

WARRANTY LIMITED	1
WARRANTY LIMITED - ROADMASTER CHASSIS	5
WARRANTY INFORMATION FILE	8

**HOLIDAY RAMBLER
MOTORHOME LIMITED WARRANTY**

**WARRANTY
LIMITED
- 2003 Endeavor Diesel**

What the Period of Coverage Is:

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

If you use your motorhome for any rental, commercial or business purposes whatsoever, the Limited Warranty provided by Warrantor covers your new motorhome when sold by an authorized dealer for ninety (90) days from the original retail purchase date or the first 24,000 miles of use, whichever occurs first. In addition, the Limited Warranty provided by Warrantor covers the steel or aluminum frame structure of the sidewalls (excluding slide outs), roof, and rear and front walls for twelve (12) months from the original 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 Consumer Affairs 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. 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.

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 two 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, you must, to the extent permitted by law, notify Warrantor directly in writing of the failure to successfully repair the defect so that Warrantor can become directly involved in performing a successful repair to the identified defect.

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:**

**Warrantor's 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.

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 conditioner, 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.

**What the Warranty
Does Not Cover**

***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, and odometer tampering shall discharge Warrantor from any express or implied warranty obligation to repair any resulting defect.

***Disclaimer of
Consequential &
Incidental Damages***

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

Legal Remedies

ANY ACTION TO ENFORCE THIS EXPRESS OR ANY IMPLIED WARRANTY SHALL NOT BE COMMENCED MORE THAN ONE (1) YEAR AFTER THE EXPIRATION OF THIS WARRANTY. Some states do not allow the reduction in the statute of limitations, so the above reduction may not apply to you.

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

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.

WARRANTY LIMITED - ROADMASTER CHASSIS

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. 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.

Limitations of Implied Warranties

Warrantor's Limited Warranty covers defects in the manufacture of the Roadmaster Chassis (as defined herein) and defects in materials used to manufacture the Roadmaster Chassis. The term "Roadmaster Chassis" as used herein means only the frame; frame cross members; steering axle, including the axle king pins and bushings; hubs and bearings; brake calipers; rotors, brake backing plates and related parts of the axle; tie rods; drag links; drive shafts, including the U-joints; carrier bearings; and, the axle housing and its internal parts. Also see the section "What the Warranty Does Not Cover" set out below.

What the Warranty Covers

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.

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 two 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, you must, to the extent permitted by law, notify Warrantor directly in writing of the failure to successfully repair the defect so that Warrantor can become directly involved in performing a successful repair to the identified defect.

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:

**Warrantor's 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.

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.

What the Warranty Does Not Cover

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, and odometer tampering shall discharge Warrantor from any express or implied warranty obligation to repair any resulting defect.

Events Discharging Warrantor from Obligation Under Warranty

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.

Disclaimer of Consequential & Incidental Damages

ANY ACTION TO ENFORCE THIS EXPRESS OR ANY IMPLIED WARRANTY SHALL NOT BE COMMENCED MORE THAN ONE (1) YEAR AFTER THE EXPIRATION OF THIS WARRANTY. Some states do not allow the reduction in the statute of limitations, so the above reduction may not apply to you. **THIS WARRANTY GIVES YOU SPECIFIC LEGAL RIGHTS. YOU MAY ALSO HAVE OTHER RIGHTS WHICH VARY FROM STATE TO STATE.**

Legal Remedies

**ROADMASTER CHASSIS DIVISION
MONACO COACH CORPORATION**

91320 Coburg Industrial Way
Coburg, Oregon 97408

**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 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.

HOLIDAY RAMBLER 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.

Holiday Rambler®

The foregoing is not a warning. See Holiday Rambler's Limited Warranty or call Holiday Rambler at (877) 466-6226 for warranty information and limitations.

Endeavor

SECTIONS

- 1 GENERAL INFORMATION*
- 2 DRIVING & SAFETY*
- 3 CARE & MAINTENANCE*
- 4 APPLIANCES*
- 5 EQUIPMENT*
- 6 WATER SYSTEMS*
- 7 LP-GAS SYSTEMS*
- 8 ELECTRICAL SYSTEMS - HOUSE*
- 9 ELECTRICAL SYSTEMS - CHASSIS*
- 10 CHASSIS INFORMATION*
- INDEX*

SIGNS



This sign indicates a NOTE.



This sign indicates a WARNING or a CAUTION with additional information attached.



This sign indicates INSPECTION is required.



This sign indicates ASSEMBLY/INSTALLATION or DISASSEMBLY/REMOVAL is necessary.



This sign indicates the specified part requires OIL/LUBRICATION.



This sign indicates a reference to the Warranty INFORMATION FILE located within the grey box inside the motorhome.

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

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 this unit, this document will not reflect modifications that may have been performed by previous owners.

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Endeavor

SECTION 1 GENERAL INFORMATION

INTRODUCTION	13
CUSTOMER RELATIONS	13
REPORTING SAFETY DEFECTS	14
TAKING DELIVERY	14
RESPONSIBILITIES	14
DEALER RESPONSIBILITIES	14
CUSTOMER RESPONSIBILITIES	15
SERVICE SUGGESTIONS	15
PREPARE FOR THE APPOINTMENT	15
PREPARE A LIST	15
BE REASONABLE WITH YOUR REQUESTS	15
NO LOOKING OVER THE TECHNICIANS SHOULDER	16
INSPECT THE WORK PROPERLY	16
OWNER'S RECORD - SERIAL NUMBERS	17
OWNER'S RECORD - PERSONAL PROPERTY	18
OWNER'S RECORD - INSURANCE	19
GLOSSARY OF TERMS	20
VENDOR LIST	24
SURVEY	29
LIMITED WARRANTY TRANSFER APPLICATION ...	31

INTRODUCTION

This section contains warranty information and knowledge for the operation and care of the motorhome. Not all information may be applicable to your model of motorhome. More detailed information with **CAUTION** or **WARNING** instructions, other than what is found in this chapter, can be found in the manufacturer's owner manuals located in the owner information box.

In time you will develop a knack for spotting wonderful little roadside locations by turning off the main highway and exploring. There are many modern recreational vehicle parks (including state, county and federal parks) with good facilities where you can obtain hook-ups for electrical, water and sewage connections. Directories are published which describe these parks and the availability of services and hook-ups. On overnight or weekend trips, chances are you will probably not fill up the sewage holding tanks, deplete the water or LP-Gas supply, or run down the batteries which supply the living area with 12 Volt DC current. On longer trips, when you have stayed where sewer connections and utility hook-ups were not available, it will be necessary to stop occasionally to empty the holding tanks and replenish the water and LP-Gas supply.

Many gas stations have installed sanitary dumping stations. Publications are available which list these dumping stations. When stopped for the night the Holiday Rambler motorhome is built to be safely parked in any spot that is relatively level and where the ground is firm. Try to pick as level a parking spot as possible. Your facilities are with you and the motorhome is fully self-contained.

The safety alert symbols of **CAUTION** or **WARNING** are "Personal Safety Instructions." It is important to thoroughly read and understand these safety instructions where the symbols are 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.

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 Consumer Affairs 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 RELATIONS

**Customer Service Department
91320 Coburg Industrial Way
Coburg, OR 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 Holiday Rambler. 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 Holiday Rambler. 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 Seventh Street
Washington, DC 20590**

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 read 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 Holiday Rambler 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 are 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

Don't 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 Technicians
Shoulder***

Please don't 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.

FOR YOUR OWN REFERENCE

OWNER'S RECORD - SERIAL NUMBERS



INFORMATION: Many of the serial numbers for various items and components are filed on the Data Card located in the Warranty Information File box. Refer to the Manufacturer's individual Owner's Manuals for serial number locations that are not listed below.

Motorhome Serial Number _____

Motorhome Federal Vehicle Identification Number (VIN) _____

Door Key Number _____

Range Model & Serial Number _____
(Located under top burner plate)

Microwave Model & Serial Number _____
(Located behind door on case)

Refrigerator Model & Serial Number _____
(Located inside refrigerator compartment)

Generator Model & Serial Number _____
(Located in outside compartment on generator)

Roof Air Conditioner(s) Model & Serial Number _____
(Located under top cover on air conditioner)

Inverter Model & Serial Number _____

FOR YOUR OWN REFERENCE

OWNER'S RECORD - PERSONAL PROPERTY

Value

[illegible]

FOR YOUR OWN REFERENCE

OWNER'S RECORD - INSURANCE

Company: _____

Policy #: _____

Agent's Name & Address: _____

Business Phone #: _____

Emergency Phone #: _____

Renewal Date(s): _____

Notes: _____

GLOSSARY OF TERMS

AC Electricity - Alternating current also known as household power.

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

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

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

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.)

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

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 when you are at campgrounds. It is called city water because you pull water 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.

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, charger and DC generators.

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

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

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

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

DC Electricity - Direct current also known as battery power.

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

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

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

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

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

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

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 - 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.

OHM - A unit for measuring electrical resistances.

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

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

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

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

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

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

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

Shore Line Plug - The 120 Volt 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 motorhome slightly so that it can be towed.

TS1 - Terminal Strip One.

VIM - Vehicle Interface Module.

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.

VENDOR LIST

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.
(574) 463-4858
www.dometic.com

Alternator

Leece-Neville
800-349-2628
www.prestolite.com

Awnings

Carefree
800-621-2617
www.carefreeofcolorado.com

Axles

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

Eaton Corporation

800-328-6687
www.truck.eaton.com

Batteries

Interstate
800-272-6548
www.interstatebatteries.com

Brakes (Anti-Lock)

Eaton
800-826-4357
www.eaton.com

Brakes (Exhaust)

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

Carbon Monoxide Detector

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

Cooktop

Seawood Products
(562) 699-7997
www.seawardproducts.com

Dash Radio

Sony
800-222-7669
www.sony.com

DVD Player

Sony
800-222-7669
www.sony.com

Engine

Cummins
800-343-7357
www.cummins.com

Energy Management System (Optional)

Intellitec
800-251-2408
www.intellitecsve.com

Entry Step

Kwikee
800-736-9961
www.kwikee.com

Fan - Bathroom/ Exhaust

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

Filters

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

Fire Extinguisher

The Fire Extinguisher Co.
(919) 563-4911

Furnace

Atwood
800-873-4328
www.atwoodmobile.com

Generator

Onan
800-888-6626
www.onan.com

Inverter

Trace Engineering
(360) 435-8826
www.traceengineering.com

Leveling Jacks - Hydraulic

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

Liquefied Petroleum Protectors

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

LP-Gas Tank

Manchester
800-753-8265
www.mantank.com

Microwave

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

Outside Mirrors

Velvac Mirror
800-783-8871
www.velvac.com

Rear Vision System

Sony
800-222-7669
www.sony.com

Refrigerator

Norcold
800-543-1219
www.norcold.com

Satellite

Satellite System
800-287-5052

Shock Absorbors

Monroe
800-880-7580
www.tenneco-automotive.com

Slide-Out Motor

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

Steering Gear

TRW
(615) 444-6110
www.trw.com

Storage Trays

Kwikkee
800-736-9961
www.kwikkee.com

Television

Sony
800-222-7669
www.sony.com

Television Antenna

Winegard
(319) 754-0600
www.winegard.com

Tires

Goodyear Tire & Rubber
800-399-2772
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.allison.com

VCR

Quasar
800-545-2672

Water Filtration

Everpure

630-654-4000

www.everpure.com/consumer/rv

Water Heater

Atwood

800-873-4328

www.atwoodmobile.com

Washer/Dryer (Optional)

Splendide

(503) 655-2563

www.splendide.com

Water Pump

Shurflo

800-854-3218

www.shurflo.com

Wheels - Aluminum

Accuride

800-626-7096

www accuridecorp.com

Windshield Wipers

Diesel Equipment

(336) 373-8331

www.diesequipment.com

NOTES

SURVEY

2003 ENDEAVOR DIESEL

Your suggestions are very important to us and we are continually striving to improve the quality of our manuals. After becoming familiar with your new recreational vehicle and the accompanying manual, please take the time to answer the following questions. When you are finished please return it to our Technical Publications Department. Feel free to attach an additional page if you desire.

1. Is this your first recreational vehicle? YES / NO

2. Was the overall appearance and lay-out of this manual what you expected to see in your new recreational vehicle?

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

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

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

NAME: _____ **PHONE:** (____) _____

ADDRESS: _____

SERIAL # _____

CUT ALONG
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Postage
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**TECHNICAL PUBLICATIONS
MONACO COACH CORPORATION
91320 COBURG INDUSTRIAL WAY
COBURG, OR 97408-9908**

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HOLIDAY
RAMBLER

Limited Warranty Transfer Application

Mail Monaco Coach Limited Warranty
Transfer Application to:

Monaco Coach Corporation
Warranty Transfer
91320 Coburg Industrial Way
Coburg, OR 97408

Please read terms and representations below before signing.

DEALER IMPRINT

A PRIOR OWNER INFORMATION

TRANSFER COVERAGE FROM:

FIRST NAME	INITIAL	LAST NAME	VEHICLE IDENTIFICATION NUMBER
------------	---------	-----------	-------------------------------

B NEW OWNER INFORMATION

TRANSFER COVERAGE TO:

FIRST NAME	INITIAL	LAST NAME	TELEPHONE NUMBER
------------	---------	-----------	------------------

STREET ADDRESS	DATE OF TRANSFER
----------------	------------------

CITY	STATE	ZIP	ODOMETER READING AT TRANSFER
------	-------	-----	------------------------------

SIGNATURES

C

NEW OWNER'S SIGNATURE	SELLING DEALER SIGNATURE
-----------------------	--------------------------

TERMS & REPRESENTATIONS

By your signature(s) on 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 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.
5. You understand that the Limited Warranty does not cover the chassis, component parts and appliances if they are covered by a separate warranty issued by the chassis, component part or appliance manufacturer.



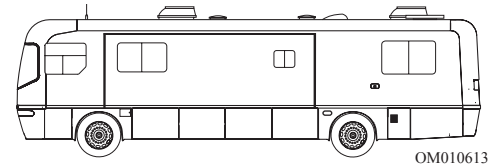
Endeavor

SECTION 2 DRIVING & SAFETY

DRIVING SAFETY	33	TIRE CHART	67
INSPECTIONS	33	INSPECTING & PRESSURE	68
FAMILIARIZE YOURSELF	33	TIRE VIBRATION	69
SAFETY SEAT BELTS	33	TIRE ROTATION	69
TIPS FOR DRIVING	36	TIRES - SUPPORTING WHEN LEVELING	70
CHECKLIST - PRE-TRIP PREPARATIONS	39	STORAGE OF TIRES - LONG-TERM	70
HITCH	42	IN CASE OF FLAT TIRE	72
USING THE REAR RECEIVER	42	VIEWS	74
TOW PLUG CONNECTION	43	FRONT	74
REAR VIEW SYSTEM	43	REAR	74
BACKING UP A MOTORHOME	45	ROADSIDE	75
CHECKLIST - SET-UP PROCEDURES	47	CURBSIDE	75
DRY CAMPING TIPS	48	SPECIFICATIONS - DIMENSIONS CHART	76
BREAKING CAMP	52	SMOKE DETECTOR	76
EMERGENCY PROCEDURES - ROADSIDE	54	OPERATION	76
LIGHT - RETRACTABLE	54	HOW TO TEST	77
TRANSMISSION - ROCKING OUT	55	MAINTENANCE	77
JUMP STARTING	55	TROUBLESHOOTING	77
TOWING PROCEDURES	58	LP-GAS DETECTOR	78
BRAKE - DISABLING PARKING BRAKE	59	TESTING	78
TIRES	59	ALARM	79
THE IMPORTANCE OF AIR PRESSURE	60	CLEANING	79
HOW MUCH AIR SHOULD I CARRY IN MY TIRES	60	CARBON MONOXIDE DETECTOR	80
TIRE PRESSURE INFLATION GUIDELINE	61	OPERATING INSTRUCTIONS	80
WEIGHT TERMS	61	ALARM	81
WEIGHT LABEL	63	TESTING	81
WEIGHING THE MOTORHOME	63	CLEANING	81
		FIRE EXTINGUISHER	81
		EGRESS EXIT WINDOW	82

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

DRIVING & SAFETY



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. Any defect found could result in problems on the road that may cause lost time and money. Several states require that the motorhome be inspected prior to registration. Know and observe the laws of the state(s) in which you will be traveling. Laws may vary from state to state. A systematic inspection conducted prior to moving the motorhome will ensure nothing is overlooked and will assist in familiarizing the owner with the motorhome. Prior to moving the motorhome perform a general inspection which includes examining the condition of the vehicle and the surrounding area of the motorhome for hazards. Look high and low when walking around the motorhome.

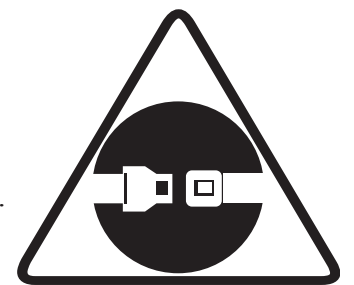
The location of the driver's seat in the motorhome is higher and further to the left than most vehicles. This creates a different perspective of the roadway. Rely on the outside mirrors to line up with the center of the road and to check the conditions behind the motorhome. The dashboard may contain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

Familiarize Yourself

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 any seats that are not equipped with a safety belt while the motorhome is in motion. Seat belts must only be used on permanently mounted seats. The driver's seat must be locked in the forward facing position while motorhome is in motion. Do not use a seat belt on more than one person.

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

Safety Seat Belts



Seat Belt.eps



WARNING: Seats must be pointed in a forward position and seat belts fastened while the motorhome is in motion. Avoid seat rotation while in transit. Children must not be transported unrestrained. Infants must be placed in approved safety seats. Small children must be restrained in child safety seats. Failure to comply with these rules can lead to injury or death.



WARNING: 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. Children must not be transported unrestrained. Infants must be placed in approved safety seats. Small children must be restrained in child safety seats. Failure to comply with these rules can lead to injury or death.

Child Safety Seat:

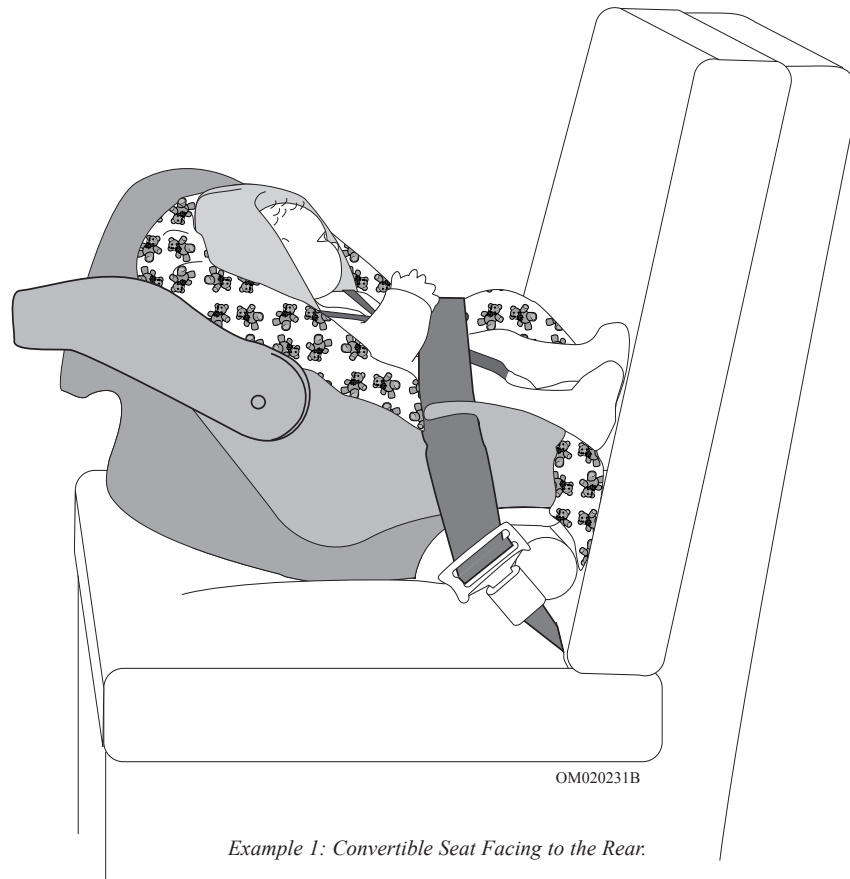
Children that fit into the list below require the use of a child safety seat. In the motorhome, the child safety seat can be positioned in two places. On the front passenger (co-pilot) seat and on the forward facing permanently mounted booth dinette seat.



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

A child safety seat is required for a child:

- 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 above shoulders. (See Example 1).



Example 1: Convertible Seat Facing to the Rear.

- Children over 40 pounds (ages 4 to 8) 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).



WARNING: There are many styles of safety and booster seats. Refer to the manufacturers manual for proper installation and how to properly secure the safety or booster seat.



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.



CAUTION: Seat belts must only be used on permanently mounted seats. Do not use a single seat belt on more than one person.

Seat Belt Care:

Keep the belt clean and dry. To clean, use a mild soap and lukewarm water. Never use bleach, dye or abrasive cleaners as they may weaken the belt. Inspect the belts periodically. Check for cuts, frays or loose parts. Replace any damaged parts. Do not disassemble or modify the system. Replace the belt assembly if it has been in a severe impact, even if damage is not obvious.

Tips for Driving

The motorhome is a complex vehicle and requires an increased level of 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 all perimeters of the motorhome: front, sides, rear, roof and undercarriage. Insure 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 the 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.

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, use the exhaust or engine brake. 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 the distance required to stop the motorhome.



Downhill.eps

When backing up, have the co-pilot stand at the road side rear corner so the co-pilot remains visible in the roadside mirror. The co-pilot can watch for any 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 them. Signs should be posted at bridge entrances. Check the posted height of all overpasses or situations where overhead clearance is limited. Keep in mind, road surfaces may have been repaved or become packed with snow and 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.

- 
- A black and white illustration of a triangular warning sign. Inside the triangle, a car is shown driving down a steep slope. The car is tilted upwards, and several horizontal lines behind it indicate motion or speed. The sign has a thick black border. Below the sign, the text "Downhill.eps" is written in a serif font.

Negotiating a right hand turn in a motorhome can be difficult. Many drivers fear they can not 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:

-

- 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.

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 any interior lights while driving. They can create a glare on the windshield, decreasing visibility.
- Dim the dash lights to a comfortable level to reduce the level of glare.

Extreme Heat and Hot Weather Conditions:

- Observe all gauges frequently. Any variations from the normal conditions should be evaluated promptly.
- Check tire pressure frequently when traveling in hot conditions. Tire air pressure increases with heat. It is not advisable to 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 which are more susceptible to fatigue in extreme heat.

Winter and Cold Climate Conditions:

- The motorhome should be prepared for Cold Weather Use.
- Keep speeds slow and steady. Make moves gradually and increase visual distance for a gain in reaction time.
- If road or weather conditions are treacherous find a safe stopping place and wait for conditions to improve.
- Avoid using an engine retarding device on wet or slippery surfaces, which can cause the drive wheels to skid.
- Wipers should be in good condition and the washer reservoir should have sufficient window wash fluid that has antifreeze included within it.
- Use the mirror heat to keep the mirrors clear.
- Remove any ice build-up from the entry step to avoid accidental slipping.

Wet Conditions:

- The risk of hydroplaning is increased if tires are worn or improperly inflated.
- Be aware that heavy rain or deep standing water can affect brake application causing them to apply unevenly or grab.

Refueling:

- Truck stops are good refueling points for motorhomes.
- For your convenience there is a fuel port located on either side, near the front of the motorhome.
- Check overhead clearance heights before pulling through the fuel island.
- Be aware of the concrete/steel posts installed around the fuel island.
- 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 the gloves in the outside compartment.
- To prevent grease and fuel deposits from being tracked into the motorhome when refueling, change shoes before entering the motorhome. Store the extra pair near the entry door.



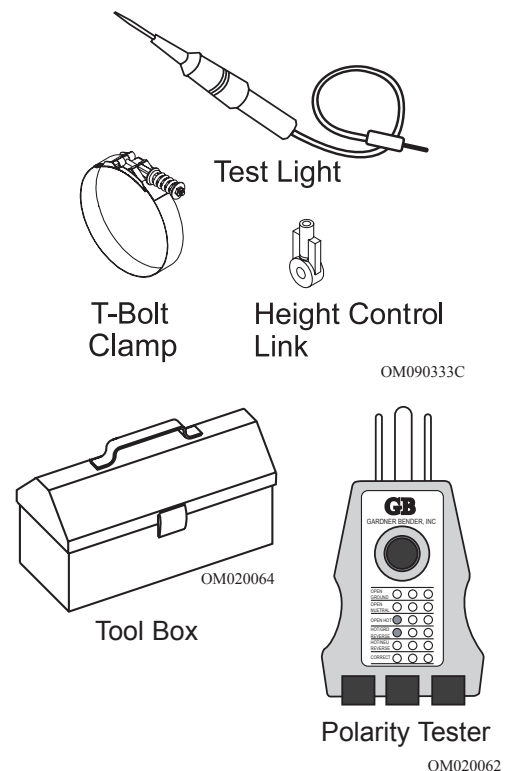
WARNING: Avoid the risk of fire or explosion. Turn off all pilot lights and appliances before entering a refueling station.

Before departure several items will need to be prepared. Some suggestions are listed below. Use the lists as general guides when preparing to depart.

Items To Carry:

- Local, State and National Maps. Truck atlases can be useful for showing maps, refueling stations and truck repair facilities.
- An emergency road kit containing a flashlight, road flares, warning signs and a fire extinguisher.
- Potable/non-potable water hoses and a water pressure regulator.
- Hand tools.
- 12 Volt DC test light and a 110 AC Polarity Tester. These may be helpful when on the phone with a technician.
- A battery hydrometer to check the condition of battery electrolyte.
- A spare 12 Volt continuous duty solenoid (if applicable).
- An assortment of spare fuses.
- One link kit for ride height control assembly (air suspension only).
- A spare alternator belt.
- Charge air cooler T-bolt clamp.

CHECKLIST - PRE-TRIP PREPARATIONS



Interior Items:

- Start refrigerator operation the night before departure to get a head start on the cooling process. Pre-cool items prior to loading the refrigerator.
- If necessary, load pots, pans, utensils, soap, linens, etc.
- Secure and fasten the bi-fold and pocket doors. Lock the shower door.
- Close roof vents and windows.
- Secure any 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.
- Turn interior lighting off.
- Certain floor models may require the bedroom television to be stowed. The latch must be in the locked position and the television secured.

Exterior Items:

- Check operation of all exterior lights; headlamps, taillights, brake and clearance lights.
- Check the battery fluid and fill to level - both house and chassis batteries.
- Check all fluid levels on the chassis and generator. (See chassis section and generator manual for details.)
- Check the fuel/water separator in the engine service compartment. Clean and drain if needed.
- Adjust the mirrors.
- Check 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 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 any unusual noises.

Driving Preparations:

- Check operation of all exterior lights, headlamps, taillights, brake and clearance lights.
- Inspect fluid level (if applicable) in front wheel oil bath hubs.
- Fill the fresh water tank. Disconnect and store the fresh water hose.
- Check all tire pressures.
- Check both house and chassis battery condition.
- If applicable, program the navigation system.
- Secure all awning locks.
- Check 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 obstructions.
- Check fuel level gauge. Check all other dash gauges for operation and correct level indications.
- Secure and lock the entry door for travel.

Storing Cargo

Passenger side storage bay doors have been fitted with pantographic hinges. When the latch is opened the storage doors will swing out and up, caution must be exercised when opening and closing bay doors.



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

It is important to remember that regardless of how large the motorhome is 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. While 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.

When loading the motorhome, please follow these guidelines:

- Be sure to 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.
- In order to maintain a low center of gravity and to prevent top heaviness 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.

Helpful Hint:

- Remove multi-purpose items, versatile clothing and periodic unused cargo to enable more storage.



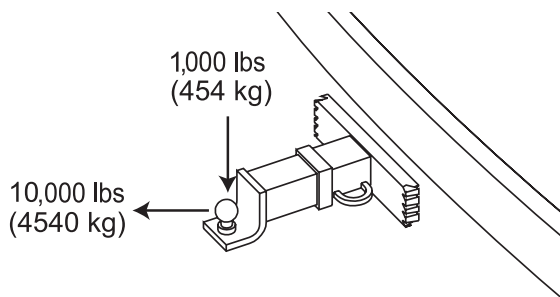
WARNING: Towing a vehicle which exceeds the rated capacity of the hitch should be avoided, as it will place undue stress on components and cause unusual handling characteristics in the motorhome. It could also void the warranty. If there are any questions call a factory technician.

HITCH - Using the Rear Receiver

When using the rear hitch remember that the motorhome is intended for towing light loads. The motorhome is designed to be used primarily as a recreational vehicle. Towing will affect durability and economy. Safety and satisfaction require proper receiver use. Avoid excessive loads or other misuse. 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, and any vehicle or trailer towed by it, must not exceed the GCVW.



WARNING: Any trailer being towed by a motorhome must have adequate brakes. Failure to follow these instructions will create a safety hazard and may result in an accident.



 MONACO COACH CORPORATION	Coburg, Oregon Springfield, Oregon Wakarusa, Indiana Elkhart, Indiana Nappanee, Indiana	Do Not Cut, Weld or Modify
	Do Not Exceed Vehicle Ratings	
	Maximum Towing Capacity 10,000 lbs. Maximum Vertical Load 1,000 lbs.	

OM020128D

OM020128F

Tow Car or Trailer:

1. Connect tow car or trailer with light harness to motorhome and perform a light check.
2. Connect safety chains.
3. Check the tow car or trailer and the motorhome before starting a trip and at each rest stop.
4. 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. Check tires on the tow vehicle frequently.

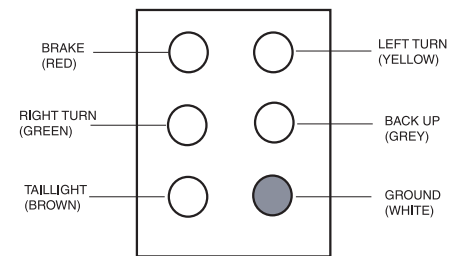


WARNING: Most states and Canadian provinces require any trailer or vehicle being towed have adequate auxiliary brakes. Failure to comply with these state and Canadian province requirements may result in fines and/or pose a safety hazard, which may result in an accident.

The motorhome is pre-wired from the factory with an electrical harness for towing. The harness is located on or near the hitch receiver. Convuluted tubing protects the tow harness wires until ready for use. Current draw should not exceed ten amps for each designated light circuit. Depending on the light configuration of the tow car, an electrical taillight converter may be required.



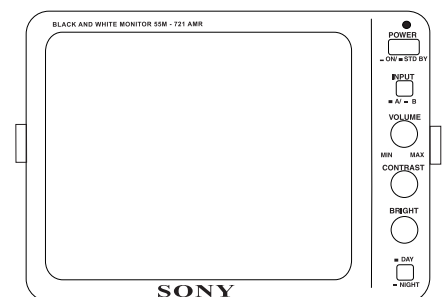
NOTE: When towing a trailer or vehicle with a tow-wire system, a turn signal/brake light converter will be needed to adapt the tow plug wiring to the item being towed.

Tow Plug Connection

OM020166

The motorhome is equipped with a rear vision and voice system. The field of view is 140° in the diagonal plane, 121° in the horizontal plane, and 90° in the vertical plane. The rear vision system consists of a camera with a microphone and a monitor.

The driver can see what is behind the motorhome with the ability to listen to a guided assistant. This is useful during backing procedures. The rear vision system will automatically turn ON when the gear selector is placed in reverse. Turning the main power switch ON will allow continuous operation of the rear vision system when the ignition key is on.

REAR VIEW SYSTEM

OM060103

Power Switch:

The switch, when **ON** (in) position, turns on the monitor for viewing. The **green** LED indicator illuminates. When the switch is **OFF** (out), the monitor is in a **STANDBY** mode of operation. The **green** LED remains illuminated when the ignition is on. The monitor displays rear viewing when the transmission is shifted to **REVERSE**.

Camera Selector:

This switch should be left in the **CA1** (out) position. **CA2** (in) position is not used in the motorhome.

Day/Night Switch:

This switch should be left in the **DAY** (out) position for normal viewing. When set in **NIGHT** (in), picture brightness is reduced. **NIGHT** should be used for night viewing and driving through tunnels.

Bright Control:

Clockwise rotation increases the picture brightness. Counterclockwise rotation decreases the picture brightness.

Contrast Control:

Clockwise rotation increases the picture contrast. Counterclockwise rotation decreases the picture contrast.

Audio Control:

Clockwise rotation increases the volume level. Counterclockwise rotation decreases the volume level.

The camera angle may be adjusted to display a suitable rear view. The camera housing cover will need to be removed to gain access to the hexagon mounting bolts. The mounting bolts can be repositioned to the desired angle. Refasten the camera housing cover and seal using an appropriate sealant.

**BACKING UP A
MOTORHOME**

If the destination does not have “pull-through” sites try to pick a solid, level site. If possible, pick a site located on the left side. The driver will have a better field of vision by using the driver side mirror. If the site is on the right side the driver will have to use the passenger side mirror for backing up, which leaves a blind spot. When a potential site is spotted, stop the motorhome before the site. Get out and observe the area for soft ground, posts, large rocks, low hanging limbs or other obstacles. If the site meets your criteria, prepare to back in carefully.

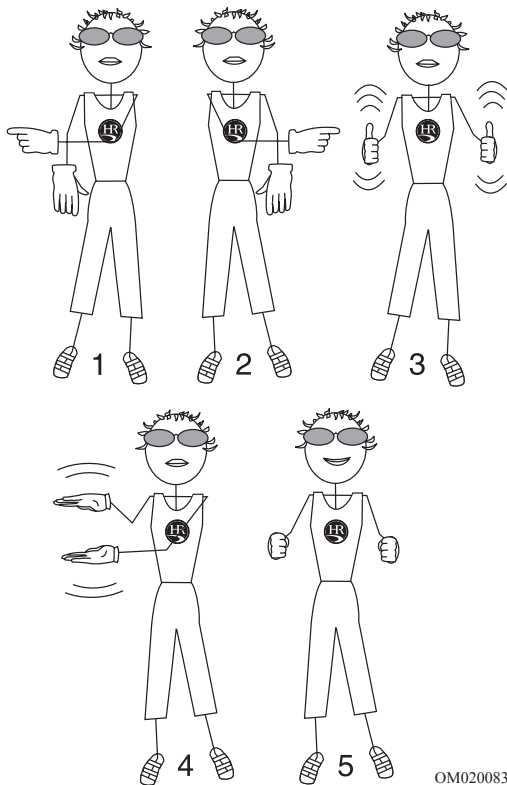
Backing up can be a challenge for even a long-time owner of recreational vehicles. Follow some simple guidelines to help reduce the challenge. When backing up, the driver (pilot) should be comfortable using the mirrors, the back-up camera and the co-pilot’s directions (ground guide) for assistance. Practice backing up, with the co-pilot’s guidance, in a large unobstructed parking lot. Backing up a motorhome is a team effort.

The backing up process should begin while the motorhome is in forward motion. Maneuver the motorhome to align it with the chosen site. This allows straight alignment with the site. Aligning the motorhome with the site will require considerably more room than an automobile and 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 straight lines, such as road markings, as reference points when possible.

The co-pilot’s job is just as important 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 driver side mirror at all times. The co-pilot should make a conscious effort to maintain sight of the driver through the driver side mirror as the front of the motorhome maneuvers. If the driver loses sight of the co-pilot, stop the backing up process until the co-pilot is in view. To avoid mishaps, the co-pilot should be focused only on what the driver is doing, with brief observation moments. The driver should receive directions only from the co-pilot. If necessary, stop the backing up process to have co-pilot inspect other areas or angles of concern. Use of walkie-talkies will aid in guidance.

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

If desired direction is left, the co-pilot points left. For example: The co-pilot uses his/her right arm and forefinger to point distinctly left, with arm and finger held on a horizontal plane, to indicate the desired direction of travel of the rear of the motorhome. This type of directional signal can be easily discerned in the mirror by the driver. The directional signal given should remain steady until the desired movement is completed.



The Five Directional Signals are:

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 vertically, 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 the amount of distance to stop point.
5. Closed fists indicates STOP.

OM020083

Backing Up Trailers:

Trailers have only one pivot point. Trailers may be backed up. Towed vehicles using a tow bar or tow dolly have more than one pivoting point which makes this type of equipment not suitable for backing. If using this type of towing equipment, plan ahead. Park safely along the road and walk a distance if necessary to avoid a possible back up situation. Avoid putting the motorhome and tow vehicle in a backing situation. To back up this combination, completely disconnect the tow vehicle from motorhome. Trying to back up the motorhome with a tow vehicle connected will result in damage to the motorhome, tow vehicle and towing device.

The same rules for backing a motorhome may be applied when backing a trailer. When preparing to back a trailer into a space, maneuver the motorhome sweeping wide, then turn back to the opposite direction. This will set the motorhome and trailer in a position to maneuver the trailer into space. When backing a trailer, the driver may become disoriented with the direction of the steering wheel and the direction of the trailer. The bottom of the steering wheel must be moved in the desired direction of 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 driver side mirror, using the five hand signals for guiding.

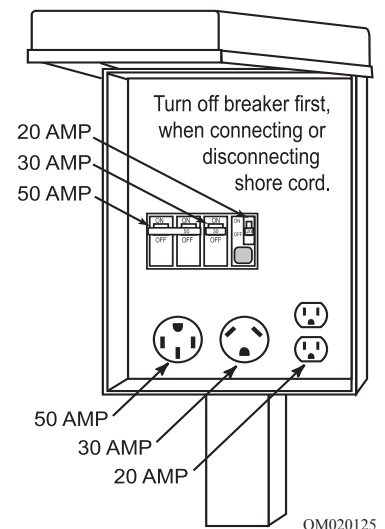


CAUTION: Tow bars or car dollies generally are made to travel in a forward direction only. Most towing equipment of this type is not designed for backing. Never attempt short back up distances with a tow bar or tow dolly. Damage to the motorhome, vehicle or towing device will result.

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

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

CHECKLIST - SET-UP PROCEDURES



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!

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



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

Plan ahead and conserve resources while dry camping.

Dry camping requires fully charged and properly maintained batteries (corrosion cleaned, terminals tightened, cables checked, etc.). If battery water is low, fill the batteries with distilled water only. Water containing a high concentration of minerals will alter the batteries chemistry reducing battery capacity and performance. Before arriving at your destination, fill the LP-Gas tank (LP-Gas generators) or fill the motorhome with fuel (diesel generators) to increase generator running time.

Begin with a full fresh water tank and empty waste holding tanks. When the fresh water tank is low, the waste holding tanks will more than likely be full. Empty the waste holding tanks before refilling the fresh water tank.

Solar panels are a valuable addition to help charge the batteries. If the motorhome is equipped with two panels, the first panel will offset the parasitic loads. The second panel (and adding a third if possible) will charge the batteries during daylight hours. Clean the solar panels regularly for optimum performance. Dust, dirt, grime and pollution from the road and air will decrease their efficiency. Clean the solar panels with window cleaner and a soft cloth.

Most dry camping locations can accommodate motorhomes of various lengths. Confirm that the facility you plan on visiting can accommodate your motorhome's length and size. Arrive during daylight hours to properly set-up the motorhome and prepare for the night ahead. Getting to a site on narrow and winding campground roads takes skill and patience. Avoid low hanging limbs, tree trunks and barriers lining the roadway. Have the co-pilot or the campground host provide assistance when maneuvering the motorhome around curves and bends.

When dry camping, hookups are not a concern. Take extra time to properly set-up. Make sure there is plenty of space to extend the slide-out room(s). Before lowering the air suspension and leveling the motorhome, check underneath for obstacles that may damage undercarriage components.

For motorhomes equipped with automatic leveling, be sure people and pets are not moving in the coach during the leveling process. When leveling manually, interior movement is less critical.

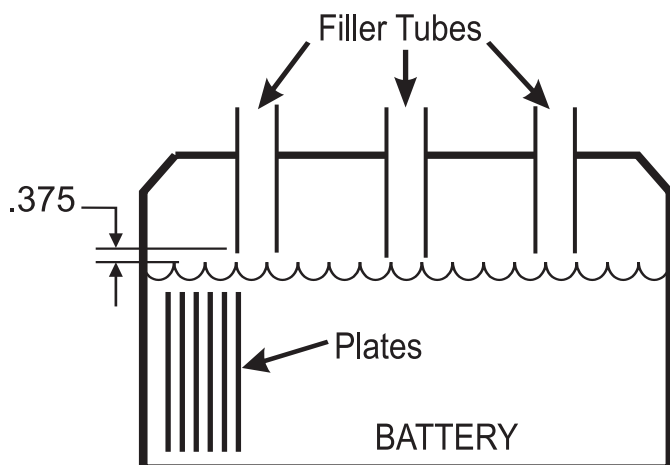
Setting Up for Dry Camping:

- Switch refrigerator operation from Auto to LP-Gas.
- Operate the water heater on LP-Gas. Turn it on about an hour before hot water is needed.
- If the furnace is needed during the nighttime, set the thermostat temperature a bit lower preventing the furnace from cycling all through the night.
- Check on small items that use battery power, such as the porch light, bay lights, the light under the step, generator compartment lights, engine compartment lights, etc. If the television is not being used, turn off the 12 Volt booster. Even one light accidentally left on, such as under the front cap, reduces battery reserves quickly.
- Some battery draw is unavoidable. The battery cut-off switch at the entry door must be on to operate many interior items such as lights or the furnace.
- Keep flashlights handy. Build a campfire when spending nighttime hours outdoors. Extinguish the flames before retiring for the evening. Many campgrounds place wood or cement barriers between the site space and fire pit. Illuminate any barriers or obstacles in the pathway to the motorhome.
- Place a large flashlight inside the front door for navigating through the coach during the night without having to use interior lights. If interior lighting is needed, use one light in a central location, such as the vanity.
- During the day it is still important to conserve on energy. Turn on the water pump only when using water. Turn the pump off when not in use. The water pump does not draw an abundance of power, however all battery amp hours are important and should be conserved.
- If it is too early in the morning or too late in the day to run the generator, use the inverter for AC power. Remember to turn off the inverter when not in use. When the rest of the campers are up and about, turn on the generator and run it for a couple of hours to help charge the batteries. The generator may seem loud, however, the noise is minimal just a short distance away from the coach. Run the generator during clean up and preparation for the day.
- Check the monitor panel frequently and keep track of water usage and battery consumption. Routinely check the LP-Gas level. Remember the furnace uses more gas in cold weather.

- Careful management of water is critical when dry camping. Know the motorhome tank capacities. Picture the amount of liquid in a gallon container. Visualize that amount each time you run the water. If you are dry camping for extended period, limit shower usage. Turn the water off when soaping down in the shower. If water conservation is critical, take a sponge bath. Conserve water while brushing your teeth. Chances are a campground without hookups will not have large comfortable shower rooms or bathrooms. It may only be equipped with primitive facilities, however, if it helps to economize on water, use them.
- Do not fill the sink full of water to wash a few dishes. Use disposable dishes whenever possible. Conserve propane by cooking dinner over the campfire. However, if cooking over the campfire is not desired, use the cook top or microwave. If you use the inverter to operate the microwave, battery power will be consumed quickly. If possible, use the generator to operate the microwave. It is healthy for the generator to operate under a heavy load such as the microwave.
- Allow the generator to power up for a couple of minutes before applying a load.
- To conserve on battery power, plan what is needed from the refrigerator prior to opening it. If weather does not permit eating at the picnic table, or if no picnic table is available, eat at the dinette table by candlelight.
- Leave shoes outdoors or at the entry step to avoid tracking in dirt. Open windows during the day instead of using the roof air conditioner.
- Get back to nature and still enjoy the comforts of the motorhome. With a little imagination, the ways to conserve available resources while dry camping are endless.

Typical Current Draw:

- One continuous duty solenoid is a .7 Amp draw, two solenoids will be a 1.4 Amp draw.
- A 13" TV has a 1.7 Amp draw.
- Rope lights (10 ft) are a 1.3 Amp draw.
- The porch light is a 2.0 Amp draw.
- One fluorescent dual bulb light has a 2.1 Amps draw.
- One halogen ceiling light has a .09 Amp.



NOTE: The distilled water level in battery should be 3/8" below the filler tube.

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Battery State of Charge vs. Voltage / Specific Gravity			
Voltage	Specific Gravity	State of Charge	Depth of Charge
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%

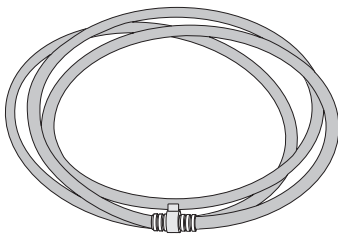
Battery Voltage: Fully charged with battery at rest for one hour.

BREAKING CAMP

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

Outside Checklist:

- Disconnect the cable TV, lower the television antenna and (if applicable) the satellite dish.
- Disconnect and stow the phone line.
- Retract the awnings and secure them for travel.
- Close LP-Gas tank valve. Check the level of the LP-Gas Tank to ensure a sufficient amount is available.
- Drain and flush the holding tanks. First close the grey water valve, run enough cold water down the sink and shower drains until the grey tank is at least 50% full. Be careful not to overfill or flood the grey tank. Next, open the black tank valve allowing the drain cycle to complete. **If applicable**, connect a **non-potable** water hose to the No-Fuss hose bib and flush the black tank system. Close the black tank valve, open the grey water valve. The water from the grey tank will help flush the solids from the drain hose.
- Disconnect the sewer hose. Flush hose with clean water from **non-potable** hose. Store the hose. Install the sewer cap.
- Fill the fresh water tank (using the potable hose). Disconnect and store the fresh water hose. Remove any hose protected 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.
- Inspect fluid level in oil bath hubs (if applicable) and check all tire pressures.
- Secure all compartment doors and entry door.
- Inspect tires and wheels.
- Check for fluid leaks under or around the motorhome.



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

Engine Checklist:

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

Interior Checklist:

- If applicable, retract leveling jacks allowing the air suspension to obtain proper ride height.
- If applicable, clear the slide room path, clean the floor, move the driver seat forward and make sure the bay doors are shut. Retract the slide room(s). When the slide room is fully retracted secure any slide room awning locks.



NOTE: To operate the kitchen slide the ignition must be OFF, 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 any loose, heavy or sharp objects in case of a sudden stop.
- Close all cabinet doors and drawers.
- Turn off interior lights.
- Turn off water heater, water pump and furnace.
- Walk through the interior and check for any unsecured items.
- Turn the interior lighting off.
- Check the fuel level gauge. Check 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 any forgotten items.
- Secure and lock the entry door for travel.

EMERGENCY PROCEDURES - ROADSIDE

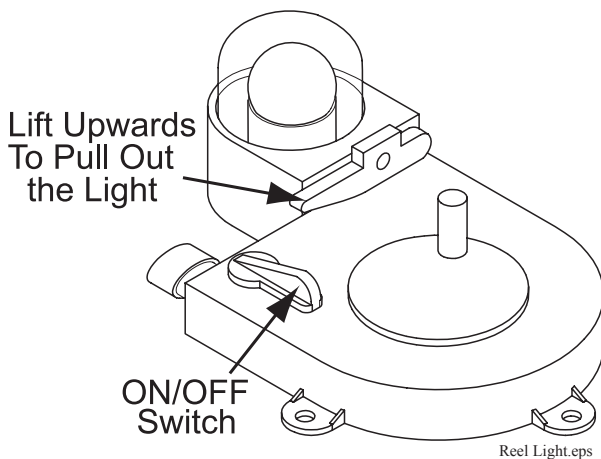
If an emergency situation occurs, use the appropriate braking technique and pull off the roadway a safe distance from traffic (if possible). Set the parking brake and turn on the hazard warning flashers, especially when parked alongside traffic lanes. In the event of an emergency stop due to a mechanical breakdown or other motorhome related problems, contact the manufacturer's **Customer Support** at **(1-877-466-6226)** or an emergency service provider.

An emergency road kit should include at least three reflective warning signs, road flares, a flashlight, spare automotive fuses and an assortment of hand tools. For added safety a separate fire extinguisher should be considered. The motorhome is equipped with a fire extinguisher located inside next to the co-pilot seat. 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.

Light - Retractable

The retractable light is located in places of limited lighting for emergency purposes. Normally, one will be located in the engine service compartment and in the front generator compartment.



To use:

1. Activate light by moving **ON/OFF** switch to the **ON** position.
2. The light is on an 18' retractable reel cord. To operate, lift the lever and pull the light out.
3. The light has a magnetic base attached. Locate a place to attach the light so you can work hands free.
4. To replace bulb push down on clear plastic cover and twist.
5. To rewind, crank the handle in the retract direction. When it is fully retracted, push down on the lever handle to keep the light locked into place.

**Transmission -
Rocking Out**

It may be possible to rock the motorhome out if it is stuck in snow, mud or deep sand. Shift the selector to **D** (Drive) and apply steady light throttle. Never apply full throttle as the wheels may spin and bury the motorhome deeper. When the motorhome has moved forward as far it will go, apply and hold the service brakes. Allow the engine to return to idle before selecting the **R** (Reverse). Release the brake and apply light throttle until the motorhome has rocked as far it will go. Again apply the service brake and allow the engine to return to idle. Repeat this process if the motorhome has moved a greater distance. If the process does not free the motorhome call for towing assistance.



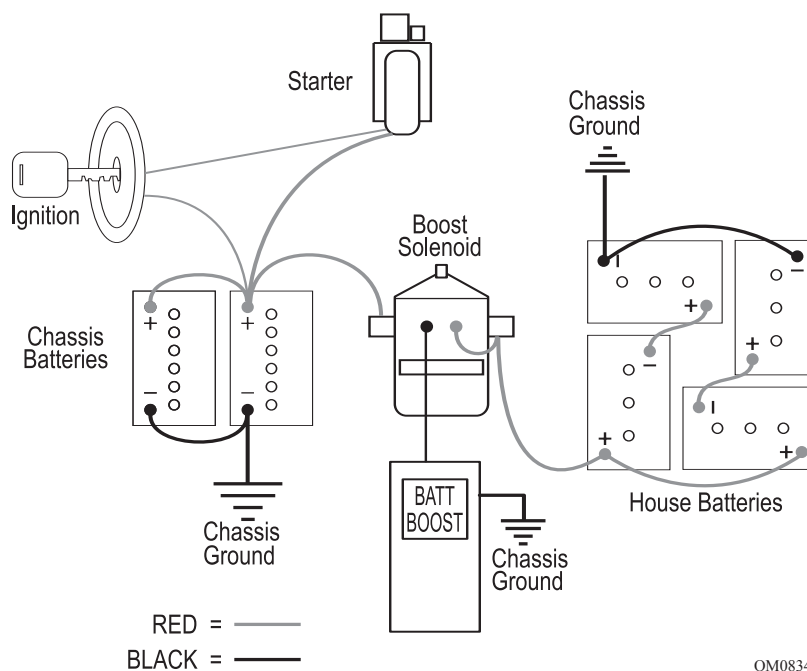
NOTE: Sudden movements or lurching the motorhome with an open throttle can result in damage to the transmission. Avoid this condition by making shifts only when the throttle is closed and engine is at normal idle.

Alternative Starting Procedure:

A weak or discharged battery will not supply the amount of CCA (Cold Cranking Amps) necessary to initiate and maintain cranking the engine while supplying 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 will increase chassis battery voltage.

Auxiliary Start Switch:

The Auxiliary Start switch engages a heavy-duty solenoid to electrically connect the house batteries to the engine battery in the event the engine won't 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.

**Jump Starting**

To Use the Solenoid

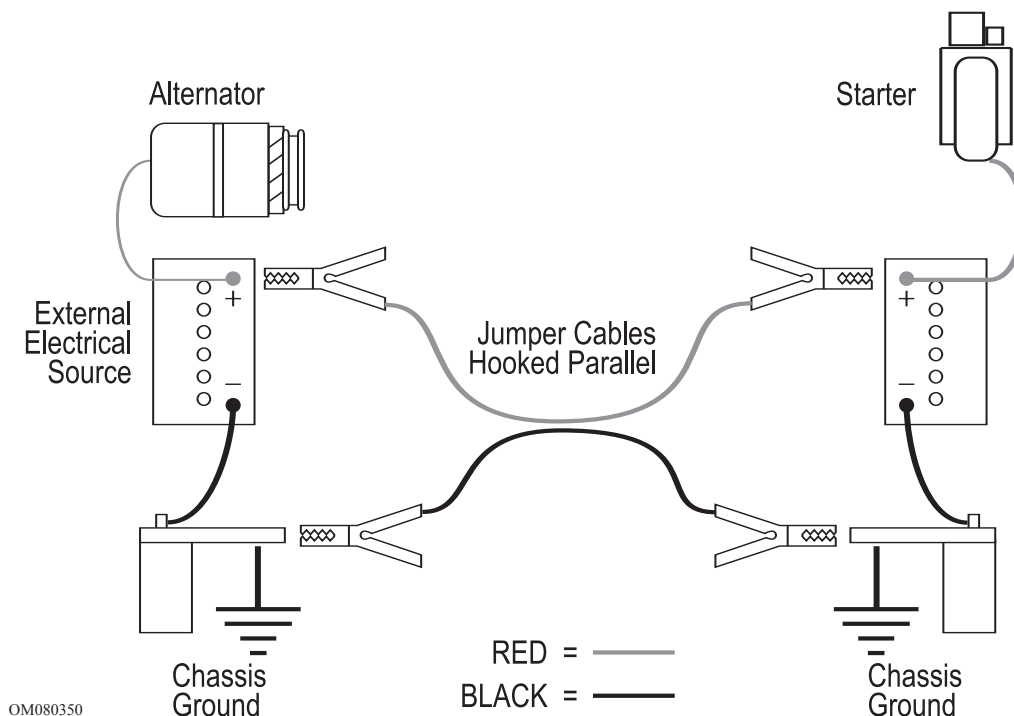
- With the ignition key off, press and hold the Auxiliary Start switch for 10 seconds. After 10 seconds, continue to hold the switch down and try to start the engine.
- If the engine fails to crank, or does not crank fast enough, discontinue the attempt. Continued attempts only diminish any remaining surface charge in the chassis battery, ending any future alternative attempts.
- Next, start the generator. This may require using the Auxiliary Start switch as the generator starts from the engine battery. When the generator is operating, the electrical combination of the generator, inverter and (if applicable) battery maintainer will charge the batteries.
- Allow the generator to run approximately ½ hour before attempting to start the engine.
- After a ½ hour of generator operation, with the generator operating, hold down the Auxiliary Start switch for one minute. Release the switch for one minute, then engage the switch for one minute. Alternate this cycle 3-5 times. This will avoid overheating the Boost solenoid.
- Next, hold the switch down for one minute and turn the key on. The battery voltage gauge on the dash should indicate at least 12 Volts. If voltage is sufficient with the Auxiliary Start switch held down, try starting 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 gases. 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.



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.

**Jump Starting:**

- 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.
- 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.
- Turn **ON** the battery disconnect switches and attempt to start the engine. **DO NOT** crank the engine more than a few seconds.
- After the engine has started disconnect the cables. Disconnect the negative (-) cables before disconnecting the positive (+) cables to prevent arcing.
- If the engine does not crank, or cranks slowly, **DO NOT CONTINUE**. Seek professional help. Extensive damage, fire or injury can occur.

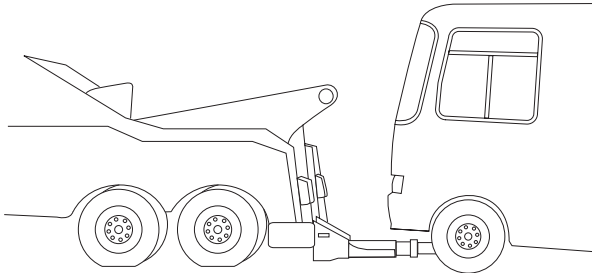
In the event of a roadside emergency, contact the nearest **Cummins Center** at **1-800-DIESELS (800-343-7357)** for Cummins Customer Assistance Center.



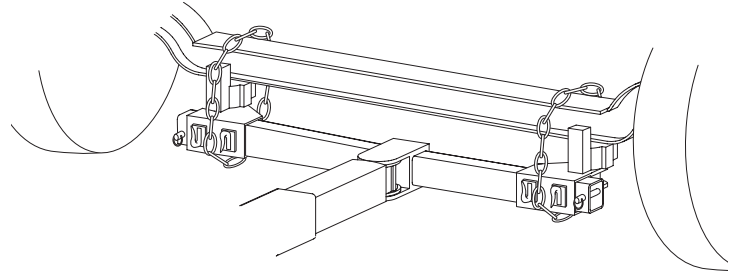
WARNING: The gases around the battery can explode if exposed to flames, sparks or lit cigarettes. An explosion can result in injury or vehicle damage. Batteries contain sulfuric acid, which burns skin, eyes and clothing. Do not connect the end of the second cable to the negative (-) terminal of the battery 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.

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 mile-post 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.

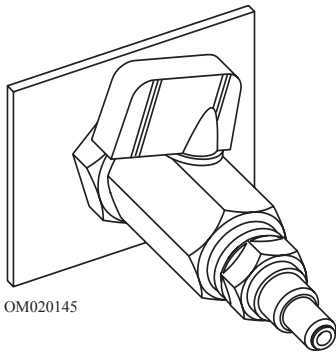


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The towing company may need to locate the air nipple to release the air brakes (air brakes only). The air nipple is located in the front generator compartment and should be used by towing personnel only. If the motorhome needs to be towed, use the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



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- 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.
- The drive shaft must be removed to prevent damage to the transmission. Secure the 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.

Chock the wheels securely prior to disabling (caging) the park brake. This procedure is for the emergency conditions only. Exhaust all other means of releasing the brakes prior to performing this procedure.

Drum Brake Models:

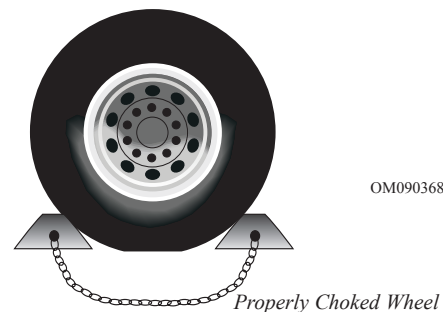
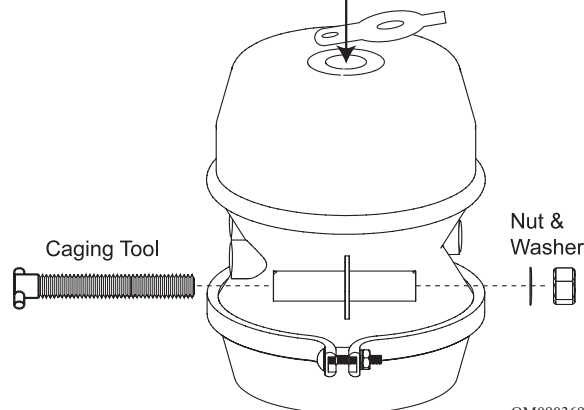
- Place wheel chocks firmly against wheel before performing this procedure.
- Remove the plug from the center of rear brake chamber on the drive axle.
- Remove the caging tool from its holder on the brake chamber and insert tool into hole. Turn the tool clockwise to engage.
- Screw nut and washer onto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



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

Brake - Disabling Parking Brake

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

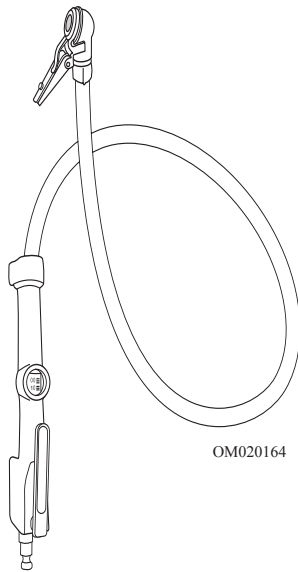


The tire designed for the motorhome is a very technical and precisely engineered product. To obtain the maximum wear and best service out of the tires it is helpful to understand the function of a tire. A tire is a “container” that holds air. It is the combination of air and the tire casing that supports the motorhome and its contents. The following information concerning tires, weighing the motorhome and subsequent tire information are set in the order in which the process is performed or experienced. The motorhome must be weighed fully loaded before the proper tire inflation pressure can be obtained.

Since the tire is the only contact the motorhome has with the road surface, it is critical that proper tire pressure be maintained so that it will properly support the weight of the motorhome. Inadequate tire pressure will lead to abnormal wear or sudden tire failure. The tire performs other functions such as traction for moving, stopping, steering and providing a cushion for the motorhome.

TIRES

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

How Much Air Should I Carry in My Tires?

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 it is fully loaded. The chart within this section indicates the weights that can be properly supported by varying air pressures. Decreasing air pressure decreases load carrying capacity.

Tire Pressure Inflation Guideline

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 is contained in this section of the manual.

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 OVER INFLATE OR UNDER INFLATE 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.

The **GVWR (Gross Vehicle Weight Rating)** and **GAWR (Gross Axle Weight Rating)** stickers on the motorhome (normally located on the support pillar next to the driver's seat) will show the chassis manufacturer's and/or the RV manufacturer's total vehicle maximum weight ratings 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 for which a single axle is designed. These per axle and total maximum weight ratings could be limited by the tires, wheels, axle and axle bearings, the motorhome frame or other components of the motorhome.

The GAWR sticker is only a guide in knowing the maximum loaded axle weights, and subsequently the correct tire inflation pressure. 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 know its actual weight. Weigh the front axle, the total unit and the rear axle. It is possible for a motorhome to be within the GVWR yet overloaded on an axle. It is even possible for one wheel position to be overloaded, even though the GAWR has not

WEIGHT TERMS

been exceeded. For this reason (if there is room to the sides of the scales) weigh each wheel position of the motorhome. This will give a clear indication of exactly how the weight of the motorhome is distributed. These 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. 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 NCC.
- **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.
- **Net Carrying Capacity (NCC):**
Maximum weight of all occupants including driver, personal belongings, food, fresh water, LP-Gas, tools, tongue weight of towed vehicle, dealer installed accessories, etc., that can be carried by this motorhome. (NCC is equal to or less than GVWR minus UVW.)
- **Gross Combination Weight Rating (GCWR):**
Means the maximum allowable loaded weight of this motorhome and any towed trailer or towed vehicle.
- **Gross Axle Weight Rating (GAWR):**
The load-carrying capacity specified by manufacturer of a single axle system, as measured at tire ground interfaces.
- **Gross Combined Axle Weight (GCAW):**
The sum of the total weight of all axles when added together.
- **Sleeping Capacity Weight Rating (SCWR):**
Manufacturer's designated number of sleeping positions multiplied by 154 pounds.

**Weight Label
(Example)**

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 an exemplar Motorhome as manufactured at the factory with full fuel, engine oil and coolants (*1)	_____	_____
<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.....	_____	_____
<u>GCWR</u>	(Gross Combination Weight Rating) means the maximum allowable loaded weight of this motorhome and any towed trailer or towed vehicle.(*2).....	_____	_____
	FACTORY INSTALLED OPTIONS are options installed at the factory but do not include dealer installed after market equipment...	_____	_____

CARGO CARRYING CAPACITY (CCC) COMPUTATION

GVWR	_____	_____
minus UVW	_____	_____
minus fresh water (*3) weight of ____ gallons @ 8.3 lbs./gal	_____	_____
minus LP-Gas weight of ____ gallons @ 4.5 lbs./gal	_____	_____
minus SCWR of ____ persons @ 154 lbs./person.....	_____	_____
CCC for this motorhome (*4)	_____	_____

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

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) The UVW has been determined by weighing an exemplar motorhome with some but not all optional equipment available for each model year, make and model of motorhome. The result of the weighing of the exemplar motorhome is then used in calculating the UVW of other motorhomes of same model year, make and model. Your actual UVW may vary based upon options ordered. Please contact the manufacturer for the actual weight of each option.

(*2) Consult your Owner's Manual for towing limitations, restrictions and other guidelines.

(*3) 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.

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

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Improperly inflated tires, or suspension that is incorrectly loaded, can result in poor fuel economy, poor handling and over-stressed chassis components. Vehicle loading affects tire inflation pressure and the load carried by each axle. Motorhome axle configuration and floor plan styles will require different weighing procedures.

**WEIGHING 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 a minimum tire pressure of at least 75 psi. must be maintained. Tire pressure below 75 psi. can overheat and damage the tire casing leading to premature tire failure or blowout.

Slide-out Tire Pressure:

A motorhome equipped with slide-out room(s) will weigh slightly heavier on the driver's side. The tire inflation pressure of the driver's side tires determines the inflation pressure for all tire(s) on that axle. This is due to the weight transfer that occurs when cornering. Approximately the same weight load will be transferred to the passenger side around left-hand corners.



NOTE: When weighing a motorhome equipped with a slide-out room, 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.

Scale:

Certified public scales are located in a variety of places such as moving and storage lots, farm suppliers with grain elevators, gravel pits, recycling companies and large commercial truck stops.

If you are not aware of a nearby public scale, check the local area telephone book yellow pages under “scales-public” section or “weighers.” A nominal fee will be charged, but this is money wisely spent.

Weight scale types and weighing methods will affect the procedure used to determine proper tire inflation pressure and axle loading. There are several types of scales in use today. A platform scale will allow the entire motorhome to fit on the scale, which will read the GVW with only one scale recording required. A segmented platform scale is designed to weigh only one axle at a time, which may require two or three scale readings to determine the GAW or GVW total. A single axle scale enables one axle at a time. Some scales will read only one wheel position at a time due their physical size. Several scale readings may be required to determine the GAW or GVW total.

Slide-out equipped motorhomes will require each wheel position to be weighed. This is referred to as a four corner weigh. This type of weighing procedure will accurately determine what the correct tire inflation pressure should be. Depending on the type of scale being used, several different scale readings may be required.

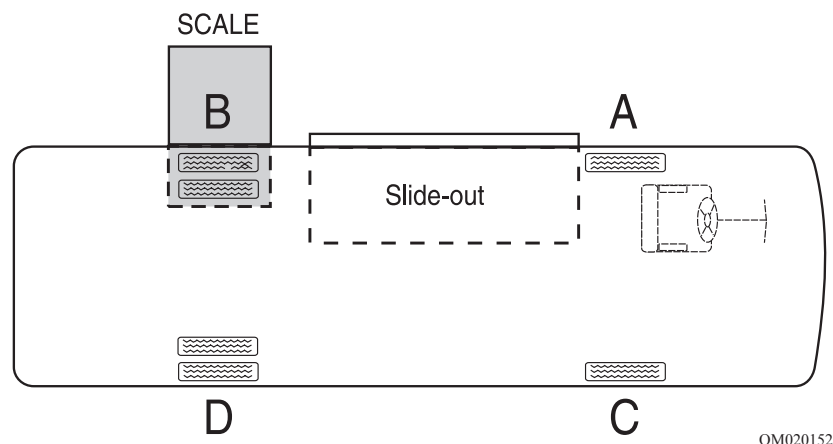


NOTE: The most accurate method to determine proper tire pressure is a four corner weigh. A slide out motorhome will require each tire to be weighed independently. Weighing an axle will net the total weight carried by that axle. When calculating the drive axle dual tire pressure using a independent corner weigh method, divide the total weight by two to determine the weight carried by each tire. When weighing the entire drive axle, divide the total weight by four to determine the approximate weight carried by each tire.

Example:

The motorhome must be weighed fully loaded to obtain accurate scale readings and to determine the proper tire pressure.

- Take the rear axle Gross Axle Weight Rating (GAWR) and divide it by two. Record the figure next to scale B, $GAWR \div 2$. Example: If rear axle GAWR is 13,000 lbs. $GAWR \div 2$ would be 6,500 lbs.
- Weigh the driver's side rear corner (scale B) and record the scale reading next to Gross Axle Weight (GAW) for scale B. Example: Scale B reading is 5,100 lbs.
- Repeat procedure for the rest of the scale readings.
- Add the GAWR from scales B and D and enter the sum next to the final GAWR. Example: 13,000.
- Add the GAW from scales B and D and enter this sum next to the final GCAW. Example: 10,000.
- Compare scale readings GCAW against GAWR readings. All figures on line 2 are not to exceed figures on line 1.
- Use tire chart with scale reading to determine correct tire pressure.

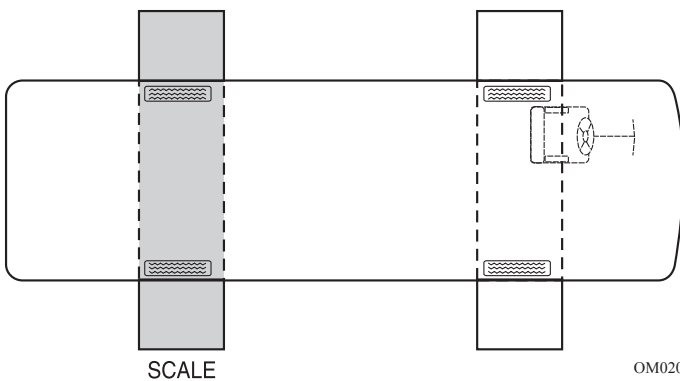


REAR					
SUBTOTALS					
Scale B	1	$GAWR / 2 =$	6,500	B1 + D1	= 13,000 GAWR
	2	GAW =	5,100		

Scale D	1	$GAWR / 2 =$	6,500	B2 + D2	= 10,000 GCAW
	2	GAW =	4,900		



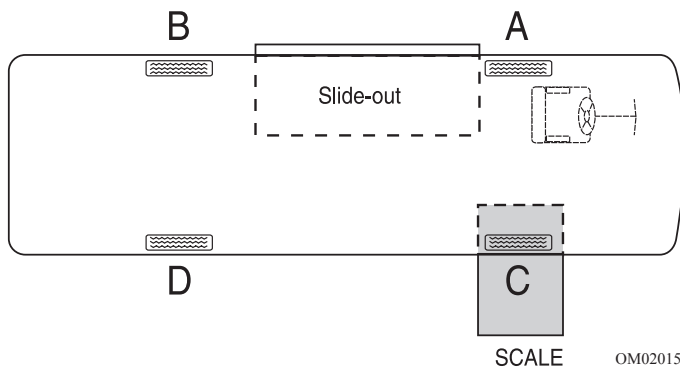
NOTE: Scale readings and Gross Axle Weight Ratings in the example are fictitious. Actual scale readings and Gross Axle Weight Ratings will vary with model and options.



Weighing a two axle non-slide motorhome.

- Record the Gross Axle Weight Ratings (GAWR) and the Gross Vehicle Weight Rating (GVWR).
- Weigh and record each wheel position or total axle weight.
- If necessary, adjust the payload so the GAWR is not exceeded. Total combined weights must not exceed the GVWR.
- Using the tire chart, locate the recommended air pressure for the weight carried by each tire. Adjust the tire pressure accordingly.

REAR		FRONT		TOTALS	
GAWR	+	GAWR	=	GCVW	
GAW	+	GAW	=	GCAW	



Weighing a two axle slide-out motorhome.

