



**OWNER'S MANUAL QUESTIONNAIRE**

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, postage paid, 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?**

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**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.**

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

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

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**NAME:** \_\_\_\_\_ **PHONE:** (\_\_\_\_) \_\_\_\_\_

**ADDRESS:** \_\_\_\_\_

CUT ALONG  
DOTTED LINE



FOLD

FOLD



CUT ALONG  
DOTTED LINE

# NAVIGATOR

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## SIGNS

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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 gray box inside your 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.**

# NAVIGATOR

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## INTRODUCTION

This chapter 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 not fill up the sewage holding tank, deplete the water or LP-Gas supply, or run down the batteries which supply the living area 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 for you to stop occasionally to empty the holding tanks and to replenish your water and LP gas supply.

Many gas stations have installed sanitary dumping stations. Publications are available which list these dumping stations. When you stop for the night your 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. You are self-contained.

The safety alert symbols mean **CAUTION** or **WARNING** - "Personal Safety Instructions." Read and understand instructions where these symbols are displayed in this manual. Failure to comply with specific instructions may result in personal injury or death. Many instructions are required by National Safety Associations.

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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

**Holiday Rambler Consumers Affairs Department  
606 Nelson's Parkway  
Wakarusa, Indiana 46573  
800-522-7519 or 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 202-366-0123 in Washington DC area) or write to:

**NHTSA  
400 Seventh Street  
US Department of Transportation  
Washington, DC 20590**

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## **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. Your 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.

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## ***Dealer Responsibilities***

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

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

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

**Customer  
Responsibilities**

As a new motorhome owner you are responsible for regular and proper maintenance. This will help you prevent conditions arising from neglect that are not covered by your 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 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.

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.

**WARRANTY  
INFORMATION  
FILE**

**HOLIDAY RAMBLER 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.

## **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.

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### ***Prepare for the Appointment***

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

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### ***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.

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### ***Be Reasonable With Your Requests***

Don't leave a list of 20 items to be serviced and expect to have your motorhome back by five o'clock. If you list a number of items, and you must have your motorhome back by the end of the day, discuss the situation with the service manager and list your 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.

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### ***No Looking Over the Technicians Shoulder***

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

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### ***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**



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** Model & Serial Number \_\_\_\_\_  
(Located under top cover on air conditioner)

**FOR YOUR OWN REFERENCE**

**OWNER'S RECORD - PERSONAL PROPERTY**

Item	Serial Number	Value

**FOR YOUR OWN REFERENCE**

**OWNER'S RECORD - INSURANCE**

Company: \_\_\_\_\_

\_\_\_\_\_

Policy #: \_\_\_\_\_

\_\_\_\_\_

Agent's Name & Address: \_\_\_\_\_

\_\_\_\_\_

Business Phone #: \_\_\_\_\_

\_\_\_\_\_

Emergency Phone #: \_\_\_\_\_

\_\_\_\_\_

Renewal Date(s): \_\_\_\_\_

\_\_\_\_\_

Notes: \_\_\_\_\_

\_\_\_\_\_

\_\_\_\_\_

\_\_\_\_\_

\_\_\_\_\_

\_\_\_\_\_

**LIMITED  
WARRANTY -  
2001 Navigator**

**HOLIDAY RAMBLER MOTORHOME LIMITED WARRANTY**

**What the Period of Coverage Is:**

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

If you use your motorhome for any rental or commercial 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 comes first. A conclusive presumption that your motorhome has been used for commercial 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 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.

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**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.

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.

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***What the Warranty Covers***

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.

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***What We Will Do to Correct Problems***

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. Normally any factory defect or damage is detected and corrected at the factory during the inspection process performed by the Warrantor. 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.

The Warranty Registration form must be returned to Warrantor promptly upon purchase to assure proper part replacement or repair and to activate your Limited Warranty. 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 (1-800-46-6226). The mailing address is:

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***How to Get Service***

**P.O. BOX 465  
Wakarusa, Indiana 46573**



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.

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**What the Warranty Does Not Cover**

This Limited Warranty does not cover: any motorhome sold or registered outside of the United States or Canada; items which are added or changed after the motorhome leaves Warrantor's possession; items that are working as designed but which you are unhappy with because of the design; normal wear and usage, such as fading or discoloration of fabrics, or the effects of condensation inside the motorhome; defacing, scratching, dents and chips on any surface or fabric of the motorhome, not caused by Warrantor; routine maintenance, including by way of example wheel alignments; the automotive chassis and power train, including, by way of example the engine, drive train, 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, 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.

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**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.

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**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.** 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, AND 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 twenty-four (24) months from the original retail purchase date or the first 24,000 miles of use, whichever occurs first.

If you use the Roadmaster Chassis that your motorhome is mounted upon for any rental or commercial 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 purposes arises if you have filed a federal or state tax form claiming any business tax benefit related to your ownership of the motorhome.

**LIMITED  
WARRANTY  
- 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**

### **What the Warranty Covers**

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.

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### **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.

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. Normally, any factory defect or damage is detected and corrected at the factory during the inspection process performed by the Warrantor. 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.

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### **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 (1-800-466-6226). The mailing address is:

**P.O. Box 465  
Wakarusa, Indiana 46573**

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.

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***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.

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***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.** Some states do not allow the exclusion or limitation of consequential or incidental damages, so the above exclusions may not apply to you.

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

**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, AND YOU MAY ALSO HAVE OTHER RIGHTS WHICH VARY FROM STATE TO STATE.**

**HOLIDAY RAMBLER  
606 Nelson's Parkway  
Wakarusa, Indiana 46573  
Telephone 800-522-7519 or 877-466-6226**

## VENDOR LIST

### Air Conditioner

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

### Air Conditioner- Dash

SCS/Frigette  
800-433-1740

### Alternator

Leece-Neville  
800-349-2628

### Aqua Hot

Vehicle System  
800-685-4298

### Awnings

Carefree  
800-338-2378  
www.carefreeofcolorado.com

### Girard Systems

800-621-2617

### Axles

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

### Eaton Corporation

800-328-6687

### Battery Isolator

Powerline  
800-443-9394

### Battery Maintainer

“Keep It Up”  
Lamert Enterprise  
800-853-3748

### Batteries

Centennial  
800-536-3536

### Nationwide Batteries

800-367-1407

### Interstate

800-272-6548

### Bose Home Theater

Bose Corporation  
800-288-2673  
www.bose.com

### Brake-Anti-Lock Brake System

Eaton  
800-826-4357  
www.eaton.com

### Carbon Monoxide Detector

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

### Carbon Monoxide & Liquefied Petroleum Protectors

MTI Industries, Inc.  
800-383-0269

### Citizen Band Radio (C.B.)

Cobra  
733-889-3087

### Cooktop

Seaward Products  
562-699-7997

### Drapery Motor

Somfy  
800-63-SOMFY

### Engine

Cummins  
800-343-7357  
www.cummins.com

### Entry Step

Kwikkee  
800-736-9961

### Fan - Bathroom Exhaust

Fan-Tastic Vent  
800-395-4045  
www.fantasticvent.com

### Faucet

Moen Faucets  
800-289-6636  
www.moen.com

### Filters

Racor Fluid Filters  
800-344-3286

### Fire Extinguisher

The Fire Extinguisher Co.  
919-563-4911

### Generator

Onan  
800-888-6626  
www.onan.com

### Inverter

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

### Leveling Jacks - Air

HWH Corporation  
800-494-3213

### Leveling Jacks - Hydraulic

RVA  
760-746-5732

### LP Tank

Brunner  
800-753-8625

### Microwave

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

### Navigation

Mito Corporation  
800-433-6486

### Outside Mirrors

Velvac Mirror  
800-783-8871

### Power Blind

Hunter Douglas  
800-22-STYLE  
www.hunterdouglas.com

### Power Cord Reel

Glendinning Marine  
843-399-6146

**Slide-Out Motor (Bedroom)**

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

**Slide-Out Motor (Living Room)**

HWH Corporation  
800-494-3213

**Rear Vision System**

Mito Corp.  
219-295-2441

**Refrigerator**

Norcold  
800-543-1219  
www.norcold.com

**Satellite System**

Datron DBS 4500  
800-287-5052

**Security System**

Viper  
Directed Electronics Inc.  
800-274-0200  
www.dei.com

**Slide-Out**

Kitchen - Generator HWH  
800-494-3213

**Steering Wheel (Smart Wheel)**

Vehicle Improvement Products  
847-395-7250

**Solar Panels**

RV Solar Consultants  
541-937-9812

**Television/VCR**

Sony  
800-222-7669

**Television Antenna**

Wingard  
319-754-0600

**Tires**

Goodyear Tire & Rubber  
800-399-2772  
www.goodyear.com

**Toilet**

Micropher  
800-358-8280

**Transfer Switch**

ISCO  
219-264-4156

**Transmission**

Allison Transmission  
800-524-2303

**Washer/Dryer**

Splendide  
800-736-4127  
www.splendide.com

**Water Pump**

Aquatec  
800-975-9995  
www.aquatec.com

**Wheels**

Accuride  
800-626-7096

**Windshield Wipers**

Diesel Equipment  
336-373-8331

# NAVIGATOR

## SECTION 2 DRIVING & SAFETY

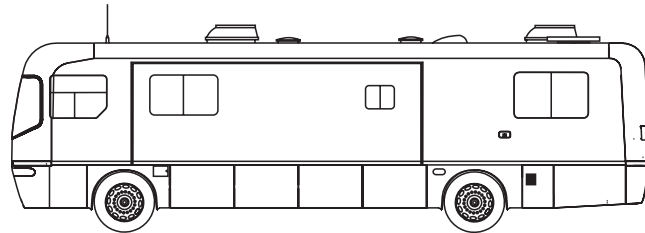
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This section contains information on: driving tips, emergency situations, towing, safety devices, weighing the motorhome and tires.

## DRIVING SAFETY



### Inspections

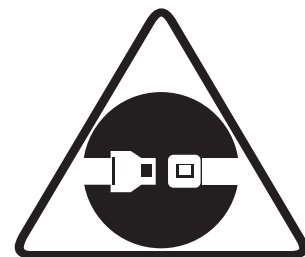
There are significant differences between a passenger automobile and your new motorhome. You should always be aware of these differences when traveling. The key for safely operating the motorhome is inspection. Any defect found could result in problems on the road that can result in lost time and money. There are several states that require the motorhome be inspected prior to registration. Know and observe the laws where you will be traveling as they may vary from state to state. A systematic inspection conducted prior to moving the motorhome will ensure nothing is overlooked. An inspection process assists you in becoming familiar with the motorhome. Prior to moving the motorhome, perform a general inspection by examining the condition and area around 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 giving 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 you. The dashboard may contain more gauges and controls than are normally found in passenger automobiles. Become familiar with these gauges and what they are indicating 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 motorhome is in motion are equipped with safety seat belts. While traveling, do not occupy beds or any seats that do not have a safety belt. 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



**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 cause injury or death.**

## Tips for Driving

The motorhome is a complex vehicle and requires an increased level of driving awareness and attention 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 any obstacles. Utilize the driving mirrors to observe traffic conditions as well as parts of the motorhome: tires, bay doors, blind spots, etc. Use a push-pull method of steering, with both hands parallel on the steering wheel. The motorhome is also heavier than an automobile with a higher center of gravity. These factors affect the reaction time of the motorhome. Swerves and sharp turns, especially performed at high speeds, could result in loss of control of the motorhome. Keep the size of the motorhome in mind and drive with extra caution to avoid situations which might require quick momentum changes. Increase your 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.

When backing up, have the co-pilot stand at the driver's side rear corner so the co-pilot remains visible in the driver's rear view mirror. The co-pilot can watch for any obstacles and give hand signals during the backing up process. When traveling, make sure bridge being crossed can support the weight of the motorhome. Check the tonnage limit of the bridges before crossing. Signs should be posted at bridge entrances. Check the posted height of all overpasses or situations where overhead clearances are 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.
- Side spacing is best maintained by keeping the motorhome centered in the driving lane.
- Driving lanes in work zones can be uneven, congested and narrower than usual.
- Be cautious of road debris which can damage the undercarriage of the motorhome or become lodged in the dual tires causing damage to the tires, wheel rims or tow car.
- Keep in consideration that posted speed signs are passenger



automobile rated. Therefore, an extra awareness of the driving conditions and appropriate speed for a motorhome are necessary, especially on corners and mountain roads.

- Downgrade speed should be at least 5 mph less than upgrade speed, or downgrade speed should be attainable within 3 seconds of a brake application.
- Use a 4 second rule when following other vehicles at speeds under 40 mph. Use a 5 second rule when following at speeds over 40 mph.

### **Right Turns:**

The right hand turn can be an intimidating turn which requires negotiation. Many drivers fear they can not make the turn without turning into the other lane or jumping the curb. Here are a few tips:

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

### **Left Turns:**

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

### **Night Driving:**

- As always be well rested and alert when driving. If necessary, find a safe stopping place to rest until ready to continue.
- Avoid using interior lights while driving, as 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 variation from 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 your visual distance for a gain in reaction time.
- If the road or weather conditions are treacherous find a safe stopping place and wait for conditions to improve.
- Avoid using engine retarding device on wet or slippery surfaces, they 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.
- 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.
- Be aware of which side the fuel port is on. There may not be adequate space to move around the parking lot in order to reposition for the pump.
- 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 may get hung up on the motorhome, causing body damage.



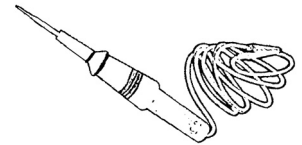
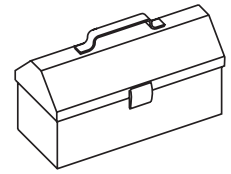
**WARNING: Avoid the risk of fire or explosion. Turn off all pilot lights and appliances before refueling.**

Before departure several items will need to be prepared. Items to pack. Preparing the motorhome for travel. Making facility arrangements or just dry camping along the way. Listed below is a general checklist which may be used as a guide when preparing to depart.

## CHECKLIST - PRETRIP PREPARATIONS

### Items To Carry:

- Emergency Road Kit (road flares, warning signs, flashlight, fire extinguisher).
- Local, State and National Maps. Available are truck atlases showing maps, refueling stations and truck repair facilities.
- Potable/non-potable water hoses and a water pressure regulator.
- Hand tools.
- 12 Volt DC test light, this 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 hose clamp.



Test Light



Hose Clamp



Link

### Interior:

- If possible, start refrigerator operation the night before departure to get a head start on the cooling process. Pre-cool items prior to loading the refrigerator.



Polarity Tester.



**NOTE: While traveling, use the inverter to supply power to the refrigerator. Upon arrival, turn the inverter OFF and switch refrigerator operation to LP-Gas or hook the motorhome to shore power.**

- Fill the fresh water tank. Disconnect and store the fresh water hose.
- 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.

### Engine Checklist:

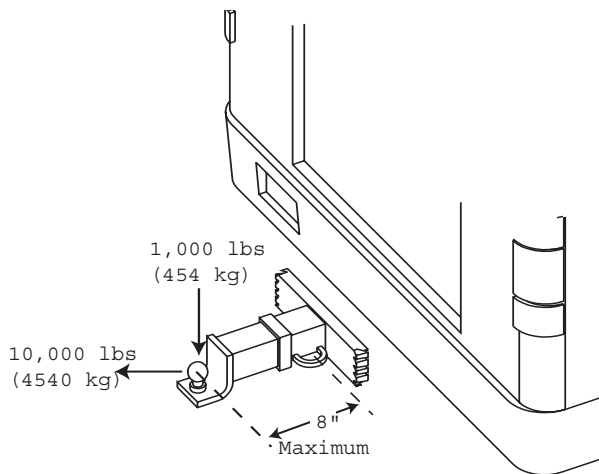
- Inspect the engine, transmission and the engine compartment for fluid leaks.
- Inspect the area under the motorhome for fluid leaks or puddles.
- Check all fluid levels, oil, antifreeze, transmission, hydraulic fluid and washer fluid.
- Inspect belts and hoses for wear.
- Inspect wiring for loose,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

- Start engine and listen for any unusual noises.

**Driving Preparations:**

- Check operation of all exterior lights, headlamp, taillight, brake and clearance lights.
- Inspect fluid level (if applicable) in oil bath hubs and check tire pressure.
- Check house 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.

**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. Your safety and satisfaction require proper receiver use. Avoid excessive loads or any other abuse. Do not use the motorhome to tow anything until it has been driven 500 miles (800 kilometers). Weight pushing down on the rear hitch must not exceed 1,000 lbs. We recommend weighing the motorhome when fully loaded to be certain there is proper weight distribution of the GCVW (gross combined vehicle weight). When weighing the motorhome add all passenger weight to the GCVW total. The motorhome fully loaded, including 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.**

**Tow Car or Trailer:**

1. Connect tow car or trailer with light harness to motorhome. Perform a light check.
2. Connect safety chains.
3. Inspect tow car or trailer 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 causes a safety hazard and may cause extensive damage. Check the tires on the tow vehicle frequently.

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

### ***Tow Plug Connection***

#### **The tow harness wires are color coded:**

1. Brown, 12 gauge - tail lights.
2. White, 12 gauge - ground.
3. Black, 14 gauge - right turn signal.
4. Yellow, 14 gauge - left turn signal.
5. Black w/white stripe, 14 gauge - brake light.

When hooking up a tow plug connection you should strip the wires 3/8". Twist the wire and place under the clip and secure the screw. Make sure there are no loose strands of wire which could short against the case or other terminals.

The motorhome is equipped with a rear vision and voice system. This system is designed to provide the driver with a view of the rear of the motorhome. The rear vision system consists of a camera with a microphone, located at the rear of the motorhome. The monitor is equipped with several adjustable features:

### ***Rear View System***

- Volume control knob
- Contrast and brightness settings
- Day/night dimmer control

The driver can see what is behind the motorhome with the ability to listen to a guidance assistant. The rear vision system will automatically turn ON when the gear selector is placed in reverse. Turning the main power switch to ON will allow continuous operation of the rear vision system when the ignition key is turned ON. For more detailed instructions see the manufacturer's manual.



**NOTE: The input select button is to remain in the OUT position.**



## **BACKING UP A MOTORHOME**

If your destination does not have “pull-through” sites try to pick a solid, level site. If possible, pick a site located on the left side. This is the preferred 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 particular criteria prepare to back in carefully.

Whether you are a long time owner of recreational vehicles or just starting out, backing up can be a challenge. Following some simple helpful guidelines may 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 first, backing up with the co-pilot’s guidance in a large unobstructed parking lot. It 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.

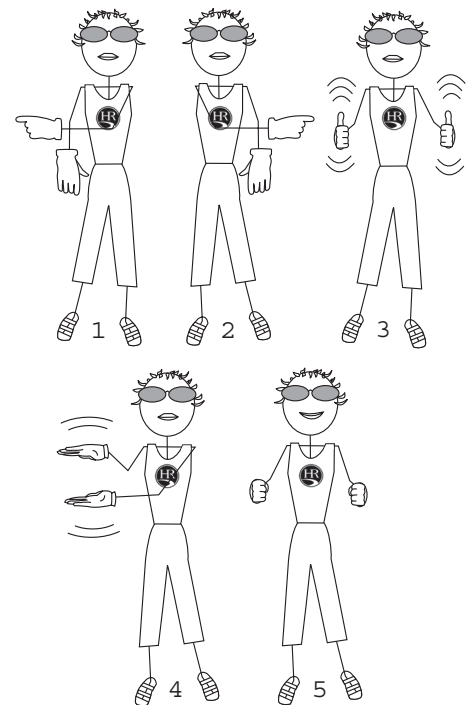
The co-pilot will perform just as important a job as the driver. When guiding the driver, the co-pilot should be located safely at the left rear corner of the motorhome, facing forward, while remaining visible in the driver side mirror at all times. The co-pilot should make a conscious effort to maintain 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 returns to 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.

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

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

**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. This 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. Try to avoid putting the motorhome and tow vehicle in a backing situation. The only way to back up this combination is to completely disconnect the tow vehicle from motorhome. Trying to back up this combination, even as small as a foot, 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 tow vehicle 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. A tip here is to move the bottom of the steering wheel 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.**

## CHECKLIST- SET-UP PROCEDURES

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 discussed in detail in other sections.



**For more detailed information refer to the section pertaining to the item of interest.**

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



**NOTE: To operate the kitchen slide: The ignition must be OFF, the park brake must be set and the bay doors directly under the slide room must be closed.**



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

- Follow the procedures and guidelines for “Leveling the Motorhome.” If the motorhome is equipped with hydraulic jacks, be certain the parking surface will accommodate the weight placed on the jacks.



**CAUTION: Hot asphalt may not support the weight that is placed on the hydraulic jack pads. Place thick plywood under the jack pads to help disperse the weight. Never use the leveling system to support the entire weight of the motorhome. Damage from excessive torsional twists can result.**

- Open the LP-Gas tank valve.
- If possible, begin appliance operation on LP-Gas for the first 60 minutes. This will allow time for the inverter to stabilize the battery charging. Switch the refrigerator operation to gas, start the water heater and furnace (if needed).
- 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.



**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 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. A water pressure regulator is built in. 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**

For extended dry camping, management of all resources is essential. The motorhome has large batteries, plenty of water and large holding tank capacities. With a little care and forethought it is possible to go a long way with only the wonderful amenities you bring with you.

Conserve water! The motorhome holds a lot, but it goes down the drain fast. Don't waste water you don't actually use. Use the manual valve on shower head and turn the water off and on as needed while showering. You can reduce water needed for a shower by as much as two-thirds. Don't let water run in the sink while you do other things, such as wiping up the kitchen or brushing your teeth.

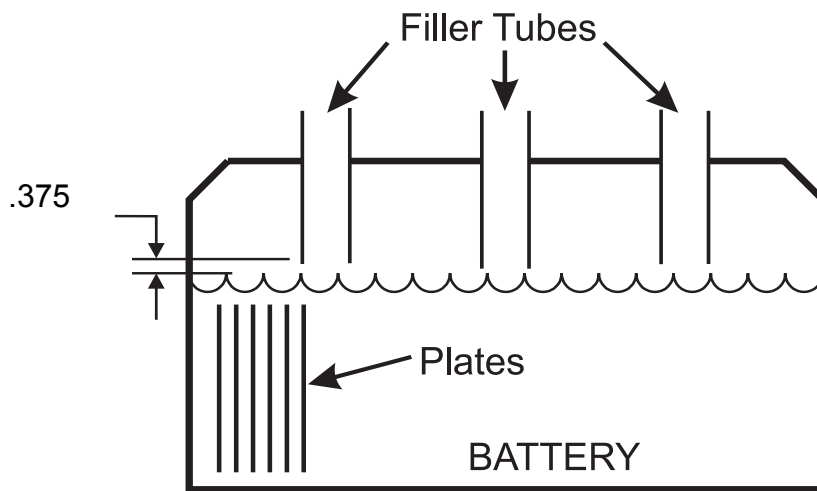
Conserve battery power. Use electricity sparingly. Turn off the inverter when it is not in use. Only turn it on when you need it. However, remember that when the generator is running the inverter charges the batteries automatically.

Charge the batteries when they are half down. At half charge the battery voltage will be 12.2 Volts. Use a hydrometer for testing the battery electrolyte. A good rule of thumb is to run the generator three to four hours daily, which should supply enough power. Never try to use batteries until they are completely dead, or until the lights "dim out." Each time the batteries are cycled lower than half charge the ability to recharge up to full capacity is diminished. The damage that occurs is cumulative and will eventually render a battery useless.

If you are in a habit of starting the engine regularly remember that the alternator output is lower at idle, and that even at a fast idle it may take as much as an hour to replace what it took to start up the engine. Also, realize that running the engine for a short time may increase moisture contamination in the fuel and oil. It is better to run the engine less often and run it longer, for perhaps an hour. The good news is this can be included in your battery recharge schedule. Solar panels can greatly increase the time you can operate between battery charges.

Remember that different motorhomes have different equipment and that everyone has different habits and expectations. The above general guidelines should provide a useful starting point for building your own schedule and regimen for extended stays where power and water are not available. You too can become less dependent on hook-ups.

- Make sure to turn all appliances on to operate from LP-Gas.
- The battery cut off switch will need to be left on.
- Purchase extra solar panels, if desired.
- Understand the inverter operations.
- 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.



Battery State of Charge	Spec. Gravity	Voltage
100%	1.265	12.7
75%	1.225	12.4
50%	1.190	12.2
25%	1.155	12.0
Discharged	1.120	11.9 or Less

*The distilled water level in the battery should be 3/8" below the vent tube.*

## **BREAKING CAMP**

Listed 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.
- 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. 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.
- Disconnect and stow the phone line.
- Inspect fluid level in oil bath hubs and check tire pressure.

### **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 sounds.

### 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. Once 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 and the bay doors under the slide room must be closed.**

- 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.
- Start engine, turn off water heater, water pump and furnace. If applicable, turn inverter ON. Switch refrigerator operation to electric. Be sure to turn inverter OFF and switch refrigerator operation back to LP-Gas or hook-up the motorhome to shore power upon arrival.

### 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.
- 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.
- 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.
- 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

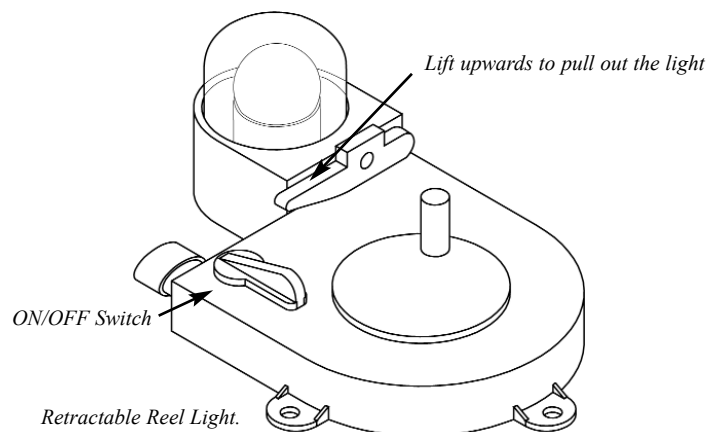
If an emergency situation should occur, use the appropriate braking technique and pull off the roadway a safe distance from traffic (if possible). Set the parking brake. Turn ON the hazard warning flashers especially when parked alongside traffic lanes. In the event of an emergency stop due to a mechanical breakdown or other motorhome related problems contact Monaco Coach Corporation Customer Support (1-877-466-6226) or your emergency services provider.

An emergency road kit should include at least three reflective warning signs, road flares, 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 can 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

1. The bay light switch (located just inside the entry door) will need to be turned ON. **To activate the light:** Move the switch to the ON position.
2. The light has an 18' retractable reel cord. **To operate:** Lift the lever and pull the light out.
3. The base of the light is magnetic, allowing for hands-free operation.
4. **To replace the bulb:** Push down on the clear plastic cover and twist.
5. **To rewind:** Crank the handle in the retract direction. When fully retracted, push down on the lock handle to secure the light into place.



**Transmission  
-Rocking Out**

It may be possible to rock the motorhome out if you are stuck in snow, mud or deep sand. Shift the selector to D (Drive) and apply steady light throttle. Never full throttle as you may spin the wheels and bury yourself 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.**

When using jumper cables to start the engine, make sure the cables are connected in parallel. That is positive (+) to positive (+) and negative (-) to negative (-). Always connect your positive (+) before the negative (-) and disconnect the negative (-) before the positive (+) to prevent arcing. When using an external electrical source to start the engine shut the disconnect switch to OFF position.

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.

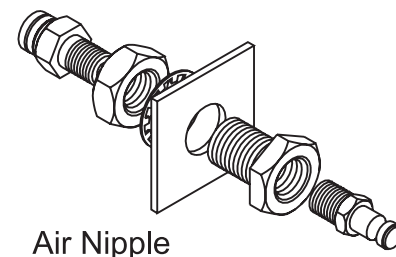
In the event of a roadside emergency, contact the nearest Cummins Center or phone 1-800-DIESELS for Cummins Customer Assistance Center.

**Jump Starting**

If a towing company is called for service it is recommended that they use a lowboy/landall type of trailer and if a tow truck is used it needs to have a stinger (an arm that goes under motorhome and hooks to front cross member). Inform the tow company of the weight and length of the motorhome, number of passengers and milepost location.

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

- Secure any loose or protruding parts if the motorhome is damaged.
- Inspect points of attachment on a disabled motorhome. If

**TOWING  
PROCEDURES**

Air Nipple

attachment points are damaged, select other attachment points at a substantial frame structural member.

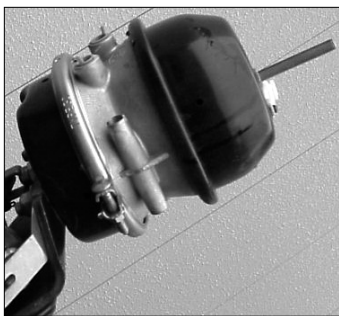
- Never allow anyone to go under a motorhome while it is being lifted by towing equipment unless the disabled motorhome is adequately supported by safety stands.
- Do not tow the motorhome from the rear. Towing from the rear will cause the front tires and suspension to be seriously overloaded, possibly resulting in a tire or front suspension failure. Rear frame extensions are not designed to withstand weight loads imposed by lifting the rear of the motorhome.
- If rear wheels are disabled, place the motorhome on a flat bed trailer or use a heavy duty dolly under the rear wheels and tow from the front of the motorhome.
- The drive shaft must be removed to prevent damage to the transmission.



**WARNING: In the event the motorhome requires towing, ensure all precautions are followed. The driveline must be disconnected and the mudflap may need to be removed. When towing a motorhome equipped with the HWH Air-Leveling System, the ignition MUST be left in the ON position so that air suspension may operate. Damage to the motorhome from a towing company will not be covered by Holiday Rambler.**

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### **Brake - Disabling the Parking Brake (Air Brakes only)**



Brake Chamber.

- Block wheels securely before attempting this procedure.
- Remove the plug from the center rear brake chamber. Save plug for reuse.
- Remove the caging tool from its holder on the rear brake chambers and insert it into the hole. Turn the tool clockwise to engage.
- Use a wrench to tighten the nut down, which compresses 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 the tool to its original location and replace the plug.
- Repeat process for the other side.



**WARNING: Do not attempt to disassemble brake chambers without special tools and without having studied specific manufacturer's instructions. Chambers contain springs under very high tension. Improper handling could result in component damage or personal injury.**

## TIRES

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 tire casing that supports the motorhome and its contents. In addition, since the tire is the only contact the motorhome has with the road surface, it must provide other functions such as traction for moving, stopping, steering and providing a cushion for the motorhome.

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.

A tire that is underinflated will build up excessive heat that may go beyond the design limits of the rubber and radial cords. This could result in sudden failure. A tire that is underinflated will also cause poor motorhome handling, rapid and/or irregular tire wear and an increase in rolling resistance which results in a decrease of fuel economy.

Over-inflation will reduce the tire’s footprint/contact patch with the road, thus reducing traction, braking capacity and handling of the motorhome. A tire that is over-inflated for the load will have a harsh ride, uneven tire wear and becomes 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.

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 shows weights that can be supported by various air pressures. Utilizing less air pressure means a lesser load can be carried by the tire.

### ***The Importance of Air Pressure***

### ***How Much Air Should I Carry in My Tires?***

## **Weight Terms**

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 RV, 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, you must weigh your motorhome 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 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 you 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.

MODEL YEAR: 2001 MAKE: \_\_\_\_\_ MODEL: \_\_\_\_\_

UNIT NO. \_\_\_\_\_ CHASSIS VIN: \_\_\_\_\_

		<u>LBS.</u>	<u>KGS.</u>
<b><u>GVWR</u></b>	(Gross Vehicle Weight Rating) is the maximum permissible weight of this fully loaded motorhome .....	_____	_____
<b><u>UVW</u></b>	(Unloaded Vehicle Weight) is the weight of an exemplar Motorhome as manufactured at the factory with full fuel, engine oil and coolants (*1) .....	_____	_____
<b><u>SCWR</u></b>	(Sleeping Capacity Weight Rating) is the manufacturer's designated number of sleeping positions multiplied by 154 pounds (70 kilograms) .....	_____	_____
<b><u>CCC</u></b>	(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.....	_____	_____
<b><u>GCWR</u></b>	(Gross Combination Weight Rating) is the maximum allowable combined weight of this motorhome and the towable product (*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) .....	_____	_____

**CONSULT OWNER MANUAL(S) FOR SPECIFIC WEIGHING INSTRUCTIONS AND TOWING GUIDELINES.**

**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.

## WEIGHING THE MOTORHOME

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.



**WARNING: Improperly inflated or overloaded tires can cause a blowout. An overloaded axle can cause a component failure of the suspension system. Tire blowouts 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 side. Tire inflation pressures between the driver side and passenger side will differ. More air pressure will be required in the driver side tires due to the added weight on that side.



**NOTE: When weighing a slide out motorhome, each tire must be weighed independently to obtain the correct weight carried by each tire.**

### Tag Axle Motorhome (Roadmaster chassis):

A motorhome equipped with a tag axle will require adjustment to the air pressure regulator for the tag axle. Adjustment of the regulator helps maintain proper axle weight distribution ratios. The adjustable regulator and gauge package is located in the engine compartment on the driver side. The regulator controls the amount of air pressure in the tag axle air bags. Increasing the regulator air pressure gauge reading increases the amount of air pressure in the tag axle air bags, which increases the downward force of the tag axle. Applying more downward force to the tag axle increases the weight carried by the tag axle. Increasing the weight carried by the tag axle decreases the weight carried by the drive axle and slightly increases the weight applied to the front steering axle.

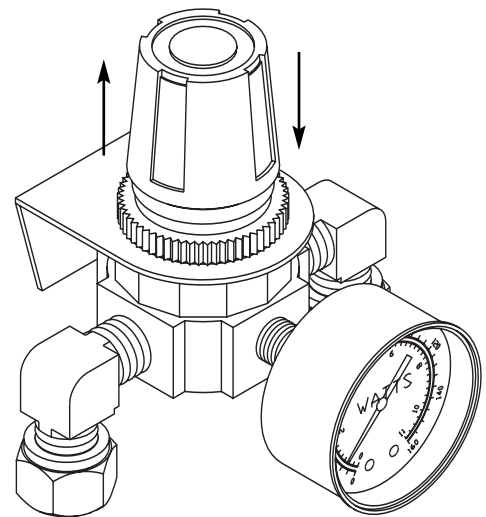
**Tag Axle Regulator Adjustment:**

The pressure regulator adjustment knob has a positive lock. Pull up on the knob to unlock, push down on the knob to lock. Tighten or turn the knob clockwise to increase air pressure. Loosen or turn the knob counterclockwise to decrease air pressure. When decreasing regulator air pressure the regulator will release excess air through the regulator discharge port. Each time an increase or decrease of air pressure to the regulator is made an air pressure stabilization procedure will also be performed.

The stabilization procedure equalizes the regulator to hold a constant air pressure setting. To perform the stabilization procedure:

- Start the motorhome and allow the air system to reach a full charge, indicated by the release of air from the air dryer.
- Raise the tag axle using the tag axle switch on the shift panel. Allow approximately 20 seconds for the system to discharge air from the tag axle air bags.
- Lower the tag axle. The regulator will now hold the new air pressure setting.
- Push down on the regulator adjustment knob to lock the setting.

