set-up mode must be entered to change a setting.

To Enter the Set-Up Mode:

- Press and hold the **SETUP** button for five seconds. LED lamps will change from **green** to **red**.
- If a setting change does not occur within five seconds, the remote returns to the user menu.
- Use the Remote Owner's Manual to cross-reference the LED lights to their respective indication.

Idle Mode:

Setting the **IDLE** mode controls the threshold (in watts) that turns the inverter on from search mode. The adjustment range is 5 to 100 watts. The factory setting is five watts. Press the **INVERT** button to change the settings.

Battery Capacity:

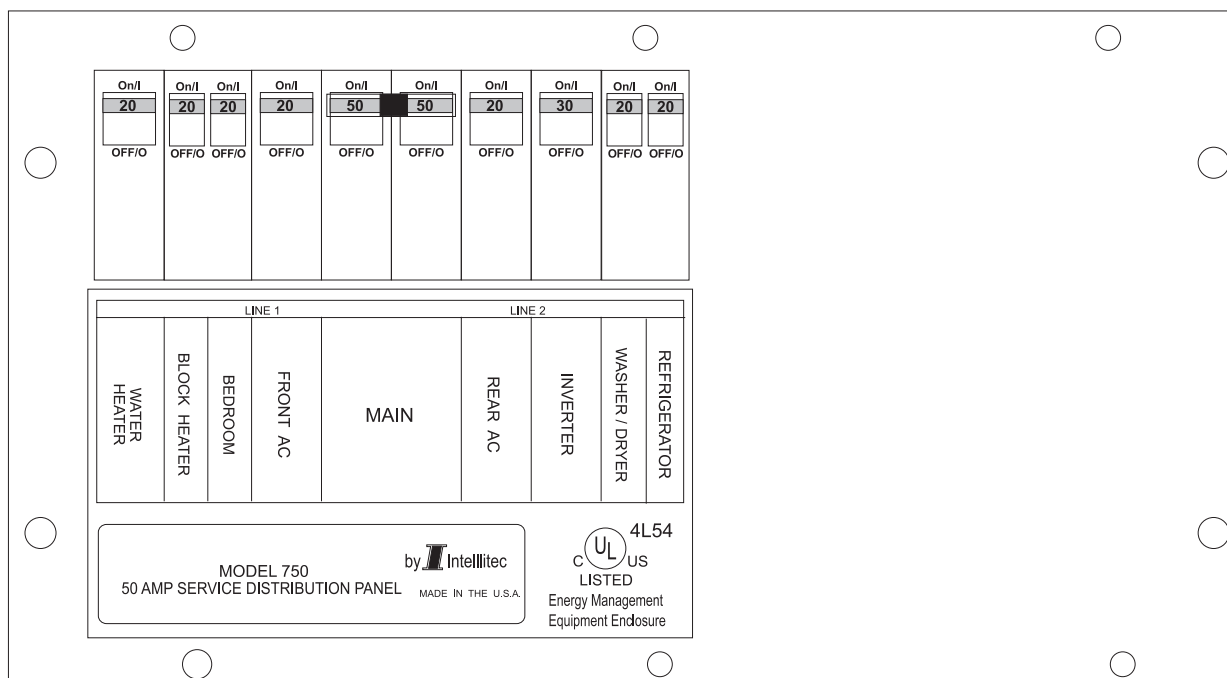
Setting the proper battery capacity tailors the internal charger to optimum values. The Factory setting is 400. Press the **CHARGE** button to change the settings.

DISTRIBUTION PANEL (50 AMP)

The AC distribution panel is located in the bedroom. The main AC panel 120 Volt circuit breakers receive power from the transfer switch, which is powered by either shore power or the on-board generator. Power is introduced into the panel to the 50 Amp MAIN breaker first, followed by power being fed into the individual branch circuit breakers. The panel label describes the breaker layout and the item, outlet or appliance to which they pertain.

WARNING:

This panel contains high voltage which can cause serious injury or death. Before beginning any work or testing procedures involving the electric panels, or any of the branch circuits, be sure the motorhome is unplugged from shore power and the generator is not running. Certain testing procedures can require the AC power to be on. Only qualified personnel or personnel with electrical backgrounds should attempt any testing procedures.



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NOTE:

This panel will change with options.

Branch circuit breakers supply AC power to the different items or “loads.” Should a breaker “trip” from over current use, or a short circuited condition, the load should be tested or disconnected to determine the reason the breaker tripped. If no cause is found, or not readily apparent, reset the breaker by toggling the breaker to the **OFF** position, then back to **ON**. Should the breaker trip again after the load is re-applied, there may be a fault with that particular load. Do not continue to reset breaker until the problem has been diagnosed and corrected.

The internal configuration of the circuit breaker is designed to trip when excess current causes the breaker to heat up. The trip action of the circuit breaker can occur within milliseconds due to the speed at which electricity can travel. Breakers are designed to operate at a continuous load of 80% of the breaker’s rated capacity. For example: A breaker with a 20 Amp rating will operate a continuous 16 Amp load. This design leaves a small amount of working capacity within the breaker. When an inductive load is applied, such as when an electric motor turns on, the motor starts to spin and current consumption may momentarily exceed the rated capacity of the breaker. As the electric motor comes up to operating speed, the electric motor’s current consumption will decrease. The AC current load then falls back into the breaker’s rated 80% set point. This electric principle should be kept in mind when using anything other than 50 Amp shore service and using appliances with electric motors, such as air conditioners. When using outlets, care should be considered when applying loads such as electric motors, heaters, coffee makers, toasters, hair dryers or other large current consuming loads. The current rating is usually stated on most electrical items. The current rating will either be rated in amps or watts. Current ratings stated on electrical items will change slightly with voltage fluctuations. As voltage increases, current consumption decreases. As voltage decreases, current consumption increases. This may explain why in some instances items operated at borderline voltage to current tolerances may seem fine in one location but problematic in another.

NOTE:

To calculate watts to amps simply divide the watt figure by the voltage of which the item operates from. For example: The electrical item is rated at 1370 watts. Divide that by the operating voltage of 115 Volts which equals 11.913 Amps. Use this formula to calculate the amount of load to the available power supply.

GFCI Breakers & Outlets

A ground fault circuit interrupter (GFCI) is incorporated in an outlet.

The GFCI offers two types of protection. One type of protection is from over-current or shorts to guard against hazardous ground fault currents that can result in injury or death. Ground fault currents 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. The device will offer protection against the type of shock that can result from faulty insulation, wet wiring from inside an appliance, or any device or equipment plugged in or wired to that circuit. The ground fault portion of the outlet uses sensitive electronics inside the outlet to detect a ground fault problem. The electronics monitor the normal current flow to the black, hot wire through the load (eg. a light bulb or appliance) and back to the white neutral, or white wire. If just a small amount of the current comes back on the safety ground wire, the electronics will trip the outlet, stopping the flow of electricity. The amount of current it takes to trip the device from a ground fault varies slightly from the different outlet manufacturers (approximately 30 milliamps or less).

Electrical shocks resulting from ground faults can be felt, but such a shock is considerably less than one without ground fault protection. People with heart conditions, or other conditions that make them susceptible to shocks, can still be seriously injured. A GFCI outlet will not protect against shock from a normal current flow. For example, a shock from touching both metal prongs of an electrical cord or appliance while plugging it in.

WARNING:

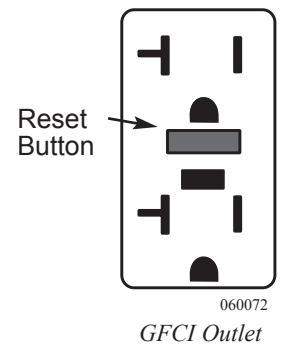
If an outlet continually trips, DO NOT continue to reset the outlet until the problem has been identified and corrected.

NOTE:

The ground fault outlet should be tested once a month to ensure it is operating. Use the TEST button on the outlet. It should trip with an audible “click.” The outlet will not trip if AC power is not present at the device. If power is present and the device will not trip, replace it before using that circuit.

NOTE:

One milliamp is 1/1000 of one amp.



Energy Management System (Optional)

The Energy Management System is easily identified by the remote display panel located inside motorhome.

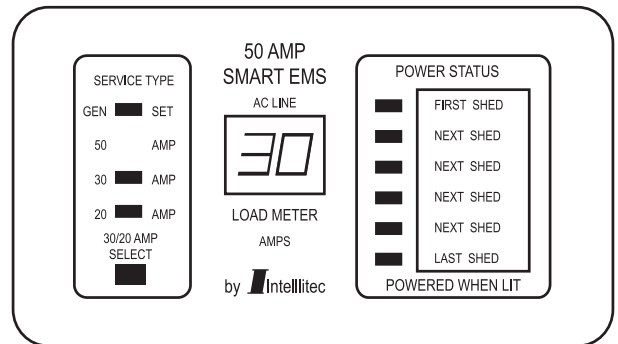
The 50 Amp Smart EMS consists of two elements: the display panel and the bedroom distribution panel. The distribution panel, located in the bedroom, is a completely self-contained 120/240 Volt power distribution and energy management system intended to be used in recreational vehicles. It is housed in 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 6 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.

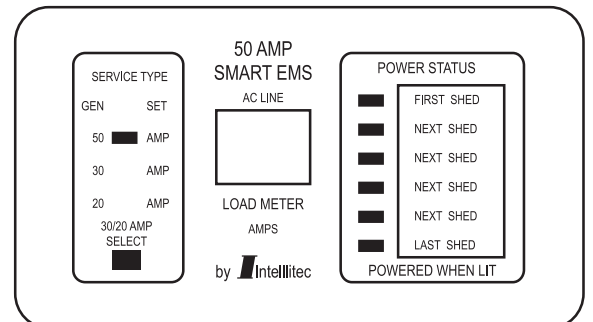
Operation: If 120 Volt AC is not available at the distribution panel, L1 or L2 outputs, the system shuts itself off. This feature is intended to prevent the system from drawing current from the +12 Volt DC battery supply when not in operation.

When 120 Volt AC power is applied, the system automatically powers up and determines the nature of the power source. **On 50 Amp Shore power, the load meter will not indicate Amp load.**



With 30 Amp Input

060082



With 50 Amp input

060082b

If the generator is running, 120 Volt AC will be present at the distribution panel L1 (Line 1) and L2 (Line 2) inputs. In this mode the energy management feature is disabled and all control relay contacts are closed, energizing all of the controlled loads. The control module sends a signal to the display panel causing the load meter to display actual load current, the GEN SET service indicator to light and all power status indicators to light.

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. The load meter will indicate the Amp's Load. 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 in memory. The system continues to turn off loads until the total current falls below shore power amperage or all of the six controlled loads have been shed. Through this process the system has "learned" the amount of current that each particular load draws. This feature compensates for the differences in current draw over a range of line voltage and ambient temperature, by re-learning the load each time it is 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:

There is a two minute minimum delay period after a load is shed before the load will be turned on again to prevent air conditioners from turning on with 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 3 hour period be limited to 80% of the service rating. For that reason the 50 Amp EMS calculates the average running current for the system and, if it exceeds 80% of the service rating, the EMS sheds loads to reduce the average current below that limit.

For example, if a system operating under 120 Volt AC, 30 Amp service has been running at the 30 Amp limit for three hours, the EMS will change its shedding threshold to 24 Amps and turn off loads until the 24 Amp limit is attained. If the user selects the 20 Amp service mode this limit will translate to 16 Amps. Because the EMS calculates a running 3 hour average, if the average load current drops below the limit the system will restore power to loads based on their impact on the limit. If the system is in the averaging mode the decimal point at the lower right corner of the load meter on the display panel will illuminate.

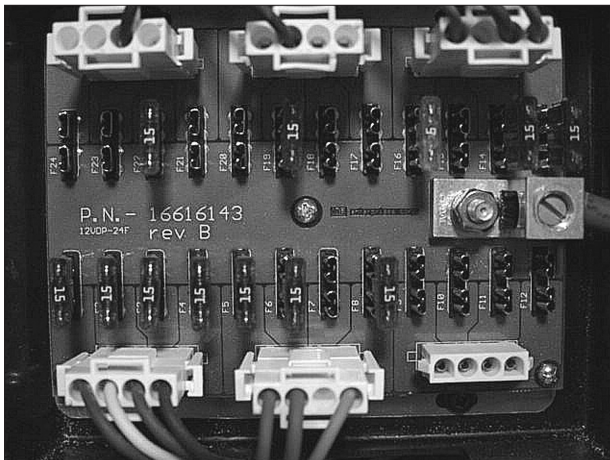
Display Panel: The display panel connects to the distribution panel located in the bedroom. Six power status LED's indicate power is applied to those loads. These LED's are on when the power is applied. The load meter has a two digit display to indicate the amount of current actually being drawn by all the appliances in the motorhome.

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.

DISTRIBUTION PANEL - HOUSE 12 VOLT

The 12 Volt DC house distribution panel contains fuses (located in the bedroom) that protect the electrical circuits. These fuses are a standard automotive type.



12 Volt Panel Label

FUSE	CIRCUIT	AMP	COLOR	GA
F1	BATHROOM-PASS SLIDE	15	BLU	14
F2	PORCH,PASS SIDE NON SLIDE	15	YEL	14
F3	BEDROOM	15	GRN	14
F4	FRONT VENTS	15	VIO	14
F5	CEILING LTS, FRONT	15	RED	14
F6	REAR VENTS	15	VIO/BLK	14
F7	ACCENT LIGHT (OPT.)	15	BRN	14
F8	REAR RADIO (OPT.)	15	GRY/BLK	14
F9	BATH DRIVER SIDE	15	ORG	14
F10	GALLEY LIGHTS	15	RED/BLK	14
F11	REAR BATH (DST-DBD)	15	BLU/BLK	14
F12	OPEN			
F13	FURNACE/ROOF A/C	15	GRY	14
F14	MONITOR PANEL/WATER PUMP	10	RED	12
F15	WINTERIZATION (OPT.)	15	GRN	14
F16	DASH RADIO (OPT.)	5	GRY	16
F17	OPEN			
F18	OPEN			
F19	REAR DRIVER S/O (OPT.)	15	GRN	14
F20	REAR PASS S/O (OPT.)	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			

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Interior 12 Volt fuse panel

060252

FUSES

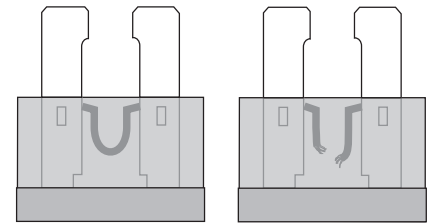
The 12 Volt DC fuses, located in this distribution panel, service the interior house lighting, ventilation fans, monitor panel, furnace and water heater. Should a fuse blow it will be evident by the broken metal strip located in the center of the fuse. Replacement fuses should be of the same amperage. If a higher rated fuse is installed it can damage the wiring. Fuse current set points follow much of the same electrical principle as the 120 Volt AC breakers. Using 12 Volt DC as the electro-motive force can make it more susceptible to outside influences, such as corrosion from weathering or oxidation.

The large variety of applications this voltage can be used in makes it a staple for most of the recreational vehicle and automotive industries. The danger from shocks with this voltage is minimized, but can still occur. A good example is when a magnetic field is generated, then collapses when the power supply is cut. The result is a discharge that can reach tens of thousands of volts for a short time period. Care should be used when working with this voltage as current values can be quite high, like in the case of battery cables.

Shorting a battery cable to ground with a battery at a reasonable state of charge can result in a fire or serious personal injury from a burn.

AMPERAGE	COLOR
1	BLACK
2	GRAY
3	VIOLET
4	PINK
5	GOLD
7.5	BROWN
10	RED
15	BLUE
20	YELLOW
25	CLEAR
30	GREEN

Amperage Chart. amperagechart



GOOD FUSE

BLOWN FUSE

ATO Fuse

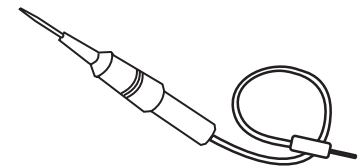
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Tools of the Trade

Two different testing tools maybe be used for testing electrical circuits. Either may be used, depending upon personal preference. In any situation, the testing tool is an invaluable piece of equipment when it comes to determining an electrical problem.

Test Light:

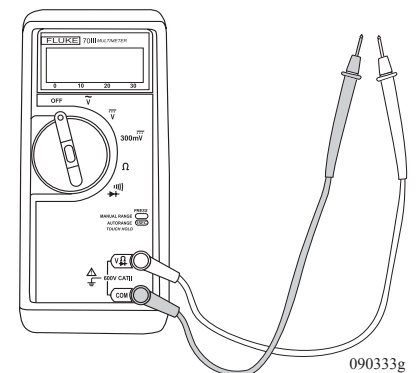
One of the most widely used tools for testing a 12 Volt DC problem is the test light. Test Lights come with a light bulb, probe and ground clip. The test light may be the better suited tool if a 12 Volt DC light is not working.



Test Light 090333b

Volt Ohm Meter:

A Volt Ohm Meter (VOM) is used to perform a multitude of tests. It is generally used when exact values are needed for evaluation. These meters come in analog or digital format and measure a wide scale of voltages and perform a variety of functions. In the case of a charging system problem the meter may be the tool of choice.



090333g

Should it become necessary to use testing tools, take precaution and consider three things:

1. Recognize when a problem is beyond your skill level. Attempting a repair without knowledge of it can lead to major problems.
2. Would the repair be cost effective and cause less problems than if it were repaired by a professional at a later date? How many times has a repair seemed simple enough only to find it has taken an entire day?
3. Would the current situation be potentially dangerous if left to be repaired at a more convenient time?

NOTE:

Check all related fuses before assuming you have encountered an electrical problem or situation. Spare fuses should be kept on hand and can be purchased from auto parts stores. A fuse description label is on the distribution panel cover.

WARNING:

If a fuse blows replace the fuse with same amperage rating and type. Installing higher amperage fuses can damage the wiring or the item the fuse is protecting, or may cause a fire. If the fuse repeatedly blows after replacing it do not continue to replace it. Have the problem diagnosed and corrected by a qualified technician.

BATTERY - How It Works

Batteries come in different sizes, types, amp hours, voltages and chemistries. There are nearly as many descriptions of battery types and how they should be used as there are people willing to offer advice on them. Although it is not possible to cover batteries in their entirety, there are guidelines that can be followed to ensure that the batteries are well maintained.

The operation of the battery is based on a chemical reaction. The battery is a container of lead plates, insulators and a solution of distilled water and sulfuric acid known as “electrolyte.” The 12 Volt DC battery is actually six batteries in one case. When charged, each cell has a voltage of 2.1 Volts DC. When six cells are hooked together this makes a 12.6 Volt DC battery (fully charged).

Electrons are stored on the negative plates. When a load (eg. a light bulb) is placed between the positive and negative terminals, the electrons move from the negative plate to the positive plate through the “load” and then back to the ground terminal. At this time the sulfuric acid leaves the water and adheres onto the plates of the battery. The electrolyte solution keeps the electrons from flowing while the battery is in the “at rest” position.

Charging the battery moves the sulfuric acid back into solution with the distilled water. A battery left in a low or discharged state will cause the acid to “sulfate.” In attempting to recharge the battery, the acid has become hardened and no longer will leave the plates and enter into the liquid solution with the distilled water. The lowered acid to water ratio has a direct affect on the battery’s ability to release the stored electrons (power output) and the length of time it can perform (reserve capacity). Batteries left in a discharged condition will readily freeze, causing the case to crack and allowing the solution to spill. The plates can also warp. This is why batteries should not be left or stored in a “discharged” condition.

House Batteries

House batteries are designed for use with 12 Volt DC operated lights, appliances and inverters. These are available in many sizes and types.

Types of House Batteries:

- Liquid Lead Acid (LLA)
- Absorbed Glass Mat (AGM)
- Gel Cell

NOTE:

Tap water contains minerals which can alter battery chemistry and ruin the battery. Use only distilled water when refilling the LLA battery.

CAUTION:

Many types of petroleum based products or battery by-products can damage the paint finish. Do not allow these types of chemicals to get on the paint finish. If the chemicals splatter on to the painted surfaces, immediately rinse the surface using plenty of water and a mild automotive detergent.

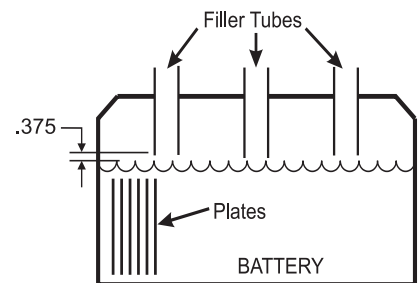
Battery Maintenance

Liquid Lead Acid (LLA) battery cells should be checked at least once a month. The level should be above the top of the plates, but not overfull. The electrolyte level should be approximately 3/8" below the well to allow room for expansion while the battery is being charged. Over-filling the battery will allow the electrolyte solution to boil or gas out of the battery cap.

Remember to use only distilled water to refill the battery. A battery with a low electrolyte level will rapidly boil out the water once the plates have been exposed to air.

Periodically check the batteries for corrosion and cracks.

Replace vent plugs that are cracked or missing. Keep the top of the batteries clean. The accumulation of electrolyte and dirt may permit small amounts of current to flow between the terminals, which can drain the battery.



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.

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Check the battery connections for tightness and corrosion. If corrosion is found, disconnect the cables (mark cable locations) and carefully clean them with a mild solution of baking soda and water, or an aerosol product specifically designed for battery maintenance. Do not allow cleaning solution to seep into the battery and damage the electrolyte balance. Use water to rinse the top of the battery and surrounding area when done. Carefully hook the cables back to the battery. The battery cable to battery terminal connections should be metal to metal. Coat the terminals with petroleum jelly or an anti-corrosion grease.

WARNING:

Liquid lead acid batteries produce hydrogen gas while being charged. This is highly explosive. Do not smoke around batteries and keep all source of ignition or flames away from batteries. The hydrogen gas may explode resulting in fire, personal injury, property damage or death.

Testing the Battery

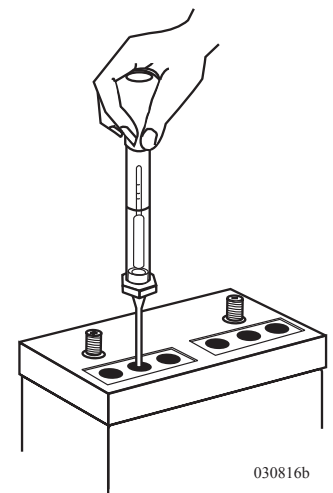
A battery can be tested and monitored several ways. The Monitor Panel on the Systems Control Center in the hallway shows the voltage of the house batteries at a quick glance. The most efficient way of testing the LLA batteries is to check the electrolyte solution using a hydrometer.

Hydrometers are available in different types, such as cylinder graduation (shown here) or floating ball types. Hydrometers can be purchased from most auto parts stores. The hydrometer tests the battery electrolyte solution, measured in specific gravity. Distilled water has a specific assigned gravity of 1,000. The hydrometer is calibrated to this mark. Pure sulfuric acid has a specific gravity reading of 1,840. The acid is 1.84 times heavier than water. The electrolyte solution is about 64% water to 36% acid (fully charged battery). Hydrometers with cylinder graduation are graphed and the exact state of specific gravity can be determined.

Temperature and recent battery activity (charging or discharging) affect the hydrometer readings. It is best to check the battery when it has been “at rest” for at least three hours, although readings taken at other times will give a “ballpark” figure. When using the hydrometer, draw the electrolyte solution up into the tube. Allow the hydrometer to attain the same temperature as the electrolyte solution. Note the reading for that cell. Complete the same test for the rest of the cells on that battery bank.

The hydrometer is calibrated at 80° F. Temperature affects the hydrometer readings. The higher the electrolyte temperature, the higher the specific gravity reading. The lower the temperature, the lower the specific gravity reading. Add or subtract four points for each 10° variance from the 80° F chart. Readings between cells should not vary more than 50 points.

If one cell in a particular battery bank being tested is at a 50% state of charge while the others are indicating a full charge, charge only that battery to see if the low cell will come up. At the same time, do not over charge the “healthy” cells.



Hydrometer (Cylinder Type) testing a LLA type battery.

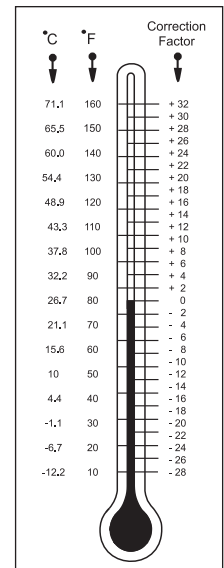
If the low cell does not come up after charging, this battery can damage the rest of the battery bank and should be replaced. An accurate digital volt meter + - .5% will also give an indicator of the battery's state of charge. Another test is to place a specific load on the battery for a predetermined length of time equal to that particular battery's rating. This machine is usually an adjustable carbon pile that can vary the load being applied to the battery(s) while monitoring voltage to see if they will perform to their specific rated capacities.

NOTE:

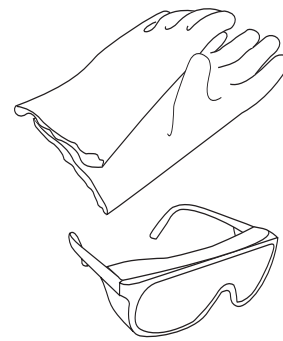
See the chart for temperature compensation. Liquid levels should be even between the cells of the battery being tested as it will affect the accuracy of the test.

WARNING:

Sulfuric acid in the batteries can cause severe injury or death. Sulfuric acid can cause permanent damage to eyes, burn skin and eat holes in clothing. Always wear splash-proof safety goggles when working around the battery. If the battery electrolyte is splashed in the eyes, or on skin, immediately flush the affected area for 15 minutes with large quantities of clean water. In case of eye contact, seek immediate medical aid. Never add acid to a battery once the battery has been placed in service. Doing so may result in hazardous splattering of electrolyte.



Temperature Correction Chart.
030815



tools.eps2

Battery Voltage & Current

Why does the voltage on a discharged battery measure the same as a fully charged battery until the loads are applied? **The simple answer is:** A battery creates electrical power by converting energy from a chemical reaction into electrical energy. As this reaction slows down the battery voltage will drop. In a lead acid battery the electrolyte conductivity (how well electrical current can flow through it) changes. The same current may be available but the rate of the reaction decreases, causing a voltage drop.

Another way of looking at this is to use the analogy of a water pump (a battery is an electric pump). The pressure in psi (pounds per square inch) that a pump delivers is like a battery's voltage. The volume of water in GPM (gallons per minute) is like the electrical current. Look at a 12 psi pump with no loads (the pump is running but the outflow valve is turned off). The pump will run and the internal pressure of the pump will build up to some point higher than 12 psi. When the valve is opened, and the water is free to flow into the loads, the pressure will drop to the rated output pressure of 12 psi, but only if the load is not too big. If the pump is designed to maintain 12 psi at 15 GPM, and a load demanding 20 GPM is connected, the pump will not be able to keep up and the pressure will drop to a lower psi. If the load is reduced or removed the pump will catch up and return to its rated 12 psi pressure. If the pump has an infinite source of water, such as a lake or the water utility (this is like the grid, no battery), the pump will never run out of pressure.

If the pump never runs out of pressure, and is operated at or below its 15 GPM level, it will hold 12 psi. However, a pump that is connected to a water tank with a finite capacity will start to lose the ability to hold pressure as the level of water in the tank drops. Think of siphoning water from a bucket. As the level of the water drops, the volume of water exiting the siphon slows down.

When the tank is full it is capable of feeding more “pressure” to the pump inlet due to gravity, and the pump always has enough water available to maintain its rated pressure and volume. However, if the water tank gets low the pump will not have enough water volume coming in to maintain 12 psi at 15 GPM. If the loads are removed from the pump by closing the valve on the outflow, even with low pressure in the tank the pump will eventually pressure up to 12 psi. It will just take it longer to get there. When the valve is opened the pump will sustain 12 psi for a brief period, but since the tank is no longer feeding the pump as fast as needed the pressure will eventually drop. This analogy can be restated by replacing the pump with a battery, pressure with voltage, volume with amps, outflow valve with a switch, water with electricity and the water tank with the battery electrolyte.

The level of the tank could be thought of as the rate of the reaction occurring in the electrolyte. When the battery is fully charged the electrolyte has an excess of reactions taking place to feed the battery terminals. This tapers off with time as the electrolyte is spent, so maintaining voltage becomes possible. With no loads the discharged electrolyte will be capable of producing close to the rated voltage, but only after a period of time has elapsed for enough of a reaction to take place to bring the voltage back up. Hopefully, this explanation will clarify why a battery measured at rest can indicate close to its rated voltage but will not run a load.

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 80° F when the discharge cycle begins. However, increasing the discharge load applied to the battery from 5 Amps to 10 Amps on a 100 Ahr battery does not yield ten hours of discharge time. This is due to the internal reactions which occur when a battery is discharging. Actual discharge time for a 10 Amp load may be closer to eight hours of discharge time. Increasing the load applied to the battery to 20 Amps will not yield five hours discharge time but may be less than three hours. It might be understood as a point of diminishing return.

Calculating applied loads to an inverter to approximate run time from the battery amp hours available is not an equal trade up when voltage is inverted and amperage is calculated. When the inverter is used to operate an AC load it uses approximately ten times the DC current needed from the battery when inverting 12 Volts DC to operate the 120 Volt AC item. There is also a small efficiency loss of about 10% when inverting. For example: When using the inverter to operate an AC electrical item, which has a current draw rating of 2 Amps, the inverter will use over 20 Amps DC power from the batteries.

Determining Current Consumption:

First determine the amount of current used by an AC item. For example: The television is rated at 200 watts at 120 Volts AC. Calculate watts to amps. Divide 200 watts by the operating voltage of 120, this equals 1.6 Amps. Multiply 1.6 Amps AC current by a factor of ten the inverter will use, this equals 16 Amps DC battery current. Add the revised 10% efficiency loss figure, this calculates to a total of 17.6 Amps DC. If the battery bank capacity is rated at 500 Ahrs., actual elapsed time to the suggested 50% state of charge would net viewing time for the television at approximately 13 hours in ideal conditions.

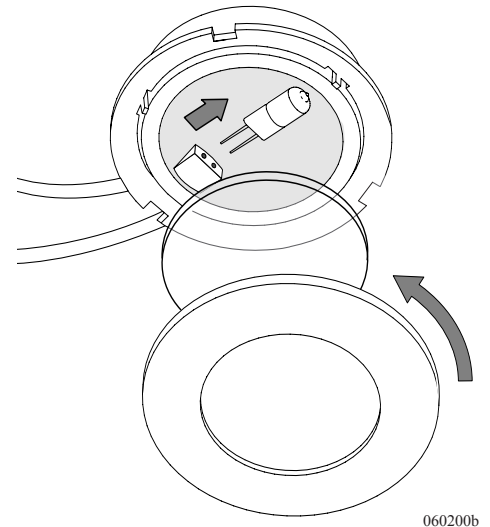
The run time figure will vary greatly with the actual state of charge of the battery bank when the discharge process begins. Ambient temperature, combined with other working loads, such as lights and parasitic loads applied to batteries, affect run times. Calculating the exact run time is not precise due to all the variables and equations involved; however, an approximate time figure can be obtained. Proper battery maintenance and charge cycles affect battery performance. Observe the battery condition with hydrometer and voltage readings. Use only distilled water when filling batteries. To achieve the highest quality of battery performance and longevity maintain the batteries in their proper operating range.

LIGHTS - INTERIOR HALOGEN

The bulbs inside the halogen lighting are replaceable.

To Replace a Bulb:

1. Remove outer trim ring by rotating outer trim ring counter-clockwise.
2. Remove safety lens by pressing lens towards a retaining tab. Pull lens down and away.
3. Carefully grasp bulb and pull bulb from socket.
4. Use a clean cloth or piece of tissue to grasp new bulb.
Do not touch bulb directly as this can cause a "hot spot" and may result in immediate bulb failure.
5. Align contacts of bulb with terminals in fixture base.
Insert bulb until contacts are firmly seated.
6. Replace safety lens.
7. Align tabs in trim ring with slots in fixture base. Rotate lens clockwise until trim ring locks into place.



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CAUTION:

Do not touch halogen lighting while on. They can cause a burn. Do not touch replacement bulbs. Oil in the hands can cause a "hot-spot" to occur. If the bulb is touched, clean bulb with alcohol.

MAP LIGHTS

The overhead map lights are powered by 12 Volts DC and require the Battery Cut-off Switch at the entry door to be turned on for power.