- Slide rooms must be in the retracted position.
- Record the Gross Axle Weight Ratings (GAWR) and the Gross Vehicle Weight Rating (GVWR).
- Weigh and record the weight placed on each tire.
- If necessary, adjust the payload so the GAWR is not exceeded. Total combined weights must not exceed the GVWR.
- Using the tire chart, locate the recommended air pressure for the weight carried by each tire. Adjust the tire pressure accordingly.

REAR					
SUBTOTALS					
Scale B	1	GAWR / 2 =		TOTALS	
	2	GAW =			
			B1 + D1	=	GAWR
Scale D	1	GAWR / 2 =		TOTALS	
	2	GAW =			
			B2 + D2	=	GCAW
FRONT					
SUBTOTALS					
Scale A	1	GAWR / 2 =		TOTALS	
	2	GAW =			
			A1 + C1	=	GAWR
Scale C	1	GAWR / 2 =		TOTALS	
	2	GAW =			
			A2 + C2	=	GCAW

TIRE CHART

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	2350	3460	3570	2680	2780	2880	2980	3070	3160	3375(F)			
		S	2410	2540	2680	2800	2930	3060	3170	3280	3400	3500(F)			
70R19.5	75	D		2720	2860	3000	3115	3245	3415(F)						
		S		2895	3040	3195	3315	3450	3640(F)						
245/70R19.5	75	D		3415	3515	3655	3875(F)	3940	4075	4375(G)					
		S		3640	3740	3890	4080(F)	4190	4335	4545(G)					
265/70R19.5	75	D				3750	3930	4095	4300	4405	4560	4805	4860	5070(G)	
		S				3970	4180	4355	4540	4685	4850	5070	5170	5355(G)	
9R22.5	65	D	3120	3270	3410	3550	3690	3820	3950(F)						
		S	3190	3370	3560	3730	3890	4050	4210	4350	4500(F)				
10R22.5	65	D	3690	3870	4040	4200	4375	4520	4670	4875(F)	4970	5110	5250(G)		
		S	3770	4000	4210	4410	4610	4790	4970	5150(F)	5320	5490	5680(G)		
11R22.5	75	D				4760	4950	5120	5300	5470	5750(G)	5800(H)			
		S				4990	5220	5430	5640	5840	6175(G)	6240	6430	6610(H)	
12R22.5	65	D				5190	5390	5590	5780	5960	6150	6320	6500	6750(H)	
		S				5450	5690	5920	6140	6370	6590	6790	7010	7390(H)	
245/75R22.5	75	D		3260	3425	3640	3740	3890	4080	4190	4335	4410(G)			
		S		3470	3645	3860	3980	4140	4300	4455	4610	4675(G)			
255/70R22.5	75	D		3585	3765	3970	4110	4275	4410	4455	4610	4675	5070(H)		
		S		3815	4005	4190	4370	4550	4675	4895	5065	5205	5510(H)		
265/75R22.5	75	D			4040	4205	4370	4525	4685	4805(G)					
		S			4070	4255	4440	4620	4800	4975	5150	5205(G)			
275/70R22.5	75	D					4535	4750	4960	5165	5370	5575	5775	5975	6175(H)
		S					4885	5080	5305	5530	5750	5965	6185	6400	6610(H)
275/80R22.5	75	D					4855	5080	5305	5525	5745	5965	6180	6395(H)	
		S					5265	5515	5755	6000	6235	6475	6710	6940(H)	
295/75R22.5	75	D			4690	4885	5070	5260	5440	5675(G)	5800	6005(H)			
		S			4725	4945	5155	5370	5510	5780	5980	6175(G)	6370	6610(H)	
295/80R22.5	75	D				4855	5100	5335	5570	5805	6035	6265	6490	6720	6940(H)
		S				5480	5750	6020	6285	6550	6810	7070	7320	7580	7830(H)
315/80R22.5	75	D					5840	6070	6395	6540	6770	6940	7210	7610(J)	7390
		S					6415	6670	6940	7190	7440	7610	7920	8270(J)	8820
285/75R24.5	75	D			4740	4930	5205	5310	5495	5675(G)					
		S			4770	4990	5210	5420	5675	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. The motorhome manufacturer is not responsible for the accuracy of the information disclosed or for any errors within the Tire Inflation Chart.

Inspecting & Pressure

Regularly check the tire pressure. A nail or screw can lodge in a tire and create a slow leak. The object may eventually be spotted on a front tire or an outside rear dual. However, if there is a slow leak on an inside dual, it will probably go unnoticed. If you begin driving unaware that an inside dual tire is low on air pressure or is flat, very quickly (in most cases a few miles) the outside rear tire will heat up due to carrying double the load. This can lead to failure of the outside tire resulting in two flat tires on the same side of the same axle.

Check the tire pressure every two weeks or at least once a month and before any 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 your 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. These have 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 has the valve stem pointing inward. Nothing should restrict the ability to easily check the tires 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.



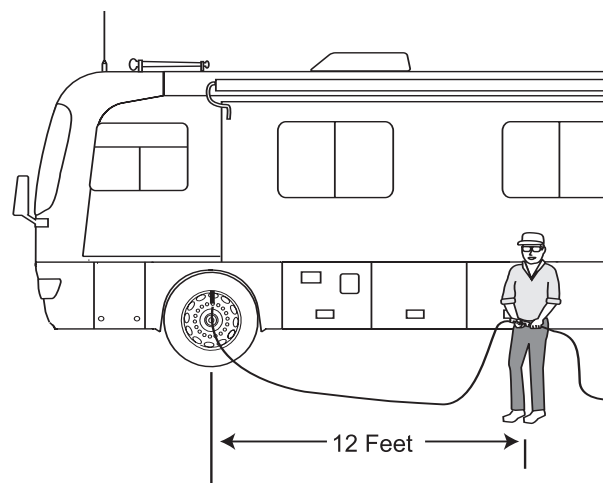
WARNING: Improperly inflated tires can effect handling or cause sudden tire failure possibly resulting in loss of vehicle control. Always use an accurate tire pressure gauge when checking tire pressure.

Lower Than Recommended Pressure can Cause:

- Tire squeal on turns.
- Rapid and uneven wear on the edges of the tread.
- Tire rim bruises and rupture.
- Tire cord breakage.
- Excessive tire temperature.
- Reduced handling quality.
- High fuel consumption.

Unequal Tire Pressures on Same Axle can Cause:

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



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WARNING: Driving on a tire with low air pressure can exceed the design limits of the tire. Damage to the sidewall of the tire can occur. A damaged sidewall can burst upon inflation causing serious damage, injury or death. Aged tires are also susceptible to sidewall damage. For safety purposes clear the area of people and pets during tire inflation. Inflate tires using a remote inflation device.

Sudden tire failure or blowout is often preceded by tire vibration. Some other 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 immediately after such an occurrence. Continue to inspect the tires periodically thereafter in case minor damage occurred. Rotation forces can continue to stress damaged areas that can manifest later in a sudden tire failure. If an unusual vibration begins, or a bulge is noticed in a sidewall, have the tires evaluated by a qualified professional as soon as possible.

Tire Vibration

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

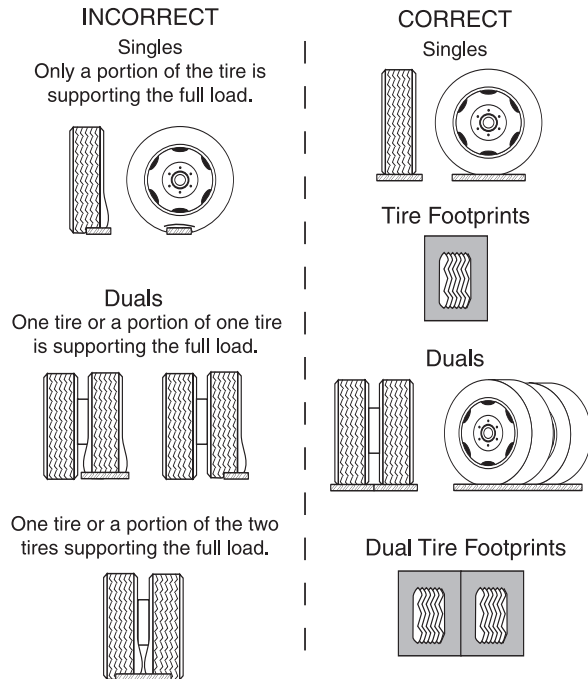
Tire Rotation

After a tire rotation, check and adjust the inflation pressures for the actual loads of the wheel position accordingly.

Tires are warranted by the tire manufacturer. The motorhome manufacturer is not responsible for warranty coverage or tire wear.

Tires - Supporting When Leveling

Tire "Support" Methods



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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.

Proper Cleaning:

Road oil will cause deterioration of the rubber. Dirt buildup will help hold chemicals in the air next to the tire and will also cause deterioration.

When cleaning any rubber product, 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, RV tires may last longer due to limited annual mileage and exposure.

Storage of Tires - Long-Term

The motorhome is designed for recreation not long-term storage. However, unless you are living in your motorhome full-time you will have a need to store it. Rubber tires age faster when not being used. A cool, dry, sealed garage is the preferred method of storage. Many recreational vehicles are stored outside in the elements. Some storage surfaces may cause tires to age prematurely. Placing a barrier (i.e. cardboard, plastic or plywood) between the tire and the storage floor/ground surface will help to protect the tires.

When the tire is anticipated to be out of service for a period of thirty days, the motorhome should be in the long-term storage condition. The ideal conditions include placing the motorhome on blocks to remove all weight from the tires (then the inflation pressure can be reduced to 15 psi). However, this is not always possible. With a few simple steps the aging effects from long-term storage or a non-use period can be reduced.

- 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.
- The tire inflation pressures should be increased to 25% above the actual load when the tire is placed in the storage condition.
- 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.
- Store the motorhome out of a high ozone area.



NOTE: When the motorhome is stored the tires should be inflated to maximum inflation pressure as indicated on the sidewall of the tire.

Failure to take these steps can cause early deterioration and shorten the life of your tires.

The type of surface the motorhome is parked upon will have an affect on how much moisture accumulation occurs on the chassis and flooring. Moisture can eventually seep into the interior. Further, the type of surface can affect the tires.

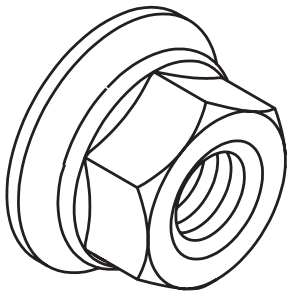
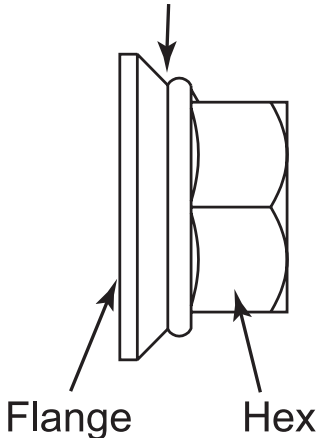
- Gravel covered parking areas still allow moisture to evaporate from the ground, through the gravel and to the underside of the motorhome.
- Sealed concrete pads allow better ventilation under the motorhome.
- Storage buildings with sealed concrete floors or heated storage facilities greatly reduce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

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.

In Case of Flat Tire

In the event of a flat tire, contract roadside assistance or emergency roadside service. The size and weight of the motorhome and tires require the 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. To contact Toyo Tire call 800-442-8696. Save the old tire for any warranty coverage.

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



OM090268C

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, this will not improve the nut torquing performance. Excessive lubricant makes the nuts hard to handle, attracts dirt to the nuts and may cause unsightly appearance to the wheel. Only used nuts need to be lubricated.
- Since 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 500 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 recreational vehicle is in motion.

Front Wheels:

Slide the front wheel over the studs, being careful not to damage stud threads. Snug the nuts in sequence, do not tighten them fully until all have been seated. Tighten the nuts to 500 ft.lbs in sequence (as shown in the illustration).

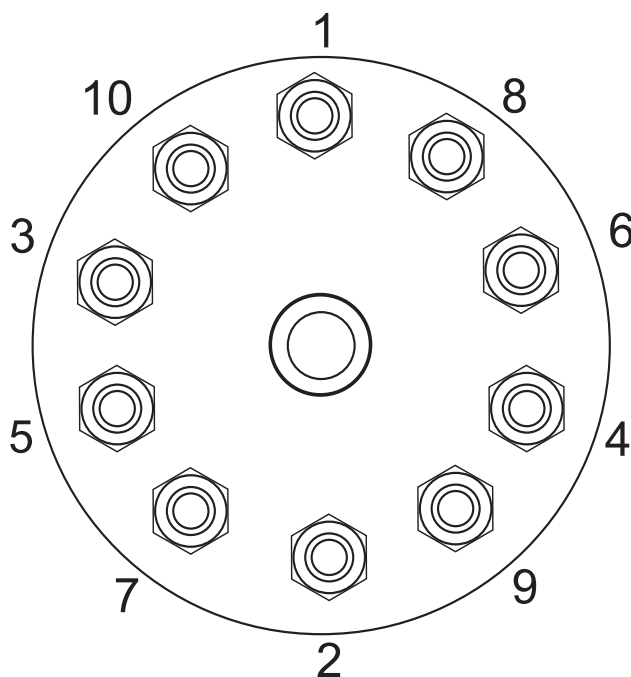
Dual Rear Wheels:

Slide the inner dual wheel over the studs, being careful not to damage the stud threads. Align the handholds for valve access and slide the outer dual wheel over the studs, again being careful not to damage the stud threads.

Snug the nuts in sequence, do not tighten them fully until all have been seated. Tighten the nuts to 500 ft. lbs. using the sequence (as shown in the illustration). The hub mount wheels use two piece flange cap nuts for both front and rear applications. No inner cap nuts are required.

Torque the Nuts Properly:

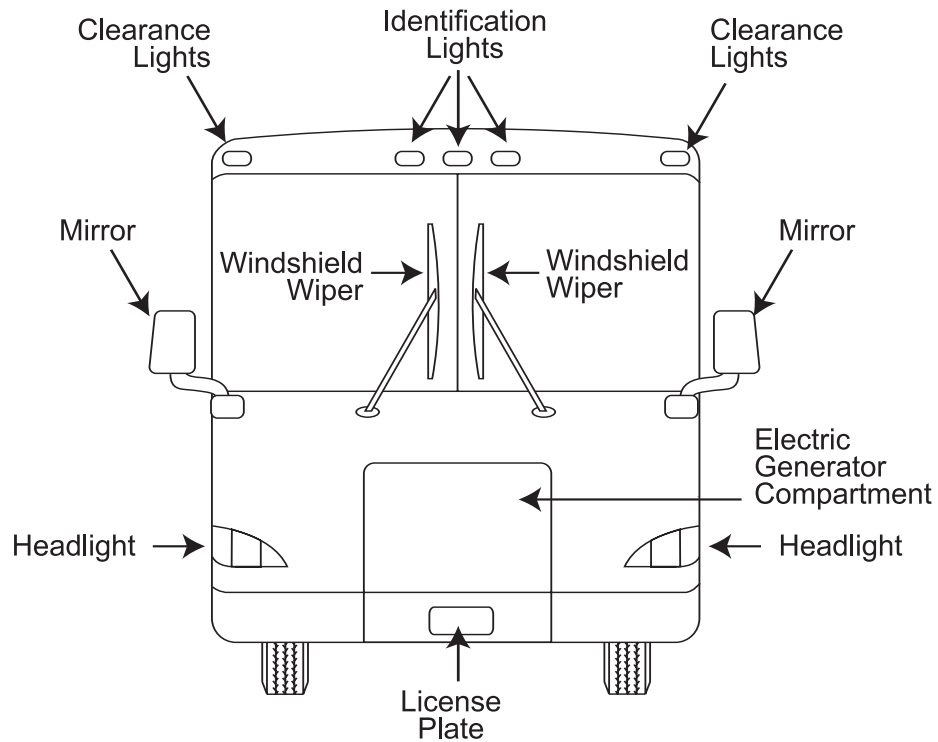
- Tighten the wheel nuts to the recommended lug nut torque. Do not over tighten.
- Maintain the nut torque at the recommended level through planned periodic checks or at 10,000 miles intervals, whichever comes first.
- If air wrenches are used they must be periodically calibrated for the proper torque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



Nut Tightening Sequence

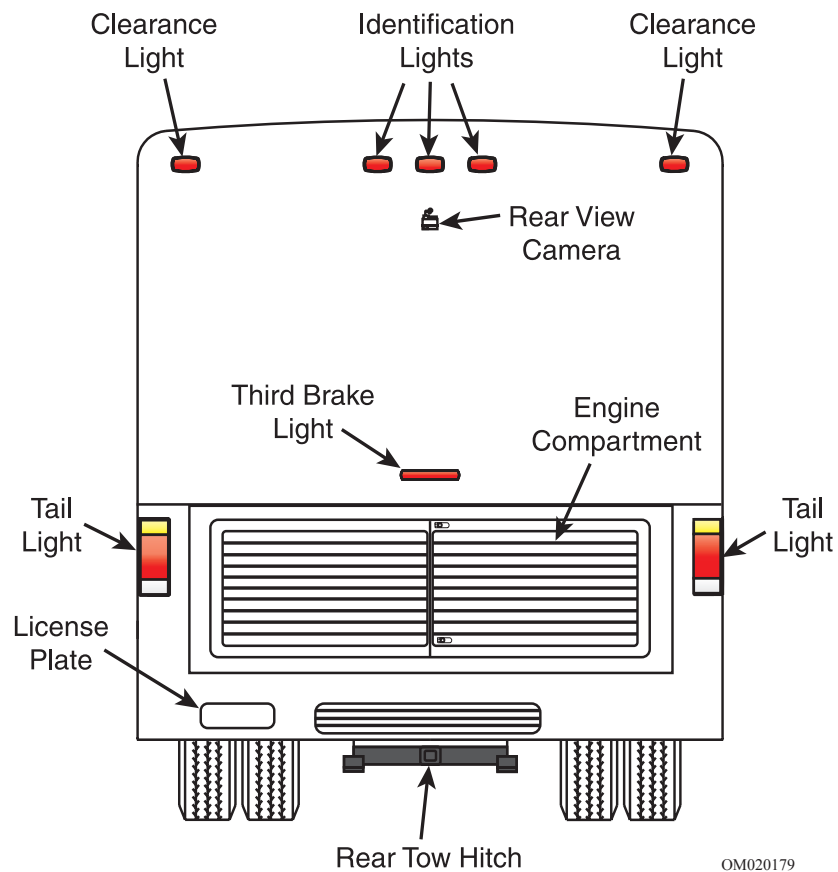
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VIEWS - Front



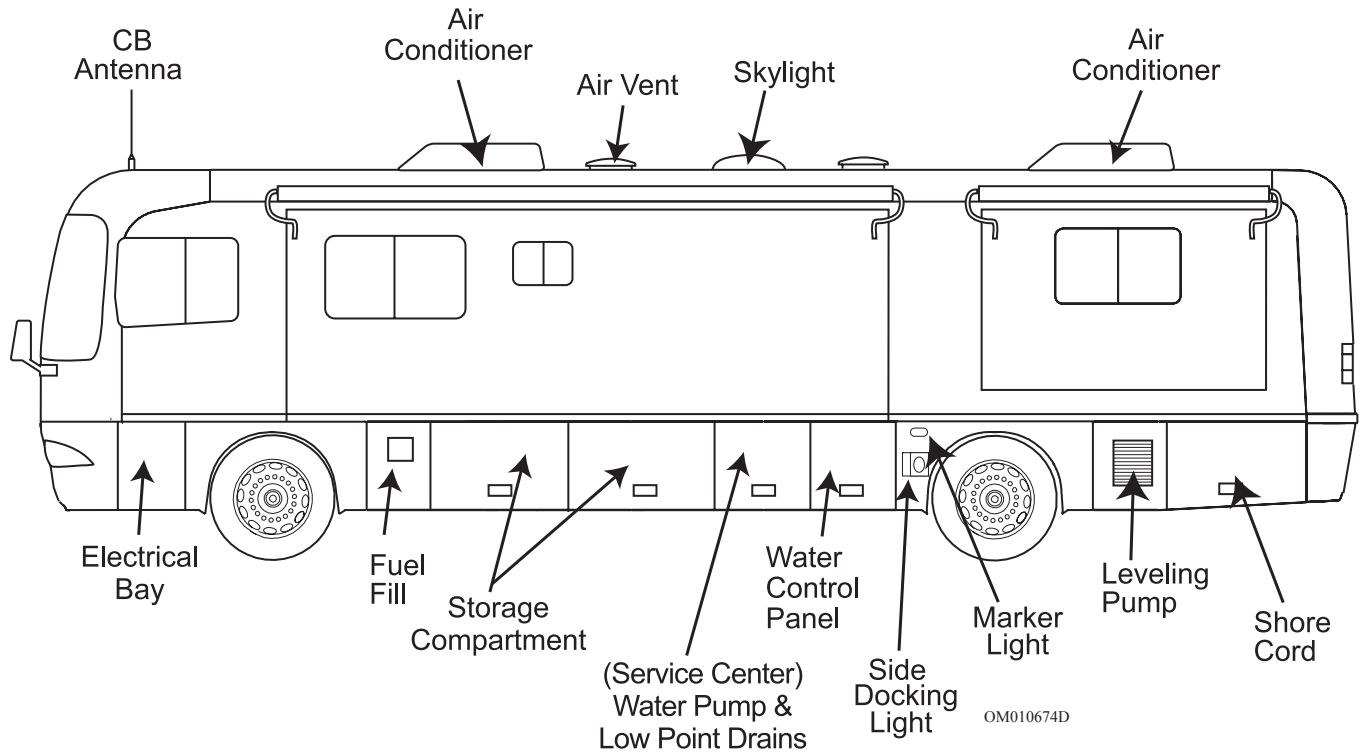
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Rear

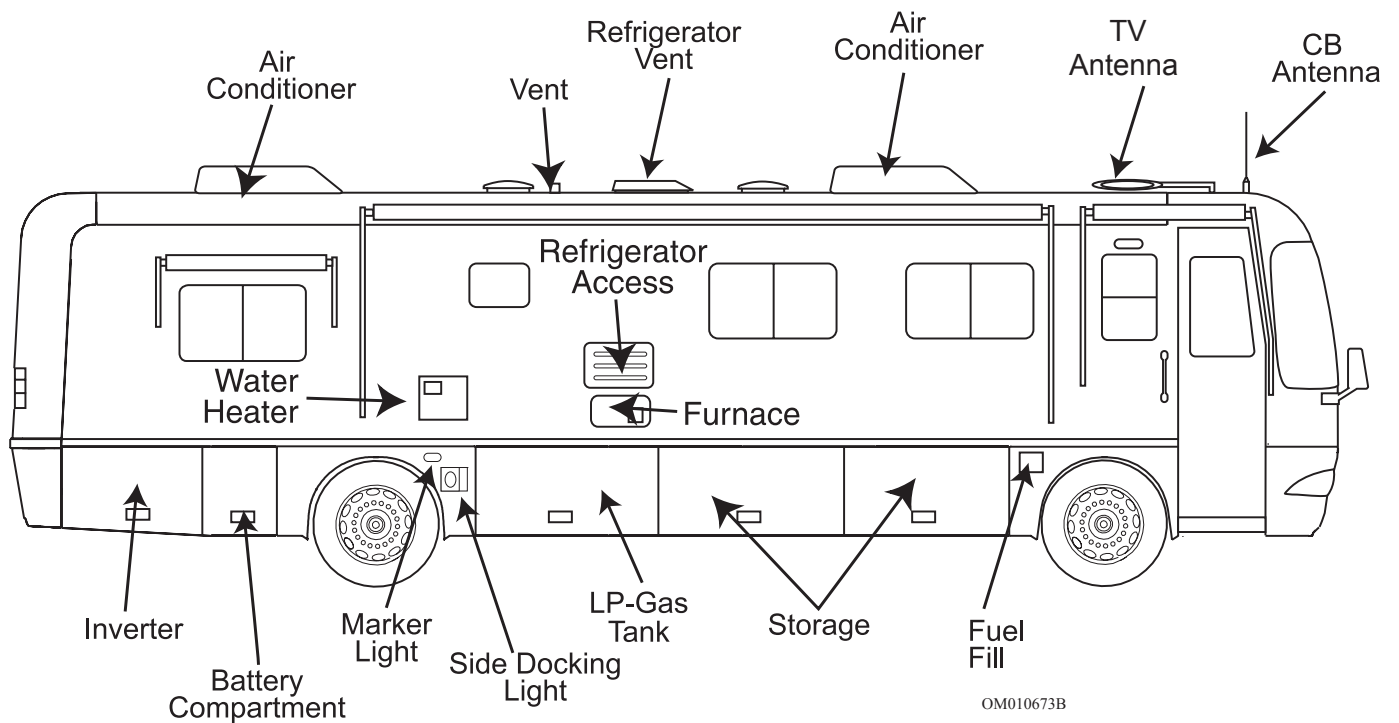


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Roadside



Curbside



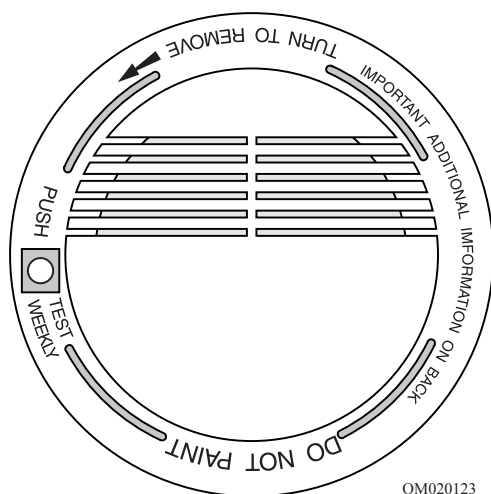
SPECIFICATIONS - DIMENSIONS CHART

MODELS	34PBD	36PBD	36PST	38PBD	38PBDD	38PST	40PBD	40PBDD	40PWD	40DST	40PST	40PDT
Wheelbase	196"	216"	216"	242"	242"	242"	256"	256"	256"	256"	256"	256"
Overall Length	34' 11"	36' 7"	36' 7"	38' 9"	38' 9"	38' 9"	39' 11"	39' 11"	39' 11"	39' 11"	39' 11"	39' 11"
Overall Height	12' 0"	12' 0"	12' 0"	12' 0"	12' 0"	12' 0"	12' 0"	12' 0"	12' 0"	12' 0"	12' 0"	12' 0"
Interior Height	6' 6"	6' 6"	6' 6"	6' 6"	6' 6"	6' 6"	6' 6"	6' 6"	6' 6"	6' 6"	6' 6"	6' 6"
Interior Width	94.5"	94.5"	94.5"	94.5"	94.5"	94.5"	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"	100.5"	100.5"	100.5"	100.5"	100.5"	100.5"



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.

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

Operation

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

How to Test

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 arms 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.

A smoke alarm is designed to be as maintenance free as possible. However, there are some simple steps to perform in order to keep the smoke alarm working properly:

Maintenance

- 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 should be cleaned every six months to help keep the unit working efficiently.
- The smoke alarm will beep once a minute when a low battery condition exists. The battery must be replaced immediately.

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

Troubleshooting

- **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.

LP-GAS DETECTOR

The LP-Gas detector is provided for safety. It detects 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.

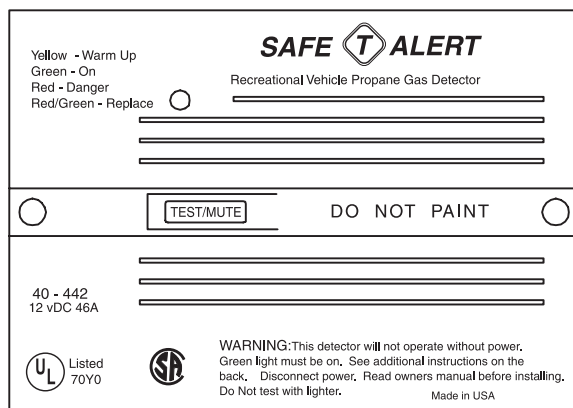
Butane, like propane, is heavier than air and will settle to the floor level where it will be detected. When this occurs, press **Test/Mute** button to stop the alert sound for 60 seconds.

Other combustibles which will be detected include alcohol, liquor, deodorants, colognes, perfumes, wine, adhesives, lacquer, kerosene, gasoline, glues, most cleaning agents and propellant of aerosol cans. Most are lighter than air in their vapor state and will only be detected when the motorhome is closed up.

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 gas detector operates on 12 Volt DC, with a current draw less than 1/10th of one amp.



CAUTION: The detector will not alarm during the three minute warm up cycle.



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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 a dangerous level of propane or methane gas is detected. The detector will continue to alarm until the gas clears or the **TEST/MUTE** switch is pressed.

Procedures To Take During An Alarm:

1. Turn off all gas appliances, (stove, heaters, furnace), extinguish all flames and smoking material. Evacuate, leave doors and windows open.
2. Turn off the propane tank valve.
3. Determine and repair the source of the leak. Seek professional help if necessary.



CAUTION: Do Not re-enter until the problem is corrected.

Alarm Mute:

Press the **Test/Mute** button when the detector is in alarm.

1. The **red** LED will continue 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.

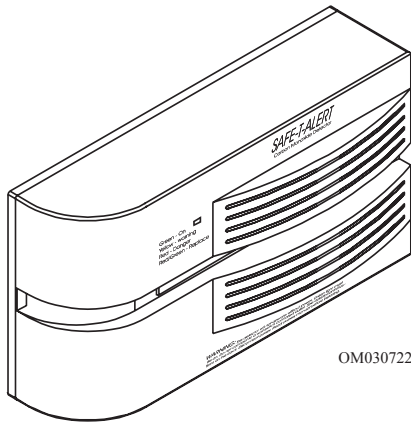
Fault Alarm:

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.

Cleaning

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.

CARBON MONOXIDE DETECTOR



The motorhome is equipped with a carbon monoxide detector. Carbon monoxide (CO) is a colorless, odorless and tasteless gas. 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. In cases of mild exposure the symptoms may include: a slight headache, nausea, vomiting and fatigue. 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. The CO detector is designed to detect the toxic CO fumes that result from vehicle exhaust and incomplete combustion sources like a furnace, gas stove or water heater. Consequently, it is uncommon for household smoke from cigarettes or normal cooking to cause the alarm to sound.



NOTE: 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 your hearing.

Operating Instructions

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. 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 the conditions as follows:

- **Green** - Indicates **ON** or normal condition. The CO detector has power and is sensing air for the presence of CO gas. The alarm horn will not sound.
- **Yellow** - Indicates a “**trouble**” or malfunction condition. The alarm horn will sound and cannot be reset by the **TEST/RESET** button. The CO detector is not working properly and must be immediately replaced or repaired.
- **Red** - Indicates an “**alarm condition.**” The detector has sensed the presence of a hazardous level of carbon monoxide. The alarm horn will sound continuously until the **RESET** switch is reset.

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.

Testing

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 button in until the alarm sounds. The alarm will stop beeping in about 30 seconds.

Cleaning

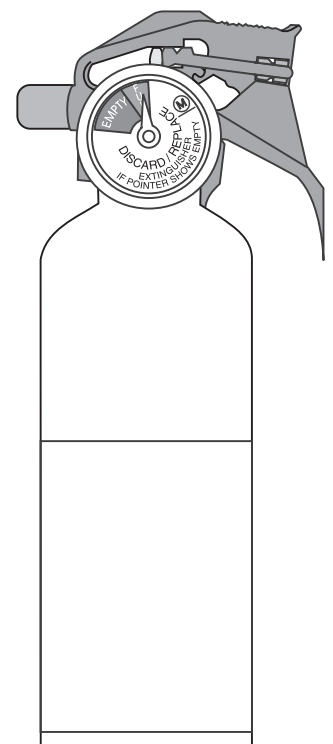
Use a vacuum cleaner to remove dust or any other buildup on the detector. Do not wash. Wipe the detector with a damp cloth and dry it with a towel. Do not open the detector for cleaning. Do not paint the detector. It is recommend that the carbon monoxide detector be replaced every 10 years.

The 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, you and your family should 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, this will cause a loss of pressure.

Use the **PASS** word!

- **P**ull the pin to unlock the extinguisher.
- **A**im at the base (bottom) of the fire and stand 6-10 feet away.
- **S**queeze the lever to discharge the agent.
- **S**weep the spray from left to right until totally extinguished.

**FIRE
EXTINGUISHER**

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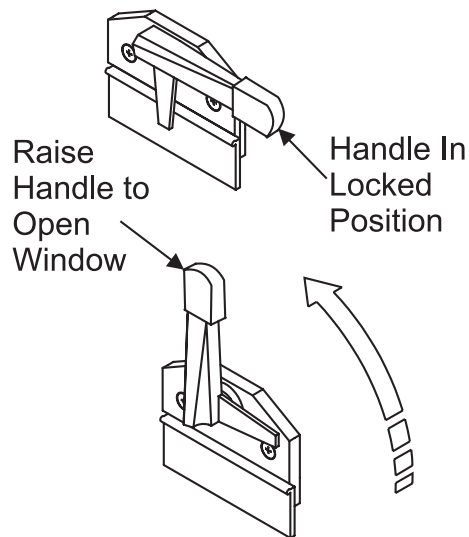
EGRESS EXIT WINDOW

An egress window is designated for use as an exit in the case of an emergency. Inside the motorhome the egress window is easily identified by the red locking handle. It is also marked as an "EXIT." The glass slider in the egress window operates the same as all other windows.

- To open the egress window, lift the red handle and push outward on the window.
- To close the egress window, pull the window closed and lower the handles to lock window in place.



CAUTION: The egress window should be opened twice a year to ensure proper operation. Over time, the rubber seal will tend to stick to the egress window. Occasional operation will help prevent the rubber seal from sticking.



Egress Window Handle

OM020029

Endeavor

SECTION 3 CARE & MAINTENANCE

EXTERIOR CARE	85
CORROSION	85
WASHING	85
DRYING	86
WAXING	86
TIRE CARE	87
CARE & MAINTENANCE OF ALUMINUM WHEELS	88
BRIGHT METAL	88
EXTERIOR MAINTENANCE	89
ROOF CARE & SEAL INSPECTIONS	89
INTERIOR CARE	91
FABRICS	91
FABRIC SPECIFICATION CHARTS	94
VINYL	96
LEATHER	98
ULTRA-LEATHER	98
FLOORS - CARPET CLEANING	100
FLOOR - TILE	101
FLOOR -LAMINATE	102
SHOWER -CLEANING	102
CEILINGS	103
WALL COVERINGS	103
WOOD CARE	105
COUNTERTOPS	107
WINDOWS	108
MOLD & MILDEW	109
MINI-BLINDS	110
DAY/NIGHT SHADES	111
STORAGE	111
SHORT - TERM	111
LONG - TERM	112
WINTER STORAGE	115
REMOVAL	115

EXTERIOR CARE
Corrosion

The most common cause of corrosion to the motorhome is the accumulation of road salts, grime and dirt. These elements, combined with moisture, may possibly cause early component failure. Salt air and fog from coastal trips can greatly accelerate the corrosion process. Corrosive materials collected from roadways accumulate on the undercarriage, around wheel openings and on the radiator charge air cooler package. These areas need to be cleaned periodically to help prevent component failure due to corrosion. 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.** Remove road debris and mud that has accumulated. Material left behind can intensify the corrosion problem.



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 1,800 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.

The life of the exterior paint finish can be extended if properly cared for. Periodic cleaning will help preserve the paint finish. The motorhome is painted with a “base coat, clear coat system.” The clear coat is a polyurethane based material which brings out the shine or 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 as they will scratch the clear coat and leave a soap film. The use of specially designed automotive washing utensils, such as soft bristle brushes, are acceptable as long as they do not trap abrasive material and scratch the surface while being used. 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 the build up is excessive, run water over a soft brush while gently scrubbing 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 any detergent residue.

Washing

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 until all chamois material has absorbed water. Wring excess water from chamois. Start at the top and work towards the bottom. Use a downward “S” pattern to remove water from the surface and 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: 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-ups. 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 all manufacturer’s 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’s 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.

Road oil will cause deterioration of the rubber. Dirt buildup will help hold chemicals in the air next to the tire and will also cause deterioration.

Tire Care

When cleaning any rubber product, 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.

Care & Maintenance of Aluminum Wheels

- Clean frequently with high pressure water from a hose. The use of mild detergent will speed the cleaning process. Do not use harsh alkalis, alcohol or acidic cleansers. A secondary hand washing with a soft cloth may be required to remove some stubborn road films.
- When the tires are removed the entire wheel must be cleaned and inspected. With a wire brush or sandpaper remove dirt, corrosion or any foreign materials from the tire side of the rim. Do not use a wire brush or other abrasive substances to remove dirt and corrosion on the polished surface of the wheel.
- To maintain the original appearance of the aluminum wheels the following procedures are recommended:
 1. After installing new wheels (prior to operating your motorhome) use a sponge, cloth or soft fiber brush to wash the exposed wheel surfaces with a mild detergent/warm water solution.
 2. Rinse thoroughly with clean water.
 3. Wipe dry to avoid water spots.
 4. Use a high quality, non-abrasive polish to remove stubborn road tars, insects or hard to remove deposits.
 5. To protect the appearance surface on Accu-Forge wheels, wax the cleaned surface with a high quality car wax.
 6. Clean the aluminum wheels as frequently as required to maintain their appearance.

Bright Metal

All chrome, stainless steel and aluminum 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 any 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. While the coach is parked it is exposed to extreme temperatures, humidity, ultraviolet rays, acid rain and other organic environmental conditions. While in operation the coach is subject to twisting and flexing caused by (for example) going in and out of driveways, bouncing through potholes and driving through winding mountain roads.

Periodic inspections of the fiberglass exterior may reveal minute cracks in the surface commonly called “spider cracks” or “hairline cracks” which are caused by the flexing of the fiberglass exterior. These are normal. If a crack represents a threat to the integrity of the fiberglass it will open up and the weave of the cloth would be visible. If the exterior has been damaged, prevent moisture penetration, especially in freezing climates. Cover the area as quickly as possible. Use plastic sheeting and tape, if necessary, so that moisture will not get into the motorhome and damage the interior.

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 vehicle unattended with the slide room extended for long periods of time. If the vehicle is to be stored outside throughout the winter months, a full interior inspection for water leaks should be made bi-monthly.

Extensive sealing has been done at the factory; however, the normal twisting and flexing that occurs while traveling may have compromised a seal or seam. All joints and seams should be inspected at least **twice a year** and recaulked 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.



CAUTION: All joints and seams should be inspected at least twice a year and recaulked as necessary.



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

**Roof Care &
Seal Inspections**

Sealant Types

Acryl-R:

Acryl-R is used on all roof openings such as vents, skylights, any roof mounted antennas and ladder roof mounts. The sealant should be applied only where the equipment bases meet the roof. Clean the old sealant that is lifting before applying with new. Make sure the roof is dry and free of dirt. This product is usually found in a caulking tube. Care should be used when near an edge, as the product will spread out. Masking tape may be used to mask around area to avoid mishaps. The roof air conditioners use a closed cell foam base gasket. No sealants are required. The roof air conditioners should be checked for tightness by the four mounting bolts located in each interior corner of the air conditioner roof opening. Torque specification is 40-50 in/lbs. The base gasket should be compressed to approximately one half inch.

Acrylic Sealants (geocel 2300):

This product is 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:

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

Clear Silicone Sealant:

Primarily this product is 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:

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

The fabrics have been manufactured with the same quality you would expect to find in a furniture store. If the fabric is abused, it can be damaged. Special care needs to be taken when your 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 from sun damage.

Protect the fabric from any unnecessary exposure to moisture. The sofa, pillows, dinette cushions, living area chair, driver/passenger seating and window treatments have been treated with *Scotch Guard* to prevent overall water spots and soiling. Frequently used items will wear accordingly and may require more attention than those items not regularly used.

INTERIOR CARE *Fabrics*

Use the Following 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 are not recommended since they may have an adverse reaction on backing of specific upholstery fabric.
- 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 refer to cleaning instructions recommended by the fabric manufacturer for specific fabrics. The “Fabric Specification Charts” (located on the following pages) list specific fabric codes under “Cleaning Code.”

“**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.

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

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

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

“Finishing” - If necessary, press as following:

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

Fabric Specification Charts

FABRIC	CONTENT	CLEANING CODE	APPLICATION
JEWEL .565			
Hierarchy Co. Charcoal	70% Acrylic, 30% Olefin	S	Sofa
CJ121335 Elias/RX 333 Color Multi	58% Acrylic, 42% Polyester	S	Free Standing Dinette, Living Room Pillow
Bagley RR Col. Wheat	47% Polyester, 42% Cotton Chenille, 11% Cotton	S	Living Room Pillow, Bed Room Pillow, Valance
21146 col. 93C0001 Chamois	52% Rayon, 48% Cotton	Dry Clean	Bedspread
LeBeau 20347-B4LU Cinnabar	61% Rayon, 39% Polyester	W-Spot Clean	Living Room Pillow, Bed Room Pillow, Valance

CORAL GABLES .796			
CJ11200 Muriel/X 205 Bisque	59% Rayon, 41% Polyester	S	Sofa, Living Room Pillows, Valance, Booth Dinette, Chair
Coral Gables Ivory #02000	55% Acrylic, 24% Herculon, 21% Olefin	S/W	Free Standing Dinette, Living Room Pillows, Valance
21145 Col. Raffia	100% Cotton	Dry Clean Only	Bedspread, Bed Room Pillow
Silkara Color 824 Cocoa	68% Rayon, 32% Acetate	Dry Clean Only	Bed Room Pillow, Valance

FABRIC	CONTENT	CLEANING CODE	APPLICATION
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RIVERIA BLUE .797			
CP11363 Fiarhaven 276 co. Bark	83% Rayon, 17% Polyester	S	Sofa
Bunbury - Orion	54% Cotton, 46% Polyester	S	Valance, Chair
LeBeau 20347 - A2LU Ciel	61% Rayon, 39% Polyester	W-Spot Clean	Living Room Pillow, Bed Room Pillow, Valance
Patina - (48174-A2Gu Ciel	18% Cotton, 48% Rayon, 34% Polyester	W-Spot Clean	Free Standing Dinette, Booth Dinette
Corragio Col. Moonstone	55% Viscose Chenille, 30% Polyester, 15% Viscose Rayon	S	Living Room Pillow, Valance
29034 38C 0001 Pecan	50% Cotton, 50% Polyester	S/W	Bedsread, Bed Room Pillow

EMERALD ISLE .798			
38279-A2MU Cashmere	58% Rayon, 42% Polyester	S-Dry Clean	Sofa, Pillow, Valance
CJ11214 Kelly Co. Mushroom	56% Cotton, 44% Polyester	S	Chair
Lombard 39309-A9UU Olive	30% Cotton, 34% Olefin, 35% Acrylic, 1% Poly	X-Vacuum Only	Free Standing Dinette
Shogun Co. Boysenberry	36% Cotton, 17% Cotton Chenille, 28% Acrylic Chenille, 19% Polyester	S	Living Room Pillows, Valance, Booth Dinette
27122 Backstreet A2JD Ginger	41% Rayon, 59% Polyester	S-Dry Clean	Bedsread, Bed Room Pillow
Eros Color 362 Leek	100% Polyester	S-Dry Clean	Bed Room Pillow, Valance

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 outlined in the Morbern Vinyl section below.

Morbern Vinyl:

Vinyl requires periodic cleaning to maintain its neat appearance and to prevent the buildup of dirt and contaminants that may permanently stain and/or reduce the life of the vinyl if not removed. The frequency of cleaning depends upon the amount of use and the environmental conditions in which the vinyl is subjected. The procedures used for cleaning are dependent upon the end-use circumstances.



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

Normal Cleaning:

Most common stains can be cleaned using warm soapy water and clear water rinses. Moderate scrubbing with a medium bristle brush will help to loosen soil from the depressions 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 removed immediately. The procedure for removal of the more severe staining agents are outlined below.



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

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.



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

Ballpoint Ink:

Permanent Marker Ink spots will stain the vinyl permanently. Wipe the stain immediately with rubbing alcohol in a well ventilated area to remove much of the stain.

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.



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

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 may have set, use a cloth soaked in diluted mild detergent with gentle rubbing. Any remaining stain should be washed with diluted bleach. Rinse repeatedly with cold water.

Chewing Gum:

Scrape off as much gum as possible using a dull knife. Rub the gum with an ice cube to harden and make it easier to remove. 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 it beyond its 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:

Use lukewarm water and sponge repeatedly. Any loose material should be gently scraped with a dull knife. 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 with 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.



NOTE: Vinyl requires periodic cleaning to maintain its appearance and to prevent the buildup of dirt and contaminants that may permanently stain or reduce the life of the vinyl if left untreated. Frequency of cleaning and procedures used depend upon the amount of use and the environmental conditions in which the vinyl is subjected. 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.

Leather

Spots & Spills:

Absorb excess liquid immediately with a clean cloth or sponge. Use water only if necessary. Do not use a cleaning product. If water is used, clean the entire area where the spot occurred. An example would be the entire seat cushion or the entire arm. Allow to air dry. Do not dry the wet areas with hair dryers, etc.

Stubborn Spots and Stains:

Use lukewarm water and a mild soap to work up a thin layer of suds on a piece of cheesecloth. Scrub the surface. Rinse with a piece of clean, damp cheesecloth. Allow to air dry. Do not use saddle soap, cleaning solvents, furniture polish, oils, varnish, abrasive cleaners, soaps or ammonia water.



NOTE: These are recommended or suggested methods of cleaning. The manufacturer is not responsible for damage incurred while cleaning. Always test the cleaning method in an inconspicuous area first before applying to the entire area.

Ultra-Leather**Care Instructions:**

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

Removing ballpoint pen stains:

Wipe the stain off with ethanol (ethyl alcohol). If the stain cannot be removed with ethanol, use the following procedure. Proceed with caution when using toxic chemical.

- Prepare bleach. Dilute household bleach (sodium hypo chloride) with the same amount of water.
- Place a piece of tissue and apply the solution prepared by step 1 (do not apply too much). Cover it with polyethylene film to prevent the solution from drying.
- Remove the tissues occasionally to check on the condition of the stain. When the stain is almost gone, remove the tissues completely. Do not leave on for more than one hour.
- Wash the stain with sufficient amount of water.

If there is residue of bleach, polyurethane resin and back cloth will deteriorate. Therefore, neutralize it by the following method:

- Place a piece of tissue as in step 2, and apply hydrogen peroxide solution (15%).
- Leave the solution on for approximately 30 minutes, then remove the tissue.
- Completely remove the residue of hydrogen peroxide on the ultra-leather with water.

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

For more information, please call: Ultrafabrics, LLC
Sales and Marketing: 1-888-361-9216
Customer Service: 1-877-309-6648

Floors - Carpet Cleaning

Use the solution(s) specified in order from 1-8, until the stain is removed.

	DRY CLEANING FLUID	NAIL POLISH REMOVER	DETERGENT SOLUTION	WARM WATER	VINEGAR SOLUTION	AMMONIA SOLUTION	SPOT REMOVAL KIT	CALL PROFESSIONAL	PERMANENT CHANGE
SPOTS	A	B	C	D	E	F	G	H	I
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 the recommended cleaning agents have proven to be 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.

Cleaning Solutions:

- Dry Cleaning Fluid:** A nonflammable spot removal liquid, available in grocery and hardware stores.
- Nail Polish Remover:** Any acetate, which often has a banana fragrance. Do not use if it contains acetone.
- Detergent Solution:** Mix two cups of cold water and 1/8 teaspoon mild liquid detergent (no lanolin, non-bleach).
- Warm Water:** Lukewarm tap water.
- Vinegar Solution:** One cup white vinegar to one cup water.
- Ammonia Solution:** One tablespoon household ammonia to one cup water.
- Spot Removal Kit:** Available from retail carpet stores or professional cleaners.
- Call Professional:** Additional suggestions, special cleaning chemicals or the ability to patch the area might be available.
- 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.

Floor - Tile

Various types of surfaces that vary in porosity and abrasive finishes are used in a motorhome. These surfaces can be very difficult to protect and maintain. Regular maintenance is all it takes to keep the tile in the motorhome looking showroom new. Once the slide-out has been extended, be sure to keep the tile floor clean to prevent dirt from scratching the tiles when retracting the slide-out.



NOTE: Tile is ceramic and will chip and/or break easily. Avoid dropping heavy or sharp objects on the tile.

Cleaning Tile:

Use a damp sponge mop or a cloth to clean tiles and maintain their luster. If moderate staining occurs, cleaning with a window cleaner such as Windex™ should do the job. If preferred, use a mild solution of hot water and all-purpose cleaner for tile floors, walls and countertops. Rinse with clean water and with a soft cloth to prevent streaking. Avoid cleaning tile with soap. Soap forms a film which will dull the luster. Soap also promotes the growth of mildew and bacteria. Do not use powdered cleaners on unglazed tile floors. Undissolved powder will dull the surface. Grout sealers are available that protect the porous surfaces. If a sealer is used, follow the sealant manufacturer's guideline for application. Additionally, never use sealers on unglazed tiles. With the exception of terracotta, which may be oiled or waxed, it won't be necessary to polish or buff the tiles to maintain their finish.

Grout:

The grout used is a two part concrete mix. It is normal for this type of grout to develop surface cracks over time. In motorhome application, due to the constant flexing of the flooring, this process can accelerate. If the grout requires cleaning, scrub with a plastic brush. Do not use steel wool as small particles may remain and produce unsightly stains.



NOTE: Before using any solution to clean the tile, check the manufacturer's warning label to ensure the safety of the product. If there is any doubt, apply several test patches of the solution in an inconspicuous place to determine the product's suitability.

Floor - Laminate

The laminate flooring used in the motorhome provides style, durability and easy maintenance. The laminate flooring is a high pressure laminated flooring designed to be incorporated as a floating floor. The flooring material is constructed of three main components. The surface, similar to many countertops, contains aluminum oxide particles to form an extremely hard durable surface. The carrier or core layer is constructed from high density fiberboard. A tongue and groove design will allow for a tighter bond. The backer or bottom layer is also made for balance and strength.

Care and Cleaning:

Everyday cleaning is as simple as vacuuming the floor to remove dirt and debris. A cotton string mop is recommended for occasional mopping with a minimal amount of water. Use a mixture of soap-free household cleaner and water (vinegar and ammonia both work well) for a more thorough cleaning.

- Stains should be wiped away 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 beauty and appearance of flooring.



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



NOTE: Any unusual or unique problems can be addressed by contacting Wilsonart at (800) 433-3222.

Shower - Cleaning

Showers are susceptible to soap build up. Showers should be cleaned weekly to prevent burdensome clean-up. Using the same solution used to clean tile floors will be sufficient for the shower. However, to control mildew growth spray the shower with household chlorine bleach and allow it to stand for five minutes. Clean the glass shower doors with window cleaner on a weekly basis to maintain the shine. If water spots cannot be removed from the 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 instrument. Apply a new sealant, which can be found at most recreational vehicle supply stores.

Ceilings

The ceiling of the motorhome can be a variety of materials or fabrics, many of which require little or no care or maintenance.

Vinyl:

The soft touch padded vinyl ceiling can be cleaned using the procedures discussed in the vinyl article of this section. Generally, a mild soap and water is sufficient for cleaning vinyl.



NOTE: Use care not to puncture the padded vinyl.

Ozite:

To clean the ozite ceiling, mix a solution of 8 oz. warm water, 4 oz. white vinegar, 1 oz. bleach and 4 oz. club soda. Spritz on and blot dry. Do not rub or scrub as this may damage the surface.



NOTE: Do not over-saturate the Ozite surface as this may damage the ceiling.

Hardwood Vinyl & Decorated Paneling:

Hardwood vinyl and decorated paneling are sensitive and demanding materials. 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 for cleaning to protect the material.

Under no circumstance should bleach, alcohol, oil-based spray cleaners or cleaning agents with solvents, citrus oil or harsh chemicals be used. Other liquid spray cleaners may also cause damage to the material.

Time is very important when removing substance from wall coverings that are solvent based or contain color. 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.

Wall Coverings**Care for the Satinesque Wall Covering:**

Any stain should be removed as quickly as possible to minimize any reaction between the staining agent and the wall covering. Time is very important when removing substances that are solvent based or contain color. Examples: nail polish, oil, shampoo, lacquer, enamel, paint, ink and lipstick.

Always begin cleaning with a mild detergent such as soap. If necessary, move to a stronger cleaner such as household bleach, liquid household cleaners or rubbing alcohol. Before using one of the stronger cleaners test the cleaning agent on a small inconspicuous portion of the wallcovering to make sure that the cleaner does not affect the color or gloss of the wall covering.

Normal Dirt:

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

Nail Polish, Shellac or Lacquer:

Remove liquid using a dry cloth. Use care not to spread the stain. Quickly clean the remaining stain with rubbing alcohol. Rinse with clean water.

Ink:

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

Chewing Gum:

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

Pencil:

Erase as much of the pencil mark as possible. Wipe any 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.

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.

Wood Care

Wood should be treated the same as a piece of fine furniture. Care and cleaning of the wood surface is essential in maintaining the natural beauty of wood. Keep in mind that wood finishes can vary widely. Test a new cleaning solution in an inconspicuous area to check for possible damage.

The care and cleaning of the solid wood surfaces and the wood products used in the motorhome depends on individual choices and preferences. Numerous waxes, polishes and finishing products are available for use. Always follow the manufacture label and instructions. The solid wood surfaces should be cleaned weekly. Dust regularly with a soft, lint-free cloth. Dampen the cloth slightly with water. Wipe one small area at a time and dry immediately.

For stubborn stains, use a clean cloth dampened with a solution of mild, non-alkaline soap (like dishwashing liquid) and water. Dry thoroughly using a soft cloth. Buff lightly, following the direction of the grain. Never use abrasive cleaners, scouring pads or powdered cleansers.

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 to the proper uses, although 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	USAGE
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 seal.
280-320	Extra Fine	Removing dust spots or marks between finish coats.
360-600	Super Fine	Remove luster of surface blemishes after finish coat.

Steel Wool:

Abrasive material composed of long steel fibers of varying degrees of fineness that are matted together. The 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.



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

Fixing Scratches in Stained Woodwork:

"Quick and simple" rarely describe 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:

Dents are the results of wood fibers being crushed and compressed. Dents can be raised back to original level by steam. To raise a dent, place a damp cloth over the dent and hold a medium-hot iron on it. The steam will cause 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:

Inspect 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 rag, a small brush, or even a cotton swab, apply a thin coat of a 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 putting oil-based wood stain into marker-like containers. Just rub the stain marker on the scratch. Start with a stain color that is lighter than the original finish, because torn and scratched wood fibers will absorb stain quickly 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:

Several professional woodworkers use similar procedures and tricks when it comes to scratches and nicks, most of which can be easily repaired. Always test an inconspicuous area of the wood prior to repairs to ensure no damages to the finish.

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).

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 professionally trained individual.

The Solid Surface was created for a lifetime of easy care. Just follow the simple guidelines listed here to the keep countertop surface looking nice.

Countertops

Routine Care:

The motorhome countertops are finished with one type of finish: matte/satin. All solid surface sinks and bowls have a matte/satin finish. Soapy water or ammonia-based cleaners will remove most dirt and stains from all tops and bowls. However, slightly different techniques must be used to remove different stains. Follow the recommendations below.

Cleaning 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 Solid Surfaces Sink:

Occasionally clean by using *Soft Scrub Liquid Cleanser* and a Grey *Scotchbrite* pad. Scrub the sink, rinse and towel dry. Do this as often as necessary.

Removing Cuts and Scratches:

Because the beauty of the surface goes all the way through the Solid Surface, countertops are completely renewable. Use the following instructions to remove minor cuts and scratches.

- Sand with 180 grit and then 320 grit sandpaper 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:

The Solid Surface withstands heat better than ordinary surface materials; however, hot pans and some 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. In most cases the surface can be repaired if it is accidentally damaged.

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. Always run cold water into the Solid Surface sink when pouring boiling water into the sink.

Windows

Water Spots:

Any glass will develop water spots if not cleaned properly. A spotting effect is 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 is a natural phenomenon. The amount of condensation will vary with climate conditions, particularly in relative humidity. Condensation occurs from water vapor present in the air. Each of us add more vapors by breathing, bathing, cooking, etc. Water vapor 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 the 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 hot water as it produces steam.
- Do not heat the motorhome interior with the range or oven. Heating with the range or oven increases the risk of toxic fumes and allows oxygen depletion. Also, open flames add moisture to the interior air increasing condensation.
- In very cold weather leave the cabinet and closet doors partially open. The air flow will warm and ventilate the interior of the storage compartments and the exterior wall surface, reducing or eliminating condensation and preventing the possibility of ice formations.

What is Mold?

Mold is a vegetative growth or a plant belonging to the Fungi group. Being a plant, mold will need food to grow. Mold growth can be a result from moisture and certain temperatures. Some molds can cause mildew wherever there is poor air circulation, poor lighting, damp and warm areas. Molds, as they grow, will cause considerable damage and leave a musty odor, discolor fabric, and stain surfaces. Molds produce microscopic cells called "spores" that can spread easily through the air.

Mold & Mildew

What does mold need to grow?

Mold only needs a few simple things to grow and multiply: moisture, nutrients and a suitable place to grow. Prevention of mold and mildew begin with keeping things clean. Greasy films contain many nutrients for mildew causing molds when moisture and temperatures are right. Soil on dirty items, such as fabrics and furniture, may supply enough nutrients for mold to grow. Many of the synthetic fabric such as acetate, polyester, acrylic and nylon are mildew resistant. However, soil on these fabrics may supply the nutrients to start mold growth. Any soiled fabric should be cleaned thoroughly to help prevent mildew from occurring.

Indoor Air Regulations and Mold:

Standards, or threshold limit values, for concentration of mold or mold spores have not been set. Currently, there is 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.

Basic Mold Cleanup:

The key to controlling mold is keeping things clean and limiting moisture. If mold is a problem in the motorhome, here are some suggestions on resolving the condition:

- Eliminate the source of the water problem or fix the leak to prevent mold growth.
- Materials or furnishing must be cleaned and dried within 24-48 hours to prevent mold growth.
- Clean mold off hard surfaces with water and detergent. Dry the surface completely.
- Reduce indoor humidity to 30-60% to decrease mold growth by venting bathrooms, dryers and other moisture-generating sources to the outside using conditioners and de-humidifiers. Increase ventilation by using exhaust fans when cooking, dishwashing, showering and cleaning.
- Open doors between rooms (especially doors to closets that may be colder than the rooms) to increase air circulation.
- Respond promptly when you see signs of moisture and/or mold. Repair leaks or wipe spills immediately.
- If materials with mold cannot be cleaned, they should be removed and properly disposed.

Mold and mildew can develop in the motorhome just as it can in a residential home. Taking the above steps at home, and in the motorhome, are ways to control moisture prevent molds from growing.

Mini-blinds

- To maintain the mini-blinds, on a frequent basis vacuum with the brush attachment or use dusting tools (available on the market) designed specifically for mini-blinds.
- Wash the mini-blinds with mild soap and water in a tub or hang the blinds on a fence or wall and gently rinse them with a hose.

The day/night shades are made of polyester blended material. Use the following guidelines to care and maintain the day/night shades:

Day/Night Shades

- Vacuum with a brush attachment. Use a dusting tool regularly.
- Use a weak solution of dish soap and water to spot clean the shades with a slightly damp cloth. Avoid soaking or saturating the shades with water. Over saturation will break down the finish of the shade.
- 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.

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.

**STORAGE -
Short Term****Checklist-Short Term Storage**

- If applicable, retract the slide room(s). Do not store the motorhome with slide room(s) 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 battery cut-off switch.
- Batteries should be stored fully charged. Batteries stored in a discharged state will readily freeze.
- If possible, park the motorhome so that the batteries are accessible for charging or changing without having to move the motorhome.
- If available, leave the motorhome hooked to shore power. Leave the main battery disconnect switch **ON**.
- Careful placement of a small heat source in the interior will help control moisture. Desiccate filter systems will help remove interior moisture.
- If AC power is not available turn the chassis battery disconnect switch **OFF**.
- If possible, store the motorhome inside a storage building.
- If stored outside, inspect all seams and seals 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 bi-monthly, inspecting behind all cabinet doors and drawers.

Long-Term

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

There are preventative measures which should be taken and preferable situations to use when storing a motorhome. Such measures will aid in protecting and preventing a motorhome from the damaging effects caused by an accumulation of moisture.



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 to **OFF**.
- When stored outside, use the available DC Volt meters to make a quick reference check of the batteries while the motorhome is in storage. If the motorhome is stored outside, solar panels may offset the parasitic loads.
- Preventative measures should be used if the voltage readings are low. When using preventative measures, taking the motorhome out of storage or moving the motorhome in case of an emergency is a much easier process.



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

If AC power is available:

The chassis battery disconnect switch will remain **ON**. The inverter will charge both house and engine battery banks. A 30 Amp shore power service will be more than adequate.



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:

- The type of surface the motorhome is parked upon will affect how much moisture accumulation occurs on the chassis and flooring. Moisture can eventually seep into the interior.
- Parking the motorhome on a grass surface, with the tires supported by blocks, is a perfect situation for moisture to accumulate.
- A gravel covered 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 inside moisture condensation or humidity. These systems help control mold and mildew growth.
- 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.
- Cardboard templates can be made for the windows to protect these items from exposure to direct sunlight.
- Tire covers are available to protect the sidewall of the tires from cracking. Make sure the tires contain the correct air pressure. Underinflated tires can be damaged.
- Washing the exterior regularly will help control moss accumulation. The clear coat has UV protective substances. 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. Open all cabinet doors looking 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. If necessary, use the proper sealants and recommended application procedures.

Fuel:

A full tank of fuel will help 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 Cummins manual or a Cummins distributor for further detailed information on fuel stabilizers and additives.

Brakes:

Brakes also 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 linings upon the first few applications, reducing the friction action of the linings.

Engine:

Internal combustion engines need to be “exercised” on a regular basis. Run engine at operating temperature for at least 15 minutes before shutting down engine. This will ensure that 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.

Electric Motors:

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

Winter Storage

- **Plumbing Lines** - Drain and protect by filling with approved RV antifreeze.
- **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** - To protect the interior fabric from fading, cover windows by pulling blinds, closing shades or using a separate cover such as a sheet.
- **Holding Tank** - Drain and rinse. Close valves.



Add a small amount of antifreeze 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. Disconnect the cables. Remove the batteries and store them in a cool dry place. Check and recharge as needed. Never park the coach where the battery door cannot be opened.
- **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.

If the motorhome was properly and carefully prepared for storage, removing it 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.

Removal

- 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, tail-lights, 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 any other type of 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 ice-maker to ensure the ice does not contain traces of antifreeze or other contaminants.

- Open cabinet doors and drawers inspecting for water leaks at joints or fittings. Repair as necessary.
- Operate all 12 Volt 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 functioning properly.
- Inspect the 120 Volt electrical system which includes the power cord, inverter/converter all outlets and exposed wiring.



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

- Start and run the generator.
- Confirm that the batteries are charging. Operate the 120 Volt appliances and air conditioners. If an electrical item or appliance is not functioning properly, contact the dealer or an authorized service center to have it evaluated.
- Have a qualified technician inspect the LP-Gas system and perform an LP-Gas leak test. The leak test should also include an LP-Gas regulator adjustment (if needed). The test can also verify if the regulator is faulty and should be replaced. Have the LP-Gas tank inspected.
- Operate each LP-Gas appliance. Observe all burner/pilot flames for proper color and size.
- Inspect and clean the interior.
- Check the sealant around all roof and body seams and windows. Reseal if necessary.
- Lubricate all the exterior locks, hinges and latches with a graphite lubricant.
- Check the windshield wiper blade condition. Check the wiper/washer operation.
- Wash and wax the exterior. Inspect 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 any necessary adjustments and/or correct defects.

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Endeavor

SECTION 4 APPLIANCES

INTRODUCTION	121	THERMOSTAT	138
REFRIGERATOR	121	AIR CONDITIONER ROOF	140
OPERATING SPECIFICS	122	RETURN AIR FILTERS	141
REFRIGERATOR CONTROLS	122	OPERATION	141
INVERTER MODE OPERATION	123	FURNACE	142
CONTROL PANEL - TWO DOOR	123	OPERATION	142
CONTROL PANEL - FOUR DOOR (OPTIONAL)	124	USING THE FURNACE	143
ICE MAKER (OPTIONAL)	125	TIPS	143
DOORS	126	IF THE FURNACE FAILS TO LIGHT	143
ALARMS	126	WATER HEATER	144
SERVICE	127	BEFORE USING THE WATER HEATER	144
COOLING UNIT FANS (FOUR DOOR MODELS)	127	WATER HEATER COMPARTMENT	145
STORAGE	127	WATER HEATER BYPASS SYSTEM	145
MICROWAVE OVEN	127	PRESSURE TEMPERATURE RELIEF VALVE	145
OPERATION	130	DRAINAGE & STORAGE	147
MICROWAVE COOKING	132	TIPS	147
CONVECTION COOKING	133	TROUBLESHOOTING	147
TIPS	134	WASHER/DRYER PREPARED	147
CARE & CLEANING	135	WASHER/DRYER (OPTIONAL)	148
COOKTOP	135	OPERATING INSTRUCTIONS	149
OPERATION	136	CLEANING THE DRAIN SCREEN	150
LIGHTING TOP BURNERS	136	CLEANING THE WASHER/DRYER	150
BURNER GRATE	136	WINTERIZING THE WASHER/DRYER	151
TIPS	137		
CLEANING & MAINTENANCE	137		

INTRODUCTION

This section covers operation and care of various appliances found in the motorhome. The motorhome is equipped with a refrigerator, cooktop range, microwave, furnace, water heater, roof air conditioner and several optional appliances. Many of these appliances operate on AC or DC current, LP-Gas or a combination of all three.



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 manual.



WARNING: Before entering any type of refueling station make sure all LP-Gas operated appliances are off. 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. 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.

The refrigerator in the motorhome operates on a different principle than a standard household refrigerator. Knowing these differences should answer questions or solve problems that may arise. A standard household refrigerator uses a different type of refrigerant. In a household refrigerator, a compressor pumps refrigerant vapor into a condenser where the heat from the refrigerant dissipates and the vapors condense to a liquid. The liquid refrigerant pumps through a metered orifice or capillary tube at the evaporator. At this time, the refrigerant changes from liquid to a vapor. This change cools the evaporator. Air blows across the evaporator and into the interior of the refrigerator. This system is efficient as long as 120 Volts AC is available.

The motorhome refrigerator uses a combination of fluids and gas for refrigeration: ammonia, water, sodium chromate and hydrogen gas. The cooling unit is pressurized to approximately 350 psi. The chemicals are heated to a gaseous state, which rise to the top of the cooling unit into a condenser where it forms droplets as it cools. As the vapor condenses, it "extracts or absorbs" heat from inside the refrigerator. Using gravity, the droplets return through the absorber coils to the absorber vessel to start the process again. To ensure longevity and proper operation of the cooling unit follow the specific instructions for use and care. With proper care and maintenance, the refrigerator should provide years of trouble-free service.

REFRIGERATOR

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.
- It is important to operate the refrigerator only when level. Level the refrigerator (from front view) within 3° side to side and 6° front to back. Use 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 the chemicals that 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.



NOTE: To reduce the possibility of food spoilage, keep the interior box temperature at or below 54° 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.

Refrigerator Controls

In order for the refrigerator to operate:

- The house batteries must be charged.
- The LP-Gas valve must be on.
- The water valve must be on (icemaker option only).
- The refrigerator AC cord plugged in (located in outside refrigerator access door).

If the controls do not light up check the house batteries charge status or see if the 12 Volt wires are plugged into the refrigerator's circuit board (outside in refrigerator access door).

Inverter Mode Operation

While the motorhome is traveling the ice maker may be operated using the 120 Volt AC electric mode to keep the freezer contents cold. The electrical combination of the engine's alternator and the inverter will supply the power necessary to operate the ice maker on 120 Volts AC. Operation the refrigerator on LP-Gas when refueling can be dangerous. Use the AC electric mode when in travel to avoid this situation. Disable this feature when the engine is turned off. House battery power will be quickly consumed when using the inverter to operate the ice maker on AC electric. At location, hook to shore power, start the generator or switch refrigerator operation to LP-Gas. Turn the inverter off when not in use.

To Enable this Feature:

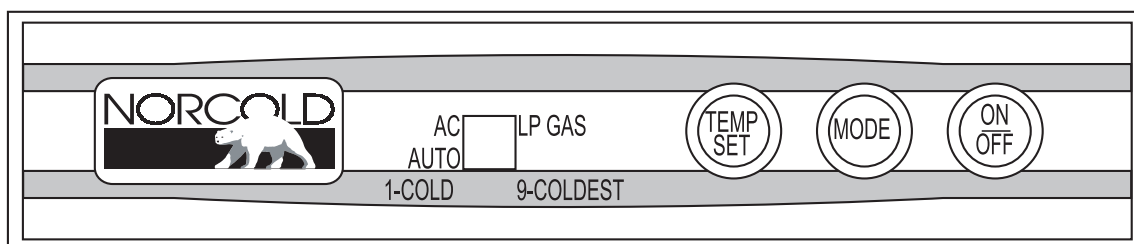
1. Turn the inverter **ON**.
2. Turn the ice maker **ON**. Select AC Power operation.

To Disable this Feature:

1. Turn the inverter **OFF**.
2. Hook to shore power, start the generator or switch operation to LP-Gas.



NOTE: Use this feature only when the engine is running. Failure to disable this feature with the engine off will result in dead house batteries. Hook up to shore power, start the generator or switch refrigerator operation to LP-Gas.



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**Control Panel
- Two Door**

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

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.

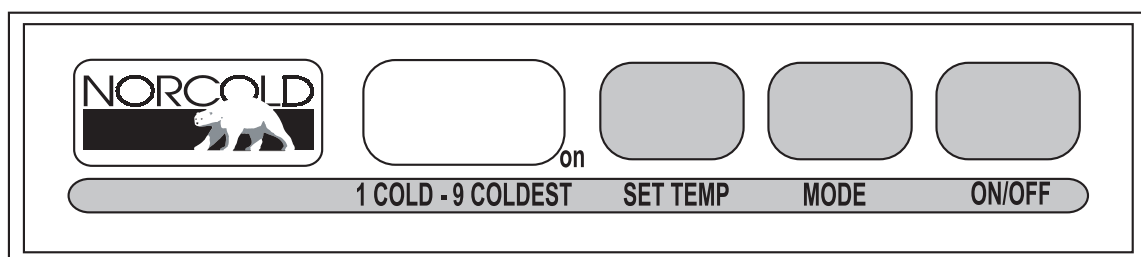
If the LP-Gas does not ignite within 30 seconds, the control changes to a different energy source or the gas safety valve closes and F displays. Turn the refrigerator off then back on. If the gas does not ignite after several attempts, consult your dealer or authorized Norcold service center.

Automatic Mode:

The refrigerator selects AC power over LP-Gas in Auto mode. The controls select the energy source in this sequence.