When increasing the air pressure setting allow approximately a two pound pressure increase before the stabilization process. Example: If the desired setting is 30 psi., slowly rotate the regulator adjustment knob clockwise to 28 psi. Perform the stabilization procedure. Regulator setting will stabilize to approximately 30 psi. When decreasing the air pressure setting rotate the regulator adjustment knob counterclockwise, allowing the excess air to be discharged. Next, perform the stabilization procedure.



*Pull knob up to unlock.  
Push down knob to lock.*



## Scales

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. The size of some scales will allow the entire motorhome to fit on the scale, which will read the GVW with only one scale recording required. Other scales are designed to weigh only one axle at a time, which may require two or three scale readings to determine the GAW or GVW total. 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. Slide out motorhomes with a Tag Axle will require a six position 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.**

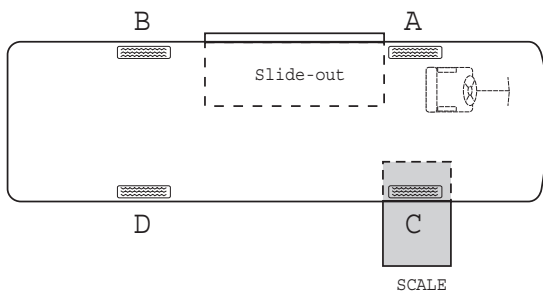
**Example:**

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 5100 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.



**NOTE: Scale readings and gross axle weight ratings are fictitious. Actual scale readings and gross axle weight ratings will vary with model and options.**



**Rear**

**Scale** 1. GAWR  $\div$  2 (6,500)

**B** 2. GAW (5100)

+

=

1. GAWR (13,000)

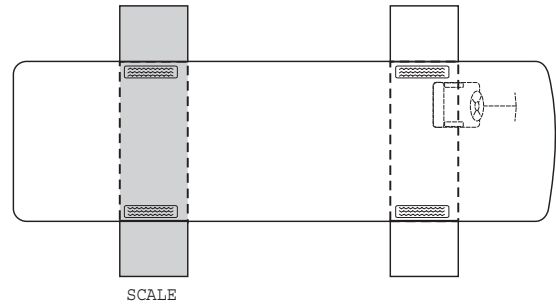
2. GCAW (10,000)

**Scale** 1. GAWR  $\div$  2 (6,500)

**D** 2. GAW (4,900)

**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.

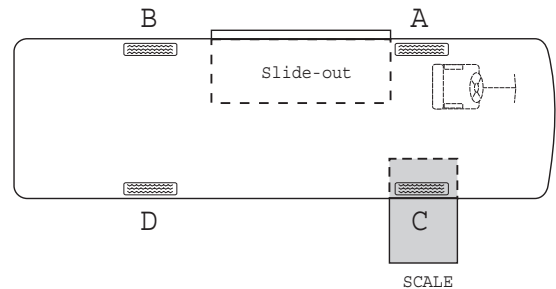


$$\underline{\text{GAWR (Rear)}} + \underline{\text{GAWR (Front)}} = \underline{\text{GCVW}}$$

$$\underline{\text{GAW (Rear)}} + \underline{\text{GAW (Front)}} = \underline{\text{GCAW}}$$

**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.



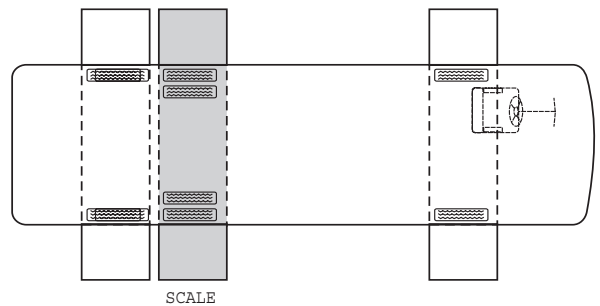
<b>Rear</b>		<b>Front</b>	
<b>Scale B</b>	$\frac{\underline{\text{GAWR}} \div 2}{\underline{\text{GAW}}}$	<b>Scale A</b>	$\frac{\underline{\text{GAWR}} \div 2}{\underline{\text{GAW}}}$
+	=	+	=
	$\frac{\underline{\text{GAWR}}}{\underline{\text{GCAW}}}$		$\frac{\underline{\text{GAWR}}}{\underline{\text{GCAW}}}$

<b>Scale D</b>	$\frac{\underline{\text{GAWR}} \div 2}{\underline{\text{GAW}}}$	<b>Scale C</b>	$\frac{\underline{\text{GAWR}} \div 2}{\underline{\text{GAW}}}$
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<b>Scale D</b>	$\frac{\underline{\text{GAWR}} \div 2}{\underline{\text{GAW}}}$	<b>Scale C</b>	$\frac{\underline{\text{GAWR}} \div 2}{\underline{\text{GAW}}}$
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**Weighing a tag axle non slide motorhome.**

- Record the gross axle weight ratings (GAWR) and the gross vehicle weight rating (GVWR).
- Weigh and record each corner or total axle weight.
- If necessary, adjust the tag axle regulator to compensate for the payload carried by the tag, drive and front axles.
- Perform the regulator stabilization procedure.
- 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.

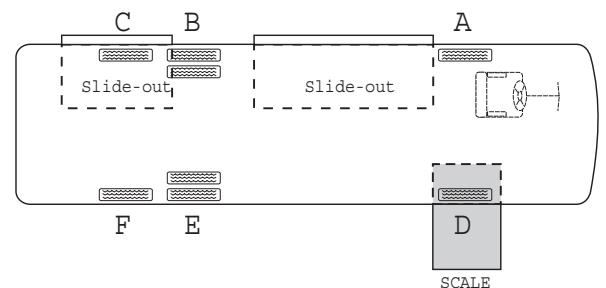


$$\underline{\text{GAWR (Tag)}} + \underline{\text{GAWR(Rear)}} + \underline{\text{GAWR (Front)}} = \underline{\text{GCVW}}$$

$$\underline{\text{GAW (Tag)}} + \underline{\text{GAW (Rear)}} + \underline{\text{GAW (Front)}} = \underline{\text{GCAW}}$$

**Weighing a tag 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 each side of each axle.
- If necessary, adjust the tag axle regulator to compensate for the payload carried by the tag, drive and front axles.
- Perform the regulator stabilization procedure.
- If necessary, adjust the payload so the GAWR is not exceeded. Total combined weights must not exceed the GVWR.



	<b>TAG</b>		<b>DRIVE</b>		<b>FRONT</b>
<b>Scale C</b>	$\frac{\text{GAWR} \div 2}{\text{GAW}}$	+ =	=	<b>Scale B</b>	$\frac{\text{GAWR} \div 2}{\text{GAW}}$
	$\frac{\text{GAWR}}{\text{GCAW}}$			<b>Scale A</b>	$\frac{\text{GAWR}}{\text{GCAW}}$
<b>Scale F</b>	$\frac{\text{GAWR} \div 2}{\text{GAW}}$			<b>Scale E</b>	$\frac{\text{GAWR} \div 2}{\text{GAW}}$
				<b>Scale D</b>	$\frac{\text{GAWR}}{\text{GAW}}$

TIRE SIZE	MAX Speed Rating (MPH)	Dual (D) Single (S)	INFLATION PRESSURE PSI													
			65	70	75	80	85	90	95	100	105	110	115	120	125	
8R19.5	75	D S	2350 2410	2460 2540	2570 2680	2680 2800	2780 2930	2880 3060	2980 3170	3070 3280	3160 3400	3375(F) 3500(F)				
225/70R19.5	75	D S		2720 2895	2860 3040	3000 3195	3115 3315	3245 3450	3415(F) 3640(F)							
245/70R19.5	75	D S		3415 3640	3515 3740	3655 3890	3875(F) 4080(F)	3940 4190	4075 4335	4375(G) 4545(G)						
265/70R19.5	75	D S				3750 3970	3930 4180	4095 4355	4300 4540	4405 4685	4560 4850	4805 5070	4860 5170	5070(G) 5355(G)		
9R22.5	65	D S	3120 3190	3270 3370	3410 3560	3550 3730	3690 3890	3820 4050	3950(F) 4210	4350	4500(F)					
10R22.5	65	D S	3690 3770	3870 4000	4040 4210	4200 4410	4375 4610	4520 4790	4670 4970	4875(F) 5150(F)	4970 5320	5110 5490	5250(G) 5680(G)			
11R22.5	75	D S				4760 4990	4950 5220	5120 5430	5300 5640	5470 5840	5750(G) 6175(G)	5800(H) 6240	6430	6610(H)		
12R22.5	65	D S				5190 5450	5390 5690	5590 5920	5780 6140	5960 6370	6150 6590	6320 6790	6500 7010	6750(H) 7390(H)		
245/75R22.5	75	D S		3260 3470	3425 3645	3640 3860	3740 3980	3890 4140	4080 4300	4190 4455	4335 4610	4410(G) 4675(G)				
255/70R22.5	75	D S				3585 3815	3765 4005	3970 4190	4110 4370	4275 4550	4410 4675	4455 4895	4610 5065	4675 5205	5070(H) 5510(H)	
265/75R22.5	75	D S				4040 4070	4205 4255	4370 4440	4525 4620	4685 4800	4805(G) 4975	5150	5205(G)			
275/70R22.5	75	D S					4535 4885	4750 5080	4960 5305	5165 5530	5370 5750	5575 5965	5775 6185	5975 6400	6175(H) 6610(H)	
275/80R22.5	75	D S					4855 5265	5080 5515	5305 5755	5525 6000	5745 6235	5965 6475	6180 6710	6395(H) 6940(H)		
295/75R22.5	75	D S				4690 4725	4885 4945	5070 5155	5260 5370	5440 5510	5675(G) 5780	5800 5980	6370	6610(H)		
295/80R22.5	75	D S					4855 5480	5100 5750	5335 6020	5570 6285	5805 6550	6035 6810	6265 7070	6490 7320	6720 7580	6940(H) 7830(H)
315/80R22.5	75	D S						5840 6415	6070 6670	6395 6940	6540 7190	6770 7440	6940 7610	7210 7920	7610(J) 8270(J)	7390 8820
285/75R24.5	75	D S				4740 4770	4930 4990	5205 5210	5310 5420	5495 5675	5675(G) 5835	6040	6175(G)			

Holiday Rambler is not the author of this chart and makes no representation or warranty concerning the accuracy of the information disclosed by the chart. Holiday Rambler is not responsible for the accuracy of the information disclosed or for any errors within the Tire Inflation Chart.

Check the tire pressure regularly. If a tire is punctured by a nail or screw, creating a slow leak, it may eventually be spotted if it is a front tire or an outside rear dual. However, if there is a leak on an inside dual the chances of noticing it without an air pressure check are very slim. If you begin driving unaware that an inside dual tire has a low air pressure or is flat, very quickly (in most cases a few miles) the outside rear tire (next to the low air pressure tire) will heat up from carrying double the load, leading to failure of the outside dual tire. The motorhome will end up with two tires flat on the same side on the same axle.

The air pressure should be checked every two weeks or at least once a month and before any major trip. The RV tire air pressure should be checked every “drive” morning on both long and short trips (driving a day or less). The tires should be checked before leaving on a trip and again before you start your trip home. If the motorhome is stored for any length of time the air pressure should be checked prior to storage. More importantly, check the tire pressure when it is pulled out of storage.

Check the tire pressure when the tires are “cold” and have not been driven for more than one mile. The stated load capacity for a given cold inflation pressure is based on ambient outside temperature. If you must check the tires when they are warm or hot, allow for a slight increase in air pressure and make sure they are within a couple of pounds of each other on the same axle (does not apply to slide-out equipped motorhomes). Never let air out of a hot tire.

To check or maintain the inflation pressure in the tires, use a quality truck tire air gauge which has an angle dual head. This type of gauge will allow you to check inflation of the inner dual wheel which has the valve stem pointing outward. The outer wheel has the valve stem pointing inward. Nothing should restrict the ability to check the tire’s air pressure daily when traveling in the motorhome. Pressure sealing valve caps should always be used to prevent air from escaping from the valve stem. If there are valve stem extension hoses, make sure they are good quality stainless steel braid reinforced and are securely anchored to the outer wheel.

Optimum tire performance is achieved with proper inflation pressures for the loads being carried. The air pressure of all tires should be checked and corrected prior to travel, or daily if in full time use.

Tires of different patterns should not be mixed on the same axle. The difference in tractive force could cause rear end gear fight and mechanical damage to the drive train. Tires of different size or construction must never be mixed on the same axle.

**Higher than recommended pressure can cause:**

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

**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.
- High tire temperatures.
- Reduced handling.
- High fuel consumption.

**Unequal tire pressures on same axle can cause:**

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

---

**Tire Rotation**

The useful tire life of your tire is achieved by the uniform wear for all tires. This can be increased with tire rotation. The first tire rotation is the most important. The tire rotation pattern used for the motorhome should be evaluated by the tire manufacturer. Any unusual or unique wear pattern which may have developed should be evaluated before rotation. Misalignment, imbalance or other mechanical problems may exist and will need corrected prior to rotation.

The tire rotation should be performed every 6,000 to 8,000 miles, or at any sign of uneven wear. After a tire rotation, the inflation pressures should be checked and adjusted for the actual loads of the wheel position accordingly.

Tires are covered by the tire manufacturer. Holiday Rambler is not responsible for tire wear.

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**Blocking  
- When Leveling**

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

**Proper Cleaning:**

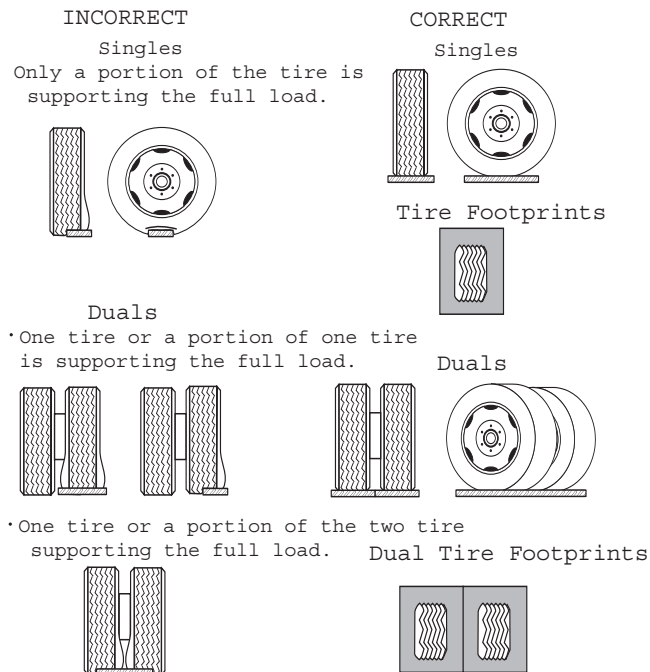
Road oil will cause deterioration of the rubber. Dirt buildup will help hold chemicals in the air next to the tire and will also cause deterioration.

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.

### Tire "Blocking" Methods



The RV 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 RV's 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.

### Storage of Tires - Long Term

There are a few steps that can be taken to reduce the aging effects from long-term storage or a non-use period. Thoroughly clean the tires. Cover the tires to block direct sunlight and ultraviolet rays. Store the RV out of a high ozone area. Failure to take these steps can cause early deterioration and shorten the life of the tires.



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

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.



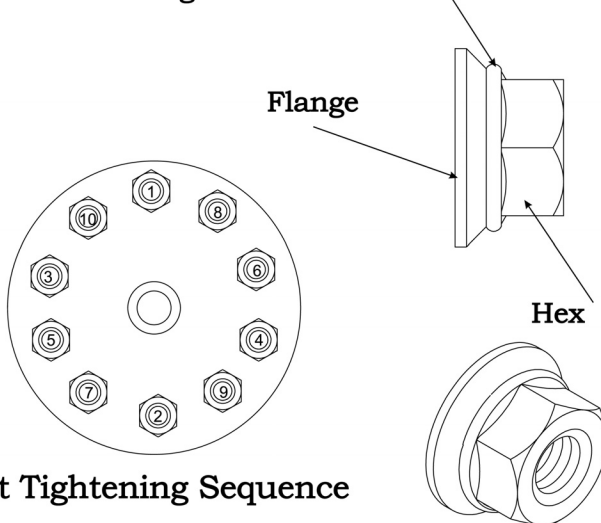
## In Case of Flat Tire

If you have a flat tire it is recommended to call for roadside service. The size and weight of the motorhome and its tires requires proper equipment to change the tire. A professional service technician will have the proper equipment and training 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. Goodyear Tire Company has an emergency number which offers 24 hour assistance. To contact Goodyear call (877) 484-7376. The old tire should be saved for warranty.

### Hub Piloted Mounting:

- Before using flange nuts that have already been used in service, apply 2 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 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 twelve o'clock to center the wheel to reduce runout.

For used Nuts, Add 2 Drops of Oil  
Between Flange and Hex



Nut Tightening Sequence



**NOTE: Loosen and tighten lug nuts in a star pattern sequence. Sequence tighten to 50 ft lb first, then sequence tighten to 500 lb (over tightening can cause distortion).**

### 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:**

- Be sure to tighten the wheel nuts to the recommended 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.

- 
- 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.

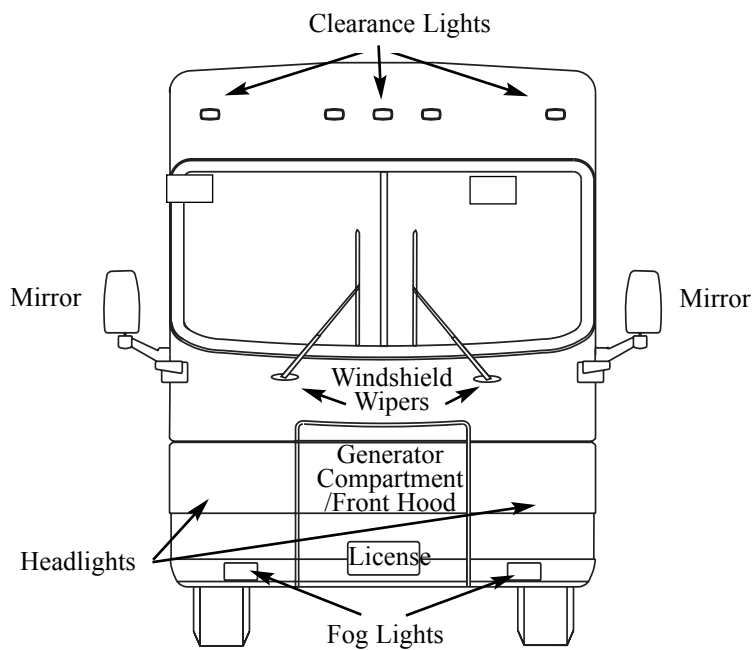
### **Care & Maintenance of Aluminum Wheels**

## SPECIFICATIONS - DIMENSIONS CHART

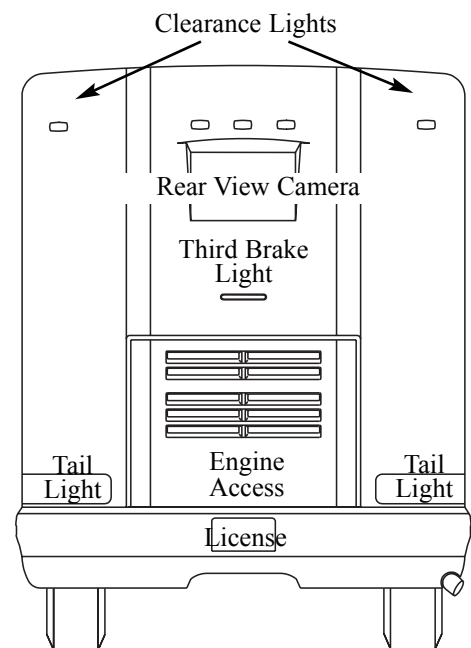
Measurements	40PBS	40WDS	40PBD	42CDS	42DSS	43PBD
Wheelbase	262"	262"	245"	262"	262"	271.5"
Overall Height w/AC	12'	12'	12'	12'	12'	12'
Interior Width	96"	96"	96"	96"	96"	96"
Exterior Width	101.5"	101.5"	101.5"	101.5"	101.5"	101.5"

## VIEWS - Front & Rear

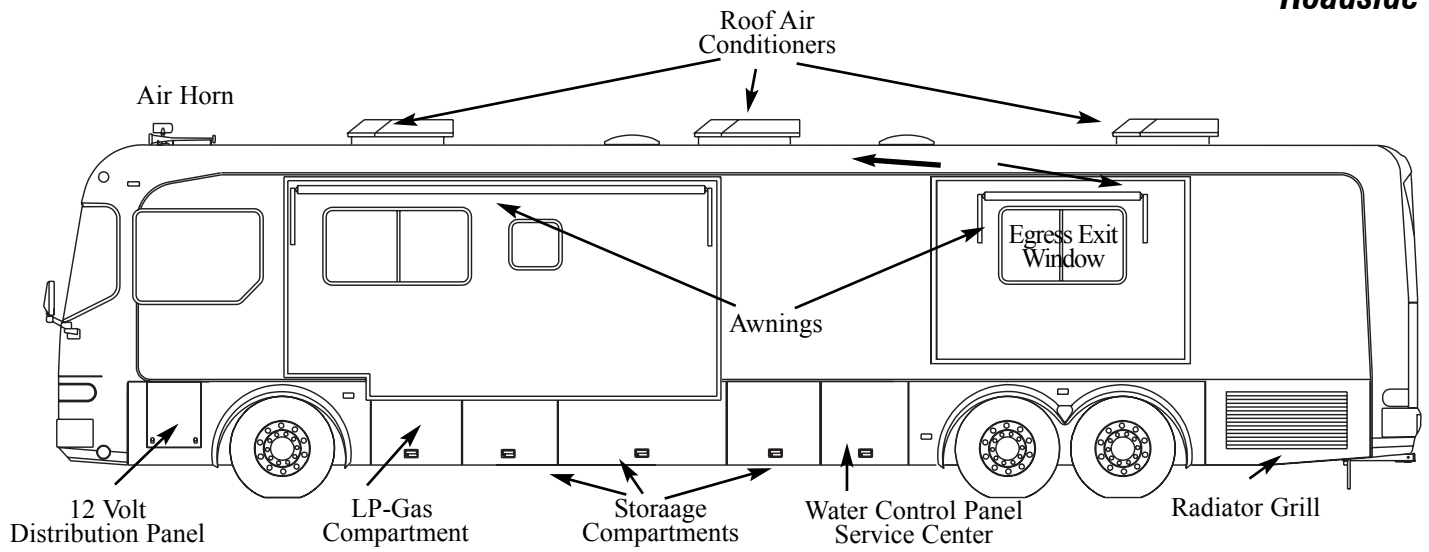
**Front**



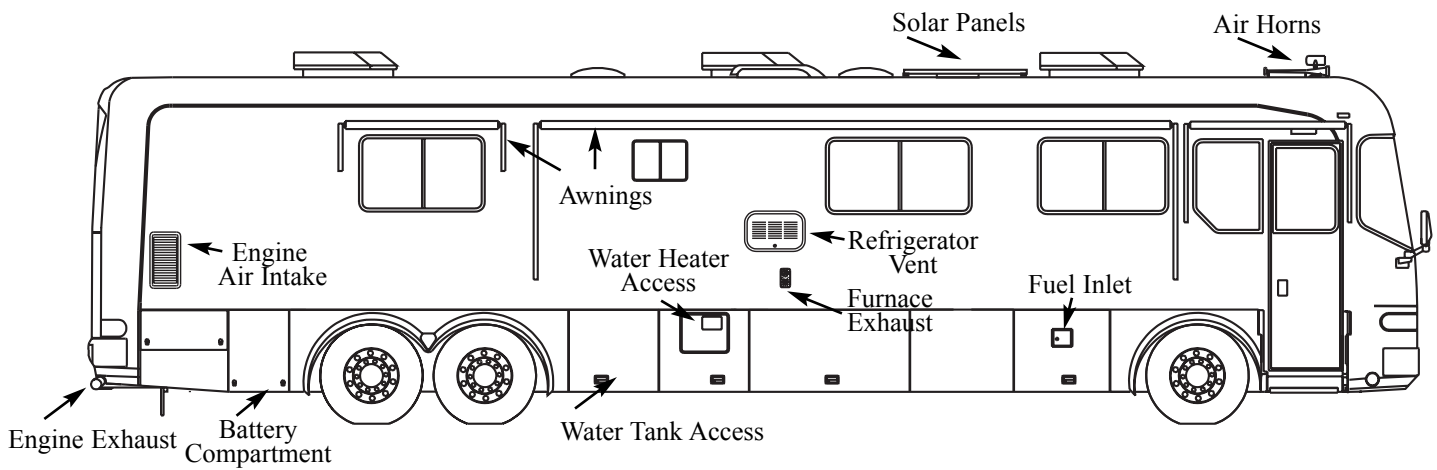
**Rear**



# IEWS Roadside



# Curbside



## SECURITY SYSTEM (OPTIONAL)

The “Viper” security system is designed to provide years of trouble free operation. The only maintenance required is changing the battery in the remote once a year. The range of the remote will decrease and the green LED will dim when the battery becomes weak. The two remote transmitters (key fobs) are programmed to the receiver using a computer based “Learn Routine.” The learn routine will dictate how the system operates. The Standard transmitter configuration is set at installation. An authorized dealer can customize the transmitter configuration.



### Transmitter Configuration-Standard

**AUX Button** - Controls the silent mode function.



**Lock Button** - Controls the arming function.



**Green LED** - Indicates power at the Key Fob.



**Unlock Button** - Controls the disarming function.



**Horn Button** - Controls the panic function.

### Using the System

Arming:

The system is armed by pressing the LOCK button on the transmitter remote for one second. When armed, the system will “chirp” once. The parking lights flash once, the entry door and selected bay doors will lock. The red LED system status light flashes once per second indicating the system is armed and functioning properly.

If the system chirps twice when armed, the red LED will flash in groups. These groups are system diagnostic codes. The second chirp is a “Bypass Notification.” Bypass notification will arm the system however, one or more system sensors are “open.” The system arming mode can be changed to “Passive Arming.” In passive arming mode and the ignition is OFF, thirty seconds after the entry door is opened and closed, the system begins a countdown. The red LED flashes twice per second. An audible chirp will occur twenty seconds after the last protected door or zone is closed. The system will then arm and lock the doors ten seconds later.

When armed:

- The System will use “Warn Away” chirp signal for impact sensing. Light impact, siren will chirp.
- A Heavy impact, continuous alarm will sound.
- Opening any door, alarm will chirp for three seconds followed by

a continuous alarm.

### Disarming:

The system is disarmed by pressing the unlock button. The parking lights flash twice, the alarm will chirp twice and the doors unlock. Any additional chirps are “Tamper Alert.” When the system chirps four or five times during disarming, the red LED will blink the code for the zone that has been tampered with.

### Panic Mode:

Press the horn button for one second. The siren will sound and the parking lights will flash for the programmed duration. The panic mode can be exited at any time by pressing the horn button again. If you are threatened, this is helpful in attracting attention to the motorhome.

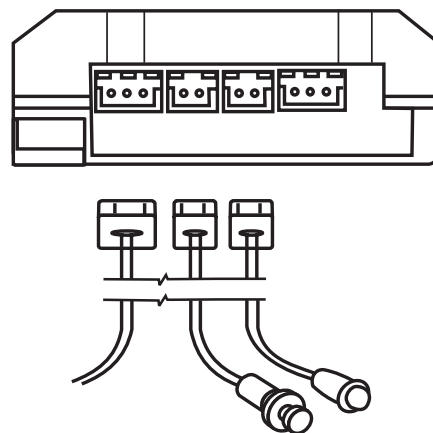
### Silent Mode:

Prior to arming or disarming the system, the confirmation chirp(s) can be temporarily turned OFF. Press the AUX button for less than one second prior to arming or disarming the system. System will either Arm or Disarm silently. The chirp will be silenced only once each Arm or Disarm cycle.

**NOTE: A Warn Away chirp will not sound when the system is armed in Silent Mode. A heavy impact will sound a continuous alarm.**

### Valet Mode:

This feature is useful in servicing, washing or storing the vehicle. The Valet Mode will not allow the system to sound an alarm. While in Valet mode the remote will lock and unlock the doors. The red LED status light is a solid glow in the Valet Mode. There are two ways to access the Valet Mode: One is with the key fob, the other is with the Valet/Program button.



1. Valet/Program button.
2. Red LED status light.

**Entering Valet Mode with Key Fob:**

1. Open entry door.
2. Press the lock button.
3. Press the unlock button.
4. Press the lock button again.
5. Ensure the red LED is a steady glow.

**Entering Valet Mode with Valet/Program Button:**

1. Turn the ignition ON.
2. Turn the ignition OFF.
3. Press and hold the Valet/Program button ten seconds and release.
4. Ensure the red LED is a steady glow.

**Multi-Level Security Arming**

This feature applies to one arming cycle only. The selection of which sensor inputs are active and which are bypassed can be set when arming. Press the lock button within five seconds after arming. Each time the lock button is pressed another zone or zones are bypassed. Reset the system to monitor all zones by turning the ignition key on.

**Table of Zones:**

- Zone One is the pin switches.
- Zone Two is the Warn away.
- Zone Three is the Entry Door.
- Zone Four is the Bay Doors.
- Zone Five is the Ignition.

**Quick Reference Guide:**

- Lock - Arms or activates the system.
- Unlock - Disarms the system.
- Lock - While driving will arm the system.
- Ignition ON and the Valet button pressed will disarm without a transmitter.
- Ignition ON, then OFF, then pressing the Valet button for ten seconds enters or exits the Valet Mode.
- Press and hold the HORN button for one second to enter the Panic Mode.
- Press the HORN button to exit the Panic Mode.
- Press the AUX button for Silent Mode Activation.

**Tips:**

- Remember the location of the Valet/Program button.
- Know the number of Valet/Program button pulses for disarming.
- There is a 24 hour support number located on the back of the key fob.
- The headlights will only flash when using the Key Fob.

- The range of the remote key fob is about 1,200 feet.

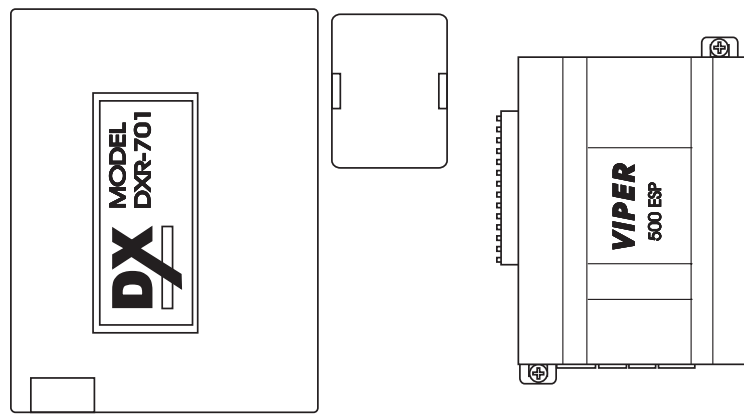
### Troubleshooting

- Valet/Program not responding - Ensure the button is plugged into the blue port of the receiver.
- Red Status LED doesn't work - Ensure the LED is plugged into the correct socket.
- Shock Sensor won't trigger alarm - Ensure NPC system has not triggered.
- System has no power - Ensure the 15 amp fuse (front run panel) is not blown.
- The system is not responding to the remote - Ensure the Valet mode is not entered.

### Changing the Programming - Entering the "Learn Routine"

The following information is provided for changing the programming features. It should be used only by an authorized service center.

1. Open the door.
2. Turn ignition ON, then OFF.
3. For menu selection: Press and hold the Valet/Program button.
4. Select a feature.
5. Program a feature.
6. Release the Valet/Program button.

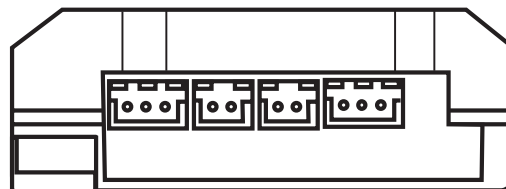


#### When the feature is programmed:

- Other features can be programmed within the same menu.
- Another menu can be accessed.
- The learn routine can be exited.

#### To access another feature in the same menu:

- Press the valet/program button the number of times necessary to advance to the desired feature.
- Press the valet/program button and HOLD.





### Selecting another menu:

- Press and hold the valet/program button.
- The system will advance and chirp is audible to accessed menu after three seconds.

### Exiting the Learn Routine:

This can be done in one of four ways:

1. Close the door.
2. Switch ignition ON.
3. Do not respond for longer than 15 seconds.
4. Press the Valet/Program button an excessive number of times.

### System Features Menus

The system features are broken into two separate menus. Both can be accessed to customize the system by an authorized dealer. The following features have been programmed into the security system.



**NOTE: \*Bold indicates the factory default settings.**

### Basic Features - Menu One

**Active/Passive Arming:** Select **\*ACTIVE**. When active arming is selected, the system will only arm with the transmitter. Passive arming will allow automatic arming after the door is closed.

**Chirp ON/OFF:** Select **\*Chirp ON**. Allows control of the chirp which confirms arming or disarming.

**Ignition Controlled Door Locks ON/OFF:** Select **\*ON**. When turned on the doors will lock three seconds after the ignition is turned ON and unlock when the ignition is turned OFF.

**Active/Passive Locking:** **\*Active** selected. Active locking means the doors will not lock when the system is passively armed. Passive locking means the doors will lock when the system is passively armed.

**Panic with the Ignition ON:** Turned **\*OFF**. Many states prohibit a siren from sounding in a moving vehicle. This feature is designed to comply with those laws and regulations.

**Door Lock Pulse Duration:** **\*.8**

**Forced Passive Arming ON/OFF:** Forced Passive Arming **\*OFF**. Forced Passive Arming will occur one hour after the ignition is turned OFF. When this feature is turned on it will force passive arming, even if a zone is left open or invalid.

**Automatic Engine Disable (AED) ON/OFF:** **\*Not wired.**

**Armed While Driving/Vehicle Recovery System (VRS):** Turned **\*OFF**.

**Code Hopping ON/OFF:** Turn **\*ON**. This enables a mathematical formula to change the code each time the transmitter and receiver communicate.

**Advance Features - Menu Two**  
**Siren/Horn Honk:** **\*Continuous**.

**Siren Duration 30/60 Seconds:** **\*180 seconds**.

**Nuisance Prevention Circuitry (NPC) ON/OFF:** With **\*OFF** selected. This enables the system to respond to repeated triggers on the sensor inputs indefinitely. When a zone triggers three times in one hour, it may be necessary to switch to ON. This will bypass that zone for an hour. That hour will determine if that zone can trigger the system. If that zone triggers in the hour it will reset the one hour timer. If that zone does not trigger in the hour the zone will become active and allow the system to be triggered again.

**Progressive Door Trigger ON/OFF:** **\*ON**.

**Valet Pulse Count 1 to 5 Pulses:** **\*ONE**. This is the number of times the Valet/Program button must be pressed before disarming the system.