Overhead Lights:

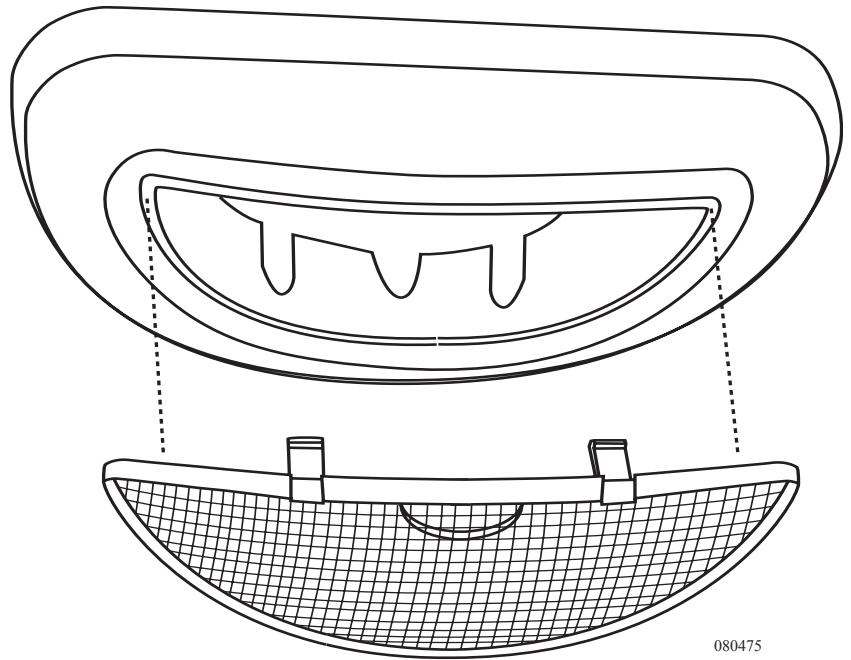
Turn the headlight switch fully counterclockwise to turn the overhead map lights on. Swivel the lens to direct lighting.



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To Replace a Bulb:

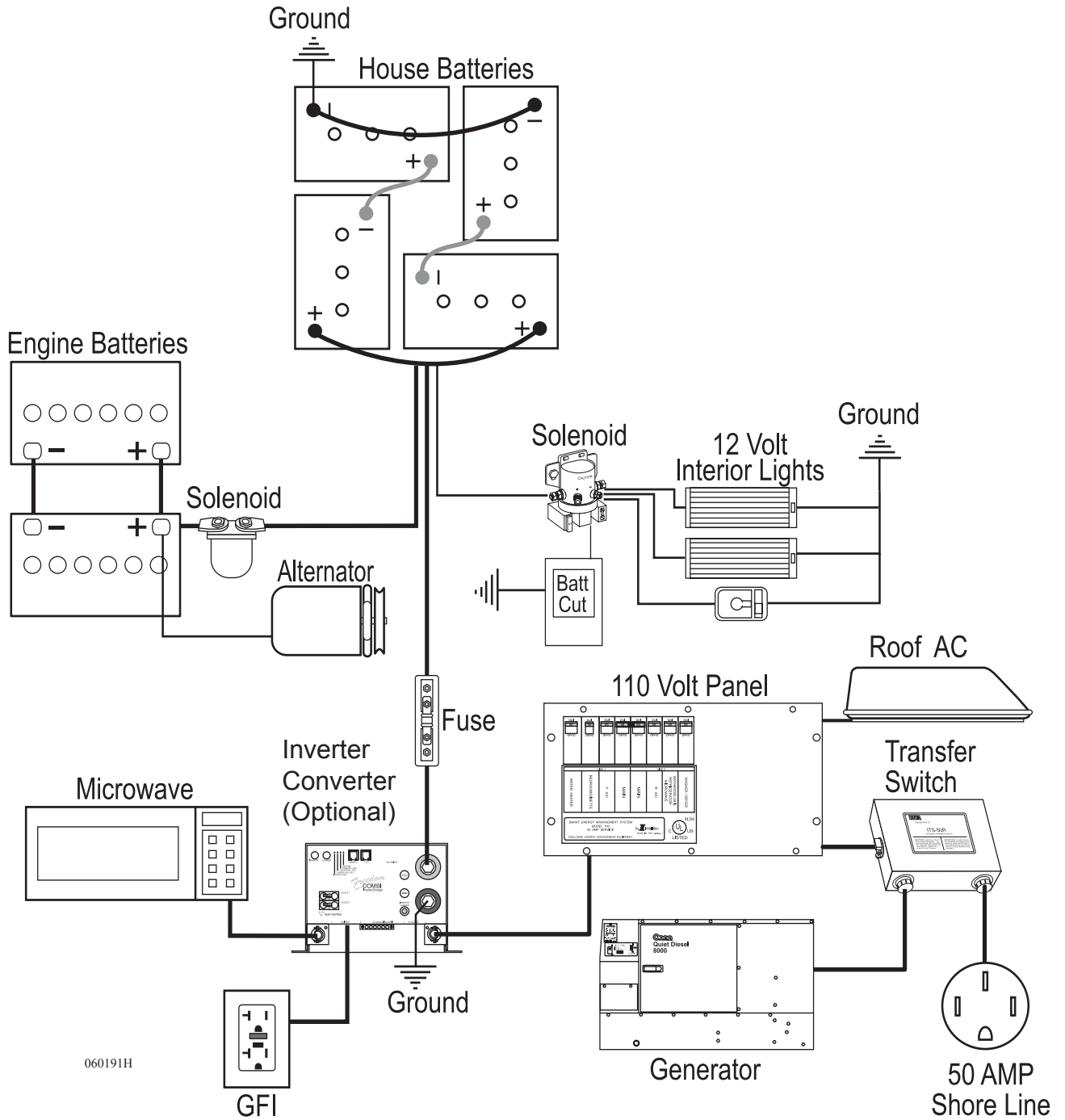
1. Insert a small screwdriver into the slots on the map light lens to release locking tabs.
2. Replace with a 12 Volt, type 906 bulb.
3. Install cover.



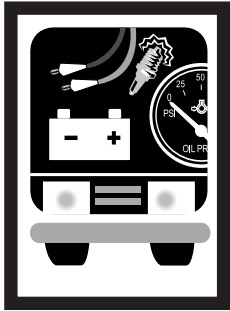
BULB USAGE - INTERIOR

LOCATION	BULB NUMBER
WALL LAMPS	12V 912 or 921
CEILING LIGHTS	GE F IST8-CW
COSMETIC/VANITY LAMP	93 or 1003
PORCH LIGHT	1141
ROUND 3" HALOGEN CEILING LIGHT	12V 10W 4J
MAP LIGHT (OVERHEAD)	12V TYPE 906
DASH LAMP	GE 161
BEDROOM CABINET LIGHTS	Sylvania 912 or 921
DINETTE	921

ELECTRICAL LAYOUT (TYPICAL)



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NEPTUNE 2005

ELECTRICAL SYSTEMS - CHASSIS
SECTION 9

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CHASSIS ELECTRICAL - INTRODUCTION

A majority of the chassis electrical functions are designed to operate from 12 Volt DC (direct current) power. This is why the chassis batteries play such an important role in the function of the motorhome. Therefore, it is important to keep the 12 Volt DC system(s) in good working order. These systems, with their incorporated electronics, are voltage sensitive. If DC voltage is not within specification, some electronic items may be damaged.

The two different systems, chassis and house, have their own batteries. The chassis battery supplies 12 Volt DC power to the front distribution panel located in an outside compartment by the roadside front wheel. This panel contains mostly engine system fuses and wiring such as headlights, taillight, dashboard functions, gauges, etc. 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.

WARNING:

When welding is involved for motorhome repair or modification, only qualified, experienced technicians should weld on the chassis. Improper welding procedures and materials may weaken the assembly or result in damage that is not obvious and may not cause an immediate problem or failure. Unauthorized modifications or repairs to the chassis could result in a forfeiture of warranty coverage.

DANGER:

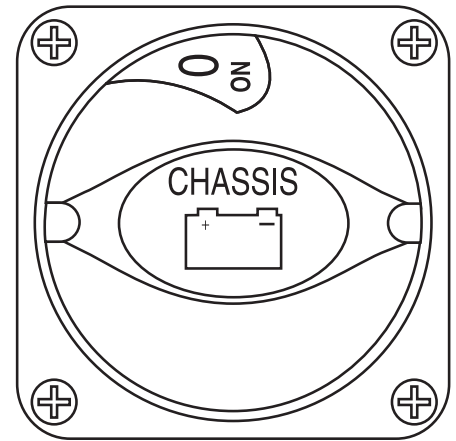
Due to the sensitive nature of the electronics on the chassis, the following precautions are required to protect electrical components in the motorhome chassis:

- 1. Disconnect the (+) positive and (-) negative battery connection.**
- 2. Cover electronic control components and wiring to protect from hot sparks.**
- 3. Disconnect the terminal plugs from the engine Electronic Control Unit, located on the passenger side of the engine block.**
- 4. Disconnect all the plugs from the transmission Electronic Control Unit, located in the roadside front electrical bay.**
- 5. Disconnect the wiring from the alternator.**
- 6. Do not connect welding cables to electronic control components.**
- 7. Attach the welding ground cable no more than two feet from the part to be welded.**

BATTERY DISCONNECT - CHASSIS

The main battery disconnect switch, located in the battery compartment, controls the DC power to the front electrical bay. Most chassis and engine functions are interrupted when the battery disconnect is turned off. Some electronic components of the engine and transmission require a constant power source, and will continue to draw power when the disconnect is off.

Turn the main battery disconnect switch off when the motorhome is going to be stored for more than 48 hours, or when performing electrical maintenance.



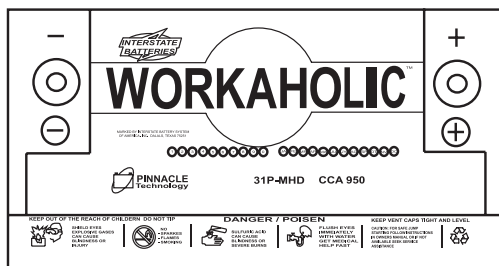
Battery Disconnect
Located in Battery
Compartment

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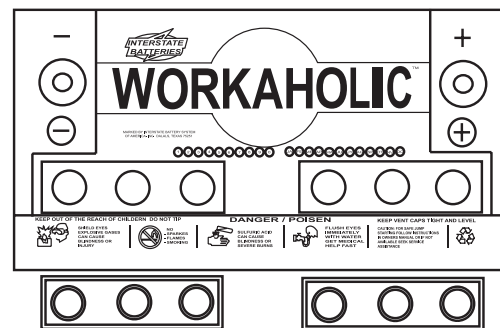
BATTERY - CHASSIS Starting Battery

Starting batteries are designed for high output cranking power, but not for deep cycle like the house batteries are designed to do. Starting batteries will not last long in deep cycle application. “Cold Cranking Ampere” is a measurement of amperage output that can be sustained for 30 seconds at 0° F. Starting batteries use thin plates to maximize the surface area of the battery. This allows a very high starting current that will permit the plates to warp when the battery is deep cycled (discharged).

The starting batteries are located in the engine compartment. Periodically **inspect** the mounting hardware and trays. Trays and hardware should be tight and clean with no corrosion.



Battery with cover.



Battery with cover removed. Cut plastic to remove cover.

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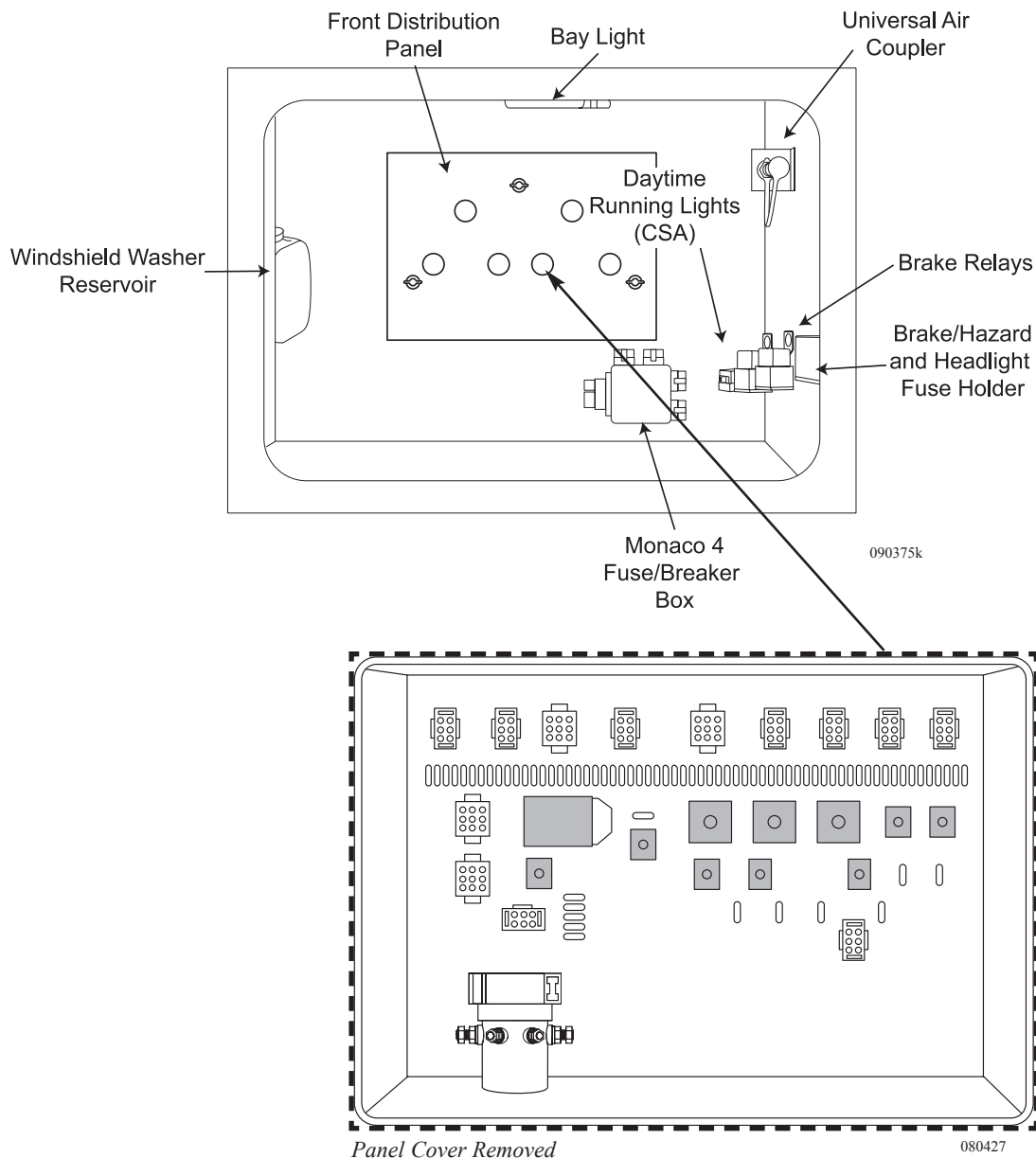
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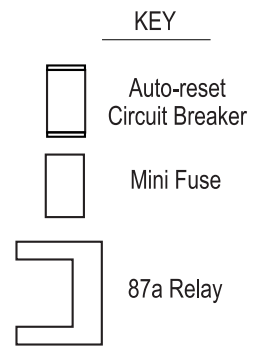
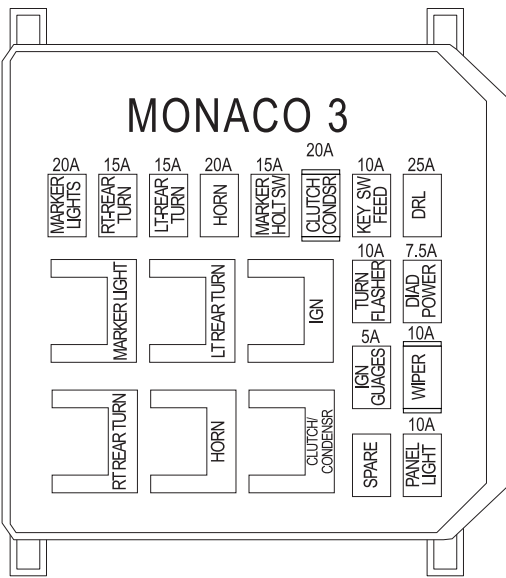
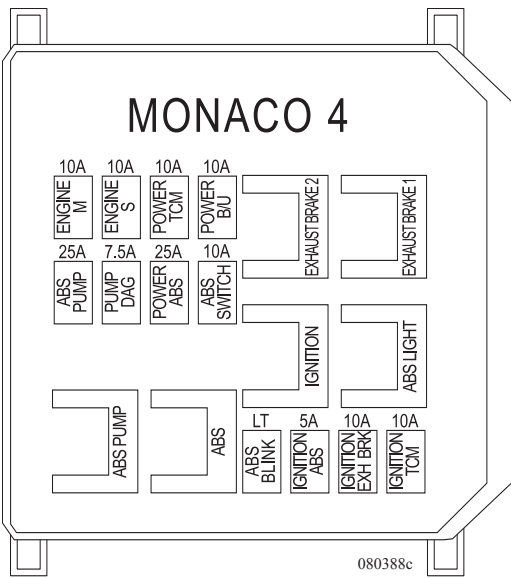
Replacement batteries should have the same cold cranking amp (CCA) rating.

FUSES & CIRCUITS - Front Distribution Panel

The front electrical panel is located in the outside roadside front compartment and contains the fuses, self resetting supply circuit breakers, solenoid and relays.

The automotive fuses and emergency flashers are located in the front electrical panel. The fuses are the standard plug-in type (ATO). When a fuse “BLOWS,” the wire in middle of the plastic case will be broken. A bad or blown fuse must be replaced with a fuse of the same rating and type. Using a fuse of a different type rating will defeat the circuit protection provided by the fuse, which could result in damage to the motorhome’s electrical system. If a fuse has been replaced and it “BLOWS” repeatedly, that may be an indication that a fault exists or an electronic component has failed. It is recommended that the motorhome be taken to a qualified RV technician before any future use to diagnose and repair the problem. Circuits are identified on the fuse label located on the inside of the electrical cover. Remove three wing nuts, turn cover over to view.





FUSE NO.	DESCRIPTION	MAX FUSE SIZE	FUSE NO.	DESCRIPTION	MAX FUSE SIZE	FUSE NO.	DESCRIPTION	MAX FUSE SIZE
<u>CHASSIS</u>			<u>IGN #1</u>			<u>SWITCHED HOUSE 12 VOLT</u>		
4-1	STEP MOTOR	25	4-19	STEP/ISO SENSE	7.5	4-33	DRV POWER SEAT	15A c.b.
5-2	STEP SWITCH	7.5	5-20	LEVELING JACKS	15	5-34	PASS POWER SEAT	15A c.b.
6-3	SPARE	15	6-21	SPARE	3	6-35	STORAGE LIGHTS	15
3-4	CHASSIS READ OUT	3	3-22	SLIDE-OUT RELAY	15	3-36	SERVICE LIGHT	7.5
2-5	SPARE	15	2-23	SPARE	15	2-37	SPARE	15
1-6	SPARE	15	1-24	FIREPLACE	15	1-38	SPARE	15
4-7	SPARE	15	<u>ACC #1</u>			2-39	SPARE	20
5-8	SPARE	15	2-25	REAR VISION	5	1-40	BAY 12 V RECEPT	15
6-9	SUNVISOR	5	1-26	SPARE	5	4-41	DASH RADIO	5
3-10	CB RADIO/COMPASS	5	4-27	SPARE	10	7-42	SPARE	15
2-11	PWR WINDOW DRV DR	15	7-28	SPARE	15	8-43	RANGE	3
1-12	DAYTIME RUNNING LTS	15	8-29	ACCESSORY	15	9-44	SPARE	15
<u>IGN #2</u>			9-30	SPARE	15	6-45	STEPWELL LIGHTS	15
4-13	DASH A/C	20	6-31	SPARE	15	3-46	SPARE	15
5-14	JACK/ANT WARNING	5	3-32	FOG LAMPS	15	4-47	LP/CD DETECTOR	3
6-15	TV/LEVEL LOCK OUT	7.5	<u>NON SWITCHED HOUSE 12 VOLT</u>			5-48	FREEZER	15
3-16	MIRROR HEAT	15	4-66	RADIO MEMORY	10	6-49	DRV S/O PWR #1	15
2-17	MIRROR MOTORS	2	5-67	REFER	5	3-50	PASS S/O PWR	15
1-18	AIR HORNS	20	6-68	SPARE	15	2-51	DRV S/O PWR #2	15
<u>RELAY FUSE</u>			3-69	SPARE	10	1-52	PASS S/O PWR	15
1-59	POWER AWNING	15	2-70	SYST.HEAT/SNAP DISC	5	4-53	MAP LIGHT	7.5
2-60	IGN LOCK OUT	15	1-71	HOUSE READ OUT	3	5-54	12VOLT COMP RECEPT	15
3-61	SIDE DOCK LT RELAY	15	<u>CIRCUIT BREAKERS</u>			6-55	BATT.BOOST/TV BOOST	5
6-62	N/A	15	INTERIOR FUSE PANEL			3-56	DASH FANS	15
5-63	N/A	15				2-57	SPARE	15
4-64	N/A	15				1-58	SERV LT/AUX 12V PWR	15
65	MARKER LIGHTS	10						

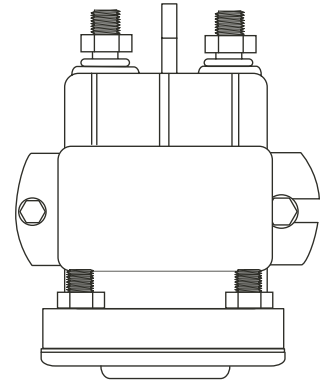
THIS FUSE LABEL COVERS STANDARD AND OPTIONS THAT ARE ASSOCIATED WITH THIS FUSE PANEL. CHECK YOUR BUILD ORDER TO SEE HOW YOUR COACH IS EQUIPPED.

080427f

Battery Boost Solenoid

The battery boost solenoid is located in the battery compartment. A dash-mounted momentary switch is added to provide a BOOST for the chassis batteries from the house batteries in case the chassis batteries are weak and will not crank the engine.

When traveling, the solenoid is engaged, charging both the house and chassis batteries at the same rate of voltage.



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Relays

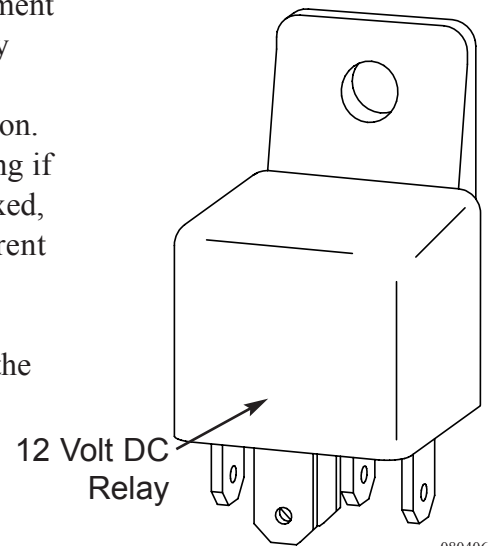
The motorhome uses various relays to operate electrical equipment such as lights and motors. If a relay needs to be replaced, carefully record the location of each wire and all markings or labels.

Relays can look the same in appearance, but differ in function. Note that on the side of the relay is a schematic drawing identifying if the relay is 87 or 87a relay. These current ratings differ, and if mixed, will create problems. Ensure the replacement relay is of the current rating to assure proper operation.

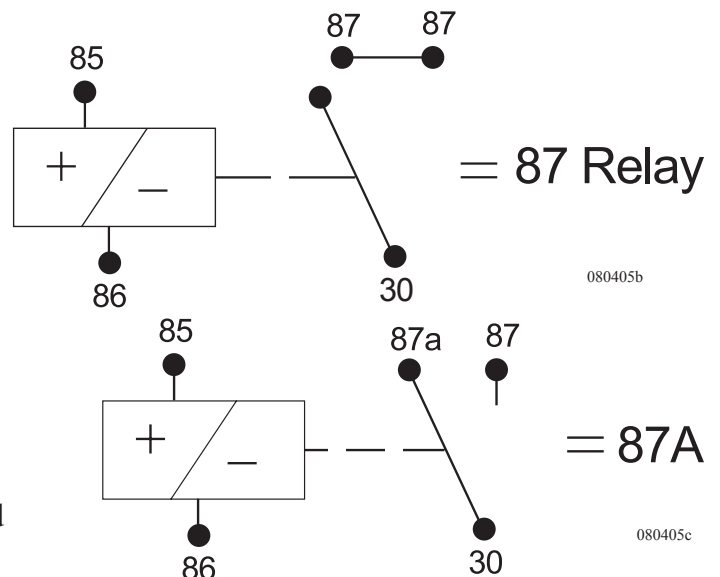
Another indicator to the type of relay is the post or legs. Turn the relay over and look at the post.

Note the differences between the numbered posts:

1. The 30 post is the incoming fuse and/or breaker power. Some relay applications supply power to the 30 post. Some use it for ground. The 30 post can be used many different ways.
2. The 85 post is one side of the coil, tripped different ways.
3. The 86 post is the opposite side of the coil, tripped different ways.
4. The 87 posts are not common to the 30 post until the relay is tripped. When the relay trips, both 87 posts are common to the 30 post.
5. Using an 87a relay, the 30 post and the 87a post are common. When the coil is tripped, the 87a post becomes inactive and the 30 post becomes common to the 87 post located on the outside of the relay.

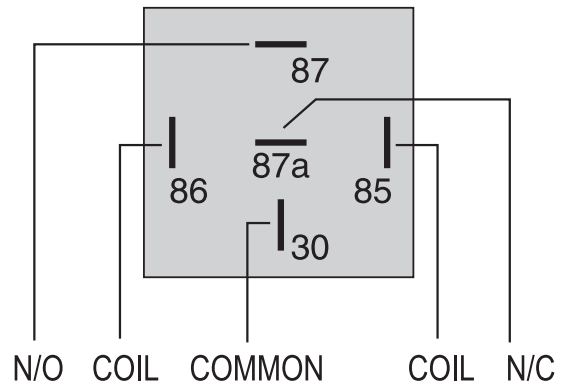


080406



A Single Pole Single Throw relay (SPST) is an electro-magnetic switch consisting of a coil (terminals 85 & 86), one common terminal (30), one normally closed terminal (87a), and one normally open terminal (87).

When the coil of the relay is at rest (not energized) the common terminal (30) and the normally closed terminal (87a) have continuity. When the coil is energized, the common terminal (30) and the normally open terminal (87) have continuity.



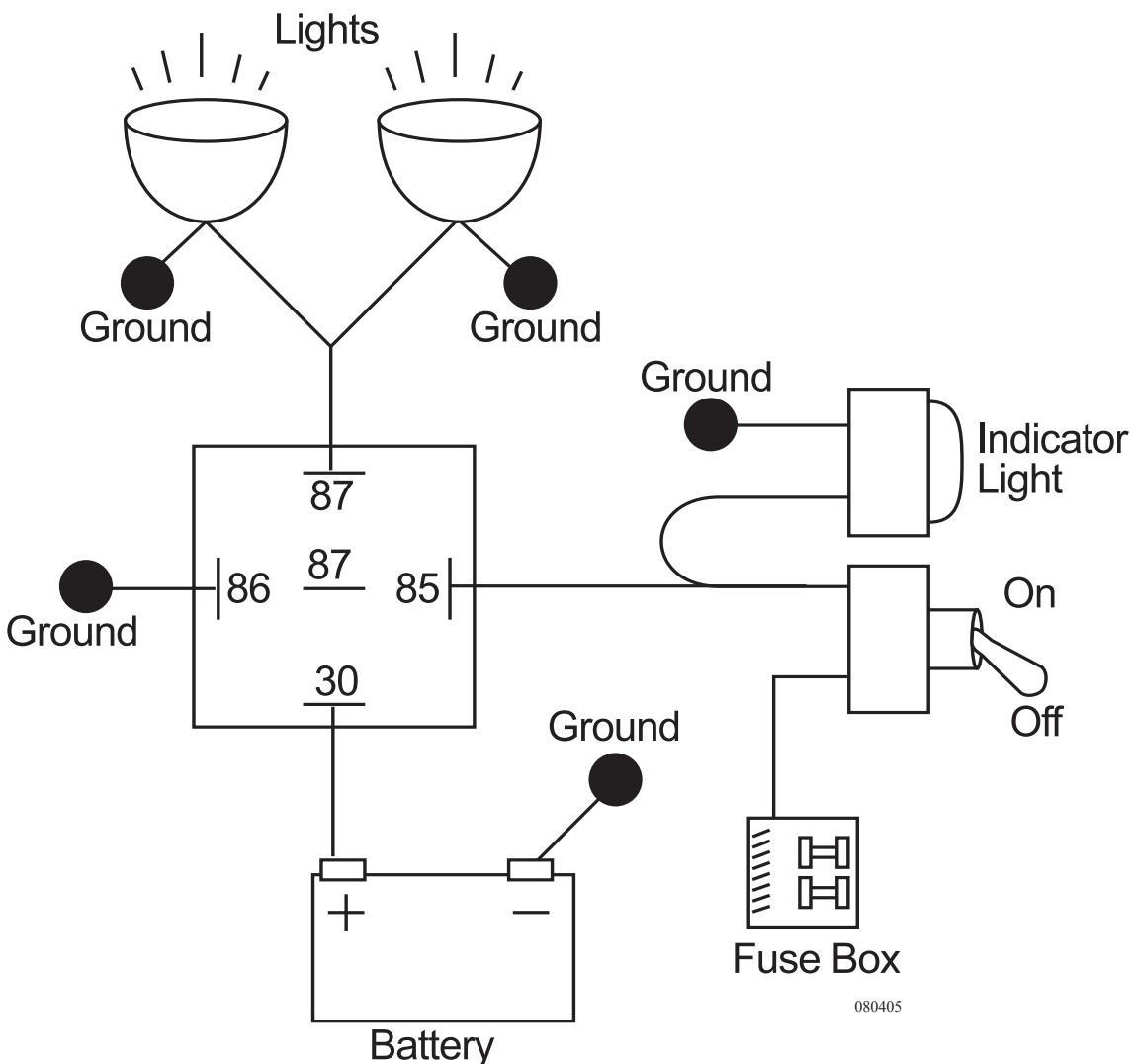
Single Pole, Single Throw Relay 12 Volt DC.

080405d

NOTE:

When there is power applied to the coil, the coil sets up a magnetic field in the windings. When the power is removed, the field collapses. A momentary high voltage discharge will occur. This is how an ignition coil works.

EXAMPLE:



080405

ALTERNATOR

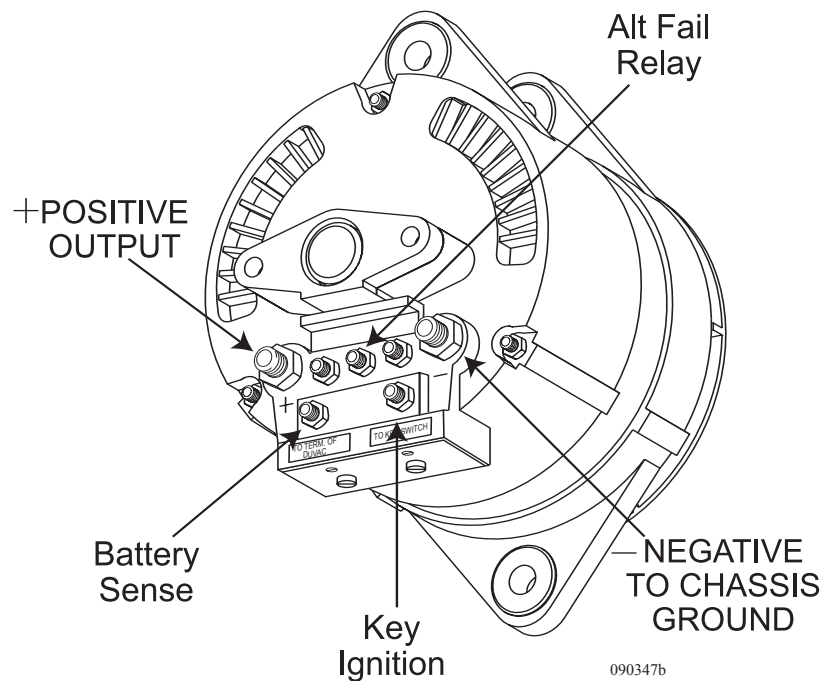
The alternator is designed for output through the engine operating range. When traveling, keep an eye on the voltmeter in the dash area. Normal readings should be between 13 to 14.5 Volts DC. Higher or lower voltage indications indicate a potential problem with the charging system. If the alternator output drops below an acceptable level, a charge indication warning lamp will illuminate.