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

Control Panel - Four Door (Optional)



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 and hold the **MODE** button to select between Automatic AU, AC or LP operation.
- **TEMP SET Button** - Adjusts the temperature.
 - To adjust push and hold the **TEMP SET** 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:

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 **AUTO** displays, release the button.
- Press and hold the **TEMP SET** button until the desired temperature displays, release button.
- In **AUTO** mode, AC or LP will remain lit for 10 seconds or 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 F displays. Turn the refrigerator off then back on. If the gas does not ignite after several attempts consult your dealer or authorized Norcold service center.

Tips

- Cool items first, if possible, before putting them into the refrigerator.
- Keep the doors shut. Think about what you want before opening the doors.
- Allow the refrigerator 24 hours of operation before actual use to help it get a "head start" with the refrigeration process.
- A box of open baking soda will help absorb food odors.

The icemaker works from 120 Volts AC only. The icemaker functions only after the freezer temperature is low enough. City water or the water pump must be on and the valve for the water supply line to the icemaker must be on.

***Ice Maker
(Optional)***

- 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 contaminates. Do not operate the icemaker without water pressure supplied to the refrigerator. This can cause damage to the ice maker assembly.



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

Doors

The refrigerator doors use a positive latch that secures the door with a "click" to prevent the door from opening while traveling. The doors use a heating element located in the flapper on the left door (four-door model) or in the door (two-door model). The heating element activates when operating the refrigerator in any mode to help prevent moisture accumulation in high humidity conditions.

When storing the motorhome, the refrigerator doors have a storage position that locks the doors partially open. This will help reduce odor from mold and bacteria. A completely sealed refrigerator in storage is a perfect environment for mold and bacteria to grow.

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

Alarm

The refrigerator uses an audible alarm that sounds 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 displaying a code.



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



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



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

Service

The LP-Gas function of the refrigerator and LP-Gas pressure will need servicing yearly, depending on use. Over time, the BTU rating of the flame can change, affecting the refrigerator's performance. Ambient temperature and humidity can also affect performance and function. The BTU rating lowers when operating on LP-Gas at an altitude higher than 5,500 feet. This affects the refrigerator's performance. If possible, switch mode operation to AC while at a higher altitude.

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

**Cooling Unit Fans
(Four Door Models)**

- 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 cleanser or a solution of liquid dish detergent and warm water. Do not use scouring pads or abrasive cleanser 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.

Storage

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.

The microwave oven is operated from 120 Volt AC supplied by shore power, the generator or the inverter. Microwaves heat food using sound waves generated at a very high frequency (2,450 MHZ) to agitate the water molecules inside the item being heated. The higher the water content is to solids, the faster the response or the shorter the cooking time. Inside the microwave is a turntable that rotates when the microwave is operating. This will help heat the food evenly. The turntable can be turned off if a baking dish or other large item is used. The microwave is designed to sit over a range or cooktop. When cooking from the cooktop use the microwave's two speed ventilation fan. The fan draws air in from the bottom of the microwave through a pair of grease filters then discharges the filtered air out through a charcoal filter at the top. The ventilation fan is controlled by a thermostat and activates automatically from heat produced by the cooktop.

**MICROWAVE
OVEN**

The microwave offers many different features. Some include varied cooking times with different power settings: automatic sensor cooking, a kitchen timer, metric to American conversion chart (which includes temperature and weight), on screen programming help, childproof lockout and auto defrost cycles. The screen can display one of three different languages.

After placing the food in a suitable container, open the oven door and put it on the glass tray. The glass tray and roller guide must always be in place during cooking. Ensure the door is firmly closed before use.

Microwave Tips:

- Turn the oven off before cleaning.
- Keep the inside of the oven clean. When food spatters or spilled liquids adhere to oven walls, wipe with a damp cloth. Mild detergent may be used if the oven gets dirty. The use of a harsh detergent or abrasive cleaner is not recommended.
- Clean the outside oven surface with soap and water. Wipe away any residue using a damp cloth. Dry with a soft cloth. To prevent damage to the operating parts inside the oven, do not allow water to seep into the ventilation openings.
- If the control panel becomes wet, clean with a soft, dry cloth. Do not use harsh detergents or abrasive on the control panel.
- If steam accumulates inside or around the outside of the oven door, wipe it away with a soft cloth. This may occur when the microwave oven is operated under high humidity conditions and in no way indicates a malfunction of the unit.
- 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. Simply 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.



NOTE: The microwave is for food preparation only. Do not use the microwave to dry clothes, newspapers, shoes or other items.

Microwave Facts:

One of the most useful documents for the microwave is the operations manual, located in the owner's information file box. Read it carefully and keep it for reference. Another useful item is a microwave cookbook. Many will contain information about cooking principles, techniques, hints and recipes. Ensure food is in the microwave during operation to absorb the microwave energy. The magnetron, cycling on and off, may be heard for power levels less than 100%.

Condensation is a normal occurrence in microwave cooking. The moisture within foods and the room humidity will influence how much moisture condenses

in the microwave. Covered foods will not usually produce as much condensation as foods that are not covered.

About Cooking:

- Food should be arranged with the thickest area towards the outside of the dish.
- Monitor cooking times. Use the shortest amount of time required for cooking and add time as needed. For popcorn, follow product instructions and carefully monitor for the duration of popping time.
- Cover the food while cooking to prevent splatter and reduce condensation.
- Stir the food from the outside of the dish to the center, once or twice, between cooking.
- Turn food over during cooking to speed cooking times. Large food items should be turned at least once during cooking time.
- Use standing times to prevent over cooking. Covered food will continue to cook after it is removed from the microwave oven.
- Check for indications that the food is thoroughly cooked.
 - Food is steaming throughout, not just around the edges.
 - Poultry thigh joints come apart and move easily.
 - Meat or poultry is not pink in color.
 - Fish is opaque and flakes easily with a fork.
 - Center bottom of the dish is very hot to touch.

A meat thermometer is the best way to ensure that the food is cooked. The meat thermometer should be inserted into the thickest part of the meat, away from bone or fat. Most food should range between 160° F to 180° F. Never leave the thermometer in during cooking as it can shatter.

FOOD	DO	DO NOT
Eggs, Sausage, Fruit & Vegetables	• Puncture egg yolks before cooking to prevent bursting. • Pierce skins of potatoes, apples, squash, hot dogs & sausages to allow steam to escape.	• Cook eggs in shells. • Reheat whole eggs.
Popcorn	• Use specially bagged popcorn for use in the microwave. • Remove popcorn when popping slows to 1 or 2 seconds in between pops. • Use the POPCORN setting.	• Pop popcorn in regular brown bags or glass bowls. • Exceed maximum time on popcorn package.
Baby Food	• Transfer baby food to small dish & heat carefully. • Stir often. • Check temperature before serving.	• Heat disposable bottles. • Heat rubber nipple. • Heat baby food in original jar.
General	• Cut filled baked goods after heating to release steam. • Stir liquids before and after heating to avoid boiling over. • Use deep bowls for cooking liquids or cereals to avoid boiling out of the container.	• Heat or cook in closed jars or air tight containers. • Use for canning. (Cooking and heating may not destroy bacteria) • Deep fry. • Dry wood, gourds, herbs or wet paper.

Microwave Cooking Safety:

- Always use pot holder to prevent burns when handling utensils that are in contact with hot food. Enough heat can transfer from food through utensils to cause skin burns.
- Stay near microwave when cooking and check frequently during cooking to prevent over cooking.
- Never use the cavity as a storage area for cookbooks or other items.
- Avoid steam burns by directing steam away from face and hands.

Operation

The microwave/convection oven operates from 120 Volt AC supplied by shore power. The microwave has a power output of 850 watts and a convection heater output of 1400 watts. Oven capacity is 1.1 cubic feet.

The microwave/convection oven has the ability to cook food with heat like an electric oven or preheat the oven with heat and cook with microwaves. Other features include the ability to cook with microwaves and convection at the same time, sensor cooking and a built-in broiler. A brief overview of these features may aid in the operation of the microwave/convection oven.



NOTE: The microwave is for food preparation only. Do not use the microwave to dry clothes, newspaper, shoes or other items.

Safety Lock:

The microwave comes with a safety lock feature. This feature prevents the oven from operating accidentally. To use this feature:

- Press the **CUSTOM HELP** pad.
- Press the **1** pad.
- Press the **START/TOUCH-ON** pad.

The oven is now locked. If any button is pressed the word **LOCK** appears on the screen. The fan and hood light is still operational with the Safety Lock feature on. To return the oven to normal operation:

- Press the **CUSTOM HELP** pad.
- Press the **1** pad.
- Press the **START/TOUCH-ON** pad. The oven will resume normal operation.

Setting The 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.

Kitchen Timer:

- Press the **KITCHEN TIMER** pad.
- Using the number pads enter minutes and seconds, or 00 if no seconds.
- Press the **START/TOUCH-ON** pad to begin timer. Timer end will be signaled by one long beep.

Hood Light:

To turn the hood light on or off touch the **LIGHT** button.

Ventilation Fan:

Press the **FAN HI/LO** button once for high, twice for low and three times for off.

Press the STOP/CLEAR pad to:

- Erase, if you make a mistake during programming.
- Cancel the kitchen timer.
- Stop the oven temporarily during cooking.
(Press the **START/TOUCH-ON** pad to resume.)
- Return the time of day to the display.
- Cancel a program during cooking (touch the pad twice).

Turntable On/Off:

- Press **TURNTABLE ON/OFF** pad to stop or start the turntable.
- Enter the cook time desired minutes and seconds.
- Enter power level desired.
- Press the **START/TOUCH-ON** pad.

Microwave - Timed Cooking:

The maximum amount of cooking time is 99 minutes and 99 seconds.

Be sure to enter minutes and seconds. If seconds are not desired enter 00.



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



NOTE: When cooking in convection mode try to avoid using the inverter as the AC power source due to the high rate of battery consumption.

Microwave Cooking

Press and hold the **START/TOUCH-ON**. The microwave pad operates at 100% power until the pad is released. This mode can be used for up to three minutes and up to three consecutive cycles.

One Minute Cook Times:

Press the **MINUTE PLUS** pad if one minute at full power is desired or to add one minute intervals to cooking time. The **MINUTE PLUS** pad must be pressed within one minute of closing the door, or during selected cooking time.

For safety the **MINUTE PLUS** feature will lock out if there is no microwave activity within one minute of closing the door. Use the **START/TOUCH-ON** pad to reset the one minute safety period.

Microwave Cooking:

To use 100% power, enter cook time by pressing the number pads. Press the **START/TOUCH-ON** pad to begin cook time. To use settings lower than 100% power, use the number pads to enter desired cooking time. Press the **POWER LEVEL** pad. Use the number pad to select desired power level. Press the **START/TOUCH-ON** pad to begin cook time.

Multiple Sequence Cooking:

If sequential cooking times with varied power levels are desired, press the **POWER LEVEL** pad and select desired power level. Use the number pad to enter cook time for the first interval. Press **POWER LEVEL** pad again, select desired power level, then enter cook time for the next time period. Press the **START/TOUCH-ON** pad to begin sequential cooking. The microwave can hold up to four sequential cook time periods. If full power is desired in any of the time periods, skip the power level step and 100% power is automatically selected.

Keep Warm:

Press the **KEEP WARM** pad during cooking time to automatically keep food warm for up to 30 minutes after cooking time has expired. To use this feature after cooking time has expired, or after the food has been removed, place the food back into oven and press the **KEEP WARM** pad.

Defrosting:

Defrosting can be done on manual time selection or use the microwave's CompuDefrost.

Manual Defrost:

Press the **POWER LEVEL** pad. Select number 3 for defrost power. Enter desired defrost time. Be sure to stir or break food apart at regular intervals.

CompuDefrost:

The microwave has automated defrost programs for different foods and weights. Press the **CompuDefrost** pad to enter this mode. Press **CompuDefrost** again to select between ground meat, steak or chicken. Use number pads to enter weight of food being defrosted. Press **START/TOUCH-ON** to begin defrost cycle.

Sensor Cooking:

The microwave has electronic sensors that sense moisture or humidity given off by the food during the cooking process. Electronic sensors will be affected if room temperature exceeds 95° F. To adjust the sensor cooking mode to allow for more or less cooking time, press the **SENSOR COOK** pad. Press the **POWER LEVEL** pad once to increase cooking time or twice to decrease cook time.

To use the sensor cooking mode, press the **SENSOR COOK** pad. Select the number or food desired from the library listed adjacent to the **SENSOR COOK** pad. Press the **START/TOUCH-ON** pad to begin sensor cooking.

The interior of the microwave produces heat just as in a regular oven. The convection cooking mode has special options such as a broil mode, the ability to preheat oven by convection and use of microwaves to complete cooking or to preheat.

Convection Cooking

NOTE: When using the convection oven feature, leave the turntable in place and do not restrict the rotation. This can damage the microwave.

Cooking with Convection:

Press the **CONVEC** pad. Press the numbered pad with the desired cooking temperature. Press the numbered pads for desired cooking time. Press the **START/TOUCH-ON** pad to begin convection cooking.

Manual Broiling:

The Manual Broiling temperature is automatically preset to 450° F. Only the cooking time can be adjusted.

To use the broiler, press the **BROIL** pad. Enter amount of cooking time. Press the **START/TOUCH-ON** pad to begin preheating the oven. Four beeps will signal the end of the preheat cycle. Food can now be placed into the oven.

CompuBroil:

The CompuBroil cooking method has programs preset for common foods like hamburgers, steaks, chicken and fish. Temperature and time are preset depending on the food quantity. The amount of cooking time can be adjusted to fit particular needs. The **POWER LEVEL** pad will vary the preset cooking time. **Press once for more time and twice for less time.**

To use the **CompuBroil** feature: Press the **CompuBroil** pad and select the food number from the food library next to the CompuBroil pad. Enter the number of pieces being broiled. Press the **START/TOUCH-ON** pad to begin the preheat cycle. A series of four beeps signal the end of preheat cycle.

Automatic Mix Cooking:

This method combines both the convection oven and microwave at the same time. The microwave uses 30% power on **HIGH/MIX** and 10% power on **LO/MIX** while in this mode. The convection temperature can be changed from 100° F to 450° F. The default convection temperature is 325° F for both **HIGH/ MIX** and **LO/MIX**.

To use this feature: Select either **HIGH/MIX** or **LOW/MIX** and use the number pads to enter cooking time. Press the **START/TOUCH-ON** pad to begin the mixed cooking cycle.

CompuRoast or CompuBake:

These features can be used for food items ranging from pastries and cakes to roasts, chicken and pork. The temperature is preset for both functions. Only the cook times can be tailored for individual preference by entering into either the **CompuRoast** or the **CompuBake** mode. Press the **POWER LEVEL** pad once for more cooking time and twice for less cooking time.

To use either function: Press the desired pad, enter the food type from list next to the mode used and enter the food type being cooked by using the number pad.

To use **CompuBake**: Press the **START/TOUCH-ON** pad to begin the preheat cycle.

To use **CompuRoast**: Enter the weight of item using the number pads. Press the **START/TOUCH-ON** pad to begin the preheat cycle. Four beeps will signal the end of the preheat cycle and the oven is now ready.

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.
- To test utensil for microwave compatibility place it in the microwave with an 8 oz. plastic cup of water. Set the microwave at full power for one minute. Carefully feel the utensil. The entire utensil should be cool to the touch.
- Cover food with a paper towel or upside-down plate to help keep food spattering to a minimum. Place a paper towel on the turntable to keep clean-up at a minimum. Use only microwave-safe paper towels.
- Clean all spills or spatters before they dry.

- 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.
- Some food wrappers may be foil lined. Check the wrapping carefully before cooking or heating. A small amount of foil is acceptable if it is not wrinkled or near the sides of the microwave.
- If the microwave screen is not lit, plug another electrical appliance into the same outlet the microwave was plugged in to verify AC power is present. If the test item works, contact an appliance repair facility to have the microwave checked.

The exterior of the microwave is plastic and metal. The interior is metal. Do not use a scouring pad, harsh or abrasive cleanser, chemical cleaners or petroleum based thinners as these can damage the finish. Use mild soap and water with a damp cloth or paper towel to remove most 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.

Care & Cleaning

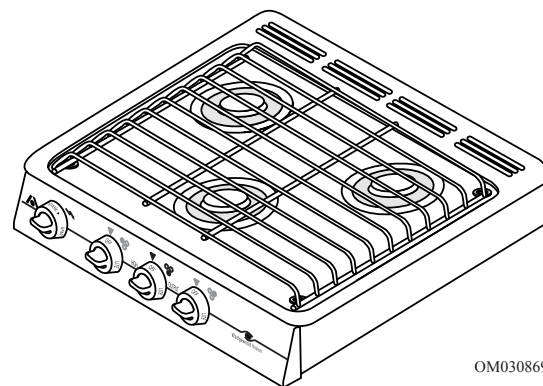
Grease Filters:

Do not operate the oven without the grease filters in place. This can damage the microwave. Grease filters should be cleaned at least once a month. To remove the filters, use the pull tab to slide the filter to the end of the opening and tip down. Soak the filters in the sink or in a dishpan filled with hot water and detergent.

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

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.

COOKTOP



OM030869

Operation

The cooktop will operate when the following conditions have been met:

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

To use the cooktop open the desired burner valve and rotate the igniter knob, clockwise, at the left hand side of the stove.

Before cooking on the range top the cover must be in full upright and folded position. Push the cover toward the outside wall to prevent it from falling onto the range top during cooking.

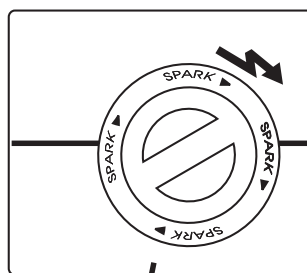
- Never close the cover while the burners are in use.
- Do not use the cover as a griddle.
- The oven may be used with the cover down.
- The bi-fold cover must always be closed when the motorhome is in transit. To close cover, pull up and out on the top of cover.



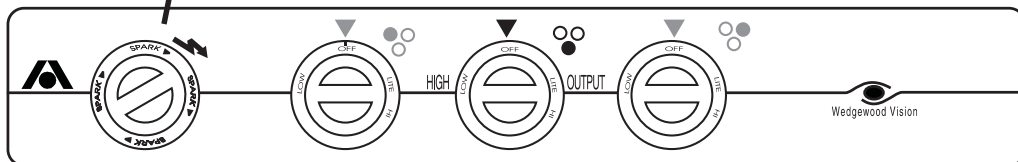
WARNING: Do not heat motorhome interior with the range or oven. Gas combustion consumes oxygen inside the motorhome. Carbon Monoxide is an odorless, colorless and highly poisonous gas.

Lighting Top Burners

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



WARNING: Top cover must be open when the cooking surface is in operation. Do not cover the oven vent openings while the oven is in operation.



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Burner Grate

The burner grate is attached to the cooktop cover by two spring clips located on the underside of the cooktop cover. The burner grate can be separated from the cooktop cover for cleaning purposes. Place a towel down onto the countertop next to the cooktop. Lift the cooktop cover up by the front corners, just high enough to clear the top of the burners. Pull the cooktop cover toward the front of the cooktop and lift it away. Place the cooktop cover upside down onto the towel. Squeeze both of the grate spring clips to remove the grate from cooktop cover.



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.

Tips

1. A yellow flame is an indication of incorrect fuel/air ratio. Lowered BTU output and carbon build up can occur.
2. When cooking at an altitude above 5,000 feet the flame may change appearance and the flame BTU output will be lowered. 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 the cooktop cover to help keep the underside of the cooktop clean. Place strips of aluminum foil on the cooktop floor pan and under burners. Do not restrict air flow of mixture tubes.
5. Pre-heat the oven for 10 minutes prior to use.

Cleaning Tips:

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

Cleaning & Maintenance

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 cleanser 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.

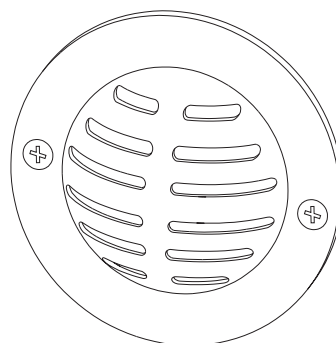
Porcelain Enamel:

Porcelain enamel is a type of glass fused on steel at a very high temperature. It 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 and maintenance of the porcelain, call “*Hopes Cultured Marble Polish*” at 800-325-4026.

THERMOSTAT

The comfort control operates the HVAC (heating, ventilating and air conditioning) system. A thermostat located in the overhead compartment above the entry door operates all the roof air conditioners functions as well as the LP-Gas furnace operations. The comfort control uses a liquid crystal display to inform the operator of its current program status.

There are six different functions of the HVAC system: **OFF**, **FAN**, **COOL**, **HEAT PUMP**, **AUX. HEAT** and **FURNACE**. The repeated pressing of the **MODE** button makes these selections. The **FAN** button controls the roof air conditioner fan speed. Three speeds are available: low, medium and high. Fan speed control applies to the roof air conditioner's blower speed only. Selecting the fan speed **AUTO** adjusts the fan speed automatically, depending on temperature set point and actual temperature in a selected zone. The roof air conditioners will use all three blower speeds (low, medium or high) in the **COOL** mode when selecting **AUTO** fan when selecting **AUTO** fan if operating in **HEAT PUMP** mode, only low or high blower speeds are available. There are separate operating zones for the motorhome designated **Zone 1** and **Zone 2**. Pressing the zone button toggles the zone selection. The selected zone number flashes while the other remains steady. Pressing the **UP** or **DOWN** buttons controls the temperature range for any HVAC function. The remote temperature sensor for **Zone 1** is located on the bottom of the overhead compartment above the entry door. **Zone 2** uses a temperature sensor located in the bedroom.



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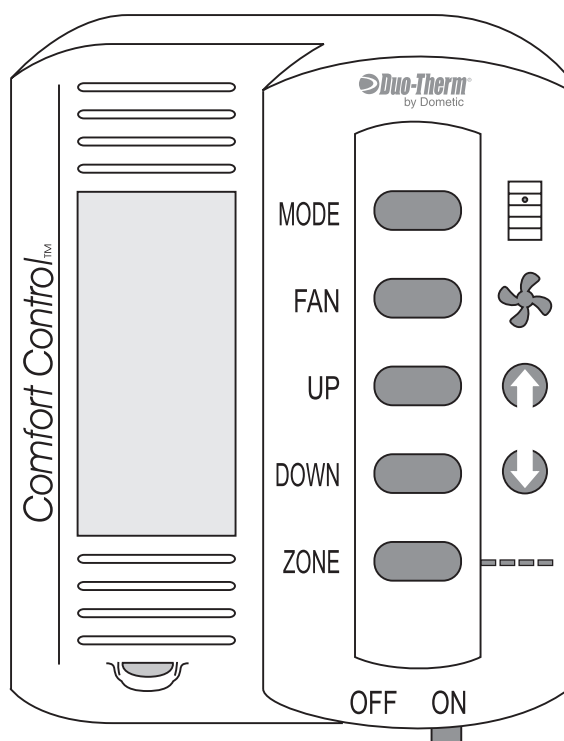
NOTE: The Comfort Control must be **ON** to operate any function of the HVAC system. The Comfort Control must be in the same mode for all zones to function properly. One zone cannot be on **COOL** while the other zone uses **FURNACE**. **DO NOT** attempt to mix the modes for separate zones. Heating or cooling the motorhome will not be any faster by selecting a very high or very low temperature setting.

Comfort Control Reset:

Should the comfort control exhibit unusual symptoms or not respond to commands, it may require a reset. The reset establishes factory defaults.

To Reset:

- The Battery Cut-off switch must be on.
- Press and hold **MODE** and **ZONE** buttons simultaneously while switching the **ON/OFF** switch to **ON**.
- Five to ten seconds after switching the comfort control **ON**. The letters "**FF**" appear. Release the **MODE** and **ZONE** buttons. The comfort control backlighting will remain illuminated. The factory default settings of 72° F for **COOL** and 68° F for **FURNACE** are then established.
- Select the **MODE** to confirm factory default. Set desired setting in the comfort control using normal programming procedures.



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AIR CONDITIONER - ROOF

The motorhome is equipped with two independent 13,500 BTU roof air conditioners. The roof air conditioners operate from 120 Volts AC only, either from shore power or from the on-board generator. Operations are controlled by the 12 Volt DC comfort control. The electronics in the comfort control use a telephone type patch cord to send a low voltage signal to the roof air conditioner's circuit board. The circuit board controls the desired roof air functions and/or LP-Gas furnace operations. The refrigerant operation principal of the roof air conditioner is the same as the dash air conditioner or a household type refrigerator. The function is that of an enclosed system. The compressor draws refrigerant into it. A high-pressure vapor is then sent to a condenser where the heat is expelled into the atmosphere. The vapor leaves the condenser as a high pressure liquid. This liquid is forced into a metered capillary tube and then into the evaporator or low side pressure. The refrigerant then changes from liquid form to vapor as heat extracts. The vapor then draws back into the compressor to start the cycle again. When operating the roof air conditioners in heat pump mode, the principals of air conditioning reverse. The refrigerant flow reverses, blowing heated air into the interior of the motorhome.



NOTE: The air conditioning system will freeze the moisture in the air depending on the humidity content. Under high humidity conditions it is recommended to set the blower fan speed to High.



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

Aux. Heat Mode:

When selecting the **HEAT PUMP** mode, or if operating in **HEAT PUMP** mode and ambient temperatures are approximately 30° F, the air conditioner will stop the Heat Pump operation and begin Aux. Heat operations. Automatic selection of an auxiliary heat (the furnace) becomes the primary heat source and furnace operations begin. The **AUX. HEAT** mode is due to refrigerant characteristics in cold temperatures. The furnace remains the primary heat source until ambient temperatures rise above 42° F. When ambient temperatures are between 30-42° F., the Defrost cycle initiates approximately every 40 minutes of compressor operation. The blower motor will stop for five minutes and the comfort control displays **DEFROST**. After the defrost cycle Heat Pump operation will resume.

Return Air Filters

Clean the return air filters frequently and for the environment for which they operate. The return air filters are inside the air intake vent covers located on the motorhome ceiling. Never operate the air conditioner without the return air filters in place. This may plug the evaporator core with dirt and substantially affect performance of the air conditioner.

To Clean:

- Remove the vent cover and filter.
- Wash the filter and cover in warm soapy water. Do not use solvents.
- Rinse the filter and cover thoroughly with fresh water. Allow to dry.
- Reinstall the filter and cover.

The roof air conditioners operate from the comfort control only under the following conditions:

- 120 Volts AC is supplied from either shore power or the generator.
- The battery cut-off switch is in the ON position and house batteries are charged.
- The **ON/OFF** switch is ON at the comfort control.

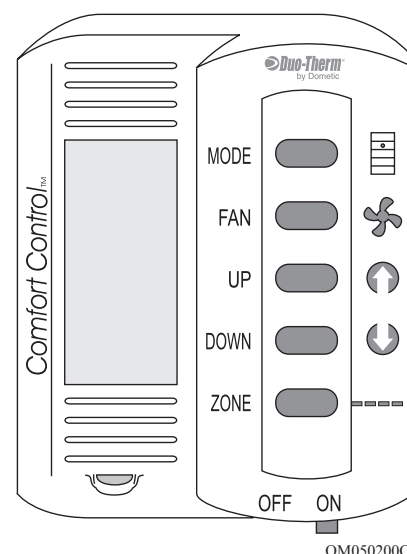
Zone Selection:

The desired zone selection is the first step in utilizing the comfort control. Press the **ZONE** button to select Zone 1 or 2 for programming purposes. The zone currently in programming will flash while the other zone display is constant.

Fan Operation:

This mode circulates the interior air by using the roof air conditioners blower. The fan speed will control the roof air conditioners blower speed in the following modes: Fan, Cool or Heat Pump.

- Press the mode button repeatedly until FAN is displayed.
- Press the FAN button to select the desired fan speed.



Air Conditioner Operation:

The living room comfort control operates the roof air conditioner functions.

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



NOTE: The compressor will engage approximately two minutes after blower motor activation. This prevents accidental compressor activation against high pressure.

Heat Pump Operation:

The living room comfort control operates the roof air conditioners.

- Select the desired Zone by pressing the **ZONE** button.
- Press the **MODE** button repeatedly until **HEAT PUMP** is displayed.
- Set desired fan speed by pressing the **FAN** button.
- Set desired heating temperature by pressing the **UP** or **DOWN** buttons.

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.



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.



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

Operation

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

The furnace will operate when the following conditions have been met:

1. The LP-Gas valve on the LP tank is open and the LP-Gas valve at the furnace is on.
2. The house batteries in the motorhome are fully charged.



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.

- Slide the **ON/OFF** switch to the **ON** position.
- Select the **FURNACE** mode on the Comfort Control using the **MODE** button.
- Select the **AUTO** speed with the **FAN** button.
- Select the desired temperature with the arrow up and down buttons.

Using the Furnace

- 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.
- It is advisable to use the furnace to heat the inside of the motorhome during transit. Outside temperature can vary to extreme cold. The dash heater may not provide adequate heat to the interior.

Tips



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

If the furnace fails to light make sure the LP-Gas supply valves are 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.

If the Furnace Fails to Light

To Charge the House Batteries:

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



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

WATER HEATER

A ten-gallon water heater is the standard feature for the motorhome. The water heater operates by using one of two methods. The first method is 120 Volts AC, supplied either by shore power or the on board generator. The 120 Volt AC uses a heating element like the one found in a house water heater. The 120 Volt AC method is the more efficient if shore power is available.

The second method uses LP-Gas. The LP-Gas incorporates the use of an Automatic Ignition circuit board operated by 12 Volt DC. Two thermostats control the water temperature: One for the 120-Volt and the other for the LP-Gas. The water heater manufacturer presets the temperature of both thermostats.

The process for heating water is simple. Water is pumped into the bottom of the water heater tank. LP-Gas, 120 Volt AC, or a combination of both, heats the water. The heated water is discharged out of the top of the tank upon usage.

The water heater is equipped with a by-pass valve for easy winterization and a Temperature Pressure Relief valve for safety. The water heater has aluminum clad tank. An anode is not necessary.

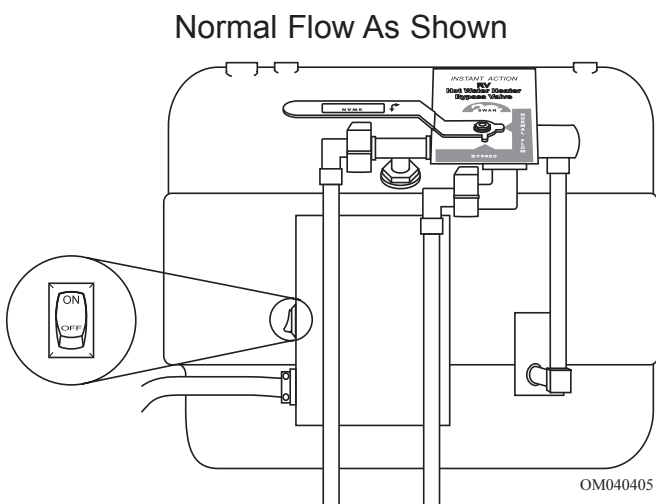


NOTE: The automatic ignition circuit board will make three attempts to light the burner. If the burner does not light by the third attempt, the ignition circuit board will go into "lock-out." Cycling the on/off switch will reset the ignition board.



NOTE: Do not operate the water heater by either function without water in the water heater tank. This can damage the thermostats and the electric heating element.

Before Using the Water Heater



Prior to using the water heater, purge all trapped air from the water system. To purge the air and pressurize the system, fill the fresh water tank by using the on board water pump or hooking up to city water. Check the tank for any obvious water leaks. Once the system is pressurized, turn the hot and cold valves on for each water faucet, one at a time, inside and outside of the motorhome. Run each faucet until a steady stream of water with no air bubbles or air pockets are present. The water heater does not need to be operating while in this process. Locate the water heater bypass valve on the back of the water heater; select the "Normal Flow" position. While at the back of the water heater ensure the small **ON/OFF** switch position is set ON.

Periodically check the service compartment and screen in the door on the outside of the motorhome to ensure no foreign material has accumulated which will prevent the flow of combustion and ventilating air.

Water Heater Compartment

The water heater bypass is a valve located on the back of the water heater. By turning the valve to **BYPASS** position, water diverts away from entering the water heater. The water heater should be in the **BYPASS** position when winterizing. Bypassing the water heater will keep antifreeze out of the water heater, if antifreeze is used for winterization.

Water Heater Bypass System

For water heater operation turn the valve so that the handle points to **NORMAL FLOW**.

The water heater is equipped with a Pressure-Temperature relief valve. The water heater may discharge at the Pressure-Temperature relief valve during the heating cycle, due to thermal expansion of water. The Pressure-Temperature relief valve is designed to open if the water temperature within the heater reaches 210° F (98.8° C), or if the water heater pressure reaches 150 psi. This can be related to the fact the motorhome utilizes a closed system. A discharge is a normal occurrence and is not necessarily a faulty valve. 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, utilize the following procedures to replace the air.

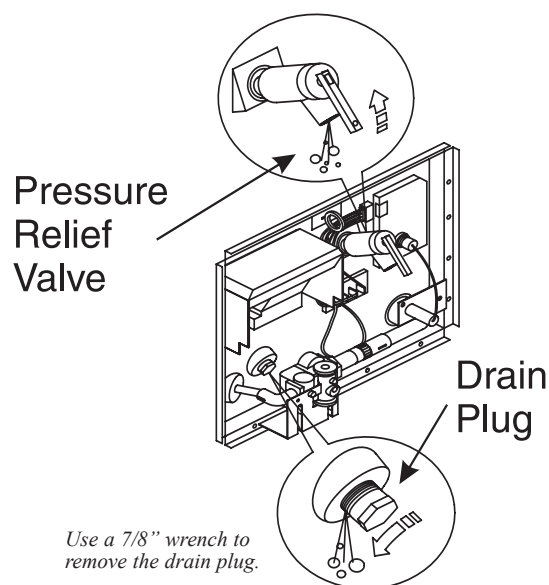
Pressure - Temperature Relief Valve



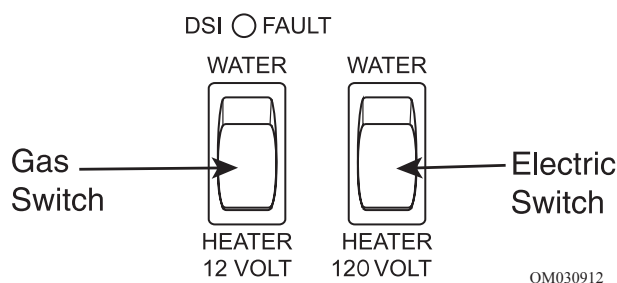
CAUTION: Ensure the water heater tank is cool prior to checking the valve.

1. Turn OFF the water heater.
2. Shut OFF the incoming water supply.
3. Open the closest hot water line of the motorhome.
4. Pull the handle of the relief valve until the flow of water stops.
5. Allow the relief valve to snap shut, close the hot faucet and turn on the water supply.
6. Turn ON the water heater.

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



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The water heater operates under the following conditions:

- There is 120 Volt AC supplied from either shore power or the generator.
- Both the manual and electronic valve LP tank valves are open.
- The battery cut-off switch at the entry door is ON.
- The house batteries are fully charged.

LP-Gas Operations:

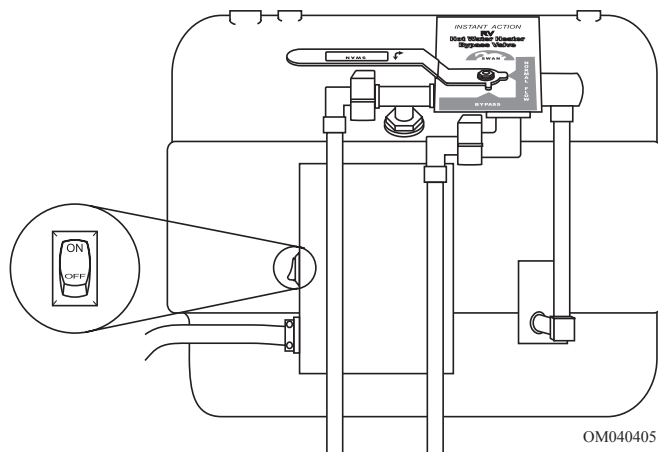
- Open and turn on the LP-Gas valves.
- Turn the water heater switch (located in the overhead compartment above the entry door) to the ON position. The water heater will make an audible "roar" from the burner when ignited. The small indicator light will illuminate briefly then go out once the water heater ignites. The indicator light will glow steady when the ignition cycle has gone into "lock-out."



NOTE: It is not recommended to operate the water heater on LP-Gas while the motorhome is in transit.



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 that can ignite. Evacuate the motorhome and shut off the LP valve. Contact a qualified service center to have the problem correctly diagnosed and repaired before resuming operation.



The 120 Volt AC Operations:

- Have either shore power or the generator supplying AC voltage.
- Turn on the water heater switch located in the overhead compartment above the entry door.
- Locate the small **ON/OFF** switch at the back of the water heater and switch to ON.
- The heating process occurs at a quicker rate with both LP-Gas and 120 Volt AC operations activated.

Draining & Storage

If the motorhome is to be stored for a long period of time, or during the winter months, the water heater must be drained to prevent damage from freezing. Refer to "Winterizing" for instructions. Be sure to refill the water heater with water before resuming operation.

Tips

- Turn off water heater when not in use to conserve LP-Gas.
- The water heater tank capacity is ten gallons. When running the shower, conserve the heated water by shutting the shower water off when not in immediate use.
- Use caution when adapted to 30-amp shore service. When the water heater element is in operation it will use approximately 12 amps. Appliances may need to be operated in sequence to avoid tripping a breaker.
- The temperature and pressure (T & P) safety relief valve on the outside of the water heater is set to open at 210° F or 150 psi. When water temperature and pressure reach these settings the valve may drip until the pressure has dropped. Avoid opening the T & P valve manually as it may continue to leak. Most hardware stores carry the valves.



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

Troubleshooting

- If water heater fails to light check the outside burner tube for obstructions. Spiders may make nests in the burner tube.
- If the indicator light on the hall panel does not light, and the water heater does not light, verify the battery cut-off switch at the entry door is on or check for a blown fuse in the house distribution panel.
- If the switch at the panel is on, but there is no hot water, check the **ON/OFF** switch located on the back of the water heater.
- If the 120 Volt piloted switch does not light check the AC source, breaker, shore cord connection or transfer switch.

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

**WASHER/DRYER
PREPARED**

1. Color coded water supply lines. A red line for hot; a blue line for cold.
2. An 1½ in. 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 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 be sure to properly seal vent to sidewall.

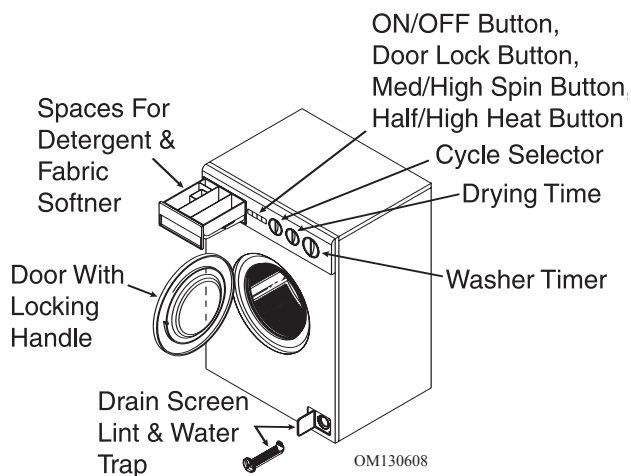


Refer to the manufacturer installation instructions if a washer/dryer is to be installed at a later date.

Further instructions are listed below 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.
- Be sure to use proper length fastener when attaching exhaust vent to exterior sidewall. Stainless steel fasteners are best suited for this as they will not rust.
- If the cabinet or closet in which a washer/dryer is installed does not have vented louvered doors, the manufacturer's installation instructions may require installation of vented doors or vents to be installed in the doors. This is for sufficient circulation of drying.

WASHER/DRYER (OPTIONAL)



The automatic washer/dryer has a capacity of up to 10 lbs. (4.5 Kg.) of dry clothing. It is front loading with an extra large door opening for easier access. It has five wash cycles, in addition to extra rinse and spin cycles.

- The washer/dryer operates on 120 Volt AC.
- To operate the washer/dryer use shore power or the generator.
- The washer/dryer water use will be approximately 16 gallons of water.



CAUTION: Open a window or vent while operating the dryer. It is dangerous to create negative air pressure inside the motorhome while operating fuel burning appliances.

Before using the washer for the first time wipe the inside and outside with a damp cloth to remove any travel dust that has accumulated. We recommend operating a rinse cycle to rinse out the washer.

To Begin a Wash Load:

- Sort and pre-treat clothes (specific directions under sorting).
- Add the measured amount of detergent suggested by the package directions (maximum two tablespoons).
- Load the clothes loosely into the washer. Close the washer door.
- Turn the cycle selector knob to the desired temperature setting.
- Decide which washing cycle you wish to use. Turn the timer knob clockwise to the desired wash setting.
- Select High or Medium spin (only for regular washing).
- Press the push button ON.
- After the cycle is complete, wait two minutes for the door lock to release before attempting to open the door.



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 explosive substances. They give off vapors that could ignite or explode. Do not add gasoline, dry cleaning solvents or other flammable or explosive substances to the wash water.

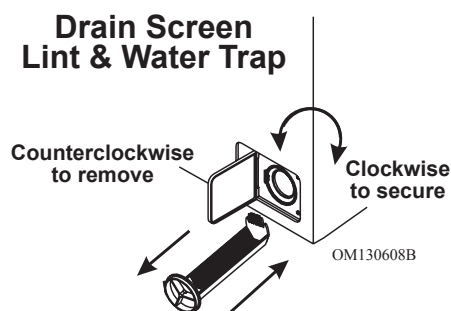


WARNING: Do not use heat to dry articles containing foam rubber or similar textured, rubber-like materials. Clean the lint screen if applicable (located on the back of the washer in the top left corner) after each use and keep the area around the exhaust opening and adjacent areas free from the accumulation of lint, dust and dirt.



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 internal Washer/Dryer components.

Cleaning the Drain Screen



The removable drain screen, which protects the pump from lint and foreign matter, needs to be cleaned periodically. The frequency in which it is cleaned depends upon the type of clothes that are washed. Cotton articles produce more lint than nylon articles. Under no circumstance should the drain screen be removed while the machine is full of water. To clean the drain screen (on an empty machine) open the service door by pressing on the left hand side. Place a cloth or shallow tray under the drain screen housing to catch any remaining water that may drip out. It may be helpful to first set the machine to spin then remove the drain screen. This procedure reduces the amount of water released. Turn the drain screen counterclockwise and pull the drain screen out. Clean the screen to remove any dirt and lint. To replace the screen, slide it back into the housing and turn it clockwise to secure. Close the service door.



NOTE: Check for water leaks before using the washer after removing and replacing the drain screen.

Cleaning the Washer/Dryer

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. Clean the interior with one cup of chlorine bleach mixed with two cups of granular detergent. Run the washer through a complete cycle using the 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 any moisture. Periodically apply a thin coat of paste wax to the inner door, especially to the area which is immediately next to the door window. This will protect the door finish from laundry spills and discoloration.



NOTE: Should the washer/dryer need removal for service, care should be taken as the washer/dryer weighs approximately 185 lbs. Proper accommodations should be made to avoid risk of injury.

Winterizing the Washer/Dryer

To winterize your washer/dryer follow the instructions below to avoid damage to your unit due to freezing:

1. Run the washer/dryer in a spin cycle to remove the majority of the water from the washer/dryer.
2. Close the hot and cold water supply valves on the inlet hoses located behind washer/dryer. Remove the hoses from the valves and allow them to drain. Leave the hoses disconnected during storage.
3. Unplug the power cord and remove the drain screen to allow the water remaining in the pump and drain hose to be evacuated. Reinstall the drain screen.
4. Wipe the inside of the washer and dryer with a clean dry cloth.

To place washer/dryer back into service:

1. Plug power cord into receptacle.
2. Make sure the drain screen is securely in place.
3. Connect the two inlet water supply hoses to the water supply valves. Red line for hot water and blue line for cold water.
4. Open water supply valves and operate washer/dryer for one complete cycle and check for leaks.



NOTE: When placing the unit back into service, allow the unit to operate for one complete cycle before doing laundry to ensure all antifreeze has been purged from the unit.

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Endeavor

SECTION 5 EQUIPMENT

INTRODUCTION	155
ENTRY STEP	155
OPERATION	155
TIPS	156
MAINTENANCE & LUBRICATION	156
STEPWELL COVER	157
ADJUSTMENTS	157
ENTRY STEP STORAGE	157
ENTRY DOOR	158
FRONT ENTRY	158
LATCH ADJUSTMENTS	158
SCREEN DOOR - CHANGING THE GLASS	158
SCREEN DOOR - REMOVING THE SCREEN	159
SLIDE-OUT OPERATION	159
EXTENDING MAIN ROOM(S)	160
RETRACTING MAIN ROOM(S)	161
MANUAL OVERRIDE MAIN SLIDE-OUT	162
EXTENDING BEDROOM SLIDE-OUT	163
RETRACTING BEDROOM SLIDE-OUT	163
MANUAL OVERRIDE BEDROOM SLIDE-OUT	164
AWNINGS	165
FRONT DOOR	165
WINDOW AWNING (OPTIONAL)	165
PATIO	165
AUTOMATIC CAREFREE (OPTIONAL)	168
SLIDE-OUT EXTENDIBLE AWNING	169
SLIDE-OUT COVER	171
AWNING CARE & MAINTENANCE	171
SUNVISORS	173
FANS	173
GALLEY FAN	173
TIPS	174
BATHROOM EXHAUST FAN (OPTIONAL)	175
BATHROOM FAN	176

DOOR-SLIDING	176
SOFA BED CONVERSION	176
SOFA HIDE-A-BED CONVERSION	177
ELECTRIC SOFA BED CONVERSION (OPTIONAL) ..	177
DINETTE	178
BED CONVERSION (OPTIONAL)	178
TABLE TOP EXTENSION	178
TABLE TOP EXTENSION (LEGLESS)	178
STORAGE UNDER BED	178
SUPER SLIDE (OPTIONAL)	179
ENTERTAINMENT SYSTEMS	179
VIDEO CASSETTE RECORDER (VCR) (OPTIONAL)	179
TELEVISION (FRONT) WITH LOCK-OUT FEATURE	179
TELEVISION ANTENNA	180
HOOK-UPS - TV CABLE, COMPUTER & TELEPHONE ..	182
ENTERTAINMENT HOOK-UP - EXTERIOR	182
VIDEO SELECTOR BOX	183
SATELLITE SYSTEM - DSS PREWIRE	184
SATELLITE SYSTEM - DSS (OPTIONAL)	185
HOME THEATER DVD PLAYER (OPTIONAL)	186
OPERATION	186
RADIOS	187
DASH	187
10 DISC CHANGER	188
CITIZEN BAND RADIO - PREWIRE	188
EXTERIOR ENTERTAINMENT CENTER	188

INTRODUCTION

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



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.

The entry step features amber lighting under the step, automatic retraction with the ignition key in the RUN position and a last out feature. Located to the left, just inside the entry door, is the step switch.

ENTRY STEP - Operation

Operating the Entry Step:

1. With the entrance door open, turn the step switch on.
2. Close the door. The step should retract and lock in the **UP** position. The step light will remain on.
3. Open the door. The step should extend and lock in the **DOWN** position with the under step light on. The step will retract when the door is closed.
4. When the 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. To hold the entry step in the retracted position proceed with the following:
 - Turn the engine ignition switch off.
 - Wait 15 seconds and then turn the power step switch from off to on, then back off again. The step will stay retracted until the step switch is turned ON, or the ignition switch is turned on. The retracted position is useful for high curbs or on boat ferries.
5. With the power switch off, the step extended, the entrance door closed and the ignition turned on the ignition override system will go into effect and the step will automatically retract.
6. Turn the ignition off and open the door. The step will extend and lock in the **DOWN** position. This is the "last out" feature. When the ignition is on the step will always activate with the door movement, regardless of the power switch position.

Tips

If the step fails to operate:

- Verify that the step switch is **ON**.
- Check the main power supply for the step. A 20 Amp circuit breaker located on the low current plate.
- 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.



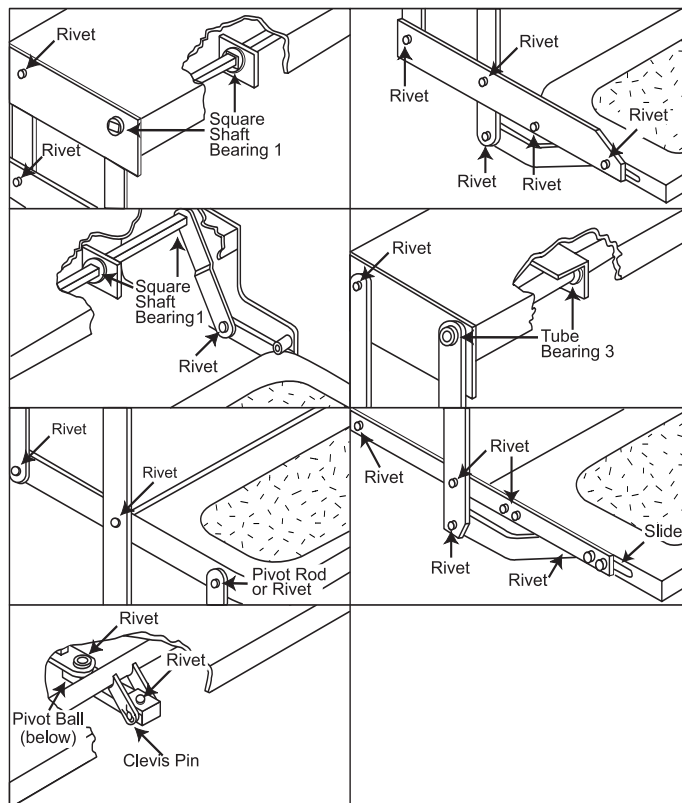
WARNING: If the motorhome is driven with the step in the extended position there is the possibility of causing major damage to both the step and the motorhome.

Maintenance & Lubrication

Clean all mud, salt and road grime from the step before lubricating. Lubricate all moving parts (bearings, pivot points, slides, clevis pin and the drive linkage ball) every 30 days with a good quality heat and moisture resistant penetrating grease. **Kwik Lube Spray Grease** is specially formulated to lubricate **Kwikkee Electric Steps** and it is also recommended for lubricating all moving parts. (Refer to the illustration.)



NOTE: Silicone lubricants and WD-40 are not recommended as they have a tendency to evaporate and dry the mating surfaces which leaves them vulnerable to the elements.



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STEPWELL COVER

The motorhome is equipped with a sliding stepwell cover that is extended and retracted by the use of a dual action air cylinder. Stepwell cover control switches are located on the panel next to the passenger seat and on the center panel next to the radio. The air cylinder is controlled by an electrically operated air valve. The air solenoid, known as a “MAC” valve, receives air pressure from the front air tank. The “MAC” valve will direct the air pressure to either side of the dual action air cylinder, moving the stepwell cover in or out. The stepwell cover will not operate without sufficient air pressure (approximately 60 psi).

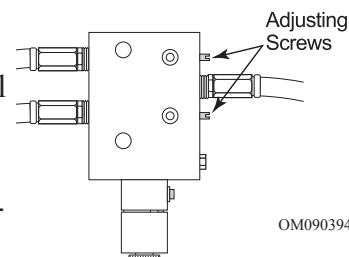


CAUTION: The stepwell cover is under air pressure. When operating the stepwell cover be sure there are no pets, shoes or other obstructions in the stepwell area. Do not operate the stepwell cover while standing in the stepwell area.

The “MAC” air valve is located in the front of the motorhome, behind the generator door mounted to the frame. The easiest way to identify the location is have someone operate the stepwell cover with the generator door open and listen for the release of air.

The “MAC” air valve has two adjustment screws. The adjustment screws regulate the air flow to either side of the air cylinder. Adjusting the screws will affect the speed in which the air cylinder moves in or out. Clockwise adjustment on the screw will decrease air flow. Counterclockwise adjustment on the screw will increase the air flow. For proper stepwell cover adjustment it is recommended that adjustments be performed by a qualified service person.

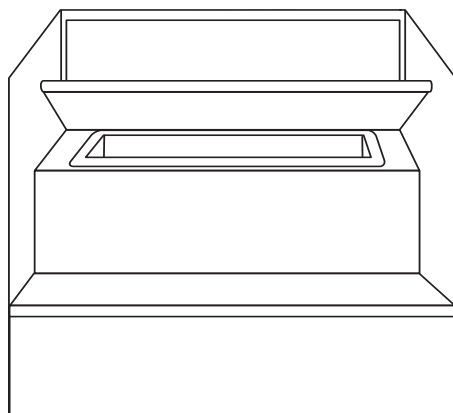
Adjustments



WARNING: When adjusting the stepwell cover clear the stepwell area of obstructions, pets or persons. Do not adjust the stepwell cover while stepwell area is occupied.

There is a handy storage compartment located just inside the motorhome underneath the top step. Lift the hinged top step to gain access to the compartment. This is an excellent place to store gloves, tools, etc.

Entry Step Storage



OM090344

ENTRY DOOR

- Front Entry

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.

Latch Adjustments

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 just slight pressure applied to the entry door. Upper and lower latches should be evenly timed. Press on the entry door to see if there is any further movement of the door.
- The entry handle should operate with little effort to open the entry door. An excessive amount of 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.



Silicone should be applied 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 - Changing the Glass

Changing the Glass in the Screen Door:

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

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.

**Screen Door
- Removing the Screen**

The slide-out rooms operate using an electric switch controlling a electric drive motor. Slide-out room operation uses many safety features preventing mechanical damage or physical harm. The slide-out room(s) will not operate until all safety requirements are met.

**SLIDE-OUT
OPERATION**

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

- The roof of the slide-out should be checked 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.



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.

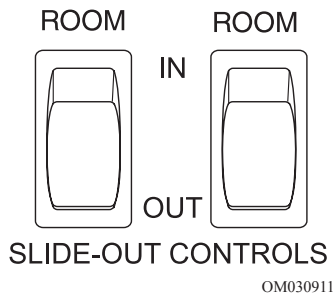


WARNING: Move the driver's seat forward before activating the slide-out room. Damage to the upholstery can occur. The outside area must be clear of any obstructions restricting slide-out room operation. Ensure there is five or more feet of clear space outside the slide-out room prior to extending or 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.

Extending Main Room(s)



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.
- Be sure the bay doors under the slide-out room are closed.
- The house batteries are fully charged.
- Be sure all people, pets and objects are clear of slide-out room path.
- If applicable, remove locking bar mechanisms on top of the slide-out room inside the motorhome.
- The control switch for the slide-out room 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.



CAUTION: If applicable, remove the slide lock bars before moving the slide-out room. Damage can result if bars are left in position. The manufacturer is not responsible for damage resulting from operating the slide-out room with the slide lock bars left in position.



NOTE: Do not leave the slide-out in the extended position during severe weather. Conditions such as high winds or heavy rain may cause damage to an extended slide-out.

**Retracting
Main Room(s)****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 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, release the switch. To continue the room movement, push and hold the switch in.
- 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 the motorhome. It will be necessary to retract the room in small increments, allowing the water time to run off.
- If applicable, place locking bar mechanisms between the wall and top edge of the slide-out room to lock room in place.



WARNING: If locking bar mechanisms are used, make sure they are secured tightly before moving motorhome. Locking bars can come loose and cause personal injury.



NOTE: Be sure you have sufficient clearance on the inside of the motorhome (driver's seat, etc.) before you retract the slide-out room. Ensure the floor is clean before you retract the slide-out room. Trapped dirt or grit under the slide-out room can scratch the floor surface. Never move the motorhome with the slide-out room extended.

Manual Override Main Slide-out

The slide-out system can be retracted in the event of a power loss.

If the Room Does NOT Move When the Switch is Pressed:

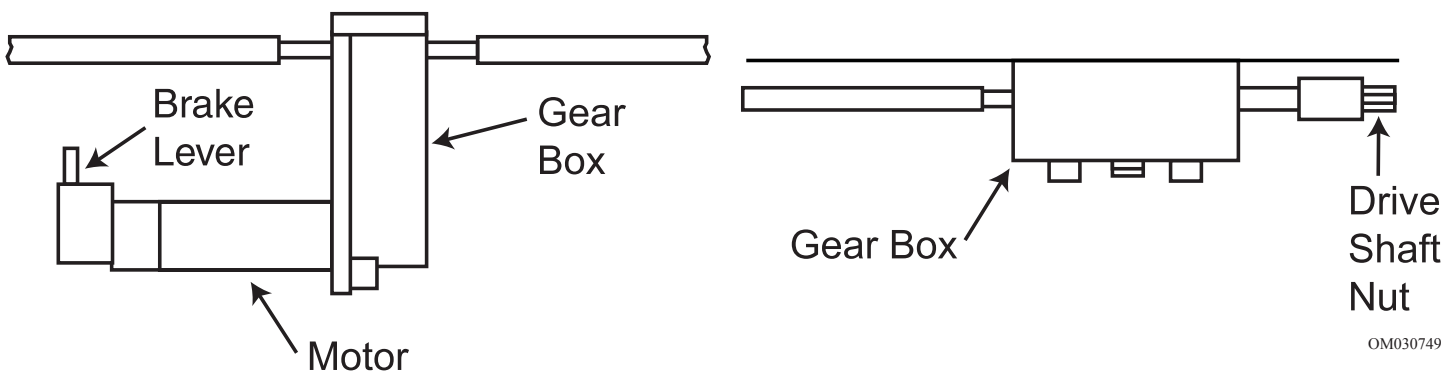
- The house battery cut-off switch must be on.
- Check if the battery is fully charged and connected.
- If applicable, make sure the locking bar mechanisms are removed.

After the previous items have been checked and the room still does not move when the slide-out switch is pressed, follow these simple steps to manually override the slide-out room:

- To move the slide-out room manually, retract the motorhome leveling jacks (see “Leveling Jacks”).
- Open outside storage compartment doors underneath slide-out room.
- Remove plastic covers, if applicable, from top of compartments to gain access to drive shaft and drive mechanisms.
- To move the slide-out room, move the lever on the motor counter-clockwise to release motor brake and turn the end of the shaft next to the gear box using a 7/8” wrench.
- Once the room is in position, apply pressure to the wrench so that the room is sealed. Return the brake lever to its normal position to lock the room in place.
- Take the motorhome to an authorized dealer for service.



NOTE: The slide-out room is heavy and may require several persons to push it into the retracted position. Once the slide-out room is in the fully retracted position, return the brake lever to the lock position to hold the room in place.



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Extending Bedroom Slide-out**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.
- If applicable, remove locking bar mechanisms on top of the slide-out room inside the motorhome.
- Press and hold the slide-out room switch in the OUT position. The switch is located on the systems monitor panel or in the bedroom under an overhead cabinet. 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 switch, which will lock the room in position.



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/or damage to the slide motor.



CAUTION: If applicable, remove the slide lock bars before moving the slide-out room. Damage can result if bars are left in position. The manufacturer is not responsible for damage resulting from operating the slide-out room with the slide lock bars left in the locked position.



NOTE: Do not leave the slide-out in the extended position during severe weather. Conditions such as high winds or heavy rain may cause damage to an extended slide-out.



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

To Retract the Bedroom Slide-out:

- Ensure there is sufficient clearance inside the motorhome for the slide-out room.
- If applicable, clean floor.
- Remove any debris from the top of the slide-out room.
- Press and hold switch to the IN position. To stop the slide-out room before it fully retracts, release the switch. To continue the room movement, push and hold the switch in.
- When the room is fully retracted, release the switch. The room will lock into position.
- After the slide-out room is retracted, if applicable, place locking bar mechanisms between the wall and top edge of the slide-out room and lock into place.

Retracting Bedroom Slide-out

Manual Override Bedroom Slide-out

The slide-out system can be retracted in the event of a power loss.

If the room does not move when the switch is pressed:

- Check to make sure the battery cut-off switch is on.
- Check if the battery is fully charged and connected.
- If locking bars are used, make sure they are removed.

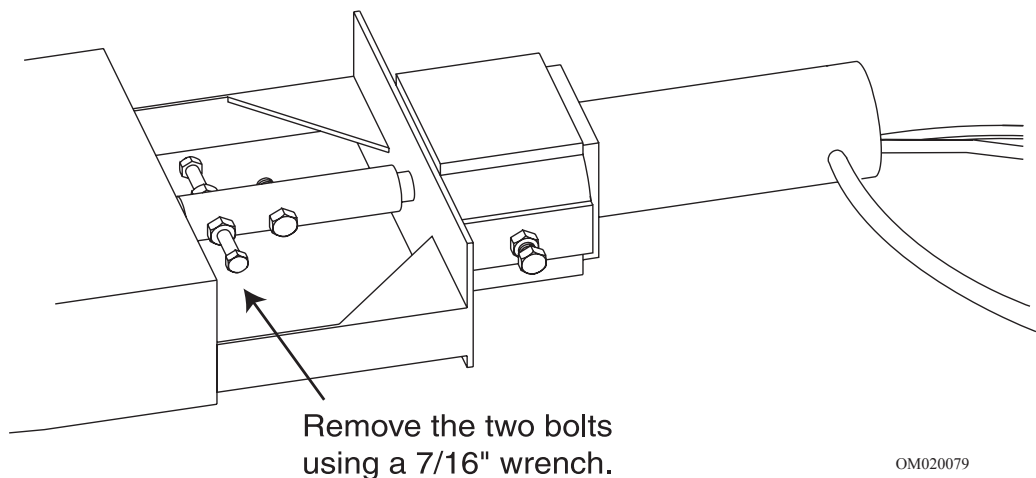


WARNING: Do not work on the slide-out system unless the battery is disconnected. Make sure the floor is clean before retracting the slide-out room. Dirt or grit that is trapped under the slide-out can cause damage to the floor.

After the previous items have been checked, and the room still does not move when the slide-out switch is pressed, follow these simple steps to manually override the slide-out room.

Manual Override for Bedroom Slide-out:

1. Disconnect the battery cables from the battery.
2. Lift up the mattress and baseboard to gain access to the slide-out cover board and mechanism.
3. The slide-out motor has a shaft with two bolts. Use an appropriate wrench (a 7/16" wrench/ratchet or an adjustable wrench) to remove the bolts. The bolts will need to be stored in a safe place to be installed after repairs have been completed.
4. The slide-out then can be pushed back in by a single person. Once the slide room has been manually retracted, reinstall the motor to prevent the room from creeping.
5. Take the motorhome to an authorized dealer for service.



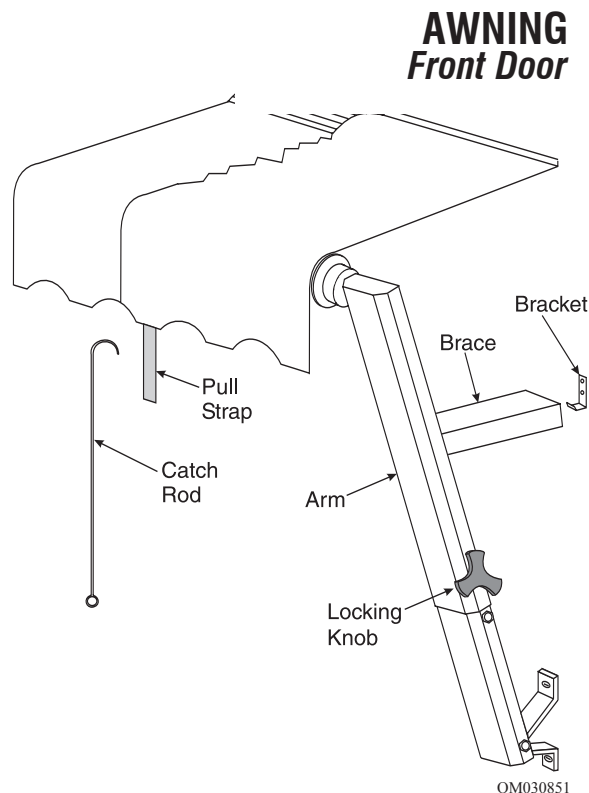
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To Extend the Awning:

- If applicable, unlock front arm lock by pulling lock down using pull rod.
- Hook the pull strap loop with awning pull rod.
- Pull strap until awning is at full extension. With free hand, level out brace arms.
- Mate the slot of brace with hook on side of the motorhome. Repeat procedure for other arm.
- Release strap slowly ensuring braces are secure. Slide the strap to rear of awning roll tube and tie to rear arm.
- If applicable, loosen locking knobs for both arms and extend arms so the canvas will clear door in the open position and tighten locking knobs.

To Retract the Awning:

- If applicable, loosen locking knobs for both arms. Lower arms to stop bolts and tighten knobs.
- Pull down on pull strap with a firm grip until tension is off the braces. Fold brace into main arms.
- Carefully allow awning to wind onto awning roll tube while holding strap in center 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.
- If applicable, lock front arm by raising lock using pull rod.



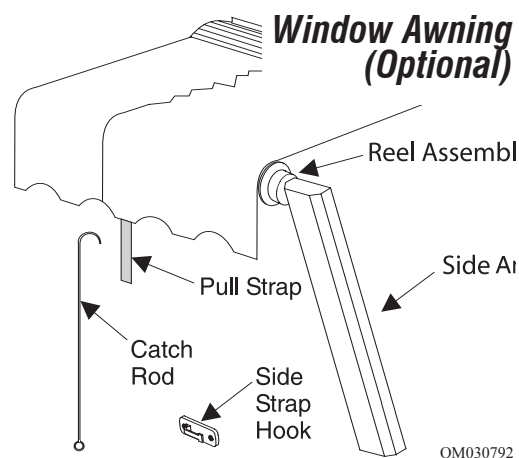
CAUTION: When the awning is at full extension do not allow the awning to snap back into the retracted position. Personal injury or damage to the awning or motorhome may occur.

To Extend Awning

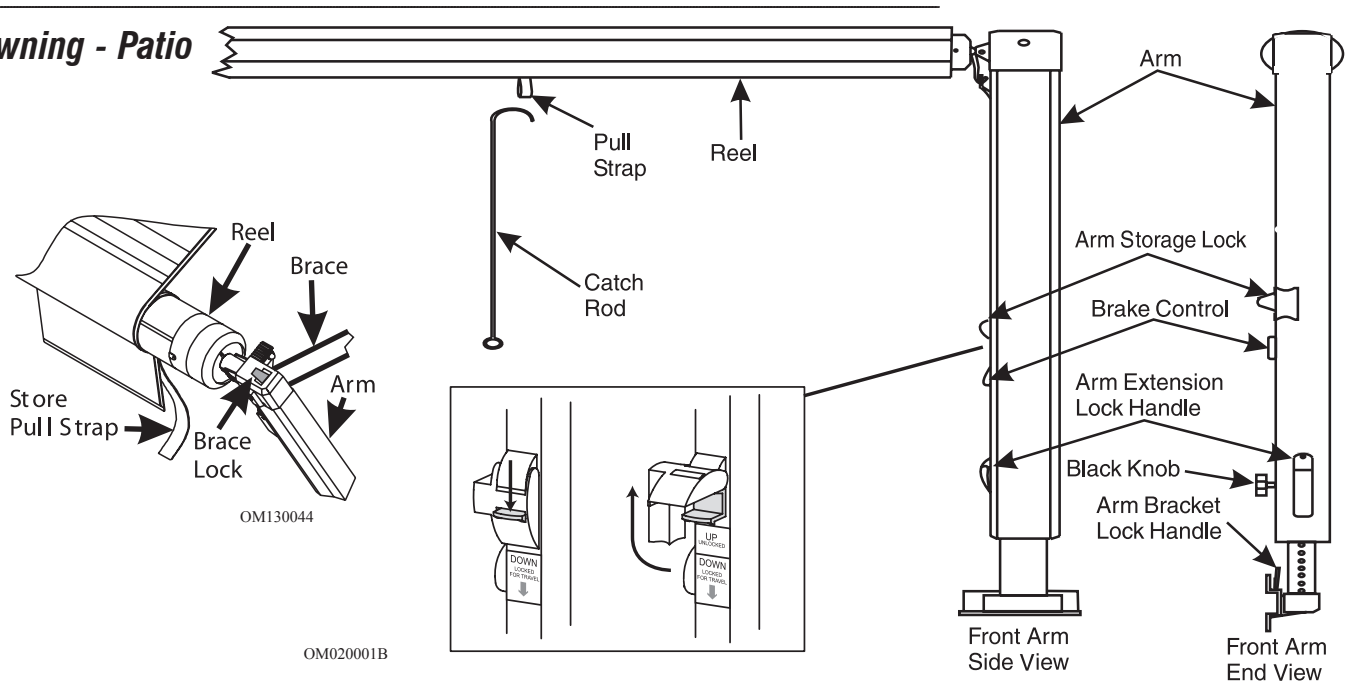
- Hook loop of pull strap with catch rod and pull awning, reel assembly and side arms to extend fully away from motorhome.
- Hook pull strap on side strap hook, remove catch rod from pull strap and store.

To Retract 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.



Awning - Patio



To Unlock the Awning:

1. Loosen the black locking knobs.
2. Unlock the storage 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 to the unlock position.

To Extend the Patio Awning:

1. Hook the loop of the center pull strap with the pull wand and draw the awning away from the motorhome to the desired extension. Slide the center pull strap to one end of the awning and store it.
2. Slide the inner rafters to the top of each arm and push outward to tension canopy. Tighten the black locking knobs.
3. Raise the arm extension lock handles and slide the awning upward. Lower the lock handles and move the awning arm upward or downward to lock the detent into the hole. First, raise the lock handles on the main side. Next, raise the lock handles to the entry door. Go to the other awning arm and do the same. Make sure the awning is straight.

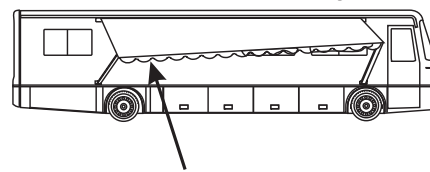
To Retract the Patio Awning:

Retract the arms and lower the awning until the arms rest on the lower stop bolts and lock into position. Loosen the two black locking knobs. Release the locking tab on the end of the awning leg. Slide the pull strap to the center of the awning while holding on to the strap. Allow the awning to roll up to the stored position.

- Snap the arm storage locks into the down position and tighten the black locking knobs.
- Verify that the brake control is in the locked or closed position.

Rain Release Setting:

After the awning has been extended, choose the rain release position to prevent water build up on the awning. To position the awning in the rain release setting, lower one arm of the awning and leave the other arm in the normal position. This will create enough of a slope for adequate water run off.

Rain Release Setting

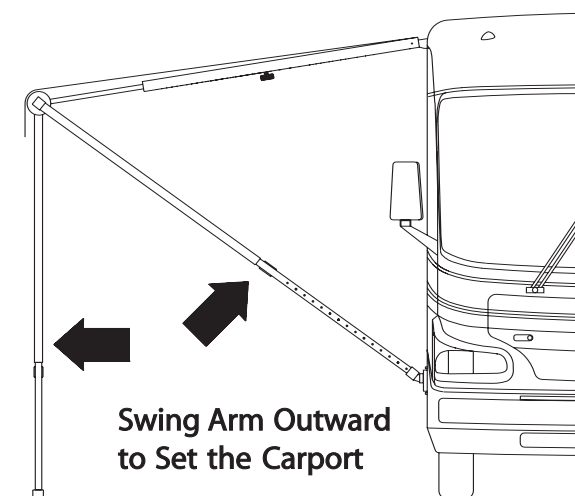
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One arm should be set lower than the other for proper water run-off.