**Door Trigger Error Chirp ON/OFF:** **\*ON**.

**Ignition Controlled Dome light Supervision ON/OFF:** **\*Not wired**.

**Double Pulse Unlock ON/OFF:** **\*OFF**.

**Channel 3 Validity/Latched/Latched Rest with Ignition/30 Second.**

**Timed/Second Unlock Output:** **\*ON AUX Channel 3**.



**NOTE: \*Bold indicates the factory default settings.**

## 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. Common causes of fires are 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.**

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### How to Test

To test the electronics of the alarm, press the test button on the cover of the smoke alarm for a few seconds. The smoke alarm will sound by making a continuous loud beep. To complete the test sequence release the button and the alarm should stop.



**NOTE: Test the smoke alarm operation after the motorhome has been in storage, before each trip and at least once a week during use.**

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### Maintenance

Vacuum the slots in the cover and sides with a soft brush attachment every month. The smoke alarm should be cleaned every six months to help keep the unit working efficiently.

The battery should power the smoke alarm for at least one year under normal use. When the battery reaches the end of its normal life a low battery warning (intermittent beeping) will indicate the need for battery replacement. It may be practical to replace the battery during the time changes in the spring and fall.

---

### Troubleshooting

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

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

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

ty period cannot be economically repaired.

Abnormal air conditions may cause the highly sensitive smoke alarm to give a false alarm. If no fire is apparent ventilate the room and/or blow fresh air into the motorhome until the alarm stops. Once cleared, the smoke alarm will automatically reset. Dust can lead to excessive sensitivity. Vacuum as needed.

Provided for safety is a gas detector. This gas detector will detect 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 reset button to stop the alert sound for 60 seconds.

The 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 3 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: This detector will not alarm during the 3 minute warm up cycle.**

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.**

## LP-GAS DETECTOR



LP-Gas Detector

## Operation

## Testing

## **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 to flash and the alarm will beep every 30 seconds until the gas level has dropped to a safe level.
2. The LED will flash Green until the end of the Mute cycle.
3. If dangerous gas levels return before the end of the mute cycle, the alarm will beep 4 times and return to phase 1.
4. After 2 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:**

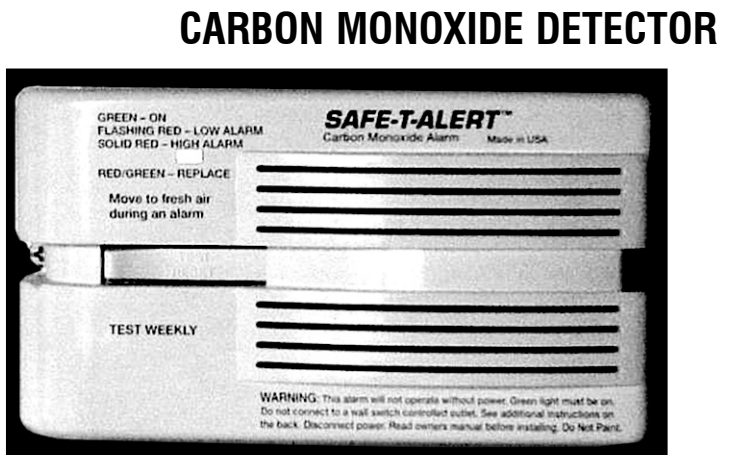
Should the microprocessor sense a fault in the gas detector, a fault alarm will sound twice every 15 seconds. The LED will alternately flash Red to Green and the MUTE switch will not respond to any command. The gas detector must be repaired or replaced.

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## **Care**

1. Vacuum the dust off the detector cover weekly (more frequently in dusty locations) using the soft brush attachment of your 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.

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 effected. 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.



*Carbon monoxide detector.*



**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.**

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 proper-

### *Operating Instructions*

ly 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 reset by the RESET switch.

---

### ***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 should 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!**

**Pull** the pin to unlock the extinguisher.

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

**Squeeze** the lever to discharge the agent.

**Sweep** the spray from left to right until totally extinguished.

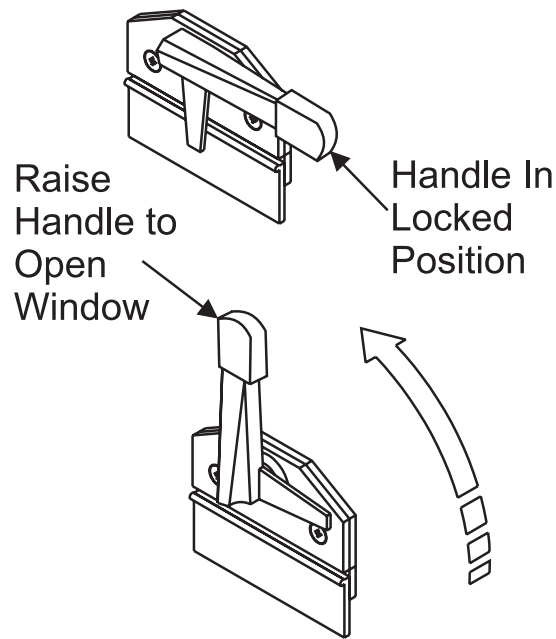
**FIRE EXTINGUISHER**



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”. Outside of the motorhome the egress window is identified by hinges along the top of the window. 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. Pull the window closed and lower the handles to lock the egress window.

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 EXIT WINDOW**



Egress Window Handle



**NOTES**

# NAVIGATOR

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# 3



**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 affective 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.

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## 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 Carnuba wax is a natural occurring wax from the leaves or fronds of the Carnuba 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 occur quickly. 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 results, 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.

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

- 
- 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.

### ***Care & Maintenance of Aluminum Wheels***

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. Aluminum wheels should be cleaned regularly with a non-abrasive cleaner recommended for aluminum wheel care. Do not use rubbing compounds.



**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.**

---

### **Maintenance - Exterior**

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.

---

### **Roof Care & Seal Inspections**

Periodic resealing of the joints and seams is necessary to prevent the entrance of moisture into the motorhome. Enough emphasis cannot be placed on this issue. Extreme damage from a water leak can occur rapidly. Never leave the vehicle unattended with the slide room extended. 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 recalced as necessary. Special attention should be directed toward the roof air conditioning seals, ceiling and plumbing vents, skylights, roof mounted antennas, windows, door molding, clearance lights

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



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

#### **Sealant Types:**

**Acryl-R:** This product 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 1/2".

**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.

**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.



**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.

**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.

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## INTERIOR CARE

### *Fabrics*

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.

Use the following guidelines for cleaning your upholstery fabrics:

- Water-based cleaners are not recommended.
- If a spill occurs, blot the soiled area. Do not rub it.
- Some solvents are not recommended since they may have an adverse reaction on specific backings of your 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 Chart:**

<b>FABRIC</b>	<b>CONTENT</b>	<b>CLEANING CODE</b>	<b>WHERE USED</b>
<b>MOCA JAVA.326</b>			
Chanterelle Oatmeal	66% Cotton 15% Rayon, 19% Polypropelene	Dry Clean Only	Sofa, LR Val., PaintedPillow
Here 99 Black	53% Poly, 21% Cotton, 18% Rayon, 8%Polypropelene	Dry Clean Only	LR Pillow, Chair, LR Val
Sparta 99 J219 Noir	53% Poly, 21% Cotton, 18% Rayon, 8%Polypropelene	Dry Clean Only	LR Pillow
Lawford 132 Midnight	54% Cotton, 46% Poly.	S	FSD
Intarsia 0024 Eggshell	64% Cotton, 36% Poly.	S	Bedsread, BR Val
Gong FSR Grape	95% Cotton, 5% Linen	Dry Clean Only	Bedroom Pillow, Headboard, BR Val
<b>CANYON SUNSET .327</b>			
F-60375-01100002	39% Cotton, 32% Poly, 29% Rayon	Dry Clean Only	Sofa, LR Val., PaintedPillow
Ming Antique	62% Cotton, 32% Spun Rayon	S	LR Pillow, FSD, LR Val
Pyrenee FL Cedar	42% Rayon,32% Cotton 26% Poly	S	LR Pillow, Chair
Baird Jacquard Rust	100% Cotton	Dry Clean Only	LR Pillow, LR Val
Vendage 18	100% Cotton	Dry Clean Only	Bedsread, BR Val
Dupioni 51 Auburn	100% Poly	S	Bedroom Pillow, Headboard, BR Val

FABRIC	CONTENT	CLEANING CODE	WHERE USED
<b>SEA STAR .328</b>			
17082 Color 3	16% Cotton, 29% Poly, 55% Rayon	Dry Clean Only	Sofa, LR Val., LR Pillow
Rizzo 71330 MO18461-009	53% Cotton, 47% Poly	S	LR Pillow, Painted Pillow, Chair, FSD, LR Val
Ferrara FSR Mint Julip	100% Cotton	Dry Clean Only	Bedsread, BR Val
Avalon 340 Aqua Marine	100% Poly	S	Bedroom Pillow, Headboard, BR Val
<b>THUNDERCLOUD .329</b>			
Rio Grande Gray	16% Cotton, 29% Poly, 55% Rayon	Dry Clean Only	Sofa, LR Pillow
Wild Life Elephant	100% Cotton	Dry Clean Only	LR Pillow, LR Val
Bedouin F Elephant	100% Cotton	Dry Clean Only	Bedsread, BR Val
New Naples VOP Cinder 302	N/A	S	Bedroom Pillow, Headboard, BR Val

VINYL	WHERE USED	CLEANING
<b>MOCA JAVA.326</b>		Follow cleaning instructions for <b>Vinyl</b> under <b>INTERIOR CARE.</b>
Brunswick New Oyster Vinyl	All Vinyl	
<b>CANYON SUNSET .327</b>		
Brunswick New Oyster Vinyl	All Vinyl	
<b>SEA STAR .328</b>		
Brunswick Pearl Vinyl	All Vinyl	
<b>THUNDERCLOUD .329</b>		
Brunswick Quicksilver Vinyl	All Vinyl	
LEATHER	WHERE USED	CLEANING
<b>MOCA JAVA.326</b>		Follow cleaning instructions for <b>Leather</b> under <b>INTERIOR CARE.</b>
Brunswick New Oyster Leather	All Leather	
<b>CANYON SUNSET .327</b>		
Brunswick New Oyster Leather	All Leather	
<b>SEA STAR .328</b>		
Brunswick Pearl	All Leather	
<b>THUNDERCLOUD .329</b>		
Brunswick Quicksilver	All Leather	

\* See instructions for “Machine Washing 100% Polyester” under *Fabric Cleaning Codes*.

LR = Living Room  
 BR = Bedroom  
 FSD = Free Standing Dinette

Several items in the motorhome can be covered with vinyl. These areas include the dash, items of furniture and the ceiling. 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 they are 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.

**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.**



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

**Bird Excreta & Vomit Stains:**

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

**Urine Stains:**

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

**Surface Mildew:**

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



**CAUTION:** Any lacquer solvent will cause immediate irreparable damage to the vinyl. Wax should never be used 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 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 scrape 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 as 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 it 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 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. The frequency of cleaning and procedures used depend upon the amount of use and the environmental conditions in which the vinyl is subjected to. Vinyl tears or holes 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 laquers and cause the vinyl to become brittle and more difficult to repair**

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**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. Let it 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. Let 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.**

---

**Leather**



### Floors -Carpet Cleaning

Use the solution specified in order from 1-6 until stain is removed.	A DRY CLEANING FLUID	B NAIL POLISH REMOVER	C DETERGENT SOLUTION	D WARM WATER	E VINEGAR SOLUTION	F AMMONIA SOLUTION	G SPOT REMOVAL KIT	H CALL PROFESSIONAL	I PERMANENT CHANGE
<b>SPOTS</b>									
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	*

### 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 or its dyes.
- Apply a small amount of the cleaning solution recommended for the particular spot. Do not scrub. Work from the edges of the spot to the center. Blot thoroughly. Repeat until spot is removed.
- Follow steps on the **Carpet Spot Removal Guide**.
- After each application, absorb as much as possible before proceeding to the next step.
- Absorb remaining moisture with layers of white paper towels, weighted down with a non-staining glass or ceramic object.
- When completely dry, vacuum or brush the pile to restore texture.
- If the spot is not completely removed, contact a professional carpet cleaner.

### Cleaning Solutions

- (A) **Dry Cleaning Fluid:** A nonflammable spot removal liquid, available in grocery and hardware stores.
- (B) **Nail Polish Remover:** Any acetate, which often has a banana fragrance. Do not use if it contains acetone.
- (C) **Detergent Solution:** Mix two cups of cold water and 1/8 teaspoon mild liquid detergent (no lanolin, non-bleach).
- (D) **Warm Water:** Lukewarm tap water.
- (E) **Vinegar Solution:** One cup white vinegar to one cup water.
- (F) **Ammonia Solution:** One tablespoon household ammonia to one cup water.

- (G) Spot Removal Kit:** Available from retail carpet stores or professional cleaners.
- (H) Call Professional:** Additional suggestions, special cleaning chemicals or the ability to patch the area might be available.
- (I) Permanent Change:** Due to the nature of the stain, there may be color loss. The carpet has been permanently dyed or the carpet yarns have been permanently damaged.



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

Regular maintenance is all it takes to keep the tile in the motorhome looking showroom new. When using your slide-out, be sure to clean the tile floor when the slide-out is extended to prevent dirt from scratching your tiles when the slide-out is retracted.

## ***Tile***

### **Cleaning Tile:**

Clean tiles with a damp sponge mop or cloth to maintain their luster. If moderate staining occurs, cleaning with a window cleaner such as *Windex* should do the job. If you prefer, you can use a mild solution of hot water and all purpose cleaner for tile floors, walls and countertops. Rinse with clear water and be sure to dry with a soft cloth to prevent streaking. Avoid cleaning tile with soap. Soap forms a film to dull the luster. Soap also promotes the growth of mildew and bacteria.

If the grout requires cleaning, scrub with a plastic brush. Do not use steel wool as small particles may remain and produce unsightly stains. Powdered cleaners should not be used on unglazed tile floors. Undissolved powder will dull the surface. In addition, sealers are not recommended on unglazed tiles. With the exception of terracotta, which may be oiled or waxed, you won't need to polish or buff the tiles to maintain their finish.

### **Cleaning Shower:**

Showers are susceptible to hot water and 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 you should spray the shower with household chlorine bleach and allow it to stand for five minutes. Weekly cleaning of glass shower doors with window cleaner should maintain the shine. If you have water build up and cannot remove spots from the glass, rubbing lightly with a razor blade will remove the 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 accomplish this, use a sharp instrument to remove the old sealant. Apply a new sealant, which can be found at an RV supply store.



**NOTE: Before using any solution to clean your tile, be sure to check the manufacturer's warning label to insure the product's safety. If you have any doubt test the solution in an inconspicuous place.**

---

## Wall Coverings

Time is very important when removing substances 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 it dry.

### 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 first 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 the gum with an ice cube to cool and harden it. 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 it on. Rinse well and dry with a soft cloth.

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.

---

The Solid Surface was created for a lifetime of easy care. Just follow the simple guidelines listed here to keep your surfaces looking good.

**Countertops**

**Routine Care:**

The motorhome countertops are finished with one type of finish: matte/satin. All solid surface sinks and bowls have the 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 you feel necessary.

**Removing Cuts and Scratches:**

Because the beauty of the surface goes all the way through the Solid Surface, the 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 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 the glass is 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.

- 
- To maintain the miniblinds on a frequent basis, vacuum with the brush attachment or use a dusting tools (available on the market) designed specifically for mini-blinds.
  - Wash the miniblinds with mild soap and water in a tub or hang the blinds on a fence or wall and gently rinse them with a hose.
  - Leave Day-Night shades in the up position when not in use to help the shades hold their shape.

### **Miniblind**

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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 LP Gas valve.
- Remove all articles from refrigerator/freezer and clean thoroughly. Prop doors open to prevent mildew.
- The 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 the battery cut-off switch OFF.
- If applicable, disable auto-genstart feature.
- Batteries should be stored fully charged. Batteries stored in a discharged state will readily freeze.

- If possible, park the motorhome leaving the batteries accessible. A battery may be charged or changed without moving the motorhome.
- If available, leave the motorhome hooked to shore power. Leave the main battery disconnect switches ON.
- Careful placement of a small heat source in the interior will help control moisture. Desiccate filter systems will help remove interior moisture.
- If AC power is not available turn main battery disconnect switches 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 help against moisture condensing at top of fuel tank.
- Vents and windows should be closed to prevent wind driven rain entrance.
- Tires should be stored at proper inflation pressure.
- A full interior inspection for water leaks should be made bi-monthly, inspecting behind all cabinet doors and drawers.

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## STORAGE- Long Term

Long term storage of the motorhome can be defined as leaving a motorhome unattended for a period of thirty days or longer. 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° Fahrenheit 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 appliances.
- Turn the battery cut-off switch to the OFF position.
- 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. By 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:**

- Both main battery disconnect switches will remain ON. The inverter will charge both the 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 have an affect on 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 prevent moisture from 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 help prevent the microbe growth. 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. 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 or Aqua Hot motors, heat exchangers and powered roof vents.

- 
- **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.

**CHECKLIST-  
Winter Storage**



**Add a small amount of antifreeze to keep valves and gaskets lubricated.**

- **Drain Traps** - Pour RV antifreeze down all drains.
- **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.
- **Refrigerator** - Clean and leave both doors propped open. Cover the exterior panels and roof vents.
- **Air Conditioner** - Remove the air filters. Clean or replace.
- **Roof** - Keep clear of snow accumulation or damage may occur.
- Storing under cover or indoors helps extend interior and exterior life.
- Diesel fuel tank should be full of fuel.

## STORAGE REMOVAL

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.

- 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 section. 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 the first two trays of ice from an icemaker. The ice may contain 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.
- Start and run the generator.



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

- Ensure the batteries are being charged. Operate the 120 Volt appliances and air conditioners. If an electrical item or appliance is not functioning or is not functioning properly, contact your 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 you choose, have your dealer or repair center double check your preparation and correct any defects or make any necessary adjustments.

**NOTES**

# NAVIGATOR

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## INTRODUCTION

This section covers operation and care of various appliances found in the motorhome. The motorhome is equipped with a refrigerator, cooktop, 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. A compressor will pump refrigerant vapor into a condenser where the heat from the refrigerant will be dissipated and the vapor will change to a liquid. The liquid refrigerant is pumped 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 is then blown across the evaporator and into the interior of the refrigerator. This system is efficient as long as 120 Volts AC is available; however, this does not allow the freedom a recreational vehicle is designed to give. The recreational vehicle refrigerator uses a combination of fluids and gas for refrigeration: ammonia, water, sodium chromate and hydrogen gas. This combination is put into a pressurized cooling unit at approximately 350 psi. It is heated to a gaseous state which then rises to the top of the cooling unit into a condenser where it forms droplets as it cools. As the vapor condenses it will “extract or absorb” heat from the inside of the refrigerator. Using gravity, the droplets return through the absorber coils to the absorber vessel to start the process again. The cooling unit has specific guidelines that need to be followed for proper operation and insured longevity. Keeping these guidelines in mind should give years of faithful trouble-free service.

## REFRIGERATOR



## Operation Specifics

The refrigerator operates from either LP-Gas or 120 Volts AC electric. Controls are electronic which require the DC Voltage to be no higher than 15.4 Volts DC or lower than 10.5 Volts DC. The AC voltage limits are 132 Volts AC maximum and 108 Volts AC minimum. The refrigerator (from front view) needs to be leveled within 3° side to side and 6° front to back. Using a torpedo or bulls eye (fence post) level, place the level onto the freezer plate. The level should be within the circle by a half of a bubble. Generally, this is within comfortable living conditions. The heat source for the cooling unit is supplied by an electric heating element, or an LP-Gas flame. The heat source, which is calibrated in BTU's (British Thermal Units), is concentrated to a specific area of the cooling unit. Operating the refrigerator in an "off level" condition separates the sodium chromate which will crystallize from the heat source. This blocks the recirculation action of the cooling unit and causes accumulative, irreparable damage. It is safe to operate the refrigerator while driving the motorhome because the chemicals are in a constant state of agitation from the movement and will not be at risk for separation. The LP-Gas side of the refrigerator and the LP-Gas pressure need to be serviced yearly, depending on use. Over time the BTU rating of the LP-Gas can change, affecting the refrigerator's performance. Ambient air temperature and humidity can also affect its performance and function. The BTU rating is lower 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 120 Volts AC electric while at a higher altitude.



**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 the box or in the outside access compartment. This can be an indication of a refrigerant leak. Contact an authorized repair facility.**

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## Tips

- If possible, cool items first 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. Wipe up any spilled soda.

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## Refrigerator Controls

The refrigerator controls are DC (direct current) operated through an electronic circuit board. The refrigerator, which operates from heat (as described previously), gets its heat source two different ways: an electric heating element or a flame from LP-Gas. Mode operation and temperature selection is made by controls on the face of the refrigerator. In order for the refrigerator to operate the house batteries must be charged, the LP-Gas valve on, the water valve on (ice maker option only) and 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).

**Doors**

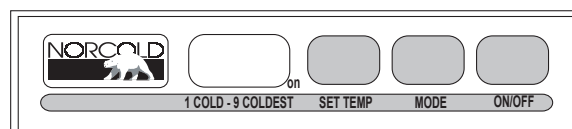
The refrigerator doors are positive lock style doors that close with a “click” to prevent accidental door opening while traveling. When storing the motorhome, the refrigerator doors have a storage position that locks the doors partially open. This will help reduce odor from mold and bacteria build-up. A completely closed up refrigerator in storage is a perfect habitat for molds and bacteria to grow. To use the storage feature open doors approximately halfway and slide the latch into the cut-out of the strike plate.

**ON/OFF Button** - Press this button to turn the refrigerator ON. Press and hold this button to turn the refrigerator OFF.

**LED Display** - This screen is used for fault code display.

**MODE Button** - Press and hold this button to cycle the refrigerator through the different modes available: AUTO, AC and LP modes. Release the button when the desired mode is displayed.

**TEMP SET Button** - Press and hold the button to select the desired temperature setting. Five settings are available, from COLD to COLDEST.

**Control Panel**

*The Refrigerator Control Panel requires 12 Volt DC to operate.*

This mode will lock the refrigerator into either LP-Gas or electric AC operation. Press and hold the MODE button until LP or AC is displayed. Release when the desired function is lit. The Alarm will sound and a code will be displayed if the function selected is interrupted or a failure occurs. Note the code and turn the refrigerator off to silence the alarm. Refer to the manufacturer’s manual for a list of codes and their meanings.

**Manual Mode Operation**

This feature will automatically select 120 Volts AC over LP-Gas operation. If 120 Volts AC is available it will use this source for operation until AC service has been discontinued. When AC is discontinued the alarm will sound and the refrigerator will automatically switch to LP-Gas operation. If the refrigerator fails to light the alarm will sound and a code will be displayed.

Press and hold the **MODE** button until **AUTO** is displayed, release the button. Press and hold the **TEMP SET** button until desired temperature is displayed, release button. In **AUTO** mode, AC or LP will remain lit for 10 seconds upon initial start or when mode has changed.

**Auto Mode Operation**

## **Inverter Mode Operation**

While traveling, the refrigerator may be operated using the 120 Volt AC electric mode to keep the refrigerator contents cool. The electrical combination of the engine's alternator and the inverter will supply the power necessary to operate the refrigerator on 120 Volts AC. Operating 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 is quickly consumed when using the inverter to operate the refrigerator on AC electric. 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 refrigerator 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 to shore power, start the generator or switch refrigerator operation to LP-Gas.**

## **Alarm**

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

1. DC or AC voltage is higher or lower than allowed specifications.
2. Refrigerator is set to auto mode and the 120 Volts AC is discontinued.
3. Liquid Petroleum Gas mode fails to light initially or fails to light after a period of operation.
4. Door has been left open longer than two minutes.
5. The circuit board detects a failure resulting in a code being displayed.



**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.**



**NOTE: Keep the interior box temperature at or below 54° F to reduce the possibility of food spoilage. The refrigerator works harder to keep a low box temperature, especially in hot, humid climates. Low box temperature may also add quicker frost build-up.**



**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.**

The ice maker works from 120 Volts AC only. The ice maker will start to function only after the freezer temperature is low enough. City water or the water pump must be on and the valve (located in vanity cabinet) for the water supply line to the ice maker must be on. Pulling the metal arm (bail) down will turn the ice maker on. Pushing the arm up will turn the ice maker off.

### ***Ice Maker Operation (Optional)***

If the ice maker is in operation while the motorhome is in motion, water may spill out of the ice tray. **Raise the ice maker arm to stop ice production while the motorhome is in transit.**



**NOTE: Do not use the first one or two trays of ice if the refrigerator has been in storage. Ice cubes may have contaminants. Do not operate the ice maker without water pressure supplied to the refrigerator. This can cause damage to the ice maker assembly.**

The refrigerator is equipped with a heating element located in the flapper on the left door (four door model) or in the door (two door model). The heating element is activated when the refrigerator is turned on to any mode to help prevent moisture build-up in high humidity conditions.

### ***High Humidity Operation***

The cooling unit is equipped with a pair of cooling fans to help pass air across the cooling unit. These fans start automatically and will be 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. **Do not** use heating guns, hair dryer or sharp objects to remove frost build-up as these can damage the interior. Leave all doors open. Defrost time can be shortened using trays of warm water. Wipe off excess water using paper towels or cotton cloth.

### ***Defrosting the Refrigerator***

Wipe using only cotton or paper towels. Products such as *FORMULA 409*, *DAWN* and *FANTASTIK* are acceptable cleaners. Do not use scouring pads or abrasive cleanser as these can damage the interior finish.

### ***Cleaning the Refrigerator***

## **HOT WATER DISPENSER (Optional)**

The water is electrically heated to a brewing/cooking hot 190° F (88° C) by a compact tank that mounts under the sink. A thermostat maintains the water at this approximate temperature. When you turn the tap, cold water enters the bottom of the tank and forces hot water out of the faucet. The system is vented so the tank is not pressurized.

### **Operation**

Turn the insta-hot switch, located in the galley, to the ON position. It will take 10 to 15 minutes for water to reach 190° F (88° C) in temperature. Steam or hot water may come out of the faucet without turning it on. After 10 to 15 minutes turn on the faucet for about 20 seconds to bleed off any steam until the hot water is dispersed. Allow the water in the tank to reheat. Repeat this step one or two times. When hot water with no steam is dispensed, turn the faucet on to use hot water. To shut off the system, turn the galley switch to the OFF position.

### **Temperature Adjustment**

If the steam cannot be stopped, or the water boils, adjust temperature as follows:

- Turn the galley switch off and unplug the power cord.
- Remove the screw and access cover.
- Insert a screwdriver in the slot of the thermostat adjusting screw and turn clockwise a 1/2 notch to increase the water temperature, or counterclockwise a 1/2 notch to decrease the water temperature.
- Reinstall the access cover, reconnect the electric power and turn on the galley switch.
- Draw three or four cups of water and allow unit to reheat.
- Repeat the procedure until desired temperature is reached.



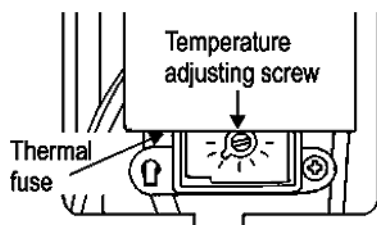
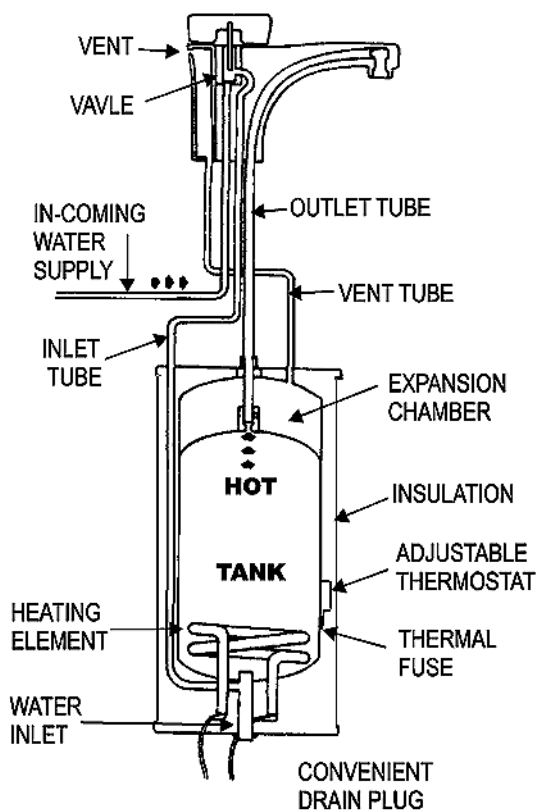
**CAUTION: Do not allow the water to boil.**

### **Cleaning Hot Water Dispenser**

Use only mild cleaners to clean the dispenser spout and plastic components. Use of cleaning agents containing acids, alkalies and organic solvents will result in the deterioration of plastic components.



**WARNING:** Use care when operating this unit. Do not allow children to operate this unit. The tank is a non-pressure tank, **DO NOT** modify this system. **DO NOT** close the vent tube or connect other types of faucets or valves to the tank. Use only the faucet supplied. **DO NOT** allow the water to boil. The water and steam dispensed can instantly cause scalds or boils. To minimize the possibility of fire **DO NOT** store flammable items such as rags, paper or aerosol cans near the tank. **DO NOT** store or use gasoline or other flammable vapors and liquids in the vicinity of this unit. **DO NOT** remove or alter the thermal safety fuse. If the thermal fuse is open contact your authorized service center. To prevent electrical shock turn the power switch **OFF** and disconnect the power cord before removing the access cover to adjust or service the thermostat.



## MICROWAVE OVEN

The microwave oven is operated from 120 Volt AC supplied by either shore power, the generator or the inverter. Microwaves heat food by 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 helps to 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 replaceable charcoal filter at the top. The ventilation fan may be operated manually or may start automatically by a thermostat activated from heat produced by the cooktop.

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 may be programmed to display one of three different languages.

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.



**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 or unplug the unit 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.**



**NOTE: The microwave is for food preparation only. Do not use the microwave to dry clothes, newspapers, 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 and the oven will not operate. The fan and hood light are still operational with the Safety Lock feature on. To return the oven to normal oper-

ation:

- 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 the time in sequence using the number pads.
- Press the **CLOCK** pad to begin time.



**NOTE: The clock is a 12 hour clock only. When AC power is discontinued the clock time will be erased.**

#### **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.

#### **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.

#### **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.

#### **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.



## **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 Settings:**

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. 100% power will be 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 and reheating is desired, place the food back into oven and press the **KEEP WARM** pad.

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 it does in a regular oven. The convection cooking mode has special options such as a broil mode, plus the ability to preheat the oven by convection and use 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 hamburger, steak, chicken and fish. Temperature and time are preset depending on the food quantity. The amount of cooking time can be adjusted

to fit any particular need. 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. 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. While in this mode the microwave will use 30% power on **HIGH/MIX** and 10% power on **LO/MIX**. The convection temperature can be changed from 100 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**. Use the number pads to enter cooking time. Press the **START/TOUCH-ON** pad to begin the mixed cooking cycle.

#### **CompuRoast or CompuBake:**

CompuRoast and CompuBake 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 and enter the food type from list next to the mode used. Enter the food type being cooked by using the number pad. To use CompuBake, press the **START/TOUCH-ON** pad to begin 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.

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#### **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 paper towels designed for microwave use only.

- 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. Small amounts of foil are acceptable if 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.

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The exterior of the oven is plastic and metal. The interior is metal. Do not use scouring pads, 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.

## COOKTOP

Cook top burners use 12 Volt DC electronic ignitor to light burners. House battery cut-off switch must be ON to supply power to ignition module. To conserve LP-Gas energy, preheat the pans only when recommended and shorten the cooking time by using the least amount of water possible. When cooking, heat the food on a higher heat setting, then turn the heat down to finish cooking.

### To Light the Burners:

1. Make sure the LP-Gas is turned on.
2. Turn the knob counterclockwise to the ignite position.
3. When ignition has occurred, continue counterclockwise rotation to set flame to the desired setting.



**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.

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### 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. To help keep the underside of the cooktop clean, remove the cooktop cover. Carefully place strips of aluminum foil on the cooktop floor pan and under burners. Do not restrict air flow of mixture tubes.

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### Care & Cleaning

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. To clean splatters or spills, use a dry cloth or paper towel while the surface is warm to the touch. Cleaning will be more difficult if spills bake on to the surface. Glass cleaner sprayed on a paper towel should be used for the cooktop surface. Do not spray glass cleaner directly on the surface. DO NOT use abrasive cleaners or steel wool. Harsh cleansers like bleach, ammonia and oven cleaner should NEVER be used. The surface burner grate and caps should be cleaned using the same guidelines as the cooktop surface.

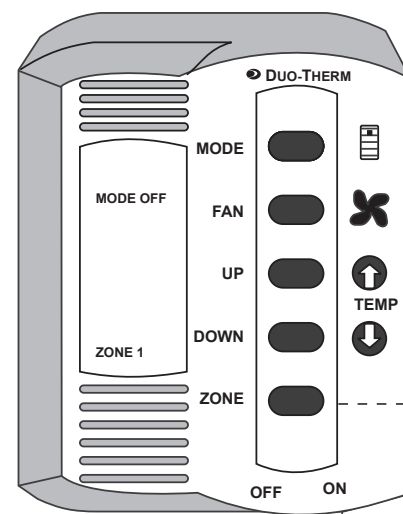
Two comfort controls are used for the HVAC (heating, ventilating and air conditioning) system. One comfort control is located in the living room. The living room comfort control will operate the front roof air conditioner functions and the LP-Gas furnace operation. If the motorhome is equipped with an Aqua-Hot, the living room comfort control will operate the dinette and living room heat exchangers.

The other comfort control is located in the bedroom. The bedroom comfort control will operate the rear roof air conditioner and (if equipped) the mid roof air conditioner functions. If the motorhome is equipped with an Aqua-Hot, the bedroom comfort control will operate the hallway, bathroom and bedroom heat exchangers. The comfort control uses a liquid crystal display to inform the operator of current mode status.

There are five different functions of the HVAC system: Off, Fan, Cool, Heat Pump and Furnace. These may be selected by repeat pressing of the MODE button. The roof air conditioner fan speed is controlled by the FAN button. 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 conditioner will use all three blower speeds (low, medium or high) when Auto fan is selected in Cool mode. If operating in Heat Pump mode and Auto Fan is selected only low or high blower speeds will be used.

The motorhome is divided into three operating Zones: front, middle and rear. The living room comfort control is Zone One, although this is not displayed. The bedroom comfort control operates the middle area, which is displayed as Zone Two. The bedroom area is considered Zone Three; however, it is displayed as Zone One on the bedroom comfort control. Zone selection is made by pressing the zone buttons. The temperature for any HVAC function is controlled by pressing the UP or DOWN buttons.

## WALL THERMOSTAT



**NOTE: The Comfort Control must be turned to ON to operate any HVAC function. Comfort Control modes cannot be mixed. One zone cannot be on Cool while another zone is set to Furnace.**



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

Should the comfort control exhibit unusual symptoms or not respond to commands, it may need to be reset. To reset:

- Press the MODE button. Display backlighting should illuminate.
- Press MODE, UP and DOWN buttons simultaneously five to ten seconds. The comfort control should return to mode OFF. The factory default settings of 72° F for Cool and 68° F for Furnace should be established.