The alternator replaces amp hours the chassis battery used to start the engine. The amount of charge the alternator sends to the chassis battery is dependent on the amount of time the engine is operated. Repeatedly starting the engine for short periods may not be enough operating time to adequately replace the amp hours the chassis battery uses to start the engine.

The function of the alternator is an electrical system voltage maintainer, not a battery charger. When the engine is operating, the alternator maintains electrical system voltage relative to a load, such as headlights and windshield wipers. When a heavy load is placed on the alternator, such as trying to charge dead house batteries, the operating temperature of the alternator will increase. Excess operating temperature of the alternator for extended periods of operation can lead to premature failure of the alternator. If the house batteries are in a low state of charge, it is recommended to charge the house batteries with the inverter or an auxiliary battery charger before driving the motorhome.

CAUTION:

Long-term use of the inverter to operate the microwave while in transit will damage the alternator. Use the generator to operate the microwave while in transit.



Alternator Testing Procedure

Alternator Testing:

- Check all wiring for burnt or loose electrical connections. Repair as needed.
- Check all grounds and electrical connections to confirm they are clean and tight.
 - a. Alternator ground to chassis frame.
 - b. Motor block ground to chassis frame.
 - c. Chassis battery ground to chassis frame.
 - d. Alternator positive output to isolator center terminal.
- Inspect the alternator for damage. A broken fan blade can damage an alternator or throw it out of balance.
- Check belt, pulley and fan for wear. Replace as needed.
- Do not disconnect the battery, or battery wire, from the alternator with the engine running as this can damage the alternator or regulator.
- The pulley for the alternator should be torqued to 80 foot pounds.
- Chassis battery voltage with the engine OFF should range from 12.2 to 12.7 Volt DC.
- Chassis battery voltage with the engine at idle should range 13.5 to 14.2 Volts DC.
- 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.

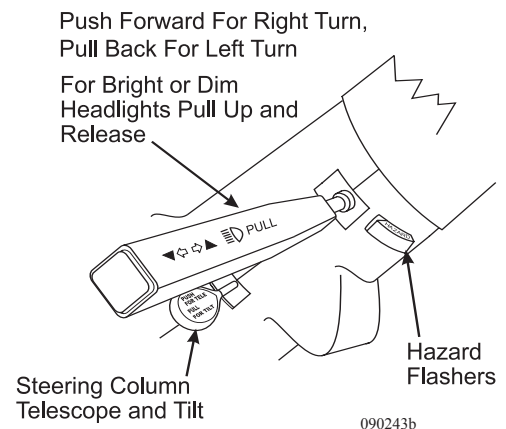
NOTE:

The alternator is not a battery charger. It is designed to maintain proper electrical system voltage. A battery with a low state of charge, or a dead battery, may overheat and damage the alternator.

STEERING COLUMN *Tilt & Telescope*

Tilt and telescope steering wheel control lever:

- To tilt the steering wheel: Pull the lever up and tilt the steering wheel to the desired level. Release the lever to lock the steering wheel in the new position.
- To telescope the steering wheel: Push and hold the lever down. Move the steering wheel to the desired location. Release the lever to lock the steering wheel in the new position.



Turn indicator and headlight high/low dimmer control:

- Push the lever forward to activate right turn indicator circuits when the ignition is on.
- Pull the lever back to activate left turn indicator circuits when the ignition is on.
- Pull the lever up to select high/low beam circuits when the headlights are on.

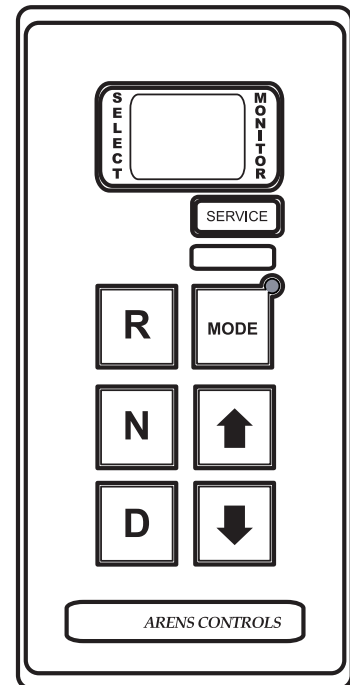
Hazard Flashers:

- The flasher button is located on the steering column.
- To turn on the four way flashers, pull **out** on the flasher button. The turn signal alarm will sound.
- To turn off the flashers, push the button **in**.

CONSOLE
Transmission Shift Selector**1. Transmission Key Pad:**

The function of each position of the keypad push-button shifter is as follows:

- Select NEUTRAL by pressing **N**. The area around the **N** button has a raised ridge so the driver can orient his hand to the Neutral button by touch.
- Select REVERSE gear by pressing **R**.
- Select the forward DRIVE range by pressing **D**. The SELECT and MONITOR will indicate "**D1**", indicating the transmission is in 1st gear. Throughout the subsequent up shifts or downshifts, the SELECT and MONITOR will indicate the gear the transmission is in.
- The UPSHIFT and DOWNSHIFT arrow buttons are used to select a higher (if not in fifth gear) or lower (if not in first gear) forward range. These buttons are not functional in NEUTRAL or REVERSE. One press changes the gear selected by one range.
- The **Mode** button enables economy mode.



080386b

To Enter Economy Mode:

Press the **MODE** button. The LED will illuminate.

To Exit Economy Mode:

Press the **MODE** button. The LED will extinguish.

NOTE:

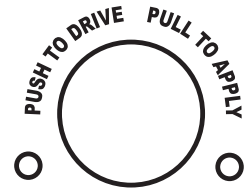
When the Auxiliary Braking device is used, the display will change to a default reading of D-3. This setting is pre-selected at the factory and can only be altered by an authorized Allison Service center. The transmission is not actually in third gear. This is only a reference point so the transmission will optimize engine-braking efficiency.

Parking Brake

The parking brake system is activated when the push-pull control knob (located on the driver's left console panel) is pulled. When the knob is pushed, the brake is released. Prior to driving, allow time for the air compressor to build up sufficient air pressure to shut off the low air warning lamp.

WARNING:

There is a possibility the parking brake can be accidentally released if the air system is charged. It is advised to fabricate a device to be placed under the parking brake handle preventing small children and pets from releasing the brake when parked. A wooden clothes-pin clasped to the shaft will be suitable.



**EMERGENCY
AND
PARK BRAKE**

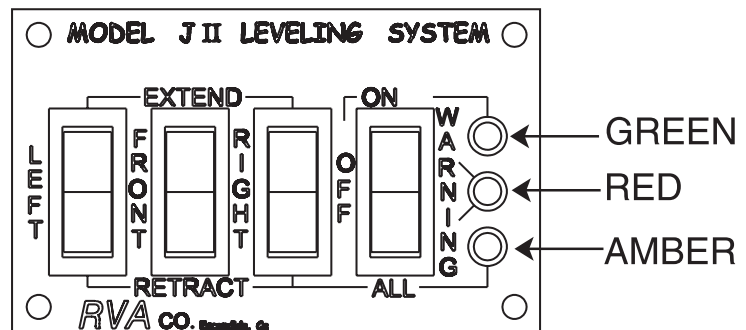
park brake.eps

Leveling Controls

The three-point hydraulic leveling system is operated from the control module to manually level the motorhome. The control features a warning system with a flashing light and an audible alarm to alert of a jack down.

NOTE:

Hydraulic leveling works only with the ignition in ACC or ON position.



080213

**DASH
Indicator Lights**

1. Check Engine:
Problem with the
Cummins Engine.

2. Park Brake:
Parking/emergency
brake is
applied.

3. ABS:
ABS possible
fault in the ABS
brake system.
Also indicates
faults codes for
service technicians.

4. Cruise:
Cruise control is engaged.

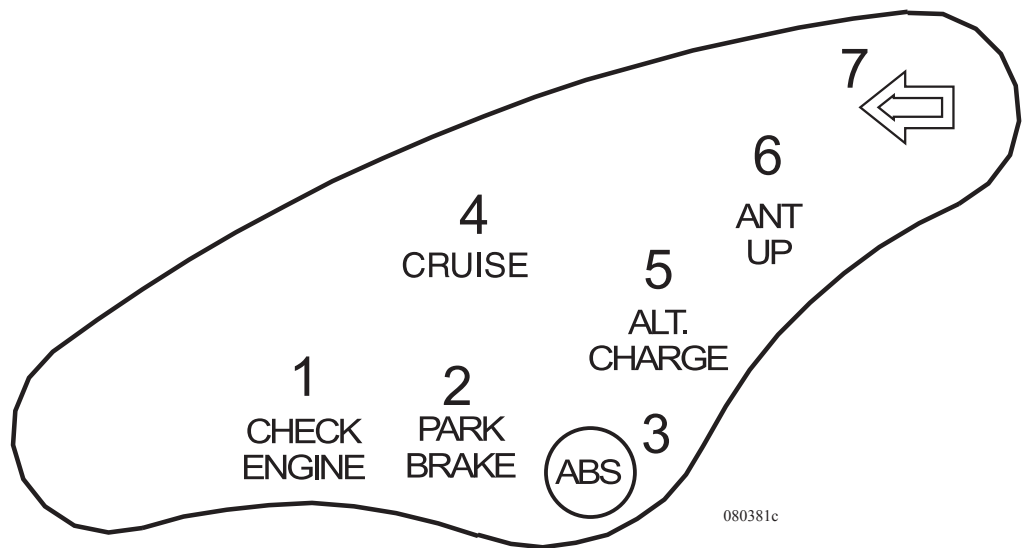
5. Alt Charge:
Failure within the alternator charging system.

WARNING:

In the event the Alt Charge lamp illuminates, pull over immediately and shut off the engine as overheating can instantly occur. Inspect the serpentine belt.

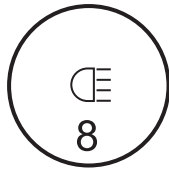
6. Ant Up:
TV antenna is not resting flat in the storage cradle.

7. Left Turn:
Left turn indicator circuits active.



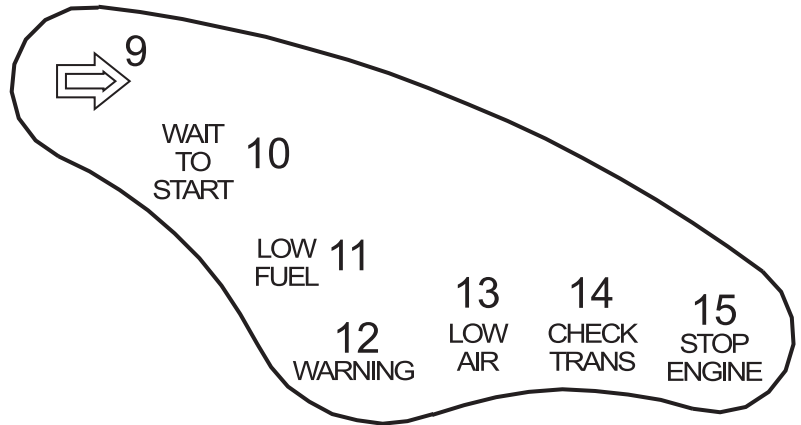
8. High Beam:

High beams when illuminated.



9. Right Turn:

Right turn indicator circuits active.



10. Wait to Start:

Monitors the intake air heater and intake manifold temperature.

11. Low Fuel:

Fuel level in fuel tank is becoming low.

12. Warning:

Out of range condition exists within the engine protection circuits.

13. Low Air:

Air storage tank low and air systems may not operate properly.

CAUTION:

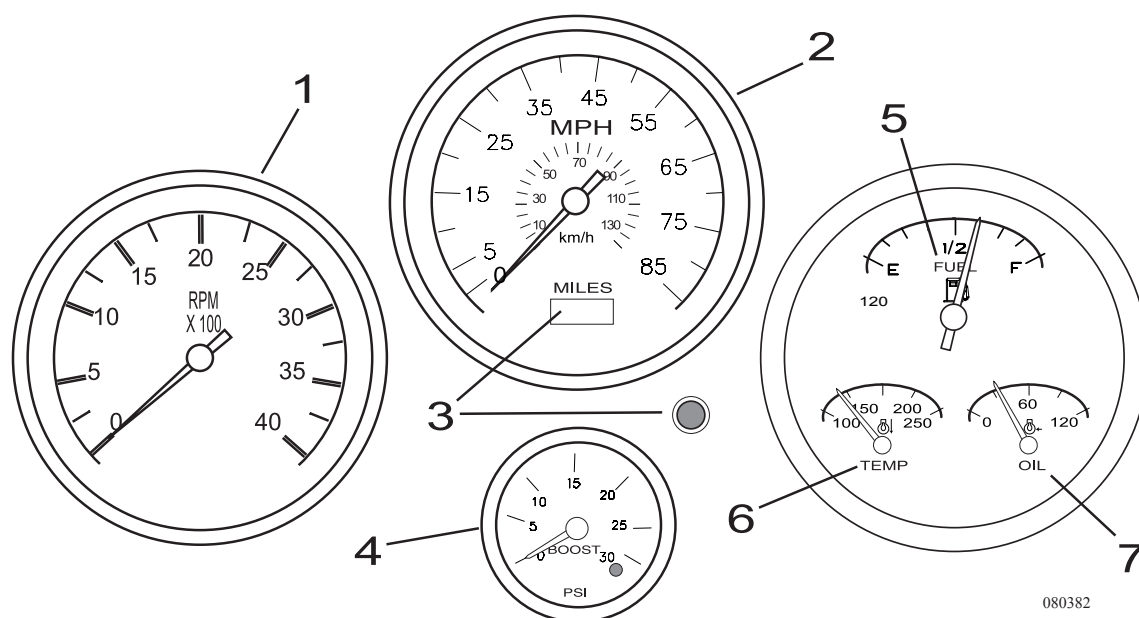
The Low Air Lamp will only illuminate when a low air indication is present. You should check the operation of the Low Air Lamp when air tank is drained.

14. Check Trans:

Alerts of problems related to the Allison Transmission.

15. Stop Engine:

Alerts of severe out of range condition within the engine protection circuits.



080382

1. Tachometer:

Displays the engine speed in revolutions per minute (RPM). Normal low idle speed can vary from 700 RPM to 875 RPM. The tachometer reads the output pulse of the alternator. If the tachometer quits, have the alternator checked immediately.

2. Speedometer:

Indicates the speed in MPH and is located on right side of the instrument cluster. The Odometer/Trip Meter is built in to the meter.

3. Odometer/Trip Meter:

Records the mileage driven, as well as total mileage on a trip. To operate, push the round black button under the speedometer. This changes the odometer mileage reading to the trip mileage reading. The black reset button sets the trip mileage back to zero when held for 2 to 3 seconds. Release the button and momentarily press the button again. This changes the trip mileage reading to the odometer mileage reading.

NOTE:

Odometer reading is indicated in miles for the dual reading (MPH and KPH) speedometer.

4. Turbo Boost Gauge:

The turbo boost gauge indicates the boost pressure produced by the engine turbocharger.

5. Fuel Gauge:

The fuel gauge will register the approximate fuel level in the tank when the ignition switch is in the run position.

NOTE:

Fuel mileage varies with driving style and road conditions. Always average more than one tank of fuel to obtain a more accurate figure.

6. Engine Coolant Temperature Gauge:

Under average conditions, the gauge will read between 160° F and 212° F. Monitor this gauge frequently when climbing hills, towing, or in high ambient temperatures.

Overheating may be a result of any of the following conditions:

- Low coolant level.
- Fan failure.
- Mechanical failure of the hoses or belts.
- Blockage of radiator fins.
- Climbing a long hill on a hot day.
- Towing a heavy trailer.
- Idling for long periods of time.

7. Engine Oil Pressure Gauge:

Indicates the pressure of the oil and not the amount of oil in the system. Normal ranges are between 15 psi and 60 psi.

INFORMATION:

Please refer to manufacturer's instructions for specific oil pressure recommendations.

NOTE:

When operating the engine cold, the pressure will be considerably higher due to increased viscosity (thickness) of the oil.

WARNING:

If oil pressure drops significantly below 35 psi while driving, or 10 psi while idling, stop the engine and check oil level.

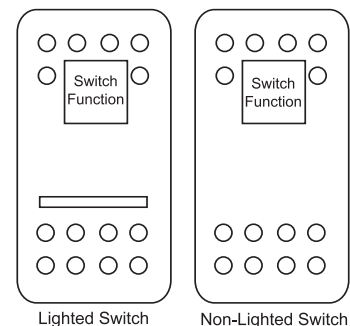
Switches

Two types of switches are used: Lighted and non-lighted. Each switch has the item or function it controls, printed on the switch. Press the top of the switch to start the function. Press the bottom of the switch to stop the function. The following is a list of switches used and their functions.

DRIVERS CONSOLE:

CRUISE POWER:

Enables the cruise control.



Lighted Switch

Non-Lighted Switch

060066C

SET/RESUME Switch:

The cruise Power and Set/Resume switches are used together to provide cruise operations and can be used to control engine idle.

- **To Establish Cruise Speed:** Accelerate to the desired speed. Press the switch to **SET**.
- **To Cancel the Cruise Control:** Step on the brake. Press the switch to **RESUME** to accelerate to the pre-programmed speed. Turning the Cruise Power switch **OFF** cancels the cruise control.

Controlling Engine Idle:

- Turn cruise control **ON**.
- Press **RESUME** momentarily to set idle at 950 RPM.
- Press **SET** momentarily, to set engine RPM at 1150.
- Press and hold **RESUME**, engine idle slowly increases. Release when desired RPM is obtained.
- Press and hold **SET** to slowly lower RPM. Release when desired RPM is obtained.

WARNING:

Do not use cruise control in heavy traffic or on roads that are winding, slippery or unpaved. Do not shift the transmission into “N” (Neutral) with the cruise control on. High engine RPM run up will occur until the cruise control is turned off.

BATT BOOST:

In the event the motorhome chassis battery has been drained and cannot start the engine, this switch momentarily "jumps" the domestic battery to the motorhome chassis battery to assist in starting the engine.



EXH BRAKE:

Auxiliary braking device for slowing down the motorhome. For flat dry road conditions apply the exhaust brake until speed is reduced. The exhaust brake is very effective for speed control in town and on local routes. Use the exhaust brake to slow down when preparing to exit onto an off-ramp, when approaching traffic lights or when approaching slowed or stopped traffic. The exhaust brake is not a substitute for the service brakes. Do not neglect service brake maintenance.

MIRROR HEAT:

The switch turns on the heaters in outside rearview mirrors. Mirror heaters should be used when defogging or deicing is needed. To use mirror heat, press the switch to the ON position.

AIR DUMP:

Dumps air from the air bags. It may be an aid in leveling the motorhome. Releasing the air from air bags will give the leveler more range of travel for leveling. Ignition must be in accessory or run position.

NOTE:

Never drive the motorhome with the air bags deflated. This may damage the motorhome.

ICC FLASH:

This function is the ICC (Interstate Commerce Commission) courtesy lamp. When the headlights are ON, the taillights and all marker lights to go off as long as the switch is pressed.

RIGHT SIDE DASH:**LH SHADE:**

Operates the power sun visor located driver side.

RH SHADE:

Operates the power sun visor located passenger side.

GEN START:

The generator automatically initiates a preheat cycle when the switch is pressed to START. The preheat cycle is indicated by the light on the switch flashing rapidly. Depending on ambient temperature the preheat cycle may last up to 10 seconds. For detailed operating instructions, see section eight.

STEP COVER:

Extends and retracts the step cover.

RADIO:

Applies power to the dash radio. This will allow the radio to be turned ON and OFF, independent of the main radio switch.

STEPWELL:**BATT CUTOFF:**

Turns power ON and OFF to interior 12 Volt panel.

ENTRY STEP:

Provides power to the Entry Step.

CEILING LIGHT:

Illuminates the front ceiling light from the entry area.

PORCH LIGHT:

Turns on the outside porch light **ON** and **OFF**.

PASSENGER CONSOLE:

STEP WELL LIGHTS:

Turn lights on and off in stepwell.

STOR LIGHT:

Turns lights on and off in basement storage bays.

PASS SHADE:

Same as “RH SHADE SWITCH” on Left Side Dash.

MIRROR ADJUST:

To adjust the outside mirrors, the small selector in the middle of the switch must be placed in the desired side. The middle position is to prevent accidental bumping of the switch and changing the mirror position. The outside mirrors have been placed so that they can be easily adjusted with an Allen wrench. After taking delivery of the new motorhome it will be necessary to sit in the driver’s seat and adjust the mirrors to driver’s needs. Both the driver and the passenger mirrors should be adjusted.

HEADLIGHT:

Pull one click to operate the parking lights. Pull two clicks to operate the headlights. Rotating the headlight switch clockwise will dim the dash lights. Rotate switch fully counter-clockwise to power maplights. Battery cut-off switch must be on for maplights to operate.

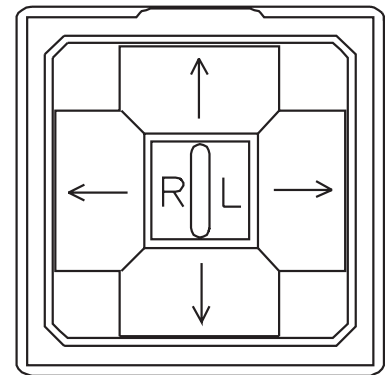
WIPER/WASHER:

Wiper operations are controlled when rotating the knob to the right. When the knob is rotated from OFF to DELAY, the wiper will turn on and time delay between wipes will occur. The amount of delay time changes as the knob is rotated. A continuous low or high speed can be obtained by rotating the knob to the appropriate position. The wipers will be turned OFF with the switch in the OFF position. When the knob is pushed in, washer fluid will be dispensed from the system and the wipers will turn on momentarily.

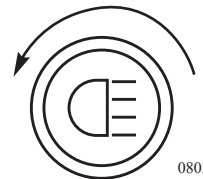
BACKUP MONITOR:

This system is designed to provide the driver with a view of the rear of the motorhome. See section two for detailed operating instructions.

Controls

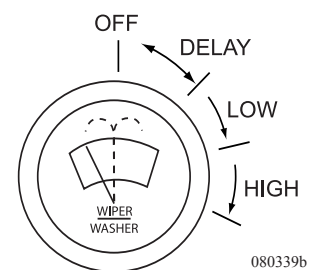


Located on Drivers Console 080378



080332

Headlight Control on dash.



080339b

Wiper Control

DASH AIR CONDITIONER & HEATER CONTROLS

The system is designed to only provide heating, cooling and defrost for the pilot and co-pilot area. The system is not capable of heating or cooling the entire motorhome.

Blower Control Switch:

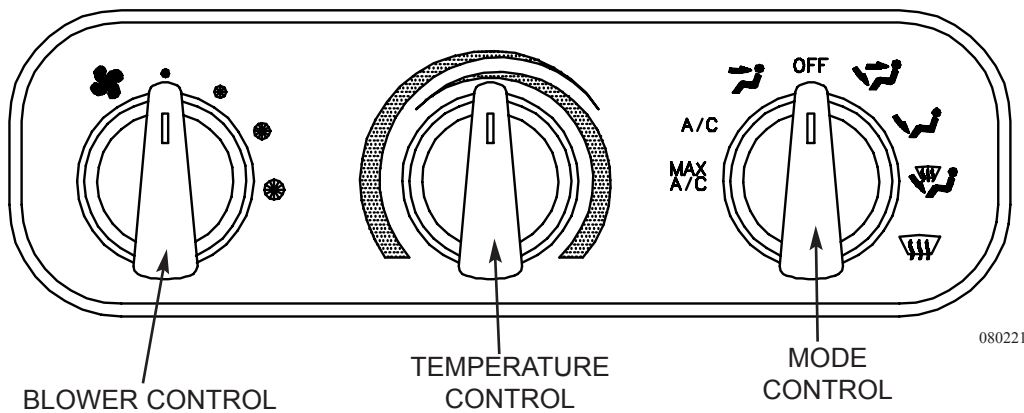
This switch controls the four speeds of the blower motor. This is one of the best and most effective ways of controlling temperature. The blower will not activate until the Mode Control Switch is set to any position other than Off.

Temperature Control Switch:

Setting the switch to the **Red** zone controls an electric water valve regulating the amount of engine coolant passing through the heating coils in the system. Rotating to the **Blue** zone sets the cut-in/cut-out temperature of the air conditioning compressor on the engine.

Mode Control Switch:

This switch directs air flow by opening or closing damper doors. Use the Mode Control Switch to direct airflow where it is needed to maximize comfort in the cockpit area.





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.



OFF - The blower motor does not operate. The fresh air inlet door will close, minimizing outside air infiltration into the motorhome.



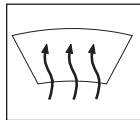
BI-LEVEL - Fresh air is drawn in and discharged through the dash and the floor.



FLOOR - Fresh air is drawn in and discharged through the floor louvers.



MIX - Fresh air is drawn in and discharged through the floor and defrost louvers. The A/C system operates to dehumidify the discharged air.



DEFROST - Fresh air is drawn in and discharged through the defrost louvers. The A/C system operates to dehumidify the discharged air.

NOTE:

The air conditioning compressor operates in all modes except VENT, FLOOR and OFF to dehumidify the air. Rotate the temperature control switch to set discharge air temperature.

Heat and Defrost Operation:

- Set the Mode Control Switch to the desired position.
- Set the Temperature Control Switch to the red zone.

A/C Operation:

- Setting the Mode Control Switch to A/C will allow outside air into the system.
- Setting the Mode Control Switch to MAX A/C will recirculate inside air. Select this position when maximum cold air is desired.
- Set the Temperature Control Switch to the blue zone.

Operating Hints and Tips:

- Air intake and discharge temperatures are greatly affected by ambient temperature and relative humidity.
- A large amount of cooling capacity is used to dehumidify air as well as cool it. After three to five minutes of A/C compressor operation, discharged air temperature should be approximately 30° F cooler than the fresh or recirculated air entering the A/C system.
- The air system on the motorhome must have adequate pressure to operate the damper doors.
- At the beginning of the day, activate the compressor with the engine at idle. This will avoid sudden high speed activation resulting in damage from lack of internal compressor lubrication.
- The dash A/C and heater system should be used monthly to keep the compressor lubricated.

Winter Use:

- De-ice the windshield using the **MIX** or **DEFROST** mode.
- Higher temperature discharge air will occur with the blower set to a lower speed setting until the engine has reached normal operating temperature.

Summer Use:

- Close all windows and vents to hot, humid outside air.
- **MAX AC** and **HI** blower will provide a quick cool down.
- Using a lower blower speed will produce cooler discharge air.

Heater:

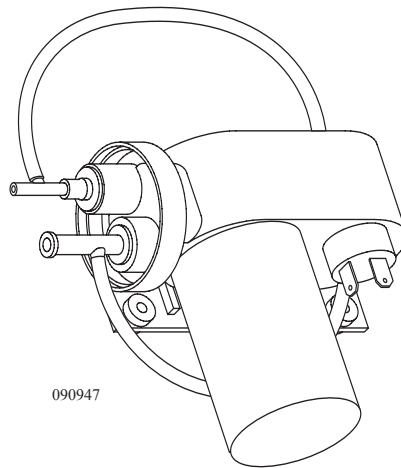
Heated engine coolant is pumped to an electric valve that controls coolant flow to the heater core. When the Mode switch is in the **MIX** or **DEFROST** position, the AC compressor will turn on to dehumidify the air to increase the efficiency of defrosting the windshield. Air is drawn into the system by a blow 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 air flow is felt at the discharge vents.

Electric Water Valve:

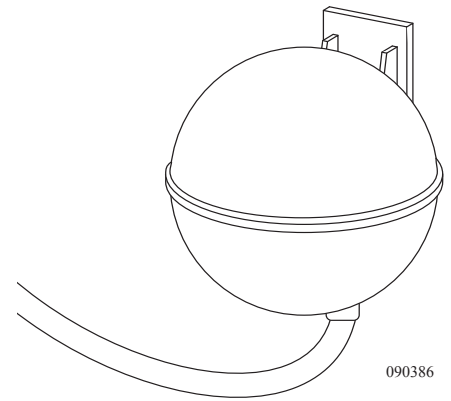
The thermostat is a potentiometer. The water valve, which controls the water flow to the heater core, is opened and closed by a stepper motor mounted on the water valve. A control module compares the output voltage from the potentiometer to the feedback for the stepper motor of the water valve. The control module then drives the motor to within one-half volt of the control potentiometer 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.



Vacuum Generator located in diesel generator compartment.



Vacuum Reservoir Ball located in diesel generator compartment.

Vacuum Generator:

The vacuum generator creates vacuum to open and close the vacuum switches. The vacuum generator creates and stores 15” of vacuum in a reservoir ball. Output from the reservoir is sent to the vent control knobs to open or close vents and switches. The vacuum generator will operate whenever the ignition is ON, and the A/C is operating.

About Refrigerants**Chemical Stability:**

The air conditioning system life and efficient operations depends upon the chemical stability of the refrigeration system. The refrigeration system is made of Refrigerant-R134a and Polyakylene Glycol (PAG) synthetic lubricant. It is very important that all materials contained within the refrigerant system be chemically compatible.

NOTE:

An ultraviolet or UV Blue Light is used for leak detection.

The only suitable compound for use with R134a is PAG. The total amount of PAG within the refrigerant system is approximately 18% of the total refrigerant in the system.

How much refrigerant is in the system? How much should be used when charging? You will need 1 oz. of PAG for each 7 feet of hose after the first 15 feet of hose. Roughly, a 40 foot motorhome will use 92 feet of refrigerant hose. Take 15 feet off the measurement and the result is 77 feet. This 77 feet is then divided by 7 for total of 11, and represents the number of ounces of PAG oil needed for the A/C system (11 oz.).

Carrying the formula one step further, the 11 oz. equal approximately 18% of the entire system. The total will equate to approximately 61 oz. or 3.8 lbs. of R134a.

High pressure readings are another way to determine the amount of charge. The ambient temperature reading is measured one inch away from the condenser. The ambient temperature reading, plus 40° F, will equate to a value from the pressure table.

EXAMPLE:

90° F. 1 inch from condenser + 40° F = 130° F ----- 198.90 PSIG -

On fully charged system the expected pressure that should be seen on the HIGH-SIDE gauge will be around 200 PSIG.

NOTE:

All systems are charged at the factory with 4.0 lbs of R134a. A fluorescent dye has been added for leak detection.

TEMPERATURE	PSI GAUGE	TEMPERATURE	PSI GAUGE	TEMPERATURE	PSI GAUGE
16° F	15.69	60° F	57.47	112° F	151.30
18° F	17.04	65° F	64.10	114° F	156.10
20° F	18.43	70° F	71.19	116° F	161.10
22° F	19.73	75° F	78.75	118° F	166.10
24° F	21.35	80° F	86.80	120° F	171.30
26° F	22.88	85° F	95.40	122° F	176.60
28° F	24.47	90° F	104.40	124° F	182.00
30° F	26.10	91° F	106.30	126° F	187.50
32° F	27.79	92° F	108.20	128° F	193.10
34° F	29.52	93° F	110.20	130° F	198.90
36° F	31.32	94° F	112.10	135° F	213.70
38° F	33.17	95° F	114.10	140° F	229.40
40° F	35.07	100° F	124.30	145° F	245.80
42° F	37.03	102° F	128.50	150° F	263.00
44° F	39.05	104° F	132.90	155° F	281.00
45° F	40.09	106° F	137.30	160° F	300.10
50° F	45.48	108° F	141.90	165° F	320.00
55° F	51.27	110° F	146.50	170° F	340.80

psi gauge_temp.eps

R-134a Refrigerant:

R134a is classified non-explosive, non-flammable and non-corrosive.

R134a is ozone friendly; however, it is not technician friendly. Proper care in handling must be observed. Under normal atmospheric pressures and temperatures R134a will evaporate so quickly it will freeze anything it comes in contact with. The open container boiling point for R134a is minus 21.7° F. This low boiling point makes for an ideal refrigerant. The tremendous amount of heat transfer which occurs when a liquid boils, or vapors condense, forms the basic principle of all A/C systems. The amount of heat required to raise or lower the temperature of one pound of water by 1° F equals one British Thermal Unit (BTU). The BTU is the standard measurement of an air conditioner system.

Safety and Handling of 134a and Pag Oil:

- Wear eye and hand protection.
- Pag Oil irritates the skin. Flush with water immediately if in contact with any body part.
- Ensure all service work on the A/C system is performed in a well ventilated work area.
- Keep open flame away from service area. The discharge of a refrigerant near an open flame can produce a poisonous gas.

NOTE:

O-rings required for the 134a system are Hydrogenated Nitrite Butadiene Rubber (HNBR), and are green in color.

Air Conditioner Refrigeration 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, located on Roadside in rear compartment, 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/dryer, located in generator compartment, 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 the pressure.

Blower and Motor - Just as the condenser has a fan, 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.