Using the Carport Feature:

(Not available with Carefree One Touch Awnings.)

1. Extend the braces and lock them into the end of the side arms. Tighten the black knobs.
2. Extend the awning as described under "To Extend Awning."
3. 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.
4. Raise the rear arm extension lock handle all the way up to the unlocked position. Extend the arm to position the awning at the desired height and lower the lock handle to lock the arms in place.
5. Drive the stakes through the bottom holes in the arm.
6. Repeat instructions 1 through 5 for the front arm extension lock handle.



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NOTE: To move the awning out of the carport position reverse the above steps.

Securing the Awning for Travel:

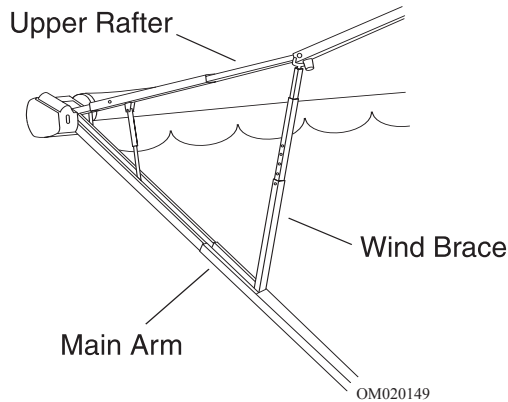
Before traveling, check the following:

1. The awning is fully retracted against the sides of the motorhome.
2. The black locking knobs are tightened.
3. The storage locks are down and in the locked position.
4. The brake control is in the full down (locked) position, and no red warning is showing.
5. The bottom of the front and rear arms are latched properly into the bottom brackets.
6. The catch rod is stored away.

Awning - Automatic Carefree (Optional)



The Carefree One Touch automatic awning requires only “finger tip” operation. A key lock on the One Touch switch pad is provided to prevent accidental deployment of the awning while the motorhome is in motion. The key is removable in the lock or unlock position. Gas filled struts keep the awning fabric tight at any extended position. The 12 Volt DC motor for the One Touch awning uses approximately 15 Amps while in operation.



To Extend the Awning:

- Verify all persons and objects are clear from the extend path of the awning and related hardware.
- Turn the One Touch key to the **ON** position.
- Depress and hold the momentary switch to **EXTEND**. Motor will automatically stop at full extension.
- Allow 14 seconds for awning to reach full extension.
- Extension distance or fabric tension is adjusted by toggling between **RETRACT** and **EXTEND**.
- Turn the One Touch key to the **OFF** position.
- Install the wind braces (2) between the upper rafter and the main arm. Adjust wind brace so the inner spring is under tension.



CAUTION: The patio awning requires nine feet of lateral clearance from the side of the motorhome. This distance will allow the awning to reach full extension. The One Touch patio awning was not designed with a carport feature or a rain release setting. The awning should be retracted if the motorhome is left unattended or high wind conditions exist. Otherwise, wind damage to the awning may occur.



NOTE: It is not required to have the awning at full extension. Awning may be stopped at any time of extension or retraction by releasing the momentary switch.

To Retract the Awning:

- Remove the wind braces.
- Verify all persons and objects are clear from the retract path of the awning and related hardware.
- Turn the One Touch key to the **ON** position.
- Press and hold the momentary switch to **RETRACT**. The motor will automatically stop at full retraction.
- It takes approximately 14 seconds for the awning to travel from the fully extended position to the fully retracted position.
- Turn the One Touch key to the **OFF** position to avoid accidental deployment of the awning while the vehicle is in motion.

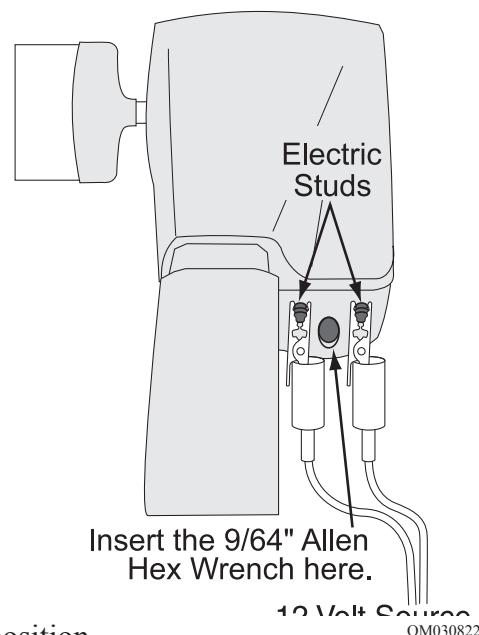
Tips - If the awning fails to retract or extend:

- Verify the One Touch key is in the **ON** position.
- The house battery cut off switch is in the **ON** position.
- The house battery voltage is at 12 Volts or above.
- Verify proper electrical connection from the awning motor to the side of the motorhome.

Emergency Retract Procedure:

If the One Touch awning fails to retract and proper DC voltages have been verified, the One Touch awning has two emergency methods of alternately retracting the awning.

1. Two exposed electrical studs are mounted externally at the forward end of the awning at the motor assembly. An alternate 12 Volt DC positive and negative supply may be applied to these connections. If awning fails to move, reverse the polarity of the alternate supply leads.
2. On the motor assembly, mounted externally at the forward end of the awning, is an opening. Insert a 9/64" Allen hex wrench. Using an electric drill, wind the awning to the retract position.

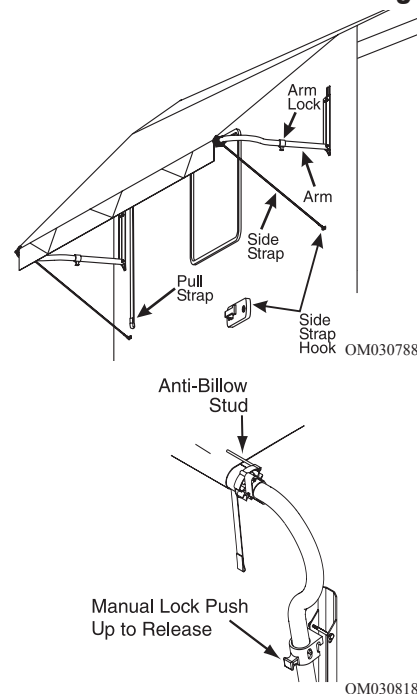


CAUTION: When using an alternate method to operate the awning, use extreme care to keep appendages, hair or loose clothing away from exposed rotating hardware.

The slide-out awning will automatically roll out with the slide room when it is extended. The slide-out awning retracts automatically and rolls up to the travel position when the slide-out is completely closed. When the slide room is extended, the awning can be rolled out completely as a window awning.

The slide-out awning has two devices to help prevent the awning from "billowing" while traveling. The first device is a pair of anti-billow studs, which are located above each end of the awning roller tube. If the awning catches wind and begins to billow, the awning metal wrap will contact the anti-billow stud. Levering downward the stud engages with a plastic gear preventing further unraveling of the awning material.

The second device uses two metal wind deflectors which are positioned just below the awning. This helps prevent side winds from scooping under the awning and unwinding the awning.

Slide-out Extendible Awning



CAUTION: The slide room and slide-out awning should be retracted during heavy wind or rain, as damage can occur to the awning or motorhome. Rain can be driven up under the slide-out awning and into the motorhome.



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

To Extend the Window Awning:

Follow the instructions for extending the slide room. Using the awning pull rod, unlock the travel latches located on the awning side arms. Find the center awning pull strap, located between the two metal wind deflectors. Use the awning pull rod to hook the pull strap loop. With a firm grip on the pull rod, pull down on the strap to extend the awning over the window. Secure the side straps on each end of the awning to the hooks provided on the motorhome.

To Retract the Window Awning:

Engage the end of the pull rod into loop on center pull strap. Pull on rod to relieve pressure on the side straps and remove straps from the hooks. Carefully allow the spring tension to wind the awning up. Do not allow the awning to snap back into position as this may damage the awning or the motorhome. Awning material should roll up evenly. Latch the awning side arm locks with the awning pull rod.

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.

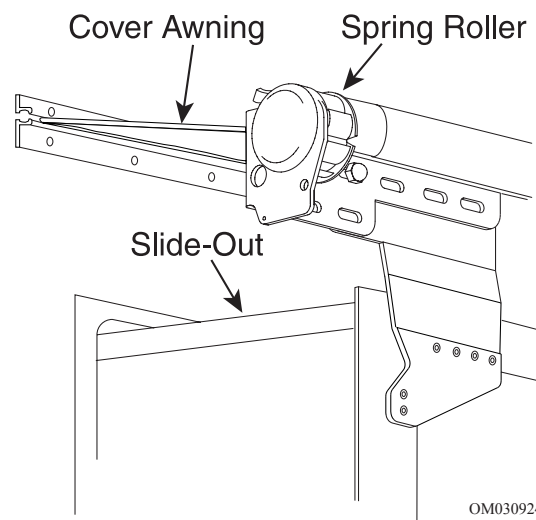


NOTE: Water may pool on top of the extended cover. As the slide-out is retracted, the water is removed when the cover retracts.

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.



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.

Awning Care & Maintenance

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.

Avoid leaving the awning partially extended during rainy conditions. The awning is at the strongest setting when the awning is fully extended.

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 rinsing. If water drips through the needle holes in the stitching use a commercial seam sealer which 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.

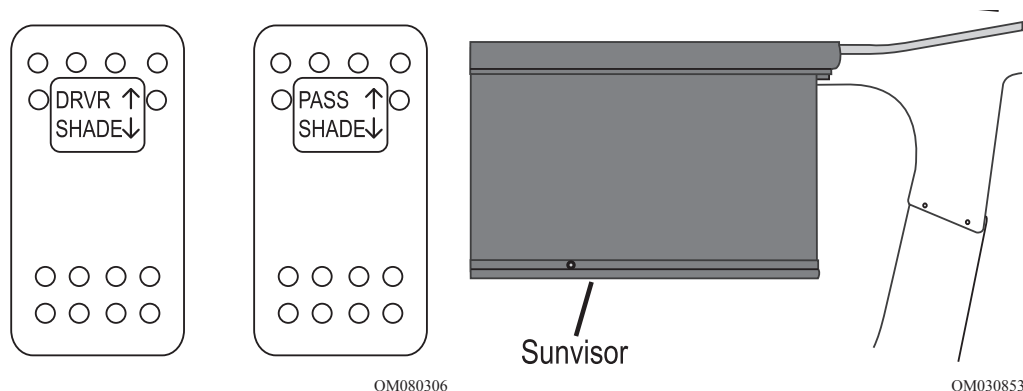
It is normal for slight leakage to occur through the fabric where water is allowed to accumulate or pocket on the fabric. See “Storm Precautions” for information on the awning settings for proper water drainage. Sometimes soap or chemical residue, such as from active agents in insect fog or sprays, can “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 Awning Magic 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. 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 made to withstand the 500 to 700 pounds that could accumulate. It is best not to subject the awning and the motorhome to the needless strain.

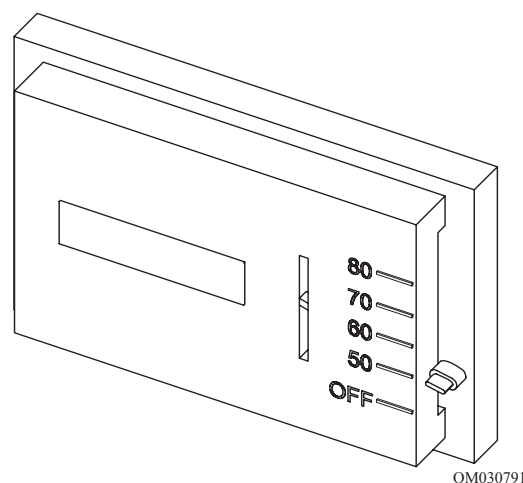
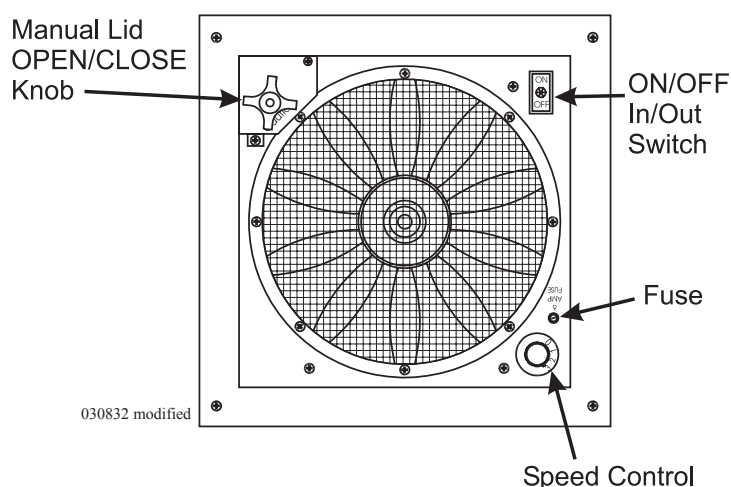
SUNVISORS

To extend the sunvisor press and hold the lower portion of the control switch until desired location is obtained. Once the desired point is obtained the sunvisor will remain in that position until changed. Retracting the sunvisor is the same as extending, except the upper portion of the switch is used. Cleaning the sunvisor should be done using a soft clean brush to remove dust.



The exhaust fan is a three-speed fan with a “0” or **OFF** position on the fan. The exhaust fan requires the presence of 12 Volt DC to operate. The fan will either pull in air or extract air from the motorhome depending on how the **IN/OUT** switch was set. The **IN/OUT** switch controls the direction of the fan rotation. There are three basic controls located on the ceiling vent fan. The knurled knob manually opens and closes the dome cover. The rotary knob selects the operating speed of the fan. When the dome cover opens approximately two inches, the fan motor begins to operate. During normal operations the knurled knob offers manual control of the dome cover for opening and closing.

FANS Galley Fan



To Operate the Fan:

- The Battery cut-off switch needs to be set **ON**.
- The wall-mounted thermostat is set for a desired temperature setting. The fan blades activate once the dome opens past approximately two inches. The dome will cycle down and up as interior temperature decreases and increases.
- The dome manually opens and closes using the knurled knob.
- Select the desired fan direction to **IN/OUT**.
- Select the desired fan speed on the Speed Control dial:

Zero = OFF

One = LOW

Two = MEDIUM

Three = HIGH



NOTE: Let fan come to a complete stop before changing fan direction.



NOTE: If the speed switch is in the "0" position the fan operates only as a vent.

Tips

- 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 either a blown fuse in the domestic fuse panel or the 6-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 airflow, especially on hot, sunny days. Close all the roof vents. The area between the open window(s) and the Fantastic Vent supplies the maximum airflow and providing the most comfort.



NOTE: Do not leave the vent cover open while the motorhome is stored or unattended for extended periods. High winds, other unusual conditions or obstructions may prevent closing. The resulting leakage could cause serious damage.

Bathroom Exhaust Fan (Optional)

The exhaust fan is a three-speed controlled fan with a zero or off position on the fan. The exhaust fan requires the presence of 12 Volt DC to operate. The fan will extract air from the motorhome. There are two ceiling vent fans. The knurled knob manually opens and closes the dome cover. The rotary knob selects the operating speed of the fan. When the dome cover opens approximately two inches, the fan motor begins to operate.

To Operate the Fan:

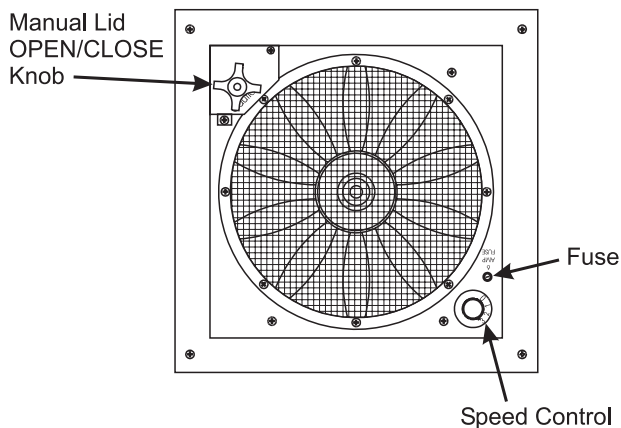
- The battery cut-off switch needs to be set ON.
- The fan blades activates once the dome opens past approximately two inches.
- The dome manually opens and closes using the knurled knob.
- Select the desired fan speed on the speed control dial:

Zero = OFF

One = LOW

Two = MEDIUM

Three = HIGH



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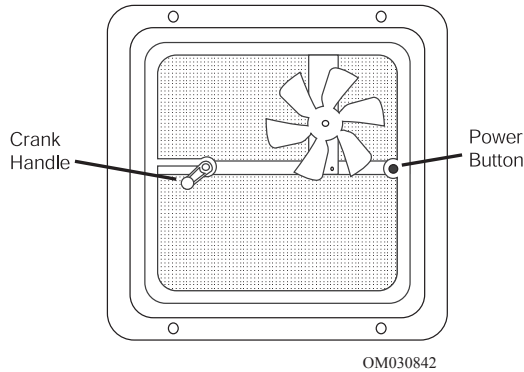
NOTE: If the speed switch is in the "0" position the fan operates only as a vent.

- 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 either a blown fuse in the domestic fuse panel or the 6-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, allow screen to air dry. 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 airflow, especially on hot, sunny days. Close all the roof vents. The area between the open window(s) and the Fantastic Vent supplies the maximum airflow and providing the most comfort.



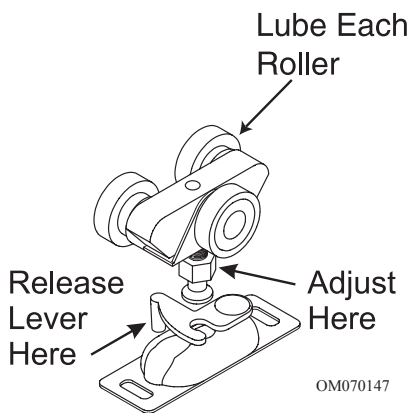
NOTE: Do not leave the vent cover open while the motorhome is stored or unattended for extended periods. High winds, other unusual conditions or obstructions may prevent closing. The resulting leakage could cause serious damage.

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, which is for ventilation only as it will not help cool the motorhome, can be 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.

DOOR-SLIDING



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. Locate the 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.



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.

SOFA BED CONVERSION

The sofa will convert easily into a bed. The sofa comes equipped with safety belts and these should be used if occupied during travel.

Sofa to Sleeper:

- Raise the sofa seat base until seat base and backrest form a “V” shape by lifting up from the center of sofa just below the seat cushions.
- Push down on seat base until the seat base and backrest are flat.
- Fold seat belts out of the way.
- Push down on seat base.

Sleeper to Sofa:

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

The sofa hide-a-bed will convert easily into a bed. Clear the area of obstruction and debris. The sofa comes equipped with safety belts to be worn if occupied during travel.

SOFA HIDE-A-BED CONVERSION

Sofa to Sleeper:

- Remove the three seat cushions to access the hide-a-bed. The seat cushions should be stored safely until the bed is converted back to a sofa.
- Release the lock on the right side of metal bar, grasp the front metal bar and lift up pulling out on the bar slightly until the leg of the bed is firmly resting on the floor.
- Fold seat belts out of the way.
- When the legs of the bed are firmly on the floor there will be another lifting bar exposed to complete the conversion process.
- Grasping and opening the lifting bar will open the bed fully. The bed is now ready for linen.

Sleeper to Sofa:

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

The sofa will convert easily into a bed. Clear the area of obstruction. The sofa comes equipped with safety belts and these should be used if occupied during travel.

ELECTRIC SOFA BED CONVERSION (OPTIONAL)

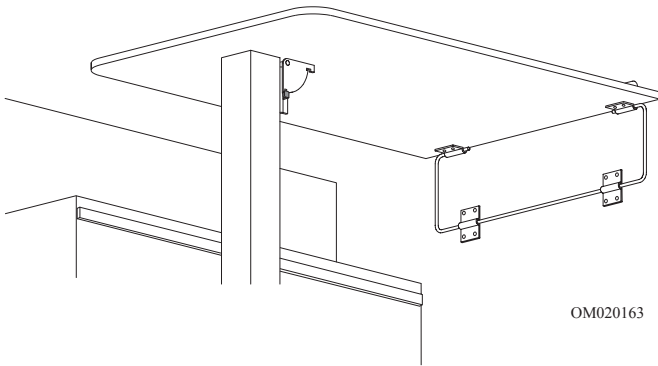
Sofa to Sleeper:

- Unlock latch at bottom center of sofa and pull bed extension frame out all the way.
- Lift bed extension cushion up and pull out all the way to lock into extension frame.
- Push switch on sofa arm to position back and bottom cushions flat against the bed extension cushion.

Sleeper to Sofa:

- Push switch on sofa arm so that back and bottom cushions are in the sofa position.
- Push in and down on the bed extension cushion to place cushion in stored position on frame.
- Push bed extension frame under sofa into locked position.
- Position seat belts for use.

DINETTE Bed Conversion (Optional)



- The booth dinette easily converts into a bed.
- Lift or remove the seat cushions to permit the table to swing down into position.
- With a firm grip, lift front edge of the table approximately six inches and push table leg lock to release the support leg.
- Swing the table leg up locking the leg into the 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.

Table Top Extension

- To extend and add table top leaf, unlock and slide table top all the way against stop.
- Lift leaf from storage compartment and place it on rails.
- Slide top and leaf against wall.
- Reverse procedure to store table top leaf.

Table Top Extension (Legless)

- To extend table, pull all the way out against stop.
- To store table, slide top all the way against the wall.

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 closing 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.

The super slide is an option that is available for use in the storage compartment bays of the motorhome. This allows for the pay-load to slide outward for easier access.

SUPER SLIDE (OPTIONAL)

- The motorhome must be level before opening.
- There are two latch releases: lift and hold up to release one, pull outward while pulling on the slide to release the other.
- Maximum weight capacity is 1,000 lbs. Never exceed this amount.



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

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, which 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.

ENTERTAINMENT SYSTEMS

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. Easy Setup procedures provide the flexibility to quickly adapt the configuration for RV usage.

Video Cassette Recorder (VCR) (Optional)

The remote control color television located above the pilot seat has lock-out circuitry. Simply stated, the ignition switch controls the front TV power outlet. Only with the ignition OFF will the front TV operate. No other television set will be affected by the lock-out circuitry. 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 front TV from the inverter depends on the state of charge of the house batteries and any additional 12 Volt DC circuitry which is being operated.

Television (Front) With Lock-out Feature

Television Antenna

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 turning on the boost switch in the passenger front overhead cabinet. 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 a 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 result one sees in the television picture is a double image. The antenna will receive a signal from the initial pass, 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:

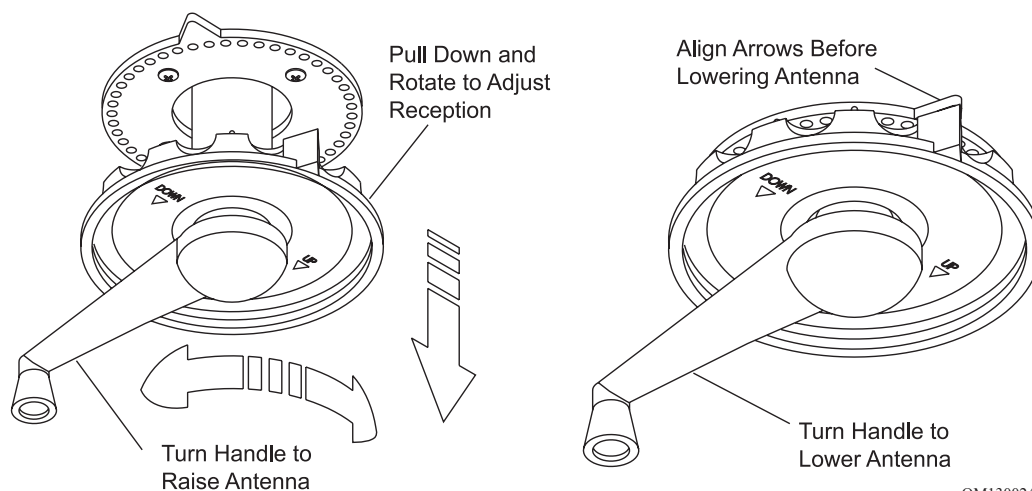
- Rotate the crank handle clockwise to raise the antenna (it is approximately 14 ½ turns).
- Pull down on the outside directional wheel and rotate the antenna until the best picture is obtained. The directional wheel is spring loaded.



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 gear or worm breakage may result.

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.

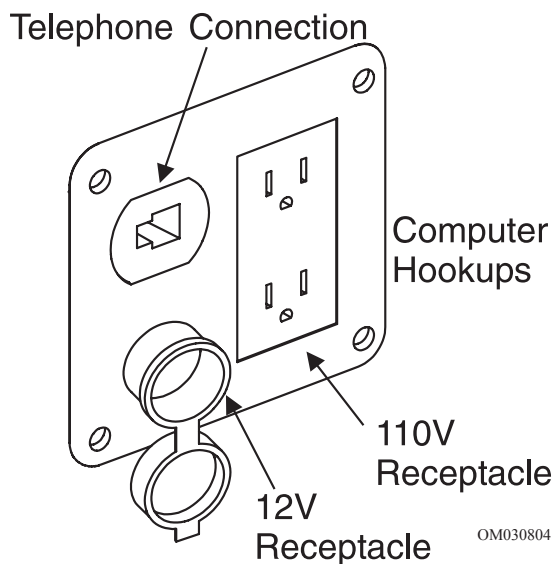


Troubleshooting the Coax Wire:

Weak or no picture can indicate a possible shorted or open coax. The coax cable is made of two conductors. A center conductor which is usually copper and the ground which is woven or braided aluminum. The "die-electric" insulating material separates the two conductors. The ground and center conductors are to remain electrically separate from one another. When installing a metal end onto a coax cable, use care so none of the woven ground strands comes in contact with the center conductor. A continuity tester is required to test a suspected fault in a coax wire. Unscrew both ends of the suspected bad coax run, with the continuity tester check between the center conductor and the outside threaded ring. If continuity is present, the coax is shorted. To test for an open connection of a particular coax run use one test lead and touch the threaded end of the coax. With the other test lead, touch the threaded ring at the opposite end. Continuity should be present. Perform the same test procedure on the center conductor. Proper electrical coax operation should indicate continuity from the center conductor at one end to center conductor at other end. Continuity should be present between each coax terminal end. There should be no continuity between the terminal end and center conductor. Though damage does not usually occur from a shorted or open coax cable, picture quality is compromised.

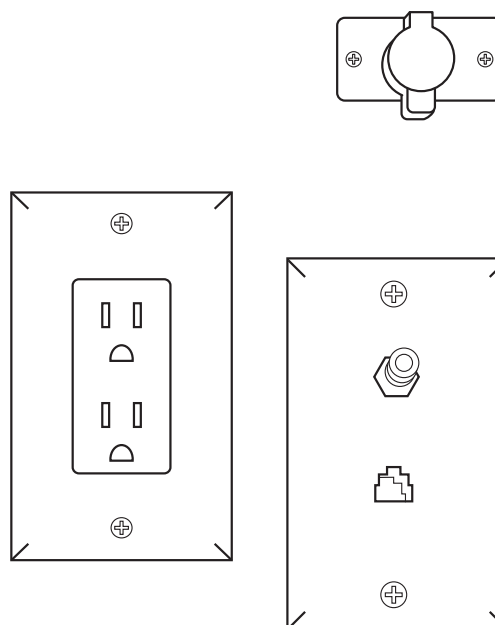
**Hook-ups - TV Cable,
Computer &
Telephone**

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
Hook-up - Exterior**

Provided for convenience in the passenger bay are entertainment connections. These include telephone jack, cable TV hook-up, a 12 Volt DC utility outlet and 120 Volt AC electrical outlet.

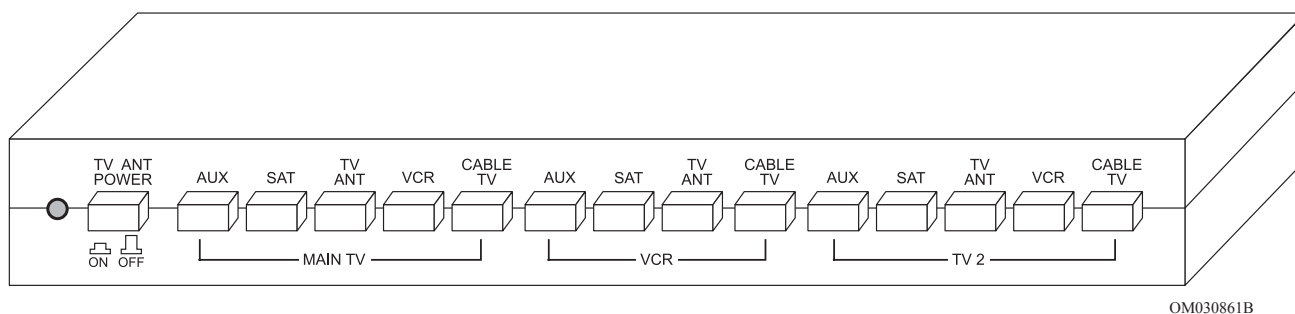


The motorhome is equipped with a video selector box which has five inputs and three outputs.

Video Selector Box

Features Include:

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



To Watch TV Using Antenna:

To view signals from an amplified TV Antenna, first press the TV antenna **POWER** button to the **ON** position. This provides +12 Volt power to the TV antenna amplifier located inside the antenna housing. To view the TV antenna signal on the main TV, simply press the **TV ANT** button located above the area marked “MAIN TV.” Follow the same procedure for TV 2. Turn TV ON and select channel.



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 degraded and you are not using an external power supply, try turning the TV Antenna Power button on the control box OFF and ON.

To Watch TV Using Cable Signal:

To view Cable TV signals on your main TV, press the **CABLE TV** button above the area marked “Main TV.” Follow the same procedure for TV 2. Turn TV **ON** and select channel.



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

To Watch TV using Satellite Signal:

To view Satellite signals on the main TV, press the **SAT** button above the area marked "Main TV." Follow the same procedure for TV 2. Turn TV ON and select channel 3. Use Satellite receiver to select channels.

To Watch TV using VCR Signal:

To view VCR signals on the main TV, press the **VCR** button above the area marked "Main TV." Follow the same procedure to TV2. Turn TV ON and select channel 3. Turn VCR ON and insert video tape to view.

To View Auxiliary Components using TV:

To view Auxiliary signals, such as game consoles, camcorder, etc., on the main TV, press the **AUX** button above the area marked "Main TV." Follow the same procedure for TV 2.

Recording Using VCR:

To record programming from the Antenna, Satellite Receiver, Cable TV or Auxiliary, simply press the appropriate button above the section marked VCR.

- To record programming from the TV Antenna to the VCR, press the **TV ANT** button above the VCR section on the switch box.
- To record programming from the Satellite Receiver to the VCR, press the **SAT** button above the VCR section on the switch box.
- To record programming from an Auxiliary device to the VCR, press the **AUX** button above the VCR section on the switch box.
- To record programming from an Cable TV to the VCR, press the **CABLE TV** button above the VCR section on the switch box.



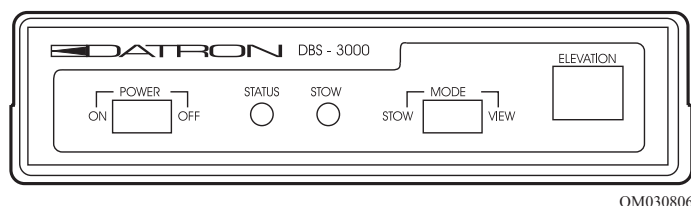
NOTE: To view Cable TV signals, you must be connected to a Cable TV input on the outside of the motorhome. Cable TV inputs are available at many of today's campgrounds.

Satellite System - DSS Prewire

The motorhome is prewired for a roof mount DSS System. The prewire will consist of a $\frac{3}{4}$ " flexible conduit, which will run from the front overhead to a spot marked on the roof. A telephone hook-up will also be provided for Pay Per View accessibility.

The satellite system (optional) is offered by Direct Satellite Services. The dish raise or stow function is controlled by the Antenna Control Unit (ACU).

Satellite System - DSS (Optional)



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DSS Satellite System requires both AC & DC power sources to operate:

- 12 Volt DC, house battery cut off switch must be **ON**.
- 120 Volt AC, hooked to shore power, start the generator or turn on the inverter.

If the dish elevation angle is unknown, determine angle as shown below:

To Set Angle:

Satellite receiver must be **ON**. Using the DSS remote, press the **MENU** button. Use cursor to select **ANTENNA**. Push **SELECT** button to enter. Select **ANTENNA LOCATION**; push **SELECT** button to enter. Select either **ZIP CODE** or **LONGITUDE and LATITUDE** settings to determine correct dish elevation setting for the viewing region. Enter elevation angle on ACU. Press **EXIT** to return to standard viewing.

To View:

- Set the satellite dish elevation angle.
- Turn the ACU (Antenna Control Unit) **ON**, then select **VIEW**. The satellite dish will raise. Allow 30 seconds for the dish to acquire satellite feed.
- Turn the Satellite Receiver **ON**.
- Using the Video Selector Box, press the **SAT** button above the area marked "Main TV." Follow the same procedure for TV 2. Turn TV **ON** and select channel 3. Use Satellite receiver to select channels.

Home Theatre Stereo System DVD Player (Optional)

The Digital Video Disc Player is located in a compartment above the driver's seat. There are several speakers located throughout the cockpit and living room areas. The DVD player operates from 120 Volt AC powered from the house electrical system. The home theater stereo system and DVD player will only operate through the front TV. The DVD player video output is connected to the front TV video input. The front TV audio output is connected to the DVD player audio input.

Operation

To Operate Any Component:

- Hook to shore power, start the generator or turn on the inverter.
- The battery cut-off switch must be ON and the house batteries charged.



NOTE: These instructions are a quick start guide and are not a replacement for the individual component manuals.

To Watch TV with Surround Sound:

- Turn front TV ON. Using video selector box, press **TV ANT** or **CABLE TV** button. Raise antenna or connect to outside cable input.
- Select channel. Turn TV volume to a low level.
- Turn ON Stereo System DVD player and push **SELECTOR** button to Video 1.
- Adjust the sound level with stereo system remote.

To Play a Video Tape on TV with Surround Sound:

- Turn front TV ON and select channel 3. Using video selector box, press **VCR** button.
- Turn ON VCR and insert video tape.
- Press **PLAY** on the VCR. Turn TV volume to a low level.
- Turn ON Stereo System DVD player and push **SELECTOR** button to Video 1.
- Adjust the sound level with the stereo system remote.

To Play a DVD on TV with Surround Sound:

- Turn ON Stereo System DVD player and push **SELECTOR** button to DVD.
- Turn front TV ON and set to channel 3.
- Insert DVD into player and press **PLAY** on the remote. Turn TV volume to a low level.
- Adjust the sound level with DVD remote.

To Watch Satellite TV with Surround Sound:

- Turn the Antenna Control Unit ON, then select **VIEW**. The dish will raise. Allow 30 seconds for the dish to acquire satellite feed.
- Turn the Satellite Receiver ON.
- Set the satellite dish elevation angle if not already done.
- Turn front TV ON and select channel 3. Using video selector box, press **SAT** button. Turn TV volume to a low level.
- Turn ON Stereo System DVD player and push **SELECTOR** button to AUX.
- Adjust the sound level with the stereo system remote.

To Play the Radio or CD Through the Surround Sound System:

- Turn ON Stereo System DVD player.
- For Radio, push **SELECTOR** button to TUNER and tune to desired station.
- For CD, push **SELECTOR** button to DVD and press **PLAY**.
- Adjust the sound level with the Stereo System remote.

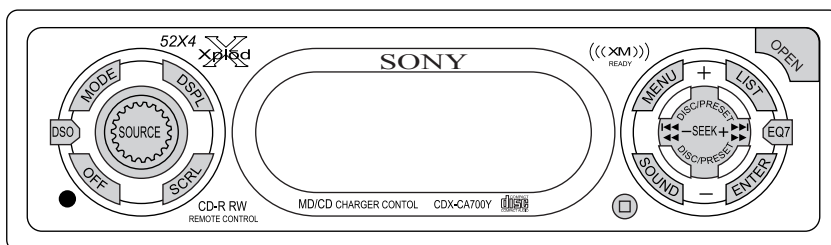
The dash radio will control the multi-functions for the dash audio. The front panel provides anti-theft protection. The tuner holds up to 18 preset FM stations and 12 AM stations. Other features include an Equalizer, Loudness control, a 12 hour Digital Clock and Autoseek Tuning. The radio power can be turned ON/OFF from the Power button on the unit or from a remote source. A remote control is supplied with radio for ease of operation.

RADIOS
- Dash**Operation:**

- Turn ON the house battery cut-off switch located at the entry door.
- Turn ON the radio **POWER** switch on the dash panel.
- To turn the radio ON, push the **SOURCE** button.
- To turn the radio OFF, push and hold the **OFF** button for approximately two seconds.
- Press the **OPEN** button to access CD slot.
- To change between the tuner and CD mode: With CD installed push the **SOURCE** button.



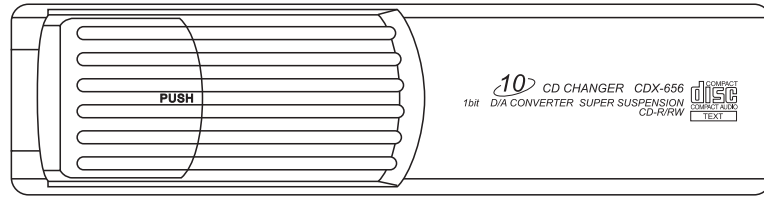
Additional and detailed information for the dash radio functions and operations can be found in the Owner's Information File Box.



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10 Disc CD Changer

The 10 disc changer is operated by the dash radio. To load a CD, slide the cover to the right, push the CARTRIDGE RELEASE button and remove the cartridge. Load CD into the cartridge and reinsert the cartridge into the changer. Close the cover. Consult radio Owner's Manual for procedure to operate the changer.



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Additional and detailed information for the dash radio functions and operations can be found in the Owner's Information File Box.

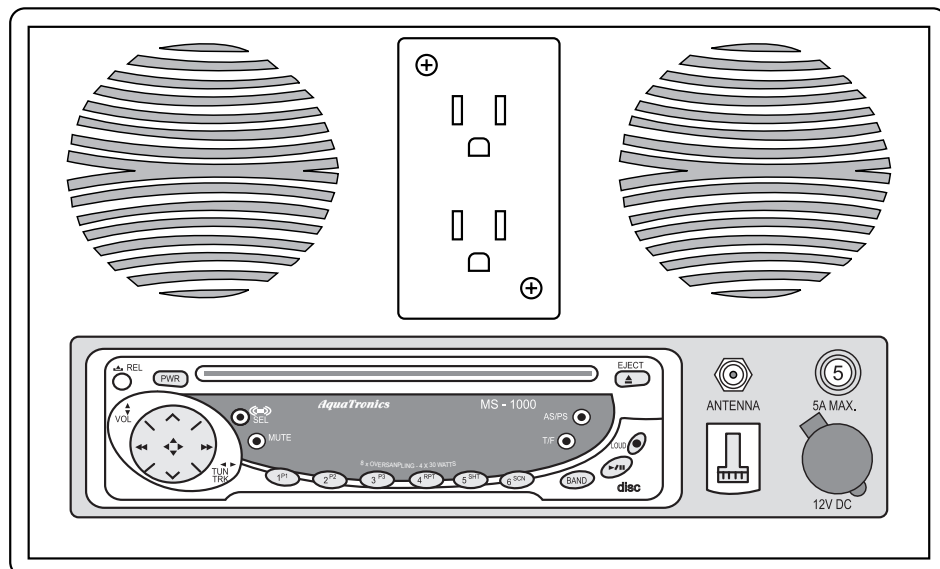
Citizens Band Radio - Prewire

A two pin connector labeled Citizens Band Radio is located behind the dash panel. It is taped along with the CB Antenna coax, which is routed to the roof mounted base. The red wire is at 12 Volt DC and is fused at two amps through the front distribution panel. The white wire is connected to the frame.

EXTERIOR ENTERTAINMENT CENTER (OPTIONAL)

The entertainment center has a AM/FM marine stereo radio with two speakers. The stereo has conformal coated circuit board to withstand salt air and humidity along with UV stable detachable control panel and electronic tuner.

Included are 12V DC, 120V AC antenna receptacles. The locking cover should be closed and locked when the entertainment center is not in use.



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Function of Features:

- **ON/OFF POWER BUTTON (PWR)** - Press this button to turn the unit on or off.
- **VOLUME/LEVEL CONTROL (VOL)** - To increase the volume level, press the up arrow button. To decrease the volume level, press the down arrow button.
- **SELECT BUTTON (SEL)** - This button is used to select the audio function (volume, treble, bass, balance, or fade) to be adjusted using the Level Control. Pressing the Select button once will set the unit for volume adjustment (“VOL” will appear on the display panel). Pressing the button additional times will select treble (“TRE” on the display), bass (“BAS”), balance (“BAL”), fader (“FAD”) or volume (“VOL”).
- **AUDIO SETTING MEMORIES (P1/P2/P3)** - Three pre-set buttons are provided on this unit to store desired audio level positions into memories which can be easily recalled. To set any of the 3 audio memories, use the following procedure:
 1. Use the Select button and Level control to adjust the setting of the volume, treble, bass, balance and fader to the desired positions.
 2. Press the Select button to call any of the audio functions on the display. Within 2 seconds of pressing the Select button, and while the audio function is still on the display panel, press the pre-set button (1 through 3) to be set and continue to hold it in. After approximately 2 seconds, the pre-set number (“P-1”, “P-2”, or “P-3”) will appear on the display panel indicating that the audio levels are now set into that memory position. The settings can be recalled at any time by pressing the Select button and then that pre-set button within 2 seconds.
- **AUDIO MUTE (MUTE)** - This button is used to mute the volume from the system. By pressing the button, the indication “MUTE” will appear on the display panel and the volume will be muted. Pressing the Mute button again will return the volume level to the setting in use before the Mute function was activated.
- **AM/FM BAND SELECTOR (BAND)** - During radio operation, each momentary press of this button will change the radio band. The indication “AM1”, “AM2”, “FM2”, or “FM3” will appear on the display panel according to your selection.

- **MANUAL UP/DOWN TUNING & AUTOMATIC SEEK TUNING (TUN)** - Each time the right arrow button is tapped, the radio will tune one frequency step higher. Similarly, each tap of the left arrow button will tune one frequency step lower. To manually tune in a station, tap the button of the appropriate direction until the desired frequency is reached.
Pressing either button for longer than 0.5 seconds and then releasing will activate the Automatic Seek Tuning function. The radio will seek the next available station and stop at the frequency. The Seek function can be stopped by pressing the button again or activating any other tuning function.
- **AUTO-STORE TUNING (AS) & PRE-SET SCAN TUNING (PS)** - During radio operation, press this button momentarily to scan the 6 stations pre-set into the memories of that band. The unit will stop at each pre-set station for 5 seconds before continuing to the next pre-set station. Press the button again momentarily to stop Pre-Set Scan operation and remain on the selected frequency. Pressing the button for longer than 2 seconds will activate the Auto-Store Tuning feature which will automatically scan the band and enter up to 6 strong stations into the 6 pre-set memories.
- **STATION PRE-SET MEMORIES** - To set any of the 6 pre-set memories in each band, use the following procedure:
 1. Turn the radio on and select the desired band.
 2. Select the first station to be pre-set using the Manual Up/Down or Automatic Seek Tuning controls.
 3. Press the pre-set button to be set and continue to hold it in. After approximately 2 seconds, the pre-set number will appear on the display panel, indicating that the station is now set into that pre-set memory position. The station can now be recalled at any time by pressing that button.
 4. Repeat the above procedure for the remaining 5 pre-sets on that band and for the other 4 bands on the unit.
- **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 (TRK)** - 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 SELECTOR (II)** - 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 (RPT)** - 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.
- **SHUFFLE PLAY SELECTOR (SHF)** - During disc play, press this button to play the tracks on the disc in a random shuffled order ("SHF" will appear on the display panel). The Shuffle Play mode can be cancelled by pressing the button again.
- **TRACK SCAN (SCN)** - During disc play, press this button to play the first 10 seconds of each track on the disc ("SCN" will appear on the display panel). When a desired track is reached, press the Scan button again to cancel the function and play of the selected track will continue.
- **DISC EJECT (UP ARROW)** - Disc play is stopped, the disc is ejected and the unit will change to radio operation by pressing this button.
- **TIME/FREQUENCY SELECTOR (T/F)** - This unit can be set so that either the clock time or radio frequency/CD player functions will normally appear on the display panel. Pressing the Time/Frequency Selector button when the radio frequency or CD player track indication is shown will change the display to show the time. Pressing the Time/Frequency Selector button will change the display to show the radio frequency/CD player indication.
- **FRONT PANEL RELEASE BUTTON** - This button is used to release the mechanism that holds the front panel to the chassis. To detach the front panel, press the button so that the left side of the panel is released. Grasp the released side and pull it off the chassis. To re-attach the panel, position the right side of the panel in place first and then press the left side of the panel until the mechanism locks it into place.

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Endeavor

SECTION 6 WATER SYSTEMS

INTRODUCTION	195
MONITOR PANEL	195
MEASUREMENT & CALIBRATION	195
SERVICE CENTER	196
WATER TANK - FRESH FILL	196
WATER TANK - FRESH GRAVITY FILL	197
WATER - CITY HOOK-UP	197
WATER PUMP	198
WATER PUMP TROUBLESHOOTING	199
WATER FILTER	200
WATER SYSTEM	200
TROUBLESHOOTING	200
FAUCET SCREENS	200
DISINFECTING FRESH WATER	201
TANK CAPACITIES - CHART	202
WASTE WATER SYSTEMS	202
PROPER WASTE DISPOSAL	202
WHAT NOT TO PUT INTO THE HOLDING TANKS	203
WASTE DRAIN & SEWAGE TANKS	203
WASTE DRAIN HOSE	204
WHAT TO PUT INTO THE HOLDING TANKS - BLACK ...	205
WHAT TO PUT INTO THE HOLDING TANKS - GREY ...	205
BLACK TANK FLUSH	205
TOILET	207
THETFORD OPERATING INSTRUCTIONS	207
TROUBLESHOOTING	208
CLEANING	208
MAINTENANCE	208
SEALAND OPERATING INSTRUCTIONS	209
TROUBLESHOOTING	210
CLEANING	211
DRAIN TRAPS & AUTO VENTS	212
COLD WEATHER USE	212
COLD WEATHER PACKAGE (OPTIONAL)	212
STORAGE - COLD WEATHER	214
WINTERIZING	214
USING AIR PRESSURE	214
USING NON TOXIC ANTIFREEZE	216

This section contains information and knowledge for the operation and care of the various water systems found in the motorhome. The motorhome is equipped with a fresh water system and a waste water system. 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 everyday. Newcomers to a self-contained motorhome soon discover water does not last very 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: fresh water tank, water pump, pressure accumulator tank, Manabloc Plumbing Manifold, gravity fill connection, water filters and a city/fresh water connection.

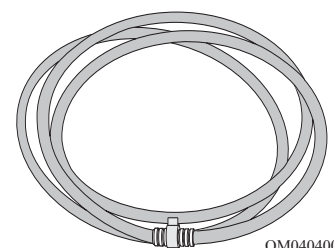
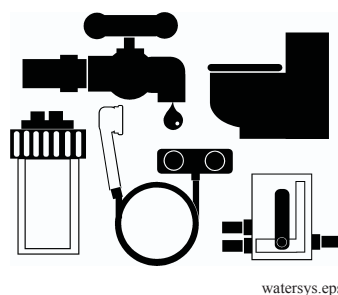
Blue tubing is used for all cold water lines throughout the motorhome. Red tubing is used for all hot water lines throughout the motorhome.

Use a water hose that is marked for potable water use only. Care of the hose is a must. **After each use, drain the water hose and coil the hose neatly. Attach the ends together to keep dirt, debris and insects out of the hose.**

Waste Water System:

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

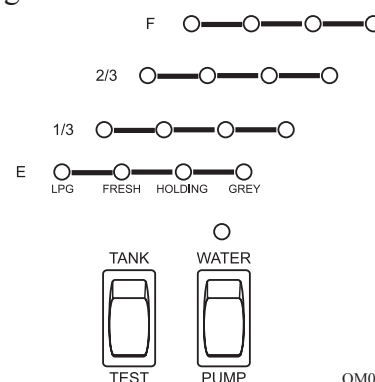
WATER SYSTEMS - INTRODUCTION



The motorhome is equipped with a monitor panel to aide in managing the storage tanks. The monitor panel will be located in a main Status Monitor Panel in the overhead compartment above the entry door. 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:

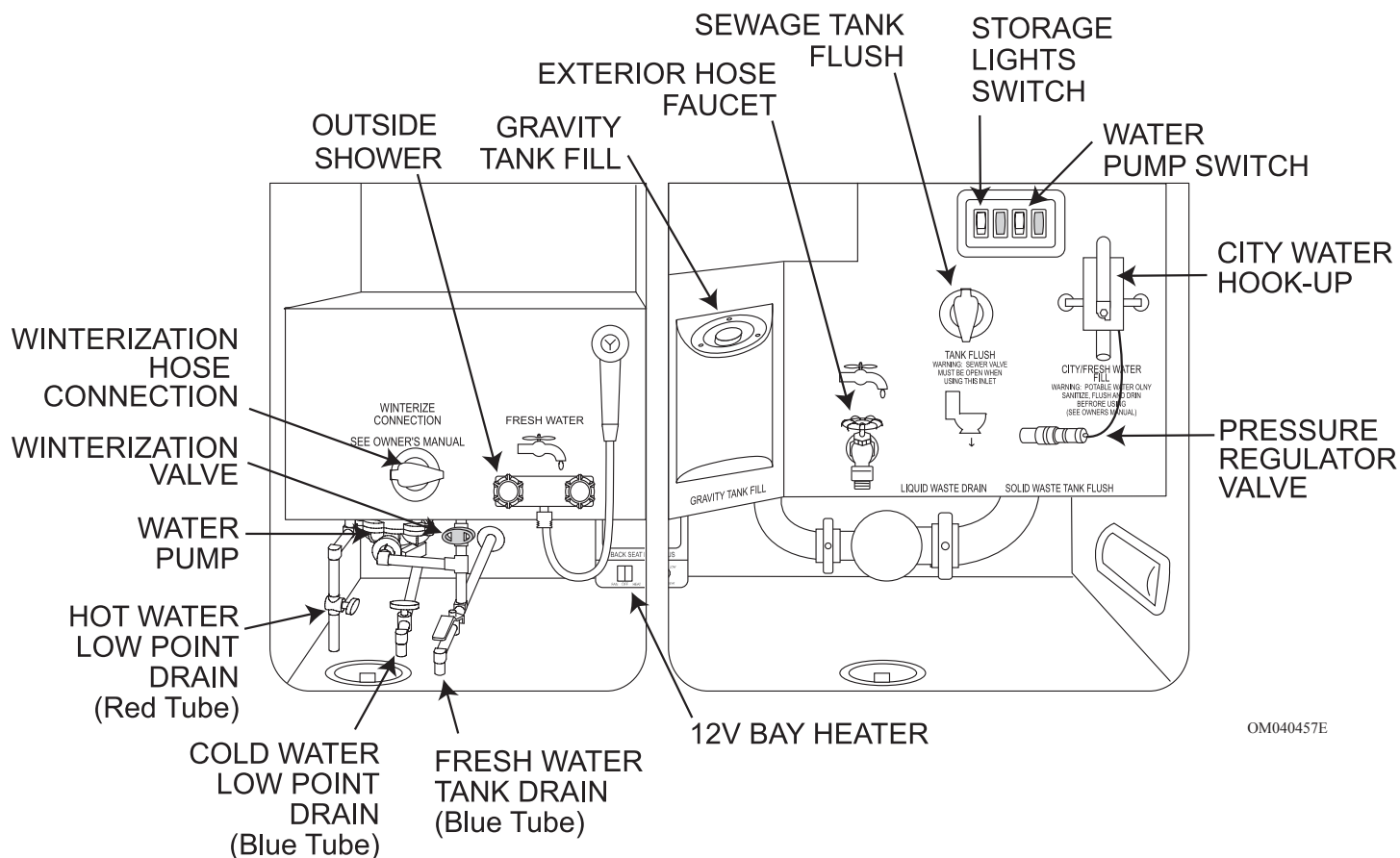
- Green lamps indicate good or normal ranges.
- Amber lamps indicate fair or partial ranges.
- Red lamps indicate full or empty ranges (depending on the scale), which are in the critical range.

MONITOR PANEL Measurement & Calibration



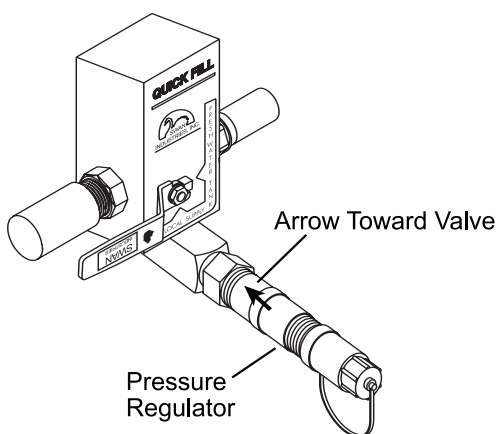
SERVICE CENTER

The service center water controls are used for performing all tasks pertaining to water usage in the motorhome. Service center is located in an outside compartment of the motorhome.



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WATER TANK - FRESH FILL



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1. Check to make sure the fresh water tank drain valve, located on roadside in the service center, is in the closed position.
2. Connect the hose labeled for potable water to the water source. Install the provided pressure regulator on the fill valve. Arrow on regulator must be pointed toward valve. On a hot day the hose may expand and burst from water pressure within the water hose.
3. Remove white plug in the end of the pressure regulator.
4. Connect the water hose to the pressure regulator inlet.
5. The fill valve should be in the Fresh Water Tank position.
6. Turn on the water at the water source. The water should be audible as the fresh water tank fills.

7. Locate the monitor panel. Locate the switch marked test. The switch is a momentary switch that requires the switch to be held in position while testing the level in the fresh water tank. Read the scale as the fresh water tank is filling. When the 2/3 tank light illuminates it should not take much longer to finish filling the tank. Do not leave coach unattended while filling the fresh water tank. The light marked “F” should start to blink as a warning that the fresh water tank is almost full. Return to the service center. When the fresh water tank is full water will come out an overflow vent above the gravity fill cap.
8. Turn off water supply as quickly as possible.
9. Return fill valve handle to “local supply.”

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

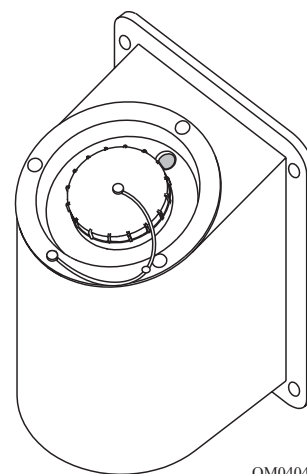
Filling the Tank:

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



NOTE: When filling tank do not leave hose unattended.

WATER TANK - FRESH GRAVITY FILL

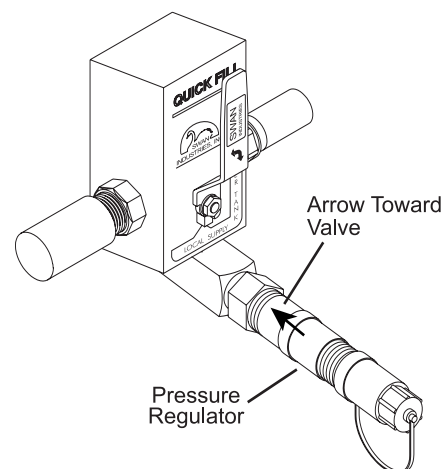


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When connecting the motorhome to fresh water, use a hose manufactured and labeled for potable water to ensure that the hose will not flavor the water.

1. Install the provided pressure regulator on the fill valve. Arrow on regulator must be pointed towards valve.
2. Remove white plug from the end of the pressure regulator.
3. Connect water hose to the city water inlet.
4. Valve handle should be in the local supply position.
5. Turn on water at water source.
6. The water pump can either be in the OFF position or in the ON position. It will not affect the water pump to leave it on.
7. Open each faucet, one at a time, to rid any trapped air inside the pipes.

WATER - CITY HOOK-UP



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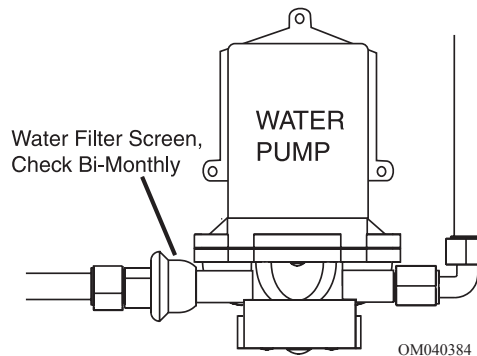


CAUTION: Some water sources develop high water pressure, particularly in mountainous regions. High water pressure is anything over 55 psi (pounds per square inch). Excessive water pressure may cause leaks in water lines and/or damage the water heater.

WATER PUMP

The water pump is used to pressurize the fresh water system when it is not connected to city water. The water pump is totally automatic and self-priming, operating on demand as water is used.

The water pump is located in the outside control compartment of the motorhome.



WARNING: Before leaving the coach for extended periods of time (i.e. overnight or longer) be sure that the city water and all water pumps have been turned off. Damage from neglect will be responsibility of the owner and not the manufacturer.

To operate the water pump, push the switch to ON. The light indicates the water pump is on. The remote switches are located in the bathroom and on the outside water control panel.

Do not allow the pump to run when the fresh water supply tank is empty. Continued operation with a dry tank may open an electrical circuit and/or damage the water pump.

To Start Pump After Unhooking City Water Supply or First Time use Proceed as Follows:

- Fill the fresh water tank.
- Open all valves and faucets except the drain valves. This includes hot and cold water valves, all faucets and the shower.
- Turn the water pump on. Wait for the water lines and the hot water tank to fill.
- Close each faucet when it delivers a steady stream of water (cold water faucets first).

Vibration induced by road conditions can cause the plumbing or pump hardware to loosen. Check for system components that are loose. Many symptoms can be resolved by simply tightening the hardware. Check the following items along with other particulars of the system.

The Water Pump Will NOT Start/Blows the Circuit:

- Check the electrical connections, fuse, breaker, main switch and ground connection.
- Is the motor hot? The thermal breaker may have triggered. It will reset when cool.
- Is the voltage present at the switch? Bypass the pressure switch.
- Does the pump operate? Check the charging system for correct voltage and check the pump for the proper ground connection.
- Look for an open or grounded circuit or motor.
- Check for seized or locked diaphragm assembly (water frozen).

The Water Pump Will NOT Prime/Sputters (No Discharge/Motor runs):

- Is the strainer clogged with debris?
- Is there water in the tank, or has air collected in the hot water heater?
- Is the inlet tubing/plumbing sucking in air at plumbing connections (vacuum leak)?
- Check for proper voltage with the pump operating.
- Look for debris in the pump inlet/outlet valves or dry/swollen valves.
- Check the pump housing for cracks or loose drive assembly screws.

The Water Pump Will NOT Shut-off/Runs When the Faucet is Closed:

- Make sure the fresh water tank fill valve is completely closed.
- Check output side (pressure) plumbing for leaks and inspect for a leaky toilet or valves.
- Look for loose drive assembly or pump head screws.
- Are the valves or the internal check valve held open by debris or is the rubber swollen?

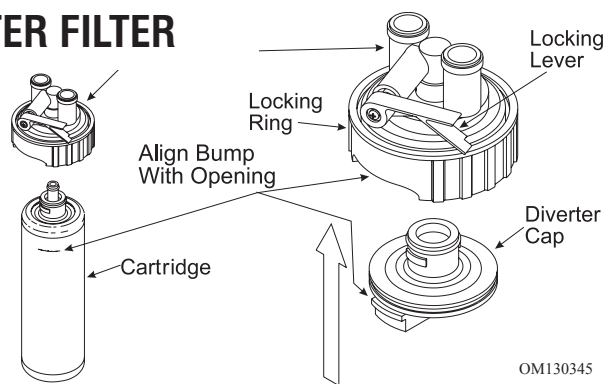
The Water Pump is Noisy or Rough in Operation:

- Check for plumbing which 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 (three long screws).
- Is the motor with the pump head removed? Is noise coming from the motor or pump head?

The Water Pump is Rapid Cycling:

- Look for restrictive plumbing/flow restrictors in the faucets or shower heads.

WATER FILTER



The water filter is located under the galley sink. It may have been installed without the cartridge placed in the unit. The unit's ADC Cartridge can easily be installed by following the instructions on the cartridge wrapper. A fresh replacement cartridge is needed when the flow of water from the faucet is restricted. The life of the filter will vary depending on the condition of the unfiltered water and the quantity used.

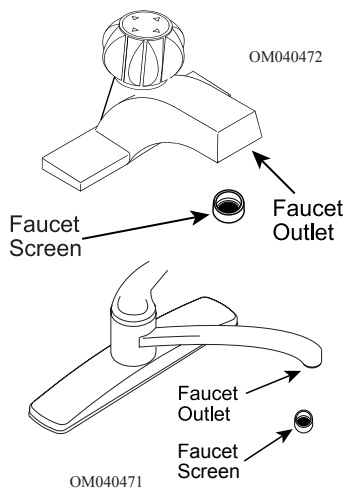
Each time water passes through the water filter, dirt particles are trapped and held in the tiny pores of the micro-pure coating on the filtering element within the cartridge. As the cartridge actively removes the impurities from the water its microscopic pores fill up and the amount of water flowing from the cartridge gradually lessens. When the flow of water from the water filter becomes too slow for convenience it should be serviced. If the cartridge is not changed, the flow will eventually stop entirely. Even if the cartridge does not indicate its need to be changed, change it at least once a year for reliable performance from the purification system.

WATER SYSTEM - Troubleshooting

Water system problems and leaks usually fall into two categories: system problems and problems caused by improper use or lack of attention. These problems usually stem from improper winterizing, poor maintenance, road vibration and campsite water pressure variations.

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. Be sure the tank drain valves are closed. If the system continues to leak take the motorhome to an authorized dealer for service.

Faucet Screens



Fresh water sources will vary by location. Build up lime deposits or debris on the faucet screens will restrict or plug the flow of water coming from the faucets. All faucet screens should be checked and cleaned every two weeks of use.

- Faucet screens are normally located on the outlet side of the faucet and held in place with a threaded collar.
- Remove screen from faucet.
- Clean screen using a small soft brush and a de-liming solution.
- Reinstall screen and check water flow.

Disinfecting the water system with chlorine bleach (superchlorination) protects you and your family from bacteriological or viral contamination from any common water source.

Disinfect the 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 prepared solution may be desired to perform this task. The gravity fill may also be used to perform the task. Remove cap off the gravity fill. Add the solution to the fresh water tank. When finished, secure the gravity feed cap.

Use Following Procedure to Disinfect Water System:

- Prepare a chlorine bleach solution using 1 gallon water and $\frac{1}{4}$ cup of chlorine bleach. Use 1 gallon of solution for every 15 gallons of tank capacity. 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) residual in the water system, and acts as a quick-kill dosage for harmful bacteria, viruses and slime-forming organisms. Concentrations higher than 50 ppm may damage the water lines and/or tanks.
- Turn the water pump OFF.
- Drain the fresh water tank. Water tank drain is located in the outside water control compartment. Close the drain and pour the solution into the fresh water tank using the gravity fill and a funnel.
- Turn the water pump ON. Open each faucet, in turn, and run the water until you smell a distinct chlorine bleach odor. Do not forget the hot water, tub and shower faucets.
- Allow the system to stand for four hours.
- Drain the system and flush with fresh water. The water tank and low point drains are located in the outside water control compartment. Flush with fresh water repeatedly, until the water system no longer smells or tastes like chlorine bleach.

TANK CAPACITIES - CHART

MODELS	34PBD	36PBD	36PST	38PBD	38PBDD	38PST	40PBD	40PBDD	40PWD	40DST	40PST	40PDT
Water Heater	10 gal.	10 gal.	10 gal.	10 gal.	10 gal.	10 gal.	10 gal.	10 gal.	10 gal.	10 gal.	10 gal.	10 gal.
Grey Tank	60 gal.	60 gal.	60 gal.	60 gal.	60 gal.	60 gal.	60 gal.	60 gal.	60 gal.	60 gal.	60 gal.	60 gal.
Black Tank	39 gal.	39 gal.	39 gal.	39 gal.	39 gal.	39 gal.	39 gal.	39 gal.	39 gal.	39 gal.	39 gal.	39 gal.
Fresh Tank	100 gal.	100 gal.	100 gal.	100 gal.	100 gal.	100 gal.	100 gal.	100 gal.	100 gal.	100 gal.	100 gal.	100 gal.
Fuel Tank	100 gal.	100 gal.	100 gal.	100 gal.	100 gal.	100 gal.	100 gal.	100 gal.	100 gal.	100 gal.	100 gal.	100 gal.
LP Tank*	38 gal.	38 gal.	38 gal.	38 gal.	38 gal.	38 gal.	38 gal.	38 gal.	38 gal.	38 gal.	38 gal.	38 gal.

* Actual filled LP capacity is 80% of listing due to safety shut off required on tank.

This chart reflects product specification available at the time of printing. Therefore any floor plans thereafter may not be reflected in the chart. All other information contained throughout the manual will still apply.

WASTE WATER SYSTEMS - Proper Waste Disposal

Most State Parks have strict regulations about discharging wastes except into authorized disposal systems. 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 of the modern rest areas along the interstate now have dump stations available. You will find a list of dumping stations from coast to coast in 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. Some major oil companies offer dump facilities at selected stations. With a little planning you will find few inconveniences in proper and legal disposal of holding tank waste.

- Do not use strong or full strength detergents to deodorize and disinfect. Use odor control chemicals made especially for holding tanks.
- Do not put automotive antifreeze, ammonia, alcohol or acetone in holding tanks. Some chemicals will dissolve plastic.
- Do not put large table scraps in the tanks. They could stick in or damage the valve seals.
- Do not flush facial tissues, sanitary napkins or other non-dissolving items into the system. Chemically treated for strength, the tissue will not dissolve like toilet paper. Special holding tank tissue is available at most RV supply stores. White toilet paper dissolves faster than colored paper.

What Not to Put into the Holding Tanks

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.



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.

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 systems. The wastewater holding system consists of a wastewater holding tank (grey tank). The grey water tank stores the sink, shower and clothes washer drain water. A sewage holding tank (black tank) stores waste from the toilet only.

Drain valves and a tank flush system dispose waste through a common termination. Each holding tank has a separate drain valve dumping the waste water (grey water) and sewage (black water) through a common single discharge outlet. The tank drain valves are located in the service center on the roadside of the motorhome. Use the water monitor panel to observe tank levels. When ready to drain the tanks, drain the sewage tank first. Next, flush the black tank with the flush system. Drain the grey water tank. Using this sequence helps flush solids from the sewer hose. When traveling, it is recommended both holding tanks be empty or less than half full.

Waste Drain & Sewage Tanks

Waste Drain Hose

A flexible three inch sewer hose attaches between the termination drain and the shore facility. Sewer hoses usually come in 10 or 20 foot lengths. The shore fitting for the sewer hose may be three or four inch pipe, which could be male or female thread. Another possibility may be a four inch pipe, with no threads, covered by a metal plate. There are many configurations. Different style adapters are available to fit most configurations. Hose ladders may also be purchased to support the hose.

It is important that the hose remains secure. Always tighten clamps and restraining devices before use. Lay the hose inline between the termination outlet and the shore fitting. Restrain the hose to prevent movement during use. Wear protective and/or disposable gloves when handling the sewer hose.

To Attach the Hose:

1. Remove termination cap. Align coupler tangs with termination tabs. Twist coupler clockwise 90° locking coupler to termination outlet.
2. Attach the other end of the hose to the drain service. Restrain hose to prevent movement during use.
3. Open the (small) grey water valve.

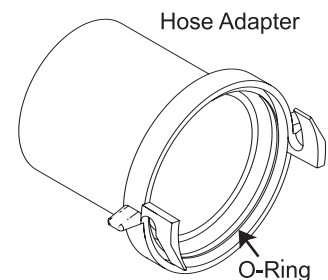
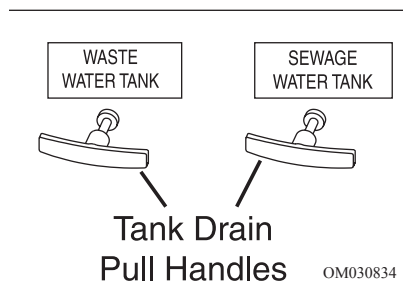
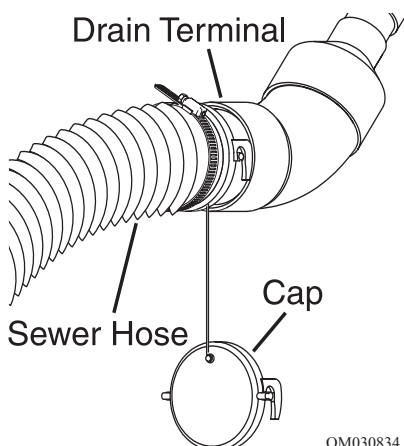


NOTE: Close the grey water valve 24 hours prior to departing to allow the tank to fill with liquid to help in the dumping process.

The (large) black water valve remains closed until the tank is full or until time of departure. This will help prevent accumulation of solids. Use the outside faucet or shower attachment for washing or rinsing.



NOTE: Lubricate the O-ring on the sewer hose adapter periodically with silicone spray. Use care when connecting the sewer hose adapter to the termination outlet in cold weather



Before using the toilet, treat the sewage holding tank with water mixed with an odor-controlling chemical. These chemicals are readily available at most RV supply stores. Pour the chemicals into the holding tank through the toilet. Add approximately three gallons of water to the holding tank first. 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 as it can cause a permanent stain. Extremely hot weather areas may require adjusted amounts of chemical to help with odor control. Repeat the chemical pre-charge to the holding tank each time the tank is cycled.



CAUTION: 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 into the Holding Tanks - Black Water Tank

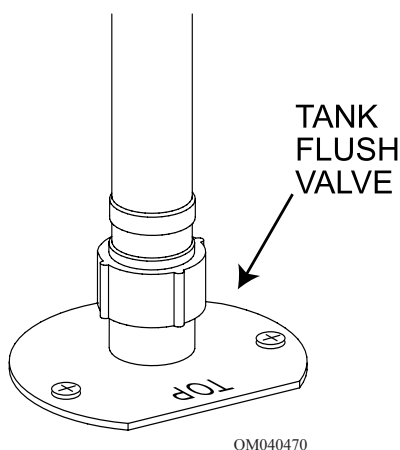
The grey water waste tank stores the sink, shower and clothes washer drain water. No chemical is required in this holding tank; however, a waste holding tank can produce odors. A reduced mixture of chemicals can help with odor control.