### Comfort Control Reset

## AIR CONDITIONER - ROOF

The roof air conditioners operate from 120 Volts AC only, either by shore power or the 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 LP-Gas furnace or (if equipped) Aqua Hot operation. The refrigerant operation principal of the roof air conditioner is the same as the dash air conditioner or a household type refrigerator. It functions as an enclosed system. The refrigerant is drawn into the compressor. The high pressure vapor is 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 changes from liquid form to vapor as the heat is extracted. The vapor is drawn back into the compressor to start the cycle again. The air conditioning principal is reversed when operating the roof air conditioner in heat pump mode. The refrigerant flow is reversed blowing heated air into the interior of the motorhome. There are ambient temperature limitations of the heat pump mode.



**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: The roof air conditioner will not operate in Heat Pump mode with ambient temperatures at or below 26° F.**

### Aux Heat Mode

If the heat pump mode is selected when ambient temperatures are approximately 26° F, or if operating in Heat Pump mode and temperature drops to approximately 26° F, the air conditioner will stop Heat Pump operation and Aux Heat operation will begin. The furnace is automatically selected as an auxiliary heat source and begins operation. The Aux Heat mode is automatically selected due to refrigerant characteristics in cold temperatures. The furnace remains the primary heat source until ambient temperature rises above 42° Fahrenheit. When ambient temperature is between 24-42° Fahrenheit, a defrost cycle is initiated approximately every 40 minutes of compressor operation. The blower motor will stop for five minutes and Defrost will be displayed. After the defrost cycle Heat Pump operation will resume.

If the motorhome is equipped with an Aqua Hot and the Aux Heat cycle is initiated the Aqua-Hot will need to be turned ON by using the Aqua Hot control switches located in the galley. The living room and dinette heat exchanger blowers will automatically begin operation. Use the bedroom comfort control to select Zone One or Zone Two heat exchangers.

The return air filters should be cleaned frequently. They are located on the motorhome ceiling inside the air intake vent covers. Never operate the air con-

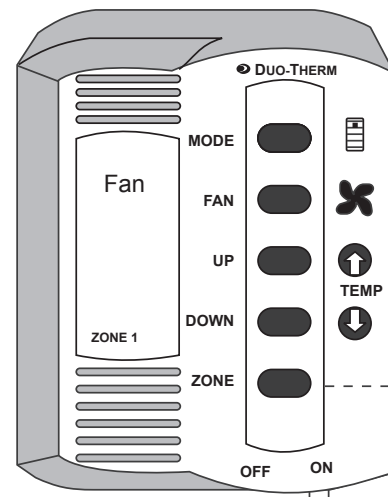
ditioner without the return air filters in place as this may plug the evaporator core with dirt and substantially affect the performance of the air conditioner.

### To Clean:

- Remove the vent covers and filters.
- Wash the filters and covers in warm soapy water. Do not use solvents.
- Rinse the filters and cover thoroughly with fresh water and allow them to dry.
- Reinstall the filters and covers.

The roof air conditioner will operate only when the following needs have been met:

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



### Fan Operation:

This mode circulates the interior air by using the roof air conditioner blower. The fan speed will control the roof air conditioner 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.

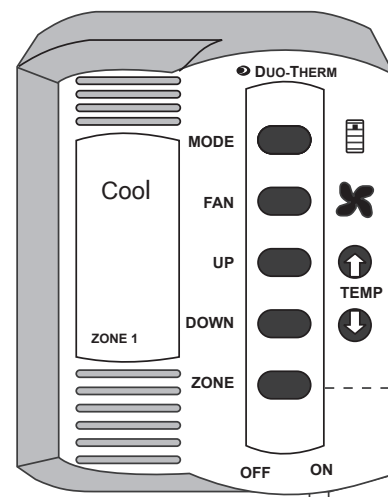
### Air Conditioner Operation:

The living room comfort control will operate the front roof air conditioner functions.

- 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.

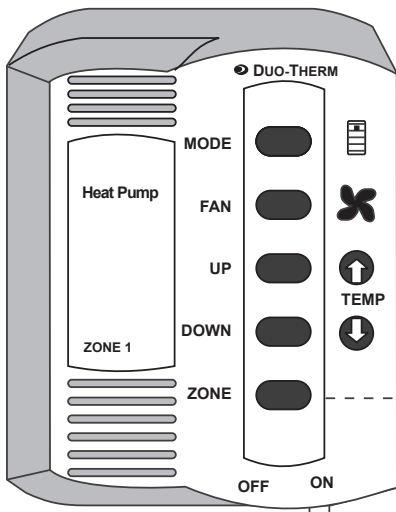
The Bedroom comfort control will operate the rear roof air conditioner functions and (if equipped) the center roof air conditioner.

- Press the MODE button repeatedly until Cool is displayed.
- Pressing the Zone button to alternate between Zone One and Zone Two. Zone One will control the bedroom roof air conditioner and Zone Two will control the center roof air conditioner.
- 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:

Living room comfort control will operate the front roof air conditioner.

- 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.

The bedroom comfort control will operate the rear roof air conditioner and (if equipped) the center roof air conditioner.

- Press the MODE button repeatedly until Heat Pump is displayed.
- Pressing the Zone button will alternate between Zone One and Zone Two. Zone One will control the bedroom roof air conditioner and Zone Two will control the center roof air conditioner.
- 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. A warm air discharge is incorporated to heat the motorhome's holding tanks.

### 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 air prover or 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 about 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 charged.
3. The battery cut-off switch at the entry door is in the **ON** position.



**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.



**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.

- Select the furnace mode on the living room Comfort Control using the MODE button.
- Select the desired temperature with the arrow up and down buttons.

### *Using the Furnace*



**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.

- 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*

### **If Furnace Fails to Light**

If the furnace fails to light make sure the LP-Gas supply valves are open and the LP-Gas switch is turned on. Make sure the battery cut-off switch at the entry door is 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. Hook-up to shore power and start the generator or 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.**

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## **WATER HEATER**

The water heater in the motorhome will heat water using two different methods. The first method is 120 Volt AC, supplied either by shore power or the on board generator. The second method is LP-Gas. The 120 Volt AC uses a heating element like those found in a house style water heater. The 120 Volt AC method is efficient if shore power is available. The LP-Gas incorporates the use of an automatic ignition circuit board operated by 12 Volt DC. The water temperature is controlled by two thermostats: One for the 120 Volt and the other for the LP-Gas. The temperature is preset by the water heater manufacturer. Water is pumped into the bottom of the water heater tank where it is heated and discharged out of the top of the tank upon usage. For easy winterization the water heater is equipped with a temperature and pressure safety relief valve and a by-pass valve.



**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 as this damages the thermostats and the electric heating element.**

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### **Before Using the Water Heater**

Before 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 is present. The water heater does not need to be operating while this is being done.



**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. 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 water heater will operate when the following conditions have been met:

- 120 Volt AC has been supplied either from shore power or the generator.
- The LP-Gas valve on the LP tank is open.
- The battery cut-off switch at the entry door is ON.
- The house batteries are charged.

### **Operation**

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

### **Water Heater - Using LP-Gas**



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

- Have either shore power or the generator supplying AC voltage.
- Turn on the water heater switch located under the galley counter.
- Both gas and electric may be used at the same time. This will speed up the process of heating water for large volume usage.

### **Water Heater - Using 120 AC**

- 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

### **Tips**

until the pressure has dropped. Avoid opening the T & P valve manually as it may continue to leak. The valves can be purchased from most hardware stores.



**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.**

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### ***Troubleshooting - LP-Gas Operations***

- 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 monitor panel does not light and the water heater does not light, make sure the battery cut-off switch at the entry door is on, or check for a blown fuse in the house distribution panel.

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### ***Troubleshooting - Electric Operations***

- If the switch at the galley is on but there is no hot water, check the ON/OFF switch located outside behind the water heater inspection panel.
- If the 120 Volt piloted switch does not light check the AC source, breaker, shore cord connection or transfer switch.

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### ***Temperature-Pressure Relief Valve***

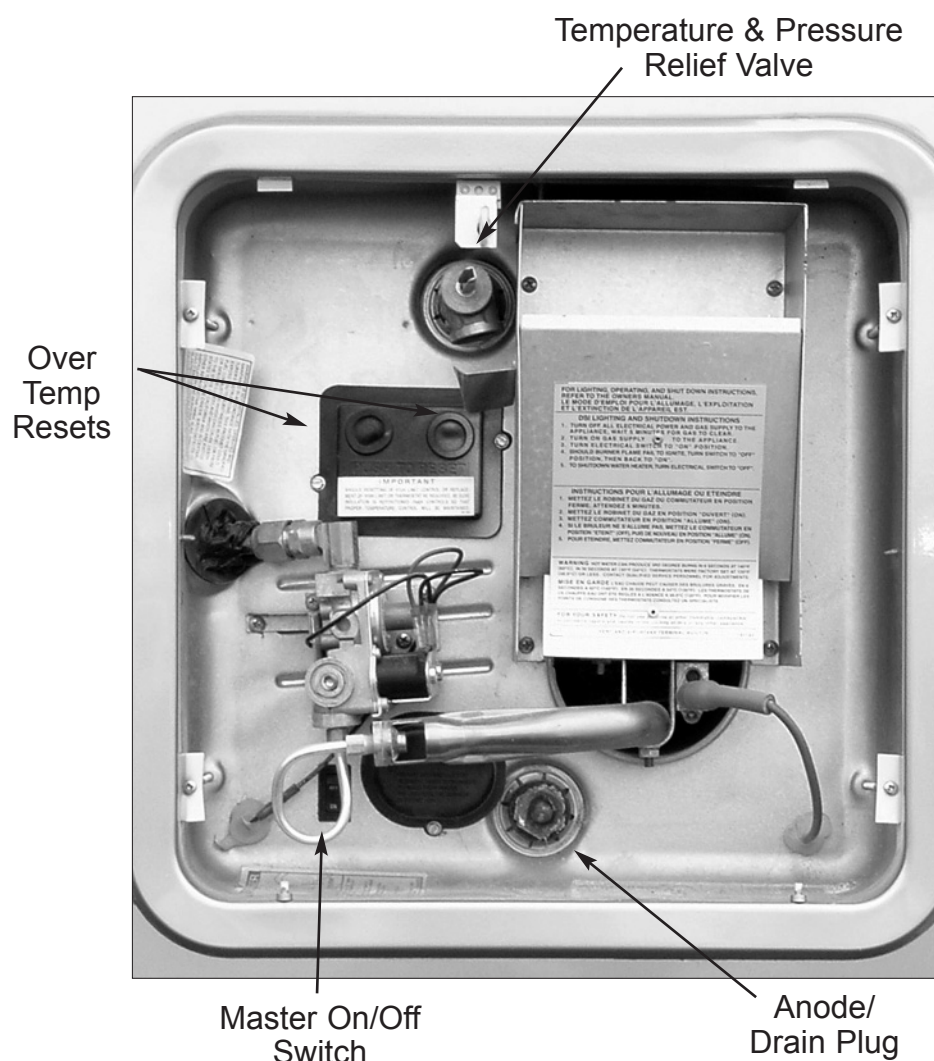
The water heater is equipped with a temperature-pressure relief valve. The water heater may discharge at the temperature-pressure relief valve during the heating cycle, due to thermal expansion of water. The temperature-pressure relief valve is designed to open if the water temperature within the heater 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. When there is a discharge, a normal occurrence, it should not be considered a faulty valve. The water heater by design has an internal air pocket to reduce the possibilities of dripping or weeping. The expanding of water, in time, will absorb the air and pocket. The air will have to be replaced utilizing a simply procedure when this occurs.



**CAUTION: Ensure the water heater storage tank is cool prior to making any check of the valve.**

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

The air pocket will have been re-established and will not need to 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.



## **AQUA HOT (Optional)**

The Aqua-Hot heat system is specially designed for use in motorhomes. The Aqua-Hot is an appliance combining a water heater with a furnace. The Aqua-Hot will provide an almost endless supply of hot water and heat the interior of the motorhome. A 50,000 BTU diesel fired burner and a 1,650 watt AC element heats a 60/40 antifreeze solution to approximately 200° F. The antifreeze solution is pumped through heat exchangers located throughout the motorhome. Four pumps are used to circulate the antifreeze solution. Three pumps supply the solution to the interior heat exchangers. The fourth pump circulates the antifreeze solution of the engine. Fresh water is heated when pumped through a coil tube inside the aqua hot.

### ***Aqua-Hot - Use of Chlorine Bleach***

Chlorine bleach or other concentrated chlorine bearing chemicals can cause failure to the Aqua-Hot's Domestic Water Loop (copper tubing) if not properly and thoroughly rinsed. The Aqua-Hot's copper tubing is rated for use with fresh water and winterization solutions only. Periodic flushing with common household chemicals, including bleach, has little or no effect on the heating system if properly rinsed with the fresh water afterwards. Failure of copper tubing, especially soft or flexible copper, can result if materials other than water or winterization solutions are allowed to reside inside the piping for extended periods as during storage or other periods of non-use. The most common cause for failure is due to an extended exposure to chlorine, solutions containing chlorine (i.e. bleach) or hydrochloric acid.



**NOTE: The Aqua Hot must be turned ON before using any heat feature.**

#### **Diesel Burner**

The diesel burner will consume approximately ½ gallon of diesel for each hour of continuous burner operation. The diesel burner is rated at 12 Volt/65 watts. Three circulating pumps are rated at 12 Volt/12 watts each. The diesel fired burner has a fast recovery rate. To heat the Aqua-Hot from the diesel burner turn the switch to the ON position. The switch will illuminate when the Aqua-Hot is ON. Allow 20-30 minutes for the Aqua-Hot to reach operating temperature before operating heat exchangers or using hot water.

#### **Electric Heat Element**

The electric element works well if plugged into 50 amp service. If the motorhome is plugged into less than 50 amp service, exercise care so the electric service provided will not be overloaded. Electric operation recovery rate is slower than the diesel burner. When the switch is turned on a relay will send power from the 110 Volt AC panel to the electric element in the Aqua-Hot. Allow two to three hours for the Aqua-Hot to reach operating temperature when operating from the electric element.

## Engine Heat Exchange System

The Aqua Hot system has an engine preheat feature to aid in starting in cold or frigid weather. Located inside the Aqua Hot is a separate engine coolant loop and an engine coolant pump. The Aqua Hot will heat the engine coolant and the internal engine pump will circulate the coolant heating the engine. When traveling, the water pump (on the engine) circulates the heated engine coolant through the Aqua Hot. Through convection, the heat will be transferred to the Aqua Hot coolant, providing hot water and interior heating.

## Engine Preheat

Turn the diesel switch to the ON position. The diesel burner will light. Turn the Engine Preheat to the ON position. This activates the engine pump circulating the engine coolant through the Aqua-Hot.

## Interior Heat Exchangers

The heat exchangers are small radiators with 12 Volt DC blower motors. Current consumption is approximately .25 watt per large heat exchanger. The small heat exchanger used in the private bath and for the holding tank bay is .10 watt.



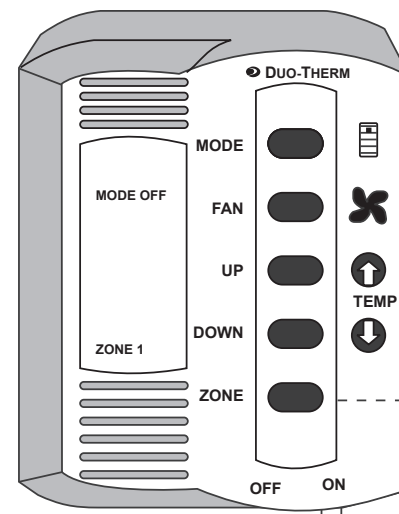
**NOTE: The HVAC (heating, ventilating, air conditioning) system will not operate correctly when both comfort controls and all zones are not in the same mode. DO NOT set control to display furnace in one zone and cool displayed in another zone.**

### To operate the furnace:

- Select either diesel burner or electric element operation.
- Turn living room comfort control to ON.
- Press the mode button repeatedly until furnace is displayed.
- Select desired temperature setting using the up or down buttons.

### To turn bedroom comfort control to ON:

- Press the mode button repeatedly until furnace is displayed.
- Pressing the ZONE button will alternate between Zones One and Two. Zone One controls hallway and bathroom exchangers. Zone two operates bedroom exchanger.
- Select desired temperature setting using the up or down buttons.



Furnace

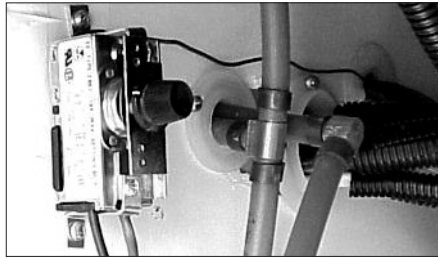


**NOTE: The blower motor of the heat exchanger in A private bathroom is controlled by the switch in the private bathroom. When the switch is on, the bathroom blower motor will cycle on and off when the hallway heat exchanger blower motor cycles on or off.**



## Bay Thermostat

If the motorhome is used in cold weather conditions you will need to locate the bay thermostat next to the Aqua-Hot. This thermostat controls the heat exchanger for holding tank bay heat. Adjust the thermostat to 40-50° F. This will help prevent freezing of the water system.



*Adjust the Bay Thermostat here.*



**NOTE: The Aqua-Hot must be turned ON when using the holding tank bay exchanger.**

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## Maintenance Schedule

### Monthly:

Check the Aqua-Hot's 50/50 solution of water and antifreeze to ensure its proper level. Do this by visually checking coolant level in Aqua-Hot's expansion tank. This should be checked only when the Aqua-Hot is at operating temperature. Adding solution to the expansion tank when the unit is cold will result in a solution overflow when the Aqua-Hot heats to normal operating temperatures.

### Annually:

Be sure to have the Aqua-Hot tuned up early. A tune up will consist of a fuel nozzle and fuel filter replacement, as well as a thorough cleaning of the combustion chamber. This simple tune up will keep the Aqua-Hot running smoothly throughout the year, as well as allow service personnel to inspect for additional wear of other components. Signs that the Aqua-Hot may need servicing are: continuous white exhaust smoke or poor ignition start up. When in operation the Aqua-Hot should have a smooth, high-pitched whine. Loud growls or other abnormal noises indicate service is required.



**CAUTION: Before cleaning or servicing disconnect all power supplies.**



**For more details about the Aqua-Hot system see the Owner's Information Box.**

**Filter/Water Separator**

The filter is on the curb side of motorhome, located behind fuel access door. Remove the two bolts at the bottom of the fuel door and swing the door upwards. The Aqua-Hot fuel filter/water separator is mounted on top of the chassis frame support.

**Draining the Collection Bowl:**

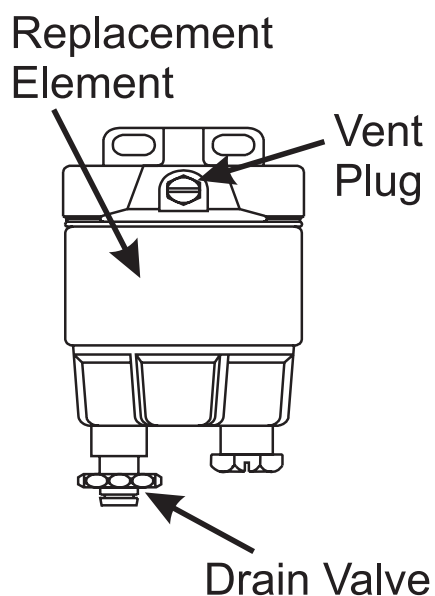
Water is heavier than fuel and will settle to the bottom of a fuel bowl which will make it appear different in color. In high humidity environments check the collection bowl more often. **With the engine and the Aqua-Hot off**, open the drain to evacuate any contaminants and then close it.

**Element Replacement:**

The contamination levels in the fuel determine the element's replacement frequency. Fuel flow to the Aqua-Hot becomes restricted as the element gradually plugs up with contaminants, resulting in noticeable heating loss and/or hard starting. If this occurs, change the element as soon as possible. As a guideline, change the element every 500 hours, annually or at first indication of heat loss, whichever occurs first. Always carry an extra replacement element as one tankful of contaminated fuel can plug a fuel filter.

**To Replace the Element:**

- Drain the filter unit of fuel by opening drain valve.
- Spin bowl/element from head and remove element.
- Coat new seals with motor oil and the install new element.
- Prime spin bowl/element with clean fuel.
- Spin bowl/element onto head and tighten firmly by hand.
- Start Aqua-Hot and check for leaks.



## **HEATING SYSTEM - FLOOR (Optional)**

NuHeat is heat matting permanently installed under the tile, carpet and wood flooring. Everyone knows heat rises, which make the radiant concept easier to understand. Radiant heat is the transfer of heat from a warmer surface to a colder surface. Forms of radiant heating have been around for years and are still in use for numerous applications. The easiest explanation of radiant heat can be described by the waves or the image of puddles of water on the highway from a distance.

The NuHeat system, like all heating systems, incorporates a temperature control panel and a sensor probe. A unique feature is the Ground Fault Circuit Interrupter which is added for safety. The mats, which are custom designed for the motorhome, can easily be added to for larger areas of coverage. A single mat will generate 12 watts of heat per linear square foot. Since the NuHeat system uses radiant heat, there is no draft from a motor at start-up or blowing dust and no ducting odor. The mat is so thin (1/8 inch thick) there is no lost storage space and a minimal weight difference.

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### **Control Panel**

- Arrow up will move the temperature up to a higher setting.
- Arrow down will move the temperature down to a lower setting.
- Sun/Day will store and recall a preset comfort level or an economic setting.
- Moon/Night will store and recall a preset comfort level or an economic setting.

The following indicators are located under the face plate for the control panel (the faceplate will need to be removed):

- Test GFCI will be for periodic testing.
- Lamp indicates status of the periodic test.
- Reset restores normal operation after periodic testing.

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### **Testing**

The NuHeat Ground Fault Circuit Interrupter should be tested monthly. The test procedure is nothing more than inserting a paperclip into the small opening labeled Test GFCI to press the test button. The line will open and turn on the Lamp indicator. You can be assured the circuit is functioning properly. If the test fails, shut off the breaker for the heating system and contact a qualified service technician immediately.

**WASHER-DRYER  
PREPARED**

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

- Color coded water supply lines: red line for hot, blue line for cold.
- An 1½” waste water drain line with a threaded cap, a P-trap and an automatic vent cap. This will drain the waste water into the grey water holding tank.
- A designated 120 Volt AC receptacle for a washer-dryer is provided.



**NOTE: Sidewall dryer vents are not part of the prep package. If a sidewall vent is to be installed be sure it is properly sealed to the sidewall.**



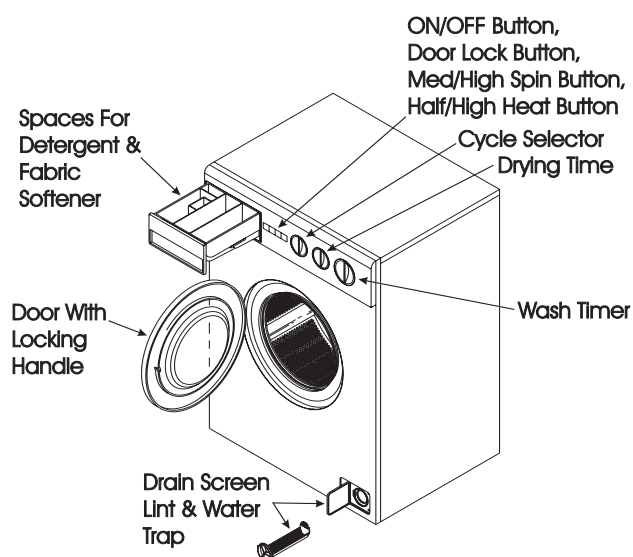
**If a washer-dryer is to be installed at a later date, follow all the manufacturer’s installation instructions.**

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

- Do not connect the clothes dryer exhaust duct to any other duct, vent or chimney.
- Do not terminate the exhaust duct beneath the motorhome.
- Use proper length fasteners 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 air.

This appliance is an automatic washer with a capacity of up to 10 lbs. (4.5Kg) 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 extra spin cycles.

- The Washer-Dryer operates on 120 VAC.
- To operate the Washer-Dryer you will need to be plugged into shore power or have the generator running.
- The Washer-Dryer can be operated while driving down the road. The generator will need to be running and the water pump will need to be on. Make sure the grey tank will have enough room for the rinse cycle.
- The Washer-Dryer water use will be approximately 16 gallons of water per load.

**WASHER-DRYER (Optional)**

## Operating Instructions

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. Operating a rinse cycle to rinse out the washer is recommended. Front load, horizontal axis washing machines require less detergent. Soap suds line should not exceed the halfway point of the glass door.

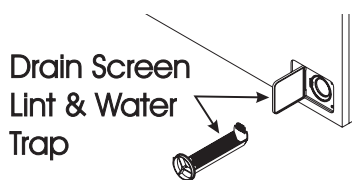
### To begin a wash load:

- Sort and pre-treat clothes.
- Add the measured amount of detergent suggested by the package directions (maximum two tablespoons).
- Load the clothes loosely into the washer. Close the washer door.
- Turn the 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. Do not add these substances to the wash water as they produce vapors that could ignite or explode. Do not use dryer to dry articles containing foam rubber or similar textured, rubber-like materials. Clean the lint screen after each use (if applicable), located in the top left corner on the back of the washer. Keep the area around the exhaust opening and adjacent areas free from lint, dust and dirt accumulation.**

### 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.**

**Winterizing the Washer-Dryer**

To winterize your Washer-Dryer follow the instructions below to avoid freeze damage:

1. With the unit off, remove the wash filter to allow the water remaining (in the pump and drain hose) to be evacuated. Replace the filter.
2. Close the inlet shut-off valves located at the manabloc water manifold system.
3. Open the low point drains to drain all the water.
4. In cold climates, air should be used to blow out the system.
5. Install the water pressure regulator on a short water hose. Connect it to the water system. Use an air hose connector on the female end as this reduces pressure. Make sure one or more faucets are open. Maximum air pressure should not exceed 35 psi.

**If antifreeze is being used in the system follow these instructions:**

1. When putting antifreeze into the water system of your motorhome, set the washer to a warm/warm fill setting and allow water to flow into the unit until the antifreeze is detected.
2. Slowly advance the timer to a rinse cycle and allow the water to flow for 10 seconds. Advance the unit to a spin cycle to remove the majority of the water from the unit.
4. With the unit off, remove the wash filter from the unit. This will allow the water remaining in the pump and drain hose to be evacuated. Replace the filter.
5. Any water remaining in the unit should contain antifreeze and be protected from freezing.



**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.**

As the Washer-Dryer is used, occasionally wipe the exterior of the cabinet 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.**

**Cleaning the Washer-Dryer**

**NOTES**

# NAVIGATOR

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**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. The step is equipped with a power switch. When the 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.

**If the step fails to operate:**

- Make sure the step switch is **ON**.
- Check the main power supply for the step. A 20 amp auto reset 12 Volt DC circuit breaker is located on the rear run 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.

- A five amp ATO blade fuse is used to illuminate the STEP OUT dash warning light. The fuse is located on the front run plate.



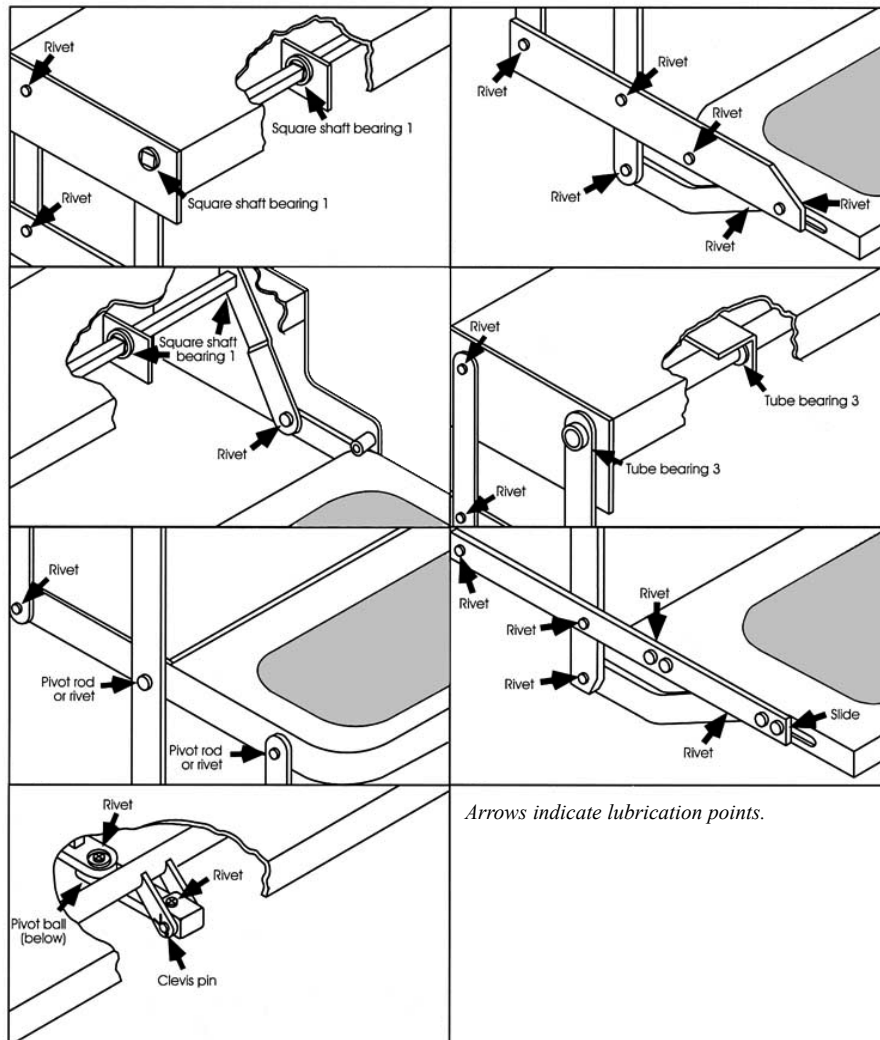
**WARNING: If the motorhome is driven with the step in the extended position there is the possibility of causing major damage to both the step and the motorhome.**

**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 picture.



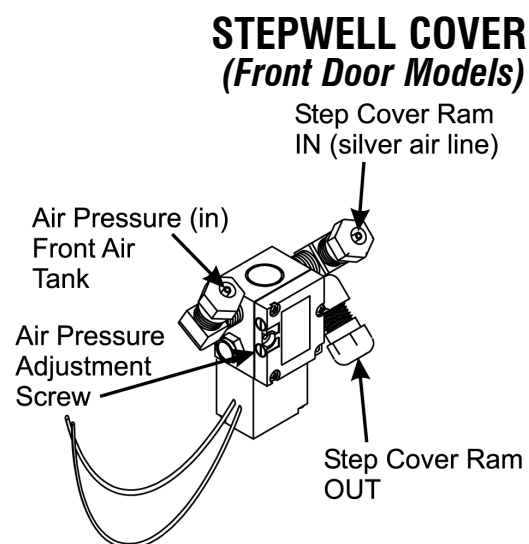
**NOTE: Silicone lubricates and WD-40 are not recommended as they have a tendency to evaporate and dry the mating surfaces which leaves them vulnerable to the elements.**



The motorhome is equipped with a sliding stepwell cover that extends and retracts by the using a dual action air cylinder. The air cylinder is controlled by an electrically operated air valve. The “Mac” air solenoid 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.

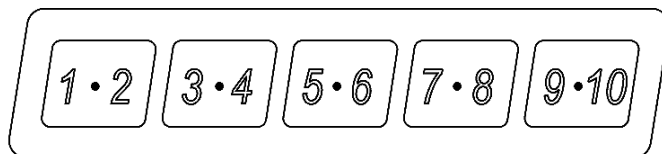
## Adjustments



**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.**

The entry door can be locked or unlocked using the touch key pad located adjacent to the entry door.

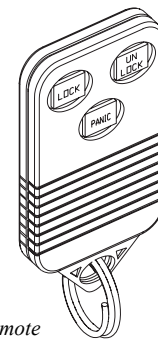
- To lock, shut the door. Pressing 7/8 and 9/0 simultaneously will lock the entry door.
- To unlock, enter your five digit PIN (Personal Identification Number).
- Then Press 3/4 to unlock the bay doors.



Keyless Entry Touch pad

NAVIGATOR

## ENTRY DOOR Keyless Entry System



Remote

5 • 1 4 0

### To Authorize the Remote:



**NOTE: These instructions are for motorhomes equipped with “keyless entry” only.**

If the remote does not respond it may need to be authorized. When authorizing a new remote the entry door must be shut. Turn the ignition key “**on/off**” five times, with the key remaining in the **ON** position at the fifth cycle.

- Using the remote, press the lock button. The entry door should lock.
- Press the unlock button. The door should unlock.
- Repeat procedure twice for each remote to be authorized.
- Turning the key “off/on/off” will exit the remote authorization mode.



**NOTE: If the motorhome is factory equipped with an optional security system, the security system remote will lock and unlock the entry door when the system is armed or disarmed.**

---

### **Latch Adjustments**

The entry door is adjusted at the factory and tested for all operations. The door incorporates three separate seals to eliminate wind noise during travel.

The door uses two separate locks for safety and security. One locking system is the door handle and the other is a dead bolt. The door handle incorporates a primary and secondary latching system. This is used to ensure secure and safe latching. There are adjustments which can be made to help maintain entry door performance.

#### **Adjusting the Entry Door Latch:**

- Determine which bolt needs adjustment.
- Slowly close the entry door observing the latch and strike bolt alignment. Do not attempt to latch if the alignment is off. If the alignment is correct, allow the latch to catch in the first (primary) position only.
- The latch should move to the second position with 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.**

---

#### **Changing the Glass in the Screen Door:**

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

**Screen Door  
- Changing the Glass**

---

#### **Adjusting the Screen Door For Up and Down Location:**

- Loosen the chrome bolts on the hinge side of the screen door; four on the top and four on the bottom.
- There are slots in the steel hinge to allow up and down movement.
- There are four Allen type screws on the top hinge and four on the bottom hinge to adjust the screen door so it fits properly to the door. The hinge should fit tightly to the trim of the door, when the screen door is latched to the door and the door is open.
- Check to see that the pad on the inside of the door is not sitting on top of the aluminum trim of the door. If it is, it will hold the screen door away from the door and you will not have a proper seal. If the pad is too large, re-size the pad.

**Screen Door  
- Adjusting the Glass**

## **SLIDE-OUT ROOM** *Extending Room*

### **To Extend the Slide-Out Room:**

- Move the driver seat forward before activating the slide-out room.
- Confirm that there is at least five feet of clearance outside the motorhome for the slide-out room to extend.
- Ensure the ignition key is in the OFF position.
- The park brake must be applied. The battery cut-off switch must be on.
- The storage bay doors under the slide-out must be closed.
- Ensure people, pets and objects are clear of the slide room travel path.
- Locate the slide-out room control switch in the passenger side overhead compartment above the entry door.
- Press and hold the slide-out room switch in the OUT position. The slide-out room will move slowly to the OUT position. 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.
- Level the motorhome with the leveling system.



**WARNING:** Before operating the slide room ensure people, pets and objects are clear of the slide room travel path. Move the driver seat forward. Ensure there is five or more feet of clear space outside the slide box prior to extending the slide room. The outside area must be clear of any obstructions which may hinder the movement of the slide room. Ensure there is sufficient clearance inside the motorhome. Never move the motorhome with the slide-out extended.