Troubleshooting

The dash A/C and Heat system uses 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**

The following information is provided to assist in troubleshooting common operational problems which may occur:

No Heating:

1. Mode 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.

No Cooling:

1. Check that the blower is operating, A/C switch is in **A/C** or **Max** 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.

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.

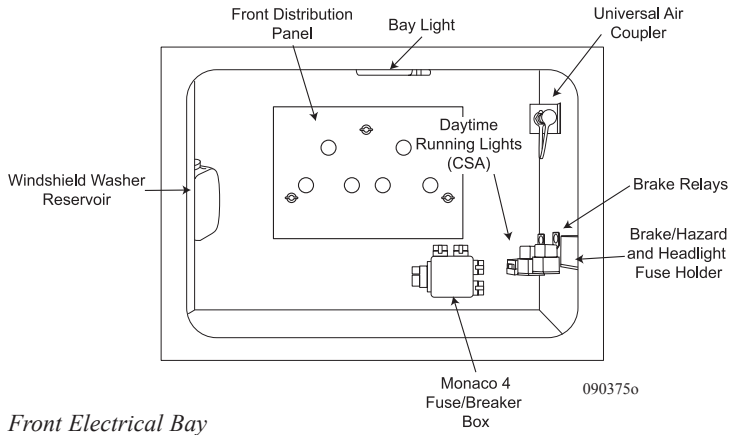
Blower Does Not Operate or Runs Slow:

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.

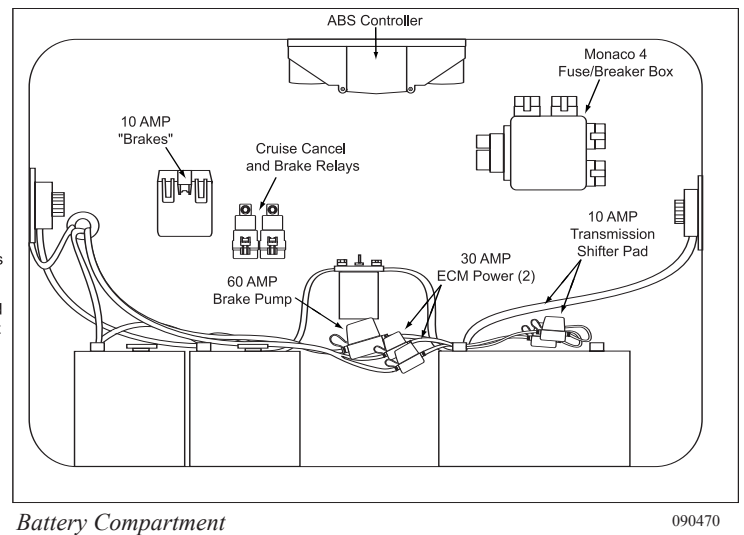
Damper Doors Do Not Operate:

1. Is the vacuum generator being powered and producing a vacuum?
2. Check the vacuum line entering the unit for vacuum.
3. Check that the vacuum solenoid mounted on unit is receiving power from the mode switch. If operating properly, the vacuum solenoid will feel hot if current is engaging the solenoid.
4. Check the mode switch.
5. Check wiring.
6. Check for a pinch in the vacuum line leading to the vacuum motor that operates the damper door in question.

CHASSIS FUSE LOCATION



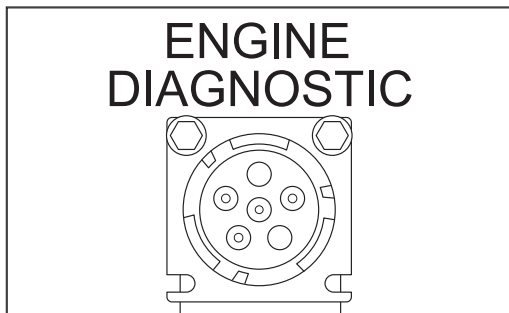
Front Electrical Bay



Battery Compartment

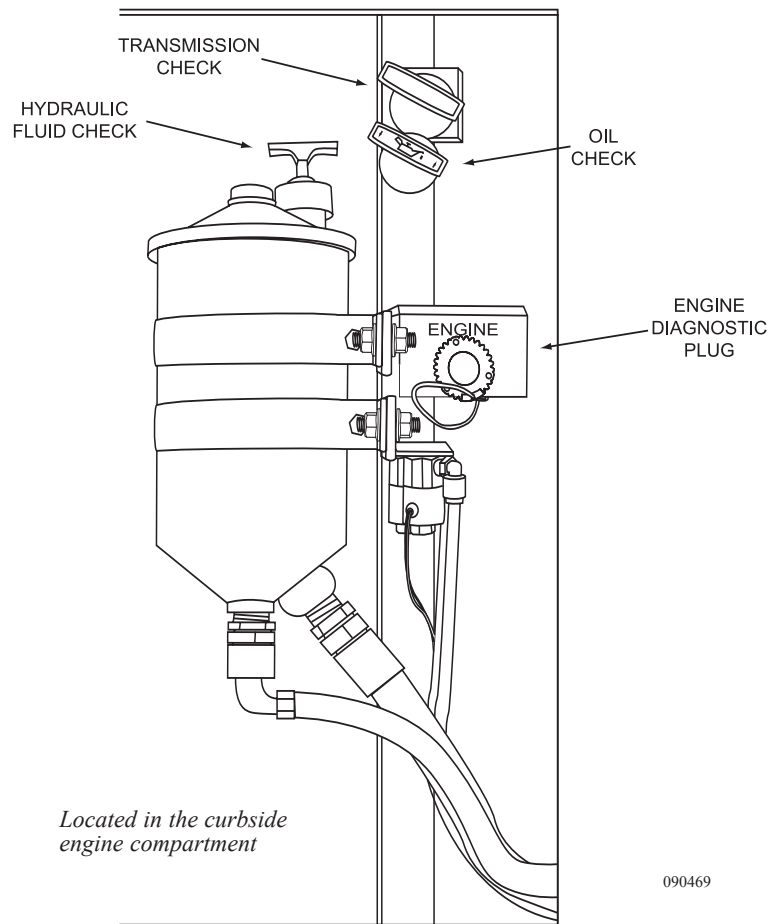
DIAGNOSTIC PLUG LOCATION

An engine diagnostic plug is located in the curbside engine compartment. There is another located left of the steering column.



Diagnostic Plug located on left of steering column

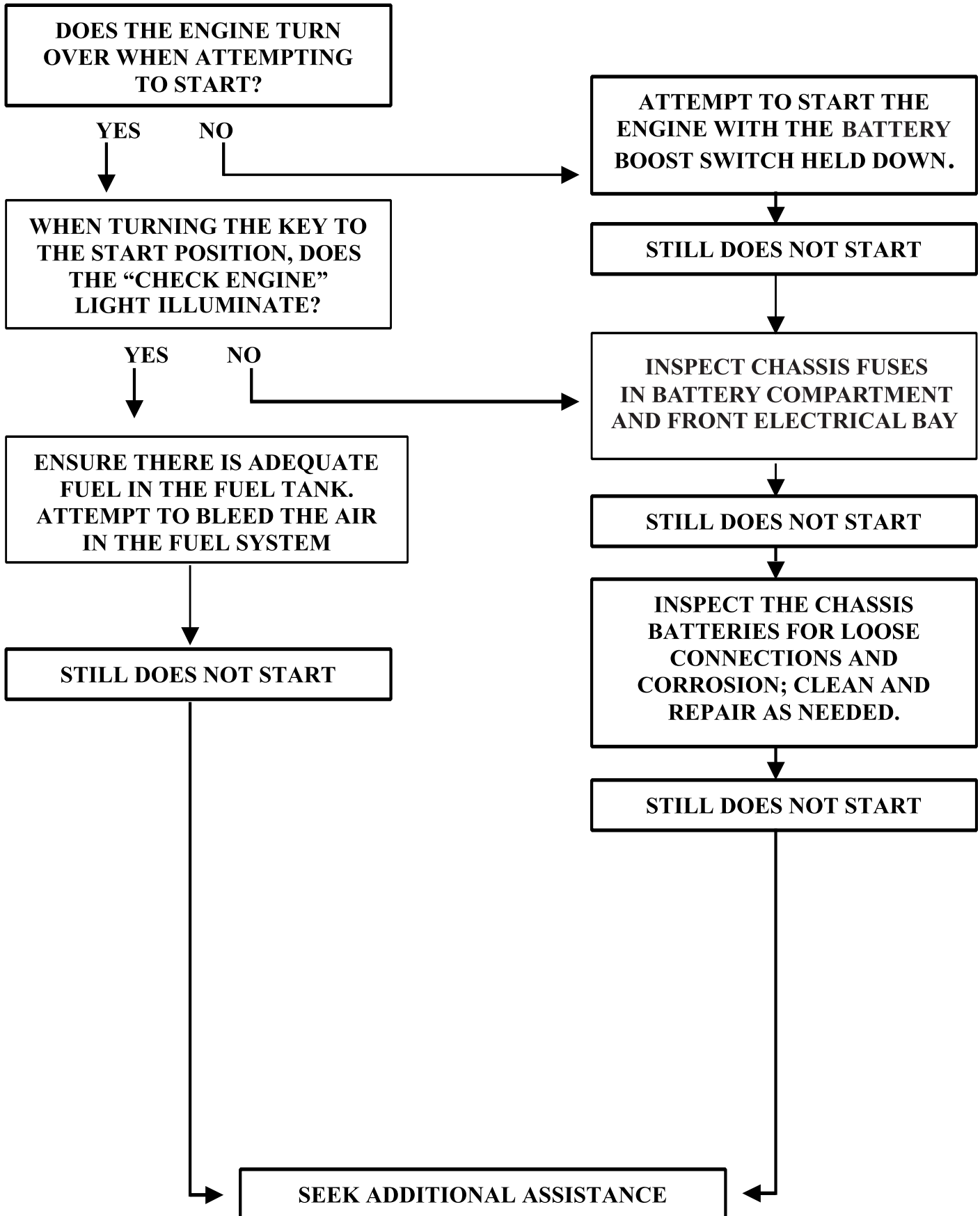
090280e



Located in the curbside engine compartment

090469

ENGINE "NO START" FLOW CHART





NEPTUNE 2005

CHASSIS INFORMATION

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This section contains knowledge and information on various components of the motorhome chassis. Following the guidelines and procedures will help you to understand and operate your motorhome. Complete instructions for engine and transmission are located in their respective operators manual included in the Owner's Information File box.

WARNING:

When frame or other welding is involved for motorhome repair or modification, only qualified, experienced technicians should weld on the chassis. Improper welding procedures and materials may weaken the assembly or result in damage that is not obvious and may not cause an immediate problem or failure. Unauthorized modifications or repairs to the chassis could result in a forfeiture of warranty coverage.

Due to the sensitive nature of the electronics on the chassis, the following precautions are required to protect electrical components in the motorhome chassis.

- 1. Disconnect the (+) positive and (-) negative battery connection, and any electronic control ground wires connected to the frame or chassis.**
- 2. Cover electronic control components and wiring to protect from hot sparks.**
- 3. Disconnect the terminal plugs from the engine Electronic Control Unit located on the passenger side of the engine block.**
- 4. Disconnect all the plugs from the Allison Electronic Control Module located in the Electrical Bay at the driver's side front of the vehicle.**
- 5. Disconnect the wiring from the alternator.**
- 6. Do not connect welding cables to electronic control components.**
- 7. Attach the welding ground cable no more than two feet from the part to be welded.**

The Roadmaster chassis design provides exceptional balance, handling and braking characteristics. The Roadmaster Rails chassis is an engine and frame unit featuring a C channel all steel frame design, providing greater structural integrity and uniform stress distribution. Incorporated in the Roadmaster chassis is an air suspension system using four air bags and Monroe gas shock absorbers. The design and set up is intended to provide the smoothest ride, best handling and trouble free service while delivering excellent drivability. The Roadmaster Rails chassis is equipped with a Cummins diesel engine. The diesel engine utilizes an electronic injection system to supply fuel to the cylinders. This electronic fuel control allows for precise fuel delivery resulting in efficient operation. The Allison 2500 MH transmission is matched to the engine. This is an electronically controlled automatic transmission using the Shift-by-Wire system. Finally the chassis is equipped with a three-point hydraulic leveling system to help minimize site selection and provide comfort when camping. The Roadmaster chassis design offers unsurpassed ease of maintenance and service.

The towing system rating incorporated in the construction of the frame is 4000 lbs. towing and 400 lbs. tongue weight.



100168b

Tag located on the curbside, from behind front wheel, and in generator compartment.

Roadmaster's exclusive rails chassis, with air suspension, consists of front and rear axles with trailing links. An air compressor mounted directly to the engine provides air pressure for the air suspension system. Each of the four air bags couples with a gas shock absorber to dampen suspension movement. The air bags themselves provide no lateral support to the suspension. This is accomplished using a panhard bar on each axle to control side motion. Each axle mounts to the trailing links that are connected to the chassis. While the suspension itself has no maintenance requirements, an annual inspection of the suspension system should be performed with special attention to tightness of fasteners and component wear.

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

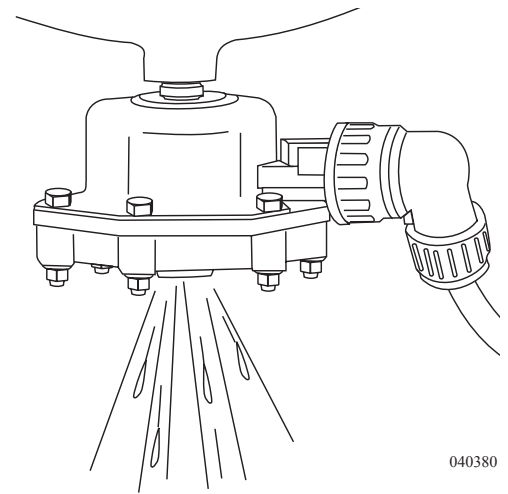
The air compressing system on the motorhome consists of an air compressor, air governor, and air tank. The compressed air system operates several items, some of which include: suspension, an air gauge (depending on options) and stepwell cover. A gear driven air compressor mounted on the engine charges the system. As engine speed increases, compressed air output increases. When air is compressed, heat is generated. Heat dissipates as the air is discharged from the compressor. Moisture condenses in the compressed air as it cools. Moisture laden air is released through the automatic drain on the bottom of the air tank. The 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. The tank is equipped with a pop valve for over-pressure protection, a manual drain valve and automatic drain valve. The manual drain is located on the DRY side of the tank. The pop valve and automatic drain valve are located on the WET side. The pop valve is designed to release pressure in the tank when the pressure exceeds 130 psi. With the ignition switched to ON, the automatic drain valve (standard brake models) wired to the brake light circuit will activate each time the brakes are applied. Only a small amount of air/water is expelled. The momentary release of air/water from the tank is audible.

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 a stepwell cover, receive air through a pressure protection valve (PPV). The PPV will not allow compressed air flow until approximately 60 psi. In case of an air system problem, the pressure protection valve will leave a reserve air charge for braking. Pressure protection valves are installed for safety.

A low-pressure air switch connected to a warning lamp on the dash console monitors the air system. The lamp will illuminate when a low-pressure condition exists. Check the operation of the low air lamp when the air tank is drained.

NOTE:

The air tank should be drained manually every 30 days. Open the manual drain on the bottom of the tank until all air escapes. Leave valve open an additional five minutes allowing excess moisture to drain.



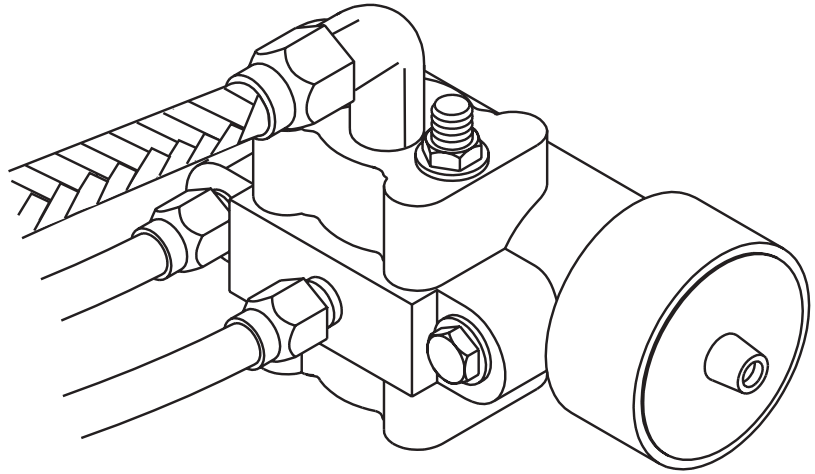
Automatic drain on standard brake models.

040380

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 105 to 120 psi.

Cut-in pressure of approximately 105 psi is factory preset from the governor manufacturer and is not adjustable. Cut-out pressure is calibrated to 120 psi. When cut-out pressure is reached, the governor will deactivate the compressor.



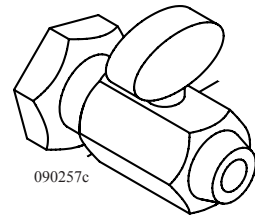
090319

Air Storage Tank

The air tank should be drained manually once per month, or more, depending on operating conditions where humidity is high. The air tank is equipped with an auto drain valve on the wet side and a manual drain valve on the dry side. The air tank has a pressure relief valve which is set to release at 130 PSI.

To Drain Air Tank:

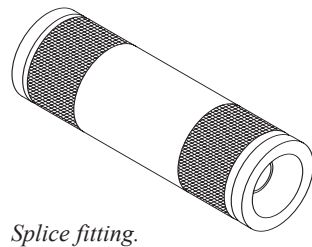
- Slowly open the manual drain valve as moisture will be expelled under pressure. After moisture and air is purged from the tank, the valve should remain open an additional five minutes to allow any remaining moisture a chance to drain.
- Close valves and start engine. Check for leaks.



090257c

Valve located on bottom of air tank in front of steer axle.

Push-in fittings, used to connect air hoses between pneumatic operated items, are designed for quick and easy maintenance and repair. Sizes and types of fittings vary for different applications. Threaded fittings adapt the push-in fittings to connect pneumatically operated items. Main parts include the release ring, locking ring, solid brass body and special rubber compound O-ring. Damaged hoses can be repaired by splicing.



Splice fitting.

090445

To Disconnect Hose:

- Push hose into fitting.
- Push release ring down against locking ring portion of the fitting body.
- While holding the release ring down, pull hose away from fitting.

To Connect Hose:

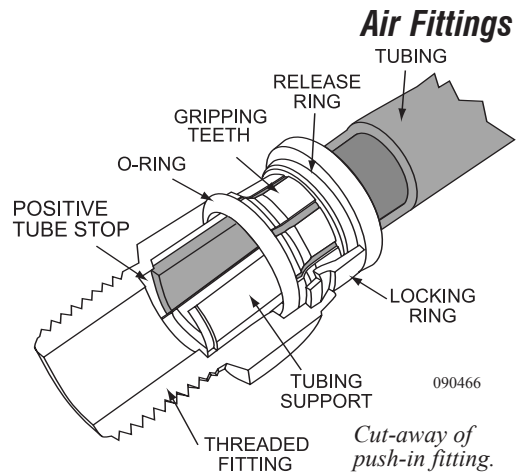
- Push hose into fitting through the release ring and the O-ring, using a slight twisting motion to seat firmly against the internal tube stop.
- Pull hose away from fitting to expand and set inner seal. Ensure hose is properly retained in fitting.

NOTE:

When putting air hose back into fitting, be sure that hose is cut as squarely as possible so that the hose will evenly seal in the fitting. The cavity of the positive tubing stop provides support to prevent leakage.

WARNING:

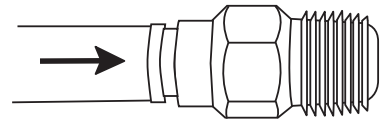
Do not remove air hoses from fittings while system is pressurized. Serious personal injury may occur.



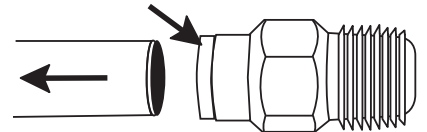
090466
Cut-away of push-in fitting.

DISCONNECT

Push hose and ring in.



Hold release ring in place.

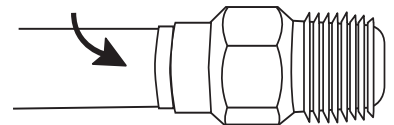


Pull hose away from fitting.

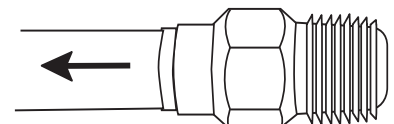
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CONNECT

Twist hose into fitting.

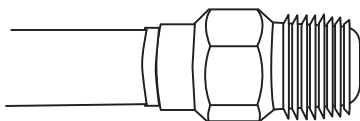


Pull hose to secure.

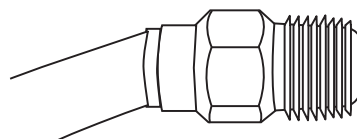


090466

CORRECT



INCORRECT



090466

Air Coupler - Universal

Provided for convenience is a remote air supply coupler, located in the front roadside electrical compartment. This female fitting will accept type C automotive male air fittings. The 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 air tank through a pressure protection valve.

To Use the Universal Air Coupler:

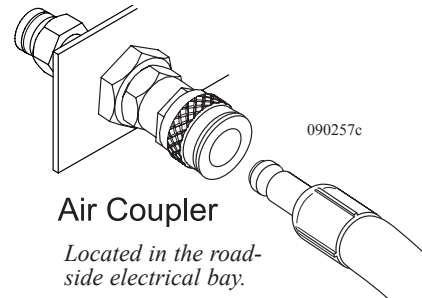
- Remove the plastic protective dust cap.
- Using a firm grip, insert the air fitting into auxiliary air supply. The locking collar is spring loaded and will lock automatically when the fitting is properly inserted.

To remove fitting:

- Firmly grip the air hose near the fitting to prevent recoil.
- Slide the locking collar back to release fitting. The collar will lock into the open position when fully retracted.
- Replace the protective dust cap when finished.

NOTE:

There are small air pressure restrictions in the pressure protection valve and tire stem valve. Due to this restriction, the maximum amount of tire pressure achieved when the system is used to fill a tire is approximately 95 to 105 psi, with the air system on the motorhome charged to 120 psi.



Air Spring Inspections

Listed below are items that can be checked when the motorhome is in for periodic maintenance.

NOTE:

Never attempt to service the air suspension on a motorhome with the air bags inflated.

- **Inspect** the outside diameter of the air springs. Check for signs of irregular wear or heat cracking.
- **Inspect** the air lines to make sure contact does not exist between the air line and the outside diameter of the air springs. Air lines can rub a hole in an air spring very quickly.
- Check to see that there is sufficient clearance around the complete circumference of the air spring while at its maximum diameter.
- **Inspect** the outside diameter 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) play a large part in ensuring that 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 and isopropyl alcohol. Unapproved cleaning methods include all organic solvents, open flames, abrasives and direct pressurized steam cleaning.

HEIGHT CONTROL VALVES

Height Control Valves (HCV) inflate or deflate air springs to maintain proper suspension height throughout the load range. Two Height Control Valves are installed at the rear drive axle to control rear suspension height and left or right tilt of the motorhome. A separate HCV is installed to control front suspension height. The three HCVs mount to the main frame of the motorhome, above the axles, with a linkage rod connecting the valve to the axle.

Actuating components inside of the valves are oil dampened to reduce valve reaction to momentary suspension bounce and rebound. When a constant suspension change occurs, such as a load change or weight transfer through a sustained corner, the valve reacts by adding or purging air from the air springs as needed.

The air springs mount between the main frame rails and the trailing links. There is a specified distance the air spring must maintain between the mounting plates. Other than specified distance between the plates will compromise ride quality and handling, and affect shock absorber travel, drive shaft angle, as well as various other running gear components.

Should it become necessary to check the suspension ride height, start with the motorhome on a flat level surface. The air system must be fully charged with the suspension normalized at ride height. Specified distances may vary plus or minus ¼". Small offset adjustments to the rear valves may be necessary to compensate for slight tilt. Example: Adjusting the curbside rear height control valve up will pivot the roadside front corner down.

NOTE:

Drive shaft angle is affected by the suspension ride height. Improper drive shaft angle can damage suspension or shorten the life of universal joints. Shock absorbers and air springs are in travel centers at proper ride height.

Adjusting Ride Height

The proper Ride Height measurements are: 6 ½" front and 8" rear. Ride heights should be within ¼".

To adjust the suspension ride height begin with:

- The motorhome on flat level surface.
- Air system fully charged.
- Suspension at normal ride height.

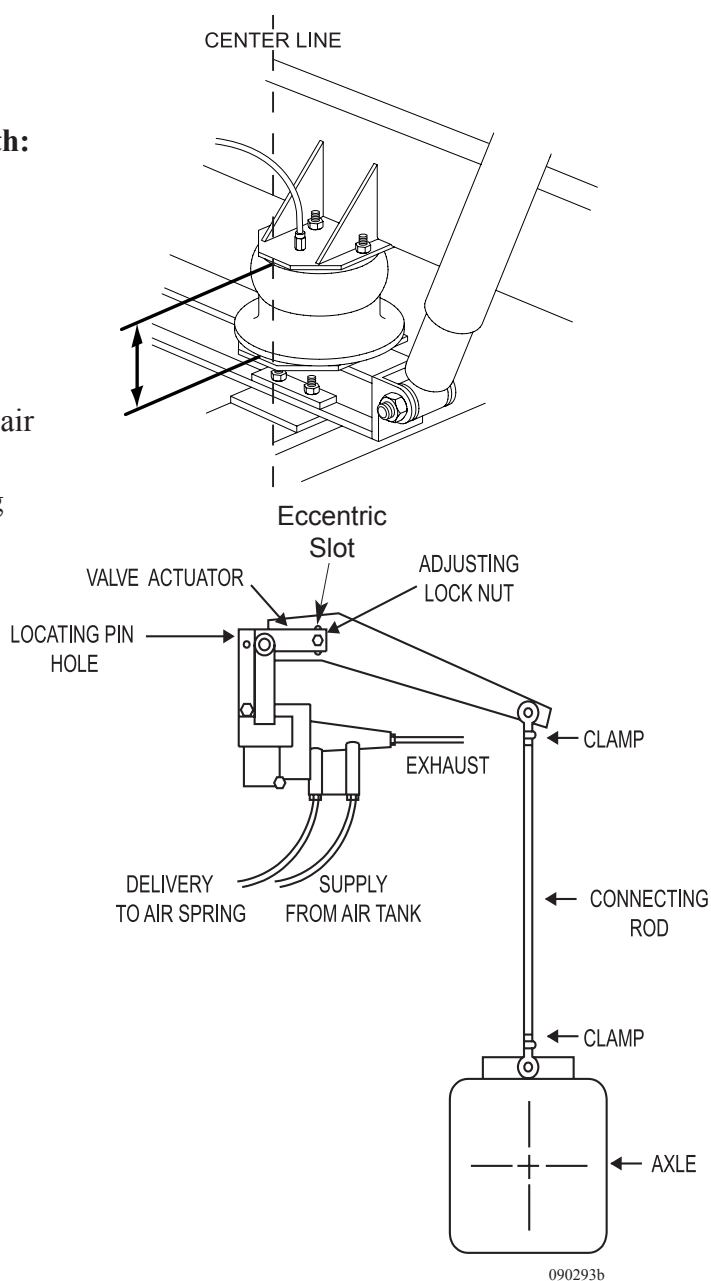
Start by checking the distance in the front.

1. Measure the distance between the mounting plates of the air springs at the centerline of the air spring.
2. If the measurement is off, loosen the adjusting lock nut at the eccentric slot on the valve.
3. Move the plastic arm up to raise suspension height and inflate the air spring. Move the plastic arm down to lower suspension height and deflate the air spring. Make adjustments in small increments.
4. After obtaining the specified distance, insert a 1/8" or 7/64" inch twist drill bit into the plastic arm and valve body. This will center the travel of internal piston. Tighten adjusting lock nut between 60 - 80 in/lbs.
5. Check adjustments made by using the Air Dump switch to deflate air springs. Start the engine and allow the air system to become fully charged. Allow the suspension to adjust and come to a neutral setting.
6. Re-check the suspension height measurement. Follow the same procedure for each rear control valve.
7. Re-check the front suspension height after adjusting the rear height control valves.

NOTE:

Do not modify length of the linkage rods. Make any necessary adjustments using eccentric slot on the ride height control valve.

Once set correctly, the ride height setting should not change, except in the case of a component failure. This is usually characterized by one end of the motorhome sitting unusually low or high. In the event this occurs, it is not advisable to drive as body or suspension damage may result.



BRAKE SYSTEM

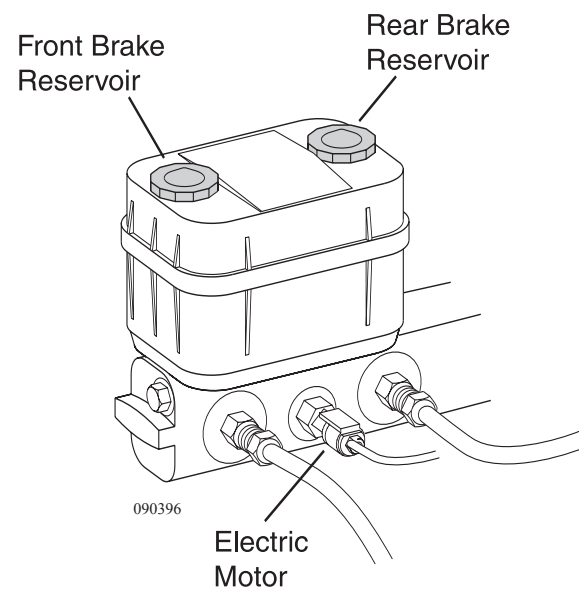
The chassis incorporates four separate braking systems: Service Brakes, Parking/Emergency, Antilock Braking System (ABS) and the Engine (Exhaust). The Service Brakes Brake System uses a hydraulic brake actuation system. This system includes a hydraulic booster assembly, a master cylinder assembly and a monitoring system. A reserve electric-hydraulic pump is included as a safety feature to provide limited power assist should the primary system fail.

The Hydro-Max brake system gets primary power for the booster from the power steering pump. The reserve electric motor pump is turned on by a relay that is activated when an integral flow switch detects the lost flow of power steering fluid. The brakes will remain operational with a greatly increased stopping distance in the event that both the primary hydraulic and the backup electrical pump fail to operate.

Electrical Pump & Master Cylinder

The electric pump motor provides reserve power for the booster assembly. The entire assembly should be replaced when a failure occurs. When the electric pump motor is working you will only have one-half the brake boost. Caution should be taken, as braking distance will be increased. To test reserve power, apply the brake pedal with the ignition "OFF." The electric pump should run and be audible.

The design of the master cylinder provides two separate brake fluid systems (front and rear). One system will operate should a failure occur in the other. When checking the fluid level in the master cylinder, the fluid should be clean with no evidence of contamination. A surge of fluid should occur when the brake pedal is applied, and fluid level should be at the bottom of the port ring openings. Since the master cylinder is the highest point of the system, gravity flow bleeding can be accomplished. Gravity flow bleeding requires only one person and NO pressure bleeder. Each caliper has a bleeder valve for removing any air in the system.



Maintenance & Troubleshooting

The most critical part of maintaining the service brake system is bleeding the system. Prior to bleeding the system, ensure all hose clamps, line connectors and fittings are tight enough to prevent air from entering the system or fluid from leaking. The hydraulic brake system must be free of air to function properly. When bleeding, check the fluid level in both the power steering reservoir and master cylinder. If power steering fluid is noticed in the master cylinder, End Cap service on the power booster assembly can correct the leak. The Hydro-Max system should be bled prior to the brake system. Applying the brakes will cycle the pump and purge any air from the electric pump system.

NOTE:

The power steering system and the hydraulic portion of the brake system are two separate hydraulic systems. The fluids are not compatible and should not be mixed. Mixing of fluids will damage the systems and reduce service life.

NOTE:

Do not attempt to move the motorhome in the event any line is disconnected, a component is removed or part of the hydraulic brake system is opened. There will be no braking capabilities until the affected system is bled.

The engine will need to be started to bleed the booster. When started, applying the brakes two to three times will purge the air from the booster. Inspect fluid levels and add fluid as required.

WARNING:

Brake lining may contain asbestos material and should only be serviced by qualified service technicians who are trained in the appropriate precautionary procedures.

Bleeding the System:

A supply of clean brake fluid must be used during bleeding. Also, maintain the proper fluid level in the reservoir during bleeding. The sequence for opening the bleeder valves is curbside rear, roadside rear, curbside front and roadside front. A clear plastic tube inserted over the bleeder valve can aide in viewing air. Place the other end of the plastic tube in a container to catch the drain. When the valve is opened, observe the flow of fluid. Once a steady flow of fluid is present, close the bleeder valve. Check the fluid level in the master cylinder and repeat the process for the remaining calipers.