What to Put into the Holding Tanks - Grey Water Tank

Ensure that there is enough liquid in the holding tanks prior to dumping the waste holding tanks. This provides a smooth flow through the valve, drain pipe and drain hose. When cycling the tank with sufficient liquid, a swirling action should remove accumulated solid wastes along with the waste liquid. Empty the sewage tank weekly to prevent stagnation and overfilling.

The motorhome comes equipped with a power flush system to aid in cleaning the holding tank. The power flush nozzle, located in the black tank, helps reduce solid build-up. Use the tank flush each drain cycle. Failure to thoroughly rinse the tank each drain cycle may result in solids accumulating and a clogged spray nozzle.

Black Tank Flush



Dumping the Tanks:

1. When preparing to dump the black tank, first close the grey water valve.
2. Fill the grey tank to at least 50% by running water in the shower or sinks.
3. Use the monitor panel to observe tank fluid levels. When the grey tank is 50% full stop filling the tank.
4. Open the black water valve. Allow the black tank to drain.
5. Use the tank flush system.
6. Connect a non-potable water hose, with pressure regulator, to the flush system fitting located in the service center.
7. Turn on the faucet allowing water to rinse the black tank at least three minutes. Never operate the system unattended. Ensure the water flows freely through the drain hose.
8. When completed turn off the faucet and close the black water valve.
9. Open the grey water valve. The water in the grey tank flushes any remaining solids from the hose. With the grey water valve open, run two gallons of water down any drain to flush the grey tank. The grey valve remains open until the next drain cycle or departure.



WARNING: Never operate the flush system unattended. Flooding may occur. Use the tank flush system each time the holding tanks are cycled. Failure to routinely use the flush system will result in a clogged spray nozzle. Turn off the water supply when finished flushing the tank.

10. If preparing for travel, close both the valves. Undo any restraining devices from the hose. Disconnect the hose from the termination outlet by rotating the fitting counterclockwise 90°.
11. Raise hose and drain using hand over hand method working hose towards shore fitting. Rinse the hose with outside facility and repeat the hose drain process.
12. Remove the hose from shore fitting. Install hose in carrier and lock door. Secure the termination cap (required by law in some states).
13. If desired, add chemicals to the tanks to control odor. Follow the chemical manufacturer's directions.



NOTE: Dump the black tank before driving.

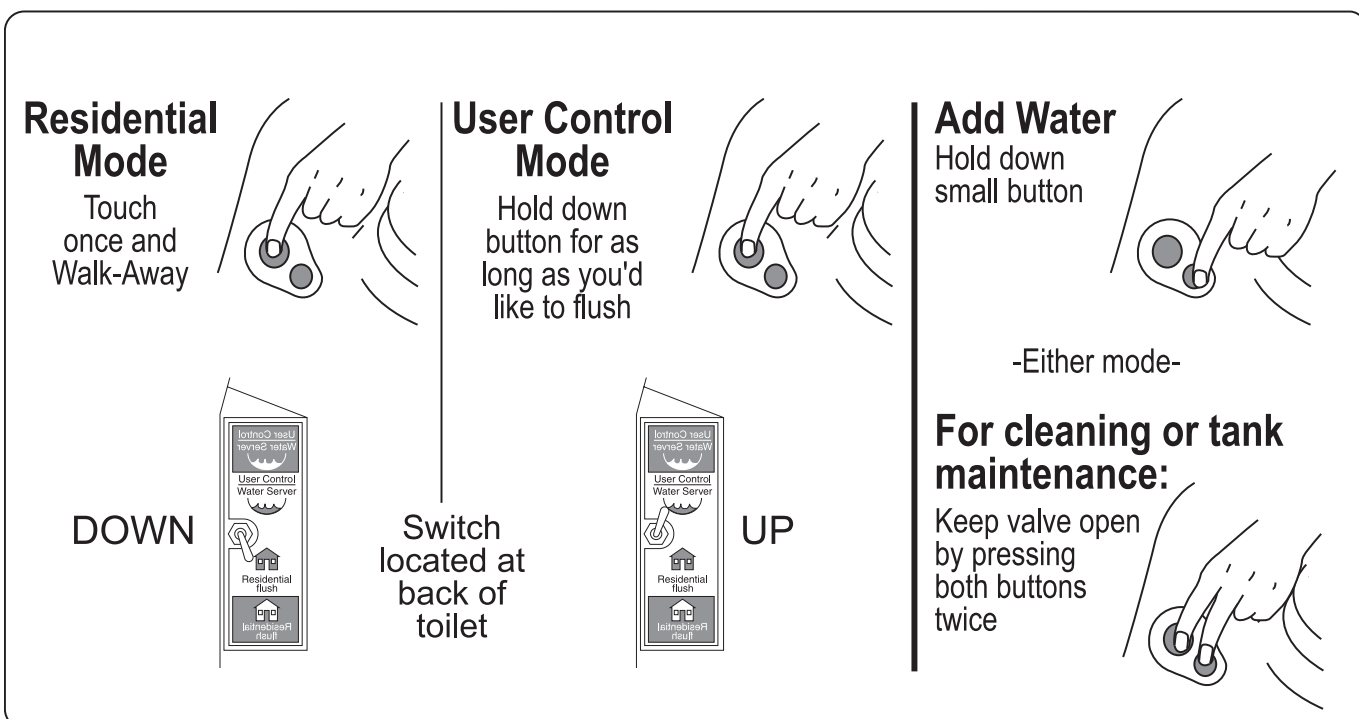
TOILET - Thetford Operating Instructions

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).

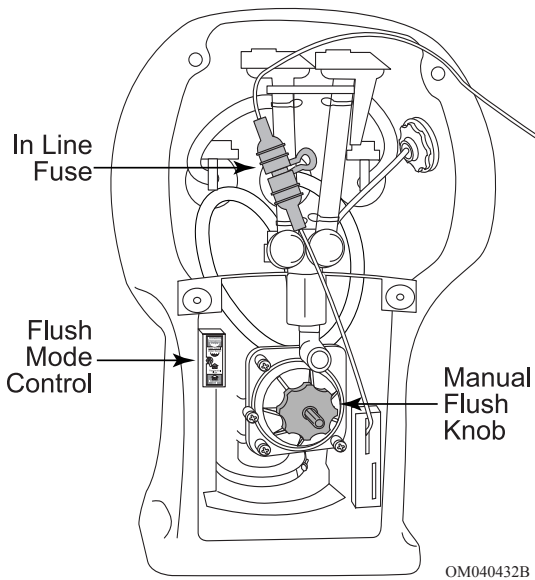
Water consumption is dependent on incoming supply pressure and flow rates. To help conserve water when dry camping or without water hook-ups, two modes to flush the toilet are available and are controlled using a switch located behind the toilet on the right side, as viewed from the front. A mirror may help locate it.

- To flush in Residential mode, move switch to Residential Flush position and push large button once and release.
- To flush toilet in User Control mode, move switch to User Control Water Saver position and hold down button for as long as you want to flush and then release. This mode provides water conservation of 50% or more.
- To add water to the toilet, press and hold the small button until the desired water level is reached. Generally, more water is required when flushing solids.
- Pressing both buttons twice simultaneously opens the flush valve to access the holding tank to add chemicals. Pressing the flush button again will close the valve.

In the event the 12 Volt DC is lost at the toilet, the valve can be manually opened using the override knob located in the back of the toilet.



Troubleshooting



Wiring:

- The toilet is wired to a 10 Amp Fuse in the house distribution panel.
- The toilet has a 4 Amp 3 Ag “slow-blow” in-line fuse located in the back of the toilet.

Leaks:

- Back of toilet: check water supply line connection.
- Between closet flange and toilet: Check screws for tightness. If leak continues, remove toilet and check flange height. Adjust if necessary to 7/16” above floor. Replace flange seal if damaged.
- Poor flush: A good flush should be obtained within 2 to 3 seconds. If problem persists remove the water supply line and check 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 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.

Cleaning

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

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.

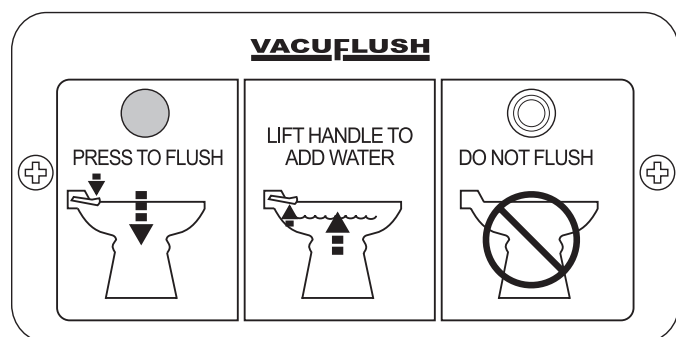
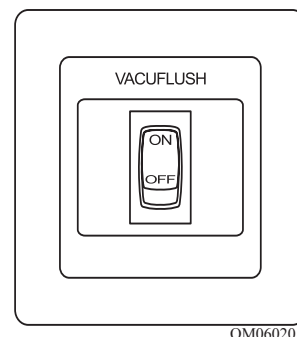


NOTE: If the motorhome is in storage for six months it is a good idea to spray silicone on the toilet valve and work it back and forth. Perform this maintenance monthly (silicone will evaporate in about 30 days).

The toilet uses water from either the fresh water tank or a city water supply. The water pump must be turned on or connect the motorhome to city water. The toilet uses 12 Volt DC to flush. The toilet flushes into the sewage tank (black water).

Sealand Operating Instructions

- To add water to the toilet, lift the flush hand lever until the desired water level is obtained. Generally, more water is required when flushing solids.
- To flush the toilet using hand lever, momentarily push the lever down. Holding the lever down will not increase flush time or water flow. The flush cycle is a timed event controlled by a microprocessor. Water pressure and flow rates vary with locations. It may be necessary to adjust the water level.
- To flush the toilet using the Vacuflush, locate the ON/OFF switch. Press the **ON/OFF** switch to ON, the flush button will illuminate green. Push the flush hand lever on the toilet down to flush the toilet. When the ON/OFF switch is OFF, the “DO NOT FLUSH” indicator light will illuminate red.

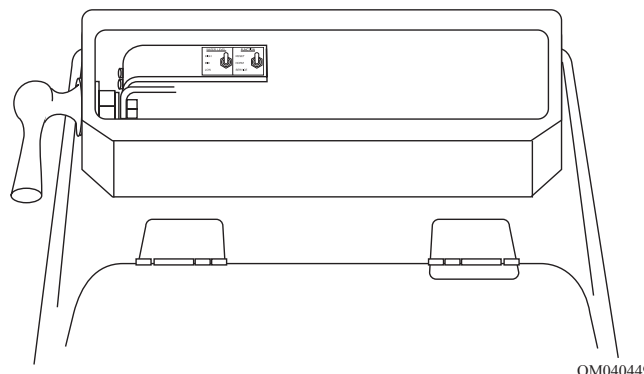


NOTE: The toilet requires 12 Volt DC to operate. Low voltage will cause toilet malfunction or failure.

Control Switches:

Under the lid are two switches.

- The Water Level switch adjusts the water level in the bowl after the flush cycle.
- The Function switch will reset the microprocessor or hold the ball valve open.



Water Level Switch:

This switch adjusts the water level in the bowl after the flush cycle.

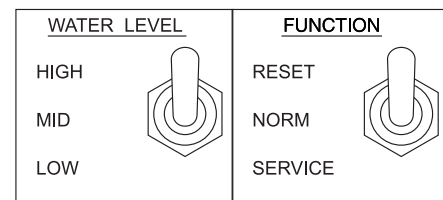


NOTE: Setting the switch to HIGH increases water consumption and water spill may occur during travel.

Functions Switch:

If the toilet malfunctions try resetting the microprocessor.

- Push and hold the switch to **RESET** for 3 seconds then back to **NORM**.
- Pushing the switch to **SERVICE** will hold the ball valve open. This feature is useful when adding chemicals to the sewage tank.



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.

Troubleshooting

WARNING: Always turn off electrical power and water to the toilet for disassembly.

PROBLEM	POSSIBLE CAUSE	SERVICE INSTRUCTIONS
Water will not stay in bowl.	A) Dirt or debris on underside of flush ball seal. B) Worn or damaged flush ball and seal.	A) Put function switch in "Service" mode and clean underside of flush ball seal. B) Remove toilet from floor, disassemble top of base and replace flush ball and seal.
Water leaks onto floor.	A) Worn or damaged bowl to base seal. B) Water line, supply hose, vacuum breaker or electric water valve connections are loose or defective. C) Worn or damaged floor flange seal.	A) Remove toilet from floor and replace bowl to base seal. B) Remove toilet from floor and place bucket under toilet bowl. Flush toilet to find source of leak. Tighten loose connections or replace defective component. C) Remove toilet from floor, remove base from floor and replace seal.
Toilet will not flush and water will not enter bowl.	A) PLC needs reset. B) Fuse is blown. C) Loose electrical connections. D) Defective flush switch. E) Defective Function switch (Service-Norm-Reset). F) PLC is defective. G) Flush ball motor is defective.	A) Put function switch in "Reset" mode for 3 seconds, then wait 3 seconds for PLC to reset. B) Replace fuse. C) Check wire connections. D) Replace switch. E) Replace switch. F) Replace PLC. G) Replace motor.
Flush ball will not open, but water enters toilet bowl	A) Defective bowl to base seal. B) Defective Flush switch, limit switches or loose connections. C) Toilet bowl and base are misaligned, causing drive arm to contact inside wall of bowl.	A) Remove toilet from floor, turn off water supply and flush toilet. If flush ball opens, replace seal. B) Check switches and connections. C) Adjust base or toilet bowl mounting centerline.
Flush ball will not close.	A) Function switch is in "Service" mode. B) Safety circuit locked flush ball in open position. C) Closed or Open Limit switch out of adjustment or defective.	A) Return Function switch to "Norm" mode B) Rest the PLC by positioning the Function switch in the "Reset" mode for 3 seconds for the PLC to reset. C) Adjust or replace Switch.
Water will not enter bowl in any Water Level setting and when the flush handle is raised to add water.	A) Loose electrical connections, defective water valve or PLC. B) No water pressure to toilet.	A) Check water valve, PLC and connections. B) Repair water system.
Water will not enter toilet bowl when the flush handle is raised to add water.	A) Loose electrical connections or defective Flush switch.	A) Check Flush switch and connections.
Water Level switch has no effect on water level in low or high positions.	A) Loose electrical connections or defective Water Level switch.	A) Check Level switch and connections.
Water will not shut off - toilet overflows.	A) Defective water valve.	A) Check electric water valve.
Flush ball will not open in "Service" mode.	A) Loose electrical connections, defective Function switch or PLC.	A) Check Function switch and connections.

Cleaning

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

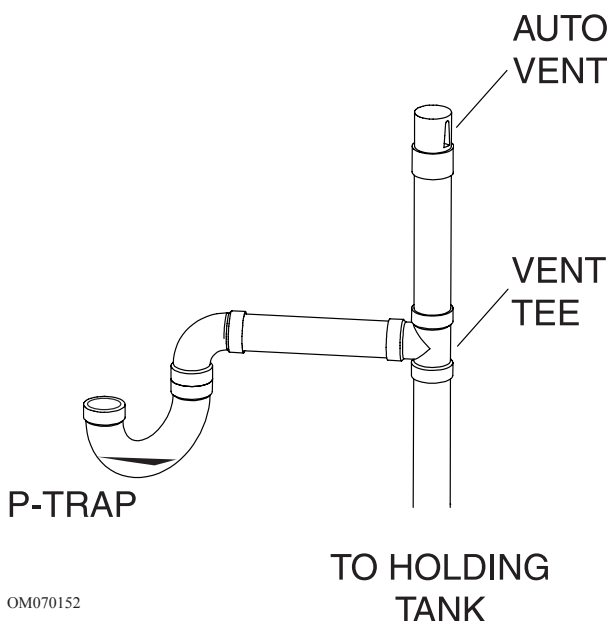
Check for Leaks:

- Back of toilet check water supply line connection. Toilet tissue works well to find leaks. The tissue changes texture when it contacts moisture.
- Between closet flange and toilet: Check flange screws making sure they are snug. Do not over tighten screws. If leak continues, remove toilet and check flange height. Adjust, if necessary to 7/16" above floor. Replace flange seal if damaged.
- Poor flush: A good flush should be obtained within 2 to 3 seconds. If problem persists, adjust the water level. If the problem persists there may be a water flow or pressure delivery problem. Remove the water supply line and check flow rate. The flow rate should be at least ten quarts (9.5 liters) per minute. Water pressure should not be below 25 psi.
- Bowl will not hold water: Check for foreign material in ball valve.



NOTE: If the motorhome is in storage for six months or longer, it is a good idea to spray silicone on the ball valve. Perform this maintenance monthly (silicone will evaporate in about 30 days).

Drain Traps & Auto Vents



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Sinks, shower and clothes washer drains incorporate a water trap or "P-trap" and auto vents to prevent waste water holding tank odor from entering the motorhome. These P-traps are usually within 54" of a vent tee. These traps must have water in them 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 drain traps. The auto vent by design is to assist in the flow of water in the drain lines. They enable a smooth flow of water in the drain without creating a vacuum.

If the auto vent is stuck in the open position, grey odors may enter the motorhome. Auto vents double as "clean outs" in case the line has to be "snaked" out.



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.



NOTE: During cold weather antifreeze must be added to the drain traps.

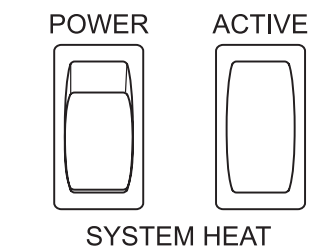
COLD WEATHER USE

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.

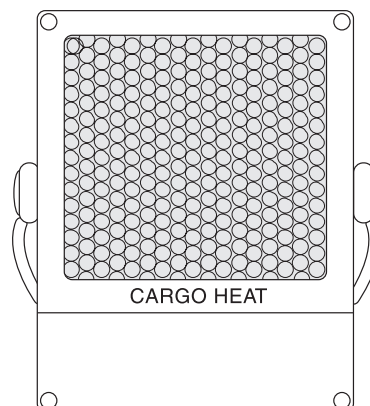
Interior water lines, fixtures, and drains above the floor are normally protected from moderate freezing temperatures as long as the furnace is operating.

Cold temperatures can adversely affect water systems below the floor level because the furnace heat does not provide heat to these components.

A bay heater with a "snap-disc" thermostat will heat the water control bay. The heater should be turned on when the ambient temperature approaches 44° F (+/- 6° F).



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BAY HEATER

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Bay Heater Operation:

Systems heat switch is turned ON to applying power to the snap disc thermostat and bay heater.

When the bay temperature reaches 40deg.F +/-6deg.F the snap disc thermostat will close applying power to the bay heater and the systems heat active indicator light will be lit. The twelve-volt heater will continue to operate until the bay temperature reaches 55deg.F +/-6deg.F. The indicator light will then turn OFF.



WARNING: The battery disconnect switches must be turned off if the motorhome is left for an extended period of time (2hrs). The battery cut-off switch does not control the bay heater circuitry.



NOTE: The bay heat system will quickly drain the motorhome batteries when not connected to shore power or operating from the generator. Only use the bay heat functions when hooked to shore power or operating from the generator. The Bay heater is not intended to heat the entire bay.

Exposed drains and water lines may freeze quickly in below freezing temperatures. If, by the way of prior experience, there are doubts as to what temperature the motorhome's water system will tolerate when the water system will not be used, winterize the water system using potable antifreeze. When the tanks are dumped, additional potable antifreeze will need to be added to the storage tanks.

STORAGE - COLD WEATHER

If the motorhome is stored where freezing temperatures may occur, drain the domestic fresh water loop completely of water. The method chosen to winterize the motorhome and water lines is up to the motorhome owner. The lines can be air blown to remove standing water or the lines can be filled with an approved FDA RV antifreeze. Either way, all interior and exterior faucets need to be opened and closed, one at a time, to be checked. All low point drains should be opened and the holding tanks emptied.



NOTE: Ice makers (if applicable), water filters, washer/dryer (if applicable) and water heaters all use domestic water and should be drained and stored in accordance with the manufacturer's recommendation for winterization.

WINTERIZING - Using Air Pressure

To use air pressure to winterize the motorhome you will need access to an air compressor and an adapter to connect the air line to the water system. Adapters can be found at any RV supply store. When hooked to the water lines the pressure should not exceed 40 psi. Higher pressure can damage the lines.

1. Remove water filter cartridge and replace filter with diverter cap (see WATER FILTER). Diverter cap comes with motorhome and will be stored inside. With diverter cap installed it creates a bypass in the water lines.
2. If applicable, winterize the washer/dryer (See Winterizing the Washer/Dyer).
3. Drain the fresh water tank and lines by opening the tank drain valve and the low point drain valves located in the outside water control service compartment of the motorhome.
4. Let all the water drain. Turn the pump on and allow it to run so that all the water is cleared out of the pump and water tank. Turn the pump off.
5. Remove water heater drain plug and open pressure release valve located in the outside water heater access compartment.
6. After the water is drained, hook an air hose to the city water connection located on the water control panel in the outside service compartment and turn the air on. Do not exceed 40 psi in the water lines and faucets.
7. When no further water can be seen coming out of the drains, move water heater bypass valve to BYPASS setting located next to water heater. Replace the water heater drain plug and close the pressure release valve. Open all faucets (including the outside spigot) one at a time to clear water from the faucet supply lines. Do not forget to drain the shower.

8. Flush toilet in user control mode until the water has stopped running.
9. If applicable remove ice maker valve outlet line located in the outside refrigerator access compartment. Cycle ice maker several times to clear water from inlet line and valve. Reconnect ice maker valve outer line.
10. Shut off air, unhook the air hose and close the city water connection.
11. You will need 1 gallon of RV antifreeze to protect various water drain lines in the motorhome. Pour 1 pint into both the kitchen and bath shower drains. Pour 2 pints into the bath sink drain, with some of the antifreeze going into grey tank to protect the drain valve. Open the toilet bowl valve, pour another 3½ pints into the toilet, letting the antifreeze run into the black tank to protect the valve located there. Pour the last pint of antifreeze into the toilet after you have closed the toilet bowl valve. Use a soft cloth to wipe out the sinks and shower (after the antifreeze is poured in) to protect the surface from stains.
12. Leave the low-point drains open until the motorhome is used again.



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

Using Non Toxic Antifreeze

If you choose to fill the water lines with antifreeze, you will need 5 gallons of FDA RV winterizing antifreeze.

1. Remove water filter cartridge and replace filter with diverter cap (see WATER FILTER). Diverter cap comes with motor home and will be stored inside. With diverter cap installed it creates a bypass in the water lines.
2. If applicable, winterize the washer/dryer (see WINTERIZE THE WASHER/DRYER).
3. Position the water tank fresh water valve in the “Fresh Water Tank” setting. Drain the fresh water tank and lines by opening the tank drain valve and the low point drain valves located in the outside water control service compartment of the motorhome.
4. Let all the water drain. Turn the pump on and allow it to run so that all the water is cleared out of the pump and water tank. Turn the pump off.
5. Remove water heater drain plug and open pressure release valve located in the outside water heater access compartment.
6. After the water is drained, move water heater bypass valve to BYPASS setting located next to water heater. Replace the water heater drain plug and close the pressure release valve.
7. Close the fresh water tank drain valve and the low point drain valves.
8. Open the winterization connection valve.
9. Install a hose to the winterize connection and drop the other end of hose into the anti-freeze container.
10. Turn ON the system water pump and operate each faucet individually until a small amount of antifreeze is present.
11. Close the faucets.
12. Open the shower faucets and flush toilet to allow a small amount of antifreeze to run into the holding tanks.
13. Use a soft cloth to wipe out the sinks and shower to protect surface from antifreeze stains.
14. Exterior faucet should be opened and closed using the same procedures as the interior faucets.
15. If the motorhome is equipped with an ice maker, remove the valve outlet line located in the outside refrigerator access compartment. Cycle ice maker several times until antifreeze is present.
16. Turn water pump off.
17. Disconnect the power supply line affecting water pump operation.

De-winterization:

For de-winterization, drain off the fresh tank and fill the fresh tank with water. Reconnect the power supply line for the water pump. Close the winterization valve, turn water pump on and operate all faucets, one at a time, until clear water is present. If applicable, cycle icemaker several times until fresh water is present and reconnect valve outlet line. Install new water filter and fill water heater with water.



WARNING: You should use only non-toxic RV antifreeze that is specifically made for potable water systems. Automotive antifreeze, if ingested, can cause blindness, deafness or death. It is recommended that this procedure be done by a qualified RV service technician familiar with motorhomes, such as the authorized selling dealer.

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Endeavor

SECTION 7 LP-GAS SYSTEMS

LP-GAS SYSTEM	221
LP-GAS DETECTOR	222
OPERATION	222
TESTING	222
ALARM	223
CARE OF THE DETECTOR	223
MONITOR PANEL MEASUREMENT	224
TANK CAPACITIES - CHART	224
LP-GAS EMERGENCY PROCEDURES	224
LP-GAS TANK	225
OPERATION	225
LP-GAS TANK FILLING	226
LP-GAS FUNDAMENTALS	227
LP-GAS REGULATOR	228
LP-GAS HOSE INSPECTION	229
LP-GAS CONSUMPTION	230
LP-GAS DISTRIBUTION LINES	231
LP-GAS SAFETY TIPS	232

This section contains information and knowledge for the operation and care of the various Liquefied Petroleum (LP-Gas) system equipment found in the motorhome. The motorhome is equipped with several appliances and various equipment which operate on LP-Gas. Some items discussed may not be applicable to all motorhomes. 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's information box.

All components for the motorhome LP-Gas systems are approved for use in recreational vehicles by a nationally recognized testing laboratory. When properly handled, LP-Gas is a clean-burning dependable fuel for heat producing components. The LP-Gas tank mounted in the motorhome contains liquid petroleum gas which is under high pressure. As the fuel is used, liquid gas vaporizes and passes through the tank valve to a regulator that automatically reduces pressure. Low-pressure gas is then distributed to components through a pipe manifold system.

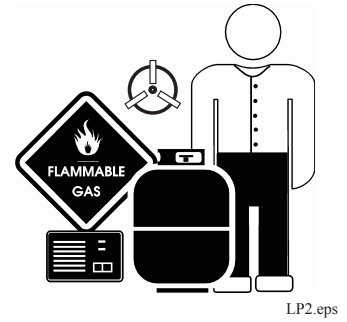
Component lighting problems are commonly caused by an improperly adjusted gas regulator. Do not attempt to reset the regulator. Adjustments need to be made by a dealer or an authorized service person.

In higher elevations or extreme cold weather (10° F/-21° C or lower) a shortage of LP-Gas may be experienced. Usage can be modified by running only one component at a time. For example, turn off the furnace while using the range. 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 checked by an authorized dealer at least once a year, and thereafter before every extended trip. Although the manufacturer and the dealer test the system carefully for leakage, travel vibrations can loosen fittings.

Leaks can be easily found by applying a leak detector solution on all connections. Leaks can usually be repaired by tightening the fittings. If not, shut off the main gas valve at the tank. Immediately see a authorized dealer for repairs. Hand tighten the tank valves only. Do not use a wrench or pliers as over tightening may damage valve seats and cause leaks. If a leak is suspected (which can be easily identified by the odor of rotten eggs or sulfur) never light a match, have an open flame or use any spark producing equipment or appliance.

LP-GAS SYSTEM



WARNING: LP-Gas is highly volatile and extremely explosive. Do not use matches or a flame to test for leaks. Use only approved LP-Gas leak testing solution for leak detection. Unapproved solutions can damage copper tubing and brass fittings. Never attempt to adjust LP-Gas regulators. Only qualified personnel should perform any maintenance or repair to the LP-Gas system.

LP-GAS DETECTOR

The LP-Gas detector is provided for safety. The gas detector detects both LP-Gas and Methane Gas. Liquefied Petroleum Gas (LP-Gas) is heavier than air and 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 LP-Gas detector is also sensitive to fumes such as hairspray, most of which contain butane as a propellant. Butane, like propane, is heavier than air and will settle to the floor level where it will be detected. When this occurs, press the reset button to stop alert sound for 60 seconds and allow the air to clear.

The other detectable vapors include alcohol, liquor, deodorants, colognes, perfumes, wine, adhesives, lacquer, kerosene, gasoline, glues, most of all cleaning agents and propellant of aerosol cans. Most are lighter than air in their vapor state and will only be detected when the motorhome is closed up.



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 detector senses unsafe levels of gas it will flash **red** and immediately sound an alarm. The gas detector operates on 12 Volts, with a current draw 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 you should test the detector. 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 a dangerous level of propane or methane gas is detected. The detector will continue to alarm until the gas clears or the **MUTE** switch is pressed.

Procedures to Take During an Alarm:

1. Turn off all gas appliances (stove, heaters, furnace). Extinguish all flames and smoking material. Evacuate the motorhome, leaving all doors and windows open.
2. Turn off the primary propane tank valve.
3. Determine and repair the source of the leak. Contact a qualified service professional if additional repairs are necessary or if the source of the leak cannot be determined.



WARNING: If the alarm sounds and there is no immediate danger open all doors and windows to air out the motorhome. Exit the motorhome and turn off the gas at the LP tank. Do Not re-enter the motorhome until the alarm stops sounding. If the alarm sounds again after the gas is turned back on, turn the gas off. Leave the gas off and contact a qualified service technician to find and repair the leak. Do not re-enter the motorhome until the problem is corrected.

Alarm Mute:

Press the **TEST-MUTE** button when the detector is in alarm.

1. The **red** LED will continue flash and the alarm will beep every 30 seconds until the concentration of LP-Gas has dispersed 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.

Fault Alarm:

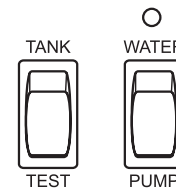
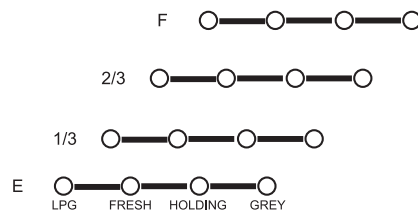
Should the microprocessor sense a fault in the gas detector, a fault alarm will sound twice every 15 seconds. The LED will alternately flash **red** to **green** and the **MUTE** switch will not respond to any command. The gas detector must be repaired or replaced.

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.

**Care of
the Detector**

MONITOR PANEL MEASUREMENT

Tank Measurement - To measure level of a tank push button on display panel located in the overhead compartment above the entry door, corresponding to tank you wish to measure. Lights on panel will turn on in sequence indicating level of tank. The display panel comes factory calibrated for accuracy and should not need to be readjusted.



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Tank Capacities - Chart

MODELS	34PBD	36PBD	36PST	38PBD	38PBDD	38PST	40PBD	40PBDD	40PWD	40DST	40PST	40PDT
Water Heater	10 gal.	10 gal.	10 gal.	10 gal.	10 gal.	10 gal.	10 gal.	10 gal.	10 gal.	10 gal.	10 gal.	10 gal.
Grey Tank	60 gal.	60 gal.	60 gal.	60 gal.	60 gal.	60 gal.	60 gal.	60 gal.	60 gal.	60 gal.	60 gal.	60 gal.
Black Tank	39 gal.	39 gal.	39 gal.	39 gal.	39 gal.	39 gal.	39 gal.	39 gal.	39 gal.	39 gal.	39 gal.	39 gal.
Fresh Tank	100 gal.	100 gal.	100 gal.	100 gal.	100 gal.	100 gal.	100 gal.	100 gal.	100 gal.	100 gal.	100 gal.	100 gal.
Fuel Tank	100 gal.	100 gal.	100 gal.	100 gal.	100 gal.	100 gal.	100 gal.	100 gal.	100 gal.	100 gal.	100 gal.	100 gal.
LP Tank*	38 gal.	38 gal.	38 gal.	38 gal.	38 gal.	38 gal.	38 gal.	38 gal.	38 gal.	38 gal.	38 gal.	38 gal.

* Actual filled LP capacity is 80% of listing due to safety shut off required on tank.

This chart reflects product specification available at the time of printing. Therefore any floor plans thereafter may not be reflected in the chart. All other information contained throughout the manual will still apply.

CHECKLIST-LP-GAS EMERGENCY PROCEDURES

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 on LP-Gas tank.
- Do not attempt to operate any electric switch as this can produce a spark and ignite the gas.
- Open windows and doors.
- Evacuate the motorhome. Stay clear of the immediate surrounding area.
- Keep open flames, spark producing devices and smoking material out of the area.
- Contact a qualified service technician to find the source and repair the gas leak.

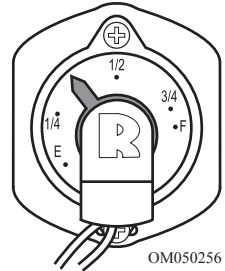


WARNING: A fire or explosion from ignited gas or gas fumes can seriously injure you or cause death.

LP-GAS TANK - Operation

LP-Gas exists in both the liquid and vapor state within the LP-Gas 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 pressure relief device. The purpose of the relief valve is to release gas or liquid caused by being overpressurized. The gauge at the tank, when full, will only read 3/4 full. The monitor panel is adjusted to indicate “FULL” at this point.

When storing portable LP-Gas tanks that are not connected to an LP-Gas system, install an approved plug in the tank outlet holes to prevent leaks. Do not transport or store LP-Gas tanks, gasoline or other flammable liquids inside the motorhome.



WARNING: Do not store or transport empty LP-Gas tanks, portable tanks, gasoline or other flammable liquids inside the motorhome. Keep open flame and spark producing materials away from the LP-Gas area. Shut off all appliances and LP-Gas tank valve (located on side of LP-Gas tank underneath the motorhome) when the motorhome is in storage. If this warning is ignored a fire or explosion could result.



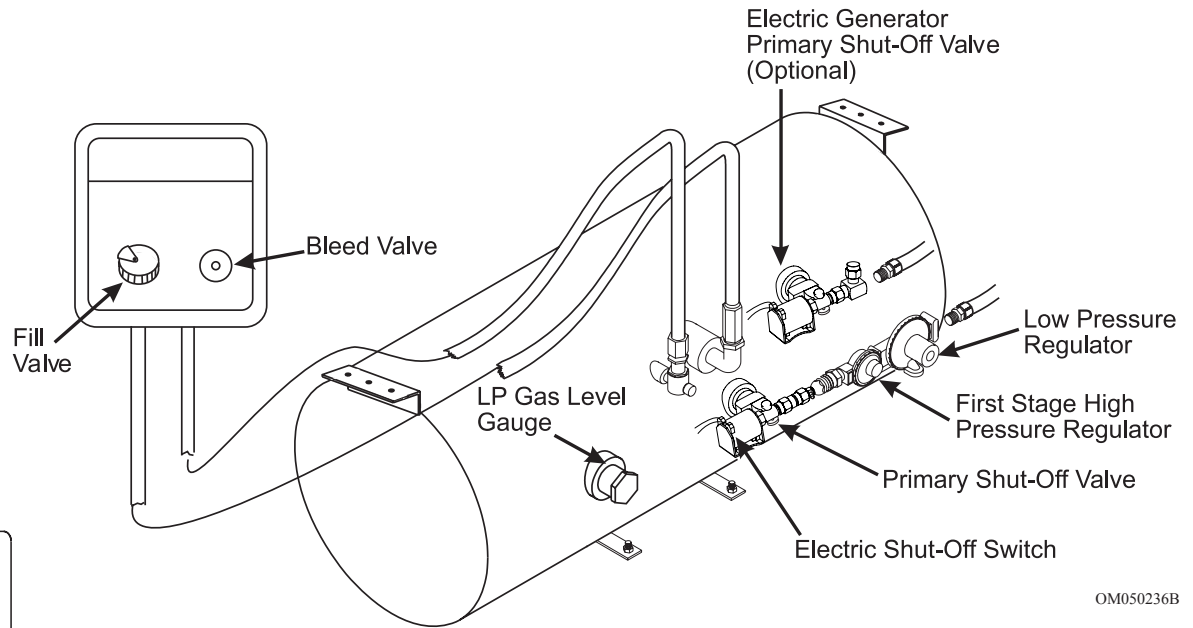
CAUTION: Pressure inside LP-Gas tanks can reach over 200 psi when exposed to direct sunlight. A high pressure safety relief valve will purge excess high pressure if necessary. LP-Gas will stop vaporizing as the LP-Gas tank temperature approaches -40° F. Appliances that consume large amounts of LP-Gas, such as the water heater or furnace, will need to be operated in sequence in extremely cold environments.



NOTE: The 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.

Tank Operation:

- Manually open the primary shut-off valve located on the LP-Gas tank.
- Turn off the manual primary shut-off valve on the LP-Gas tank when the motorhome is in between trips.
- Hand tighten the manual primary shut-off valve. Do not use a wrench or pliers to close the valve.
- The manual primary shut-off valve is designed to be closed by hand, over tightening may permanently damage the valve seat.



The LP-Gas electric shutoff switch is located in the LP tank compartment on the curbside of the motorhome. The **red** light is illuminated when the switch is **ON**.

LP-Gas Tank Filling

Woodall's Campground and Trailer Guide and other publications list refueling stations. Many travel parks sell LP-Gas. Shut off the pilot lights, appliances and igniters before filling the LP-Gas tank to prevent a fire or explosion. Have a trained service person fill the LP-Gas tank.

The LP-Gas tank fill is located in the LP-Gas tank access outside compartment. Caution the service technician, if the tank is new and being filled for the first time, to purge any air from the tank before filling. 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 vent pressure. When this happens you may detect a strong rotten egg odor near the tank and/or hear a hissing noise.



WARNING: Turn off all pilot lights and appliances while filling the LP-Gas tank to prevent a fire or explosion.

**LP-GAS
FUNDAMENTALS**

Capacity in Pounds	Capacity in Gallons	Capacity in BTU's
5	1.18	107,903
10	2.36	215,807
11	2.59	237,387
20	4.72	431,613
30	7.08	647,420
40	9.43	863,226

The above capacities allow for 20% vapor space on each cylinder

Data taken from the National Fire Prevention Association (NFPA). Pamphlet #58-1998

CONVERSIONS	
Gallons to Liters	1 Gallon = 3.785 Liters
Fahrenheit to Celsius	$F^{\circ} - 32 / 1.8 = C^{\circ}$
11 inch Water Column	= 6 1/4 Ounces Per Square Inch Pressure
27.7 inch Water Column	= 1 Pound Per Square Inch Pressure

Basic Facts About LP-Gas:

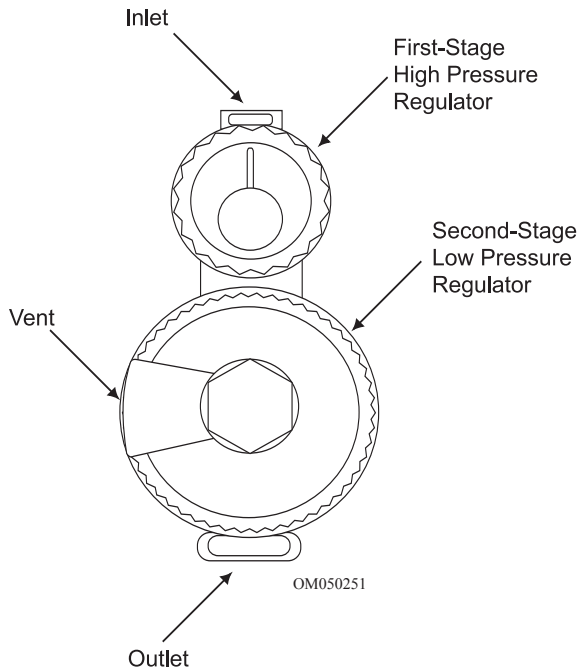
- LP-Gas detectors are a federal requirement on all LP-Gas equipped recreation vehicles.
- LP-Gas is a by-product produced by refining oil.
- Odor is added to LP-Gas after the refining process.
- Each liquid gallon of LP-Gas produces 1,502 BTU (British Thermal Unit).
- Temperature effects pressure of 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 6¼ ounces per square inch.
- An inch of Water Column is a measurement of applied pressure to one side of a U-tube ½ filled with water at sea level. The amount of pressure required to raise the water level 11", represents 11" of Water Column.

LP-GAS STATISTICS	
Pounds Per Gallon	4.24
Specific Gravity of Gas	1.5
Specific Gravity of Liquid	0.504
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°
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 in Degrees Fahrenheit	842°



NOTE: The 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



The regulator is the heart of an LP-Gas system. The LP-Gas in the tank is under high pressure. The regulator reduces the pressure of gas so that it is safe to use with various appliances. The regulator on the motorhome is a two-stage regulator. The first stage regulator reduces the full tank pressure down to a range of 10-13 psi (pounds per square inch gauge). The second stage further reduces the pressure down to an outlet pressure of 0.4 psi (11 inches of water column). The regulator is equipped with a vent that allows it to breathe. It is important to keep the vent clean and clear of obstructions or corrosion. If the vent becomes clogged, pressure from LP tank could cause a failure of the components. 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 regulator will not freeze, nor will the LP-Gas. The gas passing through the regulator will expand and cool creating moisture in the gas. This moisture will turn to ice which can build up and partially or totally block the orifice. The possibilities of freeze up is greatly reduced with the two stage regulator.

To Prevent Freeze Up:

1. Ensure the LP tank is totally free of moisture prior to filling.
2. Ensure the tank is not overfilled.
3. Keep the valve closed when the tank is empty.
4. If a freeze up occurs, have an LP-Gas distributor purge the tank.
5. Have the LP-Gas distributor inject methyl alcohol in the tank.



WARNING: Do not attempt to adjust the regulator, it is pre-set at the factory. If adjustments need to be made it requires special equipment. Failure to follow these instructions may result in a fire or explosion and cause severe personal injury or death. Do not attempt to enter the motorhome until the problem has been corrected!

**LP-GAS HOSE
INSPECTION**

It is suggested by the hose manufacturer, that the Liquid Propane Gas (LP-Gas) supply hoses used on the motorhome be subject to regular inspections. As a guideline, we suggest that all flexible LP lines connecting the slide-out, appliances, or tanks be inspected in the spring and fall of each year by a qualified RV technician.

According to the manufacturer, the inspections should consist of the following procedures and be performed when the hose is not under pressure:



1. **Inspect** the outside cover of the hose for blistering, abrasion or cuts and end coupling slippage. Cuts in the hose cover, which expose or damage the reinforcement, are cause for replacement. Hose strength is controlled by the plies of the reinforcement and, for this reason damage in this area cannot be tolerated. Small cuts, nicks, or gouges in the cover that do not go completely through the cover will not be 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 un-pressurized state, shall be removed from service.
3. Blistering or loose outer cover is cause for hose replacement.
4. Examine end 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 have determined that the failure rate may rise after this period of time. The motorhome manufacturer recommends following these guidelines to assure your continued safety and the dependable use of your recreation vehicle.

LP-GAS CONSUMPTION

Each gallon of LP-Gas produces 91,502 BTU's 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 and heating systems typically use the most gas. With sub-freezing temperatures and high winds, consumption by the furnace can be very high. Check the tank level often in cold weather.

TYPICAL APPLIANCE BTU RATINGS

Water Heater (Atwood)

6 gallon - 8,800 BTU

10 gallon - 10,000 BTU

Furnace (Atwood)

40,000 BTU

Cooktop

9,000 BTU - Front

6,500 BTU - Rear

7,100 BTU - Oven

Refrigerator (Norcold)

2-Door - 1,500 BTU

4-Door - 2,200 BTU

Determine Fuel Consumption:

To determine approximately how many hours an LP-Gas appliance will operate on one gallon of LP use the following formula:

- LP-Gas appliances are rated in Input BTU (British Thermal Unit). The rating is usually stamped or printed on a tag affixed to the appliance. For example: Input rating of the appliance is 10,000 BTU's.
- One gallon of LP-Gas produces 91,502 BTU's.
- Divide the amount of BTU's 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:

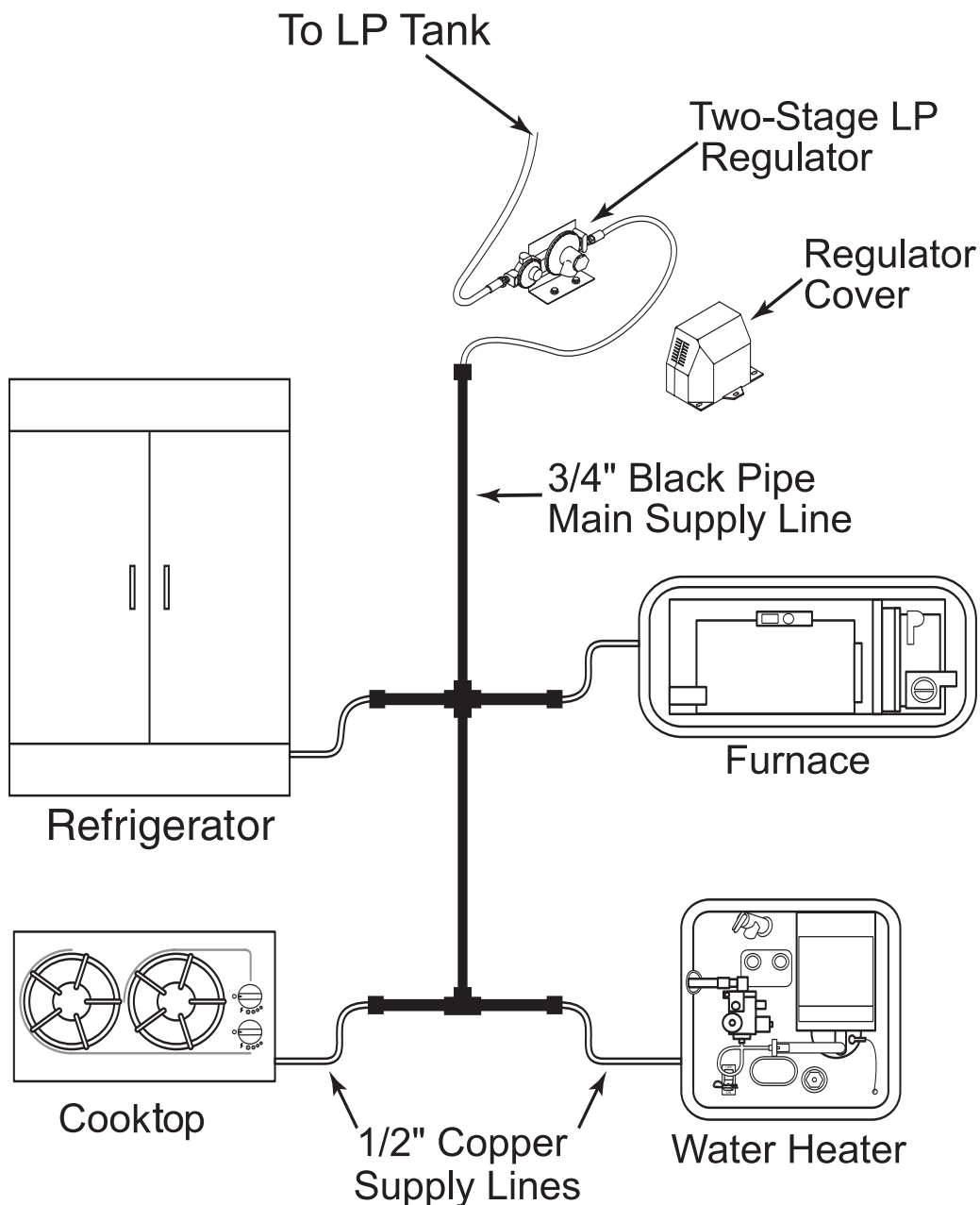
- Combine the BTU input totals of all appliances and the approximate length of time these appliances operate per day.
- Multiply the number of liquid gallons in the LP tank by 91,502.
- Divide the total of BTU's of the LP tank by the total number of BTU's the appliances consume. This will equal the approximate number of hours of operation before refueling.



WARNING: LP-Gas is highly volatile and extremely explosive. Never use matches or open flame to test for leaks. Use only approved LP-Gas leak testing solution to test for leaks. Unapproved solutions can damage copper tubing and brass fittings. Never attempt to adjust LP-Gas regulators without the use of proper equipment. Improper LP-Gas regulator adjustment will affect the performance of LP-Gas operated appliances. Incorrect flame or explosion can occur. Only qualified personnel should perform any maintenance or repair to the LP-Gas system.

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. We recommend 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 shut-off valve located on the side of the LP-Gas tank. This will prevent dangerous gas leakage that could result in an explosion and possible serious injury. If you suspect a gas leak, get the system inspected and repaired by a qualified service technician as soon as possible.



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LP-GAS SAFETY TIPS

Liquid Propane gas is one of the safest and most reliable fuels available on the market if it is 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 the users in the association about the convenience of propane use with safety and peace of mind. For information on the NPGA Gas® Check program, call (630) 515-0600 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 the construction of the containers. Both tanks and cylinders are required to undergo pressure testing and inspections; 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 the motorhomes and motorized products. These tanks are permanently mounted on the unit.

Maintenance and Safety Tips for the LP-Gas Refrigerator and the Propane Furnace:

- Have the refrigerator, furnace and venting inspected annually by an authorized service center.
- Before firing up the refrigerator, or using the propane gas furnace for the first time each season, have the venting system checked for blockage. Insects may have built nests that will obstruct flow.
- At the first indication of incomplete combustion (yellow flame instead of a blue flame or soot is present) contact a service technician immediately. Improper combustion can cause carbon monoxide buildup, which is potentially fatal!

Maintenance and Safety Tips for the Propane 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 propane gas range.

Maintenance and Safety Tips for the Propane Water Heater:

- Test the operations of the temperature and pressure relief valve. Maintain setting at no more than 210° F. to reduce the chance of hot water scalding.
- Keep flammable substances away from the water heater. Do not store items close to it as this may block the airflow the water heater needs to operate properly.
- At the first indication of incomplete combustion (yellow flame instead of a blue flame or soot is present) call a service technician immediately. Improper combustion can cause carbon monoxide buildup, which is potentially fatal!

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Endeavor

SECTION 8 ELECTRICAL SYSTEM - HOUSE

INTRODUCTION	237	BATTERY	253
SHORE POWER	237	HOW IT WORKS	253
GENERATOR	237	STARTING BATTERY	254
INVERTER/CONVERTER	238	DEEP CYCLE BATTERY	254
BATTERY DISCONNECT - HOUSE	238	BATTERY MAINTENANCE	254
BATTERY CUT-OFF SWITCH	238	TESTING THE BATTERY	255
SHORE POWER HOOK-UP	239	REASONS WHY BATTERIES FAIL	256
TRANSFER SWITCH	241	BATTERY VOLTAGE & CURRENT	258
GENERATOR - 120 AC (LP-GAS)	241	BATTERY CHARGE TIME & CONSUMPTION RATE	259
GENERATOR - 120 AC DIESEL (OPTIONAL)	242	BATTERY SPECIFICATIONS	261
PRE-START CHECKS	242	INVERTER/CONVERTER	262
RESETTING THE CIRCUIT BREAKER	243	BATTERY CHARGING	262
GENERATOR EXERCISE	243	REMOTE PANEL	263
STARTING THE GENERATOR	244	BATTERY STATE INDICATOR	264
STOPPING THE GENERATOR	244	CIRCUIT BREAKERS	264
POWERING THE EQUIPMENT	245	STAND-BY MODE	264
GENERATOR FUEL	245	POWERSHARE	264
DISTRIBUTION PANEL HOUSE 110	246	CHARGE CYCLES	265
AC PANEL	246	PASS -THROUGH RELAY	265
ENERGY MANAGEMENT SYSTEM - 50 AMP (OPT)	247	TEMPERATURE SENSITIVE CHARGING	265
DISTRIBUTION PANEL - HOUSE 12 VOLT	250	PROGRAMMING THE INVERTER	266
FUSES	251	EQUALIZE CHARGE	266
GFCI BREAKERS & OUTLETS	251	SOLAR PANEL (OPTIONAL)	268
TOOLS OF THE TRADE	252		
KNOW WHEN TO SAY NO	252		

INTRODUCTION

The motorhome 120/240 Volt AC system can be operated from three different power sources: shore power, the on-board generator or the inverter/charger. Shore power is the most efficient and should be used whenever possible. The on board generator can be used when shore power is unavailable. The inverter/charger supplies silent AC power using the house batteries of the motorhome. This source has limited AC power output 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 selected automatically by an automatic electrical switching device known as a transfer switch. The inverters supply 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. If you plan modifications or additions to the electrical system, we strongly recommend consulting your dealer for assistance to ensure continued integrity and safety of the electrical system. Please note that any modifications may void the warranty.

The motorhome is equipped with a shore power cord. The electrical cord connects the motorhome to outside electrical services. Shore power service is the most efficient source of electrical power. Use this as the primary power source. The plug end of the shore power cord is 50 Amp 220 Volt. Many facilities are equipped with this power service. 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.

Shore Power



NOTE: In instances when 50 Amp shore service is not available, care will have to be used when operating the appliances and using the outlets so the shore power service will not be overloaded.

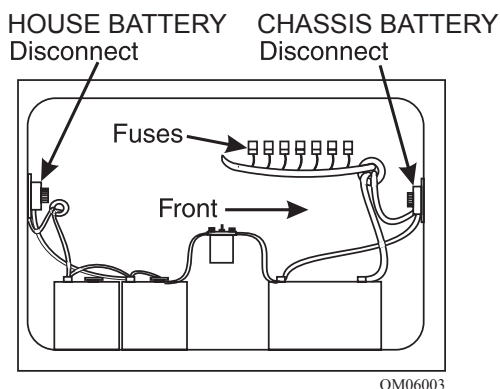
The generator can be selected for use when AC shore power is not available. The generators maximum amount of output power, measured in watts, is calculated at an elevation of 500 feet above sea level. This figure will decrease slightly with a higher altitude. Ambient temperature also effects total maximum output. The amount of AC electrical load applied to the generator determines fuel consumption.

Generator

Inverter/Converter

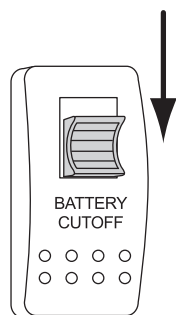
The inverter/charger can be used for silent AC power if shore power is not available, and using the generator is not going to be selected as a secondary power source. This device has limited AC power output, measured in watts. It operates only selected appliances and outlets. The inverter/charger is two components in one. First is as an auxiliary 120 Volt AC power source that uses 12 Volt DC house battery power to invert to 120 Volts AC. The second function of the inverter/charger is to use 120 Volts AC power, supplied from either shore power or the generator, and convert it to 12 Volts DC power to recharge the batteries. When dry camping, the inverter may be used to supply power to selected outlets.

BATTERY DISCONNECT - HOUSE



The main battery disconnects are located in the rear curbside battery compartment. In the compartment are a pair of battery disconnects: One for the chassis batteries and the other for the house batteries. Turn off the batteries anytime the motorhome is going to be stored and not in use. If possible, leave the motorhome plugged into an AC source with the battery disconnects on. This will help prevent the batteries from going dead. Use of the battery cut-off switch at the entry door will not turn off all DC electrical items. There are small “parasitic” loads that are present on both the house and chassis batteries. Some are federal mandate items, such as the LP detector. If the motorhome will not be used, or will be stored for more than 48 hours, it is recommended to turn the batteries off.

BATTERY CUT-OFF SWITCH



Release
Lock



OM060107

The battery cut-off switch is located inside and next to the entry door. This switch controls the 12 Volt DC power to the domestic fuse panels. The switch locks into the ON position preventing the interior DC power from being accidentally turned off. When the switch is ON, power is supplied to all the 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 and can be used to conserve house battery power. Refrigerator and inverter operation are unaffected by the operation of this switch. When turned off, this switch will not stop all parasitic loads and therefore is not a substitute for the main battery disconnect switch.

To Turn the Switch OFF:

- Simultaneously push spring loaded lock down and push the switch OFF.

CAUTION: To avoid flash damage to electrical contacts, turn OFF the interior lighting before turning OFF the battery cut-off switch.

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, all that is necessary is to connect the supplied shore power cord. If 50 Amp service is not available, electrical adapters will be required.

SHORE POWER HOOK-UP



CAUTION: Avoid flash damage to the electrical system contacts. Before hooking up to 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. Avoid standing in water when making electrical connections. Serious electrical shock and personal injury can occur. To avoid the risk of an electrical shock, turn the circuit breaker OFF for the power supply outlet before making the shore power connection.

Plugging in the Shore Cord:

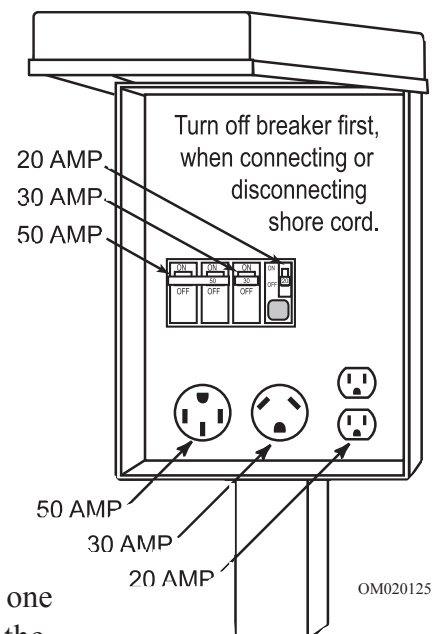
- Located in the rear roadside compartment is the shore power cord.
- Unscrew the deck plate and extend a sufficient amount of cable through the deck plate to reach the socket.
- Align cord end with socket terminals. Insert and rotate end clockwise $\frac{1}{4}$ turn locking end into socket.
- If 50 Amp service is not available, install the proper electrical adapters to 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.

After connecting the motorhome to shore power, wait approximately one minute for the inverter/charger or converter to "stabilize" charging of the batteries before starting air conditioners or other large AC loads. In the instance 50 Amp service is not available, use caution not to overload the supplied shore service breaker. Operate appliances and outlets in sequence rather than all at the same time.

Power Supply:

Different amperage supplies vary greatly in the amount of available current.

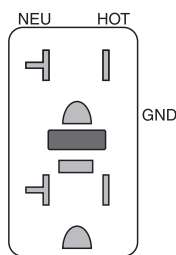
- The continuous amount of current through a breaker or fuse is only 80% of its rated capacity.



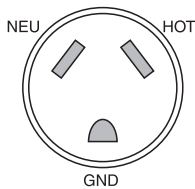
- 50 Amp 220 Volt AC shore power service consists of two power supply conductors, a neutral and a safety ground. The 50 Amp breaker simultaneously limits each power supply conductor to no more than a short-term maximum of 50 Amps for each conductor. The 50 Amp 220 Volt service actually provides 80 continuous 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:

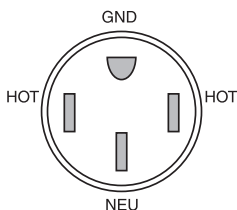
There are many different electrical adapters available to suit a variety of needs. Only UL approved adapters should be used. The most common adapter is a 50-30 Amp adapter. The type of connector adapts the 50 Amp shore cord to a 30 Amp shore power outlet. Always install the adapter to the cord prior to making the connection to the outlet.



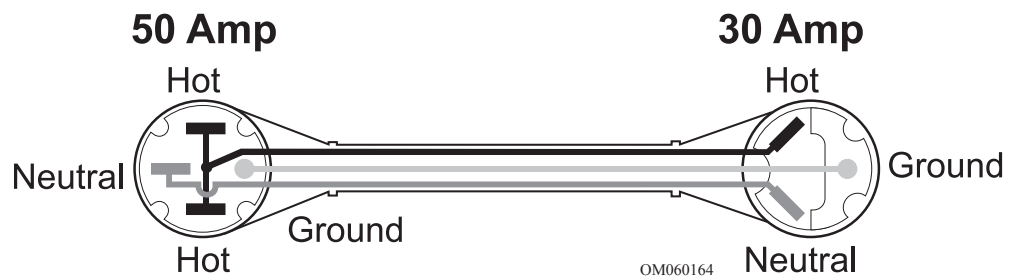
15-20 AMP
120 VOLT



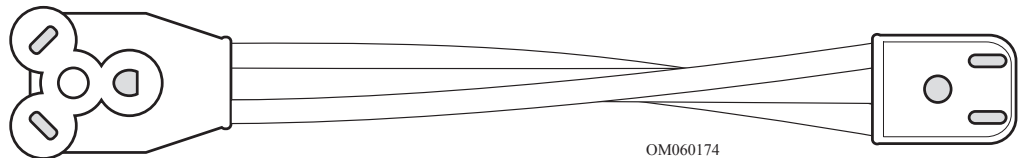
30 AMP
120 VOLT



50 AMP
220 VOLT
OM060121



Another common adapter is a 30 to 15 Amp adapter. This type of connector adapts the 30 Amp shore cord to a 20 Amp shore power outlet.



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



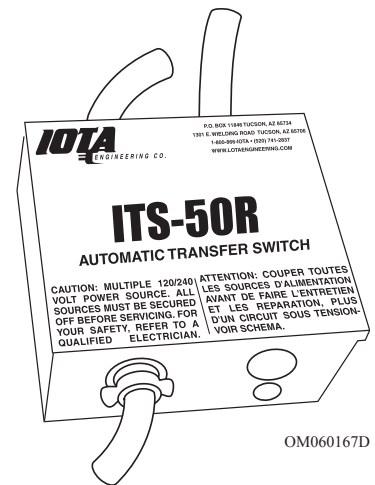
CAUTION: Avoid the risk of electrical shock or component damage by disconnecting from shore power during electrical storm activity. Use the inverter or start the generator if AC power is needed.



NOTE: Shown to the left are the three types of shore power outlets most commonly used.

The transfer switch automatically transfers AC power from the shore power cord or generator through the transfer switch to the 110/220 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.

TRANSFER SWITCH



NOTE: The shore cord is **NOT** electrically connected to the generator. When the generator is operating, the electrical contacts of the shore cord are not electrically energized.



NOTE: To prevent damage to the transfer switch contacts do not have appliances on or AC loads plugged into outlets when hooking up to shore power or starting the generator. 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.

The standard generator for the motorhome is a 6.5 kW LP generator. This generator provides 6500 watts of power. This power is 120 AC Volts at 60-Hertz Frequency with 54.2 Amps of current.

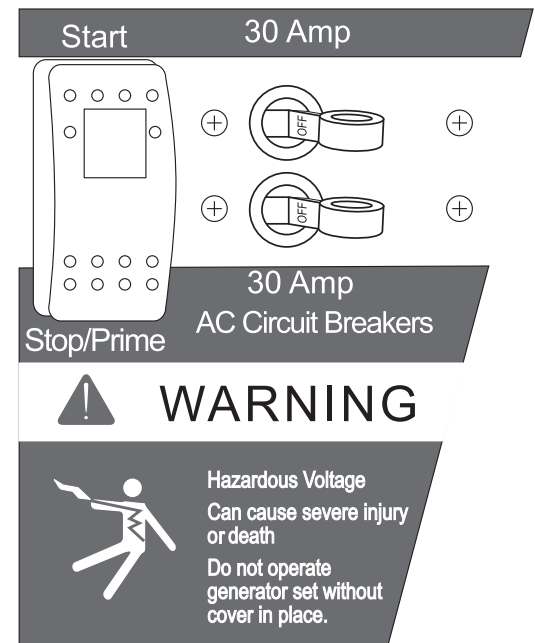
The generator is located in the front compartment of the motorhome. The generator can be started from the following locations:

- The generator remote switch, located on the dash.
- The generator control panel, located on the generator.



NOTE: Make sure the LP-Gas liquid valve is on for the generator.

GENERATOR - 120 AC (LP-GAS)



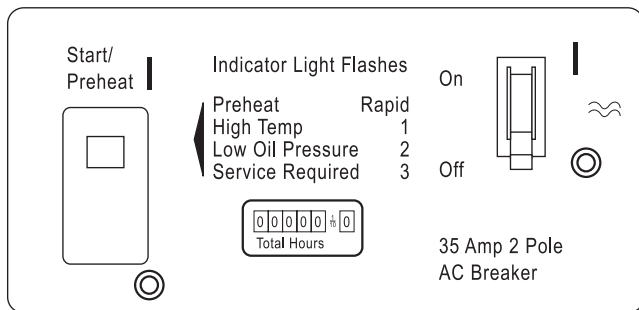
Fuel:

Use clean, fresh HD-5 grade liquefied petroleum gas (LP-Gas) or equivalent product consisting of at least 90% propane. Commercial liquefied petroleum gas fuels may contain more than 2.5% butane which can result in poor fuel vaporization and poor engine starting in low ambient temperatures (below 32° F / 0° C). Satisfactory performance on low-pressure LP-Gas models requires that the LP-Gas vapor is supplied at a pressure within the range indicated in Specifications.



WARNING: High LP-Gas supply pressure can cause gas leaks that can lead to fire and severe personal injury or death. Only trained and experienced personnel should adjust the LP-Gas supply pressure.

GENERATOR - 120 AC DIESEL (Optional)

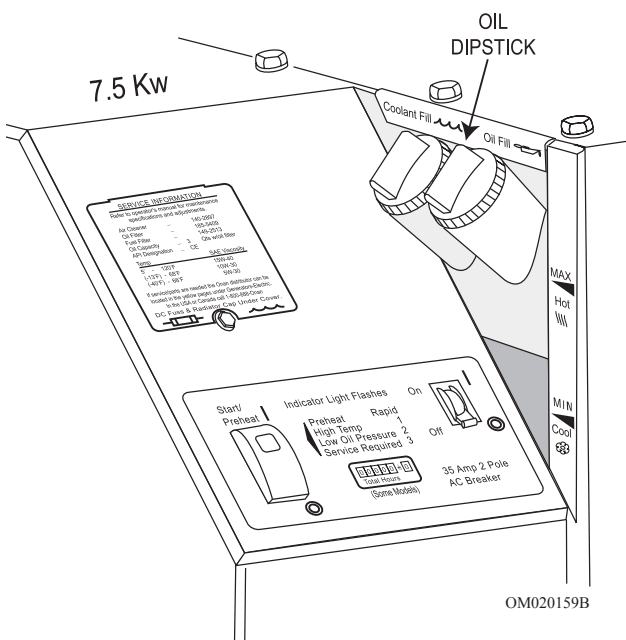


OM020159

The generator is located in the front compartment of the motorhome. The generator can be started from the following locations:

- The generator remote switch on the dash.
- The generator control panel located on the generator.

Pre-start Checks



OM020159B



Prior to the first start of the day perform a general **inspection** including oil and coolant levels. Keep a maintenance log on number of hours in operation since the last service. Perform any service or maintenance that may be due.

Before Starting the Generator:

- People and animals must be clear of hazards of electrical shock and moving parts.
- All appliances and other large AC electrical loads must be off.

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 many loads.

Resetting the Circuit Breaker

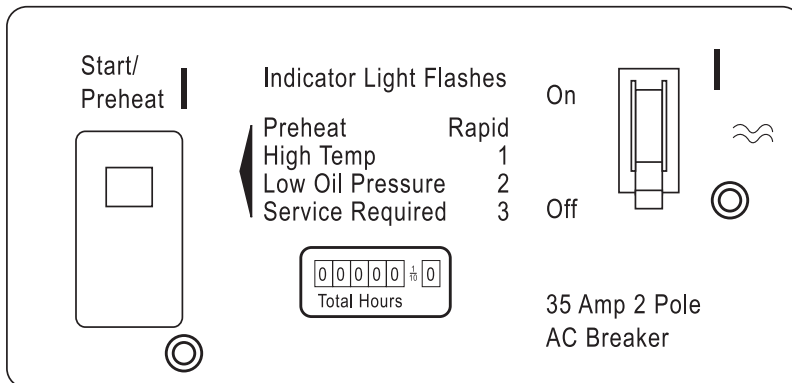


NOTE: The generator will continue to run after a circuit breaker trips.

If a circuit breaker trips, disconnect or turn off as many loads as possible. To reset the circuit breaker, switch the circuit breaker to **OFF**; then switch back to **ON** to reconnect the circuit. If the circuit breaker immediately trips, the electrical distribution system has a short or the circuit breaker is faulty. Call a qualified electrician. If the circuit breaker does not trip, reconnect a combination of loads that will not overload the generator or cause the circuit breaker to trip again. Remember to compensate for elevation and temperature changes when reconnecting loads.



NOTE: An appliance or load may have a short if it causes a circuit breaker to trip after reconnection. DO NOT continue to reset breaker. Have the problem corrected before resuming operation.



OM020159D

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, relubricates the internal engine parts and replaces the old stale fuel with a fresh supply. It also promotes removing oxides from the electrical switches and contacts.

GENERATOR EXERCISE



NOTE: Avoid short run periods of the generator set. Run the generator set under a load for a minimum of one-half hour.

STARTING THE GENERATOR

Push and hold control switch in the START position until the generator starts. Release switch. On diesel models the control switch may flash up to 15 seconds, indicating engine preheat.



NOTE: Diesel models may require priming. Hold control switch in the OFF position for one minute. 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.



WARNING: Excessive cranking can overheat and damage the starter motor. Do not crank the engine more than 30 seconds at any one time. Wait at least two minutes before resuming.

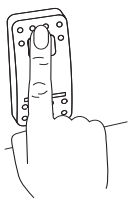


If the generator fails to start refer to the generator manufacturer's owner's manual.

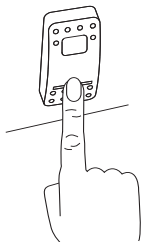


WARNING: When the motorhome is parked, position the dash air conditioner vent control in the OFF position to prevent exhaust gases from entering the motorhome. The engine exhaust contains carbon monoxide, which is an odorless and colorless gas. Carbon monoxide is poisonous and can cause unconsciousness 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 either outside, underneath, or inside the motorhome or any nearby vehicles. Operate the generator only when safe dispersion of exhaust can be assured. Monitor the outside conditions to be sure that the exhaust continues to disperse safely.

Press Top to
START



Press Bottom to
STOP



OM080357



WARNING: When parking near high grass, be sure that the hot exhaust does not come into contact with the grass, it could be a fire hazard. Hot exhaust pipe or hot exhaust gases can ignite the grass.

Stopping the Generator

Turn off all appliances and disconnect other AC loads being used. Allow the generator to run unloaded for at least one minute before shutdown. This will allow the engine to cool. Push and hold the control switch in the STOP position until the generator stops. Release the switch.



NOTE: Diesel models require only a momentary stop signal.

POWERING THE EQUIPMENT

The AC output of the generator powers the motorhome air conditioners, the AC inverter/converter 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," 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 some appliances in sequence rather than all at the same time.



NOTE: The generator may shut down when it is 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.

It is important to remember that air density decreases as altitude increases, causing the generator engine power to decrease. 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° F. a 7500 watt generator produces 6000 watts net.



REFERENCE: The generator may shut down for other reasons beside "overloads." A blink code may appear on the control switch. Refer to the manufacturer's manual to obtain an explanation of the codes.

When refueling there is always a possibility the fuel may be contaminated. Contamination of fuel affects the performance of the generator. Diesel fuel may contain water or a microbe growth (black slime). Propane, due to the refining process, may contain lightweight oil. Any contamination of fuel greatly reduces the total output of the generator and may cause erratic AC output.