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



**NOTE:** Slide-out room operation should be performed with a full air suspension system. It is not recommended to extend the slide room in snow, sleet, ice or freezing rain. There may be extensive damage resulting from the awning freezing up.

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## **Retracting Room**

### **To Retract the Slide-Out Room:**

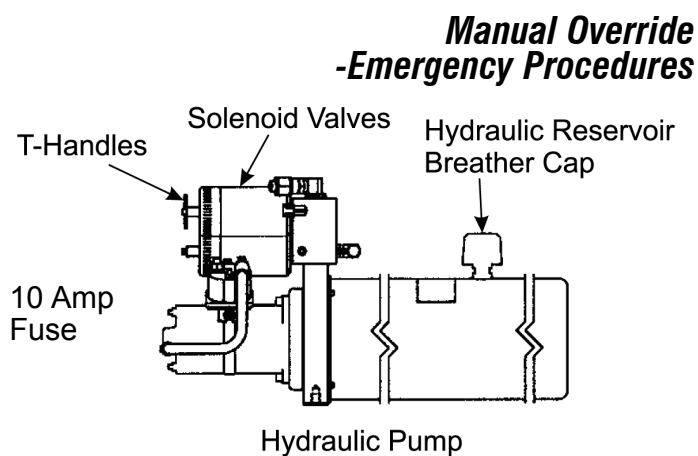
- Check for sufficient clearance inside the motorhome before retracting the slide-out room.
- Clean the floor, if applicable, to ensure there is no dirt or grit that could result in floor damage.
- Start the engine. Allow the air system to become fully charged

- and air ride system to attain normal ride height.
- If applicable, retract all hydraulic jacks or prepare the air leveling system for travel.
- Move the driver seat forward before activating the slide-out room.
- Stop engine. Ignition key remains in the OFF position during slide room operation.
- The park brake must be applied.
- The storage bay doors under the slide-out must be closed.
- Ensure people, pets and objects are clear of the slide room travel path.
- Locate the slide-out room control switch in the passenger side overhead compartment above the entry door.
- Press and hold the switch in the IN position. The slide-out room will move slowly in. To stop the slide-out room during operation, release the switch. To continue the room movement, push and hold the switch in. The motor will change tone when the slide-out room is fully retracted. The slide-out drive motor will not stop automatically, the switch must be released.



**NOTE: Be sure there is sufficient clearance on the inside of the motorhome (drivers seat, etc.) before you retract the slide-out room. If your motorhome has ceramic tile floor, make sure the the floor is clean before you retract the slide-out room. Dirt or grit that is trapped under the slide-out room could scratch the floor. Never move the motorhome without having the slide-out room retracted.**

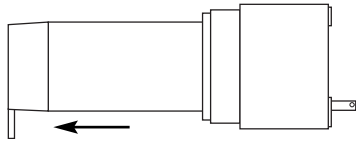
To move the slide-out room manually, retract the motorhome leveling jacks (see “Leveling Jacks”). Locate the slide room hydraulic pump on the lower left front frame of the chassis. Turn the T-Handles counterclockwise approximately six turns each. The T-Handles may turn easily at first, however, they will become difficult to turn as the internal springs are compressed. The room may move slightly as the valves are opened and internal pressure is released. It will require several people to manually move the slide-room. Close the T-handles when the room is fully retracted.



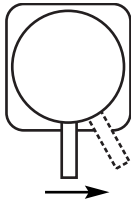
**NOTE: The slide-out room is heavy and may require several persons to push it into the retracted position. When the slide-out room is in the fully retracted position tighten the T-Handles to hold the room in place.**



## Manual Override - Bedroom Slide-Out



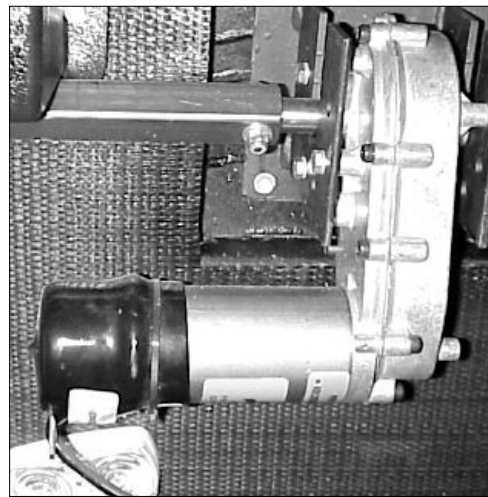
Brake lever.



Rotate  
approx. 30°  
counterclockwise  
to release the  
motor brake.

### Manually overriding the bedroom slide-out:

1. Disconnect the battery cables from the battery.
2. Lift up the mattress and base board to gain access to the slide-out mechanism.
3. The bedroom slide-out motor has a lever on the back side, rotate the lever counterclockwise about 1/8 of a turn (looking from the rear of the motor) to release the brake that locks the room in place. If the motor does not have a lever, use a 1/2" wrench to remove the four motor mounting bolts. Remove the motor.
4. Use an appropriate wrench (a 3/4" wrench/ratchet or an adjustable wrench) on the override to move the room in or out. The override is located on the opposite side of the slide-out rail from the motor.
5. Once the room is in, apply pressure to the wrench so that the room is sealed. Return the brake lever to its normal downward position to lock the room in place. Install the transit bar (if equipped). If the motor does not have a brake lever, apply pressure to the wrench so that the room is sealed and install the transit bar (if equipped). If there is no motor lever and no transit bar, the motor must be mounted back onto the slide-out system to hold the room for transport. If the room is not fully retracted, it will not be sealed from the environment.
6. Take the motorhome to an authorized dealer for service.



Location of slide motor lever.

The slide-out system has been designed to require very little maintenance. To ensure the long life of the slide-out system read and follow these simple procedures:

- The roof of the slide-out should be checked for debris such as pine needles, dirt, leaves, sticks, etc. If the slide-out has been out for a period of time, 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 inner slide rail assemblies. Check for excess build-up of dirt or other foreign material. Remove any debris that may be present.
- If the system squeaks or makes noise, apply a coat of light weight oil to the drive shaft and roller areas. Remove any excess oil so dirt and debris do not build-up. Do not use grease.
- Lubricate rubber seals with silicone spray only.



**CAUTION: Do not work on the slide-out system unless the battery is disconnected.**

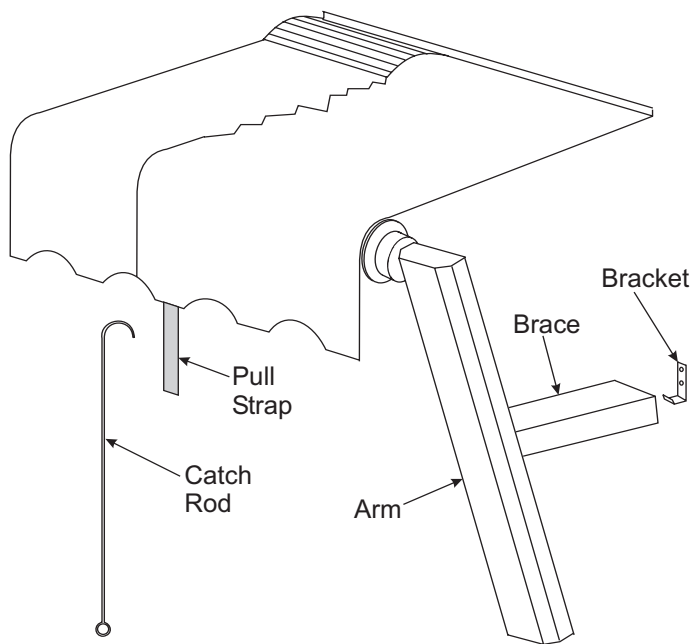


**NOTE: Do not leave the slide-out in the extended position during severe weather. Conditions such as high winds or heavy rain may cause damage to an extended slide-out.**



**NOTE: It is not recommended to extend the slide room in snow, sleet, ice or freezing rain. There may be extensive damage resulting from the awning freezing. In the event the slide-out room is extended in snow, sleet, ice or freezing rain conditions, it is recommended you clear the awning and ensure free movement prior to retracting the slide room.**

## AWNINGS - Front Door



### To Extend The Awning

- Hook the pull strap loop with awning pull rod.
  - Pull strap until awning is at full extension. With free hand, lever out inner arms.
  - Mate the slot of inner arm with hook on side of the motorhome. Repeat procedure for other arm.
  - Release strap slowly ensuring inner arms are secure. Slide the strap to rear of awning roll tube and tie to rear arm.
  - Loosen locking knobs for both arms and extend arms so the canvas will clear door in the open position.

### To Retract Awning

- Loosen locking knobs for both arms. Lower arms to stop bolts. Tighten knobs.
- Untie the pull strap and slide strap to center of awning roll tube.
- Pull down on pull strap with a firm grip until tension is off the inner arms. Fold inner arms and attach them to the velcro.
- Carefully allow material to wind onto awning roll tube while holding strap in a neutral position. This will allow material to roll up evenly.
- Awning end caps should be against the rubber bumpers. If one end cap is off, pull down on awning pull strap while holding strap slightly to opposite side, allowing awning to roll back up into position.



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

## Awning Care & Maintenance

### Care and Maintenance

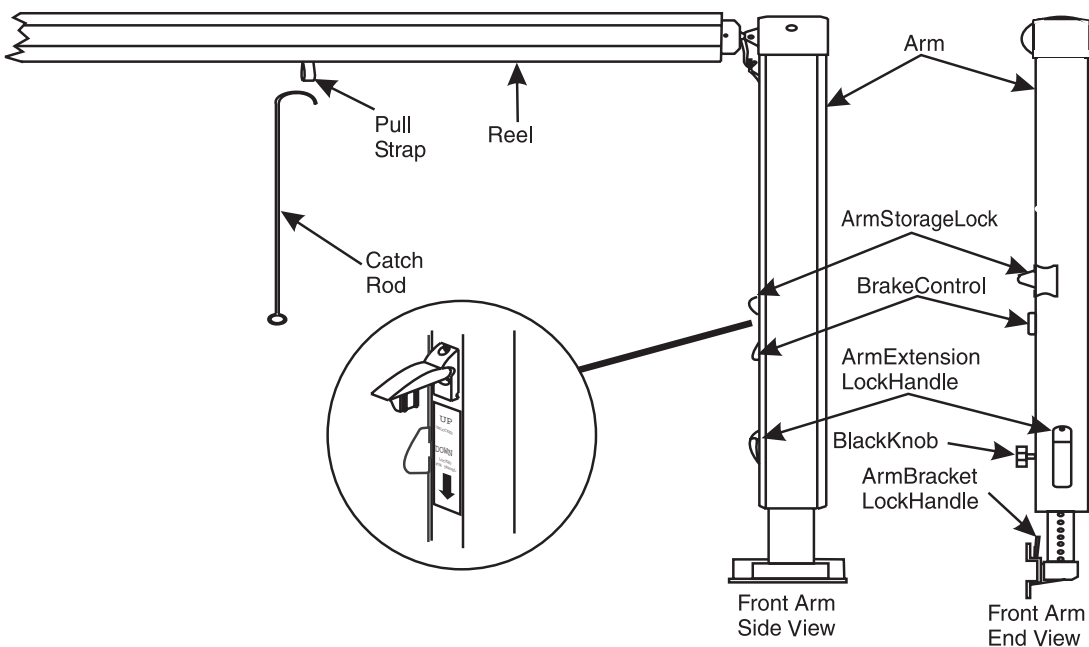
Mildew will not form on the awning material itself, but it may form on the dust accumulated on the canopy. A quality vinyl cleaner, such as Carefree Awning Magic, will help keep your awning looking new. Be sure to follow the instructions on the container.



**NOTE:** Allow the awning material to thoroughly dry before rolling the awning up. Metal surfaces should be cleaned with soapy water and thoroughly rinsed.

**Awning - Patio****To Unlock The Awning:**

1. Loosen the black locking knobs.
2. Lift the arm storage locks located on each upper arm to the unlock position. Slide the brake control, located on the front arm only, to the full up (unlock) position.

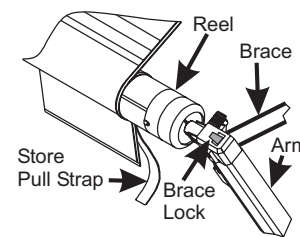
**To Extend The Patio Awning:**

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 the 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.

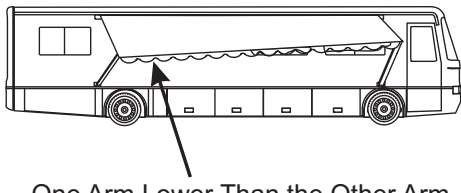
**To Retract The Patio Awning:**

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



One Arm Lower Than the Other Arm

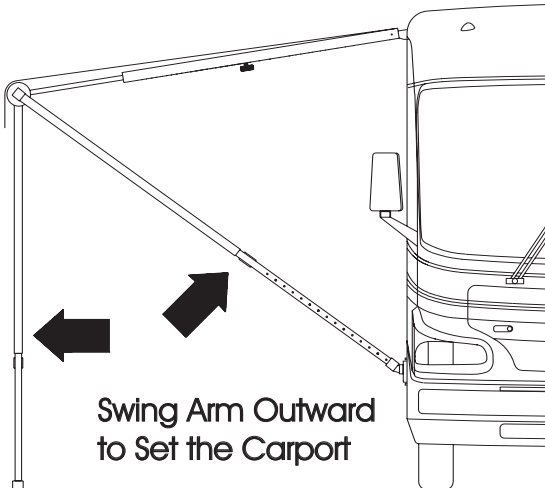
**Rain Release Setting:**

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.

**Using The Carport Feature**

To safely use the carport feature:

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.



**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.

**Care 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. Wash both sides of the awning with a quality vinyl cleaner solution using an awning brush. This process can be made easier with our support, plus other awning maintenance products. Saturate the fabric with the solution and leave it on for 15-20 minutes.

If necessary, reapply the solution to keep the 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.

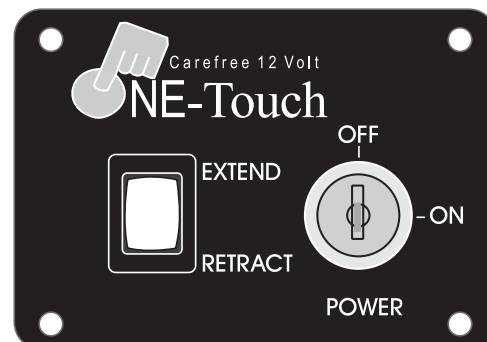
It is normal for slight leakage to occur through the fabric where water is allowed to accumulate or pocket on the fabric. See “Storm Precautions” for information on the awning settings for proper water drainage. Sometimes soap or chemical residue, such as from active agents in insect fog or sprays, can “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 (less time than closing a window), 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.

### ***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.



**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:**

- 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.
- Depress 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:**

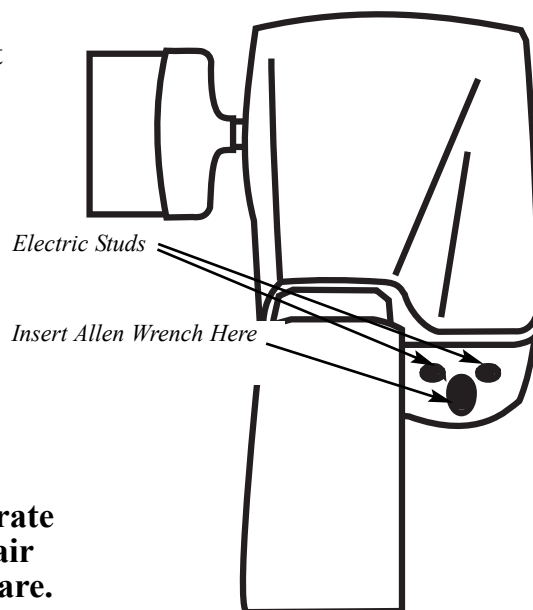
If the awning fails to retract or extend:

- 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.



12 Volt Motor.



**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 Girard Lateral Arm Awning incorporates the very latest in technology and design. This box awning offers total protection in all weather as it applies the following advanced features:

- Convenient push button operation and an optional remote control for state of the art convenience.
- Retractable arms have twin cables for increased fabric tension and longer life. Angle of arm is adjustable from 5° to 35° for maximum comfort.
- All profiles are made from aluminum, which is then powder coated to give maximum protection for both housing and mechanical parts.
- 100% acrylic fabric is weatherproof, permeable to air and resistant to mildew, rotting and fading.
- Motorized operation, which includes a manual/crank override.
- Wind sensor and/or optional remote control.

**Motorized Operation:**

Motorized operation is simple in itself. Motor (110 Volt) is housed in roller tube where it is protected from view and elements. Push the bottom button momentarily to extend the awning all the way. The awning will extend until it reaches the full extend position. Press the top button to retract the awning. The awning can be stopped in either direction, at any point, using the center stop button.

**Awning  
- Automatic Girard  
(Optional)**





**CAUTION: The motor is not designed for continuous use. In the event that the motor is used to excess, it will automatically shut off and be inoperative until internal breaker cools down and resets. The run time is four to five minutes per hour. Reset time will be 30 minutes to one hour depending on the outside temperature.**

The awning will then extend to its full projection. To retract the awning, put the switch in the **UP** position. There is no need to hold the switch once it has been activated. To stop the awning at any point in its projection or retraction, move the switch to the center position. The switch should be left in the center position at all times when the awning is stationary. The motor used in the Girard uses 300 watts and draws approximately three amps of power.

**Manual Operation:**

To manually operate the awning, use the telescoping crank handle supplied and follow the instructions in Manufacturer's manual.

**Wind Sensor:**

The awning is fitted with a wind sensor which is designed to retract automatically in the event of high winds, as long as it has 110 Volt power supply and wind has unrestricted access to wind sensor cup on roof of motorhome. Push the bottom button to extend the awning and the top button to retract it. The awning can be stopped at any point by pushing the center button marked **STOP**.

The wind sensor dominates and will override any push button commands in the event of excessive winds. If the wind sensor is activated the awning will close completely. The awning will not re-open automatically. It must be opened by using the extend button once again. This feature is intended to prevent the awning from extending or retracting excessively, further preventing possible overheating of the motor.

**Care and Cleaning of 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.

---

**Tips**

- Avoid leaving the awning partially extended during rainy conditions. The awning is at the strongest setting when the awning is fully extended.
- If the wind sensor retracts the awning, it is recommend leaving it in until the winds subsides.

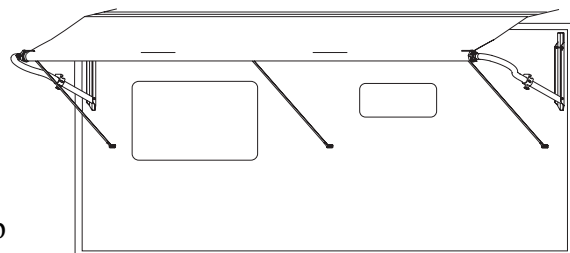
The motorhome is equipped with a slide-out awning that will automatically roll out with the slide room when it is extended. When the slide room is extended, the awning can then be fully extended providing shade to the windows.

## Slide-out Awning

### To Extend the Awning:

The slide-out awning arms are equipped with locks.

- Open the locks with the awning wand.
- Use the wand to pull down on the strap. Grasp the strap firmly hooking the loop on the end of the strap to the catch.



Awning at full extension.

### To Retract the Awning:

- With a strong grasp unhook the awning strap and insert the awning wand into the loop of the strap.
- Carefully allow the spring tension to wind the awning fabric onto the awning roll tube. Do not allow the awning to snap back into place. Damage to the awning or the motorhome may result.
- Secure the awning arm locks with the awning wand.



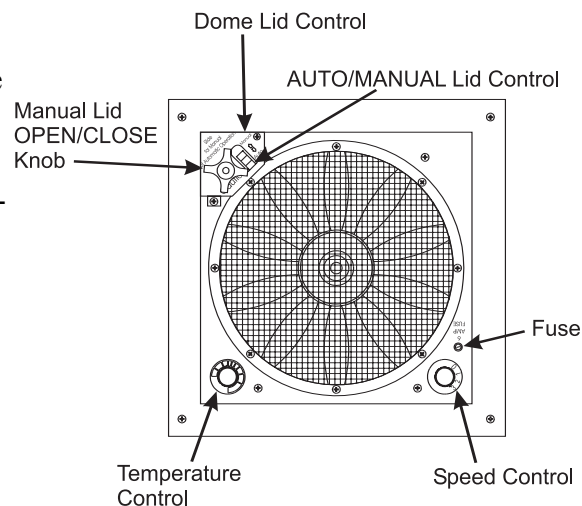
**NOTE:** At least five feet of clearance is needed between the side of the motorhome and any objects, such as trees or fences, to allow the slide room and slide-out awning to be fully extended.



**CAUTION:** The slide room and slide-out awning should be retracted during heavy winds or rain. Rain can be driven up under the slide-out awning and into the motorhome. The slide-out awning should be retracted in high wind conditions as damage can occur to the awning or motorhome. Secure the awning arm locks before travel. Failure to secure the awning arm locks will result in damage to the awning and the motorhome.

## FANS - Bathroom & Galley Fans

The fan is a three speed fan with a **0** or **OFF** position. The fan has a built in thermostat with the operating range within 22° F to 123° F. This range of operation is based on the inside ambient air temperature. This is the dark blue to dark red dial on the fan unit. The fan lid is electrically controlled during normal operations. It can be manually operated by the crank handle and thumb switch located on the fan. The thumb switch should be snapped back in the **AUTO** position immediately after using the **MANUAL** position. Once the lid opens approximately two inches, the fan motor will operate.



**To Operate The Fan:**

- Set fan switch to **ON**.
- Select the desired fan speed.

- 0 = OFF.**
- 1 = LOW.**
- 2 = MEDIUM.**
- 3 = HIGH.**



**NOTE: If the speed switch is in the “0” position the fan cover will not operate automatically.**

**Tips:**

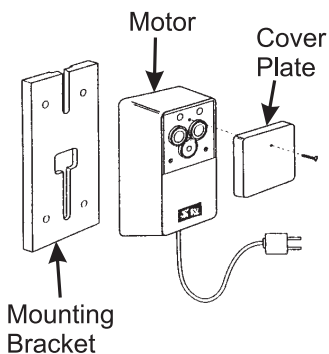
- To keep condensation from accumulating open the vent fan lids slightly to help the air circulate. Condensation occurs naturally from fluctuations in interior and exterior temperatures, humidity and dew point changes, steam from cooking or boiling large amounts of water on the cooktop. Shower usage is another culprit of condensation.
- If the fan fails to operate, check for a blown fuse either in the domestic fuse panel or the 6 amp fuse on the fan.
- To clean, remove the eight screws holding the screen. Use a non abrasive soap and water to clean. Re-install the screen after cleaning.
- Close all the vents when using your Fantastic Fan Vent. Slightly opened window(s) on the shaded side of the motorhome will afford the most comfortable air flow, especially on hot sunny days. Remember you direct airflow by slightly opening windows. Always close all roof vents and position yourself between the open window and your Fantastic Vent for maximum comfort.



**NOTE: Do not leave the fan switch in the active mode while the motorhome is stored or unattended for extended periods of time. High winds other unusual conditions or obstructions may prevent closing. The resulting leakage could cause serious damage.**

**PRIVACY DRAPERY-  
Electric (Optional)**

- Depress and hold the rocker switch on either side. The motor will move the draperies until the switch is released.
- Releasing the switch will cause the motor to stop.
- The receptacle is powered by shore power, the generator and the inverter.



**Internal Thermoswitch Shut-Off:** Your controller is designed for normal use. If run excessively, such as every few minutes, the self contained thermoswitch will shut-off the motor for several minutes. Functionally, the thermoswitch prolongs the life of the product and prevents inadvertent or accidental abuse of the mechanism.



**NOTE: If the cord stretches after use, the consumer may adjust the motor on the wall bracket.**

**Replacing Driver Tire:** A simple procedure is used with removal and replacement of the drive tire. First, cut the old tire off using care not to cut the plastic drive roller. Remove the old tire. Wipe the roller with a dry cloth to remove any dirt or residue. Finally, snap the new tire in place.

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 BED CONVERSION

### 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.

### Sleeper to Sofa:

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

The booth dinette converts into a bed:

- Lift seat cushions to an angled vertical position.
- With a firm grip, lift front edge of the table approximately six inches and push table leg lock to side.
- Swing the table leg up and lock into a horizontal position.
- Continue lifting table until table stays are clear of retainers. Pull outward and lower table down.
- Use both seat cushions and one back cushion for a mattress. Leave one back cushion in a vertical position.

## DINETTE BED CONVERSION (Optional)



**WARNING: Do not occupy the booth dinette or dining chairs while vehicle is in motion. They are not equipped with occupant restraint systems. Chairs must be stored in an enclosed area or secured with tie down straps prior to setting the motorhome into motion to avoid the risk of personal injury to motorhome occupants resulting from a crash or sudden stop.**

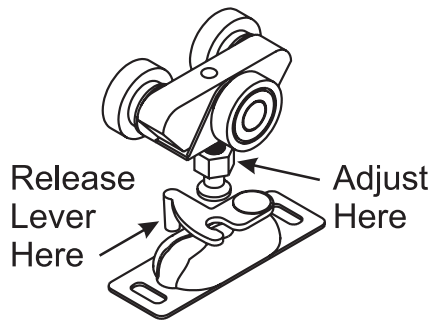
To use the storage compartment located under the bed, locate and unlock the bed deck latches. Lift up the bed by the front edge of the mattress platform. Gas struts hold the mattress and platform open. To access the engine compartment, press down on the button in each latch, open the engine hatch and secure the latch with the hook provided.

## STORAGE - UNDER BED & ENGINE ACCESS



**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.**

## 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 require adjusting. The sliding pocket door should 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 drip of oil once a year to help increase the life of the rollers and improve sliding of the door.

## SUPER SLIDE (Optional)

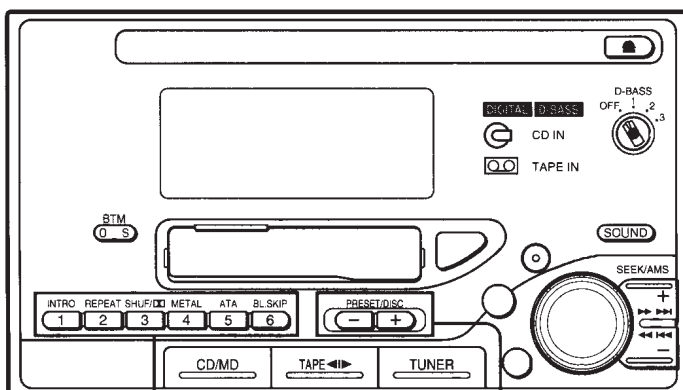
The Kwikie Super Slide is an option that is available for use in the storage compartment bays of your motorhome. This will allow you to slide your payload outward to gain easier access.

- The motorhome must be level before opening.
- There are two latch releases: one that you need to lift and hold up, the other one you will pull outward while pulling on the super slide.
- The 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 and cause bodily harm when the motorhome is not level.**

## RADIO - DASH



The dash radio is a tuner, tape player and a compact disc player. It will store twelve preset FM stations and twelve AM stations. Other features include attenuate mode, loudness control, a 12 hour digital indication clock and autoseek tuning. The compact disc player features fast forward, reverse, random track play, repeat and pause. The radio power can be turned off from two different locations. One button is located on the radio face plate and the other is in the bedroom.

- Turn on the house battery cut-off switch located at entry door.
- Turn the radio on by selecting **TUNER**.
- Turn the radio off by selecting **OFF**.

The TUNER button is used to select or switch from AM or FM. The numbered buttons are used to store or preset stations. Some other buttons which are used during radio mode include the BTM/SENS (Best Tuning Memory/Sensitivity Adjust), SEEK/AMS (Automatic Music Sensor), and the PRESET/DISC buttons. The BTM/SENS will automatically select the strongest band signal and will memorize them in order of frequency. When the SEEK/AMS button is pressed, the stations available for storage will be displayed one at a time. You can store the station by selecting one of the numbered buttons for the location. Once all preset selections are full, if another selection is made it will replace the current selection. Pressing the PRESET/DISC will present the memorized stations in order.

#### **Changing between tuner and CD mode:**

Changing between tuner and CD mode is as simple as inserting a CD. Press the **CD/MD** repeatedly to scroll over until CD is displayed. During CD/MD operations the numbered buttons control various functions of the operations.

#### **Volume Control:**

Volume is controlled when the sound button is pressed for the desired sound quality and changed using the control dial. The bass can be further enhanced with the four position rotary **D-BASS** selector switch. The effect the **D-BASS** has is that of a subwoofer system which boost the curve of the low frequency signal. The digital functions of the **D-BASS** curve produce a sharper and more powerful bass sound.

#### **Clock Operations:**

The clock is displayed when either the radio power button is pressed or the **DSPL** button is pressed. Setting the clock is a simple process, press the **DSPL** for two seconds. The hour display will begin to flash. Rotate the control dial to the desired hour. Next press the **SOUND** button momentarily and the minutes will begin to flash. Again, using the control dial, rotate for the desired minute. When you press the **DSPL** button again the clock will start operating.

1. If the radio does not function, check the house battery cut-off switch to make sure it is ON.
2. If the radio acts erratic, press the reset button. When the reset button is pressed, all memory functions will be erased.
3. The LCD display may become difficult to read at temperatures at or below 41° Fahrenheit.
4. Use the decoy cover as a theft deterrent when system is not in use.

## **CITIZEN BAND RADIO**

A Citizen Band (CB) Radio is installed in the dashboard area of the motorhome. The type and manufacturer may vary depending on availability. According to the Federal Communications Commission (FCC) rules the radio is designed for operation on any of 40 designated CB channels.

The following will cover the basic controls of most CB units:

- **PRESS TO TALK SWITCH** - Located on the microphone. It is used to control the reception and transmission. Press the switch to transmit. Release it to receive.
- **ON/OFF VOLUME CONTROL** - Turns the unit on and off and controls the speaker volume.
- **SQUELCH CONTROL** - Allows the operator to set the receiver sensitivity to a position where the noise is inaudible. Strong signals (above the setting) will be heard.
- **CHANNEL DISPLAY** - Where the selected channel is indicated.
- **CHANNEL SELECTOR** - This control selects the desired channel for transmission and reception. All channels except channel 9 may be used for communication including rendering assistance to motorists.



**For information regarding the specific unit installed in the motorhome please refer to the CB manufacturer's Owner's Manual.**

The motorhome is equipped with a cell phone antenna. The antenna lead is located behind the dash instrument cluster. To access the lead remove the inspection panel located on top of the dash pad. The antenna lead run is installed from the roof down the driver's side A-pillar. This is the section between the drivers' side window and the windshield. The coiled antenna lead should be located toward the front firewall, directly behind the instrument cluster.

## CELL PHONE - PREWIRE

The motorhome is equipped with a remote control color television located above the pilot seat. The outlet for front TV is controlled by the ignition switch so that the front TV can only be viewed while the vehicle is at rest. The TV operates from 120 Volt AC power only which 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 lighting being used.

## ENTERTAINMENT SYSTEMS Television (Front) w/Lock-out Feature

The motorhome is equipped with a power television antenna with built in electronics which uses 12 Volt DC to "boost" signal strength. Weak or fuzzy signals 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 waves, like rings from a rock thrown into a still pond. The radiating television signal can bounce back from an object such as a mountain. 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 by lowering the antenna.

## Television Antenna

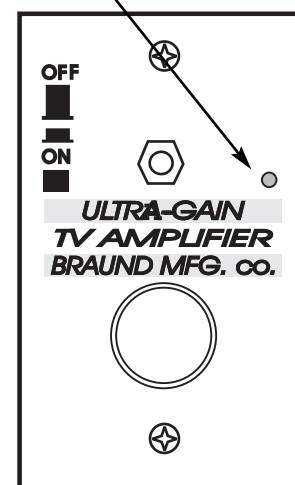
### Antenna Booster Operating Instructions:

- The antenna booster is located in the cabinet above the driver's seat, to the left.
- The power supply switch must be on.
- The green light will glow when the amplifier is on.

### To Troubleshoot TV Reception With Amplifier Installed:

- Check the domestic battery for correct voltage. The antenna booster receives power from the domestic fuse block inside the coach.
- Check the fuse from the grey wire.
- If there is no picture or the picture is weak, be sure the antenna is working. If it is working and the picture is weak, an

*Green Light is illuminated when the amplifier is on.*



12 Volt Antenna Booster.



amplifier may not improve it.

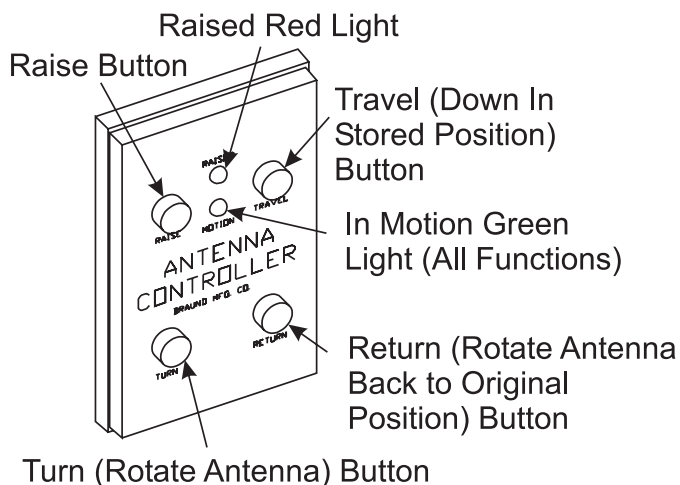
- Check for 12 Volt DC and correct polarity on the input lines. Make sure the coax fitting and center wire are making contact at the antenna and the amplifier.
- If there are white roller bars on TV, check that the power to the amplifier is coming from the battery side of the converter.

### Troubleshooting the Coax Wire

Weak or no picture. 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 conductor 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 come 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.

### To Raise the Antenna:

Visually check for clearance above the motorhome before raising the antenna. To raise the antenna press the **RAISE** button. The green light is **ON** when the antenna is in motion. The red light is **ON** when the antenna is raised.



**To Rotate the Antenna:**

Press the **TURN** button to rotate the antenna for improved reception. Press the **RETURN** button to rotate the antenna to the original position for further adjustment. The green light is ON when the antenna is in motion.

**To Lower the Antenna:**

Press the **TRAVEL** button to lower the antenna into the stored position for travel. The green light is ON when the antenna is in motion. Do not move the motorhome until the antenna is all the way down.



**WARNING: Do not raise the TV antenna near overhead electrical wires. Contact may cause serious injury or death. Do not move the motorhome when the TV antenna is up. There is a ANT UP warning light on the dash panel. When this light is lit lower the antenna before moving the motorhome.**

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 phone or laptop computer.