Flushing the system requires that the bleeder valve be left open until the fluid appears clear and uncontaminated. The system should be flushed whenever any repair has been performed, ensuring clean and uncontaminated fluid in the system.

NOTE:

Do not reuse brake fluid that has been drained as the fluid may be contaminated.

Tires, suspension, wheel alignment and shocks can affect braking performance and should be inspected prior to checking the braking system. Some problems and repairs are listed below:

- Pedal fade is a good indication of leaks in the system. Inspect and repair leaks.
- Sluggish brake response indicates air has been introduced into the system. Bleed the brake system.
- Excessive pedal travel or excessive pedal effort relates to booster and master cylinder.
- Booster doesn't function properly in power or back-up mode. Repair the booster and pump assembly.
- Booster works only in the back up mode. Repair the booster assembly.
- Booster works only in the power mode. Repair the back-up pump.
- Dragging, grabbing, squealing or pulling brakes require servicing pads and calipers.

Park Brake & Emergency Brake System

The parking brake system is activated when the push-pull control knob (located on the driver's left console panel) is pulled. When the knob is pushed, the brake is released. Prior to driving, allow time for the air compressor to build up sufficient air to shut off the air-warning lamp.

NOTE:

When the park brake is released, the Park illumination lamp will remain lit until air system pressure is above 65 psi.

WARNING:

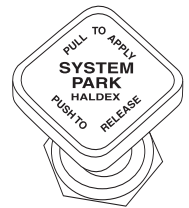
When parked, if the air tank is not depleted, there is the possibility of an accidental release of the parking brake. Traveling with small children and/or pets may require a small block to be fabricated to prevent accidental release. The block should be placed under the knob on the dash panel. A wooden clothespin, clasped at the base of the shaft, will work.

Using the Parking Brake:

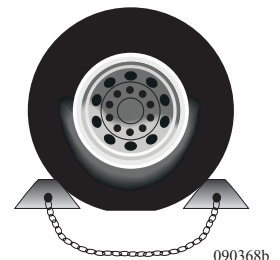
Bring the motorhome to a complete stop using the service brakes and hold the brake pedal down. Allow the engine to come to a low idle (500 to 800 RPM). Apply the parking/emergency brake by pulling up on the knob. When the parking/emergency brake is set, select N (Neutral) on the shifter panel. Release the service brake pedal.

NOTE:

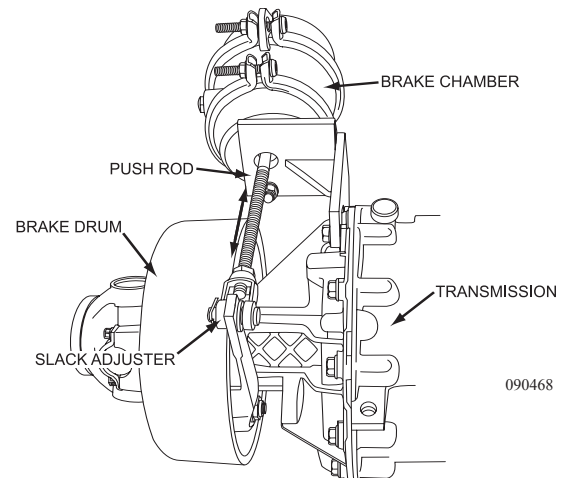
Chock all the wheels securely if the motorhome is left unattended.



park brake.eps



Properly Chocked Wheel



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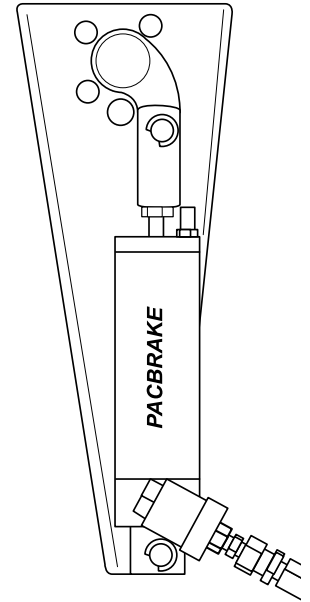
Brake drum for the park brake is located on the curbside above the transmission.

EXHAUST BRAKE

The Pac Brake exhaust retard system is an auxiliary braking device that is attached directly to the engine turbocharger. The exhaust brake operates by using a dash switch. The dash mounted switch will operate the exhaust brake when dash switch is **ON** and throttle is **RELEASED**.

When the exhaust brake is activated, a flapper inside the exhaust brake moves and restricts the flow of exhaust gases. This causes an increase of exhaust pressure within the engine. Increased exhaust back pressure quickly slows the engine speed resulting in powerful engine braking action. When the exhaust brake is activated, the amount of engine braking power developed is related to engine RPM. When an exhaust brake application is made, the engine braking affect increases with higher engine RPM.

The exhaust brake is wired to the electronically controlled transmission. When the exhaust brake is activated going down a hill, it will help control road speed or sufficiently slow the road speed until the Allison Transmission can automatically shift to the next lower gear. Downshifting automatically occurs from high gear down to second gear. Certain road conditions and engine speeds may require the transmission be manually shifted down in order to generate adequate engine RPM and increase the engine brake effect.



090392

NOTE:

The brake lights will illuminate while the Exhaust Brake is applied.

NOTE:

Activating the Exhaust Brake switch will cancel the cruise control.

CAUTION:

Use of the exhaust brake on wet and slippery surfaces can result in over-braking and loss of traction.

Maintenance

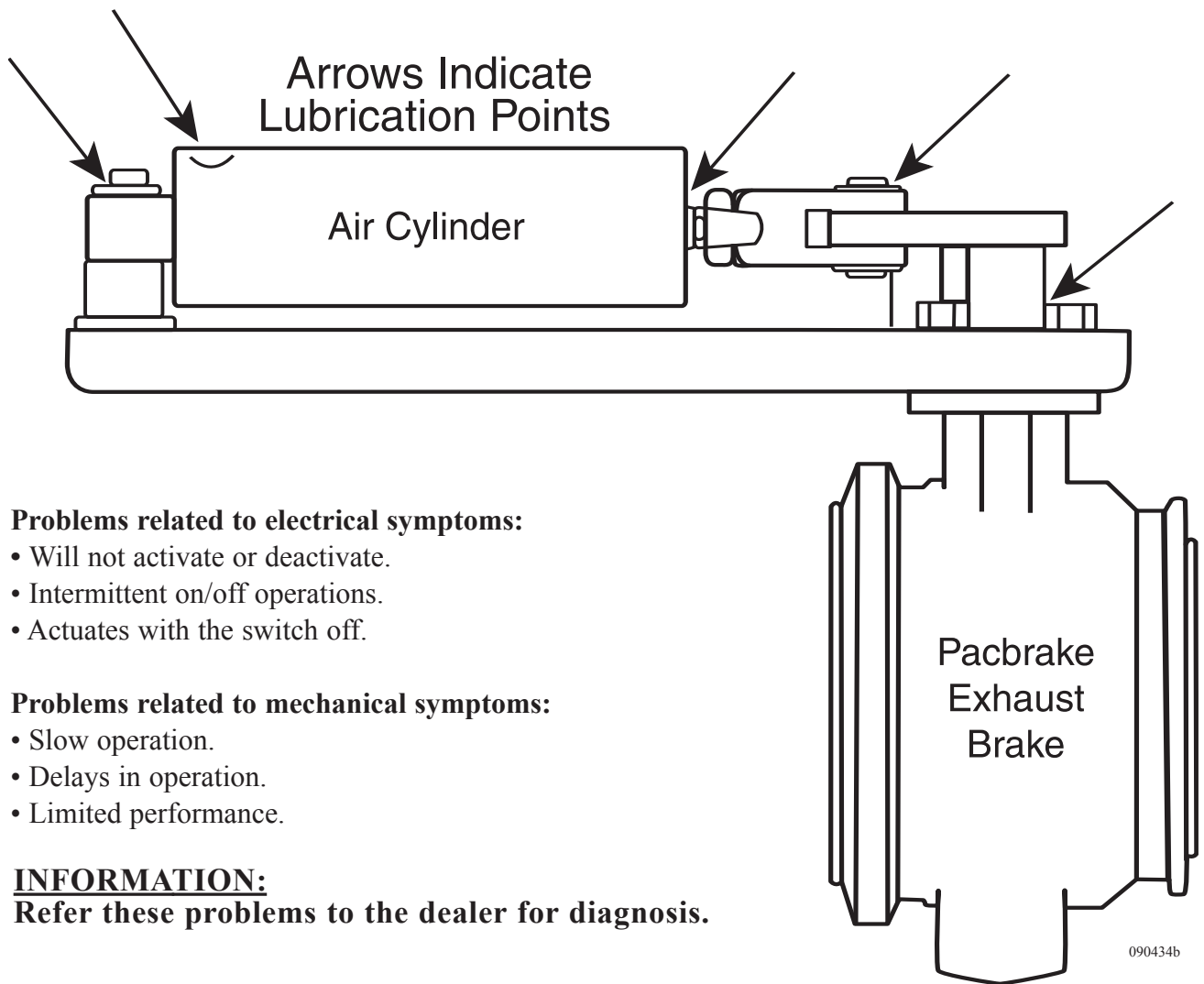
Moisture, dirt, carbon, and improper use all contribute to exhaust brake failure.

Starting the engine and idling for short periods of time is not recommended. Moisture is created within the engine and the exhaust system during cold startups. When normal operating temperatures are not obtained, moisture may get trapped in the valve housing resulting in rust and leading to insufficient operation of the exhaust brake.

To help prevent exhaust brake freeze-up caused by periods of non-use, it is recommended to use silicone spray at the points shown. Apply liberal amounts of silicone spray to the moving joints whenever the motorhome is parked for storage. Use a pair of pliers to manually operate the valve several times and work the lubricant into moving parts.

NOTE:

Do not use petroleum-based lubricants as these will burn off and possibly create a fire hazard.



Problems related to electrical symptoms:

- Will not activate or deactivate.
- Intermittent on/off operations.
- Actuates with the switch off.

Problems related to mechanical symptoms:

- Slow operation.
- Delays in operation.
- Limited performance.

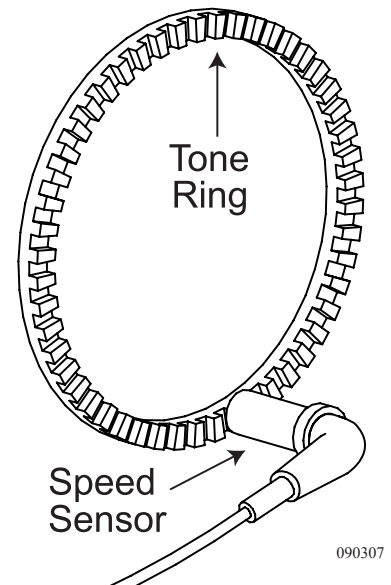
INFORMATION:

Refer these problems to the dealer for diagnosis.

ABS/ATC SYSTEM (Anti-lock Brakes)

The Hydraulic Antilock Braking System is an electronic wheel speed monitoring and control system. The Electronic Control Unit (ECU), located in the battery compartment, receives and processes signals sent from the wheel sensors located on each of the wheels. The ECU will process the signals and generate the commands to the solenoid control valves housed in the Modulator Assembly used to control the brake pressure. This process occurs when the wheels begin to lock. The rapid valve operations may even be noticed in the brake pedal.

The ABS indicator light located on the dash will alert the driver to possible system faults and is used by service personnel to assist in troubleshooting. In the event the ABS indicator light remains illuminated, normal braking is not affected. However, the ABS system may not function correctly in a panic stop. It is recommended to drive with caution and obtain service on the ABS system as soon as possible.



FRONT AXLE

While driving the motorhome, be aware of any changes in the feel of steering and have the system checked if there are any 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 not moving. Investigate any unusual or loud noises that occur. Begin by checking the hydraulic fluid level. Traveling at slow speeds over rough surfaces may cause a "clanking" noise to emanate from the steering column, but if noise is heard on smooth surfaces while turning back and forth sharply, the noise should be inspected and repaired as necessary.

Shimmy and looseness should be checked and corrected as soon as possible. If any 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 any evident play or uneven interaction between components to help pinpoint a problem. 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 spokes; a change in the alignment may indicate damage to the steering components or suspension.

Camber:

Camber, as shown, is vertical tilt of wheel as viewed from the front of the vehicle. 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:

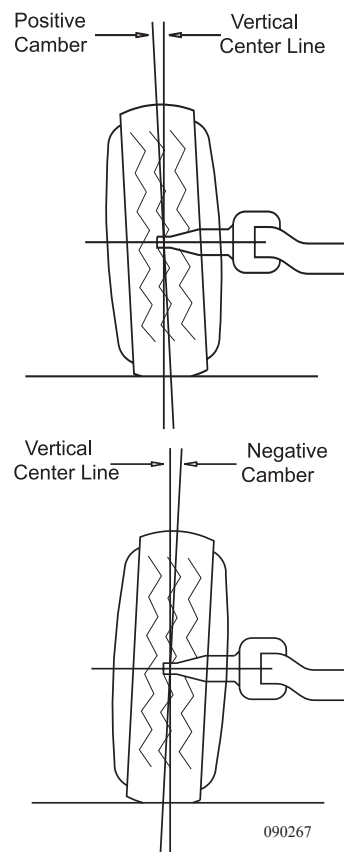
Occurs when the tire front distance is less than the tire rear distance.

Toe-out:

Occurs when the tire front distance is greater than the tire rear distance.

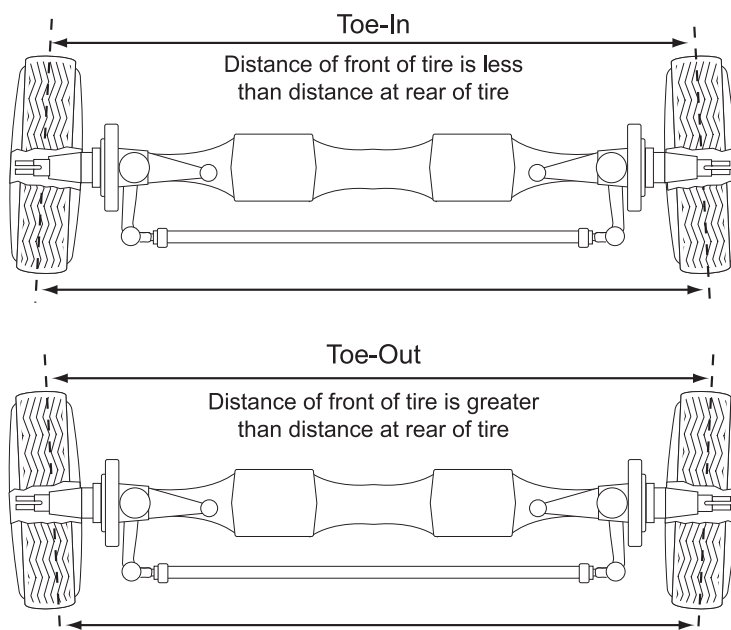
Wheels are generally set with initial toe-in. As the vehicle operates tires tend toward a toe-out condition. By starting with an initial toe-in setting, a desirable “near zero toe-in” can be achieved when the vehicle is in motion.

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.



090267

FRONT OF MOTORHOME
(Top View of Axle)



090265

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.

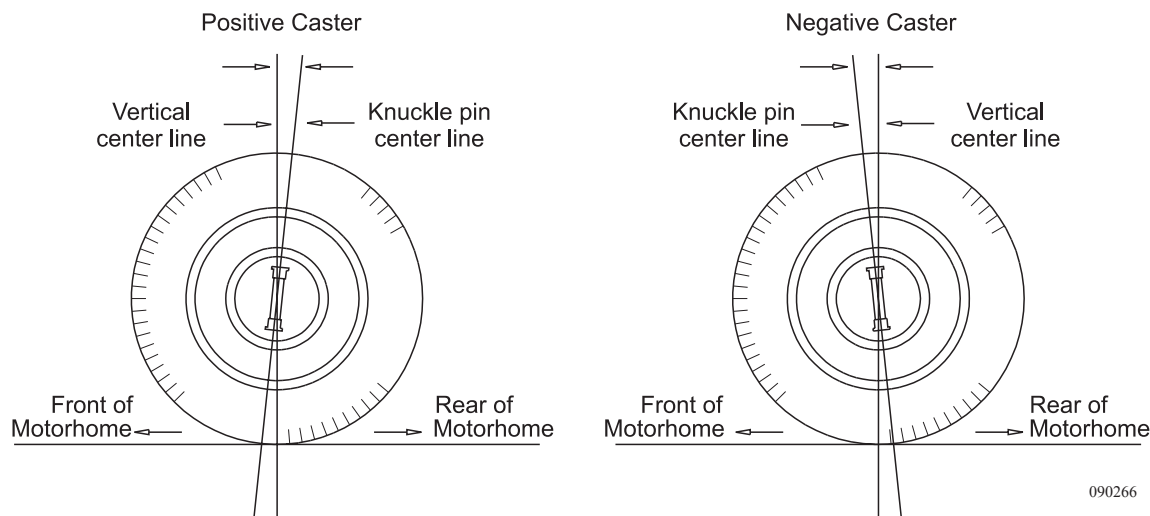
“**Positive**” caster is the tilt of the top end of the kingpin toward the rear of the motorhome.

“**Negative**” caster is the tilt of the top end of the kingpin toward the front of the motorhome.

		SPEC	TOL
LEFT FRONT	CAMBER	0.00°	0.40°
	CASTER	3.50°	1.00°
	TOE	0.03°	0.12°

RIGHT FRONT	CAMBER	-0.25°	0.40°
	CASTER	3.50°	1.00°
	TOE	0.03°	0.12°

Setting the caster angle more positive than specified may result in excess steering effort and/or shimmy. Decreasing the angle may result in vehicle wander or poor steering return to center. The caster angle is determined by the installed position of the steer axle.



Lubrication

The front steer axle on the chassis is an I-beam axle design made of forged, heat-treated alloy steel. Pivots for the axle ends are constructed using an inclined king pin configuration, which are supplemented with steel tapered roller thrust bearings that carry the front vehicle weight. The front axle weight rating is 8,500 lbs. All front axles use oil to lubricate the wheel bearings. Inspect the oil level before every trip or every 1,000 miles. The oil is drained and refilled without removing the wheel end assembly. Remove the hubcap to access the bearing cover and drain plug.

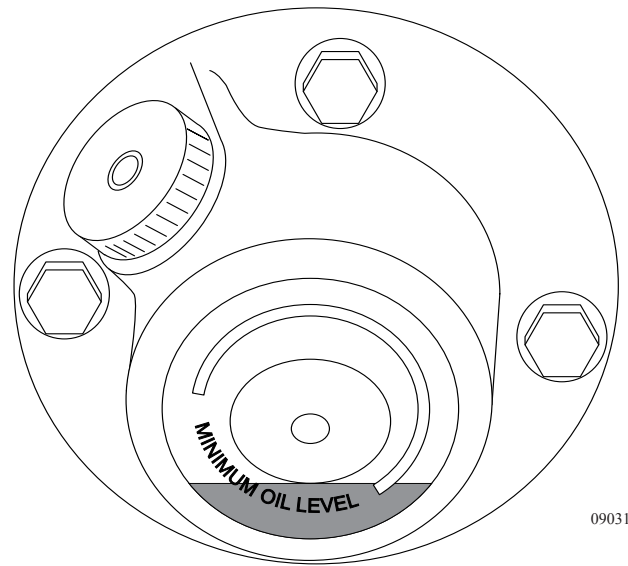
To Inspect the Oil Level:

- Remove the chrome hubcap.
- Locate the full and add mark on the outside of the clear plastic cover.
- If the lubricant level is low, add the recommended fluid until full.

Recommended Interval Change:

The recommended oil change interval is based on the operating conditions, speeds and loads. The recommended fluid replacement is every 30,000 miles or annually. Limited service applications may allow the recommended interval to be increased. Severe applications may require the recommended interval to be reduced. For more information, contact a Westport service representative.

Remove the filter plug and add lubricant. Allow the oil to flow through the bearings (this will take a few minutes), double check to see if the oil level has reached the oil level line on hubcap face. Use EP-SAE 90 gear oil or any good equivalent petroleum base or synthetic lubricant.



CAUTION:

Do not mix petroleum based oil with synthetic based oil. This could cause an oil seal failure.

Lubricant Type:

- Standard EP-SAE 90 wt. API GL-5. Lubricant temperature must never exceed 250° F (+121° C).

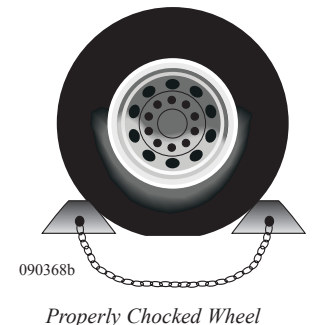
To Drain:

- Place a suitable container below the bearing cover and remove the drain plug. If the cover does not have a drain plug, remove the screws retaining the cover plate to drain the lubricant.
- Replace plug or cover plate and fill bearing assembly with the recommended lubricant.

Lubrication Maintenance Safety:

Maintenance for the system entails a periodic lubrication of the front axle components. Chock wheels for safety prior to accessing components underneath the motorhome.

Lubrication of the front axle is critical in order to avoid premature wear of the king pin assemblies and other components. Grease zerks are located at the king pin assemblies (two on each side of the axle, upper and lower) and one grease zerk on each end of the tie rod. These points require lubrication every six months or 5,000 miles with grease meeting NLGI #2 specifications.



NOTE:

Use only a hand operated grease gun on the fittings.

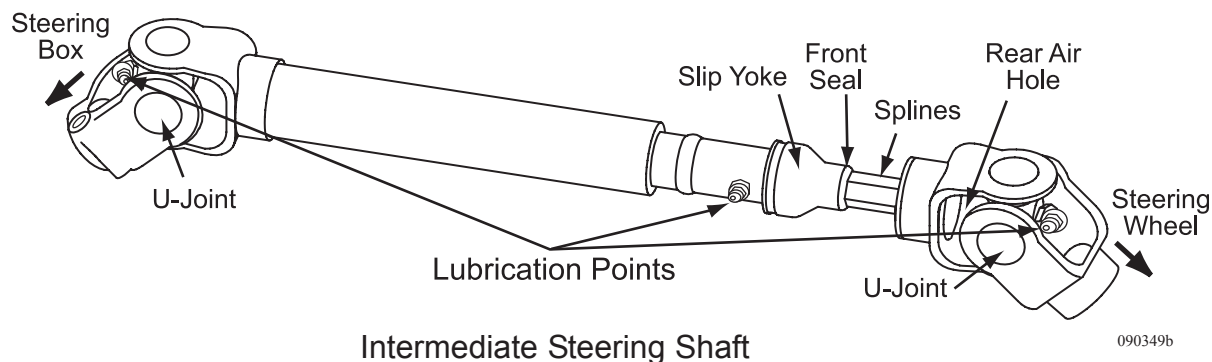
The steering wheel connects to the steering box using a driveshaft. Service the intermediate steering shaft universal joints and slip yoke every 30,000 miles or annually. Remove the steering column cover to access the upper universal joint and slip yoke. The lower universal joint is accessed from underneath in the generator compartment behind the front electrical box.

Greasing the Intermediate Steering Shaft Universal Joints:

1. Check the shaft for looseness. Repair as necessary.
2. Apply the specified grease at the grease fitting on the universal joint. Apply new grease 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 any of the needle bearings.

Greasing the Intermediate Steering Shaft Slip Yoke and Splines:

1. Check the shaft for looseness. Repair as necessary.
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 grease until new grease purges and forces finger away from the air hole in the end of the slip yoke. Greasing interval is yearly or every 30,000 miles.

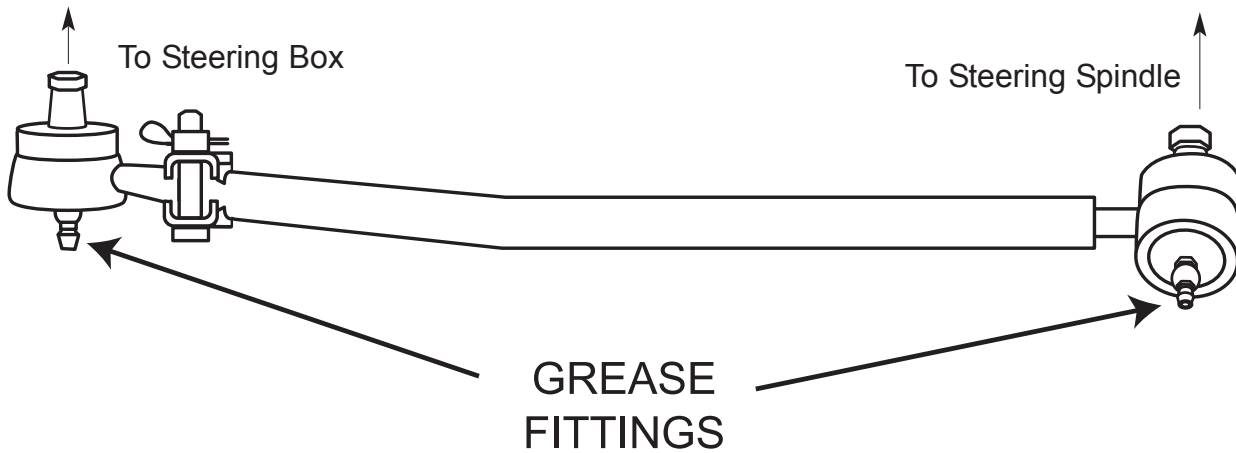


Drag Link

The drag link connects the steering box pitman arm to the steer axle. The movable joint (ball joint) uses sealed boots to prevent water intrusion. Do not rupture the boot when applying grease. Grease interval is six months or every 5,000 miles.

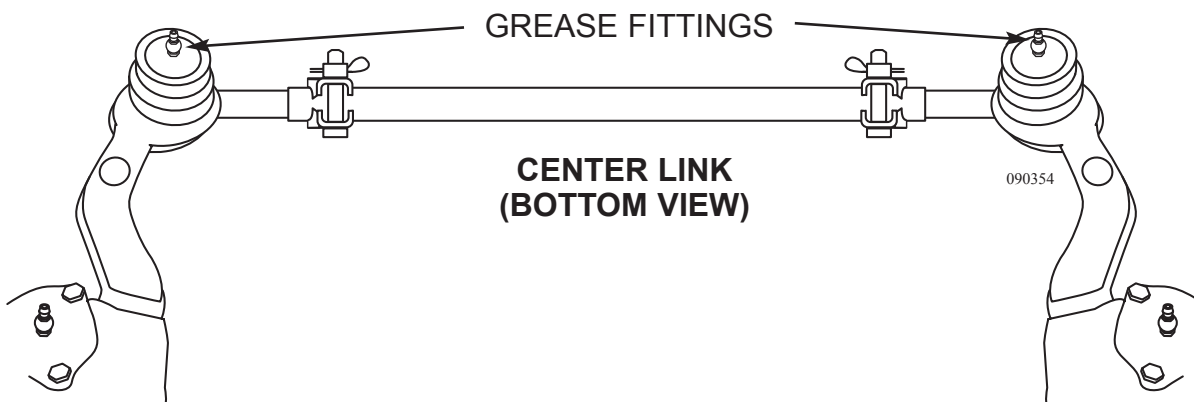
NOTE:

It will be necessary to start the motorhome and turn the steering wheel to access fitting(s).



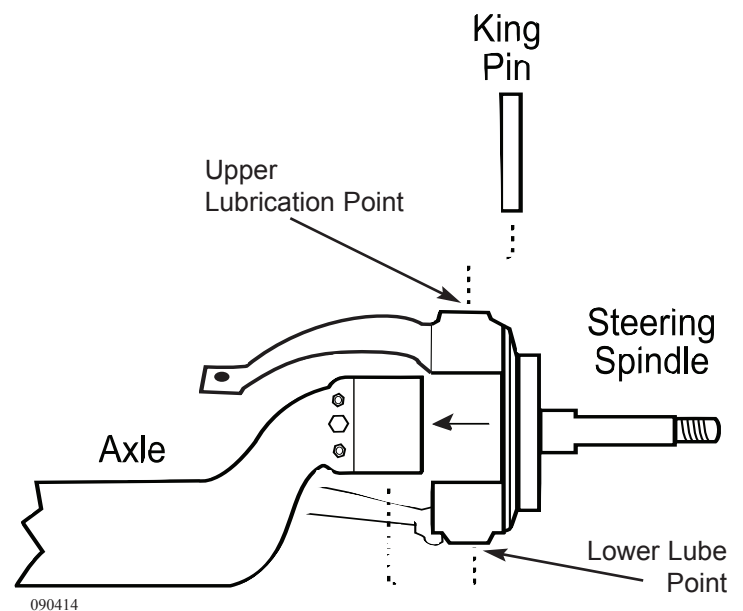
Center Link

The center link is located on the backside of the steer axle. The center link attaches the two wheels together causing the right front to track with the left front. Greasing interval is every six months or 5,000 miles.



Steering Spindles

The steering spindles attach to the front axle and pivot on the kingpin. The wheel end assembly and brake system attach to the spindle. There are upper and lower lubrication points for the kingpin. The drag link attaches to the roadside spindle. After initially lubricating the roadside and curb-side 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.

Steering Gear

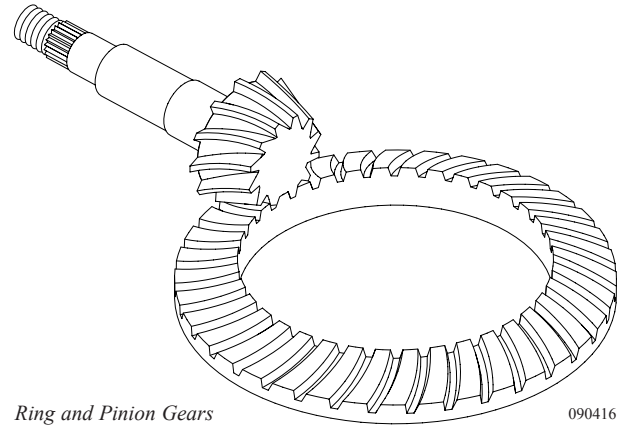
The M-100 series Sheppard steering gear requires no maintenance. Using hydraulic pressure to assist rotating the output shaft of the steering gear provides power steering. Located at the end of the input shaft of the steering gear is a poppet valve and worm drive. The poppet valve directs the hydraulic fluid pressure to a type of spool. There are worm drive threads in the center of the spool. When in the center position, pressurized hydraulic fluid bypasses the spool. When a turn is made, the poppet valve shifts to one direction or the other, directing the hydraulic pressure to one side of the spool depending on turning direction. The hydraulic fluid is then cooled before returning to the reservoir. Inspect for signs of leakage when performing fluid level checks. Changing the hydraulic filter at regular intervals will help ensure trouble free operation.

DRIVE AXLE & DRIVE SHAFT

Drive Axle:

The chassis drive axle is a single reduction axle, with a gear ratio of 4.88:1. The differential gears consist of a hypoid pinion and ring gear set and bevel differential gears. The differential carrier can be removed from the axle housing as a unit in order to perform repairs.

All power from the engine to the rear tires is transferred through the rear axle. For this reason, it is important that maintenance be performed on the axle as required to avoid premature wear of the gears and bearings in the axle.



Ring and Pinion Gears

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Drive Axle Lubricant:

The rear axle is filled at the factory with synthetic gear oil meeting MIL-L-2105D specifications. Change interval every 250,000 miles, or 36 months, whichever occurs first. If petroleum based lubricant is used, the change interval will be at 100,000 miles or yearly, whichever occurs first.

During lubricant change, fine metal particles will be observed clinging to the magnetic fill and drain plugs of the axle. These particles are normal wear particles from the axle components, but will cause faster than normal wear of the axle components if allowed to circulate through the lubricant. It is recommended that the magnetic plugs be tested, if not replaced, at each lubricant change. These plugs should have sufficient magnetic strength to pick up a 1.5 pound weight of low carbon steel. Never replace a magnetic plug with a non-magnetic "pipe plug" as they will not keep the lubricant clear of metal particles or seal properly.

The level of lubricant in the rear axle should be checked every 30,000 miles or annually, whichever comes first. This will ensure adequate lubricant in the axle for proper operation.

Proper Drive Axle Lubricant Level:

Regular inspection of the drive axle lube levels is an essential maintenance procedure.

- 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 ft. lbs.

NOTE:

When checking the lube level also check the housing breathers. Clean the breathers if dirty or replace them if damaged.