GENERATOR FUEL

AVERAGE FUEL CONSUMPTION	LP-GAS 6,3000 WATTS (lbs/hr)*	DIESEL 7,500 WATTS (gal/hr)
No Load	2.6	0.13
Half Load	4.5	0.49
Full Load	7.3	0.96

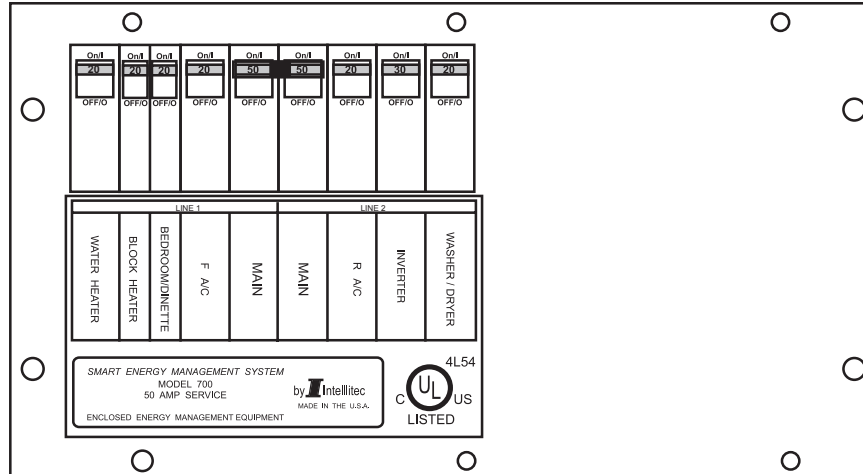
*4.5 lbs. = one liquid gallon of LP-Gas



NOTE: The motorhome manufacturer does not cover damage to the generator caused by fuel contamination, or to appliances due to erratic AC voltage.

DISTRIBUTION PANEL HOUSE 110 -AC Panel

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 to the individual branch circuit breakers. The panel label describes the breaker layout and the item, outlet or appliance to which they pertain. Labels vary from model to model.



OM060173



WARNING: This panel contains high voltage which can cause serious injury or death. Before beginning any work or testing procedures involving the electric panels, or any of the branch circuits, be sure the motorhome is unplugged from shore power, the generator is not running and the inverter is in the OFF position. Certain testing procedures can require the AC power to be on. Only qualified personnel with electrical backgrounds should attempt any testing procedures.

Branch circuit breakers supply AC power to the different items or “loads.” An electrical load is any item or device that will use current when supplied with an electromotive force. Should a breaker “trip” from over current use, or a short circuit condition, the load to which the breaker is supplying the electromotive force should be reviewed or disconnected to determine the cause of the trip. 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 reapplied it may indicate a fault with that particular load.

Do not continue to reset breaker until the problem has been diagnosed and corrected.

Breaker current ratings are current set points in which the breaker is designed to operate. The internal configuration of the circuit breaker is designed to trip when excess current is drawn through the breaker. The trip action of the circuit breaker can occur within milliseconds due to the speed at which electricity can travel. Breaker ratings are set to operate on a continuous load at 80% of the breaker's rated capacity. For example: A breaker with a 20 Amp rating will handle a continuous load of 16 Amps. This designed set point is when an inductive load is applied, such as when an electric motor turns on. As the motor starts to spin 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 fall. 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.

When using outlets, care should be considered when applying loads such as electric motors, heaters, coffee makers, toasters, hair dryer or other large current consuming loads. If the current rating of a load is not known it is usually stated on most electrical items. The rating will either be 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 load to current supply ratio.

The Energy Management System is easily identified by the remote display panel located in the hallway.

The 50 Amp Smart EMS consists of two elements: the display panel and the bedroom distribution panel. The display panel is mounted in hallway. 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. 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.

***Energy Management
System - 50 Amp
(Optional)***

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, is the 50 Amp breaker that acts as the 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 operation of six possible loads as indicated on 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 their use. If the available power source is 120 Volt AC 30 Amp shore power, the EMS attempts to keep the total 120 Volt current draw to less than 30 Amps.

Operation:

If 120 Volt AC is not available at the distribution panel, L1 or L2 outputs, the system shuts itself off. This feature is intended to prevent the system from drawing current from the +12 Volt DC battery supply when not in operation.

When 120 Volt AC power is applied the system automatically powers up and determines the nature of the power source. If the generator is running 120 Volt AC will be present at the distribution panel L1 and L2 inputs. In this mode the energy management feature is disabled and all control relay contacts are closed, energizing all of the controlled loads. The control Module sends a signal to the display panel causing the load meter to display actual load current, the generator service indicator to light and all power status indicators to light.

If 120 Volt AC is present at the distribution panel L1 and L2 inputs the system will assume that 120 Volt AC, 30 Amp shore power is available and the energy management feature will be enabled. **If only 20 Amp service is available the user must select the 20 Amp service mode by momentarily pressing the 20/30 Amp select switch on the Control Panel.** Initially, all relay contacts are closed and the total current is monitored. If the total current should exceed the service limit the system will turn off the first load in the shedding table. As the loads are turned off, it calculates the amount of current that was removed, which is the value for that load. This value is placed in memory. If the current remains above the service limit the system will turn off the next load in the shedding table. Again, calculating the amount of current that was removed and placing this value, which is the value of that load, in memory. The system continues to turn off loads until the total current falls below the service limit or all of the six controlled loads have been shed. Through this process the system has “learned” the amount of current 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 it will turn 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 three hour period be limited to 80% of the service rating. For that reason the 50 Amp EMS calculates the average running current for the system and, if it exceeds 80% of the service rating, the EMS sheds loads to reduce the average current below that limit.

For example: If a system operating under 120 Volt AC, 30 Amp service has been running at the 30 Amp limit for three hours, the EMS will change its shedding threshold to 24 Amps and turn off loads until the 24 Amp limit is attained. If the user selects the 20 Amp service mode this limit will translate to 16 Amps. Because the EMS calculates a running three 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 display on the display panel will illuminate.



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.



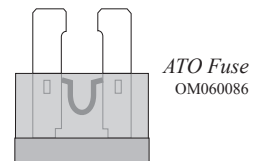
Fuses

The 12 Volt fuses, located in this distribution panel, service various components. Should a fuse blow it will be evident by the broken metal strip located in the center of the fuse. Replacement fuses should be of the same amperage. If a higher rated fuse is installed it can damage the wiring. Fuse current set points follow much of the same electrical principle as the 120 Volt AC breakers. Using 12 Volt DC as the electromotive force can make it more susceptible to outside influences, such as corrosion from weathering or oxidation.

The large variety of applications this voltage can be used in makes it a diet 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 a battery cable.

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.

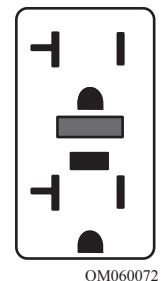
AMPERAGE	COLOR
1	BLACK
2	GRAY
3	VIOLET
4	PINK
5	GOLD
7,5	BROWN
10	RED
15	BLUE
20	YELLOW
25	CLEAR
30	GREEN



A ground fault circuit interrupter “GFCI” can be found in two different types of applications. One type is incorporated in a breaker used in 120 Volt AC breaker panels, the other is incorporated in an outlet. The GFCI, whether it is a breaker or an outlet, offer two types of protection.

One type of protection is from over-current or shorts. It also provides protection for persons against hazardous ground fault currents which can result in injury or death. Ground fault currents are currents that flow from the “HOT” or power terminal through a person to the ground. For example, touching a faulty appliance while standing on or making contact with an electrical ground such as a water fixture, bath tub or the earth. If the device has been properly installed it will offer protection against the type of shock that can result from faulty insulation, wet wiring from inside an appliance, or any device or equipment plugged in or wired to that circuit.

The “ground fault” portion of the outlet or breaker uses sensitive electronics inside the outlet or breaker to detect a ground fault problem. The electronics monitor the normal current of power, flowing to the “hot” or black wire through the load (eg. a light bulb or appliance) and coming back on the “neutral” or white wire. If just a small amount of the current comes back on the safety ground wire the electronics will “trip” the breaker or outlet, stopping the flow of electricity. The amount of current it takes to trip the device from a ground fault varies slightly from the different outlet or breaker manufacturers (approximately 30 mils or less).

GFCI BREAKERS & OUTLETS

Electrical shocks resulting from ground faults can be felt, but such a shock is considerably less than one without ground fault protection. People with heart conditions, or other conditions that make them susceptible to shock, can still be seriously injured. A GFCI outlet or breaker will not protect against shock from a normal current flow. For example, a shock from touching both metal prongs of an electrical cord or appliance while plugging it in.



WARNING: If a breaker or outlet trips continually DO NOT continue to reset breaker or outlet until the problem has been identified and corrected.



NOTE: The ground fault outlet or breaker should be tested once a month to insure it is working properly. Use the “TEST” button on the outlet or breaker. It should trip with an audible “click.” The breaker or outlet will not trip if no AC power is present to the device. If power is present and the device will not “trip,” replace it before using that circuit.



NOTE: One mil is 1/1000 of one amp.

Tools of the Trade

One of the most widely used tools for testing a 12 Volt problem is the test light. Test lights come in a variety of styles, such as a light bulb with a probe and ground clip, to the more elaborate electronic ones that measure a wide scale of voltages and perform a variety of functions. 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 an analog or digital format. Either of these two testing tools may be used, depending upon personal preference. If a 12 Volt light is not working, the test light may be better suited for this. In the case of a charging system problem the meter may be the tool of choice. In any situation the testing tool is an invaluable piece of equipment when it comes to determining an electrical problem.

Know When to Say No

Should it become necessary to use testing tools take certain precautions and consider three things. First, recognize when the problem is beyond your skill level. Nothing will create more mayhem than being armed with tools and going in an unknown direction. Good intentions have led to major problems. The second item to keep in mind is if something will cause more grief by being dealt with now than if it were left alone and repaired by a professional at a more convenient time. How many times have you said to yourself, “Oh this will only take a few minutes,” only to find it is taking an entire day and you wished you had not touched it? The third item to consider is whether or not the current situation may 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 an auto parts stores. A fuse description label lists circuits for your reference.



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.

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. The solution, when mixed together, is known as “electrolyte.” The 12 Volt battery is actually six batteries in one case. When charged, each cell has a voltage of 2.1 Volts. When six cells are hooked together this makes a 12.6 Volt battery (fully charged).

Electrons are stored on the negative plates. When a load (eg. a light bulb) is put 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 “sulphate.” 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. This can crack the case allowing the solution to spill, it can also warp the plates. The acid acts like an “antifreeze” for the battery. This is why batteries should not be left or stored in a “discharged” condition.

BATTERY - How it Works

Starting Battery

Starting batteries are designed for high output cranking power, but not for deep cycling like the house batteries are designed to do. Starting batteries will not last long in deep cycle application. The way they are rated should give a good indication of their intended use. "Cold Cranking Ampere" is a measurement of amperage output that can be sustained for 30 seconds. Starting batteries use thin plates to maximize the surface area of the battery. This allows a very high starting current but lets the plates warp when the battery is deep cycled (discharged).

Deep Cycle Battery

Deep cycle batteries are best suited for use with 12 Volt operated lights, appliances and inverters. Deep cycle batteries are designed to have a majority of their capacity used before being recharged. These are available in many sizes and types. The most common is a non-sealed, liquid electrolyte battery. The non-sealed types have battery caps. The caps should be removed periodically to check the level of electrolyte. When a cell is low, only distilled water should be added. Water consumption will vary depending on many factors: how far the batteries are depleted, how long the voltage is being applied to charge the batteries, how much voltage is used and how often this occurs.



NOTE: Tap water contains minerals which can alter battery chemistry and ruin the battery. Use only distilled water when refilling the battery.

Battery Maintenance

At a minimum, the battery electrolyte level should be checked at least once a month. Check the level sooner if the battery is frequently used. The level should be above the top of the plates, but not overfull. Most batteries have a plastic cup or well. The electrolyte level should be approximately 3/8" below the well to allow room for expansion while the battery is being charged. Overfilling 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 boil the water out rapidly once the plates have been exposed to air. This process may take only a matter of hours. If this has happened the battery is more than likely damaged.

After checking the battery's electrolyte levels it is also a good idea to check the battery connections for tightness and corrosion. If any corrosion is found disconnect the cables (make sure to mark their locations) and carefully clean them with a mild solution of baking soda and water. There are also aerosol products available that will work. This will neutralize any acid that may be present. Do not allow the solution to enter the battery as this will 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. Coat the terminals with petroleum jelly or an anticorrosion grease.



Wear safety glasses when servicing the battery.

The battery cable to battery terminal connections should be metal to metal. Periodically check the batteries for corrosion. Look for cracks and check the vent plugs. Replace them if they 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.



WARNING: Liquid lead acid batteries produce hydrogen gas while being charged. This is highly explosive. Do not smoke around batteries. Extinguish all flames in the area. The hydrogen gas may explode resulting in fire, personal injury, property damage or death.

There are several ways in which a battery can be tested and monitored. The motorhome uses a monitor panel, located in the overhead compartment above the entry door, which shows the status of the house and chassis batteries at a quick glance. Pressing and holding the test button, the power level will be displayed on the battery scale. The illustration shown explains in more detail the scale and indications.

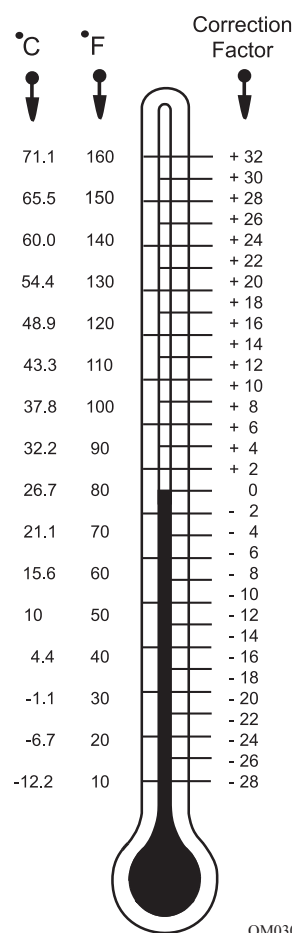
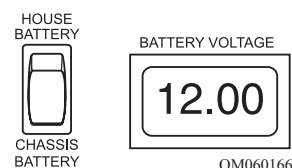
A more efficient way of testing the batteries is to check the electrolyte solution. The only way to test a battery's electrolyte solution is with a hydrometer. Many styles are available, from types with cylinder graduation (shown here) to types with floating balls. Hydrometers can be purchased from most auto parts stores. The hydrometer tests the battery's electrolyte solution which is measured in specific gravity. Distilled water has a specific assigned gravity of 1,000. The hydrometer is calibrated to this mark. Pure sulfuric acid has a specific gravity reading of 1,840. The acid is 1.84 times heavier than water. The electrolyte solution is about 64% water to 36% acid (fully charged battery). Hydrometers with cylinder graduation are graphed and the exact state of specific gravity can be determined.

Temperature and recent battery activity (charging or discharging) affect the hydrometer readings. It is best to check the battery when it has been "at rest" for at least three hours, although readings taken at other times will give a "ballpark" figure. When using the hydrometer, draw the electrolyte solution up into the tube. Allow the hydrometer to attain the same temperature as the electrolyte solution. Note the reading for that cell. Complete the same test for the rest of the cells on that battery bank.

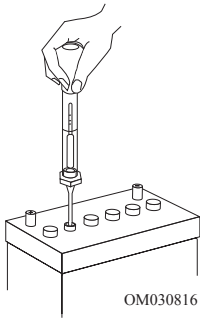
The hydrometer is calibrated at 80° F. Temperature affects the hydrometer readings. The higher the electrolyte temperature, the higher the specific gravity reading. The lower the temperature, the lower the specific gravity reading. Add or subtract four points for each 10° variance from the 80° F chart. Readings between cells should not vary more than 50 points.

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.

Testing the Battery



OM030815



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 $\pm .5\%$ will also give an indicator of the battery's state of charge.

Another test that can be performed is to place a specific load on the battery for a predetermined length of time equal to that particular battery's rating. This machine is usually an adjustable carbon pile that can vary the load being applied to the 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.

Reasons Why Batteries Fail

1. Physical Condition:

Active material flakes off the plates and falls to the bottom of the cell.

This is normal, but sediment accumulation under the plates can short out a cell. The plate separators fail to insulate positive and negative plates in a cell and the cell becomes shorted, ruining the battery.

2. Insufficient Electrolyte:

This allows exposed portions of the plates to sulfate rapidly. This reduces the battery's ability to accept a charge and the battery capacity is reduced. Accelerated erosion of the lower portions of the plates occur from higher than normal acid content due to water loss. Only the water evaporates, not the acid. The battery also has a higher internal resistance when low on water. Add only distilled water. Fill each cell to the bottom of the vent well when the battery is warm. Filling a very cold battery with water to the bottom of the vent well will cause overspill when the battery warms up and the plates expand. A Battery Formula For Failure: the battery has a higher internal resistance when low on water, therefore:

high resistance = more heat = shorter battery life!

3. Sulfation:

When a battery remains discharged for too long the accumulated lead sulfate in the plate material solidifies and cannot reenter the electrolyte. When a battery is left in a discharged state the lead sulphate will crystalize. Charging the battery does not move the crystallized lead sulphate off the battery plate. The battery is damaged.

4. Overheating:

The chemical reaction inside of the battery is increased when the battery temperature rises above 125° F. This increases the corrosion of the plates and reduces the battery life. When overheated, the battery plates tend to buckle and destroy the structural integrity of the battery.

5. Freezing:

When the electrolyte freezes, ice formed dislodges the active material from the plates. The battery case may crack and the electrolyte will leak out when thawed. It is especially important to keep a battery at full charge in cold weather to prevent freezing. The high specific gravity of a fully charged battery does not freeze as easily. Never attempt to charge a frozen battery. Warm it up first.

6. Corrosion:

Corrosion from spilled or splashed electrolyte form deposits that can conduct electricity and can cause battery drain. Clean off all corrosion, especially around the battery terminals and on the top of the battery. Prevent accumulation by coating the terminals and the exposed metal cable connectors with high temperature grease.

7. Overcharging:

Overcharging rapidly converts water to gas and decreases the electrolyte's water content as the water evaporates. The electrolyte level drops and becomes more acid in content. This subjects the plates to a higher concentration of sulfuric acid and results in early battery failure.



NOTE: Any time more than one or two ounces of distilled water is added per-cell per-thousand miles, check the motorhome charging system for overcharging. Prolonged overcharging generates excessive heat inside the battery, which buckles the plates and destroys the battery. It is a fact that over 50% of battery failures are caused by over-charging.

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 to this might go as follows: 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 get sucked down 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.

Calculating Run Times:

Calculating run time figures when operating 120 Volt AC electrical items with an inverter can be exponential. This is 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 five amps to ten amps on a 100 Ahr battery does not yield 10 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.

Battery Charge Time & Consumption Rate

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 to operate the 120 Volt 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. 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 keep batteries in their proper operating range.

Battery Specifications

CHASSIS	AH (20 HR)	CCA†	RC (25A @ 80° F) MINUTES
Chassis 12 Volt Chassis 31P-MHD (2 each)		950	450
6 Volt Domestic U2200 (4 each)	450*	**	75 Amp @ 80° F = 230 min.

*Total battery bank capacity.

**Battery connections are made in a Series/Parallel connection. †CCA Ratings are at 0° F. These are the minimum requirements.

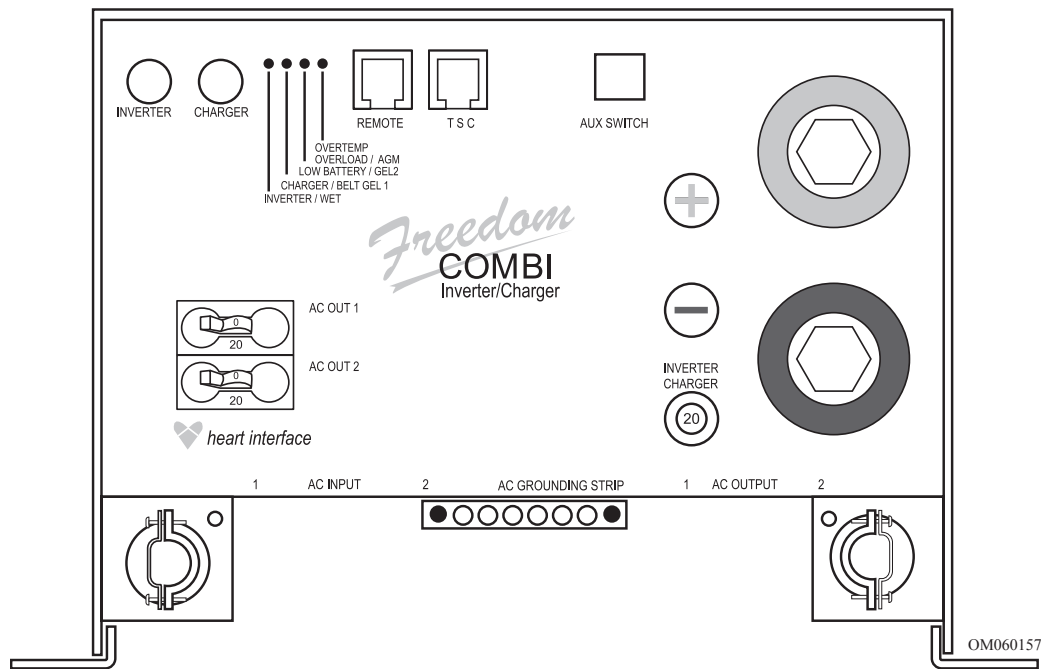
Battery State of Charge vs. Voltage/Specific Gravity			
Voltage	Specific Gravity	State of Charge	Depth of Charge
12.66	1.265	100%	0%
12.45	1.225	75%	25%
12.25	1.190	50%	50%
12.05	1.145	25%	75%
11.90	1.100	0%	100%

Voltage Reading: Battery fully charged at rest for one hour.

CUMMINS ENGINE - COLD CRANKING AMP REQUIREMENTS			
ISB	1110	CCA	12 VOLTS
ISC	1250	CCA	12 VOLTS
ISL	1500	CCA	12 VOLTS
ISM	1800	CCA	12 VOLTS

CCA Ratings are at 0° F. These are the minimum requirements.

INVERTER/ CONVERTER



The inverter performs two functions. Changing DC battery power to AC electrical power, Second, and changing 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.

Battery Charging

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:

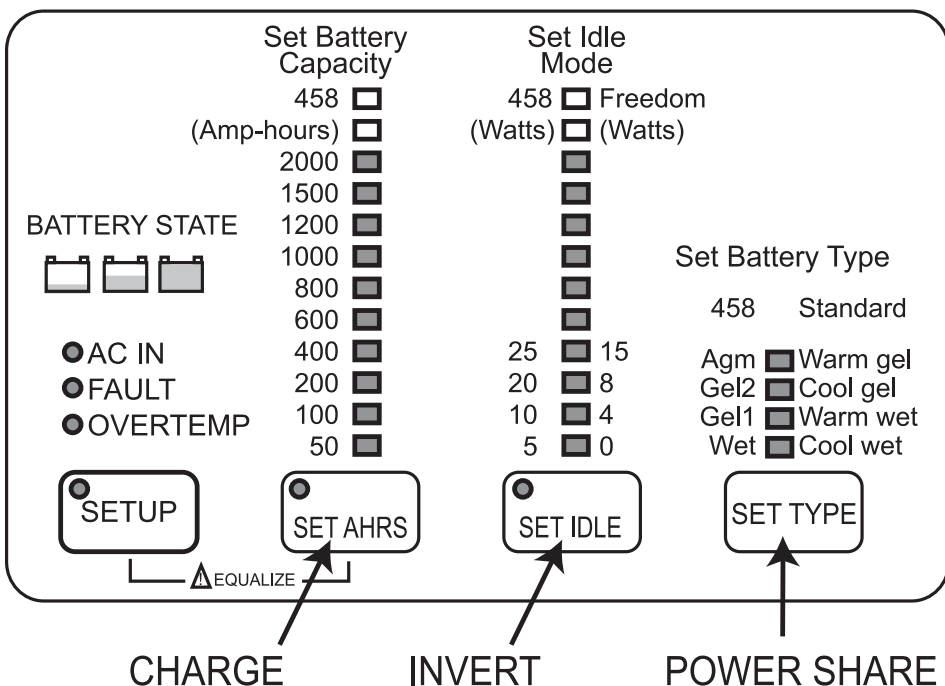
- Press the switch marked “**CHARGE**” on the remote panel.



REFERENCE: Complete detailed 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.



OM060169

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.

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:

- **First step is "BULK" charge.**

The "bulk" charge will bring the DC voltage up high, initially between 14.2-14.5 Volts DC, depending on conditions. The length of the bulk charge cycle depends on the condition of the battery, loads and other factors. When the battery voltage attains 14.2-14.5 Volts DC, the charger begins the next cycle.

- **Second step is the "ACCEPT" cycle.**

The voltage in this cycle is the same as the bulk charge cycle 14.2-14.5 Volts DC. The length of the absorb cycle will vary with state of charge of the batteries.

- **Final step is the "FLOAT" charge cycle.**

Approximately 80% of the charging has been completed at this time. The float charge voltage is generally around 13.3-13.7 Volts DC. The last 20% of the charge cycle of the batteries typically takes the most amount of time. The charging cycle is initiated each time the inverter is disconnected or reconnected to AC power. Repeated charging cycles in succession can lead to boiling of the batteries.

Incorporated in the inverter is a double pole "pass-through" relay that trips when AC power is supplied to the input terminals. This relay transfers 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.

Pass - Through Relay

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.

Temperature Sensitive Charging

Programming the Inverter

Battery Capacity and Idle Mode are adjustable. The program mode must be entered to change a setting.

To Enter the Programming 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.

Equalize Charge

Batteries can sulfate over time. When sulfating occurs some of the sulfuric acid has adhered to the lead plates of the battery and does not enter the electrolyte solution though normal battery charging. A battery with a low concentration of acid in the electrolyte will affect the battery's performance. Sulfation can occur when a battery is stored in a discharged condition or when a battery is continually cycled below a 50% state of charge. An indication a battery has sulfated is when the inverter is in float charge and the hydrometer reading has stabilized below a full state of charge (approximately 1260).

An equalize charge cycle may promote the acid to leave the lead plate and enter the electrolyte solution. This is done by charging the battery at a slightly higher than normal voltage for a short duration. The equalization cycle will charge the batteries at approximately 15.5 Volts for eight hours. To maximize the results from equalize charging initiate the equalize cycle after the inverter has entered float charge.

Only liquid lead acid or absorb glass matte (AGM) type batteries should be equalize charged. Other battery types can be damaged if equalize charged. Monitor the electrolyte solution closely when equalizing a liquid lead acid battery. A battery's "healthy" cell(s) can be damaged if overcharged. High DC charge voltages can also damage voltage sensitive electronic equipment.



NOTE: Several precautions should be used when performing an equalize charge.

Precautions to Take When Performing an Equalize Charge:

- Only equalize charge batteries with the motorhome in a well-ventilated area, preferably outdoors. Liquid lead acid batteries produce explosive hydrogen gas when charging. Extinguish all flames and eliminate other sources of ignition.
- Secure the battery compartment door in the open position.
- Remove the battery caps during the equalize charge cycle.
- A liquid lead acid battery will consume water when equalize charged. Fill battery cells with distilled water before beginning an equalize charge cycle. Do not overfill the cells. Overfilled battery cells will spatter excess electrolyte.
- Protect all painted surfaces from any electrolyte solution that may spatter during equalize charging. If the electrolyte solution spatters on the exterior painted surface rinse immediately using large quantities of water.
- Turn **OFF** the battery cut-off switch located at the entry door.
- Observing polarity, disconnect the 12 Volt DC supply from the refrigerator. Access supply leads through the outside refrigerator compartment. Tape the positive lead to prevent a short circuit.
- Avoid operating any electrical equipment while in the equalize charge cycle.

To Equalize Charge:

- Press and hold the **SETUP** button on the remote for five seconds.
- After the LED lights change from green to red press and hold the **SETUP** and **CHARGE** buttons simultaneously.
- The Battery State indicator lamps flashing sequentially indicate equalize charge. The inverter will run an equalize charge cycle for about eight hours.

To Exit Equalize Charge:

- The equalize charge cycle may be discontinued at any time during the charge cycle. Press the **CHARGE** button.
- Allow the batteries to cool for approximately three hours. Check the electrolyte solution with a hydrometer. Avoid overcharging the battery resulting in damage to the healthy cells.
- Add distilled water if necessary. Install battery caps. Use large quantities of water to rinse the entire battery compartment and surrounding area.
- Observing polarity, hook the 12 Volt DC supply leads to the back of the refrigerator. Do not reverse polarity. Damage to the refrigerator circuit board can result.



CAUTION: Never attempt to charge or equalize charge a frozen battery.



WARNING: Liquid lead acid batteries produce highly explosive hydrogen gas when being charged. Extinguish all flames and other sources of ignition. Never smoke around batteries. Danger of explosion, fire, property damage, serious personal injury or death can result!

SOLAR PANEL
(Optional)

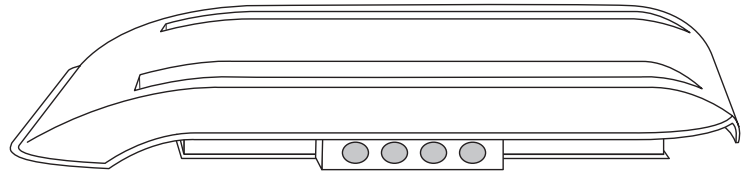
The system consists of one roof-mounted solar panel, a Combiner box (that connects the panel to the wires) and a charge controller located in the battery compartment. The solar panel is a laser-grooved, buried-grid panel that is capable of delivering about two or three amps of charge per hour in full sunlight (usually between 9:30 a.m. and 2:30 p.m.). Extensive testing has shown that the solar panel delivers enough power to offset the normal day-to-day drain on batteries caused by various parasitic electrical loads. These parasitic loads are usually associated with transmission memories, natural self-discharge of batteries and other like items. This means that the solar panel is only intended to cover these parasitic loads while dry camping.



WARNING: The solar panel needs to be cleaned monthly. The solar panel may need to be cleaned more frequently depending on weather conditions.

Combiner Box:

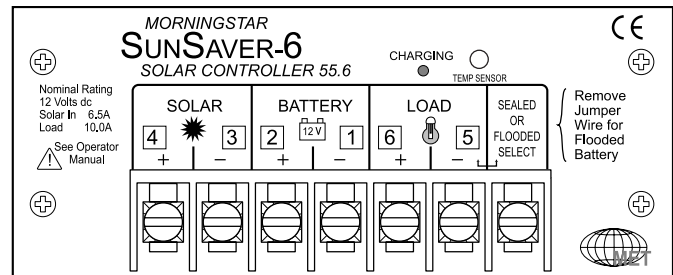
The Combiner Box is located on the side of the refrigerator vent on the roof. It has four standard knock-outs.

**Charge Controller:**

The Charge Controller was built to accommodate either Flooded Lead-Acid batteries or (sealed) Absorbed Glass Matte (AGM) batteries. The Charge Controller is limited to a maximum of three-amp charge.

The faceplate of the controller is used as a heat sink for the electronics. It will become warm to the touch especially when it is processing higher amperage. This is normal and there is no reason to be concerned. Automatic thermal shutdown (indicated by the Load Disconnect light) will activate if the controller gets too warm. The Green charge indicator illuminates when the system is charging.

The jumper wire is removed from the two right hand terminals. This sets the float voltage for the controller to Flooded Wet Cell batteries. Removing the jumper lowers float voltage for Absorbed Glass Matte batteries. This feature resets the charge parameters to work with either flooded wet cell batteries or AGM batteries. Float voltage changes from 14.2 to 13.4 Volts, which is what the AGM battery manufacturer recommends.



CAUTION: The Charge Controller panel may be hot to the touch.

Solar Panel Care:

A critical part of maintaining the solar powered battery charging system is keeping the panels clean. The amount of power that a panel will produce is directly related to the intensity of sunlight that reaches the internal crystals. A dirty panel will allow less light to reach the crystals resulting in reduced power output. A layer of dust or road grime can reduce power output by 15 to 25%. Combine dust with leaves and debris that cover two or three of the individual cells can reduce output power by 50 to 75%.

Use of the basic maintenance tips, regular inspections and regular cleaning will assure maximum performance from the solar charging system. To clean the panels use non-abrasive cleanser and paper towels. The surrounding environment and the amount of road dust encountered determines how frequently the panels should be cleaned. One to two times a month is preferred.

Tips:

1. The panels should be cleaned if a film or a layer of dust is on the windshield.
2. On a bright sunny day, charging current of two or three amps can be obtained during the peak charge cycle.
3. High winds blow dust and debris causing dirt build up on the panel. Frequently inspect the panel and clean as necessary.



CAUTION: Avoid damage to the solar panel controller. Cover the solar panel with a blanket when replacing the batteries or performing battery cable maintenance.

[illegible]

Endeavor

SECTION 9 ELECTRICAL SYSTEMS - CHASSIS

INTRODUCTION	275
BATTERY DISCONNECT - CHASSIS	275
BATTERY - CHASSIS	276
BATTERY SPECIFICATIONS - CHASSIS	277
DASH	278
INDICATOR LAMPS	278
GAUGES	280
PARKING BRAKE	282
SWITCHES	282
CONTROLS	286
AIR CONDITIONER & HEATER CONTROLS	287
STEERING COLUMN	295
TILT & TELESCOPE	295
DIAGNOSTIC PLUG LOCATION	295
FUSE & CIRCUITS - CHASSIS	296
DISTRIBUTION PANEL - FRONT	296
ALTERNATOR	298
CHECK OUT PROCEDURE	298

INTRODUCTION

A majority of the lighting and appliances are designed to operate from 12 Volt DC (direct current) power. This is why the batteries play such an important role in the function of the motorhome. There are exceptions with appliances such as the microwave or television; however, indirectly they still operate from 12 Volt DC power, as they can be operated from the inverter. The chassis functions (engine, transmission, dash air, etc.) are also 12 Volt DC.

With the all technological advancements taking place in the past several years manufacturers have now incorporated electronics into these systems. It is important to keep the 12 Volt system(s) in good working order. These systems, with their incorporated electronics, are voltage sensitive. Some items can be damaged if the DC voltage is not maintained within the designed specifications.

There are two separate 12 Volt systems. One is the chassis system; the other is the house system. These two systems, for the most part, are separate from one another. The house system does not operate engine functions; as the engine system does not operate house functions. However, within the two systems there are some inner connections. For example: While the motorhome is driven the alternator on the engine will charge the house batteries. Each system will supply 12 Volt DC power to the 12 Volt distribution panels. The 12 Volt panel that services a majority of the chassis system functions is located outside by the driver's front wheel. The other panel, located in the bedroom, services the house interior functions such as the interior lighting and appliances. You should become familiar with these panels and the items they operate.

The two different systems, engine and house, have their own set(s) of battery(s). The engine battery supplies 12 Volt DC power to the front distribution panel located in an outside compartment by the driver's side front wheel. This panel contains mostly engine system fuses and wiring such as headlights, taillight, dashboard functions, gauges, etc. The house battery(s) supplies 12 Volt DC power to the distribution panel located in the bedroom. This panel contains fuses for the house, interior lighting and appliances, such as the furnace and water heater.

The main battery disconnect for the chassis battery turns the DC power on or off to the front electrical bay. Most chassis and engine functions are interrupted when the battery disconnect is turned off. Some electronic items require a constant power source for memory retention such as the dash and CB radios. Some electronic components of the engine and transmission require a constant power source. Turn the main battery disconnect switch off when the motorhome is going to be stored, or when performing electrical maintenance. If possible, leave the motorhome plugged into an AC source with the battery disconnect switch on. This will help prevent the possibility of dead batteries.

BATTERY DISCONNECT - CHASSIS

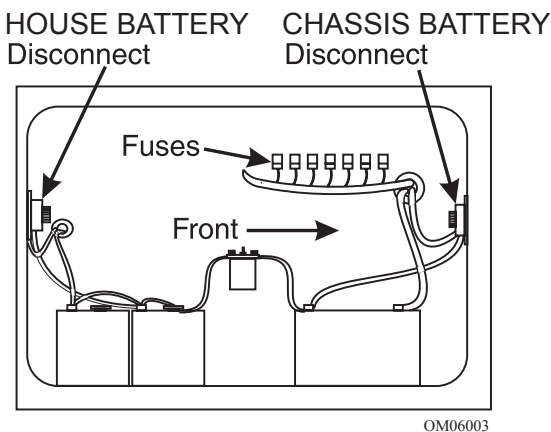
If an AC source is not available, and the motorhome is not going to be used or is stored more than 48 hours, it is recommended to turn the battery disconnect switch off.



NOTE: The solar panel (optional) will charge the batteries with the disconnect switch off.



WARNING: When the frame or other welding is involved for motorhome repair, or modification, the following precautions are required to protect electronic 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 wiring harness connectors at the transmission electronic control unit. Open bed storage compartment, open engine access door. The ECU is located above the transmission.
4. Do not connect welding cables to electronic control components.
5. The welding ground cable should be attached no more than two feet from the part to be welded.

BATTERY - CHASSIS

The chassis battery operates only chassis and engine functions. The chassis battery is a crank type battery, producing the high amperage needed to start the engine. Engine starters initially require a large amount of current to crank an engine. Initial starter amperage draw exceeds 1200 amps. The type of application in which the engine battery is used differs from the house battery application. The engine battery state of charge remains consistent. Maintenance is still required with an engine battery. Regular electrolyte level checks and hydrometer readings should be performed. High electrolyte consumption, or inconsistent hydrometer cell readings, may indicate a charging system problem. Perform a charging system and current draw check if the battery is exhibiting abnormal hydrometer readings.



NOTE: Replacement batteries should have the same cold cranking amp (CCA) rating.

Battery Specifications - Chassis

CHASSIS	AH (20 HR)	CCA†	RC (25A @ 80° F) MINUTES
Chassis 12 Volt Chassis 31P-MHD (2 each)		950	450
6 Volt Domestic U2200 (4 each)	450*	**	75 Amp @ 80° F = 230 min.

*Total battery bank capacity.

**Battery connections are made in a Series/Parallel connection. †CCA Ratings are at 0° F. These are the minimum requirements.

CUMMINS ENGINE - COLD CRANKING AMP REQUIREMENTS			
ISB	1110	CCA	12 VOLTS
ISC	1250	CCA	12 VOLTS
ISL	1500	CCA	12 VOLTS
ISM	1800	CCA	12 VOLTS

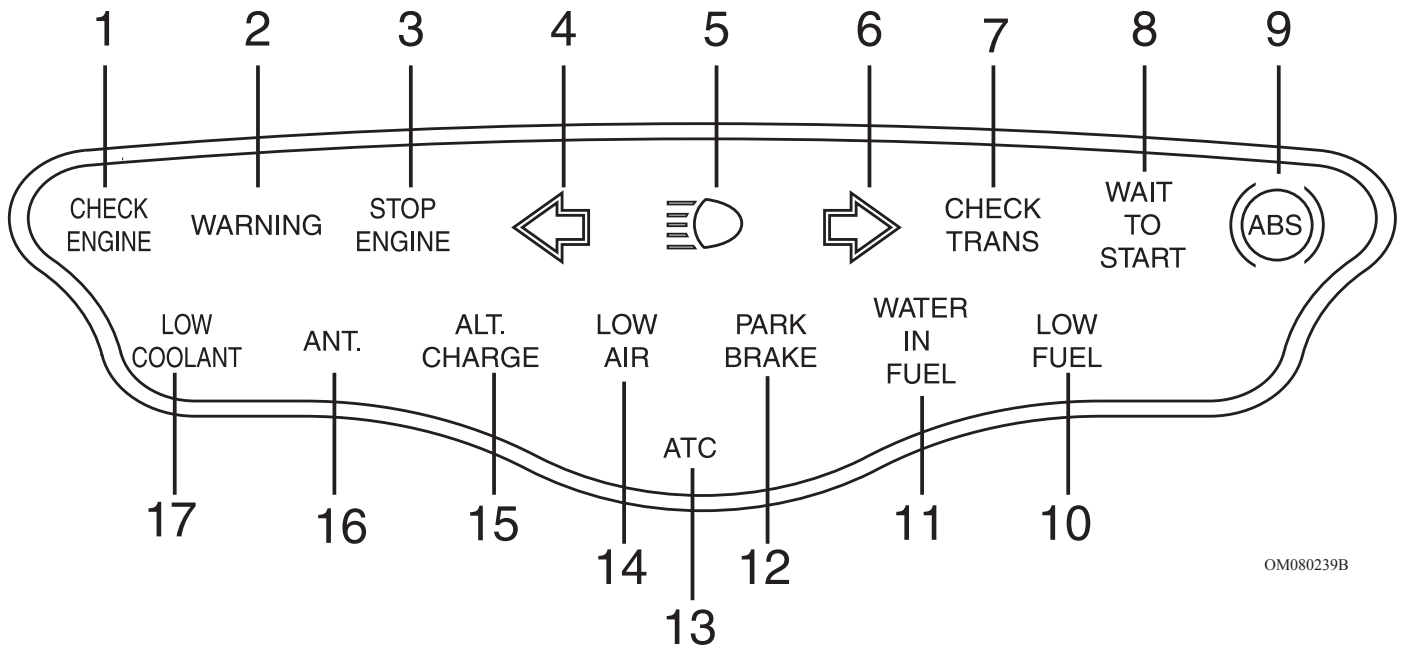
CCA Ratings are at 0° F. These are the minimum requirements.

Battery State of Charge vs. Voltage/Specific Gravity			
Voltage	Specific Gravity	State of Charge	Depth of Charge
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.

APPROXIMATE HOURS AT AMPERE LOAD					
	5 AMPS	10 AMPS	15 AMPS	20 AMPS	25 AMPS
U2200	55	22	12.5	9.1	7

DASH - Indicator Lamps



1. Check Engine:

Problem with the engine.

2. Warning:

Out of range condition exists within the engine protection circuits. Stop coach, check all fluid levels.

3. Stop Engine:

Alerts driver of severe out of range condition within the engine protection circuits. Pull over and stop as soon as possible. Shut-off engine to avoid engine damage.

4. Left Arrow - Audible Turn Indicators:

Left turn indicator circuits active. Audible indicator cancels when the brake is applied.

5. Headlight Beam:

High beams when illuminated.

6. Right Arrow - Audible Turn Indicators:

Right turn indicator circuits active. Audible indicator cancels when the brake is applied.

7. Check Trans:

Alerts driver of problems related to the Allison Transmission. The light should momentarily illuminate when the ignition is switched ON. When starting the lamp will extinguish indicating the circuits are working properly. If the lamp fails to illuminate or remains on, the transmission needs to be checked immediately. Contact the nearest Allison dealer.

8. Wait to Start:

Monitors the air intake heater at engine start up.

9. ABS:

ABS possible fault in the ABS Brake system. Also indicates fault codes for service technicians.

10. Low Fuel:

Fuel level is becoming low.

11. Water in Fuel:

Water has been detected in fuel.

12. Park Brake:

Parking/emergency brake is applied.

13. ATC (Automatic Traction Control):

The ATC indicator light will illuminate steady when the ignition key is turned ON. The light remains illuminated until the first brake application. The indicator flashes slowly when the ATC switch is pressed. The indicator light will flash quickly when an ATC event occurs.

14. Low Air:

Air tank pressures are out of operating range. Check air pressure.

15. Alt Charge:

Failure within the alternator charging system.

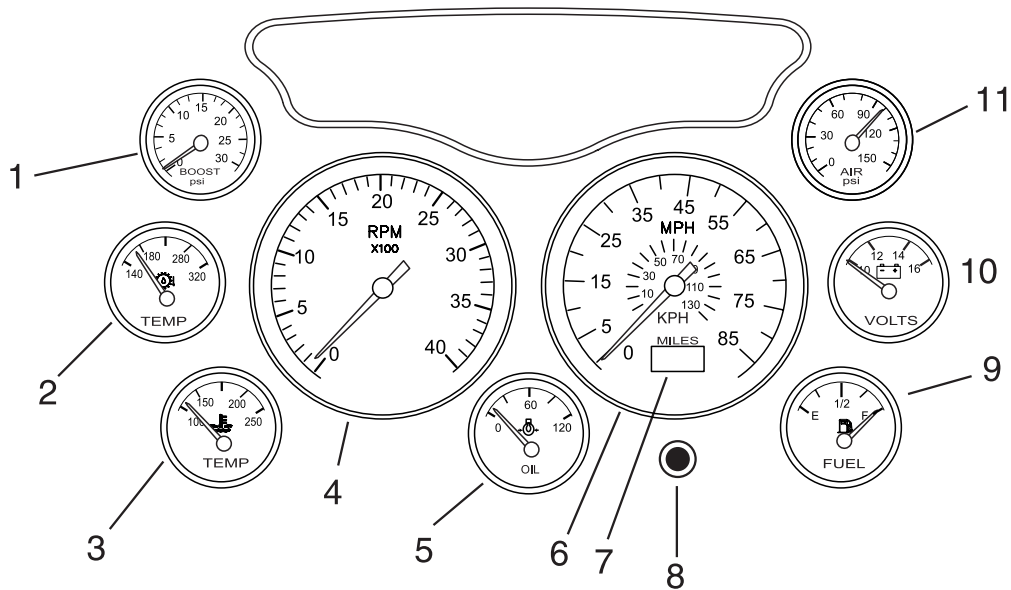
16. Ant:

TV antenna is raised. Lower antenna before moving coach.

17. Low Coolant:

Coolant level in the overflow tank is below acceptable level.

Gauges



OM080288B

1. Turbo Boost:

Indicates boost pressure produced by engine turbocharger.

2. Trans Temp:

Reads temperature of transmission fluid. Normal transmission operating temperature is 160-250° F. The maximum transmission to cooler oil temperature is 300° F. Do not let the transmission temperature exceed 275° F. If excessive temperature is indicated stop motorhome and shift to neutral. Accelerate engine to 1200-1500 RPM and allow temperature to return to normal.

3. Coolant Temp:

Under average conditions the gauge reads between 180° F and 205° F. Monitor this gauge frequently when CLIMBING HILLS, TOWING or in HIGH AMBIENT TEMPERATURES. If the gauge shows that over-heating exists (the needle moving above the 212° F area) IMMEDIATE ACTION should be taken.

Overheating may be a Result of any of the Following Conditions:

- Low coolant level.
- Hydraulic fan motor failure.
- Mechanical failure of hoses or belts.
- Blocking of charge air cooler fins.
- Climbing a long hill on a hot day.
- Towing a heavy trailer.
- Idling for long periods of time.

4. Tachometer:

Displays engine speed in revolutions per minute (RPM).

5. Oil Pressure:

Indicates pressure of oil and not the amount of oil in system. Please refer to manufacturer's instructions for specific pressure recommendations.

6. Speedometer:

Indicates the speed of the motorhome. The gauge indicates MPH and KPH.

7. Odometer/Trip Meter:

This meter records mileage driven as well as keeps track of mileage on a trip. To operate trip meter push the round black button under the speedometer. This changes 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.

8. Mileage/Trip Reset Button:

Operates the trip meter, changes the odometer mileage reading to the trip mileage reading. Press and hold to reset the trip meter.

9. Fuel:

Fuel gauge will register approximate fuel level in the tank when ignition switch is in the run position.



NOTE: Fuel mileage varies with driving style and road conditions. Always average more than one tankful to obtain a more accurate figure. The diesel Generator uses fuel from main tank and will affect fuel mileage figures. Diesel Generators will not operate below 1/4 tank to ensure there is enough fuel to run main engine.

10. Voltmeter:

This gauge shows the charge condition in the chassis battery. The normal voltage with the ignition switch ON and the engine OFF varies between 12.0 and 13.0 Volts. With the engine operating without a heavy load the battery charging voltage is about 14.0 Volts. Battery readings of less than 10.5, or more than 15.0 Volts, usually indicates a battery or electrical system problem.

11. Air Pressure Gauge:

This gauge indicates air system pressures. The normal air system operating pressures are 105 to 120 psi. These air pressures are preset at the factory. If a problem occurs with air system not maintaining normal operating pressure it is an indication of a malfunction in the air system. Use caution and stop the motorhome in a safe area. Contact your dealer immediately.



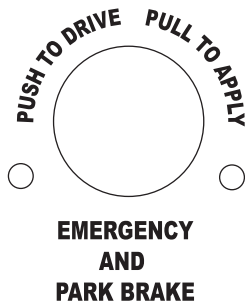
NOTE: It is not safe to drive the motorhome with low air pressure. Damage can occur to the suspension and drive line. The operation of the air brake system is also affected.



NOTE: Layouts may vary with different models and options.

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 to shut off the air warning lamp.



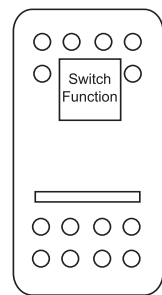
OM080313



WARNING: If the air tank is not dumped, 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 and rested on the dash panel. A wooden clothes pin clasped at the base of the shaft will work.

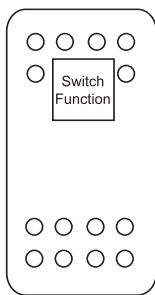
Switches

There are two types of switches used, one is lighted and the other type is non-lighted. Each switch has the function it controls printed on the switch. Press the top of the switch to start the function and press the bottom to stop the function. Following is a list of switches used and their functions.



Lighted Switch

OM060066C



Non-Lighted Switch

PEDAL IN/OUT:

Use the Pedal In/Out switch to adjust the brake and throttle pedal to be either closer or farther away. The switch moves the pedals inward or outward approximately three inches. If it is necessary to move the pedals inward, push the same switch in the opposite direction. When the pedal comes to the end of the traveling distance there will be a different sound in the noise of the motor. Stop by releasing the switch. Do not continue moving the pedals. Damage to the motor and or fuse may result if operation of the switch continues after reaching the fullest extend or retract position.

AUX START:

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.

ATC System:

The ATC system improves traction on slippery or unstable surfaces by preventing excessive wheel slip (see **SECTION 10** for detailed information).

Exhaust 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 HEATED:

The switch turns on the heaters in outside rearview mirrors. The mirror heaters should be used when defogging or deicing as needed. To use the mirror heat, press the switch to the ON position.



NOTE: Mirror heat should not be left ON unless continuous fogging conditions occur.

AIR DUMP:

Will manually dump air from the air bags. May be an aid in leveling the motorhome. Releasing the air from air bags will give the leveler more range of travel for leveling.



NOTE: Never drive the motorhome with the air bags deflated. This may damage the motorhome.

INC/DEC:

Will increase and decrease the engine idle in 25 rpm increments. There are limits to the idle speed, about 700 to 875 rpm.

ENG DIAG:

Checks engine functions.

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 15 seconds.

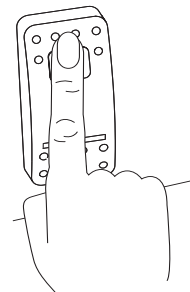
To Start the Generator:

Press and hold the switch to START. The light will flash rapidly indicating the preheat cycle. At the end of the preheat cycle the engine will crank and start. Release the switch after the generator has started and is operating smoothly.

To Stop the Generator:

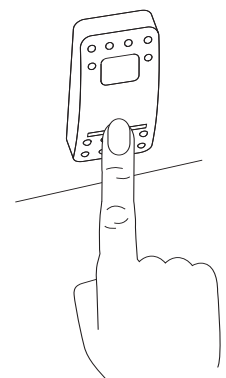
Momentarily press the switch to STOP. It is not necessary to hold the switch until the generator has stopped.

Press Top to
START



OM080357

Press Bottom to
STOP



ENTRY STEP:

Provides power to operate the Entry Step through magnetic switches.

STEP COVER:

The motorhome is equipped with a sliding stepwell cover that is extended and retracted by use of a dual action air cylinder. An electrically operated air valve controls the air cylinder. The air solenoid, known as a "MAC" valve, receives air pressure from the front air tank. The "MAC" valve will direct the air pressure to either side of the dual action air cylinder, moving the stepwell cover in or out. The stepwell cover will not operate without sufficient air pressure (approximately 60 psi).

CEILING LIGHT:

Illuminates the front ceiling light from the Entry Area.

PORCH LIGHT:

Turns ON and OFF the outside Porch Light.



WARNING: Stepwell cover is under air pressure. When operating the stepwell cover be 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.

RADIO:

Applies power to the dash radio. This will allow the radio to be turned ON and OFF, independent of the main radio switch.

LH SHADE:

Operates the power sun visor located on driver's side.

RH SHADE:

Operates the power sun visor located on passenger side.

CRUISE:

Turns cruise ON or OFF.

CRUISE CANCEL:

Signals the cruise system to disengage without losing the current speed memory.

SET/RESUME:

- Cruise SET - Actuates the Cruise Set function of the engine controller.
- Cruise RES - Actuates the Cruise Resume function of the engine controller.



WARNING: To take control of the motorhome 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 as high engine RPM run up will occur until the cruise control is turned off.

AIR HORN:

Energizes the circuitry needed for the Air horns. This should only be used on the highway and open areas.

SIDE DOCKING LIGHTS:

Operates the side docking lights to increase visibility when parking.

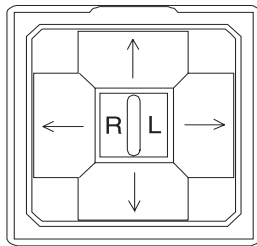
DRIVING LIGHTS:

Operates low beam headlights at 80% of their normal operating voltage.

ICC FLASH:

Flashes all exterior lights at once.

Controls



OM060097

MIRROR ADJUST:

To adjust the rear view mirror the small selector in the middle of the switch must be placed in the desired side. The middle position is to prevent accidental bumping of the switch and changing the mirror position. The outside mirrors have been placed so that they can be easily adjusted with the Allen wrench. After taking delivery of the new motorhome it will be necessary to sit in the driver's seat and adjust the mirrors to driver's needs. Both the driver and the passenger mirrors should be adjusted.



Headlight Control

OM080332



Wiper/Washer Control

OM080339

HEADLIGHT:

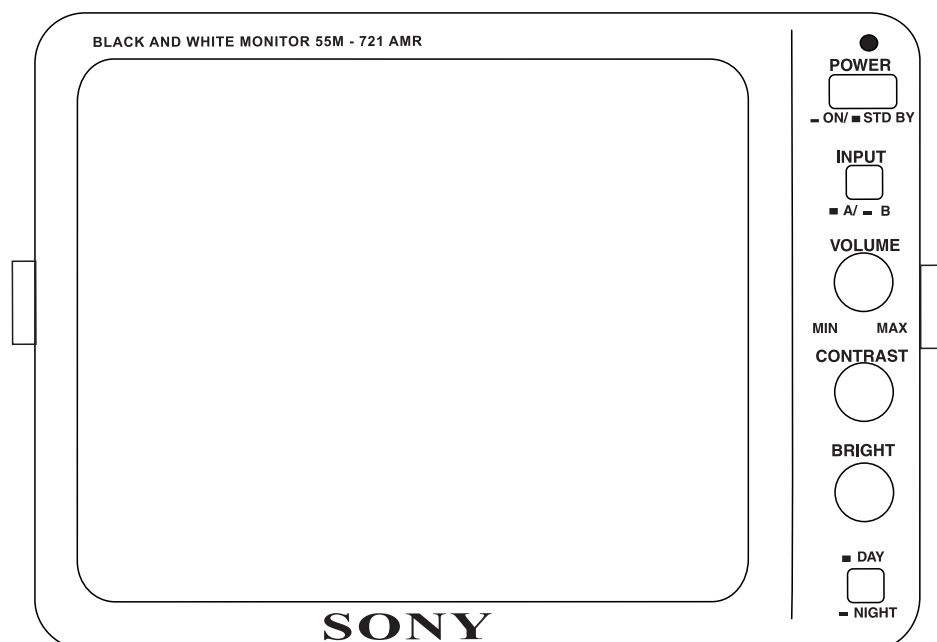
Pull one click to operate the parking lights. Pull two clicks to operate the headlights. Rotating the headlight switch clockwise will dim the dash lights. Counterclockwise rotation will illuminate the map light in the overhead compartment.

WIPER/WASHER:

Wiper operations are controlled when rotating the knob to the right. When the knob is rotated from OFF to DELAY, the wiper will turn on and time delay between wipes (ranging from 45 seconds to two seconds) will occur. The amount of delay time changes as knob is rotated. A continuous low or high speed can be obtained by rotating the knob to the appropriate position. The wipers will be turned OFF with the switch in the OFF position. When the end of the knob is pushed in, water fluid will be dispensed from the system and the wipers will turn on momentarily.

BACK UP MONITOR:

Used with the back up camera and will display the rear view of the motorhome.



OM060103

Air Conditioner & Heater Controls**Dash AC and Heater Control:**

The system is designed to only provide heating, cooling and defrost capabilities for the pilot/co-pilot area. The system is not capable of heating or cooling the entire motorhome.

Blower Operation:

The blower is selected automatically when the desired feature is selected with the **SELECT** switch. The system is shut off by placing the mode control switch in the “**OFF**” position.

A/C Operation:

The A/C dash system will operate in all modes except **VENT**, **FLOOR** and **OFF**. The **A/C** and **MAX** positions engage the A/C compressor. When the switch is positioned in the **A/C** mode fresh air is drawn through the front air intake of the unit through the A/C coil. In the **MAX** position a damper door closes off the fresh air, while another door opens to permit only air from inside the coach to be used. When maximum cold air is desired this position should be selected. Also use this position when you do not wish to introduce outside air into the coach.

Air Distribution Switch (Mode Control):

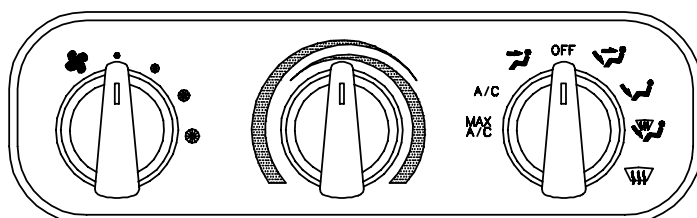
Used to direct air where it is needed to maximize the comfort of the motorhome.

Temperature Control Switch:

Controls an electric water valve regulating the amount of engine coolant passing through the heating and cooling coils in the system. Rotating to the red area provides warmer air; rotating to the blue area provides cooler air.

Blower Speed Control Switch:

Controls the speed of the blower motor, which is one of the best and most effective ways of controlling the temperature. The switch provides four speeds in all modes except **OFF**.

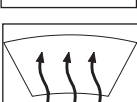


OM080221

Blower Speed Control

Temperature Control

Mode Control Switch

		MAX A/C - Recirculated air is drawn from the passenger area and discharged through the dash louvers.
		A/C - Fresh Air is drawn from outside into the system and discharged through the dash louvers.
OM090273		VENT - Fresh air is drawn in and discharged throughout the dash and defrost louvers.
		OFF - The blower motor does not operate. The fresh air inlet door closes, minimizing outside air infiltration into the motorhome.
OM090274		BI-LEVEL - Fresh air is drawn in and discharged through the dash, floor and defrost louvers.
OM090275		FLOOR - Fresh air is drawn in and discharged through the floor louvers. A small amount of air is used to defrost the windshield.
OM090276		MIX - Fresh air is drawn in and discharged through the floor and defrost louvers. The A/C system operates to dehumidify the discharged air.
OM090277		DEFROST - Fresh air is drawn in and discharged through the defrost louvers. The A/C system operates to dehumidify the discharged air.

Winter Use:

- De-ice the windshield using the DEFROST mode.
- Air will heat up faster with a slower blower speed until normal operating temperature ranges are reached.

Summer Use:

- Close all windows and vents to hot, humid outside air.
- MAX A/C and HI blower will provide quick cool down.
- Use a lower blower speed to produce cooler air.

Operating Tips and Hints:

Air intake and discharge temperatures are greatly affected by ambient temperatures and relative humidity. A large amount of cooling capacity is used to dehumidify air as well as cool it. After three to five minutes of A/C operations the discharged air temperature should be approximately 30° F cooler than the fresh or recirculated air entering the AC system.

Troubleshooting:

The dash A/C/Heat system uses a combination of compressed air (developed by the chassis system), vacuum air (developed by the vacuum generator) and electric relays and vacuum switches. Therefore, any repair can be classified in one of five categories:

• **Electrical** • **Vacuum** • **Air Conditioner** • **Heater** • **Defroster**



NOTE: Operate the air conditioning compressor once a month to maintain lubrication of compressor seals and other internal components of the system. If the air conditioning system has not been operated for longer than one week, initially engage the compressor when the engine is at an idle. This prevents sudden high-speed operation of non-lubricated compressor components.

The following information is provided to assist in troubleshooting common operational problems which may occur.

No Heating:

1. A/C switch is turned off.
2. Blower switch is turned off.
3. Verify the proper engine coolant level.
4. Verify that the engine is reaching operating temperature.
5. Verify engine coolant is reaching water valve attached to unit.
6. Verify operation of water valve to permit engine coolant to pass through valve to heater core.
7. Check unit fuses.
8. Check power supply to water valve and grounding.
9. Check wiring.
10. Engine thermostat faulty.

No Cooling:

1. Check 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 leaking.
7. Drive belt loose or broken.
8. Compressor Clutch inoperative, will not engage.
9. Expansion Valve faulty or frozen.
10. Thermostat control faulty.
11. Mode control switch faulty.
12. Compressor faulty.
13. Loss of refrigerant.

Reduced cooling:

1. Coolant valve not operating correctly.
2. Air passages obstructed.
3. Loose or worn drive belt.
4. Check blower and select switch.
5. Thermostat control valve faulty.
6. Expansion valve faulty.
7. Compressor 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 ignition switch is "ON."
5. Check blower and select switch.
6. Motor shaft seized.
7. Blower wheel out of alignment.

Damper Doors Do Not Operate:

1. Does motorhome air tank have pressure?
2. Check vacuum generator is being powered and producing vacuum.
3. Check vacuum line entering unit for vacuum.
4. 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.
5. Check mode switch.
6. Check wiring.
7. Check for pinched vacuum line leading to the vacuum motor operating the damper door in question.

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 in front of the radiator 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. The fan is part of the hydraulic system.

Receiver-Drier - Freon leaves the condenser, enters the dehydrator 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 operation of the system.

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

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. 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 would be 77 feet. This 77 feet is then divided by 7 for total of 11. This represents the number of ounces of PAG oil needed for the A/C system (11 oz.).

Carrying the formula one step further, 11 oz. is approximately equal to 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					
Ambient Temperature*	90° F	+	40° F	=	130° F
Chart Conversion	130° F = 198.90 psi				

* Ambient Temperature is measured 1 inch from the condensor.

PSIG-On a 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.

R-134a Refrigerant:

R134a is classified non-explosive, non-flammable and non-corrosive. There is hardly any odor and it is much heavier than air. R134a is ozone friendly; however, it is not technician friendly. Proper care in handling and adequate ventilation 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 heat transfer which occurs when a liquid boils, or vapors condense, forms the basic principles 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:

- When working with any refrigerant system wear eye protection and hand protection.
- Pag Oil irritates the skin. Flush with water immediately if in contact with any body part.
- Ensure any service work performed on the A/C system is in a well ventilated work area.
- Keep open flame away from service area. The discharge of a refrigerant gas near an open flame can produce a poisonous gas.



NOTE: O-rings used in a 134A system are Hydrogenated Nitrile Butadiene Rubber (HNBR). These are green in color and required for the 134A system.

A/C Heater:

The A/C system will also produce heat to warm the air in the dash area. Much like the refrigeration side of the system, a liquid will be used in the process. This liquid is the engine coolant. The coolant is passed from the radiator to an electronic water valve. The water valve, when open, will allow the coolant to flow through the heater core. The heater core is tubing and fins. Air is drawn into the system by a blower motor through the outside recirculation door opening. Air is blown through the A/C evaporator core and then through the heater core. 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.

Diagnosis of Electric Water Valve:

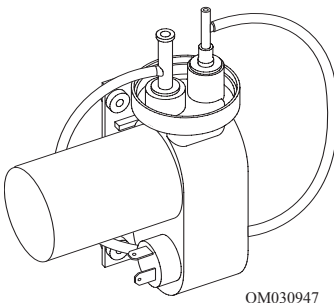
Theory of Operation: Models with a center dial temperature control use a potentiometer at the control head for input of desired temperature. The water valve which controls the water flow to the heater core is opened and closed by a stepper motor mounted on the water valve. A control module compares the output voltage from the control to that of the feedback for the stepper motor of 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.

No Heat:

- Check the blower and air mode operations. Fix or repair prior to proceeding.
- Verify the engine is reaching normal operating temperature. (Check with engine manufacturer for proper procedure.)
- Check the inlet hose at the water valve. The hose has hot water at the valve inlet. The inlet water temperature should be the same as the engine water temperature.
- With the temp control on full hot position, check the outlet hose of the water valve. The hose should be at engine water temperature.



OM030947

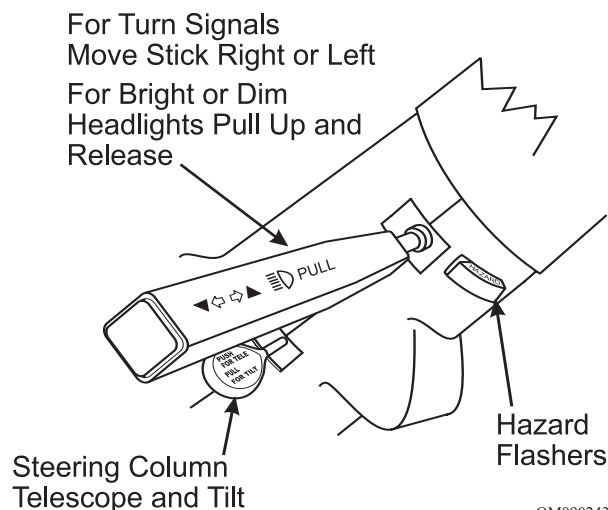
Vacuum Generator:

The vacuum generator is important to the operation of the dash heating and A/C systems. This provides the vacuum to open and close the vacuum switches. When the vacuum generator is operating it creates 15 inches of vacuum and is passed to a reservoir ball. Most dash heater and A/C systems will only require 10 inches of vacuum to operate the switches. The output from the reservoir is sent to the vent control knob. The control knob will then direct the vacuum operation to the appropriate vacuum switch to open or close vents and switches. The vacuum generator uses the air from the front air storage tank through a 1/4 inch red air line. Whenever the ignition is ON, and the A/C is operating, the vacuum generator will operate.

Tilt and Telescope Steering Wheel Control Lever: Located on the Steering Column.

- To tilt the steering wheel pull the lever up. Tilt the steering wheel where you want it. Release the lever and it will lock the steering wheel in the new position.
- To telescope the steering wheel push and hold the lever down. Push down or pull up on the steering wheel until the wheel is where you want it. Release the lever and the steering wheel will lock in the new position.

STEERING COLUMN Tilt & Telescope



OM090243

Turn Indicator and Headlight High/Low Dimmer Control Lever: Located on the Steering Column.

- Pushing the lever forward will activate the right turn indicator circuits when the ignition is on.
- Pulling the lever down will activate the left turn indicator circuits when the ignition is on.
- Pulling the lever up will select high/low beam circuits when the headlights are ON.

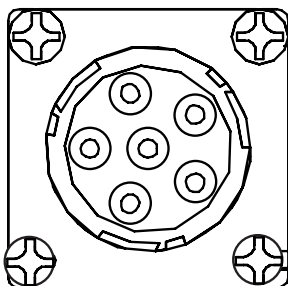
Hazard Flasher Button: Located on the Steering Column.

- Pull out on flasher button to turn four way flasher on.
- Push button inward to shut off flasher.

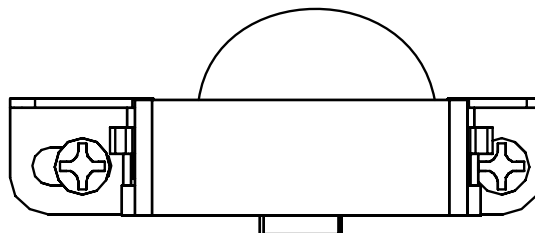
Cummins & Allison diagnostic plugs are located in the roadside electrical bay just in front of the front wheel.

DIAGNOSTIC PLUG LOCATION

Engine



TRANS

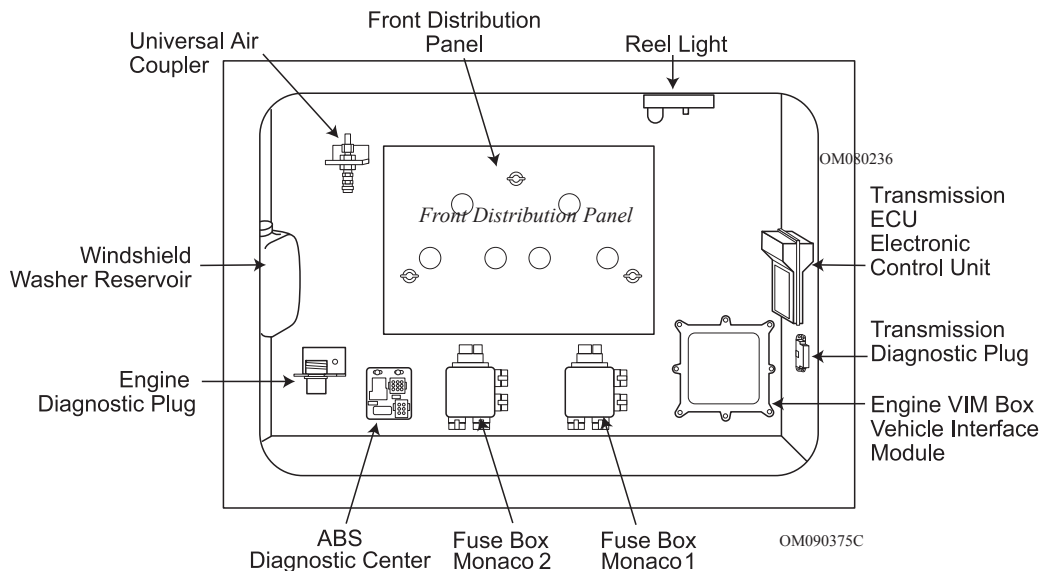


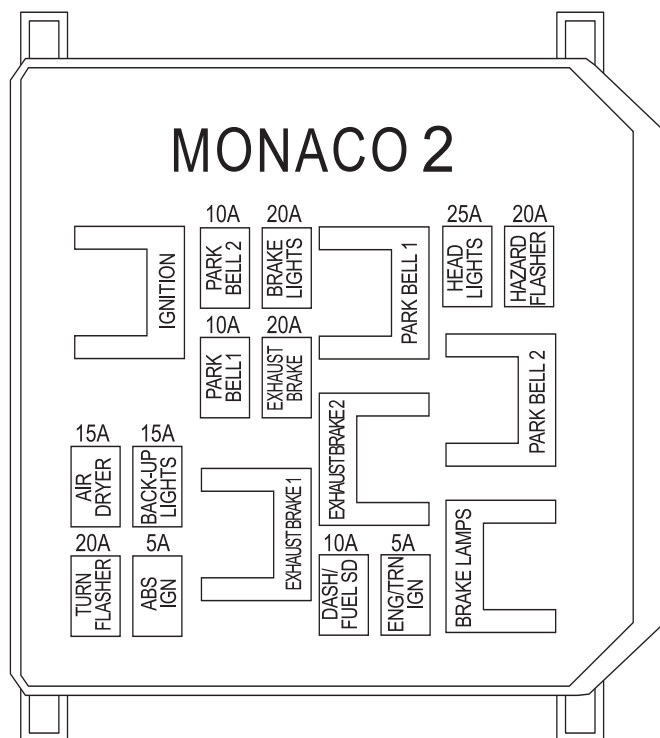
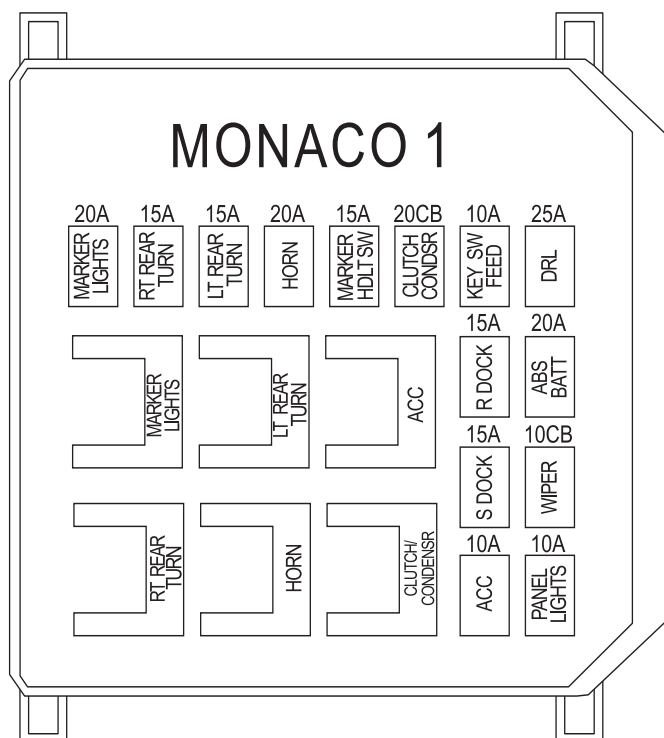
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FUSE & CIRCUITS - CHASSIS Distribution Panel - Front

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 compartment door.