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

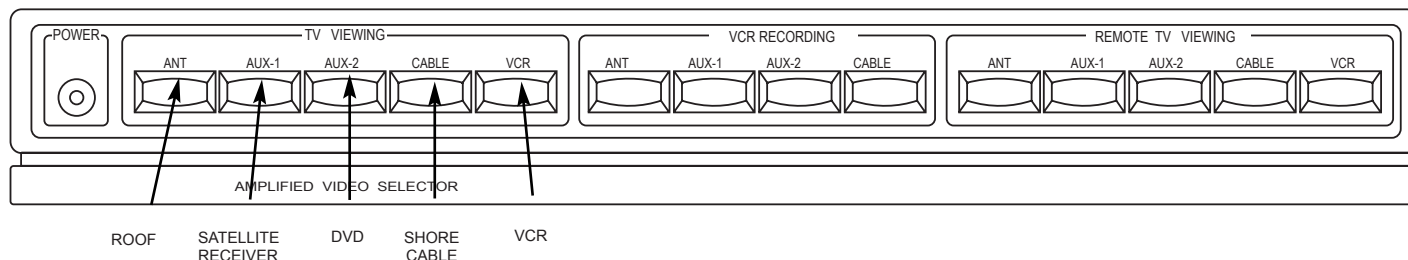
The video selector box requires a 120 Volt AC power source to function. When the power requirement is met the red LED will illuminate.

### **Video Selector Box - Powered**

There are three separate control areas of the video selector box. The front television and the optional storage bay television (if offered) are controlled with the **TV VIEWING** push buttons. The push buttons select which input that section receives.

**Push Button Selections:**

- **ANT** is the **Roof Television Antenna** which uses the TV or VCR tuner for channel selection.
- **AUX 1** is the **SATELLITE RECEIVER** (Optional).
- **AUX 2** is the **DVD**. The TV channel selection must be on channel 3.
- **CABLE** is the **Shore Cable** coax feed.
- **VCR** button uses channel 3 on the TV. Channel selection can be made with the VCR Tuner.





**NOTE: The TV located in the bay receives the same input signal as the front TV.**

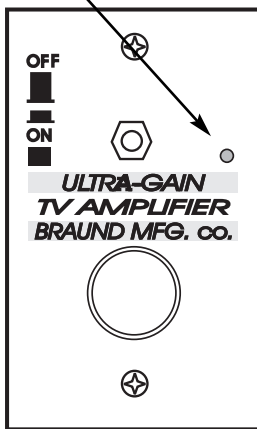
These same push buttons are located in the **REMOTE TV VIEWING** section. These are for use with the Bedroom television.

The section labeled **VCR RECORDING** is used to select the program source which will be recorded with the VCR.

- **ANT** is the **Roof Television Antenna** which uses the VCR tuner for channel selection.
- **AUX 1** is the **SATELLITE RECEIVER** (Optional).
- **AUX 2** is the **DVD**. DVD discs are protected under copyright laws and cannot be taped.
- **CABLE** is the **Shore Cable** coax feed which uses the VCR tuner for channel selection.

### Home Theater

Green Light is illuminated when the amplifier is on.

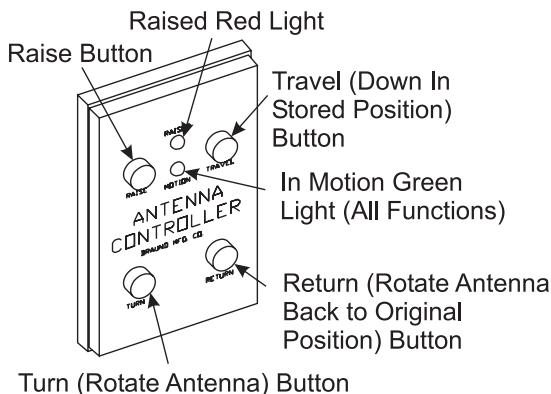
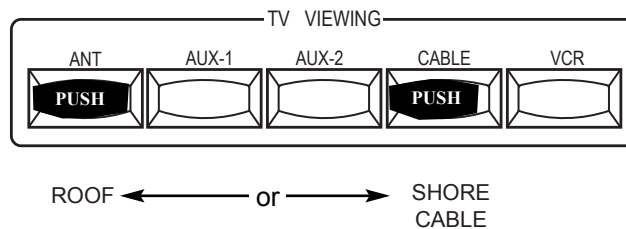


12 Volt Antenna Booster.

### Quick Start Procedures for Bose Lifestyle “30” System:

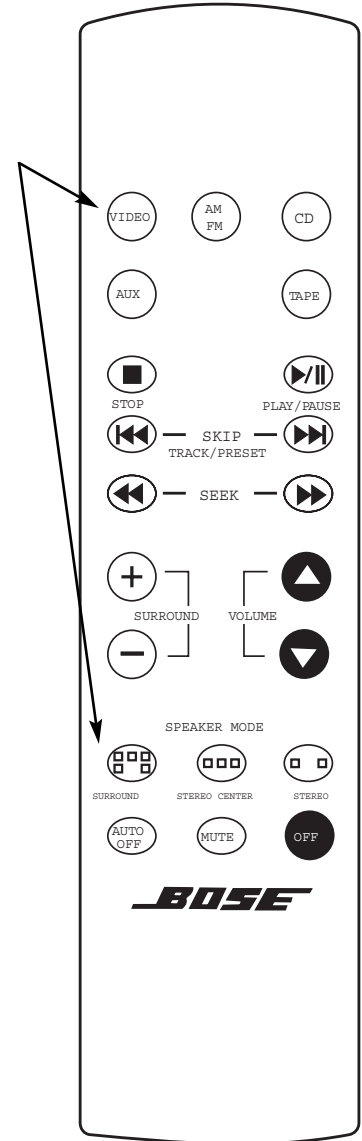
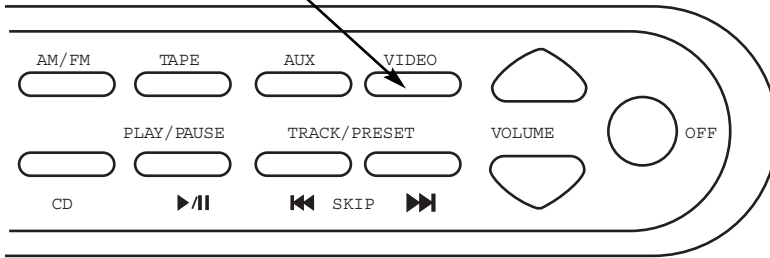
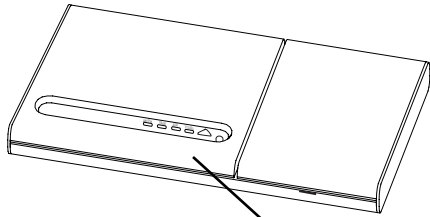
#### To Watch the Television - Front (Roof Antenna or Shore Cable):

1. **For the Roof Antenna:** Raise the roof antenna. Turn the TV Amplifier on. The green light will come on. **For the Shore Cable:** Connect the shore coax cable to the coach service bay.
2. Push either the **ANT** button or the **CABLE** button located on the Video Selector under **TV VIEWING**.
3. Turn on the Front TV and select the desired TV channel.



**NOTE: Optimum reception may require antenna adjustment.**

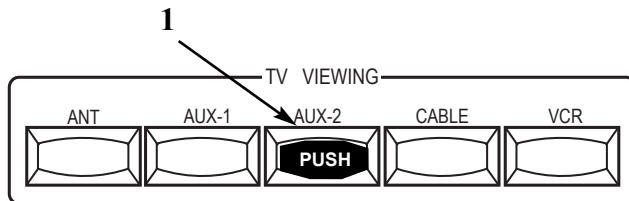
4. From the "Bose" Control Center, push the Source Select button until VIDEO appears on the screen or use the remote and select VIDEO 1. Select one of three surround speaker sound buttons from the remote and adjust the volume as desired.



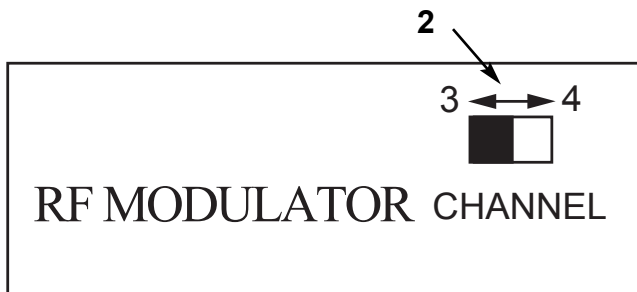
**NOTE: Certain TV models require the TV volume be turned up to a low level of sound for the BOSE system to function.**

**To Watch a DVD - Front Television:**

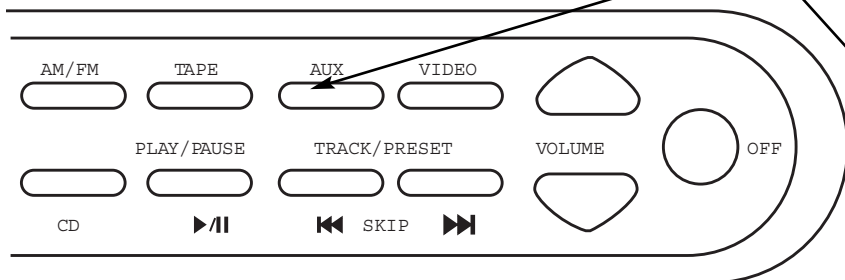
1. Push the **AUX 2** button located on the **Video Selector** under **TV VIEWING**.



2. Turn on TV and Select Channel 3, or the same channel as the RF modulator.
3. Turn on DVD player and insert a disc. It will start playing automatically.



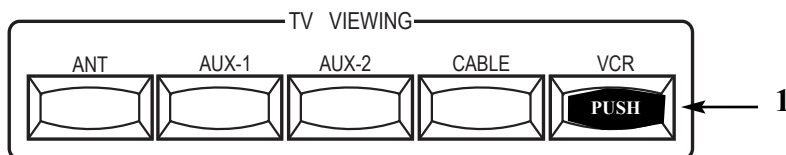
- Use either the **“Bose” Control Center** or its remote. Push the **AUX-2** button on the **Video Selector**.



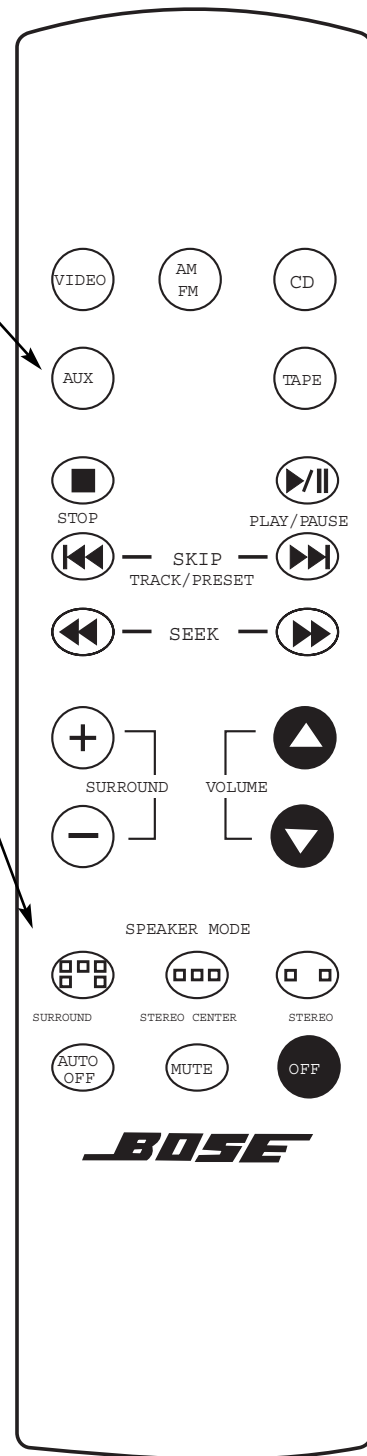
- Select one of the three surround speaker buttons from the remote. Adjust the volume as desired.

**To Watch A VCR Tape - Front Television:**

- Push the **VCR** button located on the **Video Selector** under the **TV VIEWING** section.



- Turn on the Front TV and select channel 3.
- Turn on the VCR and insert a tape. The tape will begin to play automatically.
- Use the **“Bose” Control Center** or its remote. Push the **TAPE** button.
- Select one of the three surround speaker buttons from remote and adjust the volume as required.



**To Listen to the Radio:**

1. Use the “**Bose**” **Control Center** or its remote. Push the **AM/FM** button. This will turn on the music system and select the most recently played station. The **AM/FM** button allows selection of the AM or FM bands.
2. Use the Tune buttons on the control to select the station of choice.
3. Select one of the three surround speaker buttons from remote and adjust the volume as desired.



**NOTE: The Bose system can store up to twenty AM or FM stations in any combinations.**

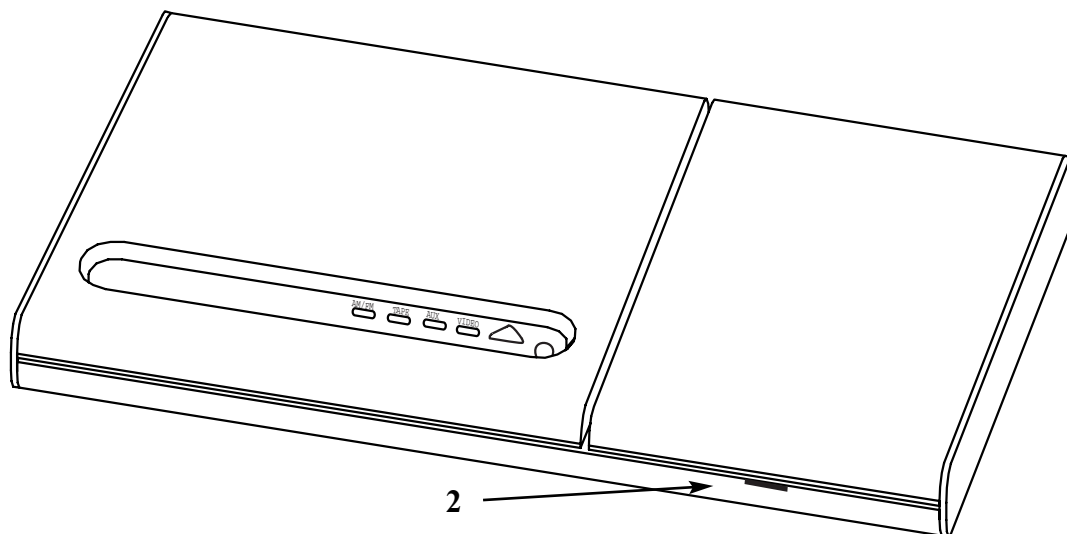
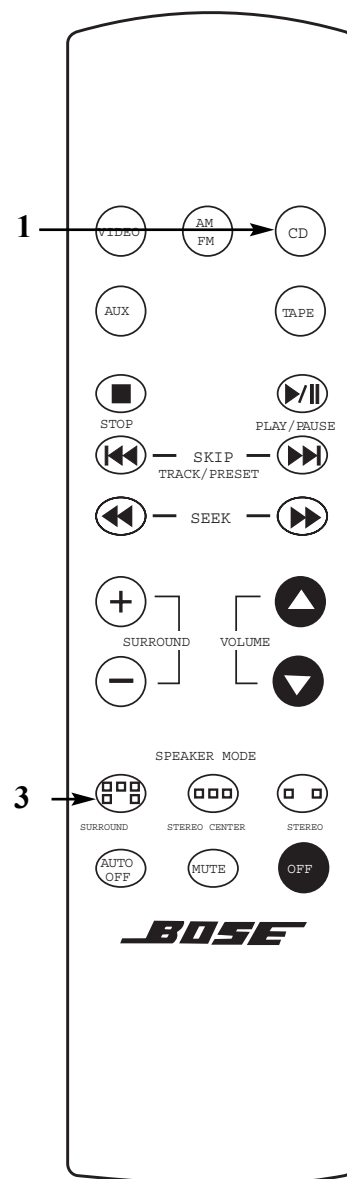
**Listening to the CD:**

1. Use the “**Bose**” **Control Center** or its remote. Push the “**CD**” button. The system will power up in the **CD** mode.
2. Raise the cover for the CD and load the cartridge. Place the CD in the cartridge label side up. Close the CD cover.
3. Select one of the three surround speaker buttons from remote and adjust the volume as desired.
4. The following buttons can be used with the CD functions:

**PLAY/PAUSE:** Starts the CD or pauses the CD.

**STOP:** Stops the rotation of the CD.

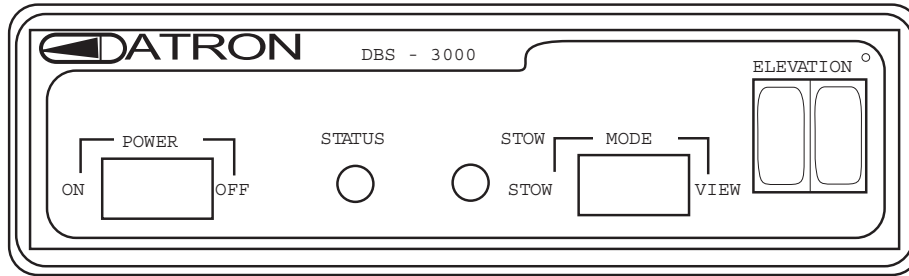
**SKIP:** Skips to the next track.



**Satellite (DSS)  
(Optional)**

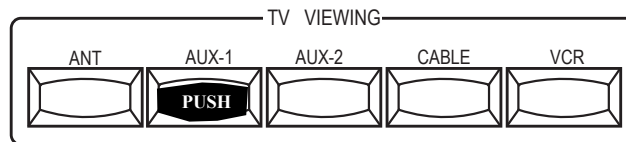
**To Watch the Satellite (DSS) - Front (Optional):**

1. Turn the power ON for the Antenna Control Unit. This requires 12 Volt DC. The Battery Cut-Off switch must be on.



Antenna Control Unit

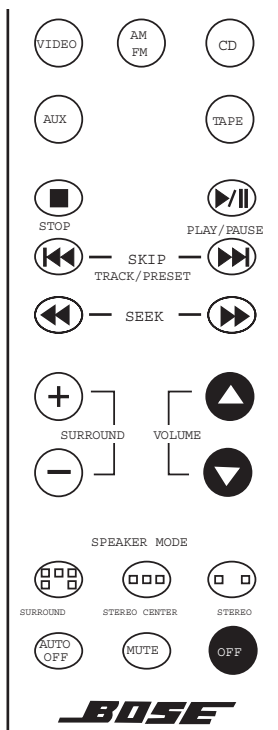
2. Ensure the **Elevation Angle Selector** is set to the proper elevation. This setting will change with locations. The DSS User's Guide describes this process.



3. Select the **VIEW** mode on the **Antenna Control Unit**. The Antenna will search for the Satellite.
4. The **Satellite Receiver** will turn on automatically when **VIEW** is pressed.
5. Use the Video Selector under **TV Viewing**. Push the **AUX 1** button.



6. Turn the TV on and Select Channel 3.
7. From the **"Bose" Control Center**, or its remote, push the **VIDEO** button. Select one of the three surround speaker buttons from the remote and adjust volume as desired.



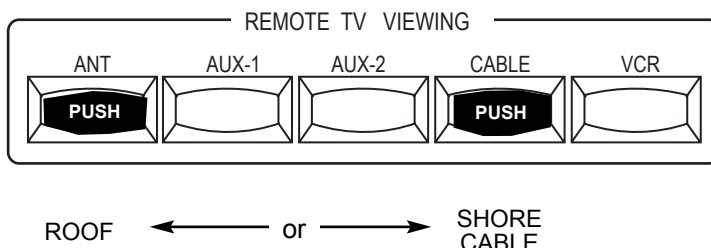
**NOTE: The satellite remote can be programmed for Infrared Ray (IR) or Radio Frequency (RF). This will enable either line of sight or control from another area. The IR setting requires the remote to have a direct line of sight to the satellite receiver. The RF setting allows the remote to operate the receiver from any room.**



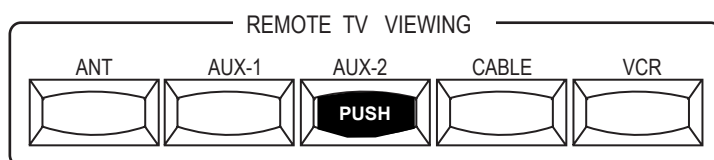
**NOTE: An alternate method to view the satellite is through the VCR. Select VCR under TV Viewing. Press the TV/Video button, and input select on the VCR Remote. L1 will be displayed. Select TAPE from Bose system for surround sound.**

**To Watch the Television - Bedroom:**

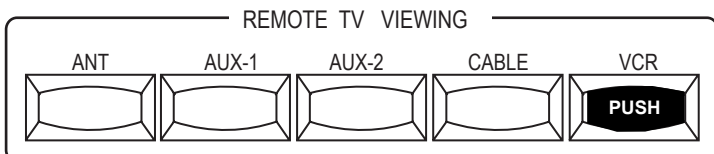
1. **Using the Roof Antenna:** Raise the roof antenna and turn on the TV Amplifier. The green light will come on.  
**Using the Shore Cable:** Connect shore coax cable to coach service bay.
2. Push either the **ANT** button or the **CABLE** button located on the Video Selector under **REMOTE TV VIEWING**.
3. Turn the bedroom TV on and select the desired TV channel.
4. Use the TV or the TV Remote to adjust the volume.

**To Watch a DVD - Bedroom Television:**

1. Push the **AUX 2** button located on the **Video Selector** under **REMOTE TV VIEWING**.
2. Turn the TV on. Select Channel 3.
3. Turn the DVD player on and insert a disc. It will start playing automatically.
4. Use the TV or TV Remote to adjust the volume as desired.

**To Watch a VCR Tape - Bedroom Television:**

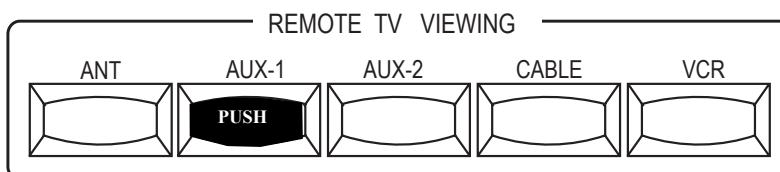
1. Push the **VCR** button located on the **Video Selector** under **REMOTE TV VIEWING**.
2. Turn on the VCR and insert a tape. The tape will start to playing automatically.
3. Turn on the bedroom TV and select channel 3.
4. Adjust the sound level on the TV or by using the TV remote.





**To Watch the Satellite (DSS) - Bedroom Television:**

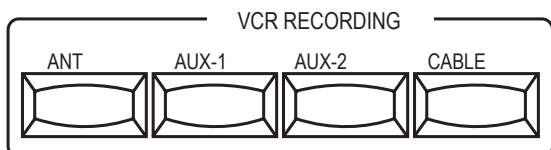
1. Turn the power ON for the **Antenna Control Unit**. This requires 12 Volt DC. The Battery cut-off switch must be on.
2. Ensure the **Elevation Angle Selector** angle is set to the current location. The DSS User's Guide describes this process.
3. Select the **VIEW** mode on the **Antenna Control Unit**. The Antenna will search for the Satellite.
4. The **Satellite Receiver** will turn on automatically when **VIEW** is pressed.
5. Go to the Video Selector. Under **REMOTE TV VIEWING** push **AUX 1** button.
6. Turn on TV and Select Channel 3, or the same channel as the **RF Modulator**.



**NOTE: The satellite remote must be programmed for RF to operate from the bedroom area. Refer to the satellite receiver manual for the procedure.**

**To Record Using the VCR:**

1. On the **Video Selector** under **VCR RECORDING** push the button that represents the program source you wish to record.



- **ANT** is the **Roof TV Antenna** which uses the VCR tuner for channel selection.
- **AUX 1** is the **SATELLITE RECEIVER** (Optional)
- **AUX 2** is the DVD. DVD discs are copyrighted and cannot be recorded.
- **CABLE** is the Shore Cable coax feed which uses the VCR tuner for channel selection.

2. Please use the prior instructions on how to activate each piece of Audio/Video equipment as desired.
3. Turn on the VCR and insert a blank VCR tape.
4. Push the record button on the VCR or VCR remote to begin recording.



**NOTE: If recording a “Surround Sound” program from the satellite receiver only, you must select Line Input from the VCR remote, using the Input Select button. This is the highest quality audio.**



**NOTE: You can record something from one source, such as the satellite receiver, while viewing a TV program from the shore cable.**

# NAVIGATOR

## SECTION 6 WATER SYSTEMS

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This section contains information on the operation and care of the various water system equipment found in the motorhome. The motorhome is equipped with two separate water systems. Optional water equipment will also be discussed, so not all information may be applicable to your 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 everyday when you are at home. Newcomers to self-contained motorhomes soon discover that water does not last very long unless some basic water conservation techniques are applied. For instance, you can use less water while showering if you wet down, turn off the water to soap up, then turn the water back on to rinse off. This way a sufficient shower can be taken using five gallons or less of water.

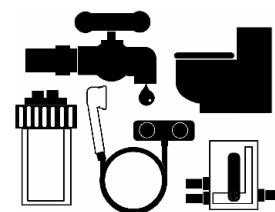
### Fresh Water System:

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.

### 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 SYSTEM General Information

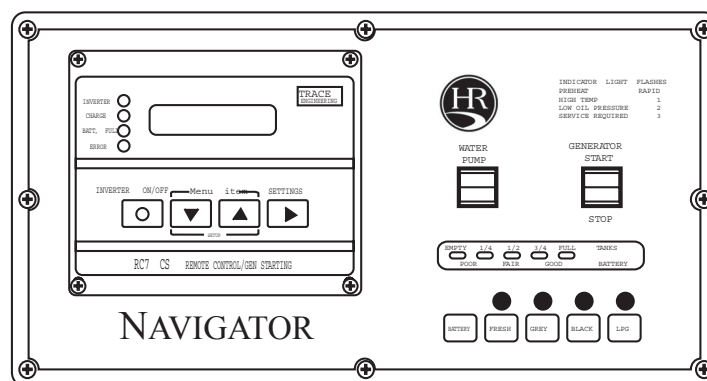


The motorhome is equipped with a monitor panel. Features include: a combination gauge that reads all water tanks (fresh, grey and black) and LP-Gas levels, separate AC and DC voltage indicators, water pump on/off switch, generator start/stop switch and the RC7GS inverter remote panel.

### Meters:

The meters for voltage and amperage monitor the AC voltage values. Each pair of volt and amp meters monitor one of the two "hot" supply lines of the 240 Volt system. Voltage and amperage values are measured inside the AC breaker panel. These meters are useful guides indicating correct, high or low AC voltage conditions. The meters monitor AC power supplied from either shore power or the generator.

## MONITOR PANEL Measurement & Calibration



Monitor Panel.



Monitor Adjustment Tool.

**Generator Switch:**

This switch starts and stops the generator.



**NOTE: If the auto-gen start system is programmed the system will override the generator start/stop switch. The RC7GS remote will then have to be used to manually start or stop the generator.**

**Tank Measurement:**

To measure the level of any holding tank push the switch on the monitor panel corresponding to the tank you wish to measure.



**NOTE: If the domestic batteries are not at a full state of charge tank readings will not be accurate.**

**Calibration:**

The monitor panel is calibrated at the factory for accuracy and should not require adjustment. If the system is displaying incorrectly calibration may be necessary.

- Completely fill the tank to be calibrated.
- Locate the three adjustment screws (one for each tank) behind the monitor panel.
- Using the adjustment tool simultaneously push the button for the tank and rotate the adjustment screw until a full tank reading is obtained.
- Repeat the procedure as necessary for the remaining tanks.
- The water tank sensors are located on the curbside of the motorhome at the end of the holding tanks.



## WATER TANK - FRESH WATER FILL

- Connect the hose to city/fresh water hook-up located in the service center on the roadside of the motorhome.
- The city water valve must be in the OPEN position.
- Turn on the water supply.
- The water pump should be in the OFF position.
- The fresh water tank has an overflow located on the curbside of the motorhome. When the water starts to come out the overflow pipe shut the water supply off as soon as possible.



**NOTE: When connecting the motorhome to fresh water be sure to use a hose manufactured and labeled for potable water to ensure that the hose will not flavor the water.**

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.

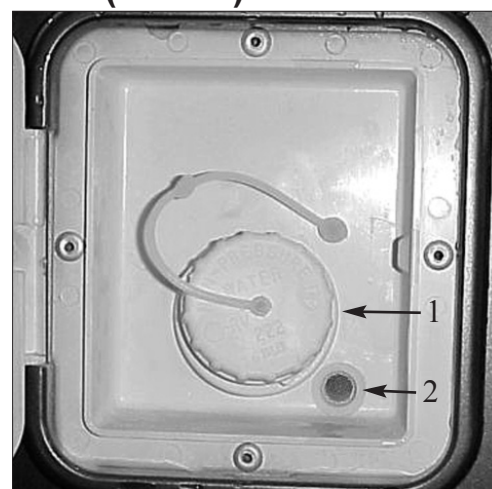
### Filling the Tank:

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

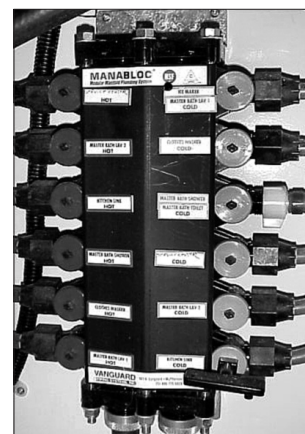


1. Gravity Fill Opening. 2. Vent Opening.

The Manibloc water manifold system separates the main hot and cold lines. The main hot and cold inputs are divided into the individual branch lines. Water flows unrestricted with no hidden fittings located behind walls.

Each faucet or appliance water line may be turned off individually. The hot water valves are located on the left and the cold water valves are on the right. Use the key provided to turn on or off any water line. When key is horizontal the water line is open. Turning the key to the vertical position shuts that water line off. Each water line is labeled for easy reference. Snap the Manibloc key into the storage position after use.

## PLUMBING MANIFOLD



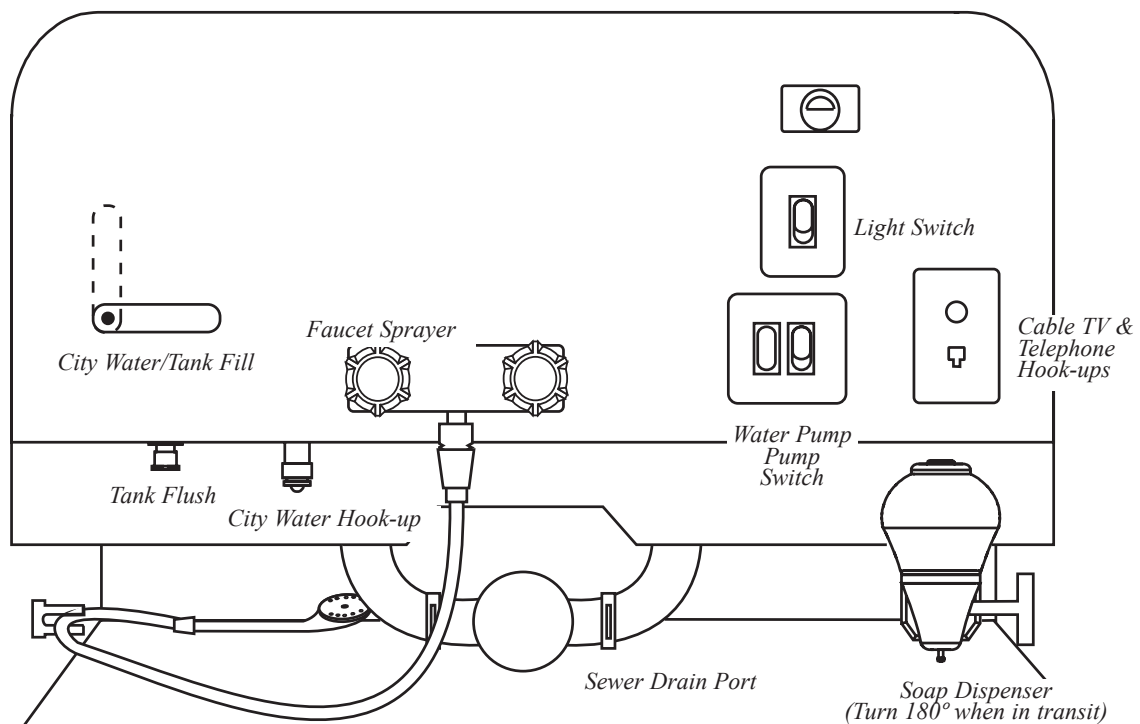
1. Manabloc tee handle. Each water line can be turned off.

## WATER - CITY HOOK-UP

- Connect the hose to city/fresh water hook-up located in service center on the roadside of motorhome.
- The city water valve must remain in closed position.
- Turn on the water supply.
- The water pump can either be in OFF position or in ON position. It will not affect the water pump to leave it on.
- City/fresh water connection has a built in pressure regulator and one way check valve that protects the motorhome to 45 lbs.



**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. The motorhome comes with a pressure regulator which should always be connected to the city water faucet to regulate hose and coach pressure.**



The water pump pressurizes the fresh water system when the motorhome is not connected to city water. The water pump is totally automatic and self-priming, operating on demand as water is used. The pressure equalizer tank relieves the water pump from cycling when a small amount of water is used. The water pump is located in a storage compartment of the motorhome.

## WATER PUMP



Water Pump.



**WARNING: Before leaving your 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 the responsibility of the owner, not the manufacturer.**

### Latching Controller

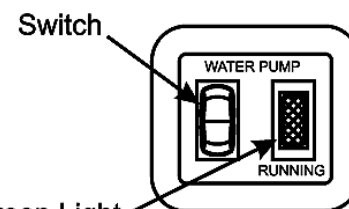
The latching controller circuitry allows multiple switch locations to operate the water pump. Pressing one of the water pump switches provides a momentary ground signal to the latching controller, turning the water pump on or off from any location. An indicator lamp at each switch location illuminates when the water pump is on.

The water pump may be operated from the following locations:

- The monitor panel.
- The bathroom.
- The service center.
- The galley.

To turn the water pump on or off:

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



Green Light

Water Pump Switch.



**CAUTION: Do not continue water pump operation when the fresh water holding tank is empty. Damage to the water pump or electrical supply system may result.**

**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 shower.
- Turn the water pump on and 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).



## **Troubleshooting**

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 tightening the hardware. Check the following items:

### **The water pump will not start/blows the fuse:**

- Check the electrical connections, fuse or breaker, main switch and ground connection.
- Check the electrical connections at the latching controller.
- Is voltage present at the pressure switch? Bypass the pressure switch.
- Is the latching controller grounding the water pump?
- Check the charging system for correct voltage and good ground.
- Check for an open or grounded circuit or motor.
- Check for 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:**

- Check to see if 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.

### **The water pump is rapid cycling:**

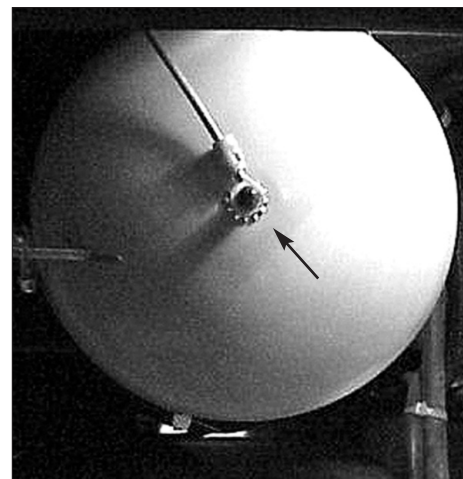
- Look for restrictive plumbing/flow restrictors in the faucets or shower heads.