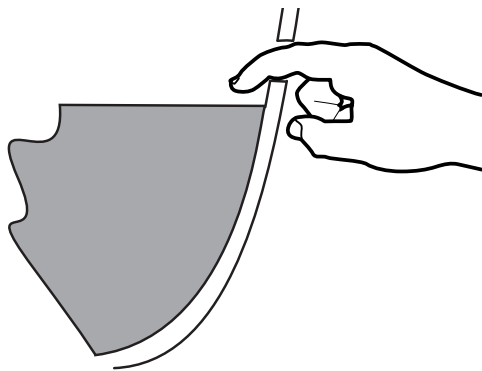
To Drain and Replace Lubricant:

With the motorhome parked on a level surface and rear axle warm, place a large container under the axle.

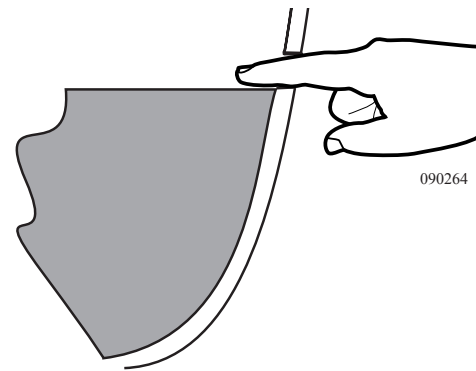
1. Remove drain plug and allow axle to drain completely.
2. Dispose of oil properly.
3. Clean the drain plug and test (replace the drain plug if needed).
4. Install and tighten drain plug to 35 ft-lbs.
5. Clean the area around the fill plug from the axle-housing bowl.
6. Fill the axle with approved lubricant until the level is even with the bottom of the fill plug hole.

WARNING:

When checking or changing the lubricant, always ensure that the axle is not "hot." Oil temperature 90° F or hotter can easily cause severe burns.



Incorrect Oil Level



Correct Oil Level

Drive Shaft:

The drive shaft transfers the power produced by the engine to the drive axle. A worn or out of balance driveline causes chassis vibration that generally increases in intensity with road speed.

NOTE:

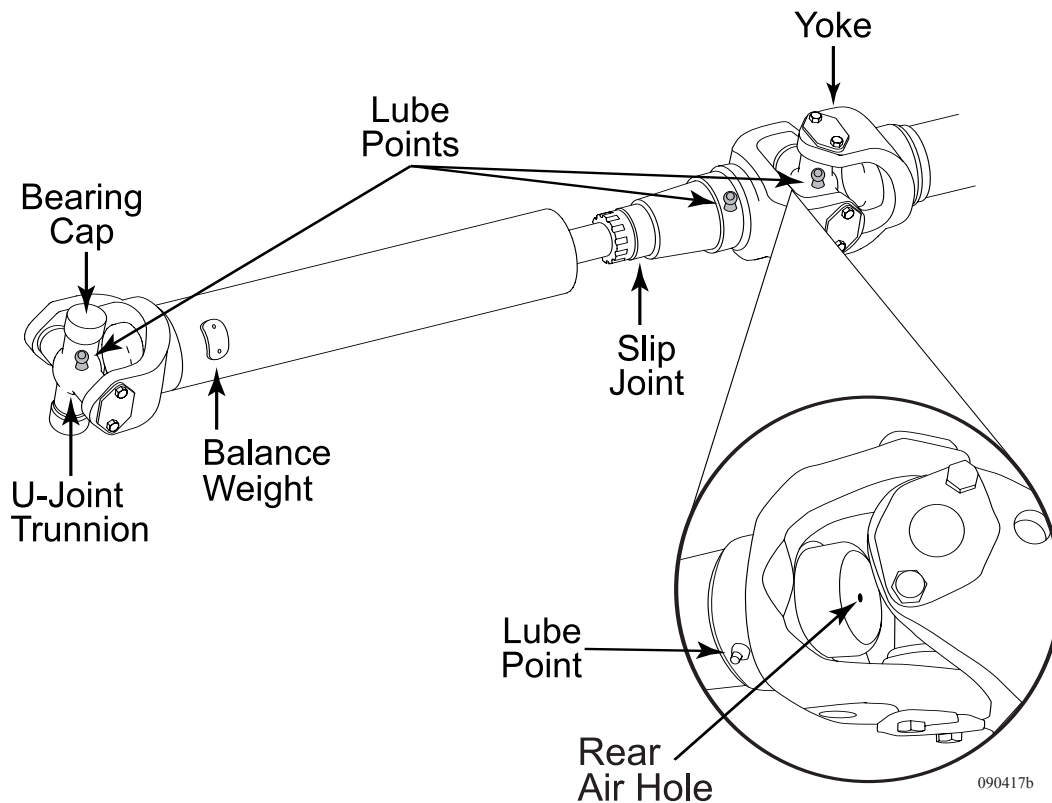
It will be necessary to move the motorhome forward or backward to access all fittings on the drive shaft.

Greasing the Drive Shaft Universal Joints:

1. Check the drive shaft for looseness. Repair as necessary.
2. Apply the specified grease at the grease fitting on the universal joint. Apply new grease until new grease purges from all the seals.
3. If new grease does not purge at the seals, loosen the bearing cap bolts and re-grease until all four caps purge. If new grease still does not purge, disassemble and clean or replace the universal joint.

Greasing the Drive Shaft Slip Yoke and Splines:

1. Check the drive shaft for looseness. Repair as necessary.
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 grease until new grease purges and forces finger away from the air hole in the end of the slip yoke. Greasing interval is 10,000 miles or annually.



WARNING:

Rotating shafts can be dangerous. Rotating shafts can snag clothes, skin, hair, hands, etc. causing serious injury or death. Do not work on or near a shaft "with or without a guard" when the engine is running.

U-Joint Angles, Phasing & Drive Shaft Balance

Correct U-joint working angles, U-joint phasing, and drive shaft balance is vital to maintaining a quiet-running drivetrain and long life of drivetrain components (including drive shaft components).

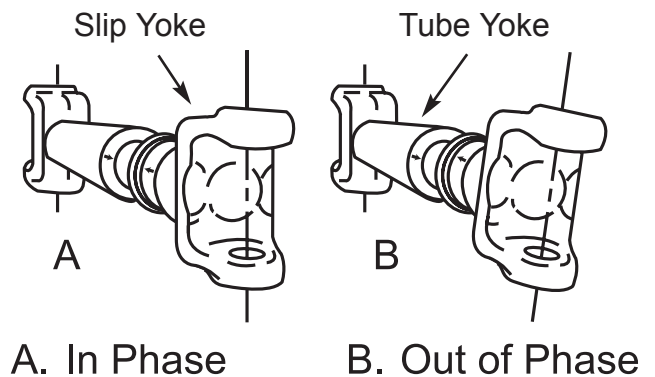
When in phase, the slip yoke lugs (ears) and tube yoke lugs (ears) are in line. Normally this is the ideal condition and gives the smoothest running shaft. There may be an alignment arrow stamped on the slip yoke and on the tube shaft to assure proper phasing when assembling these components. If there are no alignment marks, they should be added before disassembly of the shaft to assure proper reassembly.

Phasing is relatively simple on a two-joint set. Be sure that the slip yoke lugs and the tube yoke lugs are in line.

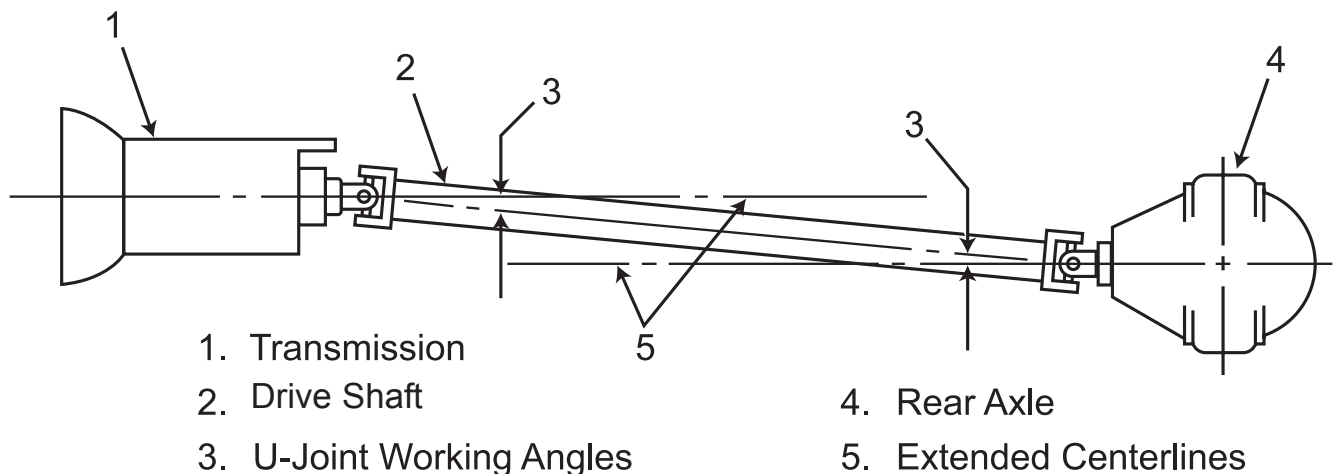
The U-Joint working angle is the angle formed by the intersection of the drive shaft centerline and the extended centerline of the shaft of any component to which the U-joint connects. Because the double oscillating motion of a U-joint that connects angled shafts causes a fluctuating speed difference between the shafts, the effect created by the U-joint at one end of the shaft must cancel the effect created by the U-joint at the other end. This is done by making U-joint working angles at both ends of the drive shaft approximately equal, with the U-joints in phase. If the yoke lugs at both ends of the shaft are lying in the same plane (a plane which bi-sects the shaft lengthwise), the U-joints will be in phase.

Any condition which allows excessive movement of a drive shaft will cause imbalance: loose end yoke nuts, loose U-joint bearing cap retaining capscrews, worn U-joint trunnions, bearings and worn slip-joint splines.

Among the most common causes of U-joint and slip joint damage is lack of lubrication. To keep the motorhome operating smoothly and economically, the drive shaft must be carefully checked and lubricated at regular intervals.



090337



090336

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 road-master chassis incorporates the "Monroe" 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.

By design, a self lubricating seal is used which will allow approximately 10% of the total oil capacity to pass onto the piston rod. The gradual process of oil loss does not affect the performance of the shock absorber during the service life. This process will be evident after a long period of service by an oil film on the body of the shock absorber. The appearance of a coating or film on the rod is completely normal, it is an indication the shock is functioning normally.

Road holding, handling, balance and braking characteristics all can be contributed to the shock absorber. The operating conditions the shock absorber must endure will determine the life span. However, since the only moving part is the piston rod, there are no springs, hinges or pins to wear out, get weak or deteriorate.

LEVELING SYSTEM

The three point leveling system features a multiple warning system and a remote control located in the driver's console. The hydraulic leveling pump is located on the curbside in the generator compartment.

CAUTION:

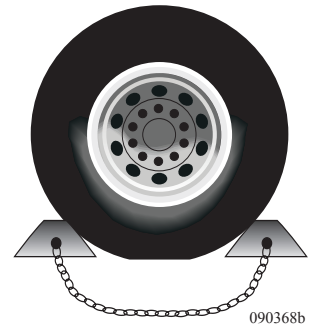
It is important that all jacks be in contact with the ground in order to stabilize and support the frame prior to leveling. The hydraulic leveling system is designed to reduce site selection problems and stabilize the motorhome when parked. No single jack should be used solely to level the motorhome. Using an improper leveling process can result in applying excess torsion stress/twist to the chassis, frame and body, resulting in damage to the windshield or entry door malfunction. The leveling jacks are not designed to change tires. This can cause problems with the suspension system, frame alignment and damage to the windshield. Never use the jacks to elevate any wheel position off the ground.

CAUTION:

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

CAUTION:

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

**Leveling System Safety Features:**

The leveling system has safety features to prevent a jack from extending during travel. The control panel will not activate until these safety features are in place.

- Turn the ignition switch to the On or ACC position.
- Place the transmission in Neutral.
- Apply the parking brake.

Warning Features Include:

- A warning system consisting of flashing lights and a bong alarm when the system is on or a jack is down or extended more than two to six inches from the fully retracted position.
- The bong alarm may activate momentarily when driving over rough roads, or negotiating curves and corners. Usually this indicates a low fluid level in the reservoir.

WARNING:

Ensure the potential jack contact points are clear of obstructions or depressions before operation. Keep all people clear of the motorhome during the leveling procedure. Never expose hands or other parts of the body near hydraulic leaks. Hydraulic lines are under high pressure. Oil leaks may cut and penetrate the skin causing serious injury.

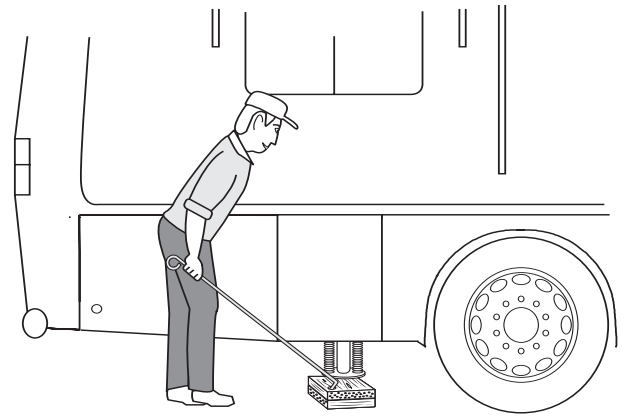
Extending the Leveling Jacks

- Select a level site if possible. If the site is not level, select another site or park the motorhome with the front facing downhill.
- Place the gear selector in Neutral.
- Apply the parking brake.
- Turn the ignition switch to the **ON** or **ACC** position, do not start the engine.
- With the ignition on, press 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:

Damage to the mud flap may occur if it is located over a raised area when suspension is lowered.

- Turn the jack control panel **ON**.
- Lower the front jack first until it contacts the ground. Then extend the rear jacks. Ensure all jacks are in contact with the ground to stabilize the frame.
- If additional height or surface support is needed, construct a 1' x 1' wooden block made from two pieces of $\frac{3}{4}$ " 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.
- Extend the front jack an additional $\frac{1}{2}$ ". This allows the front jack to act as a pivot point. This reduces stress/twist to the chassis and body of the motorhome. Incrementally extend each jack in such a manner as not to apply excessive stress/twist to the frame.
- To extend or retract a particular jack, press and hold the appropriate rocker switch to the Extend or Retract position until the desired extension is reached.
- Turn the jack control panel **OFF**.
- Turn the ignition switch to the **OFF** position.



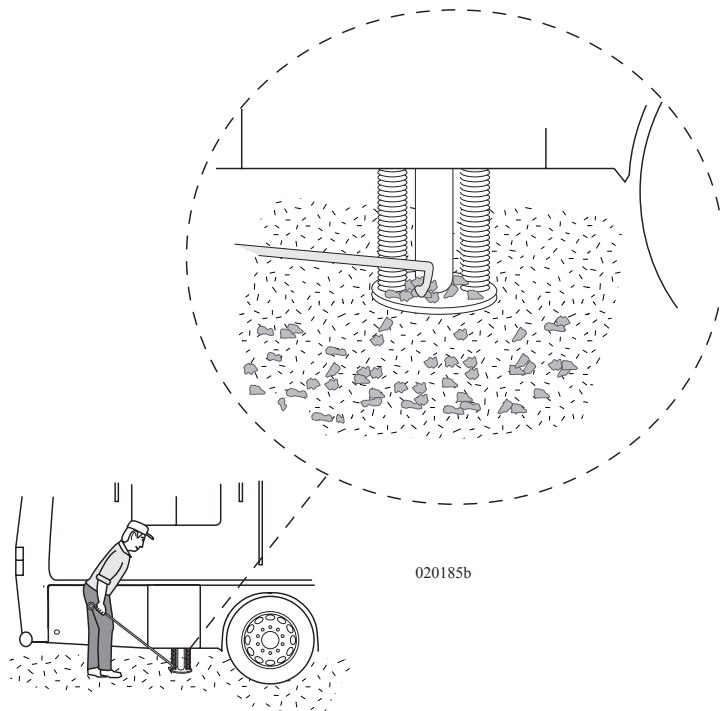
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CAUTION:

DO NOT move the motorhome while jacks are in contact with the ground or extended. Damage to the jacks may occur.

Retracting the Leveling Jacks

- With the parking brake applied and the transmission in Neutral, start the engine to bring air system to normal operating pressure.
- Turn the jack control Power switch ON.
- Momentarily press the level switch to ALL. Hydraulic pressure, in all jacks, is automatically released when the All switch is pressed. The jacks retract by the weight of motorhome and the retract springs on each jack. The bottom green light will begin blinking and all jacks will retract. This operation is on a four-minute timer. After four minutes, the green light will stop blinking and go out.



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- The red warning lamp will stop blinking and the "bong" alarm will silence when all jacks are retracted.
- 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.

NOTE:

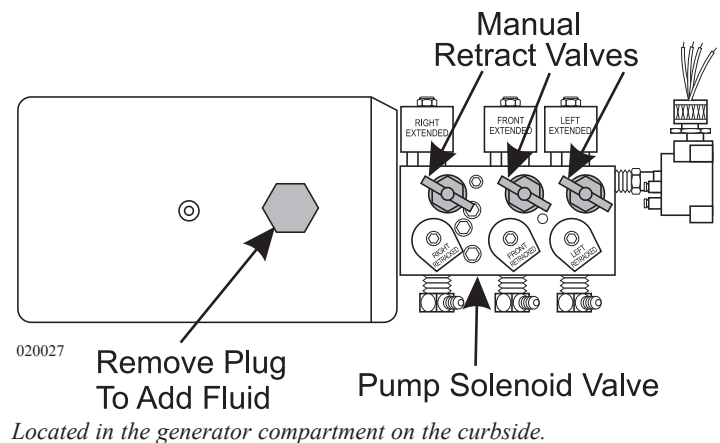
If the park brake is released or the transmission is taken out of neutral the jacks will automatically retract.

CAUTION:

Do not move the motorhome until the jacks are fully retracted. A visual check of the jacks is recommended to ensure full retraction. Do not rely solely on the lights and alarms.

Manual Retract Valves

In case of mechanical or electrical failure that would prevent the leveling jacks from being automatically retracted, the motorhome is equipped with manual emergency retract valves. The manual retract system releases fluid that is under pressure in each jack and allows the fluid to return to the reservoir. The manual retract valves are on the valve assembly manifold which is mounted on the pump motor. The pump is located in the generator compartment on the curbside.



CAUTION:

The motorhome will raise or lower when the manual retract valves are opened. If it becomes necessary to manually retract the jacks, do not crawl under the motorhome to access the valves. Make sure there is sufficient clearance so the valves may be opened safely.

To operate the manual system:

- Turn all three T-handle valves counterclockwise until they stop.
- When the jacks are fully retracted, rotate all the valves fully clockwise. In case one of the jacks is not holding pressure, one of the manual retract valves may not be fully tightened.

Maintenance

Occasionally, when the jacks are fully extended, wipe off the dirt from the jack rod. This will help lengthen the life of the jacks. How often this is done can vary from the amount and type of usage of the jacks. WD40 will serve as a solvent, as well as a lubricant. Occasional oil or grease on the extended jack ram is normal and aids in the lubrication of the seals.

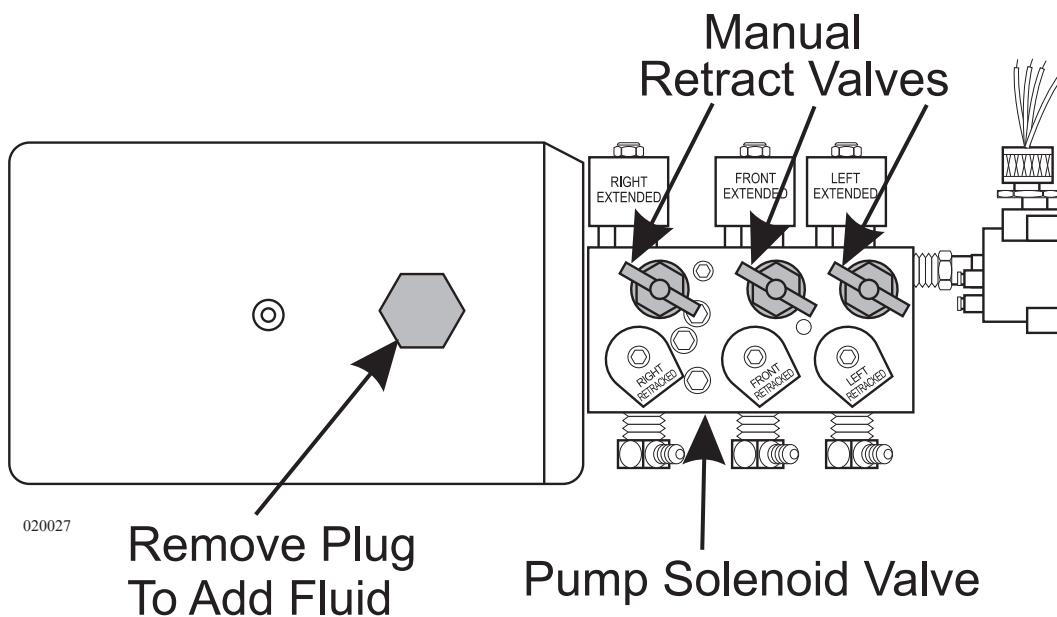
The system is designed to be self-bleeding in the event any component of the hydraulics has been removed or repaired. To self bleed, fully extend and retract each jack twice. The remote rocker switches will operate with a minimum of 7.5 Volt DC. Optimum requirements for operating the system are voltages above 9.6 Volt DC.

Adding Fluid:

An indication of a system needing fluid is the bong alarm intermittently sounding when turning corners or the pump whining or gurgling. Use Dexron III® automatic transmission fluid to fill the reservoir.

To Fill the Reservoir:

1. Turn the ignition switch to the **ON** position. Turn the jack control Power switch ON.
2. Extend any jack six inches from the fully retracted position. All other jacks remain fully retracted.
3. Unscrew the reservoir cap from the top of the reservoir.
4. Open a window or the entry door so the bong alarm is audible from outside the motorhome. Slowly fill the reservoir with fluid until the bong alarm stops sounding.
5. Replace the reservoir cap.
6. To retract the extended jack, push the RETRACT button.
7. Turn the jack control Power switch OFF.
8. Turn OFF the ignition switch.



Located in the generator compartment on the curbside.

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.

Diesel engine speed is controlled by varying the 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 the 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 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 authorized repair location for future information.

The Cummins diesel engine is a 6-cylinder in-line engine, utilizing an electronic fuel control system to supply fuel to the cylinders for precise fuel delivery, as well as built-in diagnostics to monitor engine operation.

Engine electronics also enable the use of programmable monitoring features that may cause limited engine power/vehicle speed when certain conditions arise. These features limit the operation of the engine when conditions that may damage the engine are encountered. These conditions may include such events as low oil pressure and high coolant temperature. When the engine electronics encounter such a condition, it limits the amount of power produced by the engine to help prevent or limit damage. It is possible however, for the engine to be damaged if corrective action is not taken immediately if such a condition exists.

Operation of the engine while in the limited operation mode may result in serious engine damage. If a sudden loss of power is noticed in conjunction with the engine warning lights illuminating (**STOP ENGINE**, **CHECK ENGINE** and **WARNING**), pull to the side of the road as soon as it is safely possible. Evaluate the situation.

INFORMATION:

Refer to the OEM operators manual for additional information concerning the operation, description, maintenance, and warranty information for the engine.

Diagnostic Fault Codes

The engine ECM will record three types of fault codes; Electronic Control System Faults, Protection System Faults and Maintenance Indicators. All faults recorded will be **ACTIVE** or **INACTIVE**. Not all faults will light an indicator when they are **ACTIVE**.

Illuminated Lamps:

WARNING - Indicates a failure has occurred, but the motorhome can be operated without progressive damage. The motorhome should be serviced to diagnose the failure and repaired at the first opportunity. The indication is not considered an emergency.

Solid RED STOP ENGINE - Indicates a major failure has occurred that can result in progressive damage or affect safe operation of the motorhome. The motorhome should be shut down as soon as safely possible and remain shut down until the fault can be repaired.

Flashing RED STOP ENGINE - Indicates the engine control system has started the shut down sequence. The shut down timer will give the operator 30 seconds to find a safe stopping point.

CHECK ENGINE - Indicates the engine requires maintenance or fluids. The motorhome should be serviced to correct the problem. If ignored, some maintenance conditions can cause improper engine operation and even progressive damage.

To Retrieve Active Fault Codes:

1. Turn the ignition key OFF.
2. Turn the ignition key ON immediately apply three full throttle application.
3. Observe **CHECK ENGINE** and **STOP ENGINE** lamps.
 - a. If no active codes are recorded, both lamps will remain illuminated.
 - b. If an active code is recorded, both lamps will illuminate momentarily, then flash the recorded fault.
 - c. When codes are retrieved, turn OFF the **Engine Diagnostic** switch.

The fault code will flash in the following sequence:

- The **yellow CHECK ENGINE** lamp will flash.
- There will be a short one to two second pause.
- The fault code will flash on the **red STOP ENGINE** lamp.
- There will be a short one to two second pause between each number.
- When the number has finished flashing in **STOP ENGINE**, the **CHECK ENGINE** lamp will appear again. The fault code will repeat the sequence.

Each fault code will flash twice before advancing to the next code.

STARTING PROCEDURE - *Normal Starting*

When starting the engine, always use the following procedure.

1. Turn off the vehicle headlights and any other auxiliary equipment prior to starting to ensure that all available battery power is available for the starter motor.
2. Ensure that the park brake is applied and that the transmission is in **NEUTRAL**.
3. Turn the ignition switch to the **ON** position.
4. Look at the dash warning lights; the **CHECK TRANS** light as well as the **PARK BRAKE** light on should illuminate. The **CHECK ENGINE** light should illuminate and then cycle off. If any of the warning lights fail to come on, investigate and correct the cause of the problem. If the **CHECK ENGINE** light remains on, or re-illuminates after starting, the engine ECM may have detected an engine systems fault. Refer to the diagnostics section of the *OEM Engine Manual* for corrective action. If the **CHECK TRANS** fails to illuminate, or remains on after starting, refer to the *Transmission Operator's Manual* for corrective action.
5. The **WAIT TO START** light should illuminate, then go out.
6. Wait for all warning lights to cycle through diagnostics. Pressing the throttle or holding the throttle down is not needed. Turn the ignition switch to the **START** position and crank the engine. The electronic controls on the engine will automatically deliver the correct amount of fuel for the engine to start.

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-
7. Release the ignition switch to the **ON** position immediately after the engine starts.
 8. Allow the engine to idle with no load for three to five minutes. Observe all gauges and warning lights during warm-up.

NOTE:

To avoid starter motor damage, do not crank the engine for more than 15 seconds at one time. If the engine fails to start, wait two minutes before attempting to start the engine again.

NOTE:

Oil pressure should be indicated within 15 seconds after the engine has started. Do not increase engine speed until the oil pressure gauge indicates normal. If no oil pressure is indicated within 15 seconds, stop the engine. Do not attempt to operate. The engine will need inspected and repaired prior to re-start.

WARNING:

Never attempt to start the engine by "jumping" relays or any means other than using the ignition start switch or the remote start switch. Do not attempt to start the engine unless all persons are clear of the engine before starting.

Cold Weather Starting

Starting and operating the motorhome during cold weather requires extra care and consideration. Use the following guidelines and refer to the *OEM Engine Manual* to help ensure safe, trouble-free operation of the motorhome:

1. When operating below 32° F., the engine block heater or other means to warm the engine can enhance engine starting. This will ease cranking and help prevent engine misfiring 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 it warms sufficiently for operation. Utilize the fast idle feature to quicken the process. Wait to operate the vehicle for at least three minutes or until the coolant temperature begins to move.
4. Check the air inlet and filter daily, or as necessary when driving in snow conditions.
5. The demand on batteries increase 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.

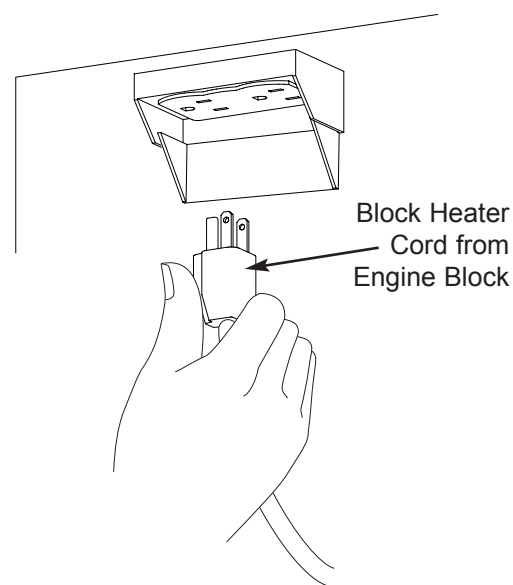
Engine Block Heater:

The block heater cord is located in the rear engine compartment. The block heater, depending on engine size, is rated between 850-1500 watts. The block heater cord may be connected to a separate power cord as long as the power cord is rated for 1500 watts and the outlet used must have a GFCI protected rate of 20 Amps. The engine may require several hours of pre-heating before it will start. It is recommended to start pre-heating the engine the night before departure. Remember to unplug the separate power cord.

WARNING:

Do not use ether cold starting aids to aid in starting the engine as engine damage may occur.

Following the maintenance guidelines in the engine manufacturer *OEM Manual* recommendations for the engine will help to 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.



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Block Heater located in Engine Compartment.

ENGINE OIL

Following the maintenance guidelines in the Cummins Operation & Maintenance Manual recommendations for the engine will help to 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 multiviscosity heavy duty lubricating oil meeting Cummins Engineering Specification CES 20071 or CES 20076, or American Petroleum Institute (API) specification CH-4 that can be used as an alternative to CES 20071 is recommended. API CG-4 is acceptable and should not exceed 75% of the standard drain interval. 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.

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 the drain interval is not recommended. There are numerous variables which is the basis of the recommendation.

NOTE:

The engine is filled with 15W-40 oil from the factory.

Proper viscosity grade of engine lubricating oils should be determined by ambient temperature during start-up and normal engine operations.

Engine Oil Viscosity for Ambient Temperatures		
	Ambient Temperatures	
Viscosity Grade	Minimum	Maximum
SAE 0W-20	-40F/-40C	50F/10C
SAE 0W-30	-40F/-40C	86F/30C
SAE 0W-40	-40F/-40C	104F/40C
SAE 5W-30	-22F/-30C	86F/30C
SAE 5W-40	-22F/-30C	122F/50C
SAE 10W-30	0F/-18C	104F/40C
SAE 10W-40	0F/-18C	122F/50C
SAE 15W-40	15F/-9.5C	122F/50C

NOTE:

The engine does not require a "break-in" procedure.

INFORMATION:

Refer to the Engine Manufacturers Owners Manual for details on the oil maintenance schedule.

ENGINE SHUTDOWN

Allow the engine to idle three to five minutes after a full load operation to allow adequate cool down of pistons, cylinders, bearings and turbocharger components. Under normal driving conditions, exiting the highway is generally lighter engine operation and the need for the three to five minutes is not necessary.

Extended Engine Shutdown

When the motorhome has been sitting for extended periods, 30 days or more, verify all the fluid levels are correct. Follow the normal starting procedures. If the oil pressure gauge does not register within 15 seconds, shut off the engine immediately to avoid damage. Consult the engine manufacturer owner's manual for guidelines on troubleshooting low oil pressure, or contact a qualified service technician. Allow the engine to idle for five minutes before operating under a load.

COOLANT SYSTEM

The cooling system consists of a radiator mounted at the rear of the motorhome, cooling fan, transmission cooler, and a charge air cooler. Steel tubes and radiator hoses allow engine coolant to flow between the radiator and the engine. The fan draws air from the outside of the motorhome, through the radiator and into the engine compartment. These components working together ensure that all the chassis systems maintain proper operating temperatures as they are inter-related. A problem with one component may cause problems with an entirely different system.

After the engine reaches proper temperature, the water regulator (thermostat) on the engine opens and allows coolant to flow from the engine, through the upper radiator hose and into the radiator. The coolant is cooled in the radiator and flows through the transmission cooler and back to the engine through the lower radiator tube. A by-pass tube installed between the thermostat housing and lower radiator tube functions to supply coolant to the transmission cooler under certain conditions to ensure proper cooling.

As the intake air passes through the turbo charger, the air is pressurized and heat is generated. The air is then cooled as it travels through the Charge Air Cooler.

With the components working together to maintain the engine and transmission at the proper temperature, proper maintenance of the cooling system is very important. One neglected component could result in cooling problems. Maintenance of the cooling system includes a proper coolant levels using the correct mixture of coolant and additives, regular inspection of system components, flushing the coolant system with approved cleaners, and ensuring that the exterior of the radiator and other external coolers are kept clean of debris.