CIRCUIT BREAKERS & FUSES

HOUSE		
1	Step Well Lights	10 amp Fuse
2	LP/CO Detector	3 amp Fuse
3	Power Seat (Driver)	15 amp Circuit Breaker
4	Power Seat (Passenger)	15 amp Circuit Breaker
5	Storage Lights	15 amp Fuse
6	Service Lights/LP SOL	15 amp Fuse
7	Auxiliary Start/TV AMP	7.5 amp Fuse
8	Reserved	
9	Map Lights	7.5 amp Fuse
10	CB Radio	2 amp Fuse
11	Service Light/Aux Power Jack	15 amp Fuse
12	Dash Fans	15 amp Fuse

CHASSIS		
13	Step Switch	5 amp Fuse
14	Step Motor	20 amp Fuse
15	Reserved	
16	Roof Horns	15 amp Fuse
17	Sunvisors	5 amp Fuse
18	Step Slide	15 amp Fuse
19	Reserved	

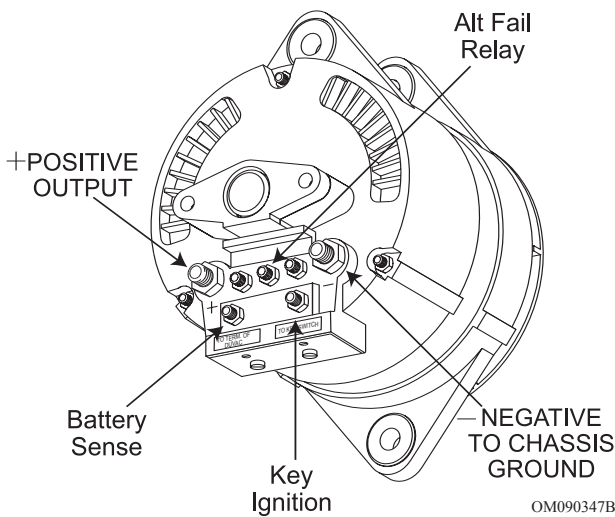
ACCESSORIES		
20	Rear Vision	5 amp Fuse
21	Leveling Jacks	15 amp Fuse
22	Air Dumps	15 amp Fuse
23	Auxiliary Lights	15 amp Fuse
24	Spot Light	15 amp Fuse

IGNITION		
25	Air Conditioner	20 amp Fuse
26	Jack/Antenna Warning Lights	5 amp Fuse
27	TV IGN Relay	5 amp Fuse
28	Slide-out - IGN Relay	7.5 amp Fuse
29	Mirror Heated	15 amp Fuse
30	Mirror Control	1 amp Fuse
31	Adjustable Pedestal	10 amp Fuse
32	Reserved	
33	Step/ISO/Vac Sense	7.5 amp Fuse

MARKER (CHASSIS)		
34	Marker Lights	7.5 amp Fuse

CIRCUIT BREAKERS	
Refrigerator 2-Way/3-Way 5/30A	
Interior Fuse Panel 50A	

ALTERNATOR



The Leece-Neville alternator with integral rectifier, regulator and remote voltage sensor is designed for reliable output throughout 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. Voltage indications higher or lower indicate a problem with the charging system. If the alternator output drops below an acceptable level, a charge indication warning lamp will illuminate.

The alternator replaces the amp hours the chassis battery uses to start the engine. The amount of charge to the batteries is dependent on the amount of time the engine is operated. Repeatedly starting the engine and driving the motorhome for a short distance, or short periods, may not be enough operating time to adequately replace the amp hours used to start the engine.

Check Out Procedure

The alternator also maintains a charge to the house batteries. The function of the alternator is an electrical system voltage maintainer, not a battery charger. When traveling, the alternator maintains electrical system voltage relative to any loads, such as headlights and windshield wipers. When a heavy load is placed on the alternator, such as trying to charge dead batteries, the operating temperature of the alternator increases dramatically. 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, or dead, before traveling it is recommended to charge the house batteries with the inverter or an auxiliary battery charger.

Specifications:

- 145 Amp standard
- The integral rectifier system utilizes 12:50 Amp diodes mounted in multiple aluminum heat sinks for efficient heat dissipation during high-output operation.
- Aluminum housings
- Bi-directional fan
- Front bearing: 305 cartridge type
- Enclosed brush system
- Operation Ambient Temperature Range (-40° to 200° F.)
- Negative Ground Configuration
- Regulator Adjustment Range 13.6 to 15.4 Volts
- Batteries may start to gas at 14.3 Volts
- Max. Operating RPM 8000

Alternator Testing Procedure:

- Check all wiring for burnt or loose electrical connections. Repair as needed.
- Check all grounds and electrical connections to ensure 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 make it out of balance.
- Check belt, pulley and fan for wear. Replace as needed.
- Never attempt to disconnect the battery or battery wire from the alternator with the engine running. This can cause damage to the alternator or the 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 Volts 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 voltmeter 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: Remember 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.

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Endeavor

SECTION 10 CHASSIS INFORMATION

CHASSIS INTRODUCTION	303	COOLANT	328
AIR SUPPLY SYSTEM	304	COOLANT - ADDITIVE (SCA)	330
AIR GOVERNOR	304	COOLANT HOSES	330
AIR DRYER	304	COOLANT SYSTEM - THAWING	330
AIR DRYER OPERATION	305	CHARGE AIR COOLER	331
AIR DRYER CYCLE	305	EXHAUST BRAKE	332
IMPORTANCE OF THE AIR DRYER	305	MAINTENANCE	332
DESICCANT-TYPE AIR DRYER	305	TRANSMISSION	333
DESICCANT CARTRIDGE	306	TRANSMISSION - SHIFT SELECTOR	333
AIR STORAGE TANKS	307	TRANSMISSION - CHECK LIGHT	334
AIR COUPLER - UNIVERSAL	307	TRANSMISSION - PERIODIC INSPECTIONS	336
AIR SYSTEM CHARGING (EXTERNAL)	308	TRANSMISSION - LUBRICATING FLUID	338
HEIGHT CONTROL VALVES	308	TRANSMISSION FLUID - DEXRON III	338
ADJUSTING	309	TRANSMISSION FLUID - TRANSYND	338
AIR SPRINGS	310	TRANSMISSION FLUID LEVELS - COLD CHECK	339
CHECKLIST - AIR BAG INSPECTIONS	310	TRANSMISSION FLUID LEVELS - HOT CHECK	340
ABS/ATC SYSTEM	311	FUEL REQUIREMENTS	340
ANTI-LOCK BRAKES	311	FUEL TANK	341
AUTOMATIC TRACTION CONTROL SYSTEM	313	FUEL/WATER SEPARATOR	341
BRAKE SYSTEMS - AIR BRAKES	314	FUEL SENDING UNIT	342
BRAKE- PARKING & EMERGENCY SYSTEMS	315	FUEL LINES & HOSES	343
DISABLING PARK BRAKE	316	HYDRAULIC SYSTEM	343
BRAKE ADJUSTMENT/SLACK ADJUSTER	316	HYDRAULIC RESERVOIR	343
BRAKE SYSTEMS - BACK-UP	317	HYDRAULIC FILTER	344
ALIGNMENT SPECIFICATIONS	318	STEERING GEAR	345
SHOCK ABSORBER	320	AIR FILTER MINDER	345
LEVELING SYSTEM	320	AIR FILTER - CHANGING	345
HYDRAULIC LEVELING	320	DRIVE AXLE	346
BEFORE OPERATING LEVELING JACKS	321	DRIVE SHAFT	346
LEVELING THE MOTORHOME	321	U-JOINT ANGLE PHASING & DRIVE SHAFT BALANCE	347
RETRACTING LEVELING JACKS	322	PARTS - COMMON SOLENOID & SENDERS	348
DRIVE AWAY PROTECTION SYSTEM	322	LUBRICATION CHARTS	350
MAINTENANCE	322	FRONT OF COACH	350
ENGINE - GENERAL INFORMATION	323	REAR OF COACH	351
ENGINE START PROCEDURE	324	CHART - FILTERS & BELTS	352
ENGINE START PROCEDURE - COLD WEATHER	324	CHART - SPECIFICATIONS	353
OIL RECOMMENDATIONS (ENGINE)	325	METRIC/U.S. CONVERSION CHART	354
OIL RECOMMENDATIONS - COLD WEATHER	327	MAINTENANCE RECORD	355
ENGINE SHUTDOWN	328		
ENGINE SHUTDOWN - EXTENDED	328		

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, 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 wiring harness connectors at the transmission electronic control unit.**
- 4. Do not connect welding cables to electronic control components.**
- 5. Attach the welding ground cable no more than 2 feet from the part to be welded.**

The Roadmaster R-Series chassis design provides exceptional balance, handling and braking characteristics. The Roadmaster R-Series chassis is an engine and frame unit featuring a semi-monocoque tubular all steel frame design, providing greater structural integrity and uniform stress distribution. Incorporated in the Roadmaster chassis is the exclusive air glide suspension system using eight outboard mounted air bags and shock absorbers. The design and set up is intended to provide the smoothest ride, best handling and trouble free service while delivering top notch drivability. The chassis has either a three point hydraulic leveling system. The Roadmaster chassis design offers unsurpassed ease of maintenance and service.

The towing system rating incorporated in the construction of the frame is 10,000 lbs. towing and 1,000 lbs. tongue weight.

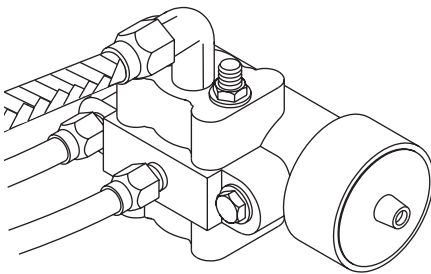
The Roadmaster's exclusive cushion air glide suspension consists of front and rear axles, with leading and trailing arms in a parallel four link arrangement. A panhard bar on each axle controls side motion. Each axle mounts to a wide platform H-frame that carries the coach body on eight outboard mounted air bags (4 front and 4 rear). Each of the eight air bags couples with a Magnum gas shock absorber. The suspension control arms attach to the frame through bushings, which require no lubrication. The preset suspension ride height automatically maintains the proper suspension height throughout the load range.

AIR SUPPLY SYSTEM

The air compressing system on the motorhome is comprised of several items: an air compressor, air governor, air dryer, front air tank and a rear air tank. The compressed air system operates several items, some of which include brakes, suspension, air horns, air gauge and stepwell cover. The air system is charged by a gear driven air compressor mounted on the engine. As engine speed increases, compressed air output increases. When the air is compressed, heat is generated. Heat dissipates as the air is discharged from the compressor. Moisture condenses in the compressed air as it cools. The moisture laden air then enters an air dryer where the air is filtered. The filtered air charges the front air tank. The front air tank is divided in two halves: a wet side and a dry side. The compressed air enters the wet side before entering the dry side. A discharge line from the dry side of the front air tank charges the rear air tank. The discharge lines use inline check valves to prevent back flow of compressed air.

The pneumatically operated items are divided into two categories: brakes and accessory air. Brakes have full use of supplied air pressure. Accessory air items, such as air horns or stepwell covers, receive air through pressure protection valves (PPV). The PPV will not allow compressed air flow until approximately 60 psi. In the event of an air system problem, the pressure protection valve will leave a reserve air charge for braking. Pressure protection valves are installed for safety.

AIR GOVERNOR



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The air governor is located in the engine compartment and performs two functions; Regulates the air compressor to cut-in and cut-out, keeping the air system in the specified operating range of 105 to 120 psi, then sends an air "purge" signal to the Air Dryer.

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 send an air purge signal to the Air Dryer. This opens the purge port of the Air Dryer, expelling moisture. The purge action of the Air Dryer is identified by the short release of air at the rear of the motorhome.

AIR DRYER

The air dryer is located in the roadside compartment behind the rear wheel. The air dryer removes moisture from the compressed air system. This is important because if air contains moisture it can freeze and prevent operation of brakes or other pneumatic operated items.

The air dryer has three functions: cooling, filtering and drying the air going through the motorhome's air system. If an excessive amount of water is present when performing the monthly air tank drain service, it may be an indication that the filter for the air dryer needs to be changed.

Air Dryer Operation

During system pressure build-up compressed air passes into the air dryer where the filter system removes contaminants and passes the air into the drying stage. Initially, moisture that condenses out collects in the base of the dryer. Moisture-laden air passes through the desiccant bed in the air dryer cartridge and is dried. When the compressor unloads, water is expelled and the dry air flows back through the dryer, drying the desiccant for the next cycle.

Air Dryer Cycle

The governor turns the compressor on when supply tank pressure drops below cut-in pressure. Compressed air passes into the air dryer at the inlet port:

- Moisture-laden air and contaminants pass through the desiccant.
- Moisture is retained by the desiccant. Moisture also collects in the base of the dryer.

When the compressor unloads the purge valve opens. The governor turns the compressor off when the system reaches cutout pressure (approximately 120 psi).

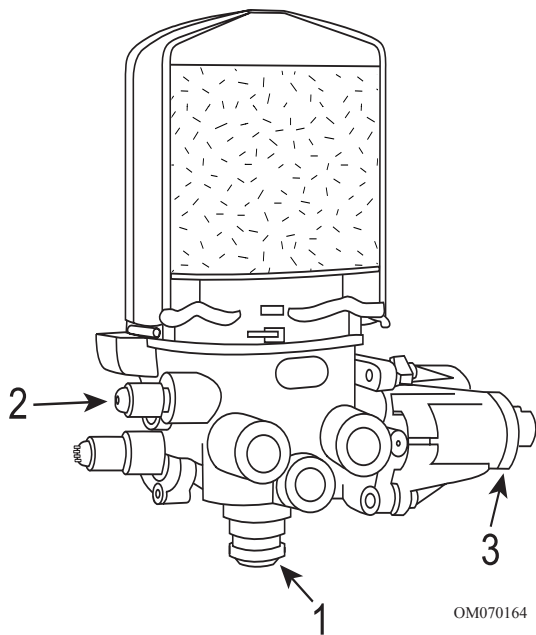
- The dryer purges and expels water collected in the dryer base.
- When the regeneration valve opens, the dry system air flows back through the dryer. A small charge of air from the front tank backflows through the filter. The backflow dries the desiccant, preparing it for the next cycle.

Importance of the Air Dryer

1. When air is compressed, the compressor takes in water vapor with the air, compresses the water vapor and puts it into the system as liquid water.
2. Liquid water that accumulates in air lines can damage seals and valves and wash away lubricants.
3. In cold weather water can freeze, block air lines and damage air system components.

Desiccant-Type Air Dryer

1. Warm, humid air from the compressor condenses into either liquid water or water vapor before entering the air dryer.
2. A desiccant-type air dryer protects the motorhome air brake system by drying moisture-laden air before it passes through the air reservoirs and into the brake system.
3. Water collects in the base of the dryer when warm air condenses the water before it enters the dryer, or inside of the dryer before the water reaches the desiccant.
4. The desiccant material then removes additional water vapor, further drying the air.
5. During regeneration phase, the regeneration valve and pressure-controlled check valve remove water from the desiccant bed with a backflow of dried, expanded system air.



Air Dryer Components:

- 1. Purge Valve:** A valve located on the bottom of the air dryer base that remains open during a compressor unload cycle. The purge valve allows collected moisture, condensation and contamination to be expelled from the air dryer during a purge cycle.
- 2. Pressure Relief Valve:** Protects the air dryer from over-pressurization.
- 3. Regeneration Valve:** Controls regeneration of the desiccant. The regeneration valve allows air from the supply and secondary tanks to bypass the outlet check valve. The air expands and backflushes moisture off the desiccant through the dryer's purge valve.

In extreme cold, verify that the air dryer heater is in good working order. The heater in the air dryer is a 100-watt heater controlled by ignition power and turned off when the ignition is switched off. The heater turns on below 45° F and off when the air dryer temperature is above 86° F. The fuse is located in the front electric bay, roadside.



WARNING: Remove all pressure from the air system before disconnecting any component, including the desiccant cartridge. Pressurized air can cause serious personal injury.

Desiccant Cartridge

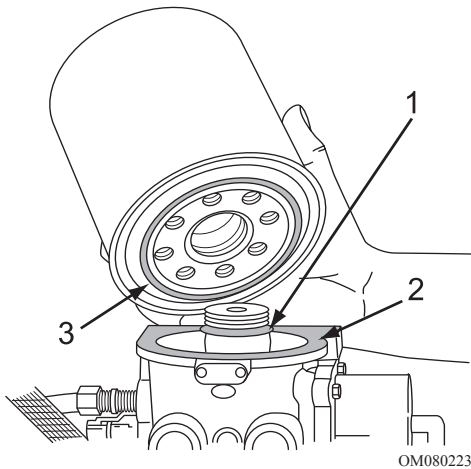


1. The replacement kit contains one cartridge and one O-ring.
2. Place wheel chocks firmly against wheel before removing cartridge.
3. Remove all air pressure from the air system.
4. Loosen and remove the old cartridge. Use a strap wrench, if necessary.
5. Remove and discard the O-ring from the dryer base.
6. Inspect and clean the seal seat. Repair any minor damage.



NOTE: If the seats are damaged so badly that a tight seal cannot be maintained, replace the air dryer.

7. Lubricate the O-Ring on the stem with a thin layer of grease.
8. Lubricate the cartridge seal with a thin layer of grease.
9. Thread the replacement cartridge onto the base until the seal touches the base. Tighten the cartridge **ONE** additional turn. **DO NOT OVER TIGHTEN.**



REPLACEMENT REQUIREMENTS		
Components	When to Replace	Why
Desiccant Cartridge	Every two to three years. When compressor is replaced. Water in supply tank	Preventive maintenance. Contaminated cartridge. Saturated or contaminated cartridge, high duty cycle (wrong application of air dryer).

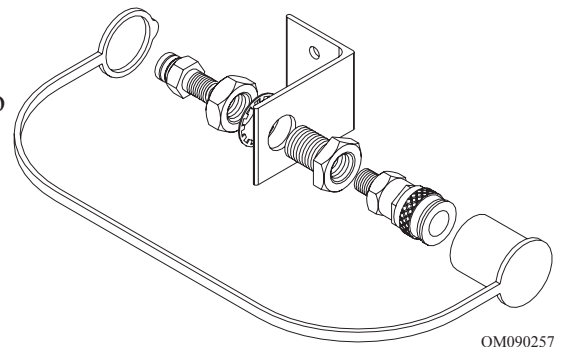
1. O-Ring
2. Seal Seat
3. Seal

The front and rear air tanks should be manually drained once a month, or more, depending on operating conditions where humidity is high. The front air tank has a drain valve for both the wet and dry side. The rear air tank only has one drain valve. Open the drain valves until all air is purged from the tanks, allowing five extra minutes for moisture to be expelled. Remember to close the tank drain valves. Both air tanks have a pressure relief valve which are set to release at approximately 130 psi.

AIR STORAGE TANKS

Provided for convenience is a remote air supply coupler. This is located in the roadside front electrical compartment. This universal female fitting will accept several types of 1/4" inside diameter male air fittings, including type C automotive. This auxiliary air fitting may be used to inflate tires, air mattresses or other pneumatic items. This fitting is not designed to charge the air system on the motorhome. The air supply for the auxiliary air fitting is charged from the front air tank through a pressure protection valve.

AIR COUPLER - UNIVERSAL



To Use this Feature:

- 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.

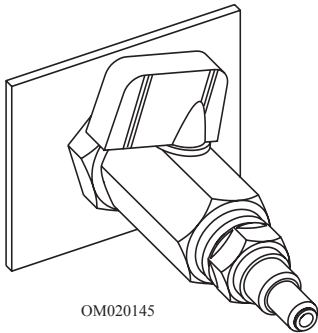
To Remove Fitting:

- 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 95-105 psi with air system on the motorhome charged to 120 psi. Maximum outlet air pressure is achieved when the air system completes the fill cycle indicated by the purge cycle of the air dryer.

AIR SYSTEM - CHARGING (External)



The air system on the motorhome can be charged from an external air supply source. Located in the front generator compartment is a type C automotive male fitting. Caution should be used when charging the air system from this fitting. The air supplied from an external source may contain moisture. Compressed air introduced into the air system on the motorhome from this fitting is not filtered by the air dryer. The auxiliary air charge fitting will charge the front and rear air tanks. A shut-off valve is installed to prevent air from escaping.



CAUTION: The external air supply source should be regulated to charge the air system on the motorhome no higher than 120 psi. Damage to the air system or pneumatically operated items may occur.

HEIGHT CONTROL VALVES

Three height control valves (HCV) inflate or deflate the air springs maintaining the proper suspension height throughout the load range. Two valves are used at the rear drive axle. These valves control rear suspension height and left or right tilt of the motorhome. Only one valve controls front suspension height. The height control valves mount to the main frame of the motorhome above the axles with a linkage rod connecting the valve to the axle.

The actuating components inside the valves are oil damped 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 adding or purging air from the air springs as needed.

The air springs mount between the trailing arms and the main frame rails. Air spring support plates mount to the main frame. There is a specified distance the air spring must maintain between the mounting plates. Other than specified distance between the plates not only compromises ride quality and handling, it adversely affects shock absorber travel, drive shaft angle and 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.

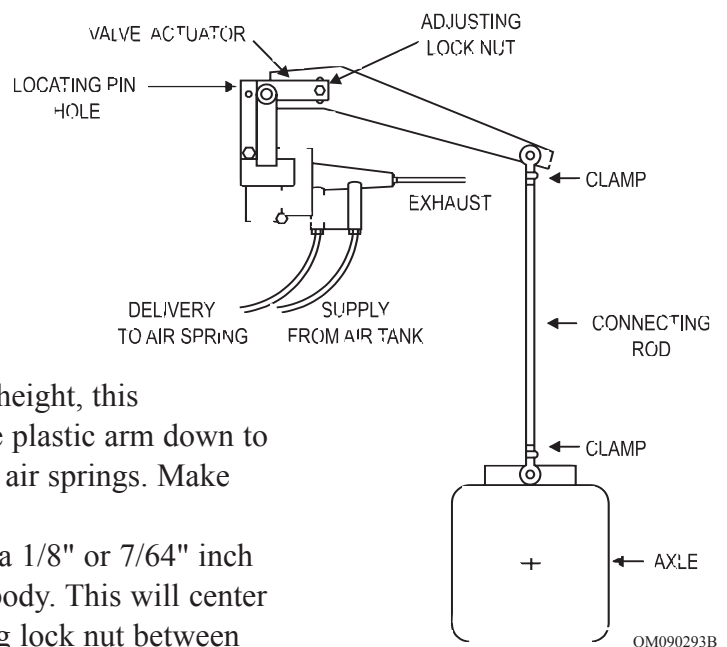
To Adjust the Suspension Ride Height Begin With:

- 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.
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, this will inflate all the front air springs. Move the plastic arm down to lower suspension height, this will deflate the air springs. 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.

Adjusting



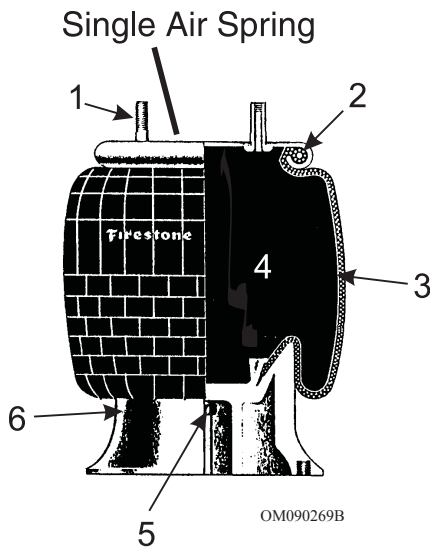
Measurements for the Endeavor :
(A) Front - 9½ in., Rear - 11½ in.



NOTE: Do not modify length of the linkage rods. Make any necessary adjustments using eccentric slot on the ride height control valve.

AIR SPRINGS

Air ride springs are available in single, double and triple convolution types plus reversible sleeve models for virtually every conceivable heavy-duty vehicle suspension application.



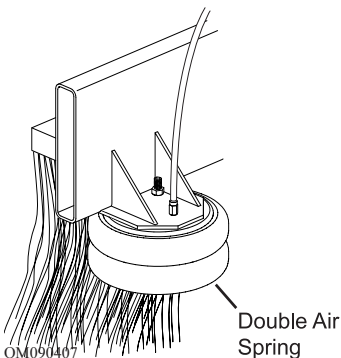
1. **STUD:** Manufactured as a permanent part of bead plate assembly for maximum strength and durability. Used to attach spring to the vehicle's suspension.
2. **BEAD PLATE:** Crimped onto bellows at the factory for a durable design and maximum quality control. Allows 100% leak proof testing prior to shipment.
3. **BELLOWS:** "Air bag" includes four plies of material: an inner layer, two plies of cord-reinforced fabric and an outer cover. Natural rubber construction provides functional properties up to - 65° F.
4. **BUMPERS:** A solid rubber or engineered plastic device designed to prevent significant damage to the vehicle or its suspension in event of a sudden loss of air pressure in spring.
5. **PISTON:** Provides a lower mounting arrangement for air spring. Controls characteristics of spring under changing pressure loads.
6. **PISTON BOLT:** Attaches piston to bellows. Sometimes extended as a means of attaching spring to vehicle suspension.

Checklist - Air Bag 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 (o.d.) of the air springs. Check for signs of irregular wear or heat cracking.
- Inspect the air lines to make sure contact doesn't exist between the air line and the o.d. 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 o.d. 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 in. This dimension can be checked with the vehicle 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 overextending.
- 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.

The motorhome is equipped with an anti-lock braking system (ABS) and automatic traction control system (ATC). The ABS system monitors wheel rotation speeds by using a 100-tooth magnetic tone ring mounted to the hub. Revolving with the wheel, the magnetic tone ring is polarized giving positive and negative pulsations. A stationary sensor is mounted adjacent to the tone ring monitoring the magnetic pulses. The pulses are monitored by the ABS electronic control unit (ECU).

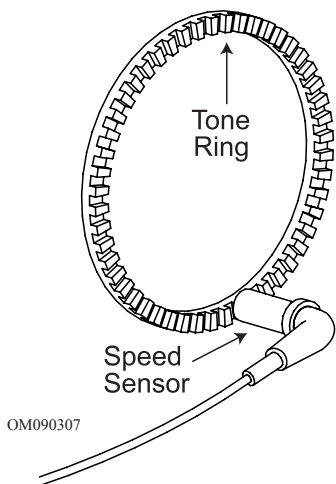
ABS/ATC SYSTEM
- Anti-Lock Brakes

The ECU monitors all available wheel sensors at the rate of 100 times per second. The ECU controls Pressure Modulator Valves. Pressure Modulator Valves have two electric over air solenoids, a hold solenoid and a release solenoid. The modulator valves are open under normal braking, allowing a straight through air signal from the treadle valve to the brake chamber. Should a wheel lose traction under a braking application, the ECU will energize the hold solenoid of the Pressure Modulator Valve to interrupt the air signal from the treadle valve to the brake chamber. The release solenoid vents the existing air signal at the brake chamber to the atmosphere, allowing the skidding tire to regain traction. Skidding tires have less tractive efficiency. It is possible, under certain conditions, to have the wheel(s) skid with a normal functioning ABS system.

The ABS itself does not apply additional braking power. The purpose of the ABS is limiting brake torque to prevent wheel locking that results in the loss of lateral stability, and increased stopping distances. Cautious driving practices and maintaining adequate safe distances when following vehicles is the key to safe vehicle operation.



WARNING: The ABS/ATC system is designed to increase tire to road surface traction. The system cannot overcome naturally occurring laws of physics. The ABS/ATC system combined with safe driving practices reduces the possibility of wheel skid and loss of lateral stability.

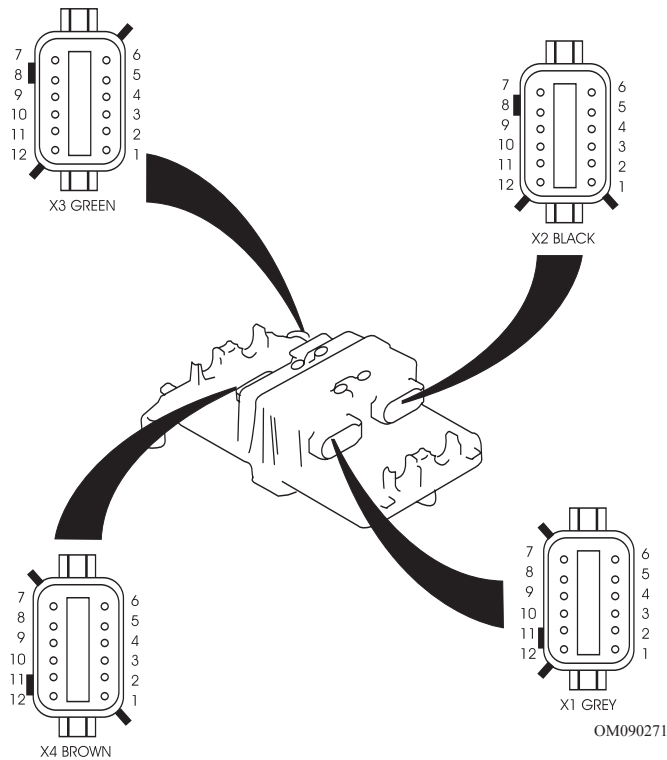


ABS Component Function:

- Speed sensors and tone rings on each wheel monitor wheel rotation.
- Each speed sensor communicates wheel rotation pulses to the Electronic Control Unit.
- ECU receives the speed sensor inputs, interprets the signal pulses, calculates speed and acceleration rates of each wheel.
- Based on the speed sensor input, the ECU detects impending wheel lock and operates the ABS Modulator Valves required for proper control. The Modulator Valves can be operated in the air, release or hold modes to regulate air pressure to the brake chambers.
- The braking force is applied at a level which minimizes the stopping distances while maintaining as much lateral stability as possible.

ABS Warning Lights:

The ABS will perform an indicator lamp check and self-diagnostic test each time the ignition is switched to the on position.



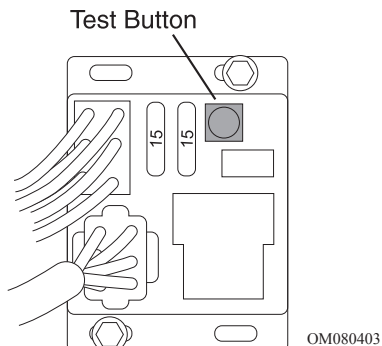
- The ABS indicator illuminates when the ignition is switched on and the engine is started, verifying the self-diagnostic test. The indicator lamp remains on until the first brake application. If the ABS light illuminates while the motorhome is being operated, there is a fault in the antilock brake system on the drive axle or steer axle. This fault will not affect normal service braking. The motorhome will need to go to a service center to repair the problem.

ABS Blink Code:

The ABS dash indicator light can be used to obtain system faults by displaying a blink code.

To Retrieve Blink Code(s):

- Turn ignition key to the **ON** position.
- Using Systems Diagnostic Center located in the roadside front electrical compartment, depress and hold test button for three seconds. Indicator light will illuminate while test button is depressed.
- After releasing test button, indicator lamp will turn off and blink code will be displayed: 1-1 will indicate no system faults.



Automatic Traction Control System**ATC System:**

The ATC system improves traction on slippery or unstable road surfaces by limiting excessive drive wheel slip. This is accomplished two ways, limiting engine torque to the drive wheel or engaging a brake to the spinning drive wheel. During normal operation engine torque is not affected. The ATC system works in conjunction with the ABS ECU (Electronic Control Unit). The ECU monitors tone ring speed of the drive wheel in relation to the other wheels. If a speed differential occurs in the drive wheel, the ECU enters Automatic Traction Control mode.

During an ATC event, the ECU will automatically react to optimize traction and safety if the motorhome encounters a slippery road surface. Engine torque is normally reduced to limit drive wheel slip.



NOTE: The ATC system is always active.

ATC Reacts to Drive Wheel Slip by:

- Reducing engine torque to the drive wheel if road speed is above 25 mph.
- Reducing engine torque and activating drive axle brake controls if road speed is below 25 mph. If the brake control activates, it remains active regardless of road speed.

ATC Indicator Light:

During normal operation, the ATC indicator light will illuminate steady when the ignition key is turned ON. The light remains illuminated until the first brake application. If an ATC event occurs, the indicator light will flash quickly. The indicator light will flash slowly if the ATC switch is activated.

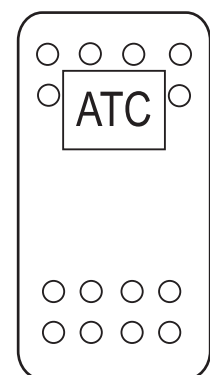
ATC Switch:

Activating the ATC switch reduces ECU control over engine torque.

- Momentarily pressing the ATC switch allows the ECU to increase the amount of engine torque applied to the drive wheel in an ATC event. The amount of engine torque applied to the drive wheel will vary with the amount of drive wheel slip versus road speed. In an ATC event, the ECU remains active regardless of road speed or switch position. The indicator light flashes slowly when the ATC switch is activated.



CAUTION: Normally the switch should remain inactive. During an ATC event (drive wheel slip), the ECU will automatically optimize drive wheel traction in most situations. Activating the switch during periods of wheel slip can increase torque to the spinning drive wheel. Drive train damage can occur if the spinning drive wheel should suddenly regain traction. If the motorhome is stuck it is advised to call a professional towing company, to limit the possibility of body and drive train damage.

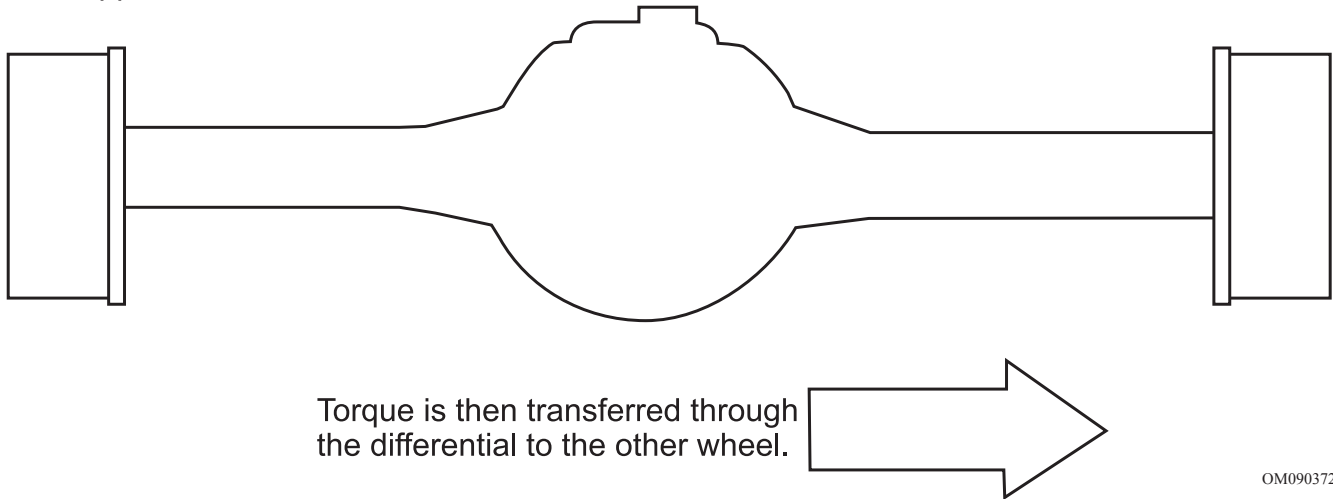


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How Automatic Traction Control (ATC) Works

If this wheel is spinning due to a slippery surface or because the wheel is off the ground, the ABS system with ATC applies the brake to this wheel.

This wheel then delivers torque to the ground.



OM090372

BRAKE SYSTEMS - AIR BRAKES

The motorhome is equipped with air brakes using the same efficient system as over the road trucks. Proper maintenance and lubrication is the key to keeping the brake system in proper working order. The brake system on the motorhome is designed to accommodate the weight of the vehicle and towing loads. This system differs from a conventional automotive hydraulic braking system and should be treated differently.

When operating a vehicle equipped with air brakes consideration needs to be given to stopping distances and air system pressures. The heavier the vehicle, the greater the kinetic energy. The motorhome requires longer stopping distances. Each brake application uses air from the air system. Give attention to the air gauge as well as the surroundings. Engine speed is directly proportional to how fast the air system is replenished. Prepare for downhill grades. Grades are generally posted in percentages. It may be necessary to select a lower gear. Make use of the engine or exhaust brake. When making brake applications use individual short applications down long hills rather than “riding” the brakes. This will extend the life of the brake lining. Avoid overheating the brakes. Hot brakes have less stopping power.

When maneuvering the motorhome around small areas, or backing into spaces, several individual brake applications might be made. Watch the air gauge. Plan ahead when parking to make it easier on yourself. When preparing to back into a space swing the motorhome so it is aligned with the parking space before backing up.

The air braking system on the motorhome is equipped with several safety features unlike that of automotive hydraulic braking systems. One safety feature is a low air pressure warning system. Should a low air condition arise while the vehicle is under operation a warning buzzer will sound and a dash warning light will illuminate alerting the operator of the situation. This warning occurs at approximately 60-65 psi (pounds per square inch).

A simple mechanical explanation of what occurs when a brake application is made is as follows: The air system supplies air to the foot brake, this is called a treadle valve. Pushing down on the treadle valve supplies an air charge signal to a brake chamber. This sealed chamber consists of a spring and air bladder. The air charge signal pushes on the bladder which extends a threaded rod connected to the automatic slack adjuster. The slack adjuster rotates the S-cam expanding the shoes against the drum. Air disc brakes follow much the same principal, with the exception of the S-cams.

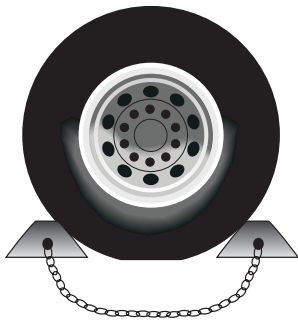
The park and emergency brake systems are combined and apply to the rear drive axle only. These are called spring brakes. When the park brake is applied, air is released from the rear brake chambers allowing the large spring in each rear brake chamber to manually push against the automatic slack adjuster. This rotates the S-cam applying the brake shoes against the drum. The air system must be charged above 35 psi so the park brake will remain released. Pushing down on the park brake handle charges the rear brake chambers with air pressure, overriding the emergency brake springs and releasing the brakes. In the event of air loss, while the vehicle is under operation, the park brake will automatically apply (this occurs at approximately 30 psi) acting as an automatic emergency brake system.

When preparing to depart, allow the air system to achieve full air pressure. This is indicated by the air gauge. Listen for the air dryer to purge, indicating full air pressure has been obtained and the air dryer is functioning. Look and listen for any abnormalities. Abnormal air pressure readings by the air gauge should alert the operator. Have the air system checked to avoid an untimely failure.

BRAKE - PARKING & EMERGENCY SYSTEMS

Disabling Park Brake

Should a failure occur in the air system, preventing air pressure from building, it may be necessary to disable “cage” the spring brakes. This is an emergency procedure only. Caging the rear air brake chambers will manually override the spring brakes and allow the vehicle to move. This procedure does not affect normal service braking.



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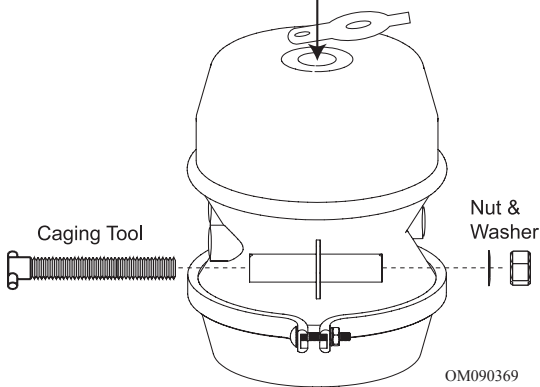
NOTE: When the park brake is released the Park illumination lamp will remain lit until air system pressure is above 65 psi.

Chock the wheels securely prior to disabling (caging) the park brake. This procedure is for emergency conditions only. Exhaust all other means of releasing the brakes prior to performing this procedure.

Drum Brake Models

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

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



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

BRAKE ADJUSTMENT/ SLACK ADJUSTER

The motorhome is equipped with automatic slack adjusters. As brake lining wears, the slack adjusters will automatically ratchet on the return stroke as needed. This ratchet action will keep the brake lining at proper adjustment. Brake adjustment should not be necessary. Indications of a vehicle needing possible brake adjustment may be noticed by the park brake not holding on a hill, or gradual loss of braking power. Automatic slack adjusters and the connecting S-camshaft require periodic lubrication.



NOTE: Replacement parts should be of the same original equipment size and type. Mixing brake components may result in unequal braking action. Brake adjustments are part of normal maintenance of the motorhome. Brake adjustments are not covered by the manufacturer.



WARNING: Brake lining may contain asbestos material and should only be serviced by qualified service technicians who are trained in the appropriate precautionary procedures. If any loss of braking effectiveness or abnormal braking indications are noticed, the brakes and slack adjusters should be inspected by a qualified brake technician.

The motorhome air braking system is equipped with several back-up safety systems and warning alarms in case of air system failure. Refinements to air braking systems have been instituted with safety as top priority. For example: should the air compressor fail to charge the air system and the low air gauge readings go undetected, a low air pressure warning buzzer will sound and the low air pressure dash warning indicator lamp will illuminate. These warning indicators occur at approximately 65 psi. This will alert the operator of an impending situation. If the motorhome is allowed continued operation, the pneumatic emergency spring brake relay valve installed in the air system senses the low air pressure condition. The emergency spring brake relay valve will release the air charge from the spring brake air chambers on the rear drive axle. In this case, the park brakes will automatically apply at approximately 30 psi. This safety back-up system acts as an automatic emergency brake system.

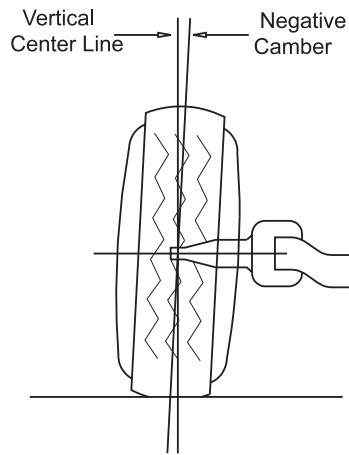
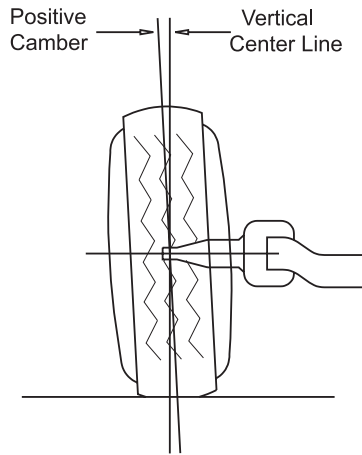
Another back up safety is the air system separation of the front and rear brakes, implemented by using two air tanks. One tank is located in the front and the other is located in the rear. This separation allows the front air tank to operate the front brakes; the rear tank operates the rear drive axle brakes. This tank division gives reassurance in case one tank experiences a failure of an accessory air item allowing the compressed air to escape. Accessory air items are other pneumatically operated items such as the air horn, step well cover, vacuum generator, etc. The accessory air items operate only when air tank pressures exceed 65 psi. This is done with pressure protection valves. Should an accessory air item fail the pressure protection valve (PPV) reserves the remaining air pressure of 65 psi for braking. This will leave the motorhome with one air tank fully charged for safety back up.

In another situation, whereby all compressed air has escaped from the rear air tank, a pneumatic back-up safety valve is installed. This is the safety inversion valve. The inversion valve senses the absence of rear air tank pressure. In this case the inversion valve will allow the operator to make a modulated spring brake application, made in conjunction with the emergency spring brake relay valve. The inversion valve allows the front air tank pressure to recharge the rear brake chambers after the modulated spring brake application has been made. This back-up system implements use of all the brakes, allowing the operator to bring the vehicle to a safe stop. In case of all compressed air charge escaping from the front air tank, the operator will still have full use of the rear brakes.

BRAKE SYSTEMS - BACK-UP

ALIGNMENT SPECIFICATIONS

The correct wheel alignment promotes longer tire wear and ease of handling while minimizing the strain on the steering system and the axle components.



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Camber:

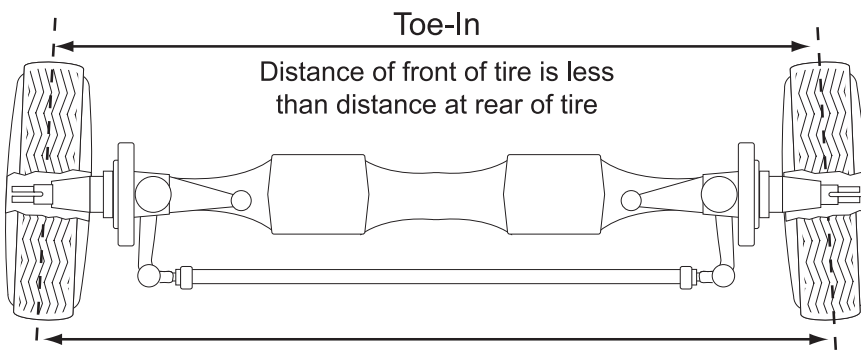
Camber, as shown, is vertical tilt of wheel as viewed from the front of the vehicle. This is machined into the axle when manufactured and is not adjustable.

- “**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).

FRONT OF MOTORHOME
(Top View of Axle)

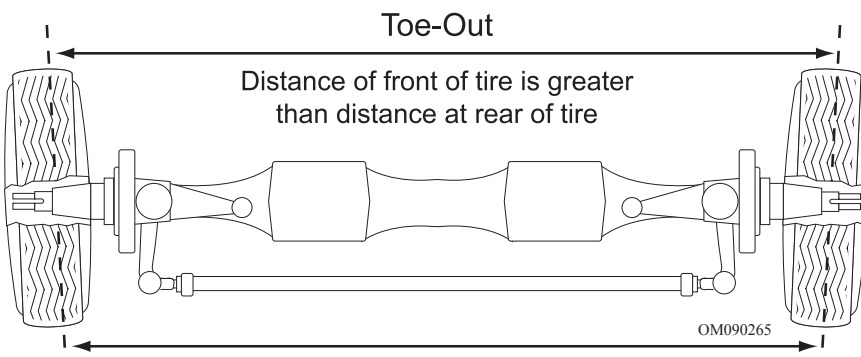


Toe-in: Occurs when the tire front distance is less than the tire rear distance.

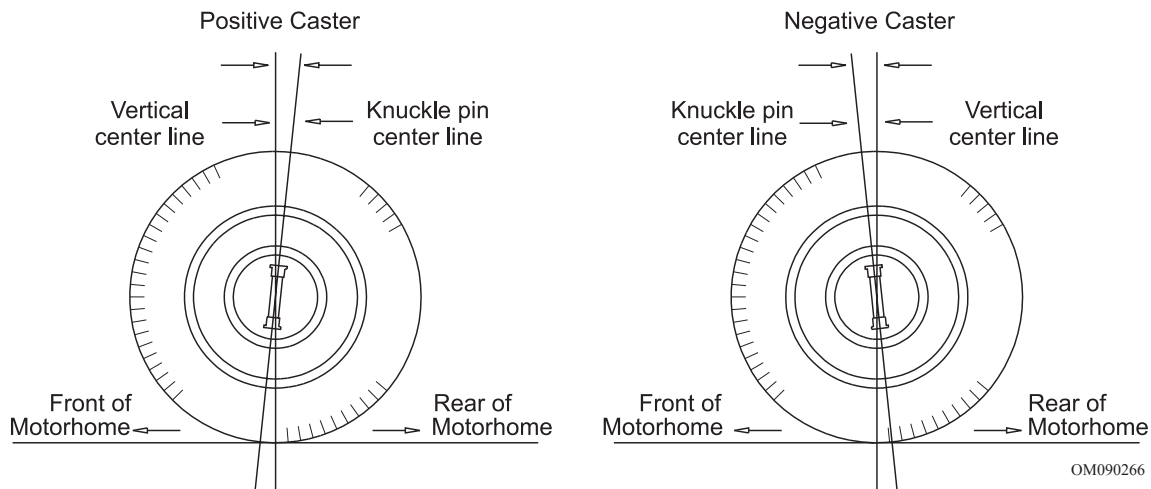
Toe-out: Occurs when the tire front distance is greater than the tire rear distance.

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, whether 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.



OM090265



Caster Adjustments:

Caster is the fore and aft tilt (toward the front or rear of the motorhome) of the steering kingpin as viewed from the side of the motorhome.

“**Positive**” caster is the tilt of the top end of the kingpin toward the rear of the motorhome.

“**Negative**” caster is the tilt of the top end of the kingpin toward the front of the motorhome.

Setting the caster angle more positive than specified may result in excess steering effort and/or shimmy. Decreasing the angle may result in vehicle wander or poor steering return to center. The caster angle is determined by the installed position of the steer axle.

		SPEC	TOL
LEFT FRONT	CAMBER	0.00°	0.40°
	CASTER	6.00°	0.50°
	TOE	0.03°	0.12°
RIGHT FRONT	CAMBER	-0.25°	0.40°
	CASTER	6.00°	0.50°
	TOE	0.03°	0.12°

SHOCK ABSORBER



Normal shock absorber appearance after a long service period.

The shock absorber by definition is a hydraulic device used to dampen suspension/body movement. Road surface irregularities are compensated for by the shock absorber. The roadmaster chassis incorporates a “Monroe” shock in the design of the 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 deflections.

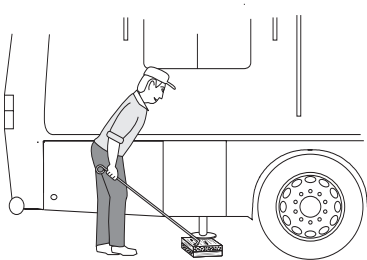
By design, a self lubricating seal is used which will allow approximately 10% of the total oil capacity to pass onto the piston rod. The gradual process of oil loss does not affect the performance of the shock absorber during the service life. This process will be evident after a long period of service by an oil film on the body of the shock absorber. The appearance of a coating or film on the body or rod is completely normal, it is an indication the shock is functioning normally.

Road holding, handling, balance and braking characteristics all can be contributed to the shock absorber. The operating conditions for which the shock absorber must endure will determine the life span. However, since the only moving part is the piston rod, there are no springs, hinges or pins to wear out, get weak or deteriorate.

LEVELING SYSTEM *Hydraulic Leveling*

The hydraulic leveling system is designed as a leveling system only. The leveling system should not be used to support the motorhome for changing tires. A tire change should always be performed by trained personnel. Attempts to change tires using the leveling jack to support the motorhome could result in damage to the motorhome and risk causing serious personal injury. Some units will have an optional air/hydraulic leveling system. Do not use both systems at the same time. Retract all jacks and turn system off before using the air leveling system.

The leveling system uses four hydraulic cylinders to level the motorhome, two cylinders located in the rear and two located in the front. The leveling system was designed to reduce site selection problems. A remote control panel located next to the driver seat operates the system. There are some essential steps to follow when operating the leveling system:



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Tips:

- Select a level site if possible. If the site is not level, park the motorhome with the front facing downhill or move the motorhome to another location.
- Before operating the system, lower the air suspension by making several brake applications, then push the Air Dump switch.
- If a jack reaches full extension and additional height is needed this can be attained by cutting two $\frac{3}{4}$ " pieces of plywood to 1'x 1' then staple the plywood together to equal 1½" thick. Drill a hole in one end, and use the awning hook to slide the block under the jack pad.

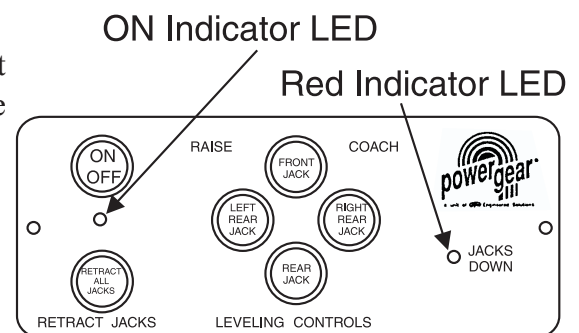
Operate the Leveling System ONLY Under the Following Conditions:

- The motorhome is parked on a reasonable level surface.
- The **PARKING BRAKE** must be engaged.
- The transmission must be in the **NEUTRAL** or **PARK** position.
- The ignition switch is placed in the **ON** position.

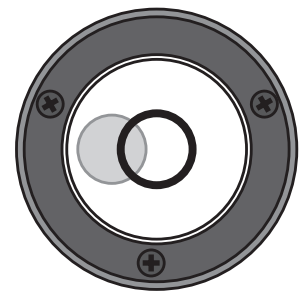
Before Operating Leveling Jacks

Clear the potential jack contact points of obstructions or depressions before operation. Keep all people clear of the motorhome during the leveling system operations. Never expose hands or other parts of the body near hydraulic leaks. Hydraulic lines are under high pressure, oil leaks may cut and penetrate the skin causing serious injury.

- Ensure all conditions have been met to operate the leveling system.
- Press the **ON/OFF** label on the control panel. The ON/OFF label illuminates, indicating the system is now operational.
- If the ON/OFF label does not illuminate, verify that all conditions have been met.
- Press the **FRONT JACK** label until the jack contacts with ground. This will be felt in the motorhome.
- The **FRONT JACK** and **REAR JACK** labels will be used to achieve a center in the level vial which is pointed front to rear of the motorhome. The air bubble will indicate the high side of the motorhome. Press the button that is opposite the air bubble in level vial. (i.e. If bubble is towards front of coach press the **REAR JACK** label.) Keep button pressed until the air bubble is centered front to back.
- The air bubble in the level indicator indicates the high side of the motorhome. Push the button opposite of the bubble, either **LEFT** or **RIGHT REAR JACK**, to level the motorhome. (i.e. If the bubble is towards left of the coach push **RIGHT REAR JACK**.) Keep the label depressed until the bubble is centered in the vial.

Leveling the Motorhome

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NOTE: Right and left rear jacks are used to level the motorhome side to side. Pushing the “LEFT REAR JACK” label on the control panel will extend the left rear jack. Pushing the “RIGHT REAR JACK” button on the control panel will extend the right rear jack. There is no individual control for right or left front jack.

Park the motorhome on a reasonable solid surface, the jacks may sink into ground on extremely soft surfaces. A load distribution pad or block may be placed under each jack. The system is not designed to lift the wheels off the ground, doing so may create an unstable condition.

Retracting Leveling Jacks

- Place the ignition switch in the **ON** position.
- Push the **ON/OFF** button. See first step of leveling.
- Push the **RETRACT ALL JACKS** label. All jacks will start to retract and return to full retract position. When all jacks return to full retract position the **JACKS DOWN** light will go out.



NOTE: To stop the jacks from retracting, turn the system **OFF** and back **ON**. The motorhome can be leveled by following the steps under “Leveling the Motorhome.”

- When the **JACKS DOWN** lights goes out, push the **ON/OFF** label on control panel to de-energize the system. Perform a brief visual inspection around the motorhome to verify that all jacks are fully retracted. Proceed to travel.

Drive Away Protection System

When the ignition switch is set to the **RUN** position, with the jacks extended, if the transmission is taken out of neutral or park or when the park brake is released, the **JACKS DOWN** indicator lights and the alarm beeper activates. The system will then automatically retract all jacks. The system will continue to retract the jacks until they are fully retracted or the park brake is reset and the transmission is shifted back into **PARK** or **NEUTRAL**.

Maintenance

- Change the fluid every 36 months.
- Check the fluid level every month. The fluid level should be within 1/4 inch of fill port lip and checked when all the jacks retracted.
- Inspect and clean all hydraulic pump electrical connections every 12 months.
- Remove dirt and road debris from the jacks as needed.
- If the jacks are down for extended periods it is recommended to spray exposed chrome with *WD 40* every seven days for protection.

In most applications the Type A automatic transmission fluid is adequate. If operating in cold temperature (less than -10 F°) the jacks may extend and retract at a slower rate.



WARNING: Never rely solely upon warning lights or a warning buzzer to determine position of leveling jacks. Make a visual check to ensure all jacks are fully retracted prior to moving the motorhome.

Fluids specially formulated for low temperatures may be desirable for cold weather operation. Consult factory for recommended cold weather fluid.

- Useable Reservoir Capacity = 1.2 gal.
- 4-Jack System Capacity = 2.4 gal. (approx.)

**ENGINE - GENERAL
INFORMATION**

The diesel engine operates differently from the conventional gasoline engine. Gasoline engines control engine speed using a butterfly throttle plate controlling air/fuel mixture inlet flow. As the throttle plate opens, vacuum created by the piston velocity draws the metered fuel/air charge into the combustion chamber, then ignites from a controlled electric ignition source. Closing the throttle plate limits the fuel/air supply, slowing engine speed, increasing intake manifold vacuum.

The diesel engine in the motorhome controls engine speed by varying fuel supply only. No throttle plates are used. An exhaust driven turbine system (turbocharger) compresses the fresh air supply into the engine. The fuel is injected under pressure into the combustion chamber. Ignition of fuel/air charge occurs from heat generated by rapid high compression. The turbo boost gauge registers amount of intake manifold pressure measured in lbs./in². Therefore, no intake manifold vacuum exists.

Diesel engine RPM (revolutions per minute) operating speeds are generally much lower than that of the gasoline engine. Peak torque and horsepower output values occur at much lower engine speeds. Idle speeds between the two engine types are similar, however maximum engine speeds are quite different. The gasoline engine generally is not regulated to a maximum engine speed. The maximum engine speed on a diesel engine is controlled by an engine speed governor set by the engine manufacturer.



WARNING: Do not operate a diesel engine where there are or can be combustible vapors. Vapors can be drawn through the air intake system and cause engine acceleration and over-speeding, resulting in fire, explosion and extensive property damage. Numerous safety devices are available, such as air intake shutoff devices, to minimize risk of an engine over-speeding where an engine (due to its application) might operate in a combustible environment, such as fuel spills or gas leaks. The equipment owner and operator is responsible for safe operation of engine. Consult your engine authorized repair location for future information.

The maintenance guidelines found in the Cummins Operation & Maintenance Manual is recommended for the engine. When followed, it will help with a longer life, better performance and more cost efficient operations. A good maintenance schedule begins with a daily awareness of the engine and its various systems.

The engine is equipped with an intake manifold grill heater. The grid heater helps engine starting in cold weather. Intake manifold air temperature is monitored by the Electronic Control Module (ECM) on the engine. If intake manifold temperature is below specified level (approximately 40° F) manifold grid heater will be activated. Grid heater activation is indicated by the **WAIT TO START** indicator lamp.



WARNING: Use of ether starting fluids may cause an explosion upon grid heater activation.

Engine Start Procedure

With the throttle at idle position, turn the ignition key to the **ON** position allowing the WAIT to START lamp to extinguish. Turn the key to the **START** position. When the engine is started, the grid heater will again energize for a time period determined by the intake air temperature and fuel temperature. Allow the engine to idle with no load for three to five minutes. The engine coolant temperature should be up to normal operating range (140°F/60°C to 212°F/100°C) before operating the engine under full throttle.

Engine Start Procedure - Cold Weather

Engine oil becomes thick and battery output is reduced in sub-freezing or extreme cold. Thick oil combined with less amperage available from the battery increases difficulty in starting the engine. Depending on ambient temperature it may be necessary to pre-heat the engine. Located in the coolant passage in the engine is a heating unit that operates from 120 Volt AC. If it is necessary to pre-heat the engine due to ambient temperature, it is recommended to activate the block heater the night before, allowing several hours for the block heater to warm the engine.

An indication of 100° or higher of the engine temperature gauge should be sufficient for the engine to start.



NOTE: The engine is filled with 15-40w multi-viscosity oil from the factory. Generally this will start the engine in temperature down to 15° F. If the engine has normalized to a temperature below 15° F. it will be necessary to pre-heat the engine before starting.



CAUTION: Upon cranking an engine in cold temperature, the starter may rapidly engage and disengage. If this occurs STOP attempting to crank the engine as starter damage may occur. Pre-heat the engine before making any more attempts to start the engine.

Block Heat:

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 be GFCI protected rated at 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.

The maintenance guidelines in the Cummins Operation & Maintenance Manual are the recommendations for the engine. When followed it will help extend engine life, 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, American Petroleum Institute (API) specification CH-4 which can be used as an alternative to CES 20071 is recommended. Lubricating oils meeting API CG-4 specifications may be used at a reduced drain interval. The engine uses Pennzoil 15W-40 heavy duty engine lubricating oil that meets Cummins specifications. A critical factor in maintaining engine performance and durability is the use of high grade multigrade lubricating oil and strict adherence to the maintenance service intervals.

A straight weight or monograde lubricating oil is not recommended. Shortened drain intervals may be required as determined by a close monitoring of the lubricating oil condition by means of an oil sampling program. The use of oil analysis to extend drain interval is not recommended. There are numerous variables which is the basis of the recommendation.

Synthetic oils API category III specifications are recommended for extreme cold temperatures only.

Low viscosity oils, used for winter operations, will aid in starting. Synthetic oils, or oil with adequate low temperature properties used for Arctic operations where the engine cannot be kept warm when shut down, will aid in starting.

The use of synthetic oils should not be used to extend drain intervals. Extended oil change intervals can decrease engine life and possibly affect the engine warranty.

Oil additives should not be used unless the oil supplier or oil manufacturer has been consulted and provided positive evidence or data establishing satisfactory performance in the engine.

OIL RECOMMENDATIONS (Engine)



NOTE: The engine does not require a “break-in” procedure.

Function of Engine Oil:

If a lubricating oil is to work in an engine it must be capable of performing various functions. Lubrication of the moving parts is the primary function. The lubricating oil should be able to form a film between metal surfaces preventing metal to metal contact and reducing friction. When there is a metal to metal contact, friction heat is generated. Welding of the part can occur and metal transfer will result in scuffing or seizing. The film of oil contacting the surfaces will provide cushioning and shock dampening as well.

Cleaning is another function. The oil should perform as a cleaner in the engine by flushing contaminants from critical components. These contaminants should be removed in the filtration system or during the course of an oil change. Oil will provide a protective barrier to prevent corrosion of non-ferrous metals.

Internal components of the engine require cooling. The primary coolant system cannot provide this cooling. Oil will transfer heat by contacting the various components then transferring to the primary cooling system at the oil cooler. The uneven surfaces in the combustion chamber are filled to act as a combustion seal within the cylinder liner and other internal components.

Synthetic Engine Oil:

In extreme environments, where ambient temperatures can be as low as 45° C (-50° F), a petroleum based oil will not perform satisfactorily in diesel engines. Synthetic oils were developed for these type applications. These synthetic oils are blend from ether and/or hydrocarbon based oils. These base oils are produced by chemically reacting lower molecular weight materials to manufacture lubricants of desired properties. All synthetic based oils must meet the API category III classifications and SAE viscosity grades.



NOTE: Synthetic oils and petroleum based oils should never be mixed.

Viscosity:

Viscosity is simply a measure of resistance of molecule layers moving relative to an adjacent layer. All fluid viscosity is affected by temperature. A multigrade lubricating oil tends to be less sensitive to temperature changes due to formulation. Lubricating oils are generally selected for use with viscosities appropriate for the expected operating temperature. The correct selection of a lubricating oil of correct viscosity is critical for optimum performance. Some effects of incorrect viscosity when the oil is too thick range from difficulty in starting, to increasing fuel consumption and reduced power output. When the oil is too thin, oil consumption is increased as well as wear from the metal to metal contact. This will also increase engine noise.

Low temperature viscosity specifications are identified by a “W” (winter). High temperature viscosity that meets the 100° C (212° F) requirements have no suffix. When a lubricating oil meets both high and low temperature requirements they are classified as multi-viscosity or multigrade.

Routine Maintenance Recommendations:

1. Check oil level daily.
2. Replace oil filter at every oil drain interval.
3. Cummins Engine Company, Inc. recommends the use of high quality, API (American Petroleum Institute) licensed CH-4 or CES20071, 15W-40, multiviscosity oil or premium oil.
4. The recommended oil drain interval is defined by the API oil performance classification and the engine duty cycle. Refer to the Cummins Operation & Maintenance Manual for complete details.

It is possible to operate diesel engines in extremely cold environments. The engine should be properly prepared and maintained. The correct lubricants, fuels and coolant **MUST** be used for the cold weather range for which the motorhome is being operated. Cold weather operation can be defined in two categories: **Winter** and **Arctic**.

**Oil Recommendations
- Cold Weather**

WINTER (32° to -25° F) (0° to -32° C): Use a 50% antifreeze to 50% water coolant mixture, use multi-viscosity oil meeting Cummins specifications and fuel to have maximum cloud pour points 10° F (6° C) lower than the ambient temperature in which the motorhome operates.

ARCTIC (-25° to -65° F) (-32° to -52° C): Use a 60% antifreeze to 40% water coolant mixture. Use oil meeting Cummins specifications and fuel to have maximum cloud pour points 10° F (6° C) lower than the ambient temperature in which the motorhome operates.



Refer to the Operations & Maintenance Manual for more detailed information.

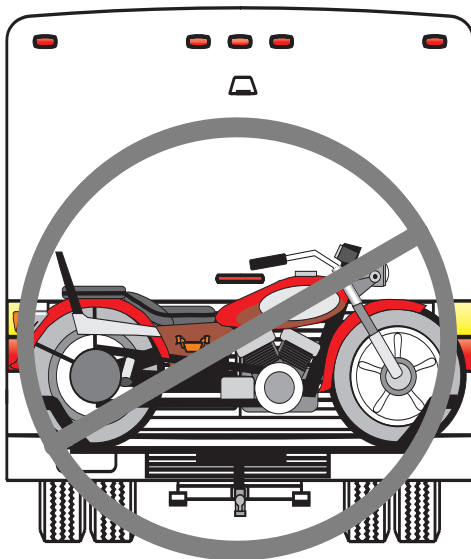
ENGINE SHUTDOWN

General guidelines for shutting the engine down are fairly simplistic. Allow the engine to idle three to five minutes after a full load operation. This allows adequate cool down of pistons, cylinders, bearings and turbocharger components. Under normal driving conditions, exiting the highway is generally lighter engine operation and the need for the three to five minutes is not necessary.

Engine Shutdown - Extended

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 Cummins Operation & Maintenance Manual for guidelines on troubleshooting low oil pressure, or contact a qualified service technician. Allow the engine to idle for three to five minutes before operating under a load.

COOLANT



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A fully formulated antifreeze or coolant containing a precharge of Supplemental Coolant Additives (SCA) is recommended. The use of either will significantly simplify coolant system maintenance. The difference between a fully formatted antifreeze and a fully formatted coolant is the percentage of water. Both contain balance amounts of antifreeze, SCA, buffering compounds and a percentage of good clean quality water. The antifreeze of coolant must meet ethylene glycol or propylene glycol recommendations. A good clean quality water in a 50/50 ratio (40 to 60% working range) mixed with fully formatted antifreeze will provide protection from -34° F to 228° F. The 50/50 mix ratio must be premixed prior to being put in the system. Placing antifreeze and water in the cooling system is not recommended. Consult the Cummins Operation & Maintenance Manual for more details.



NOTE: An over concentration of antifreeze, or the use of high silicate antifreeze, can cause damage to the coolant system and engine. Antifreeze is essential in every climate.



WARNING: Do not continue engine operation when engine temperature rises above 220° F. At 220° an engine warning light will illuminate and the engine will begin to de-rate in power output. Continued operation will result in engine damage.

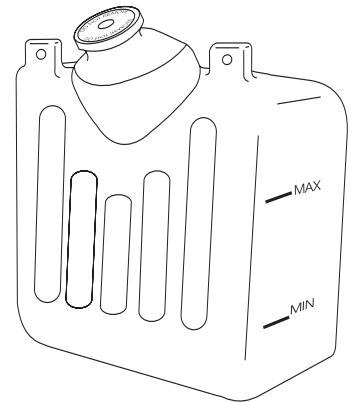


NOTE: Any item on the back of the motorhome which blocks the grill opening or changes the air flow may cause an overheating condition under some circumstances.

The coolant level and fluid freeze point should be checked with every oil change interval, at 15,000 miles, 500 hours or six months, whichever comes first. Also change the coolant filter at the same interval unless SCA concentration is over three units. The coolant should be drained and flushed at 6,000 hours or two years of service, whichever comes first.

Engine Coolant Reservoir:

A “see-through” plastic reservoir, similar to the familiar windshield washer jar, is connected to the radiator by a hose. As the motorhome is driven, coolant is heated and expands. A portion of fluid displaced by this expansion flows from the radiator into the reservoir tank. When the engine is stopped, the coolant cools and contracts. Displaced 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.



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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.