The pressure accumulator tank is mounted in the water bay near the water pump. The accumulator tank will need to have maintenance checks completed bi-monthly. The accumulator features:

1. Smooth flow from the faucets.
2. Reduced water pump cycling.
3. A precharged air cushion.
4. Elimination of pulsations and water hammer.
5. Pressure of water at faucets.

The accumulator tank has a tire valve for checking the air pressure in the tank. The precharged pressure must not exceed the water pump cut-in pressure, the pressure at which the pump restarts. The water pump has a cut-in pressure at 40 psi. Air pressure in the accumulator tank should be set at 18 to 22 psi and should not exceed 25 psi. To check the air pressure in the accumulator tank the water pump and city water will need to be off so that the water pressure is relieved. Open a faucet to relieve the remaining water pressure. Using a tire air pressure gauge, one which reads low air pressure, check the accumulator tank pressure bi-monthly. In the event you need to add air pressure to the accumulator tank, a manual pump is recommended. Airflow and pressure from a compressed air system can overcharge the tank too quickly causing the tank to rupture.

## PRESSURE ACCUMULATOR TANK

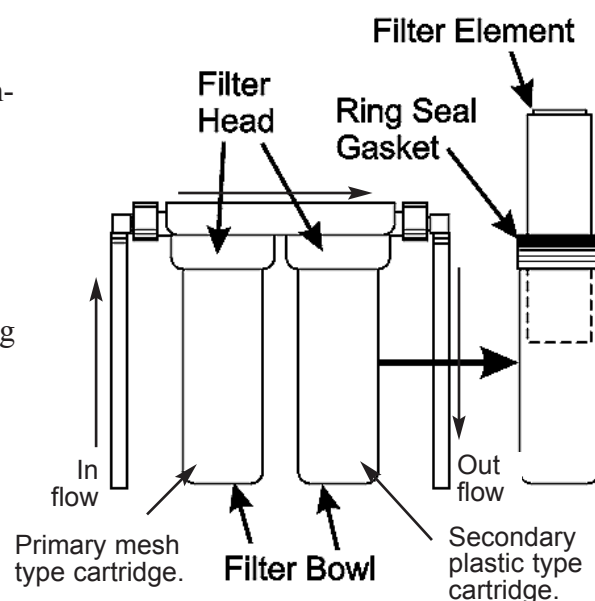


Remove tank valve cap to check air pressure.

A 2-stage filtration system if used and consists of the following filters:

- **First Stage 5 Micron Sediment Filter:** For reduction of suspended solids, dirt and rust down to 5 microns in size. Life expectancy varies with incoming water condition. Recommended change of six months to one year depending on incoming water quality and use.
- **Second Stage 56 Cubic Inch Granular Activated Carbon Filter:** Improves water quality by reducing volatile organic chemicals, chlorine, tastes and odors. Capacity of 1,500 gallons. Recommended change of six months to one year depending on incoming water quality and use.

## WATER FILTERS





Water Filter Removal Wrench.

The filter elements will need to be removed and the filter bowls reassembled, without the elements, before disinfecting the water system with a chlorine bleach solution. To change the filter elements use the following procedure.

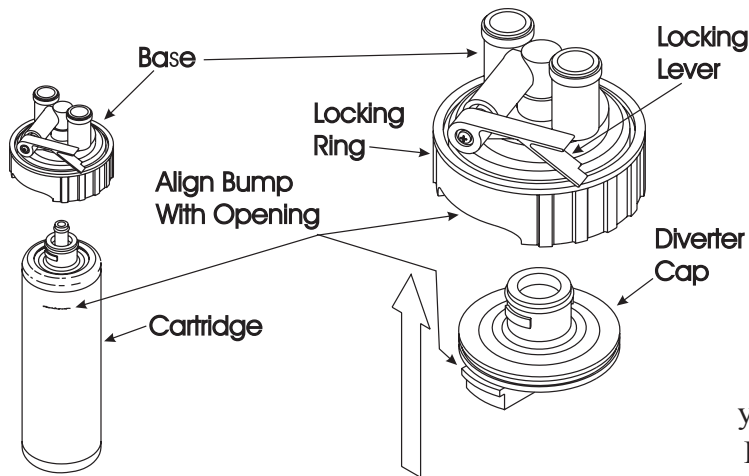
**To Remove:**

- Turn off the water supply and the water pump. Open the faucet to bleed off pressure.
- Unscrew the filter bowl from the filter head.
- Remove the old element and empty any remaining water in the bowl.

**To Install:**

- Place the elements in the bowls, observing primary and secondary filter locations.
- Screw the bowls onto the filter heads, hand tight.
- Turn on the water pump or city water.
- Open the outside faucet and purge air from the filter assembly.
- Check for leaks.

**Galley Filter**



Your Everpure water filter is located under the galley sink, and may have been installed without its cartridge. You can easily install the units ADC Cartridge by following the simple instructions on the cartridge wrapper. You will know a fresh replacement cartridge is needed when the flow of water from your faucet becomes too slow for convenience. How often will this occur? That depends on how cloudy your unfiltered water is and how much water you use.

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 inside the cartridge. As the cartridge actively removes the impurities from the water, its microscopically small pores slowly 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, eventually the flow will stop entirely. Even when a decreasing flow does not demand it, at least one cartridge change a year is recommended for reliable performance from your Everpure Water Purification System.

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. If a water line or fitting is leaking try to tighten the fitting. If the leak has not stopped use the water manifold key to shut-off the water supply valve. Have the leak repaired before returning the supply line to service.

## **WATER SYSTEM - Troubleshooting**



**NOTE: A small water leak can cause severe water damage. Shut-off the water supply and have the leak repaired.**

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

## **WATER SYSTEM - Disinfecting Fresh Water**

**You should disinfect the water system:**

- If your motorhome is new.
- If your 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 fill cap.**



**CAUTION: Do not use vinegar to disinfect water system on units using Aqua-Hot Heating Systems. Vinegar will deteriorate copper tubing.**

**Use the following procedures to disinfect water system:**

- Remove the filter elements from the filters and reassemble the filters without the elements (see "Filter").
- Prepare a chlorine bleach solution using 1 gallon water and 1/4 cup of chlorine bleach. Use 1 gallon of solution for every 15 gallons of tank capacity. Example: Add 2-2/3 gallons solution to a 40 gallon tank. Add 4-2/3 gallons solution to a 70 gallon tank. Add 6-2/3 gallons to 100 gallon tank. This mixture puts a 50 ppm (parts per million) disinfecting solution in the water system. This concentration will act as a quick-kill dosage for harmful bacteria, viruses and slime-forming organisms. Concentrations higher than 50 ppm may damage the water lines and/or tanks.
- Drain the fresh water tank. Close the drain and pump the solution (if desired) into the fresh water tank using an independently operated pump and a garden hose connected to City Water Hook-Up on the water control panel. It can be poured into the fresh tank using the

gravity fill and a funnel. Run the water until you smell a distinct chlorine bleach odor.

- Allow the system to stand for four hours.
- Drain the system and flush with fresh water. The drain is located in the outside water service compartment. Install new water filters. Thoroughly flush with fresh water until no chlorine bleach taste or smell is detected in the water system.

**Aqua-Hot  
Maintenance**

If not properly and thoroughly rinsed chlorine bleach or other concentrated chlorine bearing chemicals can cause failure to the Aqua-Hot’s Domestic Water Loop (copper tubing). The Aqua-Hot’s copper tubing is rated for use with fresh water and winterization solutions only. Periodic flushing with other common household chemicals, including bleach, will have little or no effect on the product if properly rinsed with the fresh water afterwards. Failure of copper tubing, especially soft or flexible copper, can result if materials other than water or winterization solutions are allowed to reside inside the piping for extended periods as during storage or other periods of non-use. The most common cause for failure is due to an extended exposure to chlorine, solutions containing chlorine (i.e. bleach) or hydrochloric acid.

**TANK CAPACITIES**

**TANK CAPACITIES (Approximate Gallons)**

	<b>40 PBS</b>	<b>40WDS</b>	<b>40PBD</b>	<b>42CDS</b>	<b>42DSS</b>	<b>43PBD</b>
Diesel Fuel	150	150	150	150	150	150
Water Heater	10	10	10	10	10	10
Grey Holding Tank	60	60	60	60	60	60
Black Holding Tank	46	46	46	46	46	46
Fresh Water Tank	100	100	100	100	100	100
LP Gas Tank*	45	45	45	45	45	45

\* Actual filled LP - Gas capacity is 80% of listing due to safety shut-off required at tank.

**WASTE WATER  
SYSTEMS**  
*Drain & Sewage  
Tanks*

The waste drainage system was designed to provide adequate and safe storage and/or discharge of waste materials. All materials used in fabrication and installation of system is tested by a nationally recognized testing laboratory. The entire fabricated waste system is factory tested in accordance with American National Standards Code A119.2. The drainage system uses ABS plastic piping and fittings connected to sinks, shower, toilet and holding tanks and provides for their drainage to an outside termination. The motorhome should be reasonably level for optimum operation of the systems. There are two separate waste water systems: one for waste water (grey water) and one for sewage waste (black water). Each has its own storage tank control valve and both empty through a sewer drain hose. When traveling, it is recommend both holding tanks be empty or less than half full.

- 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 get stuck in or damage the valve seals.
- Do not flush facial tissues. They are treated chemically to strengthen them and will not dissolve like toilet paper. Special holding tank tissues are available at most RV supply stores. White toilet paper dissolves faster than colored papers.

***What Not  
to Put in Waste  
Holding Tanks***

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 publications. Some major oil companies offer dump facilities at selected stations. Plan ahead in locating proper and legal disposal sites for holding tank waste.

***Proper Waste  
Disposal***

## TOILET Operating Instructions

The toilet operates from either 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).



- To add water to the toilet before using press and hold small button until the desired water level is reached. Generally, more water is required only when flushing solids.
- To flush the toilet push the large button once.

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.

To find leaks, check behind or under toilet. Take four or five sheets of toilet tissue and wipe all the seams and water line connections. Start at the top of the unit and work downward. When the tissue comes in contact with leaking water it will immediately change texture.



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

## Troubleshooting

### Leaks

- Back of toilet: check water supply line connection.
- Between closet flange and toilet: Check 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.

**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: Most chemical mixtures for holding tank odor control are poisonous. Follow the product manufacturer's directions and warnings when using any holding tank additive.**

Sinks, shower and clothes washer drains incorporate a water trap 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.

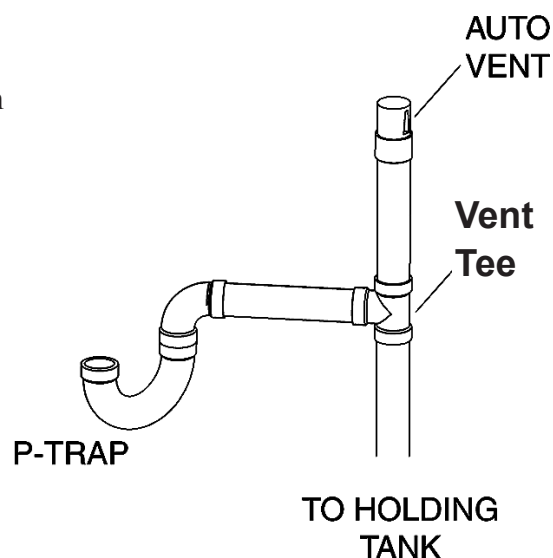
The auto vent, if stuck in the open position, can allow grey odors to enter the motorhome. These auto vents also double as "clean outs" in the event you have to snake out a line.



**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.**

**Drain Traps & Auto Vents**



## Draining the Waste Holding Tanks

When parked in an area with a sewer hook up, “exercise” the drain pipe before hooking up the sewer hose. Swivel the pipe up and down by firmly grasping both sides of the sewer drain pipe hose connection. This will exercise the O-rings. Leave the drain pipe pointing up to prevent any residual material from running out.

### Attaching the Sewer Hose:

- Turn the drain end cap counterclockwise and remove it from the drain pipe.
- Unscrew the hose access deck plate from the bottom of the water service compartment. Feed the adapter end of the drain hose up through the hole and install the hose adapter onto the drain pipe.
- Rotate the drain pipe downward for maximum flow.
- Straighten and secure hose to avoid recoil. Attach the end of the hose to the sewer connection at the dump station.



**NOTE: Ensure sewer hose connections and hose clamps are secure before use.**

The grey water holding tank valve (small valve) remains open when connected to the sewer hook-up. The black water holding tank valve (large valve) remains closed at all times except when dumping the sewage tank. When preparing to dump the black water holding tank, first close the grey water tank valve. Allow the grey water tank fluid to accumulate until the tank is at least half full or fill by running cold water through the sink and shower drains. Do not overfill the grey water holding tank.

To aid in the removal of solids, dump the black tank when the tank is at least 50% full. If it is necessary to dump the black tank when the level is below 50% add water by using the sewage tank flush system.

- With black valve closed use the sewage tank flush system to increase the holding tank level.
- When adding water to the tank using the sewage tank flush system, closely observe the tank level by using the monitor panel tank gauge indicator to prevent the tank from being overfilled.
- The sewage tank flush system should never be operated unattended.

### Dumping the Waste Holding Tanks:

- With the grey water valve closed, open the black water valve to drain the tank.
- Flush the sewage tank. Connect a separate non-potable water supply hose with pressure regulator to the sewage tank flush connection on the water service panel. For sanitary reasons, be sure not use the potable city water hose for this procedure. The large gate valve remains open throughout the flushing cycle. Turn the water on and flush the black water system for approximately two minutes. Ensure

water is flowing freely through the sewer hose.

- When finished flushing the system, turn the water off and close the black water valve.
- Open the grey water valve.
- The waste water tank is flushed by running two gallons of water down a sink drain.
- If applicable, close the grey water valve for transit.
- Disconnect and flush the drain hose with either the non-potable water supply hose or the exterior faucet. Secure the sewer hose in the travel location. Disconnect and stow the non-potable hose.
- Install the end cap (required by law in some states) and deck plate when in transit to prevent leakage. Swivel sewer drain pipe up.

### ***What to Put into the Holding Tanks - Black Water Tank***



**NOTE:** Periodically lubricate the O-ring on the sewer hose adapter with silicone spray. Use care when connecting the hose adapter to the drain pipe in cold weather.



**WARNING:** When using the black tank flush do not leave the motorhome unattended or flooding may occur. The sewage tank flush system should be used each time the black water holding tank is dumped. Failure to routinely use the sewage flush system will result in a clogged spray nozzle. Turn off the water supply to the black tank flush when finished.

The black water sewage tank stores toilet drain waste only. Before using the toilet, treat the sewage holding tank with water that is mixed with an odor controlling chemical. These chemicals are readily available at any RV supply store. The chemicals are poured into the holding tank through the toilet. Add three gallons of water to the holding tank first. Next mix the chemicals with approximately one gallon of water and add to the holding tank. Be careful not to spill the chemical on your hands, clothing or carpet as it can cause permanent stain. Extremely hot weather areas may require adjusted amounts of chemical to help with odor control. Repeat the chemical pre-change to the holding tank each time the tank is dumped.



**CAUTION:** Do not use any products that contain petroleum distillates or ammonia in place of an RV odor controlling chemical. Petroleum distillates or ammonia will damage the ABS plastic holding tanks and seals.

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 may be used for odor control.

Prior to dumping the the waste holding tanks be sure there is enough liquid in the holding tanks to provide a smooth flow through the valve drain pipe and drain hose. When sufficient liquid is in the tank a swirling action will result that should take accumulated solid wastes along with the waste liquid when the tank is dumped. The tanks should be emptied when they reach ½ full, or weekly, to prevent stagnation and overfilling.

### ***What to Put into the Holding Tanks - Grey Water Tank***

## SOAP DISPENSER - LIQUID



Liquid Soap Dispenser

The liquid soap/lotion dispenser can be used with any type of liquid soap or lotion. The liner of the bottle will not corrode or discolor the contents of the dispenser. To clean, use a soft cloth and blot dry. Do not use harsh abrasive cleansers or polishes, this can damage the finish on the dispenser.



Funnel for re-filling the dispenser.

## COLD WEATHER USE

### Cold Weather Use:

A motorhome is not designed for extended use in below freezing (32° F/0° C) weather; however, you may not experience any problems as long as the temperature does not drop too low. Interior water lines, fixtures, water storage tanks and pumps are normally protected from moderate freezing temperatures, as long as the furnace is operating. Exposed drains may freeze quickly. If in doubt about what temperature the motorhome will tolerate, winterize with a potable antifreeze.

### Storage:

If storing the motorhome where freezing temperatures may occur, the domestic fresh water loop will need to be completely drained of water. When draining the domestic fresh water system start off by draining the fresh water tank. Open the drain lever for the fresh tank and allow the water to drain.



**NOTE: Ice makers, water filters, water purifiers, water heaters, washers and the Aqua Hot all use domestic water and should be drained and stored in accordance with the manufacturer's recommendation for winterization.**

How you decide to store your motorhome and protect the water lines is up to you. You may elect to have the water lines blown out with air to remove standing water or fill the lines using an approved FDA RV antifreeze. When using either method, all the interior and exterior faucets will need to be opened and closed, one at a time, to verify that all water has been purged. All low point drains should be opened, and holding tanks emptied.

## **WINTERIZING - Fresh Water System Using Nontoxic Antifreeze**

To use air pressure to winterize your motorhome you will need access to an air compressor and adapter to connect the air line to your water system. Adapters can be found at any RV supply store. System pressure should not exceed 50 psi. when hooked to the water lines. Higher pressure will damage the lines.

1. Remove the water filter elements from the filters and reassemble the filters without the elements (see “Water Filter”).
2. Drain the fresh water tank by opening the valve located in the outside water control service compartment of the motorhome.
3. Open the water heater and the low-point drains. Turn knobs to open the drains. Opening the low point drains clears the water out of the hot and cold water lines. Leave the low-point valves open until you are ready to use the motorhome again.
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 lines. Turn the pump off.
5. After the water lines are drained, hook an air hose to the city water connection located on the water control panel in the outside service compartment. Blow out the water lines until no further water can be seen coming out of the drain lines. Do not exceed 50 psi in the water lines and faucets.
6. Open all faucets (including the outside spigot), one at a time while the air is on, to clear water from the faucet supply lines. Do not forget to drain your shower.
7. While the air is on, hold the spray nozzle (located right next to the toilet) open until the water has quit running. Hold the toilet flush pedal/handle down until the water has stopped running.
8. Unhook the air hose and close the city water connection.
9. You will need 1 gallon of RV antifreeze to protect various water drain lines in your 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. While holding down the flush pedal, pour another 3-1/2 pints into the toilet, letting the antifreeze run into the black tank to protect the valve. Pour the last pint of antifreeze into the toilet after you have released the flush pedal. Microphor toilets may be stopped in the middle of the flush cycle. Locate the on/off switch below the tank lid. Initiate the flush cycle then turn the switch off in the middle of the flush cycle. Use a soft cloth to wipe out the sinks and shower after you pour in the antifreeze to protect the surfaces from stains.
10. Leave the low-point drains open until you are ready to use your motorhome again.



**WARNING: When draining the low point hot water drain lines and the water heater, be sure the water is cool. Hot water from the lines can burn you.**

## **WINTERIZING - Using Air Pressure**

Ten gallons of FDA approved approved RV antifreeze will be required to winterize the motorhome.

1. Remove the water filter elements from the filters and reassemble the filters without the elements (see “Water Filter”).
2. Open all of the low point drains (next to the Aqua-Hot) and the drain valves to drain: the fresh water tank, water heater tank, holding tanks and fresh water lines.
3. Close all faucets, drain valves and low point drains.
4. Pour the antifreeze into the fresh water tank using the fresh water gravity fill.
5. Turn ON the system water pump and operate each faucet individually until a small amount of antifreeze is present.
6. Close off the faucets.
7. Open the shower faucets and toilet valves to allow a small amount of antifreeze to run into the holding tanks.
8. Use a soft cloth to wipe out the sinks and shower to protect surfaces from antifreeze stains.
9. Exterior faucet should be opened and closed using the same procedures as the interior faucets.
10. If the motorhome is equipped with an ice maker, remove the 3/4 inch fitting and flush antifreeze through the water line.
11. Disconnect the power supply line affecting water pump operation.

For de-winterization, drain off the fresh tank and fill the fresh tank with water. Reconnect the power supply line for the water pump. Operate all faucets, one at a time, until clear water is present.



**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.**



**WARNING: It is recommended that this procedure be done by a qualified RV service technician familiar with motorhomes, such as your authorized selling dealer.**

# NAVIGATOR

## SECTION 7 LP-GAS SYSTEMS

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## LP-GAS SYSTEM

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 are capable to operate on LP-Gas. Some items discussed may not be applicable to your 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.

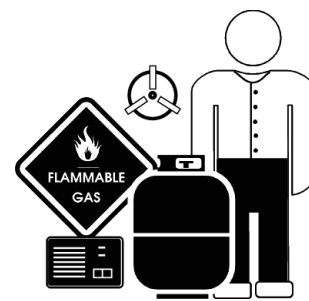
All components for your motorhome LP-Gas systems are approved for use in camping vehicles by a nationally recognized testing laboratory. When properly handled, LP-Gas is a clean-burning dependable fuel for heat producing components. The LP-Gas tank mounted in your motorhome contains liquid petroleum gas under high pressure. As 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. Never attempt to reset regulator yourself. Have your dealer or an authorized service person make adjustments.

In higher elevations or extreme cold weather (10° F/-21° C or lower) you may experience a shortage of LP-Gas. You can adjust to this by not running more than one component at a time, such as turning off furnace while using the range. If you are going to be in higher elevations or cold climates for a long period of time an authorized service person can adjust your LP-Gas regulator for these conditions.

We recommend that you have the LP-Gas system checked by an authorized dealer at least once a year, and thereafter every extended trip. Although manufacturer and dealer both test carefully for leakage, travel vibrations could loosen fittings.

Leaks can be easily found by applying leak detector solution at connections. If leak detector solution is not available a soapy water solution made with dish soap can be used. Tightening fittings usually stops any leaks. If not, shut off main gas valve at tank and see your authorized dealer for repairs immediately. Hand tighten tank valves only, do not use a wrench or pliers as over tightening may damage valve seats and cause them to leak. If you suspect a leak, which is an easily identified odor (smells like rotten eggs/sulfur) never light a match or have an open flame.

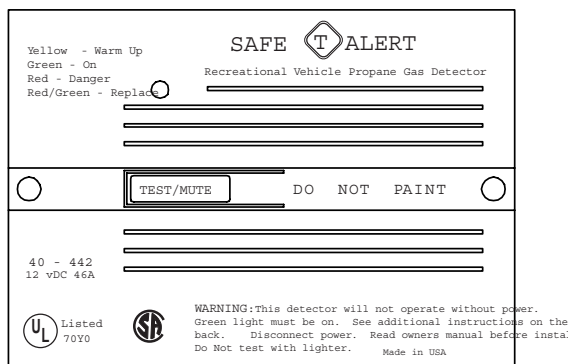




## LP-GAS DETECTOR

Provided for safety is a gas detector. This gas detector will detect 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 reset button to stop alert sound for 60 seconds.

The other combustibles which will be detected 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.



LP Detector

### Operation

Upon first application of power the LED will flash yellow for 3 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 immediately sound an alarm.

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



**CAUTION: This detector will not alarm during the 3 minute warm up cycle.**

### Testing

Depress 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 your 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.**

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, 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 4 times and return to phase 1.
4. After 2 minutes the detector will return to normal operation (solid Green) or resound the alarm if dangerous levels of gas remain in the area.

**Fault Alarm**

Should the microprocessor sense a fault in the gas detector, a fault alarm will sound twice every 15 seconds. The LED will alternately flash Red to Green and the MUTE switch will not respond to any command. The gas detector must be repaired or replaced.

1. Vacuum the dust off the detector cover weekly (more frequently in dusty locations) using the soft brush attachment of your 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



LP Tank Gauge

**Tank Measurement** - To measure level of a tank simply push button on display panel corresponding to tank you wish to measure. Lights on panel will turn on in sequence indicating level of tank.

**Calibration** - The monitoring panel comes factory calibrated for accuracy and should not need to be adjusted. If system does not read accurately recalibration may be necessary.

**To recalibrate LP tank gauge proceed as follows:**

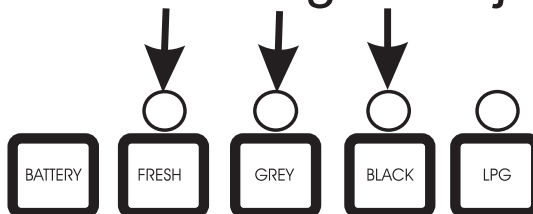
Using adjustment tool, simultaneously push button for tank and rotate adjustment point. Turn counterclockwise until the light indication is decreasing. Gently rotate the adjustment back clockwise until the light indication is at full.



**NOTE: Fill LP tank prior to calibration.**



Remove Plug To Adjust



Adjustment Point

## 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 main gas supply at the tank.
- Do not attempt to operate any electric switch.
- Open windows and doors.
- Evacuate the motorhome.
- 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.

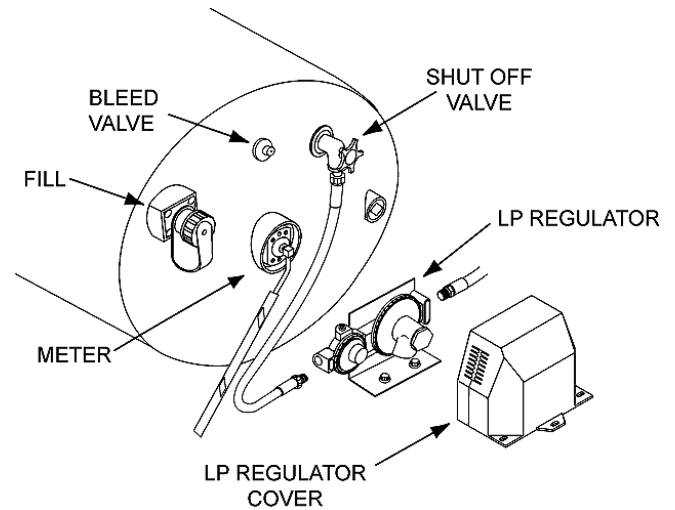


**WARNING: A fire or explosion from ignited gas or gas fumes can seriously injure you or cause death.**

**LP-GAS TANK**

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 and bleed valves are located in the LP-Gas tank access outside compartment. Caution the service technician, if your 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.



LP-Gas Tank



**WARNING: Turn off all pilot lights and appliances during the refueling of the motorhome and filling the LP-Gas tank to prevent a fire or explosion.**

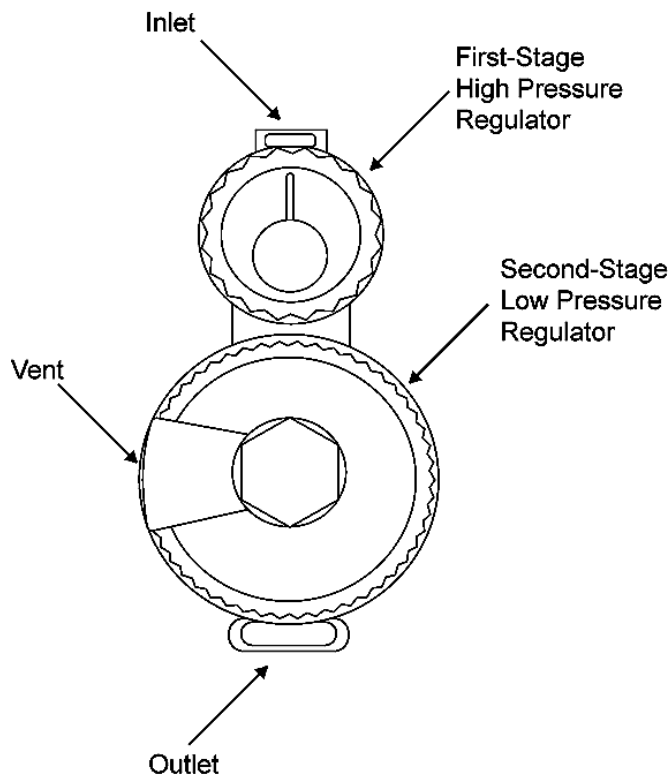
LP-Gas exists in both the liquid and vapor state with the LP-Gas tank. A "Full" tank is approximately 80% liquid. The pressure inside the tank varies with the temperature of the liquid. All tanks are required to be equipped with a pressure relief device. The purpose of the relief valve is to release gas or liquid caused by overpressurization. You will notice the gauge at the tank, when full, will only read 3/4. Your monitor panel is adjusted to indicate FULL at this point.

If you are storing portable LP-Gas tanks (do not transport or store LP-Gas tanks, gasoline or other flammable liquids inside the motorhome) that are not connected to an LP-Gas system, install an approved plug in the tank outlet holes to prevent leaks. Do not store empty LP-Gas tanks. Keep open flame and spark producing materials away from the LP-Gas area. If this warning is ignored a fire or explosion could result. Shut off all appliances and LP-Gas tank valves (located on side of LP-Gas tank underneath the motorhome) when the motorhome is in storage.



**CAUTION: Pressure inside LP-Gas tanks can reach over 300 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 which consume large amounts of LP-Gas, such as the water heater or furnace, will need to be operated in sequence in extremely cold environments.**

## LP-GAS REGULATOR



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. Simply put, the first stage regulator reduces the full tank pressure down to a range of 10-13 psig. The second stage further reduces the pressure down to an outlet pressure of 0.4 psig (11 inches of column water). The regulator is equipped with a vent so that it can breathe. This means that if pressure in the LP tank is too high the regulator will allow gas to escape through the vent until pressure returns to a normal range. 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 you notice any corrosion contact a qualified LP-Gas service technician. The regulator is mounted so that the vent faces downward. If the vent becomes clogged you can clean it with a toothbrush.

Under normal atmospheric conditions a 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.

Things you can do to prevent this freeze up are:

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.

A LP-Gas dealer will need to purge the tank if freeze up occurs. Have the LP-Gas dealer inject methyl alcohol in the tank if freeze up occurs.



**WARNING: Do not attempt to adjust the regulator, it is preset 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 REENTER THE MOTORHOME UNTIL THE PROBLEM HAS BEEN CORRECTED!**

Each gallon of LP-Gas produces approximately 92,000 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.

## LP-GAS CONSUMPTION



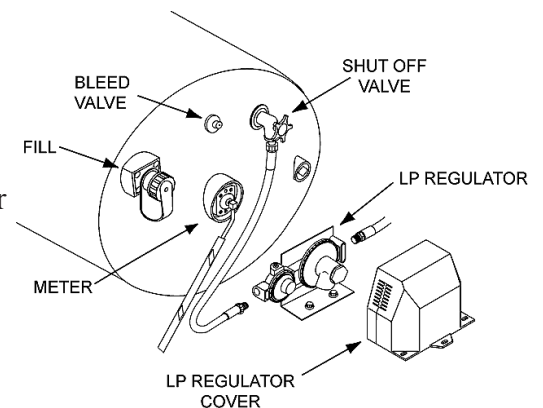
**WARNING: LP-Gas is highly volatile and extremely explosive. Never use matches or open flame to test for leaks. Use only approved LP-Gas leak testing solution to test for leaks. Unapproved solutions can damage copper tubing and brass fittings. Never attempt to adjust LP-Gas regulators without the use 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.**

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 main 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.

## LP-GAS DISTRIBUTION LINES

- Manually open the main shut-off valve located on the roadside of the LP-Gas tank.
- Turn off the manual valve on the LP-Gas tank when the motorhome is in between trips.
- Hand tighten the manual valve. Do not use a wrench or pliers to close the valve.
- The manual valve is designed to be closed by hand, over tightening may permanently damage the valve seat.

## LP-GAS TANK OPERATION



*Torpedo Tank. Usable LP-Gas capacity is 36 gallons.*

**LP-Gas  
Fundamentals**

# Capacity	Gallon Capacity	BTU Capacity
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

CONVERSIONS	
Gallons to Liters	(1 Gallon = 3.785 Liters)
Fahrenheit to Celsius	( $F^{\circ} = 9/5 C^{\circ} + 32^{\circ}$ )
11" Water Column	= 6 1/4 ozs. per sq. in. pressure.
27.7" Water Column	= 1 pound per sq. in. pressure.

**The above capacities allow for 20% vapor space on each cylinder.**

*\*Data taken from the National Fire Prevention Association (NFPA). Pamphlet #58-1998.*

**Basic Facts About LP-Gas:**

Pounds Per Gallon	4.24
Specific Gravity of Gas	1.50
Specific Gravity of Liquid	.504
Cubic Feet Gas Per Gallon of Liquid	36.38
Cubic Feet Gas Per Pound	8.66
BTU Per Gallon	91,502
BTU Per Pound	21,548
Dew Point in Degrees Fahrenheit	-44F°
Vapor Pressure at 0° F	31
Vapor Pressure at 70° F	127
Vapor Pressure at 100° F	196
Vapor Pressure at 110° F	230



**NOTE: The above information is not a complete guide for the use of LP-Gas tanks or appliances. In cold climates keep fuel levels above 50% in order to keep vaporization of LP-Gas at the highest level.**

# NAVIGATOR

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**INTRODUCTION**

The motorhome 120/240 Volt AC system can be operated from three different power sources. Shore power is the most efficient and should be used whenever possible. The on board generator has a limited amount of 120 Volts AC output power. This can be used when shore power is unavailable. The inverter/converter supplies silent AC power by using the motorhome's house batteries. This source has limited AC power output and should be used sparingly.

The motorhome's main 120 Volt AC circuit breaker panel is supplied with power from two different sources: The 50 amp shore power cord or the on board generator. The selection of the power source being used is done automatically by using an automatic electrical switching device known as the transfer switch.

The power requirement for the motorhome is 50 amp 120/240 Volt AC single phase. If a 50 amp shore power service is available, the motorhome can be directly plugged into the 50 amp shore power source with the supplied shore power cord. If a 50 amp service is not available, proper electrical adapters will be required to convert the end of the 50 amp shore cord into a compatible type of connection for the available receptacle. When plugged to anything other than a 50 amp service, appliances and other AC loads will have to be operated in sequence.

**Shore Power**

**NOTE: In many instances 50 amp shore service may not be available. Therefore, care will have to be taken when drawing power from multiple appliances and outlets so that the shore power service will not become overloaded. Use only power cords which are rated at 50 amps. Avoid using extension cords when connecting the motorhome to shore power. In most cases, extension cords are unsafe and inadequate for carrying the level of current required by the motorhome.**

The generator can be selected for use when AC shore power is not available. The motorhome's on board generator has limited 120 Volt AC power output capabilities. The generator's maximum amount of output power is specified in watts, calculated at an elevation of 500 feet above sea level. The maximum power available will decrease when there is an increase in altitude. Ambient temperature also affects total maximum output. Fuel consumption is based upon a percentage of AC electrical load applied to the generator. While using the generator, care will have to be taken when operating appliances and outlets so that the generator will not be overloaded. The generator is fueled from the main fuel tank.