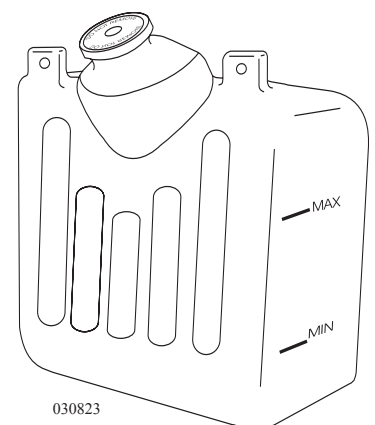
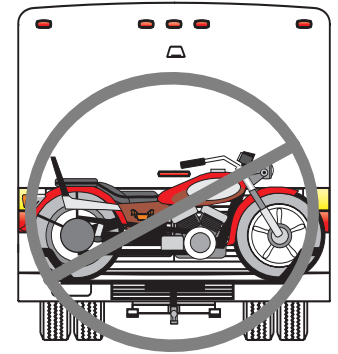
The engine coolant level should be checked daily to ensure that it is at the proper level. At the rear of the motorhome is a plastic translucent "surge tank." Under certain lighting conditions it may be difficult to see the level of the coolant in the surge tank and a flashlight held behind the surge tank should enable easier viewing.

Engine Coolant Reservoir:

The engine coolant reservoir is connected to the radiator by a hose. When the motorhome is driven, coolant heats and expands. A portion of fluid displaced by expansion flows from the radiator into the reservoir tank. When the engine is stopped, the coolant cools and contracts. Coolant is drawn back in the radiator by a vacuum. Thus, the radiator is kept filled with coolant to the desired level at all times, resulting in increased cooling efficiency. The coolant level should be at, or slightly above, the appropriate mark on the reservoir tank when the system is cold.

CAUTION:

To avoid scalding hot steam or coolant from being released from the engine cooling system, never remove the reservoir cap while the engine is running or hot. Failure to follow this warning may result in damage to the engine's cooling system and possibly cause severe personal injury.



Coolant Levels:

- Check the coolant level daily or when refueling.
- If the coolant is below the MIN mark, the low coolant alarm will sound and the low coolant light will appear on the dash.
- The coolant level remains between the MAX and MIN level in the reservoir.

NOTE:

Coolant must be changed every two years. The preferred coolant must meet Cummins specifications. An acceptable heavy/duty antifreeze/coolant, meeting ATSM D4985 or ATSM D6210 specifications, can be used.

INFORMATION:

Refer to the Engine Manufacturer Owner's Manual for details on engine coolant maintenance.

If the addition of coolant is necessary, simply remove the cap from the surge tank and add the proper mixture of coolant to the system until it reaches the proper level.

Understand that adding straight water or antifreeze to the system creates an imbalance of the coolant mixture. While adding small amounts occasionally may not affect the mixture greatly, large amounts (1/2 gallon) or frequent "top-offs" will.

Three components necessary for the proper coolant mixture are clean water, glycol antifreeze (ethylene or propylene), and Supplemental Coolant Additives (SCA). The water in the coolant system serves as the "base." It is critical to use as pure of water as possible. Salts and other minerals in the water can solidify in the cooling system causing scaling and "clogging" of the radiator.

NOTE:

Fully-Formulated Propylene Glycol-Based Engine Coolant for Heavy-Duty Engines meeting ATSM D6211-98a should be used.

Glycol antifreeze, usually in the form of ethylene glycol or propylene glycol, provides an increased boiling point of the coolant mixture, increased freeze protection, and helps prevent water pump cavitation (air bubbles in the coolant mixture that can result in wear of the engine). While the ratio of water and glycol can be adjusted to meet differing anti-boil and freeze protection, it is recommended that a mixture of 50% water and 50% glycol be used. This 50/50 mixture provides freeze protection to -32°

Coolant Additives - SCA

Additives required for the proper maintenance of the cooling system consist of Supplemental Coolant Additives (SCA). SCA provides corrosion protection for metals, protection from cavitation and contains anti-foaming agents. Inadequate amounts of SCA will not provide adequate protection of the system, excessive amounts can also create cooling system problems.

Over-concentration of SCA can result in the additives dropping out of the solution and solidifying, the outcome of which is the likelihood of scale and sludge forming that restricts coolant flow.

When performing maintenance, it is also necessary to inspect other components of the cooling system. Have an inspection performed of the surge tank cap seal and have the cap pressure tested at each oil change. The charge air cooler and radiator also requires inspection for cracks, broken welds, secure mounting, and general cleanliness.

It may be necessary to clean the radiator and external coolers more often under certain conditions. Leaves, twigs, road debris and other contaminants can block the radiator and cooler fins resulting in reduced cooling system performance. Blockage can vary depending on road conditions, climate, and regional conditions. Check the radiator and external coolers weekly for blockage, and clean as required.

To clean the radiator and external coolers, compressed air is recommended. In the event that road grime, oil, or inadequate cleaning with compressed air is encountered, a high pressure washer and degreaser may be used with caution to avoid excess pressure that can bend the radiator fins.

Refer to the Cummins OEM manual for detailed maintenance and service procedures. These services include: draining the engine coolant, flushing/cleaning the cooling system, inspecting the water pump standpipe, replacing the thermostat, gasket and seal, and replacing the coolant and SCA element.

Coolant Hoses:

Rotten, swollen and worn hoses, as well as loose connections, are frequent causes of coolant system problems. Overheating can be caused by a collapsed hose or a clog caused by rubber shedding from a rotten hose. Replace any hose found to be cracked, swollen or damaged. Connections should be inspected periodically and hose clamps tightened.

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, ballooning, chafed, kinked, or crushed hoses, and loose clamps and fittings. Correct any deficiencies found.

Coolant Overheated:

If the engine is overheated, never pour cold coolant into a hot engine. The sudden change in temperature may crack the cylinder head or block. If the engine is hot, fill slowly to prevent rapid cooling and distortion of engine castings.

Inspect the radiator core and CAC for dirt and debris build-up. Wash any accumulations using high-pressure water, being careful not to damage the fins from excessive pressure. Any grease or oil build-up should first be treated with a non-caustic degreaser to ensure a thorough cleaning.

Coolant System - Thawing:

If the coolant system becomes frozen, the motorhome must be towed. Place the motorhome in a warm area until completely thawed. If the engine is operated when the cooling system is frozen it will result in engine overheating due to insufficient coolant circulation. Once thawed, check engine, radiator and related components for damage caused by expansion of frozen coolant.

CHARGE AIR COOLER

Operation:

The diesel engine uses compression to ignite the fuel/air charge. To increase compression inside the combustion chamber (resulting in increased power output) a turbocharger is added to the engine. The turbocharger is a paired housing assembly with impellers inside each housing connected by a common shaft. One impeller is propelled by the engine exhaust, which drives the other impeller. The function of the other impeller is to increase compression inside the combustion chamber by forcing air into the intake manifold. This process works well, however, the intake air charge is heated two different ways. Through convection by the exhaust gases driving the turbocharger and any time air is compressed heat is produced. This has a negative effect inside the combustion chamber resulting in lost power potential. Therefore, a Charge Air Cooler (CAC) is installed to cool the intake air before it enters the engine. The CAC performs the same function as a radiator, cooling air instead of liquid. Ambient air passing through the CAC will cool the engine intake air charge.

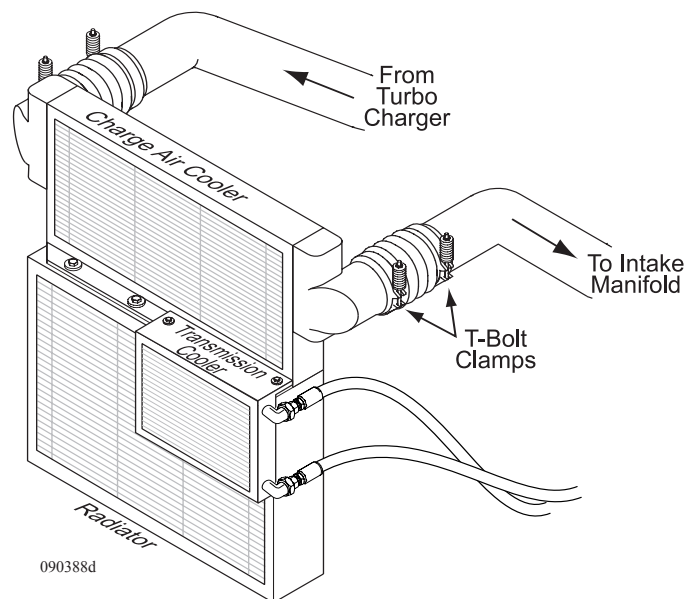
After leaving the turbocharger, intake air is compressed and heated to approximately 300° to 375° F., depending on the engine load and throttle position. Before air enters the intake manifold, the CAC cools the intake air temperature to the engine manufacturer specifications. Lowered intake air temperatures reduce exhaust emissions, improve fuel economy and increase horsepower. The CAC will continually expand and contract up to ¼" as throttle increases and decreases.

Cleaning & Maintenance:

Visually inspect the charge air cooler, every six months, for dirt and debris that may be blocking the fins. If the motorhome develops an oil leak, there is a possibility that the oil will coat the fins of the CAC. Dust will adhere to the oil film and eventually clog the fins, greatly reducing cooling efficiency. When the oil leak is repaired, the CAC must be thoroughly cleaned.

During each oil change **inspect** the engine side of the radiator/CAC assembly for foreign objects that may cause restriction.

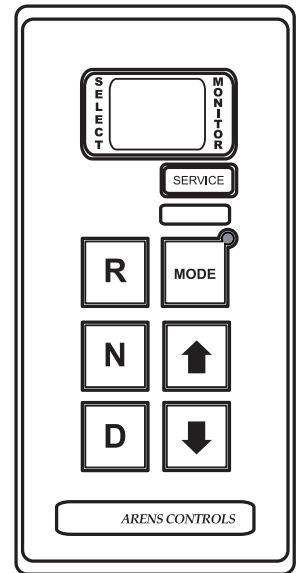
Spraying degreaser on the charge air cooler, as well as using a steam cleaner, will not damage the CAC. However, **pressure washer and steam cleaner nozzles placed too close to the CAC can bend the fins.** The recommended cleaning procedure for the CAC and the radiator, is to use a bucket of mild soap and water. Carefully wash with a bristle brush then rinse using a garden hose, with minimum water pressure, standing back a distance to avoid bending the fins.



TRANSMISSION

The Allison MH-2500 series transmission is a fully automatic, torque-converter driven, electronically controlled transmission. The electronic controls provide automatic gear selection in all drive ranges and automatic engagement of the torque converter lockup clutch.

The electronic control system has five major components: the Transmission Control Module (TCM), engine throttle position sensor, three speed sensors, Neutral Start Back Up (NSBU) switch and the control valve module. The TCM processes information received from the throttle position sensor, speed sensor, NSBU switch and control valve module. The electronic control system optimizes shift quality by using “Adaptive Shifting.” A wide variety in shifting under varied conditions is required before optimizing the shift quality. Generally, five typical shifts of a shift type are needed for shift calibration.



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Transmission Key Pad Functions:

- Selects Neutral by pressing **N**. The area around the **N** button has a raised ridge so the driver can orient his hand to the Neutral button by touch.
- Selects Reverse gear by pressing **R**.
- Selects the forward Drive range by pressing **D**. The **SELECT** and **MONITOR** will indicate "**D1**", indicating the transmission is in 1st gear. Throughout the subsequent up shifts or downshifts, the **SELECT** and **MONITOR** will indicate the gear the transmission is in.
- The **UPSHIFT** and **DOWNSHIFT** arrow buttons are used to select a higher (if not in fifth gear) or lower (if not in first gear) forward range. These buttons are not functional in NEUTRAL or REVERSE. One press changes the gear selected by one range. If the up or down button is held continuously, the range will continue to change up or down until the button is released or until the highest/lowest possible gear is selected.
- The **Mode** button enables economy mode.

To Enter Economy Mode:

Press the **MODE** button. The LED will illuminate.

To Exit Economy Mode:

Press the **MODE** button. The LED will extinguish.

Economy Mode:

Economy mode affects the upshift schedule D-3, D-4, D-5 and downshift schedule D-5, D-4, D-3. During highway driving, with the cruise control set between 55 and 65 miles per hour, setting the transmission to Economy Mode will eliminate about 99% of transmission downshifts from fifth to fourth when incurring a slight incline or overpass.

In city driving, with the transmission set to Economy Mode, the transmission will upshift approximately 200 RPM sooner using less fuel with reduced engine noise. Do not use Economy Mode while traveling in mountain terrain. The lower RPM shift schedule will reduce the flow of antifreeze, lubricating oil and airflow through the radiator resulting in increased transmission and engine temperature.

CAUTION:

Do not use the economy mode in heavy stop and go traffic or mountainous terrains. Frequent shifting occurs when in Economy Mode while using heavy throttle, increasing transmission fluid temperature. Exit Economy Mode until road conditions improve.

NOTE:

When the Auxiliary Braking device is used, the display will change to a default reading of D-3. This setting is pre-selected at the factory and can only be altered by an authorized Allison Service center. The transmission is not actually in third gear. This is only a reference point so the transmission will optimize engine-braking efficiency.

Service:

If the Service display is illuminated a fault may exist with the Shift-By-Wire system. A qualified service technician should inspect the system.

Flashing Display:

In the event the Display area begins to flash, the transmission has inhibited shift operations. This is an indicator that range shifts requested might not occur. Certain operating conditions when detected by the TCM will inhibit shifting to protect from damaging operations. This is in response to diagnostic trouble codes received by the transmission control system.

Shift inhibits falls within certain categories. Above-idle neutral range shifts are shifts from **N** (Neutral) to **R** (Reverse) or **N** (Neutral) to a forward range when the idle is in excess of 900 rpm (Above-idle). Forward/Reverse directional shifts are not permitted when measurable output shaft speed is detected.

NOTE:

Sudden movements or lurching the motorhome with an open throttle can result in damage to transmission. Avoid this condition by making shifts only when the throttle is closed and engine is at normal idle.

Certain unusual transmission operating conditions detected by the TCM will temporarily limit transmission operations. These conditions are transmission problems. The TCM will lock the Transmission in a safe gear range to permit the motorhome to be driven to a service location. The TCM may not respond to additional shift requests. Upshift and downshift may not occur and directional changes will not occur. Consult the Allison Operator's manual for more information.

Troubleshooting:

1. Turn ignition switch to **ON**. Do not start the engine. Ensure the display on the Shift Selector illuminates. If it doesn't, go to Electrical Troubleshooting Section. If it does come on, does it show **N**? The left character will be blank. If not, press **N** and see if it shifts. If it does, proceed to the next step. If it does not, go to the Electrical Troubleshooting Section.
2. Start the engine. If the engine starts, the transmission is in **NEUTRAL**. Ensure the display indicates **NN**. If it does, proceed to the next step. If it doesn't, go to the Electrical Troubleshooting Section.
3. Press the **R** button for **REVERSE**. See if **RR** is displayed. Listen for backup warning beeper. If warning beeper sounds, the Shifter has shifted the transmission to Reverse. If it does, proceed to the next step. If it doesn't, go to the Electrical Troubleshooting Section.
4. Press the **D** button for **DRIVE**. See if **D1** is displayed. If **DD** is displayed the J1939 is not working or the connector is not making contact. If **D3** is displayed, the Transmission TCM is in the Limp Home Mode (3rd gear). Contact Allison at 800-524-2303 for further instructions.
5. With the Transmission in **DRIVE** perform the following checks:
 - Press the **D** display in the window is **D1**.
 - Press the **arrow down** display in the window is **41**.
 - Press the **arrow down** display in the window is **31**.
 - Press the **arrow down** display in the window is **21**.
 - Press the **arrow down** display in the window is **11**
 - Press the **arrow up** display in the window is **21**
 - Press the **arrow up** display in the window is **31**
 - Press the **arrow up** display in the window is **41**
 - Press the **arrow up** display in the window is **D1**

If all ranges show up correctly, the Shift-by-Wire System is functioning normally. Proceed with Transmission Diagnosis per Allison Troubleshooting Procedures. If not, contact *Arens Control* at **(847) 570-6411** for further instructions.

Electrical Troubleshooting:

If no display or power to the Shift-by-Wire System occurs when the ignition is on, check the following fuses and connections at the front distribution panel, below the driver's window:

Main Power - Location is the V-Bat Terminal located at the fuse panel, below the driver's window. Look for two wires with in-line fuses. Be sure to check the in-line fuses (10 Amp).

Ignition - Location 12 or 13 on the chassis panel.

Grounds - Two located at ground post on the right side of the far right fuse panel.

Remove the Shift Selector from the Console (two U-Brackets from underneath) and check to see if the connector in the back is firmly plugged in. If it is, then run a continuity check of each of the wires listed above.

If the display still does not illuminate, replace the Shift Selector with a new one. If the Shift Selector display illuminates and the transmission does not shift into the various ranges, **inspect** the two connectors on the Actuator Assembly on the left side of the transmission. One is on a pigtail, and the other is plugged directly into the position sensor. Ensure both connectors are in good condition (no pushed out pins or damage) and properly connected.

Transmission Check Light

The electronic control system is programmed to inform the operator of a problem with the transmission system and automatically take action to protect the operator, motorhome and transmission. When the TCM detects a Range inhibit or Shift inhibit condition, the TCM restricts shifting, turns the **CHECK TRANS** light on the instrument panel and registers a diagnostic code.

NOTE:

For some problems, diagnostic codes may be registered without the ECU activating the CHECK TRANS light. The Allison Transmission authorized service outlet should be consulted whenever there is a transmission related concern. They have the equipment to check for diagnostic codes and to correct problems which arise.

Each time the engine is started the **CHECK TRANS** will light, then turn off after a few seconds. This momentary lighting is to show that the status light circuits are working properly. If the **CHECK TRANS** light does not illuminate during start up, or if the light remains on after start up, the system should be checked immediately. Continued illumination of the **CHECK TRANS** light during vehicle operation (other than start up) indicates that the TCM has signaled a diagnostic code.

Preventive Measures

Help the electronic control system oversee the operation of the transmission. Minor problems can be kept from becoming major problems if you notify an Allison Transmission distributor or dealer when one of these conditions occur:

1. The shifting feels odd.
2. The transmission leaks fluid.
3. Unusual transmission-related sounds (changes in sound caused by normal engine thermo-static fan cycling, while climbing a long grade with a heavy load, have been mistaken for transmission-related sounds).
4. The **CHECK TRANS** light comes on frequently.

Periodic Inspections

For easier inspection, the transmission should be kept clean. Make periodic checks for loose bolts and leaking fluid lines. Check the condition of the electrical harnesses regularly. Check the engine cooling system occasionally for evidence of transmission fluid which would indicate a faulty oil cooler. Report any abnormal condition to the Allison dealer.

Because the transmission fluid cools, lubricates and transmits hydraulic power, it is important that the proper fluid level be maintained at all times. If the fluid level is too low, the converter and clutches do not receive an adequate supply of fluid. If the fluid level is too high, the fluid can aerate. Aerated fluid can cause the transmission to shift erratically or overheat.

NOTE:

The motorhome should be stationary for approximately two minutes prior to checking the fluid levels to ensure fluid is stabilized.

Transmission Lubricating Fluid

Transmission performance, reliability and durability are important influences in the type of fluids used. The Transmission has been factory tested using TranSynd™ synthetic transmission fluid.

NOTE:

The ISB-300 engine with a 2500MH transmission requires using TranSynd™ synthetic transmission fluid.

The dipstick and an oil fill are located between the engine and transmission underneath the engine access door in the bedroom. A small tag has been attached to the dipstick identifying the use of TranSynd™ synthetic transmission fluid. A remote fill has been install in the rear of the motorhome. The orange colored cap can identify this. The fluid does not need to be carried through the motorhome.

CAUTION:

Use of any type of transmission lubricating fluid other than TranSynd™ will void the warranty.

Fluid and Internal Filters Change Interval Recommendations:

The fluid and internal filters may require changing earlier depending on the severity of operating conditions. The 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. Contact an authorized Allison Service center for change intervals.

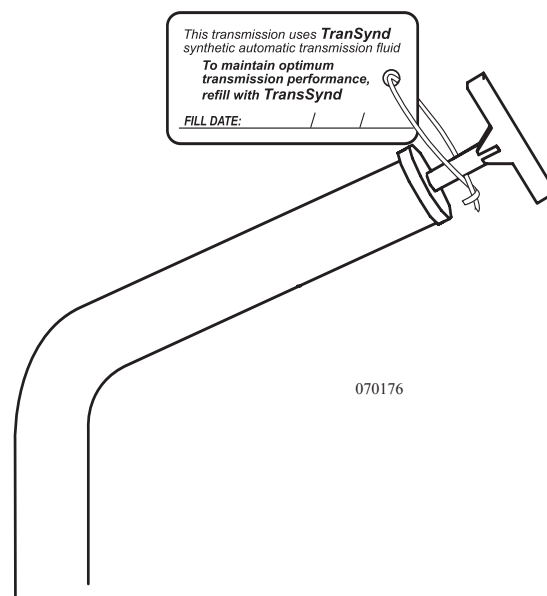
Transmission Fluid Level - Cold Check

Cold Check - Manual Check Procedures:

The concept of a cold check is to determine adequate fluid level for safe operating until hot check can be performed.

To Check the Fluid When Cold:

- Park the motorhome on a level surface. Set the parking brake.
- With the engine operated at a low idle, put the transmission in N (Neutral).
- Chock the wheels to prevent the motorhome from moving.
- Allow the engine to run at idle (500-800 RPM) for one minute.
- Apply the service brakes and shift to D (Drive), then to N (Neutral) and next to R (Reverse) to fill the system. Finally shift to N (Neutral) and release the service brakes. Allow the engine to continue to run at idle (500-800 RPM).



-
-
- Remove the dipstick and wipe clean. Reinsert the dipstick fully into the tube and remove to check fluid level. Repeat this to verify the reading if needed.
 - Safe operating level is anywhere within the **COLD CHECK** band on the dipstick. The fluid level is sufficient enough to operate until a **HOT CHECK** can be performed.
 - If the level is not within this band, add or drain the fluid as necessary to put the level to the middle of the **COLD CHECK** band.
 - Perform the **HOT CHECK** at the first opportunity after reaching normal operating temperatures (160° - 200° F/71° - 93° C).

CAUTION:

Low or high fluid level can cause overheating and irregular shift patterns. These conditions can damage the transmission if not corrected.

Transmission Fluid Level - Hot Check

- The fluid level rises as the temperature increases. The fluid must be hot to ensure an accurate check.
- Be sure the fluid has reached normal operating temperature (160° - 200° F/71° - 93° C). If a transmission temperature gauge is not present, check the fluid level when the engine water temperature gauge has stabilized and the transmission has been operated under the load for at least one hour.
- Park the motorhome on a level surface and shift to N (Neutral). Apply the parking brake and allow the engine to idle (500 to 800 RPM).
- After wiping the dipstick clean, check the fluid level. Safe operating level is anywhere within the **HOT RUN** band on the dipstick.
- The width of the **HOT RUN** band is approximately one quart of fluid at normal temperature range.
- If the level is not within this band, add or drain the fluid as necessary to put the level within the **HOT RUN** band.
- Be sure that the fluid level checks are consistent. Check the level more than once. If the readings are not consistent check to be sure that the transmission breather is clean and not clogged. If the readings are still not consistent, contact the nearest Allison distributor or dealer.

FUEL SYSTEM - Fuel Requirements

Low sulfur #2 diesel fuel or #1 and #2 commercial winter blend diesel fuels are the most common commercially available and recommended for use.

The use of #2 diesel fuel will result in optimum engine performance.

Try to obtain fuel from sources that are serviced often such as large truck service facilities. The fuel supply is fresh and the possibility of introducing contaminants or water into the fuel system is reduced. It is important to not empty the engine of fuel. The fuel system on the engine is sensitive to air. If the engine is allowed to run out of fuel, the fuel system will need to be thoroughly primed before the engine will start. Refer to the *Fuel Filters* article for priming instructions.

WARNING:

Do not mix gasohol with diesel fuel. This mixture can cause an explosion.

NOTE:

If the engine has run out of fuel it will need to be primed. Refer to Fuel Filters for instructions on priming the fuel system.

NOTE:

Due to the precise tolerances of diesel injection systems, it is extremely important that fuel be kept clean and free of dirt or water. Dirt or water in the system can cause severe damage to both the fuel pump and the fuel injectors. Fuel additives for lubricity are not recommended. There are numerous diesel fuel additives to help remove moisture from fuel, prevent microbe growth and to prevent gelling during cold weather. Before adding any type of fuel additive or extender, consult the *Manufacturer's Owner's Manual*.

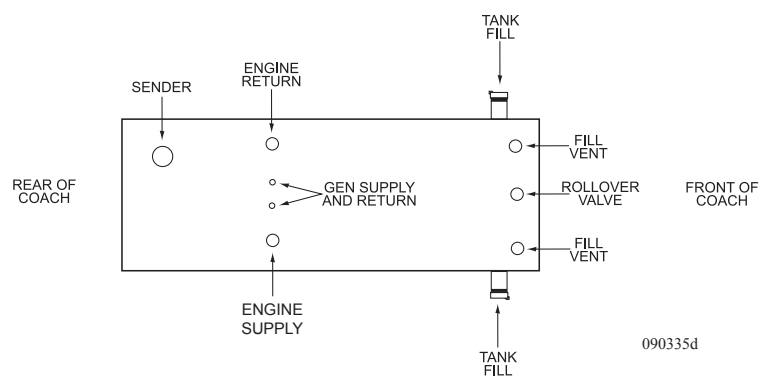
Fuel Tank

The diesel fuel tank is made of steel. The engine pickup tube is cut at a 45° angle to allow optimum flow to the engine. The generator tube is set to approximately ¼ of a tank. This will prevent depleting the fuel supply while dry camping.

Internal baffles slow fuel slosh. A check valve placed at the bottom of the baffle, at the end of the tank with the pick-up tube, prevents fuel starvation through long corners when fuel supply is low.

NOTE:

Fill the fuel tank if the motorhome is going to be stored for any length of time to reduce the amount of potential condensation. After storage, check the vent tube for blockage. It is not uncommon for insects to plug the vent tube. If pressure or vacuum exists when the fuel cap is removed, the vent tube may be blocked. The end of the vent tube is located on the curbside of the fuel tank, near the bottom.



The "Centroid" fuel sender has no moving parts and works by measuring capacitance (electrical property) between its inner and outer tubes in the tank. The more fuel between the tubes, the higher the reading. Electronics in the "hockey-puck" head of the sender convert the capacitance to current to drive the fuel gauge.

Connections:

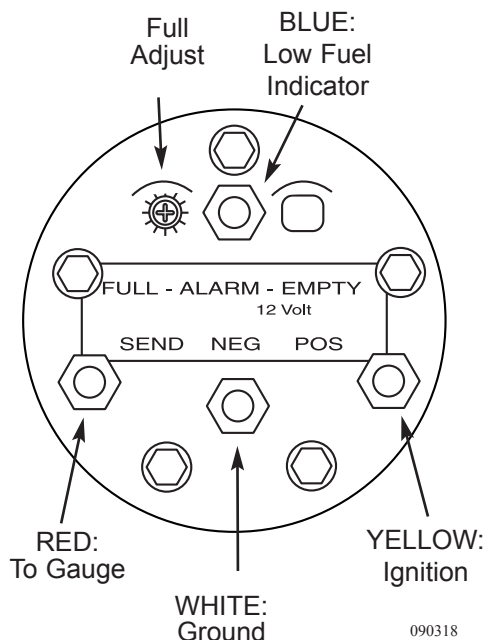
The "Centroid" sender has four connections:

- 1 & 2 - Positive (POS) and Negative (NEG):** Battery voltage to run the electronics in the sender head.
- 3 - SEND:** Connects to the SEND terminal of the gauge on the dash.
- 4 - ALARM:** Makes a connection internally to the negative (NEG) terminal when the low fuel alarm level is reached (when the fuel gauge is reading about 1/8 tank). This turns on the fuel indicator light on the dash and is not adjustable.

Adjustments:

The "Centroid" sender has two adjustments:

- 1 - EMPTY:** Adjusts for length of sender. It has been set at the factory, covered with a sealant and should not be changed.
- 2 - Full Adjustment (FULL):** The full adjustment can be used to correct for slight differences between fuel meters. During installation, it has been factory calibrated and should not need re-adjustment.



Fuel Sending Unit.

The correct adjustment technique, with a full tank of fuel, is to start with the full adjustment screw completely clockwise. This should cause the reading to be above full. Adjust slowly, rotate counterclockwise, until the full mark on the gauge is reached. The intent is to always adjust downscale rather than upscale.

Troubleshooting:

- A. Electronic Output:** The sender has a transistorized output to prevent an ohmmeter from getting a correct reading of its output resistance.
- B. Fuel Only:** The sender will not work correctly in conducting fluids such as water (it will read above full all the time in water). One possibility is that when there is a constant above-full reading there may be water in the bottom of the fuel tank.
- C. Contact Centroid:** Probably 90% of the return Centroid tests work okay on the bench. If you have incorrect readings contact Centroid (**telephone: 800-423-3574**, or preferably, **fax: 386-423-3709**) with the symptoms. A short, "fill in the blanks" troubleshooting test is provided to test the sender. It is easier to find the problem that way than after the sender has been removed from the system, since the problem is not necessarily with the sender.

Fuel Lines & Hoses

Make a visual check for fuel leaks at all engine-mounted fuel lines, connections and at the fuel tank pick-up and return lines. Leaks in this area may best be detected by checking for accumulation of fuel under the tank. Engine performance and auxiliary equipment is dependent upon the ability of flexible hoses to transfer lubricating oil, air, coolant and fuel. Maintenance of hoses is an important step in ensuring efficient, economical and safe operation of the engine and related equipment.

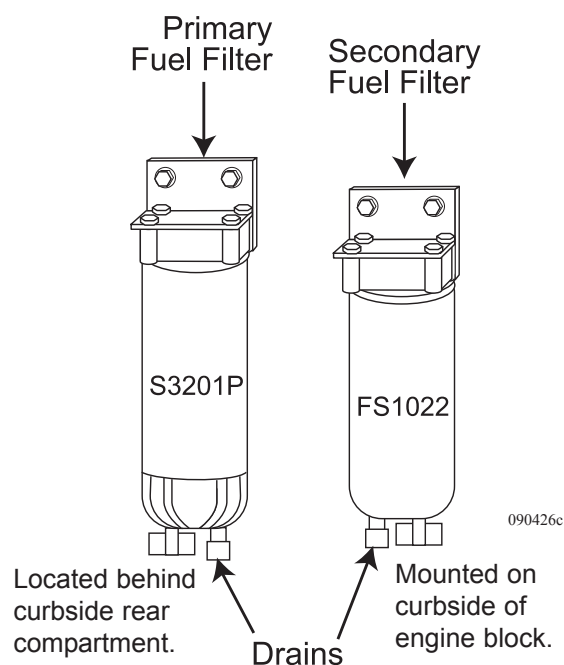
INSPECTION:

Check hoses daily as part of the pre-start inspection. Examine hoses for leaks. Check all fittings, clamps and ties. Make sure the hoses are not touching shafts, couplings or heated surfaces, including exhaust manifolds, sharp edges or other obvious hazardous areas. Over time, vibration from the engine and road can move or fatigue clamps and ties. To ensure continued proper support, inspect fasteners frequently and tighten or replace them as necessary.

The fuel filters are located on the curbside frame rail, next to the engine. The primary fuel filter has a drain and a clear sediment bowl, located at the bottom of the filter. Water (by weight) is heavier than fuel and will collect in the sediment bowl. Water can accumulate in the fuel from condensation in the fuel tank or contamination upon refueling.

The appearance of water in the sediment bowl is easily identified by the inability of water to mix with the fuel forming small pools. The water should be drained at the first opportunity. If water passes through the filters it can cause engine misfire and damage fuel injectors.

Shut off the engine and open the drain valve. Turn the valve counterclockwise approximately 1½ to 2 turns until draining occurs. Drain the fuel/water separator of water and sediment until clear fuel is visible. Turn the valve clockwise to close the drain valve.



NOTE:

Replace the primary filter every six months or 11,000 miles. Refer to the engine OEM manual for Secondary filter replacement intervals.

NOTE:

When draining or changing the fuel filters, always use a container. Dispose of the container properly. The water and sediment can contain petroleum products. Consult the local waste disposal agency for recommended disposal guidelines

In the event the engine runs out of fuel, the lift pump on the fuel pump will run for approximately one minute with the ignition ON. The ignition may have to be turned on and off several times before attempting a start. If unable to restart, contact the nearest Cummins Center or phone **1-800-343-7357** for Cummins Customer Assistance.