- Check the coolant level daily or when refueling.
- Drain and flush the coolant system every 60,000 miles or two years, and refill with a heavy-duty coolant (50/50 mix of water and anti-freeze).
- 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.



INSPECT: Stop the motorhome and inspect the coolant level before continued operation.

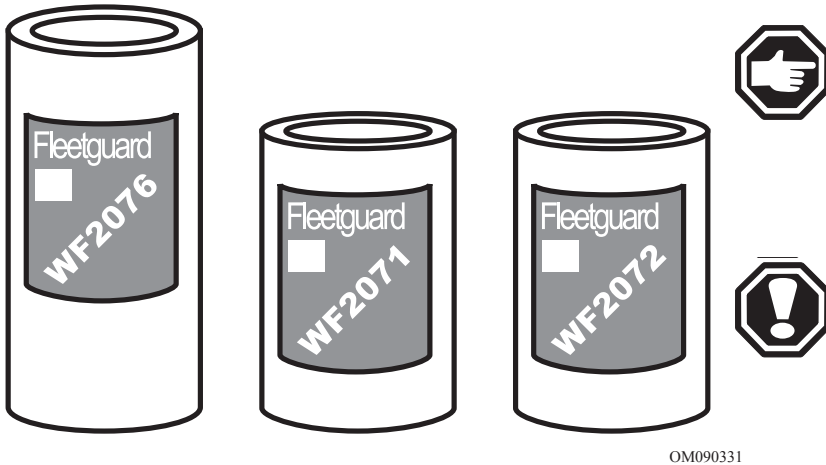
Routine Maintenance Recommendations:

1. Check the SCA concentration level every 15,000 miles/6 months.
2. Change the coolant filter every 15,000 miles/6 months.
3. Drain and flush the system every 240,000 miles/2 years, and refill with a heavy-duty coolant (50/50 mix of water and antifreeze).
4. Always use antifreeze. In addition to freeze protection, antifreeze is essential for overheat and corrosion protection.
5. The supplemental coolant additive (SCA) is required.
6. Freeze point should be measured every 15,000 miles/6 months.

Coolant - Additive (SCA)

Fully formulated products contain SCA and are required to protect the cooling system from fouling, solder blooming and general corrosion. The cooling filter is required to protect the coolant system from abrasive materials, debris and precipitated coolant additives.

Supplement coolant additives, or equivalent, are used to prevent cylinder liner pitting, corrosion and scale deposits in the cooling system. Use the correct Fleetguard coolant filter to maintain the recommended SCA concentration in the system. Maintain the correct concentration by changing the service filter at each oil drain interval.



NOTE: The correct filter is determined by the total cooling system capacity and oil drain interval. Refer to the Coolant Capacity Specifications in this section.

CAUTION: Insufficient concentration of the coolant additives will result in cylinder liner pitting and engine failure. The SCA concentration must not fall below 1.2 units or exceed 3 units per gallon of cooling system capacity.

Coolant Hoses

Rotten, swollen and worn hoses, as well as loose connections, are frequent causes of coolant system problems. Overheating can be caused by an 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.

Coolant System - Thawing

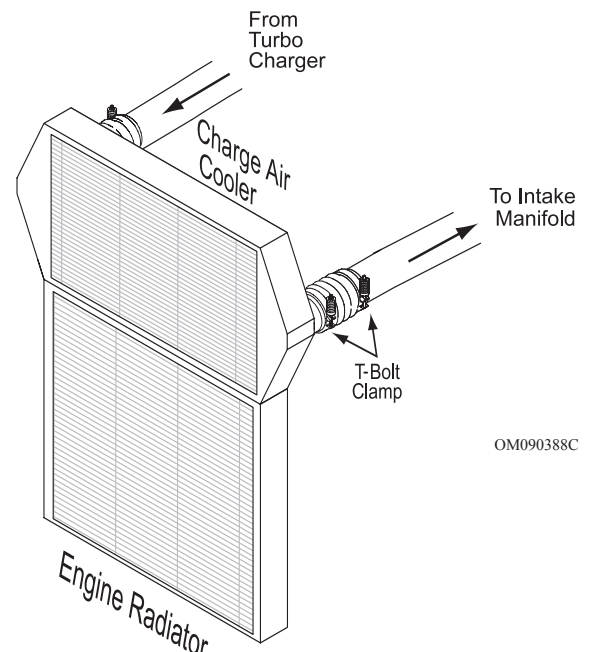
If the coolant system becomes frozen solid, place the motorhome in a warm area until the ice is completely thawed. At this point the motorhome must be towed. If the engine is operated when the cooling system is frozen it will result in engine overheating due to insufficient coolant circulation.

Once thawed, check engine, radiator and related components for damage caused by expansion of frozen coolant.

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 casting.

CHARGE AIR COOLER

The diesel engine uses compression to ignite the fuel/air charge. To increase compression inside the combustion chamber (resulting in increased power output) a turbocharger is added to the engine. The turbocharger is a paired housing assembly with impellers inside each housing connected by a common shaft. One impeller is propelled by the engine exhaust, which drives the other impeller. The function of the other impeller is to increase compression inside the combustion chamber by forcing air into the intake manifold. 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 may be mounted to either the top or side of the radiator. The CAC performs the same function as a radiator, cooling air instead of liquid. Ambient air passing through the CAC will cool the engine's intake air charge.



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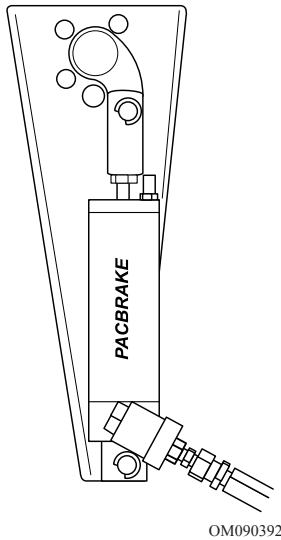
After leaving the turbocharger, intake air is compressed and heated to approximately 300° to 375° F., depending on the engine load and throttle position. Before the air enters the intake manifold, the CAC cools the intake air temperature to the engine manufacturer's specifications. Lower intake air temperatures reduce exhaust emissions, improve fuel economy and increase horsepower. The CAC will continually expand and contract up to 1/4" as throttle increases and decreases.

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.

Rear mounted radiators, with a top mounted CAC, will require more frequent visual inspections than a side mounted CAC. Litter and dust along the roadway can restrict the airflow on this type of system. During each oil change inspect the engine side of the radiator/CAC assembly for foreign objects that may be causing 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.

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 either using a dash switch or a foot switch. The dash mounted switch will operate the exhaust brake when dash switch is "ON" and throttle is "RELEASED." If the motorhome has a foot operated Pac Brake switch; the throttle must be released before the exhaust brake will activate.



NOTE: The exhaust brake will not disengage the cruise control. Application of the service brake is required to disengage the cruise control.

When the exhaust brake is activated, a flapper inside the exhaust brake moves and restricts the flow of exhaust gases. This causes an increase of exhaust pressure within the engine. Increased exhaust back pressure quickly slows the engine speed resulting in powerful engine braking action. When the exhaust brake is activated, the amount of engine braking power developed is related to engine speed (RPM). When an exhaust brake application is made, the engine braking affect increases with higher engine RPM. The exhaust brake is wired to the electronically controlled transmission. When the exhaust brake is activated going down a hill, it will help control road speed or sufficiently slow the road speed until the Allison Transmission can automatically downshift to the next lower gear. Downshifting automatically occurs from high gear down to second gear. Certain road conditions and engine speeds may require the transmission be manually shifted down in order to generate adequate engine RPM and increase the engine brake effect.



NOTE: The brake lights will illuminate while the PAC Brake is applied.

Maintenance

The exhaust brake system, used routinely at normal exhaust operating temperatures, is virtually maintenance free. There are contributing causes which can result in failures with the exhaust brake, including moisture, dirt, carbon, and improper usage.

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.

Some problems that may be encountered with the exhaust brake include but are not limited to, will not activate or deactivate, intermittent on/off operations or actuates with the switch off. These are commonly related to electrical symptoms. Other problems such as slow operations, delays in operations, and limited performance are mechanical symptoms. Refer these problems to the dealer for diagnosis.

TRANSMISSION

The Allison World transmission incorporates the World Transmission Electronic Control (WTEC) system. The system is comprised of five major components connected by a wiring harness: the electronic control unit (ECU), engine throttle position sensor, three speed sensors, remote shift selector (key-pad) and the control module. The ECU processes information received from the throttle position sensor, speed sensor, pressure switch and shift selector to activate solenoids on the control module in the transmission. The solenoids control oncoming and off going clutch pressure to provide closed loop shift control. This is accomplished by matching transmission and engine RPM during a shift to establish a desired shift profile within the ECU.

The system is monitored for the first 30 seconds of each engine start. This is referred to as “autodetect.” Autodetect searches for presence of data inputs of transmission components. Autodetect enables the ECU functions and diagnostics to respond to items that are detected.

Another feature of the transmission is the ability to “learn” or “adapt.” The electronic control system optimizes shift quality by using “Adaptive Shifting.” A wide variety of varied shift conditions is required before optimizing shift quality. Generally, five typical shifts of a consistent shift type is needed to optimize shift quality.

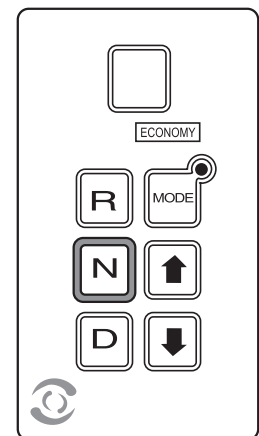
The range selection is accomplished via the remote push button selector. The controls are **R**, **N**, **D**, arrow **UP**, arrow **DOWN**, **MODE** button and a digital display window. Under normal operation press the **D** button and the digital display shows the highest forward range attainable for shift selection in use. The digital display window will also indicate codes for abnormal conditions, and can even be a useful troubleshooting aid. When the ignition is turned **ON**, the display should be visible. This display indicates the presence of neutral start command. If the display indication is not visible, there is no power to the selector and the transmission will not allow the engine to start. This is an indicator of electrical problems with the engine batteries, ECU or shift selector keypad.

The window displays gear selection, various transmission modes, oil level and transmission fault codes.

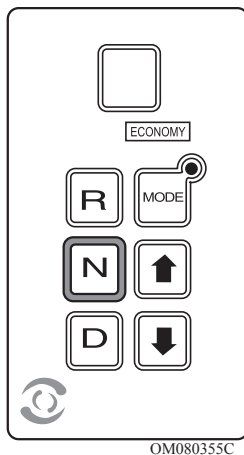
Keypad Functions:

- Select the **REVERSE** gear by pressing **R**.
- Select **NEUTRAL** by pressing **N**. The area around the **N** button has a raised ridge so the driver can orient his hand to the push buttons by touch, without looking at the display.
- Select **DRIVE** range by pressing **D**. The highest forward gear appears in the display and the transmission will shift to first gear though 6 is displayed.

Transmission - Shift Selector



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- The **UPSHIFT** and **DOWNSHIFT** arrow buttons are used to select a higher (if not in “**D**”) or lower (if not in “**1**”) forward range. These buttons are not functional in **NEUTRAL** or **REVERSE**. One press changes the gear range selected by one. If the button is held continuously, the selected range will continue to change up or down until the button is released or until the highest/lowest possible range of gears is selected.
- The **MODE** button enables a secondary shift point to be selected. This is commonly referred to as “Economy.” It is further used by the service technician to access diagnostic codes when troubleshooting. The diagnostic circuitry must be enabled to display.
- When the Auxiliary Braking device (Jacob or Exhaust brake) is used, the display changes to a default reading of 2 or 3. This default is pre-selected at the factory and can only be reprogrammed by an authorized Allison Service Center. The transmission is not in second or third gear. This is only a reference for the transmission downshift points to optimize the engine braking effect.
- Engine temperature may rise when ascending long grades using full throttle. Towing a load will increase the demand on the engine. If this occurs manually shift the transmission down to the next lower gear and use less throttle. The engine will use less fuel and RPM should increase.



NOTE: The transmission will not accept a manually selected gear change to occur if the gear selected is out of the specified operating range.



NOTE: The transmission will not shift into gear if the engine RPM is at or above 900. The display will flash 6 indicating the engine RPM is excessive. Select “N” and lower the engine RPM.

Transmission - Check Light

The electronic control system of the transmission is programmed to inform the operator of a problem with the transmission system and reacts automatically to protect the operator, motorhome and transmission. When the Electronic Control Unit (ECU) detects a **DO NOT SHIFT** (DNS) condition the ECU restricts shifting, turns on the **CHECK TRANS** light in the instrument panel and registers a fault code.



NOTE: For some problems, fault codes may be registered without the ECU activating the CHECK TRANS light. An Allison Transmission authorized service outlet should be consulted whenever there is a transmission related concern. They have the equipment to check diagnostic codes and correct problems which may arise.

Each time the engine is started the **CHECK TRANS** icon will light, then turn off after a few seconds. This momentary lighting is to indicate that the status light circuit is working properly. If the **CHECK TRANS** light does not illuminate during start up, or if the light remains on after start up, the transmission system should be checked immediately.

Continued illumination of the **CHECK TRANS** light during vehicle operation (other than start up) indicates that the ECU has signaled a diagnostic code. Illumination of the **CHECK TRANS** light is accompanied by a flashing display from the shift selector. The shift selector display will show actual range attained and the transmission will not respond to shift selector requests.

Indications from the shift selector are provided to inform the operator that the transmission is not performing as designed and is operating at reduced capabilities. Before turning the ignition off, the transmission may be operated for a short time in the selected range in order to "limp home" for service assistance. Service should be performed immediately in order to minimize potential damage to the transmission.

When the Check Trans icon illuminates the keypad will not respond to command and the transmission generally will downshift to 4th gear. The torque converter will not "lock-up" and engine speed is automatically reduced. Direction changes (i.e. forward to reverse) will not be allowed. Locate a safe secure place to park the motorhome. If the engine is shut off, then engaged after a Check Trans indication, the transmission remains in Neutral until the fault causing the Check Trans light has been corrected.

Diagnostic Codes:

The diagnostic codes are numerical representations of malfunctions in the transmission operations. Each code is a two digit main code and a two digit sub code. The codes, when detected, are logged in the ECU memory. These codes will fall in two classes: active and inactive. Active codes are codes currently effecting the ECU process. Inactive codes are retained but may not effect the ECU process. The diagnostic mode must be entered. A maximum of five codes, **D1** to **D5**, may be listed at one time. The highest priority code will be listed in **D1**. The **MODE** button will enable selection of sequential codes.

To Enable Diagnostic Code Selection Display:

- Stop the motorhome at a safe location.
- Apply the parking brake.
- Simultaneously press the **UP** and **DOWN** arrows twice to enter the stored codes. The first time the arrows are pressed will indicate the oil level display. Press the **UP** and **DOWN** arrows again.
- The codes will display one digit at a time.
- The **MODE** button is pressed to scroll through the codes.
- Any code obtained should be noted and reported to an Allison Service Center for evaluation and possible repair.
- Inactive codes can be cleared by holding the **MODE** button for approximately three seconds. Some codes are self clearing while others will require service or ignition on/off cycles to clear.

Transmission - Periodic Inspections

The Allison MH Series requires minimum maintenance. Careful attention to the fluid level and the connections for the electronic and hydraulic circuits is very important.

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 an Allison dealer.

Prevent Major Problems:

Help the WTEC III control system oversee the operation of the transmission. Minor problems can be kept from becoming major problems if an Allison Transmission distributor or dealer is notified when one of these conditions occur:

1. The shifting feels odd.
2. The transmission leaks fluid.
3. There are unusual transmission-related sounds (changes in sound caused by normal engine thermostatic fan cycling, while climbing a long grade with a heavy load, have been mistaken for transmission-related sounds).
4. The **CHECK TRANS** light comes on frequently.

The Importance of Proper Fluid Levels:

The transmission fluid cools, lubricates and transmits hydraulic power. Proper fluid levels must 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.

The MH Series oil level sensor (OLS) allows the operator to obtain an indication of sensor fluid level from the keypad shift selector. Frequently check for the presence of oil level diagnostics in the transmission. If the OLS has not been detected, troubleshooting of the OLS circuit is required. This will have to be performed by an Allison Service Center. After the OLS circuit is repaired, ensure that reset of the “autodetect” or manual selection of the OLS function by using a Pro-Link transmission diagnostic center.

Fluid Level Check with the Keypad:

- Park the motorhome on a level surface, place the transmission in “N” and set parking brake.
- The transmission should be at normal operating temperature.
- The motorhome should be stationary for approximately two minutes to ensure fluid is stabilized.
- Simultaneously press the arrow **UP** and arrow **DOWN** buttons one time.
- The fluid level will display in the digital display window. The display will indicate one character at a time. The “**o,L**” represents oil level check mode. This will be followed with fluid level indication readings. The “**o,K**” indicates a correct fluid level. Reading between the OLS and the dipstick may not agree because the OLS compensates for fluid temperatures. Abnormal indications of the OLS will be “**Lo**” representing a low fluid level, “**HI**” for a high fluid level or “**oL**” for invalid information and system problems. All indications will be followed by numeric values. The “**Lo**” and “**HI**” followed by the numeric value represents the quarts of fluid required for the system. The invalid code numbers represent specific symptoms.

Common Oil Level Fault Codes:

- 0,5 settling time too short.
- 5,0 speed RPM too low.
- 5,9 speed RPM too high.
- 7,0 sump temperature too low.
- 7,9 sump temperature too high.
- 9,5 OLS FAILURE.



NOTE: Exit the fluid level display by pressing any range button on the keypad.



NOTE: To correctly check the transmission fluid level using the dipstick, the transmission fluid must be at operating temperature. The oil level sensor method of checking the fluid level compensates for transmission fluid temperature between 60° C - 104° C (140° F - 220° F). Any temperature below 60° C (140° F), or above 104° C (220° F), will result in an Invalid for display condition.

Transmission Lubricating Fluid

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, fluid can aerate. Aerated fluid can cause the transmission to shift erratically or overheat.



NOTE: The motorhome should be at normal operating temperature and stationary for approximately two minutes prior to checking the fluid levels to ensure fluid is stabilized.

Transmission Fluid-Dexron III®

Any fluids meeting *DEXRON III*® specifications are acceptable for use in the transmission. Transmission performance, reliability and durability influence the type of fluids used. Change transmission internal filters after the first 8,000 km (5,000 miles of operation). The dipstick/oil fill is located between the engine and transmission underneath the engine access door in the bedroom. Change transmission fluid and internal filters every 40,000 km (25,000 miles) or 18 months thereafter, whichever occurs first.

Fluid and internal filters may require changing earlier depending on the severity of operating conditions. Fluid must also be changed whenever there is evidence of dirt or high temperature operation as indicated by discoloration, strong odor or fluid analysis. Local conditions, severity of operation or duty cycle will dictate more or less frequent service intervals.

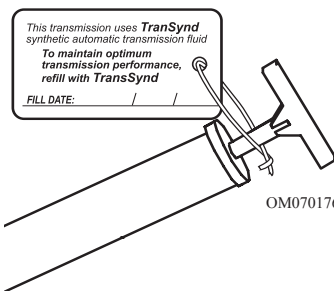


For more detailed information consult the Allison Transmission Owner's Manual.



NOTE: If a tag has been attached to the dipstick identifying the use of TranSynd™ transmission lubricating fluid see section: TranSynd™ Transmission Fluid.

Transmission Fluid-TranSynd™



If a small tag has been attached to the dipstick identifying the use of TranSynd™ synthetic transmission fluid, the transmission has been factory tested using TranSynd™. Any other transmission fluid will affect the service intervals and may affect the warranty. However, any fluids meeting *Dexron III*® specifications are acceptable for use in the transmission. The dipstick/oil fill is located between the engine and transmission underneath the engine access door in the bedroom.

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.

For 100% TranSynd™:

Initially change the transmissions main filter after the first 8,000 km (5,000 miles of operation). Following filter changes will be every 120,000 km (75,000 miles) or 36 months thereafter, whichever occurs first. Change the transmission fluid and filter every 240,000 km (150,000 miles) or 48 months whichever comes first. **THE INTERNAL FILTER IS ONLY CHANGED AT OVERHAUL.**

For mixture of TranSynd™ and Dexron III®:

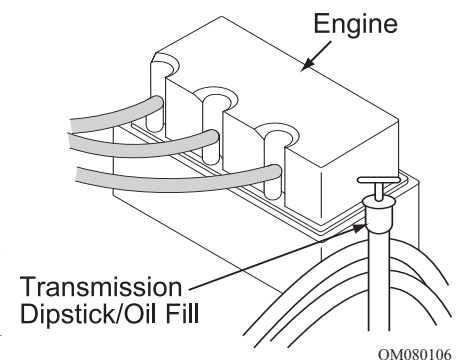
Initially change the transmissions main filter after the first 8,000 km (5,000 miles of operation). Following filter changes will be every 40,000 km (25,000 miles) or 12 months thereafter, whichever occurs first. Change the transmission fluid and filter every 40,000 km (25,000 miles) or 12 months whichever comes first. **THE INTERNAL FILTER IS ONLY CHANGED AT OVERHAUL.**

Cold Check -

The concept of a cold check is to determine adequate fluid level for safe operating until hot check can be performed.

Transmission Fluid Levels - Cold Check**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 wheels to prevent the motorhome from moving.
- Allow the engine to run at idle (500 to 800 RPM) for one minute.
- Apply the service brakes and shift to **D** (Drive), then to **N** (Neutral) and next to **R** (Reverse) to fill the system. Finally shift to **N** (Neutral) and release the service brakes. Allow the engine to continue to run at idle (500 to 800 RPM).
- Remove the dipstick and wipe clean. Reinsert the dipstick fully into the tube and remove. 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 fluid, as necessary, to put the level to the middle of the **COLD CHECK** band.
- Perform the **HOT CHECK** at the first opportunity after reaching normal operating temperatures (160° to 200° F/71° to 93° C).



CAUTION: Low or high fluid level can cause overheating and irregular shift patterns. These conditions can damage the transmission if not corrected.

Transmission Fluid Level - Hot Check

To Check the Fluid When Hot:

- Fluid level rises as the temperature increases. Fluid must be hot to ensure an accurate check.
- Be sure the fluid has reached normal operating temperature (160° to 200° F/71° to 93° C). If a transmission temperature gauge is not present, check the fluid level when the engine water temperature gauge has stabilized and the transmission has been operated under the load for at least one hour.
- Park the motorhome on a level surface and shift to **N** (Neutral). Apply the parking brake and allow the engine to idle (500 to 800 RPM).
- After wiping the dipstick clean, check the fluid level. Safe operating level is anywhere within the **HOT RUN** band on the dipstick.
- The width of the **HOT RUN** band is approximately one quart of fluid at normal temperature range.
- If the level is not within this band, add or drain the fluid as necessary to put the level within the **HOT RUN** band.
- Be sure that fluid level checks are consistent. Check the level more than once. If readings are not consistent confirm that the transmission breather is clean and not clogged. If readings are still not consistent, contact the nearest Allison distributor or dealer.

FUEL REQUIREMENTS

Low sulphur #2 diesel fuel or #1 and #2 commercial winter blend diesel fuels are the most common commercially available and recommended for use. The Cummins Engine Company Inc. recommends the use ASTM #2D fuel. The use of #2 diesel fuel will result in optimum engine performance.



WARNING: Do not mix gasohol or gasoline with diesel fuel. This mixture can cause an explosion.



NOTE: Due to the precise tolerances of diesel injection systems, it is extremely important that fuel be kept clean and free of dirt or water. Dirt or water in the system can cause severe damage to both the fuel pump and the fuel injector. 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 freeze-up during cold weather. Any fuel additives product should show supporting data for performance and benefits. Engine failures caused by incorrect fuel are not covered under warranty.

FUEL TANK

The diesel fuel tank is made of 160 thousands aluminum. The engine pick-up tube is cut at a 45° angle to allow optimum flow to the engine.



NOTE: If the motorhome has been stored for any length of time you should check the vent for blockage. It is not uncommon for insects to plug the vent tube. If the tank appears to be pressurized the vent tube may be blocked. To inspect the vent tube check on the roadside of the fuel tank, near the bottom. Always store the motorhome with a full fuel tank.

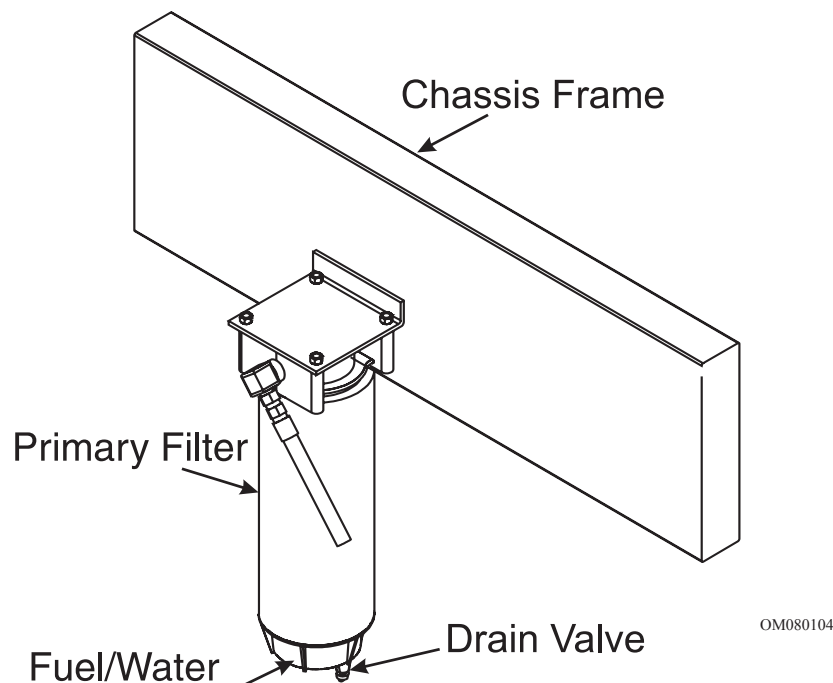
Routine Maintenance Recommendations:

1. Change the fuel filter at every oil change interval.
2. Change the fuel-water separator filter every 12-18 months or every 25,000 miles.

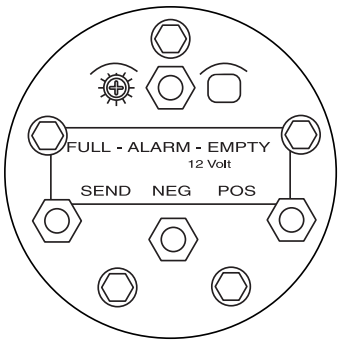
Fuel/Water separator is located in the roadside compartment behind rear wheel. If the **WATER IN FUEL** light is illuminated, the fuel filter will need to be drained. Shut off the engine and open the drain valve. Turn the valve counterclockwise approximately 1½ to 2 turns until draining occurs. Drain the fuel/water separator of water and sediment until clear fuel is visible. Turn the valve clockwise to close the drain valve.

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 Center.

FUEL/WATER SEPARATOR



FUEL SENDING UNIT



The “Centroid” fuel sender which has no moving parts, works by measuring capacitance, an 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:

- **Positive and Negative:** Battery voltage to run the electronics in the sender head.
- **Send:** Connects to the Send terminal of the gauge on the dash.
- **Alarm:** Makes a connection internally to the Negative terminal when the low alarm fuel level is reached (when the fuel gauge is reading about 1/8 tank). This turns on the alarm light on the dash. It is not adjustable.

Adjustments: The “Centroid” sender has two adjustments:

- **Empty:** Adjusts for length of sender. It has been set at the factory and covered with a sealant. It should not be changed.
- **Full Adjustment:** The full adjustment can be used to correct for slight differences between fuel meters. During installation, it has been calibrated for your meter and should not need readjustment.

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. This prevents 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: **904-423-3709**) 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 and 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 oil. Diligent maintenance of hoses is an important step in ensuring efficient, economical and safe operation of engine and related equipment.



Check hoses daily as part of the pre-start-up inspection. Examine hoses for leaks. Check all fittings, clamps and ties carefully. Make sure that the hoses are not touching shafts, couplings and heated surfaces, including exhaust manifolds, sharp edges or other obvious hazardous areas. Since all machinery vibrates and moves to a certain extent, clamps and ties can fatigue with age. To ensure continued proper support, inspect fasteners frequently and tighten or replace them as necessary.

Engine oil levels above the dipstick full mark, or a decrease in lube oil consumption, may indicate internal fuel leaks into the crankcase. Check oil level frequently for fuel contamination.



On a walk around and pre-check of the motorhome, **INSPECT** 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 the seepage continues, have the problem corrected to prevent an untimely failure.

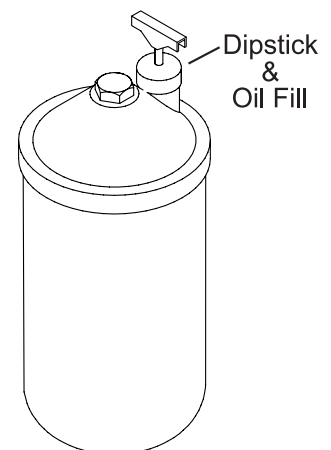
HYDRAULIC SYSTEM

The power steering reservoir with internal filter is located in rear engine compartment. The hydraulic filter assembly is located inside the reservoir. It is rated at ten micron*. The reservoir is filled with *Dexron III* Automatic Transmission Fluid from the factory.

Filter assembly: Nelson 910048A
Element number: 83213D (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 fluid is required, use only *Dexron III* Automatic Transmission Fluid.

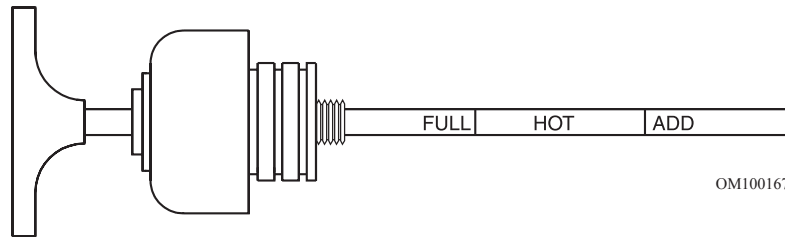
Hydraulic Reservoir

OM090391

* One micron is one millionth of one meter

Checking the Fluid Level:

1. Start the engine and allow 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 for the dipstick. Do not exceed the full mark.
6. If the fluid level is low, add fluid in small amounts, continuously checking the level until the "**FULL**" mark is reached.
7. Insert the easy grip handle back in the reservoir and rotate clockwise until securely fastened.



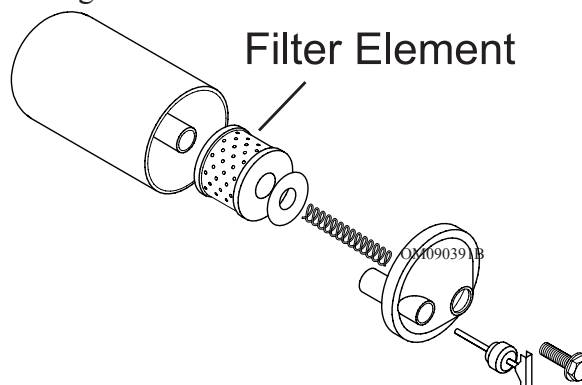
OM100167

Hydraulic Filter

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.



STEERING GEAR

The M-100 series Sheppard steering gear requires no maintenance. Power steering is provided by using hydraulic pressure to assist rotating the output shaft of the steering gear.

Located at the end of the input shaft of the steering gear is 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.

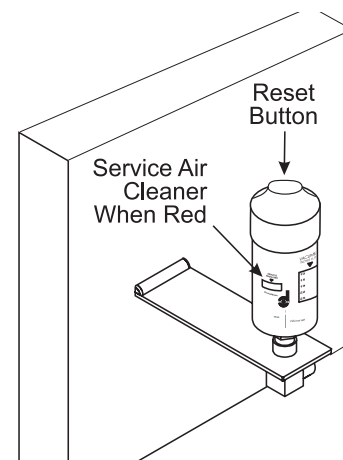
Inspect for signs of leakage when performing fluid level checks. Changing the hydraulic filter at regular intervals will help ensure trouble free operation.

The air filter minder is a precision overflow restriction gauge designed to take the guesswork out of air cleaner replacement.

The air filter minder is located in the engine rear compartment. Its operation is simple and virtually fool-proof. As dirt captured by filter cartridge slowly builds up the system pressure drop increases and is indicated by the filter minder on an easy to read scale. The indicator locks up at the point of maximum restriction so readings can be taken with or without the engine running.

When the desired change-out point is reached, the air filter should be replaced and the service indicator is easily reset by pushing the button at the bottom of the minder.

AIR FILTER MINDER



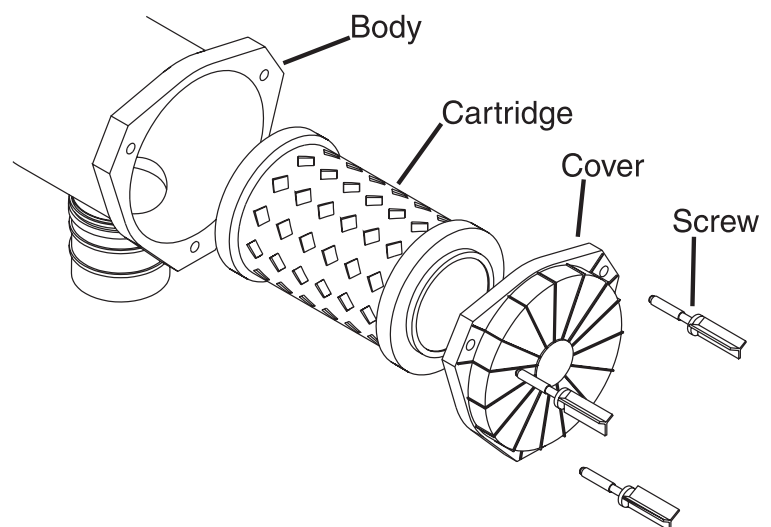
OM080105B

To replace air cleaner remove three screws and cover from air cleaner body. Remove air cleaner cartridge and discard. Install new air cleaner cartridge and secure with cover and three screws.



WARNING: Do not start the engine with the air cleaner removed and do not remove it while the engine is running.

AIR FILTER - CHANGING



OM090317

DRIVE AXLE

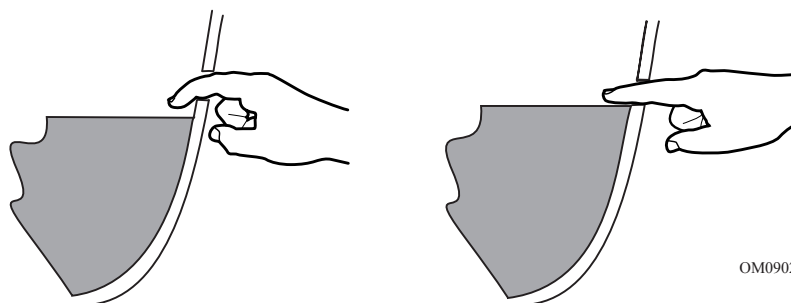


Proper Drive Axle Lubricant Level:

- Regular **inspection** of the drive axle lube levels is an essential maintenance procedure.
- 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.
- The differential is filled with API GL-5 or MT-1 type gear lubricant, Pennzoil Gear Plus Super-EW 75w-90.



NOTE: When checking the lube level also check the housing breathers. Clean the breathers if dirty or replace them if damaged.



OM090264

DRIVE SHAFT

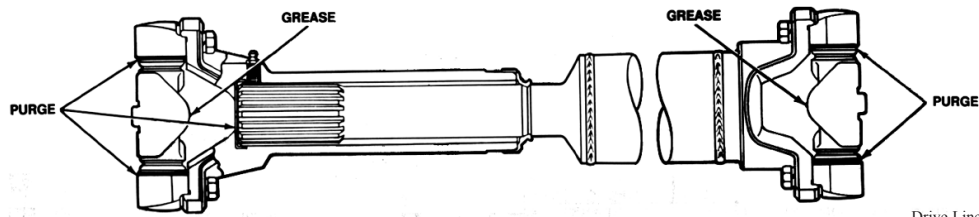
The drive shaft transfers the power produced by the engine to the drive axle. A worn or out of balance driveline causes chassis vibration that generally increases in intensity with road speed.

Greasing the Drive Shaft Universal Joints:

1. Check the drive shaft for looseness. If loose or worn, repair the drive shaft 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. If loose or worn, repair the drive shaft 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.



OM090341

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.

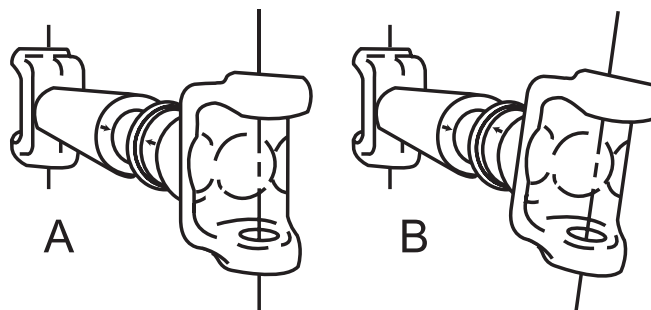
Correct U-joint working angles U-joint phasing, and driveline balance is vital to maintaining a quiet-running drivetrain and long life of drivetrain components (including driveline components).

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 driveshaft 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 driveshaft 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 bisects the shaft lengthwise) the U-joints will be in phase.

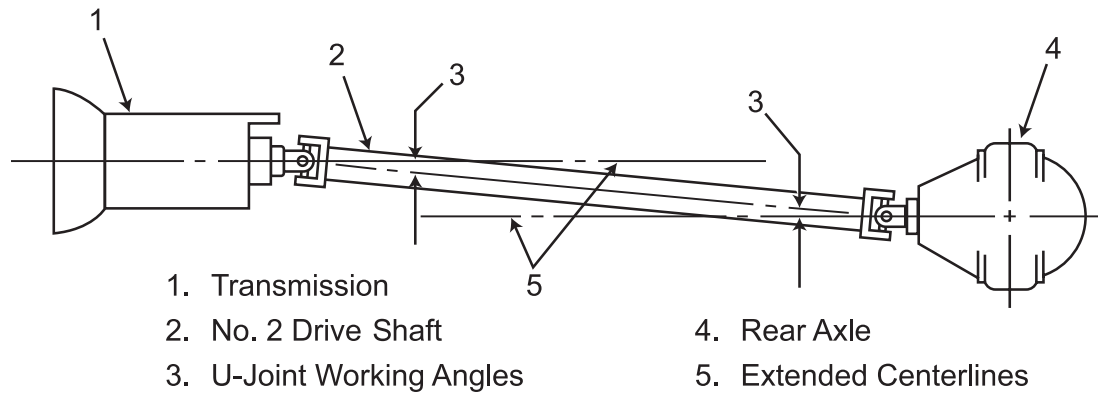
U-joint Angle Phasing & Drive Shaft Balance



A. In Phase

B. Out of Phase

OM090337



OM090336

Any condition which allows excessive movement of a driveshaft will cause driveline 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.

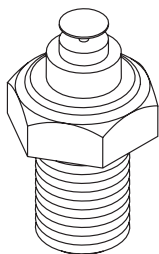
To keep the motorhome operating smoothly and economically, the driveline must be carefully checked and lubricated at regular intervals.

PARTS - COMMON SOLENOID & SENDERS



NOTE: Contact your dealer for service on any of the following components

Transmission Sending Unit

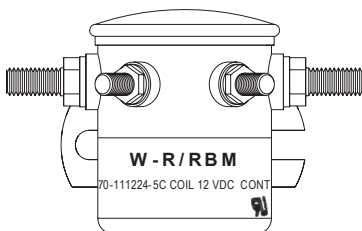


OM090260

Transmission Sending Unit:

- Located on the bottom of the tailshaft housing, between hoses.
- Type - VDO 323 0868

House Disconnect & Starter Solenoid

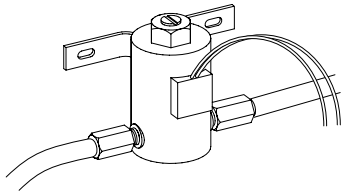


OM090313

House Disconnect and Starter Solenoid

- Solenoid interfaces start signal to Cummins starter.
- Solenoid interrupts DC power to the house fuse panel.
- Four post solenoid with isolated coil.
- Located in high low current plates.

Rear Bag Dump Solenoid

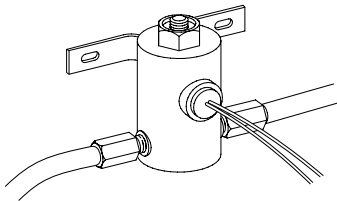


OM080399

Rear Bag Dump Solenoid:

- Only used for the hydraulic leveling.
- Dumps air in the rear bags.
- Two air-bags solenoid, one for each side.
- Location - In the roadside compartment behind the rear wheel.

Front Bag Dump Solenoid

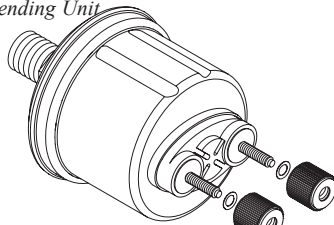


OM080400

Front Bag Dump Solenoid:

- Only used on hydraulic leveling.
- Dumps air in the front air-bags.
- Location - Open the generator door and solenoid is located on the center front fire-wall.

Sending Unit

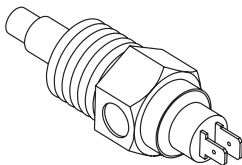


OM090258

Oil Pressure/Low Oil Pressure Warning Dual Post Sending Unit:

- One post oil pressure.
- The sending unit is located on the curb-side under the ECM.

Water Temperature Sender

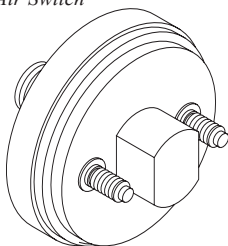


OM090259

Water Temperature/High Water Temp Dual Post Sending Unit:

- One post is used for water temperature and one post is used for the warning light.
- The sending unit is located on top of a cylinder head on the engine.

Low Air Switch

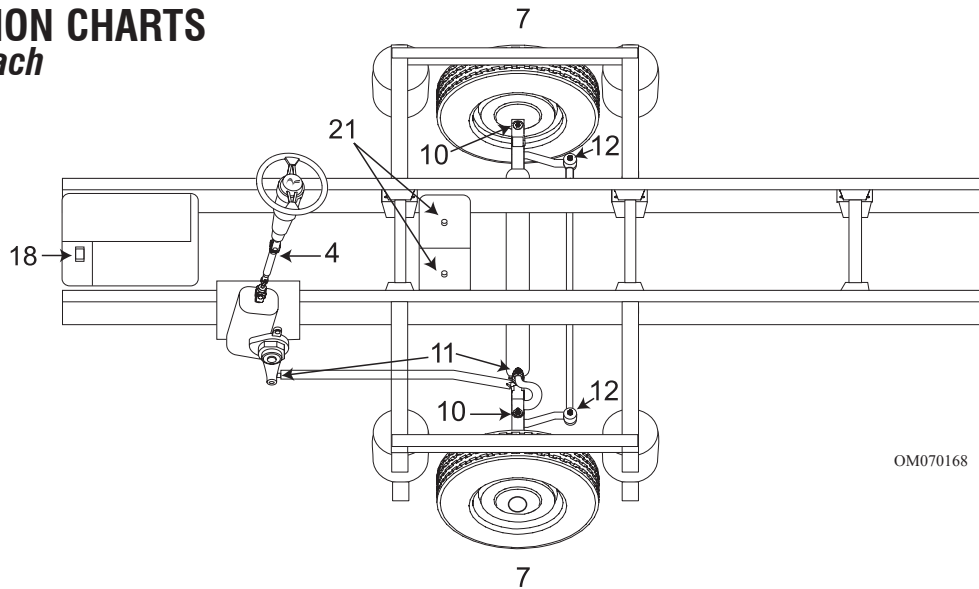


OM090253

Low Air Switch:

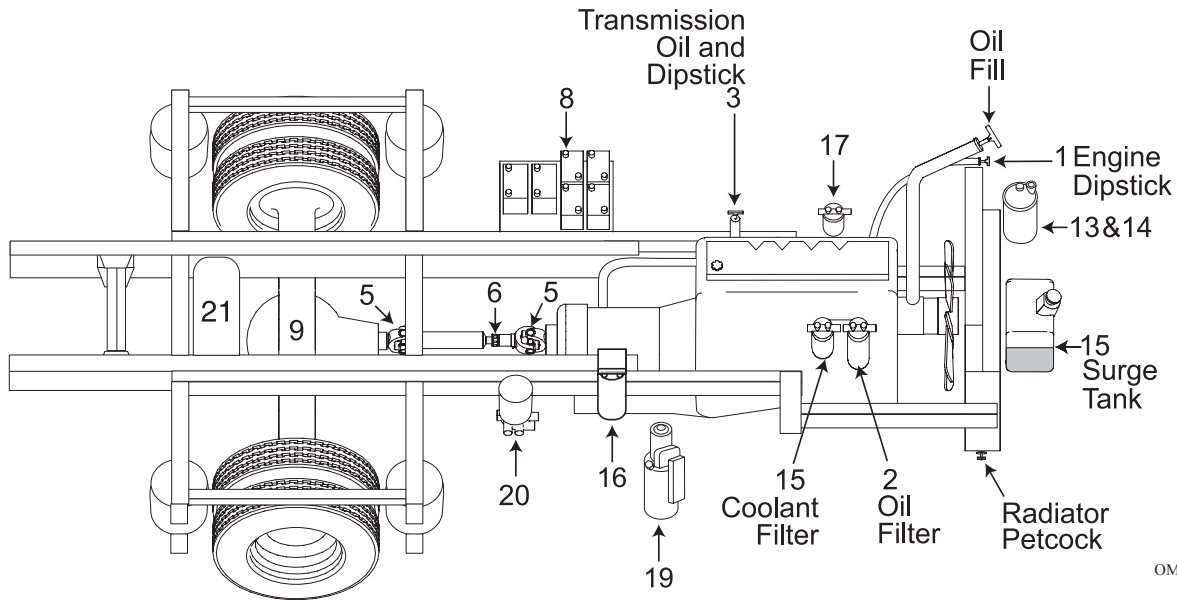
- 1/8-27 NPTF thread.
- Actuates at 66 psi.
- Single pole, two terminal.
- Switch used to illuminate park brake lamp under left dash console.
- Switch used to illuminate air lamp located behind the dash.

LUBRICATION CHARTS Front of Coach



OM070168

COMPONENT	ACTION	WHEN	CODE - REFER TO CHART
1 Engine Oil Fill/Dip Stick	Keep To Full Mark	Check Daily	EO
2 Engine Oil Filter	Replace	Refer To OEM	OEM
3 Transmission Oil Check	Keep To Full Mark	Check Daily	TF or TS
4 Steering Shaft (Inside Coach)	3 Fittings	30,000 or Annually	CL-4
5 Drive Shaft U-Joints	2 Fittings	10,000 or Annually	CL
6 Drive Shaft Slip Joint	1 Fitting	10,000 or Annually	CL
7 Wheel Bearings	Re-Pack	30,000 or Annually	HT
8 Batteries	Inspect	Bi-Monthly	DW
Battery Terminals	Apply Coating	10,000 or Annually	P
9 Rear Axle Differential	Replace	250,000 or Every 3 Years	MP
10 King Pins & Knuckles	2 Fittings Each End	30,000 or Annually	CL
11 Drag Link	1 Fitting	5,000 or 6 Months	CL
12 Tie Rod	2 Fittings	5,000 or 6 Months	CL
13 Hydraulic Fluid Reservoir	Keep To Full Mark	6,000 or 3 Months	TF
14 Hydraulic Fluid Filter (If applicable)	Replace	15,000 or Annually	TF
15 Engine Coolant Capacity	Keep To Full Mark	Daily	AF
16 Fuel Filter (Primary)	Replace	15,000 or 6 Months	FF
17 Fuel Filter (Secondary)	Replace	Refer To OEM	OEM
18 Generator Set	Hours	Refer To OEM	OEM
19 Leveler Reservoir	Fill	6,000 or 3 Months	TF
20 Air Dryer Filter	Replace	2 - 3 Years	--
21 Air Tanks	Drain	Monthly	--

Rear of Coach

OM070169B

LUBRICATION CODE CHART

CL-4	U-joints located inside the coach under the steering cover
EO	Engine oil as recommended by engine manufacturer
OEM	Refer to Equipment Manufacturers Manual.
MP	AP GL-5 or MT-1 type gear lubricant - Pennzoil Gear Plus SUPER-ew 75w-90, Synthetic
GO	EP-DAE 90 Gear Oil
CL	Chassis lubricant should be a high quality non-corrosive multipurpose lithium soap pressure gun lubricant that is water resistant and designed to withstand extremely high operating temperatures
P	Petroleum jelly, or commercial battery terminal corrosion inhibitor
AF	Consult Cummins Owners Manual for antifreeze type
TF	Transmission fluid
FF	Fuel filter
BF	Dot-3 Brake Fluid
TS	TranSynd™ synthetic transmission fluid.
CBL	Clay-based Lubricant
DW	Distilled Water
HT	High Temperature Bearing Grease

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.



NOTE: It is important to remember the generator lubrication interval is based on hours of usage. Consult the OEM for the generator service interval.

CHART - FILTERS & BELTS

ISC FILTERS AND BELTS	MANUFACTURER	NUMBER
A/C Belt	Dayco	15465
Air Filter	Donaldson	P533930
Alternator Belt	Dayco	3911581
Fuel Filter Primary	Fleetguard	FS1242
Fuel Filter Secondary	Fleetguard	FS1022
Oil Filter	Fleetguard	LF3000
Power Steering Filter	Nelson	83213D
Transmission Filter Remote Spin On	Allison	Internal Filter



NOTE: Filter and belt numbers were correct at the printing of this manual. Please verify number at 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.

ENGINE SPECIFICATIONS - CUMMINS ENGINE ISC 330	
Engine Size / Cummins	8.3 Liter
Allison Transmission	MH 3000
Torque (lbs. - ft. Max. Net at 1,400 RPM) - 330 HP	950
Cubic Inch Displacement - 300 HP	504.5
Alternator / Leece Neville	160 amp
Rear Axle Ratio	4.30:1
Tire Size / Goodyear	275/70R22.5

CHART - SPECIFICATIONS

MODELS	34PBD	36PBD	36PST	38PBD	38PBDD	38PST
Gross Vehicle Weight Rating	32,000 lbs.	32,000 lbs.	32,000 lbs.	32,000 lbs.	32,000 lbs.	32,000 lbs.
Gross Combined Weight Rating	42,000 lbs.	42,000 lbs.	42,000 lbs.	42,000 lbs.	42,000 lbs.	42,000 lbs.
Front Gross Axle Weight Rating	12,000 lbs.	12,000 lbs.	12,000 lbs.	12,000 lbs.	12,000 lbs.	12,000 lbs.
Rear Gross Weight Rating	20,000 lbs	20,000 lbs	20,000 lbs	20,000 lbs	20,000 lbs	20,000 lbs

MODELS	40PBD	40PBDD	40PWD	40DST	40PST	40PDT
Gross Vehicle Weight Rating	32,000 lbs.	32,000 lbs.	32,000 lbs.	32,000 lbs.	32,000 lbs.	32,000 lbs.
Gross Combined Weight Rating	42,000 lbs.	42,000 lbs.	42,000 lbs.	42,000 lbs.	42,000 lbs.	42,000 lbs.
Front Gross Axle Weight Rating	12,000 lbs.	12,000 lbs.	12,000 lbs.	12,000 lbs.	12,000 lbs.	12,000 lbs.
Rear Gross Weight Rating	20,000 lbs	20,000 lbs	20,000 lbs	20,000 lbs	20,000 lbs	20,000 lbs

MODELS	34PBD	36PBD	36PST	38PBD	38PBDD	38PST	40PBD	40PBDD	40PWD	40DST	40PST	40PDT
Water Heater	10 gal.	10 gal.	10 gal.	10 gal.	10 gal.	10 gal.	10 gal.	10 gal.	10 gal.	10 gal.	10 gal.	10 gal.
Grey Tank	60 gal.	60 gal.	60 gal.	60 gal.	60 gal.	60 gal.	60 gal.	60 gal.	60 gal.	60 gal.	60 gal.	60 gal.
Black Tank	39 gal.	39 gal.	39 gal.	39 gal.	39 gal.	39 gal.	39 gal.	39 gal.	39 gal.	39 gal.	39 gal.	39 gal.
Fresh Tank	100 gal.	100 gal.	100 gal.	100 gal.	100 gal.	100 gal.	100 gal.	100 gal.	100 gal.	100 gal.	100 gal.	100 gal.
Fuel Tank	100 gal.	100 gal.	100 gal.	100 gal.	100 gal.	100 gal.	100 gal.	100 gal.	100 gal.	100 gal.	100 gal.	100 gal.
LP Tank*	38 gal.	38 gal.	38 gal.	38 gal.	38 gal.	38 gal.	38 gal.	38 gal.	38 gal.	38 gal.	38 gal.	38 gal.

* Actual filled LP capacity is 80% of listing due to safety shut off required on tank.

This chart reflects product specification available at the time of printing. Therefore any floor plans thereafter may not be reflected in the chart. All other information contained throughout the manual will still apply.

MODELS	34PBD	36PBD	36PST	38PBD	38PBDD	38PST	40PBD	40PBDD	40PWD	40DST	40PST	40PDT
Wheelbase	196"	216"	216"	242"	242"	242"	256"	256"	256"	256"	256"	256"
Overall Length	34' 11"	36' 7"	36' 7"	38' 9"	38' 9"	38' 9"	39' 11"	39' 11"	39' 11"	39' 11"	39' 11"	39' 11"
Overall Height	12' 0"	12' 0"	12' 0"	12' 0"	12' 0"	12' 0"	12' 0"	12' 0"	12' 0"	12' 0"	12' 0"	12' 0"
Interior Height	6' 6"	6' 6"	6' 6"	6' 6"	6' 6"	6' 6"	6' 6"	6' 6"	6' 6"	6' 6"	6' 6"	6' 6"
Interior Width	94.5"	94.5"	94.5"	94.5"	94.5"	94.5"	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"	100.5"	100.5"	100.5"	100.5"	100.5"	100.5"

METRIC/U.S. CONVERSION CHART

U.S. Customary to Metric		
Measurement	Multiplied By	Equals/Measurement

Length		
inches (in)	25.4	millimeters (mm)
inches (in)	2.54	centimeters (cm)
feet (ft)	0.3048	meters (m)
yards (yd)	0.9144	meters (m)
miles (mi)	1.609	kilometers (km)

Area		
square inches (in ²)	645.16	square millimeters (mm ²)
square inches (in ²)	6.452	square centimeters (mm ²)
square feet (ft ²)	0.0929	square meters (mm ²)

Volume		
cubic inches (in ³)	16387	cubic millimeters (cm ³)
cubic inches (in ³)	16.387	cubic centimeters (cm ³)
cubic inches (in ³)	0.01639	liters (L)
fluid ounces (fl oz)	29.54	milliliters (mL)
pints (pt)	0.47318	liters (L)
quarts (qt)	0.94635	liters (L)
gallons (gal)	3.7854	liters (L)
cubic feet (ft ³)	28.317	liters (L)
cubic feet (ft ³)	0.02832	cubic meters (m ³)

Weight/Force		
ounces (av) (oz)	28.35	grams (g)
pounds (av) (lb)	0.454	kilograms (kg)
U.S. tons (t)	907.18	kilograms (kg)
U.S. tons (t)	0.90718	metric tons (MT or t)

Torque/Work Force		
inch-pounds (lbf.in)	11.298	Newton-centimeters (N.cm)
foot-pounds (lbf.ft)	1.3558	Newton-meters (N.m)

Pressure Vacuum		
inches of mercury (inHg)	3.37685	kilopascals (kPa)
pounds per square inch (psi)	6.895	kilopascals (kPa)

U.S. Customary to Metric			
Measurement	Subtract	Divide By	Equals/Measurement

Temperature			
Fahrenheit (°F)	32	1.8	Celsius (°C)

Metric to U.S. Customary		
Measurement	Multiplied By	Equals/Measurement

Length		
millimeters (mm)	0.03937	inches (in)
centimeters (cm)	0.3937	inches (in)
meters (m)	3.281	feet (ft)
meters (m)	1.094	yards (yd)
kilometers (km)	0.6215	miles (mi)

Area		
square millimeters (mm ²)	0.00155	square inches (in ²)
square centimeters (mm ²)	0.15	square inches (in ²)
square meters (mm ²)	10.764	square feet (ft ²)

Volume		
cubic millimeters (cm ³)	0.000061	cubic inches (in ³)
cubic centimeters (cm ³)	0.06102	cubic inches (in ³)
liters (L)	61.024	cubic inches (in ³)
milliliters (mL)	0.03381	fluid ounces (fl oz)
liters (L)	2.1134	pints (pt)
liters (L)	1.0567	quarts (qt)
liters (L)	0.2642	gallons (gal)
liters (L)	0.03531	cubic feet (ft ³)
cubic meters (m ³)	35.315	cubic feet (ft ³)

Weight/Force		
grams (g)	0.03527	ounces (av) (oz)
kilograms (kg)	2.205	pounds (av) (lb)
kilograms (kg)	0.001102	U.S. tons (t)
metric tons (MT or t)	1.1023	U.S. tons (t)

Torque/Work Force		
Newton-centimeters (N.cm)	0.08851	inch-pounds (lbf.in)
Newton-meters (N.m)	0.7376	foot-pounds (lbf.ft)

Pressure Vacuum		
kilopascals (kPa)	0.29613	inches of mercury (inHg)
kilopascals (kPa)	0.14503	pounds per square inch (psi)

Metric to U.S. Customary			
Measurement	Multiplied By	Add	Equals/Measurement

Temperature			
Celsius (°C)	1.8	32	Fahrenheit (°F)

MAINTENANCE RECORD

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, you should retain all maintenance receipts. The owner information portfolio is a convenient place to store them.

[illegible]

MAINTENANCE RECORD

Date	Odometer Reading	Serviced By	Maintenance Performed

MAINTENANCE RECORD

Date	Odometer Reading	Serviced By	Maintenance Performed

MAINTENANCE RECORD

[illegible]

MAINTENANCE RECORD

Date	Odometer Reading	Serviced By	Maintenance Performed

MAINTENANCE RECORD

Date	Odometer Reading	Serviced By	Maintenance Performed

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INDEX

A

ABS/ATC System	311
Anti-Lock Brakes	311
Automatic Traction Control System	313
Air Conditioner - Roof	140
Operation	141
Return Air Filters	141
Air Coupler - Universal	307
Air Dryer	304
Air Dryer Cycle	305
Air Dryer Operation	305
Desiccant - Type Air Dryer	305
Desiccant Cartridge	306
Importance of the Air Dryer	305
Air Filter - Changing	345
Air Filter Minder	345
Air Governor	304
Air Springs	310
Checklist - Air Bag Inspections	310
Air Storage Tanks	307
Air Supply System	304
Air System - Charging (External)	308
Alignment Specifications	318
Alternator	298
Check Out Procedure	298
Appliances - Introduction	121
Awning	165
Automatic Carefree Awning (Optional)	168
Awning Care & Maintenance	171
Front Door	165
Patio Awning	166
Slide-out Cover	171
Slide-out Extendible Awning	169
Window Awning (Optional)	165

B

Backing Up a Motorhome	45
Battery	253
Battery Charge Time & Consumption Rate	259
Battery Maintenance	254
Battery Specifications	261
Battery Voltage & Current	258
Deep Cycle Battery	254
How it Works	253
Reasons Why Batteries Fail	256
Starting Battery	254
Testing the Battery	255
Battery - Chassis	276
Battery Specifications - Chassis	277
Battery Cut-off Switch	238
Battery Disconnect - Chassis	275
Battery Disconnect - House	238
Brake - Parking & Emergency Systems	315
Disabling Park Brake	316
Brake Adjustment/Slack Adjuster	316
Brake Systems - Air Brakes	314
Brake Systems - Back-up	317
Breaking Camp	52

C

Carbon Monoxide Detector	80
Alarm	81
Cleaning	81
Operating Instructions	80
Testing	81
Charge Air Cooler	331
Chart - Filters & Belts	352
Chart Specifications	353
Chassis - Introduction	303
Checklist- LP-Gas Emergency Procedures	224
Cold Weather Use	212
Cooktop	135
Burner Grate	136
Cleaning & Maintenance	137
Lighting Top Burners	136
Operation	136
Tips	137

Coolant	328
Coolant - Additive (SCA)	330
Coolant Hoses	330
Coolant System - Thawing	330
Customer Relations	13

D

Dash	278
Air Conditioner & Heater Controls	287
Controls	286
Gauges	280
Indicator Lamps	278
Parking Brake	282
Switches	282
Diagnostic Plug Location	295
Dinette	178
Bed Conversion (Optional)	178
Table Top Extension	178
Table Top Extension (Legless)	178
Distribution Panel - House 12 Volt	250
Fuses	251
Distribution Panel House 110	246
AC Panel	246
Energy Management System - 50 Amp (Optional)	247
Door - Sliding	176
Drive Axle	346
Drive Shaft	346
U-joint Angle Phasing & Drive Shaft Balance	347
Driving & Safety - Introduction	33
Familiarize Yourself	33
Inspections	33
Safety Seat Belts	33
Tips for Driving	36
Dry Camping Tips	48

E

Egress Exit Window	82
Electric Sofa Bed Conversion (Optional)	177
Electrical System - House - Introduction	237
Generator	237
Inverter/Converter	238
Shore Power	237

Electrical Systems - Chassis - Introduction	275
Emergency Procedures - Roadside	54
Jump Starting	55
Light - Retractable	54
Transmission - Rocking Out	55
Engine - General Information	323
Engine Start Procedure	324
Engine Start Procedure - Cold Weather	324
Engine Shutdown	328
Engine Shutdown - Extended	328
Entertainment Systems	179
Entertainment Hook-up - Exterior	182
Home Theater Stereo System DVD Player Operation	186
Home Theatre Stereo System DVD Player (Optional)	186
Hook-ups - TV Cable, Computer & Telephone	182
Satellite System - DSS (Optional)	185
Satellite System - DSS Prewire	184
Television (Front) With Lock-out Feature	179
Television Antenna	180
Video Cassette Recorder (VCR) (Optional)	179
Video Selector Box	183
Entry Door	158
Front Entry	158
Latch Adjustments	158
Screen Door - Changing the Glass	158
Screen Door - Removing the Screen	159
Entry Step	155
Maintenance & Lubrication	156
Operation	155
Tips	156
Equipment - Introduction	155
Exhaust Brake	332
Maintenance	332
Exterior - Maintenance	89
Roof Care & Seal Inspections	89
Exterior Care	85
Bright Metal	88
Care & Maintenance of Aluminum Wheels	88
Corrosion	85
Drying	86
Tire Care	87
Washing	85
Waxing	86
Exterior Entertainment Center (Optional)	188

F

Fans	173
Bathroom Exhaust Fan (Optional)	175
Bathroom Fan	176
Galley Fan	173
Galley Fan Tips	174
Fire Extinguisher	81
Fuel Requirements	340
Fuel Sending Unit	342
Fuel Lines & Hoses	343
Fuel Tank	341
Fuel/Water Separator	341
Furnace	142
If the Furnace Fails to Light	143
Operation	142
Tips	143
Using the Furnace	143
Fuse & Circuits - Chassis	296
Distribution Panel - Front	296

G

General Information - Introduction	13
Generator - 120 AC (LP-Gas)	241
Generator - 120 AC Diesel (Optional)	242
Pre-start Checks	242
Resetting the Circuit Breaker	243
Generator Exercise	243
Generator Fuel	245
GFCI Breakers & Outlets	251
Know When to Say No	252
Tools of the Trade	252
Glossary of Terms	20

H

Height Control Valves	308
Adjusting	309
Hitch	42
Tow Plug Connection	43
Using the Rear Receiver	42
Hydraulic System	343
Hydraulic Filter	344
Hydraulic Reservoir	343

I

Interior Care	91
Ceilings	103
Countertops	107
Day/Night Shades	111
Fabric Specification Charts	94
Fabrics	91
Floor - Laminate	102
Floor - Tile	101
Floors - Carpet Cleaning	100
Leather	98
Mini-blinds	110
Mold & Mildew	109
Shower - Cleaning	102
Ultra-Leather	99
Vinyl	96
Wall Coverings	103
Windows	108
Wood Care	105
Inverter/Converter	262
Battery Charging	262
Battery State Indicator	264
Charge Cycles	265
Circuit Breakers	264
Equalize Charge	266
Pass - Through Relay	265
Power Share	264
Programming the Inverter	266
Remote Panel	263
Stand-By Mode	264
Temperature Sensitive Charging	265

L

Leveling System	320
Before Operating Leveling Jacks	321
Drive Away Protection System	322
Hydraulic Leveling	320
Leveling the Motorhome	321
Maintenance	322
Retracting Leveling Jacks	322
Limited Warranty Transfer Application	31
LP-Gas Consumption	230

LP-Gas Detector	78,222
Alarm	79,223
Care of the Detector	223
Cleaning	79
Operation	222
Testing	78,222
LP-Gas Distribution Lines	231
LP-Gas Fundamentals	227
LP-Gas Hose Inspection	229
LP-Gas Regulator	228
LP-Gas Safety Tips	232
LP-Gas System - Introduction	221
LP-Gas Tank	225
LP-Gas Tank Filling	226
Operation	225
Lubrication Charts	350
Front of Coach	350
Rear of Coach	351

M

Maintenance Record	355
Metric/U.S. Conversion Chart	354
Microwave Oven	127
Care & Cleaning	135
Convection Cooking	133
Microwave Cooking	132
Operation	130
Tips	134
Monitor Panel	195
Measurement & Calibration	195
Monitor Panel Measurement	224
Tank Capacities - Chart	224

O

Oil Recommendations (Engine)	325
Oil Recommendations - Cold Weather	327
Owner's Record - Personal Property	18
Owner's Record - Serial Numbers	17
Owner's Record - Insurance	19

P

Parts - Common Solenoid & Senders	348
Powering the Equipment	245
Pre-Trip Preparations - Checklist	39

R

Radios	187
10 Disc CD Changer	188
Citizens Band Radio - Prewire	188
Dash	187
Rear View System	43
Refrigerator	121
Alarm	126
Control Panel - Two Door	123
Control Panel - Four Door (Optional)	124
Cooling Unit Fans (Four Door Models)	127
Doors	126
Ice Maker (Optional)	125
Inverter Mode Operation	123
Operation Specifics	122
Refrigerator Controls	122
Service	127
Storage	127
Reporting Safety Defects	14

S

Service Center	196
Service Suggestions	15
Be Reasonable With Your Requests	15
Inspect the Work Properly	16
No Looking Over the Technicians Shoulder	16
Prepare a List	15
Prepare for the Appointment	15
Set-up Procedures - Checklist	47
Shock Absorber	320
Shore Power Hook-Up	239
Signs	10

Slide-out Operation	159	Tire Chart	67
Extending Bedroom Slide-out	163	In Case of Flat Tire	72
Extending Main Room(s)	160	Inspecting & Pressure	68
Manual Override Bedroom Slide-out	164	Storage of Tires - Long-Term	70
Manual Override Main Slide-out	162	Tire Rotation	69
Retracting Bedroom Slide-out	163	Tire Vibration	69
Retracting Main Room(s)	161	Tires - Supporting When Leveling	70
Smoke Detector	76	Tires	59
How to Test	77	How Much Air Should I Carry in My Tires?	60
Maintenance	77	The Importance of Air Pressure	60
Operation	76	Tire Pressure Inflation Guideline	61
Troubleshooting	77	Toilet	207
Sofa Bed Conversion	176	Cleaning	208
Sofa Hide-A-Bed Conversion	177	Drain Traps & Auto Vents	212
Solar Panel - Optional	268	Maintenance	208
Specifications - Dimensions Chart	76	Sealand Cleaning	211
Starting the Generator	244	Sealand Operating Instructions	209
Stopping the Generator	244	Sealand Troubleshooting	210
Steering Column	295	Thetford Operating Instructions	207
Tilt & Telescope	295	Troubleshooting	208
Steering Gear	345	Towing Procedures	58
Stepwell Cover	157	Brake - Disabling Parking Brake	59
Adjustments	157	Transfer Switch	241
Entry Step Storage	157	Transmission	333
Storage	111	Transmission - Check Light	334
Long-Term	112	Transmission - Periodic Inspections	336
Removal	115	Transmission - Shift Selector	333
Short Term	111	Transmission Fluid - TranSynd™	338
Winter Storage	115	Transmission Fluid- Dexron III®	338
Storage - Cold weather	214	Transmission Fluid Level - Hot Check	340
Storage Under Bed	178	Transmission Fluid Levels - Cold Check	339
Sunvisors	173	Transmission Lubricating Fluid	338
Super Slide (Optional)	179		
Survey	29		

T

Taking Delivery	14
Customer Responsibilities	15
Dealer Responsibilities	14
Holiday Rambler Responsibilities	14
Tank Capacities - Chart	202
Thermostat	138

V

Vendor List	24
Views	74
Curbside	75
Front	74
Rear	74
Roadside	75

W

Warranty Information File	8
Warranty Limited	1
Disclaimer of Consequential & Incidental Damages ..	4
Events Discharging Warrantor from	
Obligation Under Warranty	4
How to Get Service	3
Legal Remedies	4
Limitations of Implied Warranties	2
What the Warranty Covers	2
What the Warranty Does Not Cover	3
What We Will Do to Correct Problems	2
Warranty Limited - Roadmaster Chassis	5
Disclaimer of Consequential & Incidental Damages ..	7
Events Discharging Warrantor from	
Obligation Under Warranty	7
How to Get Service	6
Legal Remedies	7
Limitations of Implied Warranties	5
What the Warranty Covers	5
What the Warranty Does Not Cover	7
What We Will Do to Correct Problems	6
Washer/Dryer (Optional)	148
Cleaning the Drain Screen	150
Cleaning the Washer/Dryer	150
Operating Instructions	149
Winterizing the Washer/Dryer	151
Washer/Dryer Prepared	147
Waste Water Systems	202
Black Tank Flush	205
Proper Waste Disposal	202
Waste Drain & Sewage Tanks	203
Waste Drain Hose	204
What Not to Put into the Holding Tanks	203
What to Put into the Holding Tanks -	
Black Water Tank	205
What to Put into the Holding Tanks -	
Grey Water Tank	205
Water - City Hook-up	197
Water Filter	200
Water Heater	144
Before Using the Water Heater	144
Draining & Storage	147
Pressure - Temperature Relief Valve	145
Tips	147
Troubleshooting	147
Water Heater Bypass System	145
Water Heater Compartment	145
Water Pump	198
Water Pump - Troubleshooting	199
Water Systems - Introduction	195
Water Tank - Fresh Fill	196
Water Tank - Fresh Gravity Fill	197
Watery System	200
Disinfecting Fresh Water	201
Faucet Screens	200
Troubleshooting	200
Weighing the Motorhome	63
Weight Terms	61
Weight Label (Example)	63
Winterizing	214
Using Air Pressure	214
Using Non Toxic Antifreeze	216