HYDRAULIC SYSTEM

On a walk around and pre-check of the motorhome, look for oil leaks under the coach 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 (Power Steering)

The power steering reservoir with internal filter is located at the rear of the engine. The hydraulic filter assembly, located inside the reservoir, is rated at ten micron*. The reservoir is filled with Dexron-III® Automatic Transmission Fluid from the factory.

NOTE:

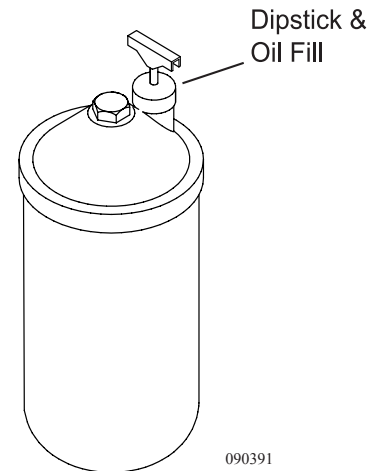
It is strongly recommended the owner carry a spare hydraulic filter and fuel filter on board. These items can be obtained through a Cummins distributor.

Filter assembly: Nelson 91085G

Element number: 84365A (ten micron*)

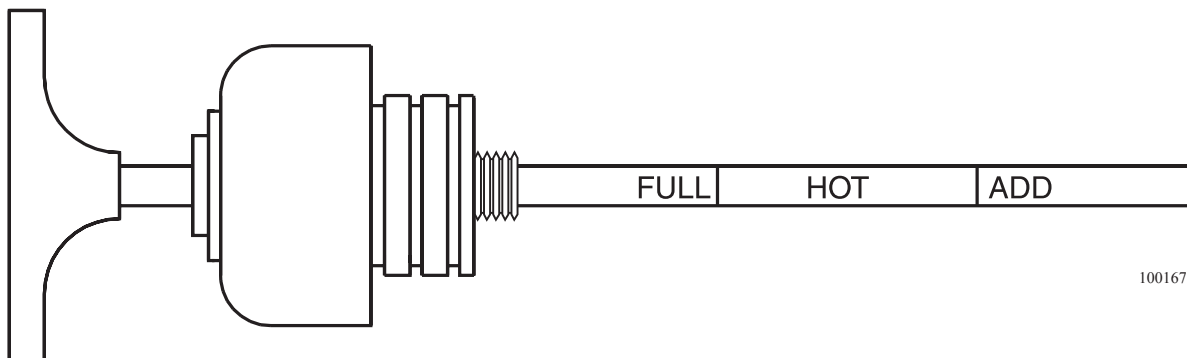
The primary function of the power steering reservoir is to keep the steering system free of contamination and to dissipate excessive heat that builds during extreme operating conditions.

Check the oil level in the reservoir every 6,000 miles or three months. The oil dipstick fill is located on top of the reservoir in the rear compartment. The oil level should be kept between the full and add marks on the dipstick. If adding of fluid is required, use only Dexron-III® Automatic Transmission Fluid.



Checking the Fluid Level:

1. Start the engine and allow it to reach normal operating temperature.
2. While the engine is at idle, turn the steering wheel left and right several times.
3. Shut the engine off.
4. The easy grip handle is rotated counterclockwise to remove the dipstick.
5. Check the fluid level on the "HOT" side of the dipstick. It should be in the area of "HOT" on the dipstick. This is the normal range. Do not exceed the full mark.
6. If the fluid level is low, add fluid in small amounts, continuously checking the level until the "FULL" mark is reached.
7. Insert the easy grip handle back in the reservoir and rotate clockwise until securely fastened.

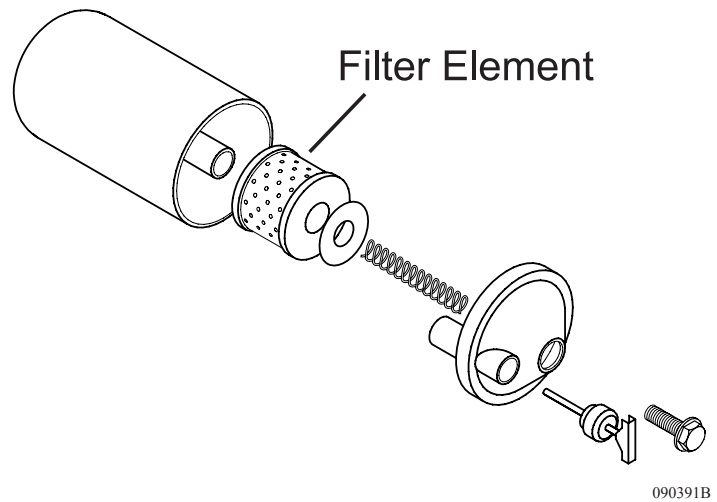


Hydraulic Filter (Power Steering)

Change the hydraulic oil filter every 15,000 miles, or once a year, for cellulose element. A synthetic media filter is available, which will extend the interval to once every five years.

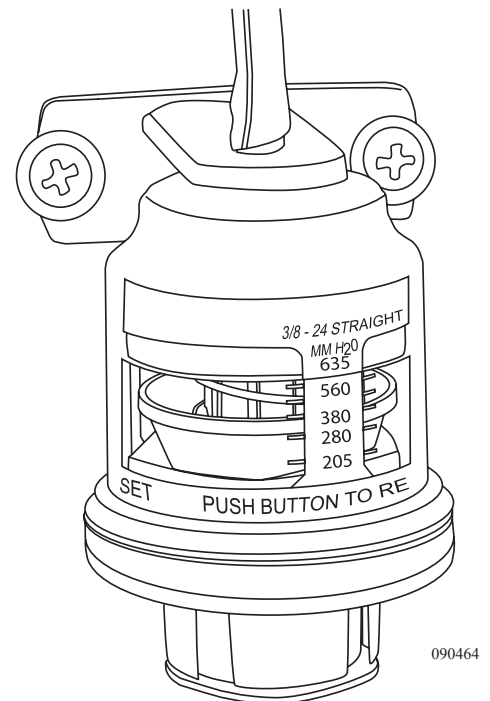
Changing the hydraulic oil filter:

1. Using a 15/16 inch wrench, loosen the center cover bolt.
2. Remove the bolt and cover plate to access the spring and filter.
3. Remove the spring and washer to remove the filter assembly.
4. After replacing the filter assembly, reverse the process to re-assemble the reservoir.
5. When attaching the cover plate in the rubber cover seal, check for any damage.



AIR FILTER Air Filter Minder

The air filter restriction indicator relays the amount of restriction present in the air intake system and should be inspected before each trip. If the **yellow** indicator approaches the **red** (top) area of the air restriction indicator, it is signaling that the air filter is becoming excessively dirty.



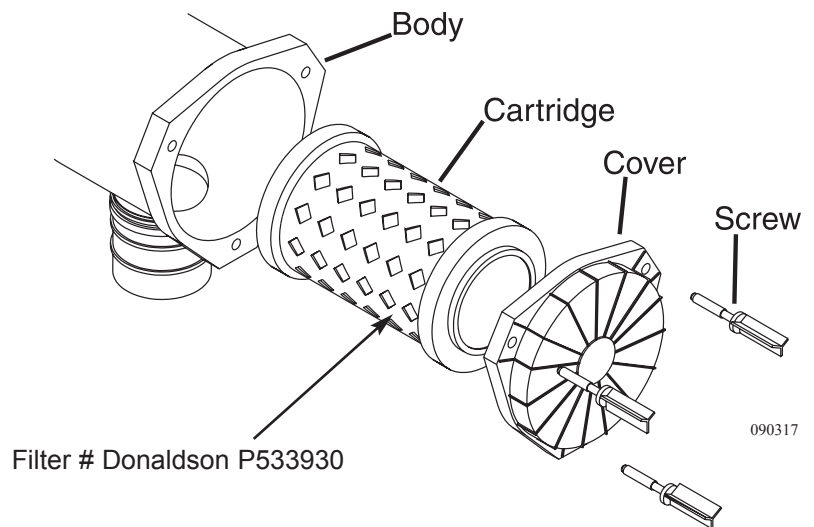
Located in rear engine compartment.

Changing the Air Filter

To replace air cleaner remove screws and cover from air cleaner body. Remove air cleaner cartridge and discard. Install new air cleaner cartridge and secure with cover and screws.

WARNING:

Do not start the engine with the air cleaner removed and do not remove air cleaner while the engine is running.



LUBRICATION MAINTENANCE

Performing regular scheduled maintenance ensures reliable operation and optimum service life of the various chassis components. Completed maintenance brings peace of mind knowing the various components have received proper service. Failure to follow maintenance guidelines, or perform scheduled maintenance, results in inefficient operation, premature component wear or component failure resulting in breakdown.

Maintenance schedules are usually performed at certain mile or time intervals. When performing high level procedures, lower level service should also be performed.

NOTE:

Maintenance schedules are based on normal operating conditions and use. Operating under unusual or adverse condition shortens service intervals.

NOTE:

Engine and transmission service intervals are listed in their respective manuals.

Proper Lubricant Waste Disposal:

When performing service maintenance on the engine, transmission or rear axle, waste fluids and filters should be properly disposed of or recycled. Package used oils, antifreeze and other fluids in sealed containers. In many cases used oil is accepted free of charge at county disposal sites. Waste fluids are toxic to pets and other animals. Waste fluids should not be left in open containers. The sweet odor of antifreeze is attractive to pets, but highly toxic.

CAUTION:

Properly dispose of used antifreeze and waste oil. Animals like the sweet odor of antifreeze and may ingest it if left in open containers. Wipe up any fluid spills. Pets may lie in puddles of fluid, many of which are irritants and can cause severe chemical burns if not properly washed.

Lubricant Classification:

Lubricants are manufactured in many forms for a variety of applications. There are many different oil and grease consistencies each with a designed application. To properly select a particular type of lubricant for a specific application, the component must be evaluated. Component stress loads, ambient temperature, working temperature and environmental exposure are just a few of the variables to consider. Select the proper lubricant for its intended application. As an example: selecting high viscosity grease to lubricate a lock cylinder results in sluggish lock cylinder operation especially in a cool environment. Conversely, using graphite to lubricate a component that is under extreme temperature and load will result in component failure.

Grease ratings and their base compounds are especially important when selecting a lubricant type for an intended application. Some grease compounds are manufactured for multi-use application. These are acceptable if the grease rating is in accordance with the manufacturer's recommended lubricant type and rating.

Lubricants:

Many chassis components require lubrication. The types of lubricants used will vary with the application of the component. A component may fail prematurely due to lack of lubrication or from using an incorrect lubricant type. The component manufacturer usually recommends a particular type of lubricant with a minimum approval rating. Most lubricants are tested under strict guidelines set by the ASTM (American Society for Testing and Materials). The NLGI (National Lubricating Grease Institute) helps disperse information to the grease production industry. Grease containers usually have an approval rating by the SAE (Society of Automotive Engineers), Mil Spec (Military Specification), API (American Petroleum Institute) or by other recognized and accepted organizations. The correct lubricant type with an approved specific rating must be used whenever applying, changing or adding any lubricant. When purchasing lubricants for a specific application be sure the label affirms the type of lubricant required with the tested rating by the term "meets or exceeds" in accordance with the manufacturer specifications.

Lubricating greases are made from different base compounds giving the grease different lubricating consistencies, properties and maximum operating temperatures. Most containers list the base compound and maximum operating temperature usually listed as melting point or drip point. Lubricating components, such as brake component for example, require a high temperature special base compound grease. Lubricating this type of component with other than specified grease type will result in inadequate lubricating qualities resulting in component malfunction or failure.

INSPECTION:

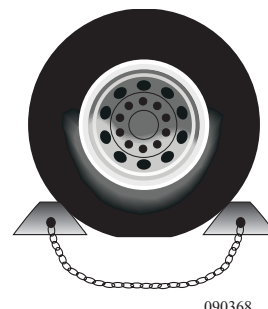
When performing any scheduled maintenance, inspect the area around where you are working. For example, changing the oil, look at the rear differential. Inspect for visual signs of fluid leaks.

Most fluids and lubricants have a distinct odor, which can be used to detect early signs of trouble. Generally, odors are most detectable soon after parking. Unusual sounds are another method of detecting a problem early. There are many types of sounds that are normal, such as the cyclic purging of the air dryer. Become familiar with the different sounds. If something sounds odd, smells peculiar or looks unusual investigate the situation.

Greasing:

Thoroughly clean all Zerk grease fittings before applying new lubricant. Keep paper towels or disposable rags handy when greasing. When lubricating items such as drive shafts and steer axle components, continued grease application is generally required until new grease appears at exit points.

Some items use sealed boots around the component to prevent moisture intrusion. When greasing these types of components, care must be given to prevent excess lubricant pressure from rupturing the seal.



WARNING:

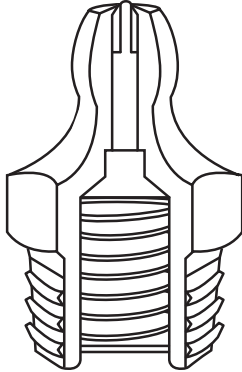
Always chock wheels before going underneath the motorhome.

Brake actuating components require lubrication to keep the actuating components freely operating. Avoid contaminating brake linings with lubricant. Particular care and attention to details should be taken when lubricating brake actuating components. Wheel removal may be necessary to gain access the grease fittings.

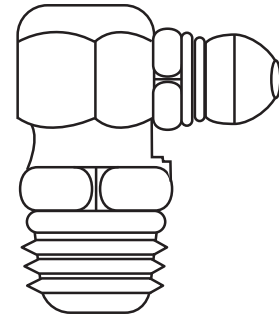
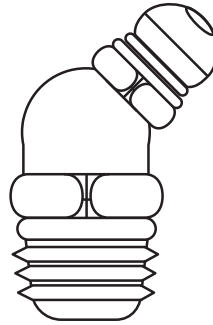
To apply grease:

- 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 inline 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.



Typical Zerk Fitting.

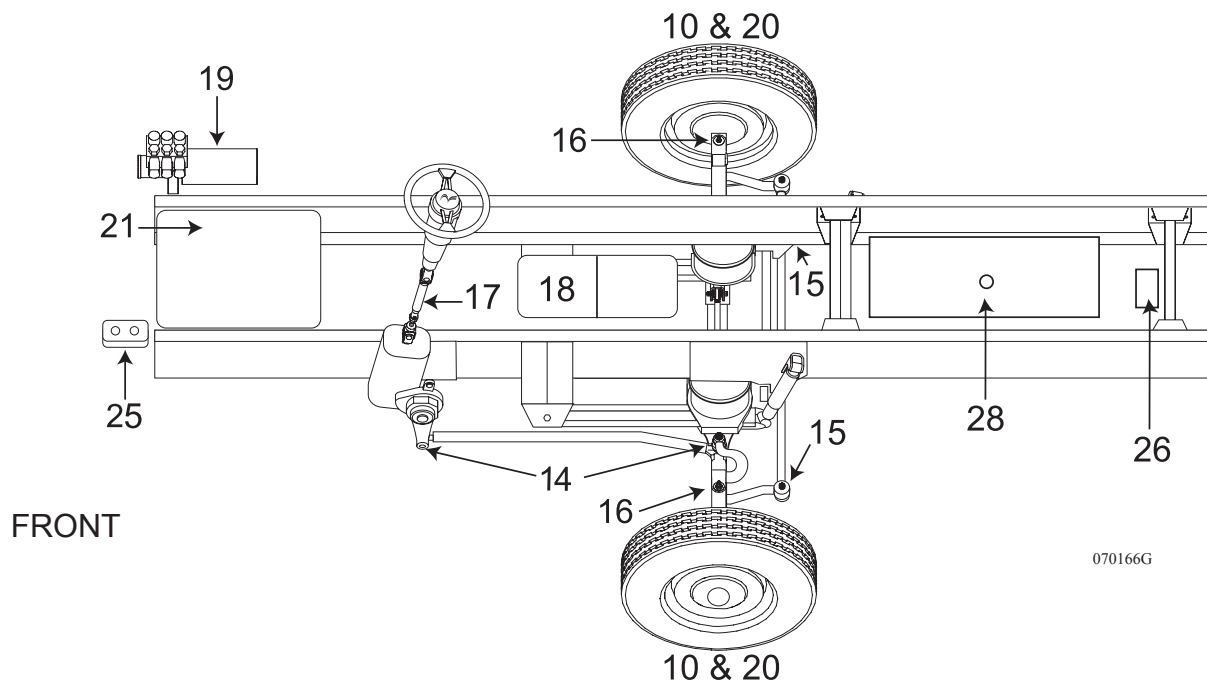


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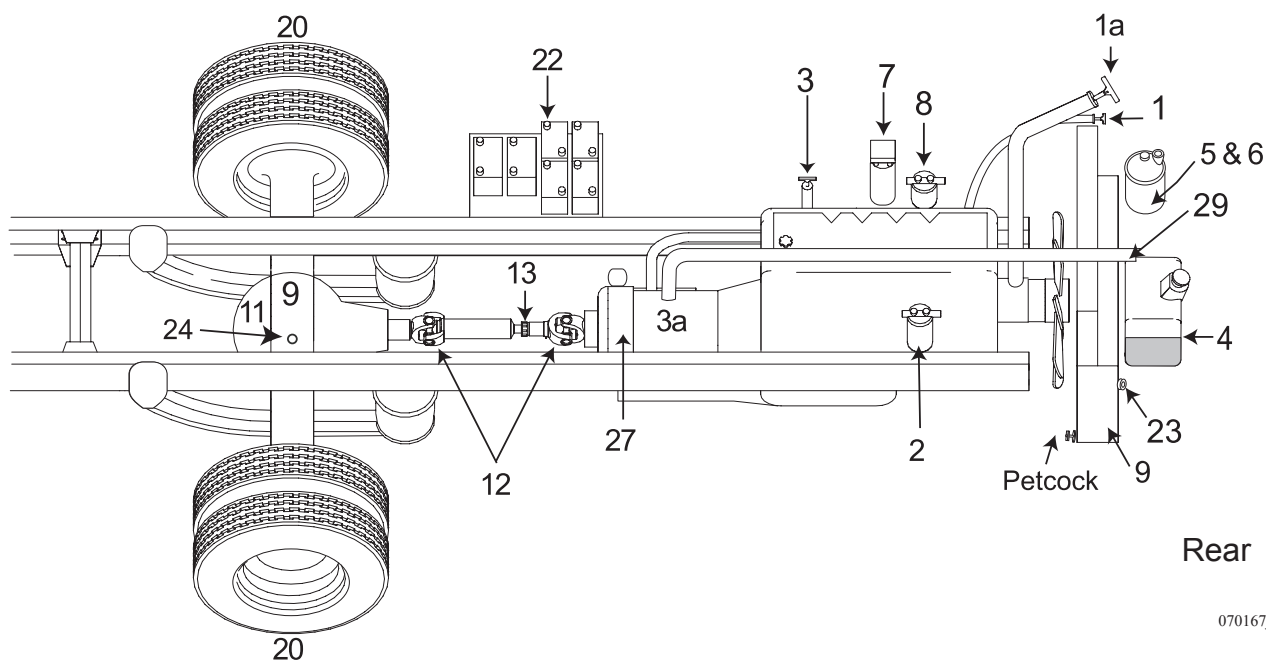
NOTE:

Some grease fittings may not be accessible until the steering wheel is turned or the motorhome is moved slightly.

LUBRICATION CHARTS



Component	Action	When	Code – Refer to Chart
1 Engine Oil	Keep to Full Mark	Before Each Trip/Daily Enroute	EO
1a Engine Oil	Drain	Refer to OEM	OEM
2 Engine Oil Filter	Replace at Oil Change	Refer to OEM	OEM
3 Transmission	Keep to Full Mark	Refer to OEM	TS
3a Transmission	Drain	Refer to OEM	OEM
Transmission Filter	Replace	Refer to OEM	TS
4 Engine Coolant – Surge Tank	Maintain Level	Before Each Trip/Daily Enroute	AF
5 Hydraulic Fluid Reservoir	Maintain Level at Sight	Before Each Trip/Daily Enroute	TF
6 Hydraulic Filter	Replace	15,000 or Annually	TF
7 Filter Fuel/Water Separator (Primary)	Inspect	Before Each Trip	FF
	Replace	15,000 or 6 months	
8 Filter Fuel (Secondary)	Replace	Refer to OEM	FF
9 Radiator/Charge Air Cooler	Inspect	Weekly	--
10 Axle Hubs	Inspect Level	1,000	GO
	Replace	30,000 or Annually	GO
11 Rear Differential	Change Fluid	250,000 or 3 Years	MP
12 Drive Shaft Universal Joints	Grease 2-Fittings	10,000 or Annually	CL
13 Drive Shaft Slip Yoke	Grease 1-Fitting	10,000 or Annually	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	5,000 or 6 Months	CL
17 Steering Shaft	Grease 3-Fittings	30,000 or Annually	CL
18 Air Tank Drains	Drain	Monthly	--
19 Leveler Reservoir	Keep to Full Mark	6,000 or 3 Months	TF
20 Tire Pressure	Check	Before Each Trip/Daily Enroute	--
21 Generator	Refer to OEM Manual	Refer to OEM	OEM
22 Batteries	Inspect	Bi-Monthly	DW
Battery Terminals	Apply Coating	10,000 or Annually	P
23 Air Filter Minder	Inspect	Before Each Trip/Daily Enroute	--
24 Axle Breather Vent	Inspect & Clean	250,000 or 3 Years	--
25 Brake Master Cylinder	Keep to Full Mark	6 Months	BF
26 ABS Module	Inspect	6 Months	--
27 Park Brake Assembly	Inspect	12 Months	--
28 Fuel Tank	Inspect	Before Each Trip/Daily Enroute	DF
29 Transmission Remote Fill	---	---	---



Lubrication Code Chart

AF	Consult engine manufacturer manual for antifreeze type.
BF	Dot-3 Brake fluid.
CBL	Clay-based Lubricant - NLGI grade 1 or 2 clay-based grease.
CL-4	E.P. (extreme pressure) grease meeting NLGI grade 2 specifications with 3 to 5% molybdenum disulfide.
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.
DW	Distilled Water
EO	Engine oil as recommended by engine manufacturer.
FF	Fuel Filter.
GO	EP-SAE 90 gear oil.
HT	High Temperature Bearing Grease
MP	Gear Oil 75W/90 meeting or exceeding MIL-2105D. API GL-5. Pennzoil® Gear Plus SUPER-EW 75W-90 Synthetic.
OEM	Refer to original equipment manufacturers manual.
P	Petroleum jelly, or a commercial battery terminal corrosion inhibitor.
SO	Synthetic Oil EW 75-W90 meeting or exceeding MIL-2105D.
TF	Transmission fluid. Use <i>Dexron III</i> ® transmission fluid only.
TS	TranSynd™ synthetic transmission fluid.
DF	Diesel Fuel Only

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 bi-monthly. It is important to remember the generator maintenance interval is based on hours of usage. Consult the OEM manual for the generator service interval.

SPECIFICATIONS CHARTS - *Dimensions*

Weights	32PBD	34PDD	34SKD	36PDD	36PDQ	36PRT
Gross Vehicle Weight Rating	25,500 lb.	25,500 lb.	25,500 lb.	25,500 lb.	25,500 lb.	25,500 lb.
Gross Combined Weight Rating	32,500lb	32,500lb	32,500lb	32,500lb	32,500lb	32,500lb
Front Gross Axle Weight Rating	8,500 lb.	8,500 lb.	8,500 lb.	8,500 lb.	8,500 lb.	8,500 lb.
Rear Gross Axle Weight Rating	17,000 lb.	17,000 lb.	17,000 lb.	17,000 lb.	17,000 lb.	17,000 lb.
Measurements						
Wheelbase	188"	204"	204"	228"	228"	228"
Overall Length	32' 4"	34' 4"	34' 4"	36' 4"	36' 4"	36' 4"
Overall Height with A/C	12'-0"	12'-0"	12'-0"	12'-0"	12'-0"	12'-0"
Interior Height	6' 9"	6' 9"	6' 9"	6' 9"	6' 9"	6' 9"
Interior Width	94.5"	94.5"	94.5"	94.5"	94.5"	94.5"
Exterior Width	100.5"	100.5"	100.5"	100.5"	100.5"	100.5"

NOTE:

The actual overall length of the recreational vehicle may differ from that indicated due to variances in the manufacturing process and/or installed components. The actual length may be greater or less than that indicated.

Tank Capacities

Tank Capacities (Approximate Gallons) All Models	
Water Heater	10 gal.
Grey Tank	52 gal.
Black Tank	52 gal.
Fresh Tank	92 gal.
LP Tank*	38 gal.
Fuel Tank	75 gal

**Actual filled LP-Gas Tank Capacity is 80% of listing due to safety shut off required on tank.*

NOTE:

All tank capacities are estimated based upon calculations provided by the tank manufacturers and represent approximate capacities. The actual "usable capacity" may be greater or less than the estimated capacities based upon fabrication and installation of the tanks.

NOTE:

This chart reflects product specifications available at the time of printing. Therefore any floor plans introduced thereafter may not be reflected in the chart. All other information contained throughout the manual will still apply.

Engine Specifications

ISB 300 ENGINE SPECIFICATIONS	
Cubic Inch Displacement	5.9 Liter 359 CI
Engine HP	600 @ 2,600 RPM
Engine Torque	660 ft. lbs. @ 1,600 RPM
Rear Axle Ratio	4.88:1
Alternator Size	160 amp

Chassis Fluid Capacities

Chassis Liquid Capacities	
Engine Oil	17 qts
Transmission Oil (Initial Amount)	22 qts (MH 2,000 & 3,000)
Transmission Oil (With Service)	19 qts w/ filter
Radiator Coolant (Initial Amount)	11.5 gal
A/C Refrigerant (Initial Amount)	3.5 lbs of 134A
Rear End Capacity	16 qts (approx)

Generator Specifications

8 Kw




SERVICE INFORMATION

Refer to operator's manual for maintenance specifications and adjustments.

Air Cleaner	-	140-2897
Oil Filter	-	185-5409
Fuel Filter	-	149-2513
Oil Capacity	- 3	Qts w/oil filter
API Designation	- CE	
Temp		SAE Viscosity
5° - 120°F		15W-40
(-13°F) - 68°F		10W-30
(-40°F) - 68°F		5W-30

If service/parts are needed the Onan distributor can be located in the yellow pages under Generators-Electric. In the USA or Canada call 1-800-888-Onan

DC Fuse & Radiator Cap Under Cover.

Generator Specifications

060148c

5.5 kW



SERVICE INFORMATION

Refer to operator's manual for maintenance specifications and adjustments

Air Cleaner	-	140-3351
Oil Filter	-	185-7444
Fuel Filter	-	149-2513
Oil Capacity	- 2Qts	w/ oil filter
API Designation	- CE	
Temp		SAE Viscosity
5 - 120 F		15W - 40
(-13 F) - 68 F		10W - 30
(-40 F) - 68 F		5W - 30

If service parts are needed the Onan distributor can be located in the yellow pages under Generators-Electric. In the USA or Canada call 1800-888-Onan

Radiator Cap Under Cover

98-7995

TMI

020159j

35 Amp 2 pole AC Breaker

Belts & Filters

ISB FILTERS & BELTS	MANUFACTURER	NUMBER
A/C Belt	Dayco	15410
Air Filter	Donaldson	P527484
Alternator Belt	Cummins	3955169
Fuel Filter Primary	Fleetguard	53201P
Fuel Filter Secondary	Fleetguard	FS 19596
Oil Filter	Fleetguard	LF 3970
Power Steering Filter	Nelson	84365A

NOTE:

Filter and belt numbers were correct at the time of printing. Verify the numbers at time of removal. The manufacturer will not be responsible for incorrect filter or belt usage. Please refer to the engine manufacturer's operating instructions for specific maintenance information.

BATTERY SPECIFICATION CHART

Application	AH (20HR)	CCA†	RC (25A @ 80° F) MINUTES
12 Volt Chassis* Group 31p - MHD (2 each)		950	195
6 Volt Domestic** U2200 (4 each)	450		75Amp@ 80° F. = 230 Min.

Approximate Hours of Ampere Load					
**U2200	5 AMPS	10 AMPS	15 AMPS	20 AMPS	25 AMPS
	110	44	25	18	14

**Batteries connected in parallel. **Four batteries connected in a Series/Parallel configuration.
†CCA Ratings are at 0° F. These are the minimum requirements.*

Battery State of Charge vs Voltage/Specific Gravity			
VOLTAGE	SPECIFIC GRAVITY	STATE OF CHARGE	DEPTH OF DISCHARGE
12.66	1.265	100%	0%
12.45	1.225	75%	25%
12.25	1.190	50%	50%
12.05	1.145	25%	75%
11.90	1.100	0%	100%

Voltage Reading: Battery fully charged at rest for one hour.

Battery Charge Voltage chart.eps

Engine Cold Cranking Amp Requirements		
Cummins ISB	1190 CCA	12 Volts

CCA Rating are at 0° F. These are the minimum requirements.

METRIC/U.S. CONVERSION CHART

U.S. Customary to Metric			Metric to U.S. Customary			
Measurement	Multiplied By	Equals/Measurement	Multiplied By	Equals		
Length						
inches (in)	25.4	millimeters (mm)	0.03937	inches (in)		
inches (in)	2.54	centimeters (cm)	0.3937	inches (in)		
feet (ft)	0.3048	meters (m)	3.281	feet (ft)		
yards (yd)	0.9144	meters (m)	1.094	yards (yd)		
miles (mi)	1.609	kilometers (km)	0.6215	miles (mi)		
Area						
square inches (in ²)	645.16	square millimeters (mm ²)	0.00155	square inches (in ²)		
square inches (in ²)	6.452	square centimeters (cm ²)	0.15	square inches (in ²)		
square feet (ft ²)	0.0929	square meters (m ²)	10.764	square feet (ft ²)		
Volume						
cubic inches (in ³)	16387.0	cubic millimeters (mm ³)	0.000061	cubic inches (in ³)		
cubic inches (in ³)	16.387	cubic centimeters (cm ³)	0.06102	cubic inches (in ³)		
cubic inches (in ³)	0.01639	liters (L)	61.024	cubic inches (in ³)		
fluid ounces (fl oz)	29.54	milliliters (mL)	0.03381	fluid ounces (fl oz)		
pints (pt)	0.47318	liters (L)	2.1134	pints (pt)		
quarts (qt)	0.94635	liters (L)	1.0567	quarts (qt)		
gallons (gal)	3.7854	liters (L)	0.2642	gallons (gal)		
cubic feet (ft ³)	28.317	liters (L)	0.03531	cubic feet (ft ³)		
cubic feet (ft ³)	0.02832	cubic meters (m ³)	35.315	cubic feet (ft ³)		
Weight/Force						
ounces (av) (oz)	28.35	grams (g)	0.03527	ounces (av) (oz)		
pounds (av) (lb)	0.454	kilograms (kg)	2.205	pounds (av) (lb)		
U.S. tons (t)	907.18	kilograms (kg)	0.001102	U.S. tons (t)		
U.S. tons (t)	0.90718	metric tons (t)	1.1023	U.S. tons (t)		
Torque/Work Force						
inch-pounds (lbf.in)	11.298	Newton-centimeters (N.cm)	0.08851	inch-pounds (lbf.in)		
foot-pounds (lbf.ft)	1.3558	Newton-meters (N.m)	0.7376	foot-pounds (lbf.ft)		
Pressure/Vacuum						
inches of mercury (inHg)	3.37685	kiloPascals (kPa)	0.29613	inches of mercury (inHg)		
pounds per square inch (psi)	6.895	kiloPascals (kPa)	0.14503	pounds per square inch (psi)		
Measurement	Subtract	Divide By	Equals/Measurement	Multiply By	Add	Equals
Temperature						
degrees Fahrenheit (°F)	32	1.8	degrees Celsius (°C)	1.8	32	degrees Fahrenheit (°F)

MAINTENANCE RECORDS

After scheduled services are performed, record the date, odometer reading and who performed the service in the boxes provided after the maintenance interval. Any additional information from “Owner Checks and Services” or “Periodic Maintenance” can be added on the following record pages. **In addition, retain all maintenance receipts.** The owner information portfolio is a convenient place to store them.

LUBRICATION SERVICE RECORD

KEY TO SERVICES

A – Lubrication & Inspection
 A1 – Motor Oil & Filter Change
 A2 – Transmission Oil Change

A3 – Drive Axle Oil Change
 A4 – Wheel Bearing Service
 B – Prescribed Service

C – Prescribed Service
 D – Prescribed Service
 E – Prescribed Service

MILEAGE	SERVICES										JOB PERFORMED	
	A	A1	A2	A3	A4	B	C	D	E	DATE	BY	
1												
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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	
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