**Generator**

## **Inverter/ Converter**

The inverter/converter 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 option. This device has limited AC power output measured in watts. It operates only selected appliances and outlets. The inverter/converter is two components in one: 1. Functioning as an auxiliary 120 Volt AC power source that uses 12 Volt DC house battery power to invert to 120 Volts AC power. 2. Using 120 Volts AC, supplied from either shore power or the generator, and converting it to 12 Volts DC power to recharge the batteries.

---

## **BATTERY DISCONNECT - HOUSE**

The main house battery disconnect switch turns the battery power supply on or off. The domestic battery disconnect switch shuts off the 12 Volt DC power to the following items: the inverter, the domestic fuse panel in the bedroom, the domestic fuse panel in the front run box and the domestic power supply in the rear run box. Turn the main battery disconnect switch off when the motorhome is going to be stored or before performing electrical maintenance on the motorhome. 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. Use of the battery cut-off switch at the entry door will not turn off all DC electrical items or other parasitic loads. There are small parasitic loads that are present on the house battery. Some are federal mandate items such as the LP-Gas detector. If an AC power source is not available and the motorhome is 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 panels will charge the batteries with the disconnect switch off.**

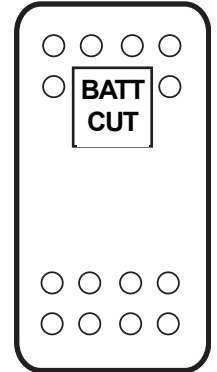


**WARNING: When the frame or other welding is involved for motorhome repair or modification, the following precautions are required to protect electronic components in the motorhome chassis:**

- 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.**
- 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 area to be welded.**

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. When the switch is ON power is supplied to all interior DC lighting and DC operated appliances. Some appliances will require both DC and AC power to operate, such as the roof air conditioner. This switch is helpful when dry camping 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.

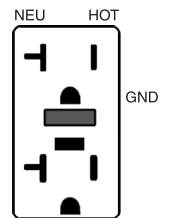
## BATTERY CUT-OFF SWITCH



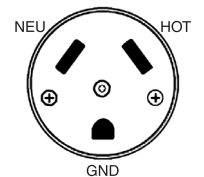
Located at entry door.

If 50 amp shore power service is available, all that is necessary is to connect the motorhome to the 50 amp shore power service using the supplied shore power cord. The cord is located in the compartment on the roadside of the motorhome. Before hooking up to the park's shore power, verify that proper voltage and ground protection are present at the outlets. After hooking up to shore power, verify proper voltage and ground protection are present in the motorhome itself. Inexpensive testers are available for this purpose. Always turn off the power circuit breaker previous to connecting or disconnecting the shore power cord. This will avoid the risk of electrical shock and momentary contact flash. After the unit is connected to shore power, wait approximately one minute for the inverter to "stabilize" charging of the batteries before starting air conditioners or other large AC loads. In many instances 50 amp shore service is not available. Proper electrical adapters must be used to connect the supplied shore power cord to the shore service available. When connecting to anything other than 50 amp shore service use caution not to overload the supplied shore service breaker. Appliances and outlet loads will have to be operated in sequence rather than all at the same time.

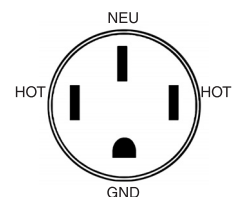
## SHORE POWER HOOK-UP



15-20 AMP  
120 VOLT



30 AMP  
120 VOLT



50 AMP  
220 VOLT



**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.



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



**WARNING:** Keep fingers away from metal contacts of shore plug end. Avoid standing water. Serious electrical shock and personal injury can occur. To avoid the risk of an electrical shock turn the circuit breaker off for the shore power outlet before making a shore power connection.

## Power Cord Reel (Optional)



Power Cable Reel

The power cord reel is a 12 Volt DC motorized assembly which will mechanically coil and stow the shore cord. The 50 amp power cord reel is located in the roadside compartment of the motorhome. The other end of the cable master power cord is wired directly to the transfer switch. The motor control switch is labeled IN and OUT, this switch operates the 12 Volt DC motor.

When extending or retracting the power cord, turn the switch to the direction desired. Assist the cord, following the direction of travel. Extend only as much power cord as necessary for reaching the outlet. The cord should be not be taut but slightly slack.

**Maintenance:** When only a short section of the shore power cable is frequently used the cable may coil sharper than normal, causing kinking of the cable. To relieve this condition, routinely extend the cable full distance. Straighten the power cable on the ground. It is important the cable remains clean. Dust and dirt on the cable may cause the system to be unable to retract the cord. After the cable is cleaned and straightened, allow the cablemaster to retract the cable into the motorhome.

At least once a year check all AC and DC wiring connections to be sure they are secure and free of corrosion. Check the neoprene covers on the in-limit switch and the power switch to be sure they are free of cracks or fracture.



**CAUTION:** Before plugging motorhome into shore power, starting the generator or using the inverter make sure all the appliances are off.



**WARNING:** Disconnect the shore power cord and the negative 12 Volt DC battery cable (at the inverter) before working on the electrical system.



**WARNING:** Insure that the inverter/converter is turned OFF before disconnecting the negative terminal from the Inverter. Remove rings, metal watch bands and other metal jewelry before working around batteries and connectors. Be cautious when using metal tools. If a tool contacts a battery terminal or metal connected to it a short circuit could occur causing personal injury, explosion or fire.

## Transfer Switch

The transfer switch automatically transfers power from the shore power cord or generator through the transfer switch to the 110 Volt AC breaker panel. When the generator is used as the power source the transfer switch has a time delay built into it before transferring power to the 110 Volt AC breaker panel. This allows the generator time to warm up before an AC load is applied to it. The transfer switch will automatically select the generator over shore power even though shore power is hooked up.



**NOTE: To prevent damage to the transfer switch do not have appliances on or AC loads plugged into outlets when hooking up to shore power or starting generator. The transfer switch will begin to disengage between 85-90 Volts AC. Operation at this voltage may damage transfer switch, appliances or other items plugged into outlets.**



The generator is located in the front compartment of the motorhome. The generator can be started from the following locations:

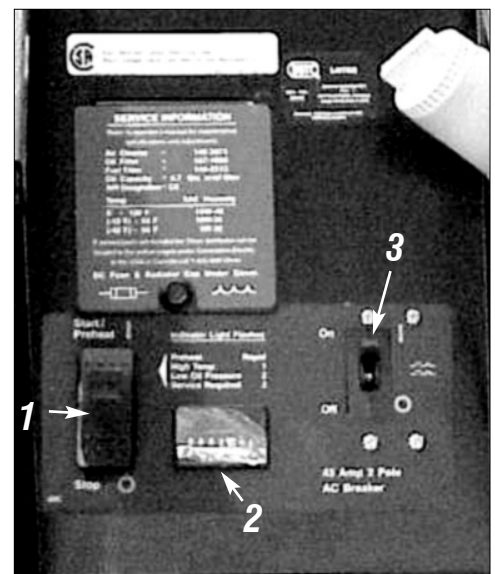
- The generator remote switch located on the monitor panel.
- The generator remote switch in the drivers area.
- The generator control panel located on the generator.
- The control panel in the bedroom.

### Prestart Checks:

Prior to the first start of the day perform a general inspection including oil and coolant levels. Keep a maintenance log on number of hours in operation since the last service. Before starting the generator:

- Perform any service or maintenance that may be due.
- Make sure people and animals are clear of hazards of electrical shock and moving parts.
- Have all appliances and other large AC electrical loads off.

## GENERATOR - 120 AC



Generator Control Panel:

1. Start/Stop Switch.
2. Hour Meter.
3. Output Breaker.

Push and hold control switch in START position until the generator starts. Release switch. On diesel models the control switch may flash up to 15 seconds, indicating engine preheat.

## Starting the Generator



**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 manufacturer's manual.



**WARNING:** When the motorhome is parked, position the dash air conditioner vent control in the OFF position to prevent exhaust gases from entering the motorhome. 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.



**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 the 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," either the generator will shut down or the circuit breaker will trip. If power consumption, in total, exceeds the generator power output, compensation for temperature and elevation may be necessary. Operate 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 approxi-

mately three percent 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: 7,500 watt generator at 5,000 ft. = 6,375 watts net. Temperature also affects maximum output power. For example: at 120° a 7,500 watt generator produces 6,000 watts net.



**REFERENCE: The diesel 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.**

If a circuit breaker trips in the main AC breaker panel, or on the generator control panel, there may be a short circuit or too much load.

### ***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.



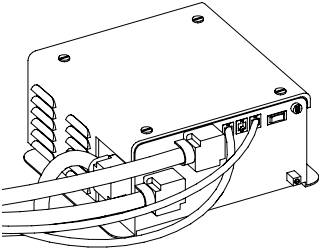
**NOTE: An appliance or load may have a short if it causes a circuit breaker to trip after reconnection. DO NOT continue to reset breaker. Have the problem corrected before resuming operation.**

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***



## INVERTER /CONVERTER



Inverter

Use the inverter when shore power is not available and the generator is not going to be used as the secondary AC power source option. To turn the inverter on or off, momentarily depress the inverter **ON/OFF** button on the RC7 GS remote. This will supply silent AC power to most receptacles, the television and microwave. It is important to remember that use of the inverter will greatly increase house battery power consumption. Turn off the inverter when not in use to conserve house battery power.

The inverter is programmable with many features. The RC7 GS remote control is used to change or add features and set variable parameters. Inverter remote may also be used to start and stop the generator.

Some of the features available are:

- Automatic generator start.
- Fully adjustable battery charge rates.
- Adjustable fuel gauge cut-out.
- Adjustable charging curves for different battery types.
- Adjustable power sharing.
- Meters Menu.

---

## RC7 GS Remote

The remote control liquid crystal display (LCD) and light emitting diode (LED) lights are used for operation status conditions. The LED lights give inverter status, charge status, battery condition and error indications at a glance. The LCD screen displays charging cycle status, various meter readings, automatic generator operation status, programming field and error messages. The inverter **ON/OFF** button turns the inverter on or off. This button can be used to start or stop the generator. The up or down arrows are used to scroll up or down through the operations field or meters field. The up arrow is used to toggle between operations and meter fields. Pressing the up and down arrows simultaneously accesses the programming field. The settings button is used to set or scroll through a particular programming field.



**NOTE: The main switch on the inverter is to remain ON.**

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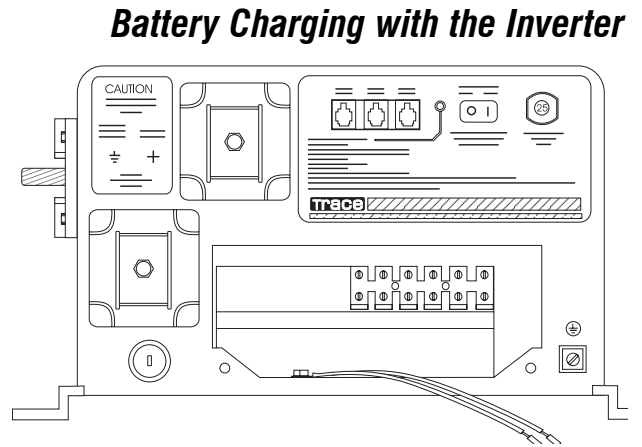
## Stand-by Operation

The inverter can be set-up for stand-by power operation. If AC input is discontinued to the motorhome the inverter will automatically provide AC power. When AC power is resumed the inverter will automatically return to “stand-by” mode. The stand-by mode is activated by momentarily pressing the “on/off” inverter remote button while the motorhome is plugged into shore power or operating from the generator. Stand-by mode is indicated by the inverter status light blinking. Battery charging is not affected by stand-by operation.



**NOTE: Remember to disable stand-by operation when not in use. House battery power may be accidentally consumed. It may run down the house batteries.**

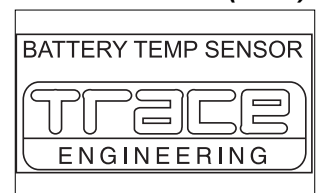
Whether hooked to shore power or operating from the generator, the internal battery charger of the inverter will automatically charge the batteries when AC power is supplied to the input terminals of the inverter. The time it takes to charge the batteries to a full state of charge varies greatly. It can take several hours or even days depending on the inverter set-up parameters and actual state of charge of the batteries. The inverter uses a three stage charging cycle. The first stage is “bulk” charge. The bulk charge will bring the DC voltage up high, initially between 14.2-14.6 Volts, actual bulk charge voltage depends on which battery type has been selected in the programming menu. The bulk charge cycle is controlled by voltage and current. The length of time the inverter is in the bulk charge cycle will vary with the state of charge of the batteries. The second stage is the “absorb” cycle. The battery voltage in the absorb cycle is the same as the bulk charge cycle between 14.2-14.6 Volts. The length of the absorb cycle is a timed event determined by the inverter. The final charging stage is the “float” charge cycle. Approximately 80% of the charging cycle has been completed by this time. The float charge voltage is generally around 13.3-13.7 Volts. The last 20% of the charge cycle typically takes the most amount of time.



**NOTE: The inverter will charge the batteries with AC power applied regardless of remote status.**

The inverter uses a battery temperature sensor to adjust charge voltage. When the battery temperature rises the BTS will send this information, registering as counts, to the inverter to decrease charge voltage. Voltage compensation with temperature variation is necessary to keep charge voltage at optimum figures. The BTS should be adhered to a house battery. If the BTS is unplugged, the inverter default setting of 77° F/25° C is used as the charge temperature reference point.

### **Battery Temperature Sensor (BTS)**

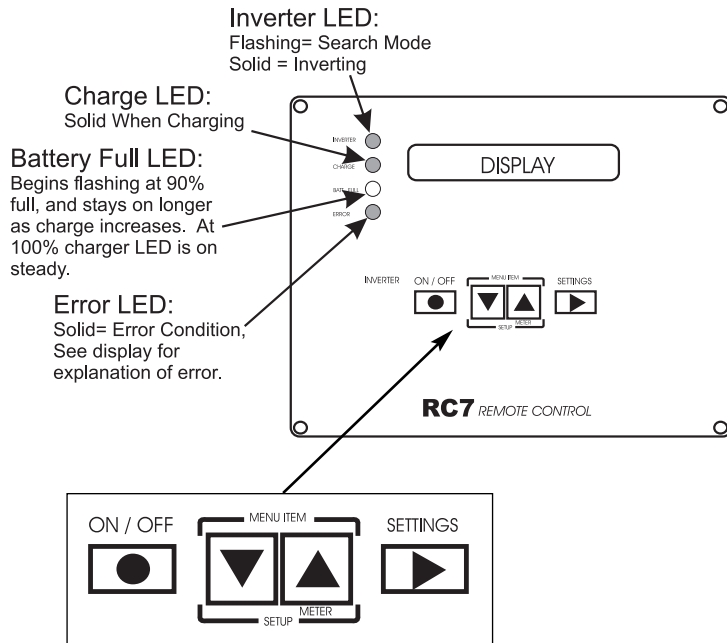


Incorporated in the inverter is a double pole “pass-through” relay which trips when AC power is supplied to the input terminals. This will transfer AC power through the inverter to a sub panel supplying AC power to outlets and appliances. When AC power is supplied to the inverter, the internal battery charger will “ramp up” battery charging voltage. A 20 second time delay allows charge stabilization before pass through AC power is supplied to the sub panel.

### **Pass-through AC Power**

## Operating Display

This field is a general overview of system status. This is the primary screen of the RC7 GS remote. This field area includes:



### Main Menu:

- **Waiting for AC:** System inactive waiting for AC power to be supplied.
- **Inverting:** Unit is inverting.
- **Charging Cycle Status:** Bulk, Absorb or Float mode.
- **Battery State of Charge:** Based on the Fuel Gauge Cutout setting. It may be displayed in percentages or as a fuel gauge.
- **Time Left To Run:** This evaluates the battery reserve capacity at current operating load. It is based on the Fuel Gauge Cutout and Battery Bank Capacity settings.
- **Time Left To Charge:** Estimated time left to charge batteries to full state of charge. This is based on Fuel Gauge Cutout and Battery Bank Capacity settings with current battery voltage.
- **Generator Start/Stop:** Use inverter ON/OFF button to remotely start the generator or to override automatic generator start feature for manual operation. This feature is available to use without altering automatic generator start programming.

## Meter Menu

This is an alternate field of main system status. To access the various meters available, depress the **UP** arrow button and hold for five seconds. The RC7 GS remote will beep. Release the button. The Avg Shunt Amps will be displayed. This field area includes:

**Avg Shunt Amps:** This measures the DC current either charging or discharging. Most of the house DC current usage is monitored by the inverter.

**Battery Voltage:** This monitors the house battery voltage.

**Inv/Chg Current:** This measures the AC current usage when the inverter is charging.

**Inverter Output VAC:** This monitors the AC output voltage while the unit is inverting.

**AC Input Amps:** The inverter uses a double pole pass through relay. This measures current consumption through the Hot 1 terminal.

**Battery Temperature:** This monitors counts of the battery temperature sensor (BTS). Counts are measured impulses which the inverter uses to calculate the battery case temperature. The charging voltage is adjusted to optimum values.

**Xformer Temp:** This monitors the transformer temperature which is measured in counts. Higher count readings are registering lower temperatures.

**FET Temp:** This monitors the Field Effect Transistor temperature which is measured in counts.

**Est Batt Cap:** This estimates the battery bank capacity in amp hours (Ahrs). Charging and discharging on a cyclic basis will give an approximate indication of the battery capacity in amp hours. Observe the reading and multiply by eight to obtain an approximate reserve capacity. This figure is only approximate and will change with cyclic use.

---

**To enter programming mode:**

- Press and hold the Set-Up buttons (up and down arrows) for five seconds. The RC7 GS remote will beep.
- Release the buttons. The programming mode has been entered when the Search Sense is displayed.
- Use the Menu buttons (up and down arrows) to scroll through available field settings.
- Use the Settings button (arrow pointing to right) to scroll through available settings for selected field.

**Programming  
the RC7 GS**

**To exit the programming mode:**

- Allow 20 seconds to elapse from the time the last key is pressed. Program changes are then accepted by the inverter in non-volatile memory.
- Momentarily pressing the set-up buttons (up and down arrows) exits the programming menu. Program changes are automatically saved in non-volatile memory.
- The inverter is now ready to use. "Waiting for AC" will be displayed or if any program changes were made with AC applied, one of the three stages of the charge cycle will be displayed.



**NOTE: Non-volatile memory is a permanent programming change accepted by the inverter. Turning the main battery disconnect switches off does not affect programming changes. Only the inverter clock time and automatic generator start/stop programming will be erased.**

---

## **Adjustable Field Settings**

### **Search Sense:**

The inverter searches for an AC load. For example: While inverting, AC loads of various amperage may be applied. These loads may range from a few watts to several amps. Search Sense is the cut-in point which the inverter will exit the “sleep mode” and start inverting at a standard output voltage. The Defeat setting allows the inverter to be at a constant standard output voltage. When changing the Search Sense value AC loads must be evaluated for proper inverter operation.

### **Auto LBCO:**

The Automatic Low Battery Cut-off may be turned on or off. These settings allow the inverter to use available DC voltage to a set value while inverting. Turning the LBCO **ON** stops the inverter when the battery voltage drops to 10.5 Volts DC. Turning the LBCO **OFF** stops the inverter when the battery voltage drops to 8.5 Volts DC. This leaves the batteries discharged, but not completely dead.

### **Battery Capacity:**

The battery bank capacity is adjustable in Ahrs (amp hours). These settings change charging curves and the length of time of the charging cycles. The range is from 125 Ahrs to 1,000 Ahrs. Select the closest Amp Hour rating for the house battery bank capacity. The auto setting will “learn” the battery bank size by user characteristics. For example: Discharging and recharging the batteries on a cyclic basis. The inverter takes several charging cycles to “learn” an individual battery bank size. When the main battery disconnects have been tuned off, the “learning” curve is erased.

### **Battery Type:**

Many types of batteries with different chemical compositions are available. Different chemical types require different charging characteristics at different voltages. Selection of available battery types are:

- AGM (absorb glass matte)
- Gel Cell
- Liquid Lead Acid

**Charge Rate:**

Charge rate is adjustable from 10 to 100%. This feature may be used in many different ways. Selecting a lower percentage charge rate lowers the inverter AC battery charger's current consumption. It will take longer to charge batteries but will leave user a few extra AC amps when operating from a limited AC power source.

**Shore Power Amps:**

This is a load shedding feature of the battery charger in the inverter. For example: Shore Power Amps set to 30 amps will decrease the AC current available for the internal battery charger's use, as pass through AC current value approaches 30 amps. Lowering shore power amps will limit the available AC current for the internal battery charger's use. This is adjustable from 5 to 30 amps, in 5 amp increments.

**RC7 GS Setup:**

This option allows the user to select the desired screen display. The Last Key will leave the menu active with the last status viewed on the display. The Rolling Display will continue to scroll through the active menu status display. Power Saver allows the display to "sleep" after viewing the status. Touch any key to "awaken" the RC7 GS remote, then press the desired key.

**LCD Contrast:**

This changes the display screen contrast. Six settings are available. Lighter contrast settings may leave the screen difficult to see in a bright atmosphere.

**External Shunt:**

The inverter monitors both AC and DC current values, whether charging or discharging (figures are approximate), by using internal or external shunts. A shunt monitors partial current consumption, allowing the majority of current to pass on heavier conductors. Programming shunt selection affects which shunt the inverter is using to monitor DC current values. Single inverter systems use their internal shunt to monitor system DC current values. When programming single inverter systems select External Shunt None. Dual inverter systems use an external shunt to monitor system current values. When programming the shunt selection of a dual inverter system, the master inverter is programmed by the remote installed in the monitor panel. The master inverter will be programmed as External Shunt This Inverter. The slave inverter will be programmed as External Shunt Other Inverter.

**Fuel Gauge Cutout:**

Battery chemistries and types have different static voltage readings at different states of charge. The battery voltage may be used to determine an approximate state of charge for that battery type and chemistry. The Fuel Gauge Cutout voltage is a reference point the inverter uses to determine a battery with no reserve capacity amp hours remaining. Changing the value of the Fuel Gauge Cutout will

affect the fuel meter, automatic generator start and stop points if set by SOC (state of charge) and time left to run or charge. The Fuel Gauge will read 0 when the Fuel Gauge Cutout pre-programmed voltage reaches 50% SOC.



**NOTE: The remaining field items are used to program the Automatic Generator Start parameters.**

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## **Automatic Generator Start**

The house batteries operate most of the interior lighting and most appliances. As the house battery power is consumed the reserve battery capacity diminishes. The inverter can be programmed to automatically start and stop the generator to keep up with the drain on the house batteries. All field reference points are house battery indications or conditions. A wide field of parameters may be chosen for the generator start and stop points. These points may be set in three categories:

1. House battery voltage.
2. State of charge (SOC). The Fuel Gauge Cut-out affects SOC.
3. Absorb or Float point of the charge cycle.

For example: The inverter can be programmed to start the generator when house battery voltage falls to 11.4 Volts. As the battery voltage rises the inverter can be programmed to stop the generator when the house battery voltage obtains a percentage of state of charge (SOC). When selecting the field reference points make sure that the start and stop points are spread apart.

It is possible to set parameters too close, causing short cycling of the generator. The menu will display the status of the generator while pending generator start. The generator must be operating correctly for proper automatic generator start and stop operation.



**NOTE: If the generator is started manually from any remote switch other than the RC7 GS remote while the automatic generator start feature is enabled, the generator will shut down due to field parameter settings.**

To override the automatic generator operation so that the generator may be operated manually, use the RC7 GS remote Inverter button to start or stop the generator. This is done using the **UP** or **DOWN** arrows while in the main menu until Generator Start/Stop: Press (on/off) is displayed. The display will inform the user of the generator's status. The generator will need to be manually stopped.

To enable the automatic generator operation, the programming mode must be entered. Before any field reference points can be established the clock must first be set. The clock set field is the last item in the programming menu.

**Clock Set:**

The clock is a 24 hour clock. If the display reads 00:01, it is 12:01 a.m. If the clock reads 13:00, it is 1:00 p.m. The hours and minutes will flash, alternating every eight seconds. Use the Settings button to advance hours or minutes. **The clock time and the generator start/stop programming will be erased whenever the main battery disconnects are turned off.**

**Generator Start:**

Selecting a state of charge (SOC) generator start point is affected by the Fuel Gauge Cutout voltage setting. SOC start points are between 40-60 percent, or the generator may be programmed to start at a specified voltage. The manual start disables the automatic start.

**Generator Stop:**

Selecting a state of charge generator stop point is affected by the Fuel Gauge Cutout voltage setting. SOC stop points are between 90-99 percent, or the generator may be programmed to stop at the Absorb or Float point of charge cycle. The manual off disables the automatic stop.

**Begin Generator Quiet Time or End Generator Quiet Time:**

The automatic generator start feature may be programmed to operate only at certain times in the 24 hour clock period. Example: The user wants the automatic generator to start operation at 10:00 a.m. and stop operation at 7:00 p.m.

**End Generator Quiet Time:**

This is the time which the automatic generator operation is to begin. Using the example time above, the 24 hour clock would be set to 10.00 hrs.

**Begin Generator Quiet Time:**

This is the time which the automatic generator operation is set to stop. Using the example time above as a reference, the 24 clock would be set to 19:00 hrs.



**NOTE: If the generator started from the automatic start program and has not reached the automatic stop set point when quiet time begins, the generator will stop and “Gen Quiet Fault” will be displayed.**



**Select Generator:**

The inverter has the capability to operate more than one generator manufacturer type. The selections are:

- Onan Quiet Diesel
- Power Tech, two and three wire.
- Other 30-80 (reserved for future).

**To disable the automatic generator operation use one of the following methods:**

- Set Generator Start and Generator Stop points back to manual **ON/OFF** positions.
- Switch off the house and chassis main battery disconnects to erase the clock time and generator start/stop programming.

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**Equalize Charging**

Batteries can sulfate over time. When this occurs some of the sulfuric acid has adhered to the lead plates of the battery and cannot enter the electrolyte solution though normal battery charging. A battery with a low concentration of acid in the electrolyte will effect 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 three hours. To maximize the results from an equalize charge initiate the equalize cycle after the batteries have 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. Several precautions should be used 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 other sources of ignition.
- Secure the battery compartment door in the open position. Extend battery trays to the full open position when equalize charging.
- Remove the liquid lead acid battery caps during the equalize charge cycle. AGM battery caps are not removable and may void the battery's warranty if removed.
- A liquid lead acid battery will consume water at an equalize

charge voltage. Fill battery cells with distilled water before beginning an equalize charge cycle. Do not overfill the battery cells. Overfilled battery cells will spatter excess electrolyte.

- Protect all painted surfaces from any electrolyte solution which 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.
- Remove the fuses from the solar panel charge leads.
- Observing the 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.
- Mark the specific location then disconnect the wires from the battery maintainer.
- Avoid operating any electrical equipment while in the equalize charge cycle.

#### **To Equalize Charge:**

- Press and hold the Settings button on the remote (arrow pointing right) for six seconds. Charge light will flash rapidly and System Status: Equalize will appear on the screen. The inverter will run the equalize charge cycle for three hours.

#### **To Exit Equalize Charge:**

- The equalize charge cycle may be discontinued at any time during the charge cycle. Press and hold the settings button for six seconds. The inverter will display System Status: Absorb for thirty seconds then switch to float charge.
- 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 fresh water to rinse the entire battery compartment and surrounding area.
- Install fuses to solar panel charge leads.
- 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.
- Hook up the battery maintainer. Be sure the wires are connected to the correct location.



**CAUTION: Never 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!**

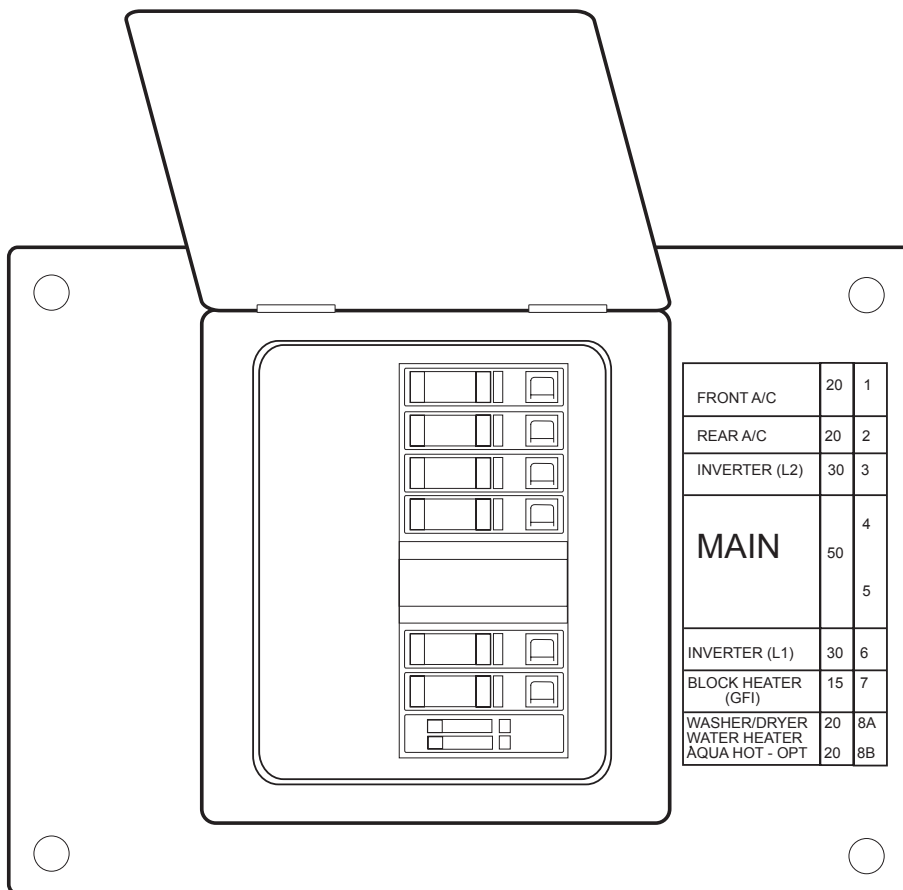
## Re-booting the Inverter

The remote is used to program or turn on or off the inverter. The RC7 GS remote is a display only. All the programming information is retained in the inverter. If the inverter exhibits unusual symptoms or behavior such as not responding to commands or displaying erroneous error conditions, “re-booting” the inverter may alleviate these symptoms.

### To re-boot the inverter:

1. Remove AC power from the inverter by disconnecting shore power and/or shutting the generator off.
2. Turn the main switch on the inverter to the **OFF** position.
3. Switch house and chassis main battery disconnects to the **OFF** position.
4. Wait 30 seconds, this allows time for capacitors to discharge.
5. Switch house and chassis main battery disconnects to the **ON** position.
6. Turn the main switch on the inverter to the **ON** position.
7. Connect the shore power cord or start the generator.

## DISTRIBUTION PANEL - HOUSE 110 AC Panel



Main Panel.

The AC distribution panels are located in the bedroom. The main 120 Volt AC panel receives power from the transfer switch, which is supplied by either shore power or the generator. The AC power is supplied to the 50 amp main breaker first, then the power is supplied to the individual branch circuit breakers. The panel label describes the breaker layout and the item, outlet or appliance to which they pertain. The sub panel receives AC power from the inverter. The sub panel supplies power to items which can be operated by the inverter. When operating from either shore power or the generator, the sub panel is automatically supplied with AC power from the pass through relay in the inverter. When hooked to shore power or operating from the generator, the AC power goes to the main AC panel first. The

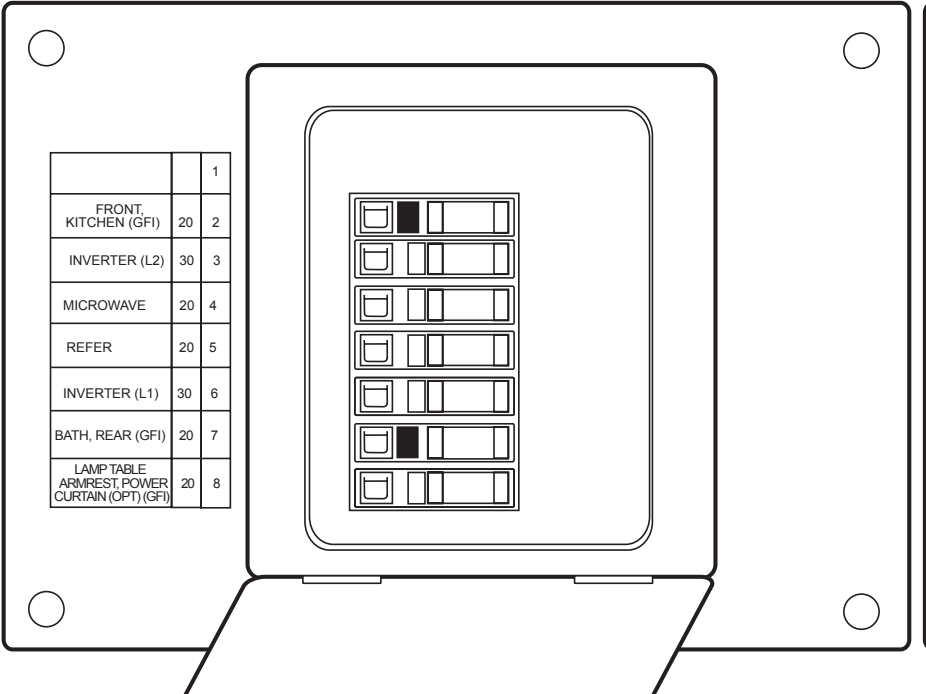
branch circuit breakers in the main panel then supply AC power to the input terminals of the inverter. The pass through relay inside the inverter trips supplying AC power to the sub panel.

When using the inverter as the AC power source, the pass through relay is normally closed. The AC power produced by the inverter supplies power to the sub panel only.



**WARNING: The 120 Volt AC panels contain 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 may require the AC power to be on. Only qualified personnel or 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 should be tested or disconnected to determine the reason the breaker tripped. If no cause is found, or not readily apparent, reset the breaker by toggling the breaker to the OFF position, then back to ON. Should the breaker trip again after the load is reapplied it may indicate a fault with that particular load. Do not continue to reset breaker until the problem has been correctly diagnosed and corrected.



Inverter Panel.

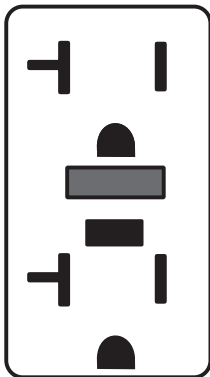
## Circuit Breaker

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 breaker will heat up from the excess current causing the breaker to trip. The trip action of the circuit breaker can occur within milliseconds due to the speed at which electricity can travel. Breakers are designed to operate at a continuous load of 80% of the breaker's rated capacity. For example: A breaker with a 20 amp rating will operate a continuous 16 amp load. This design leaves a small amount of working capacity within the breaker. When an inductive load is applied, such as when an electric motor turns on, the motor starts to spin and current consumption may momentarily exceed the rated capacity of the breaker. As the electric motor comes up to operating speed, the electric motor's current consumption will 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, such as air conditioners. When using outlets, care should be considered when applying loads such as electric motors, heaters, coffee makers, toasters, hair dryers or other large current consuming loads. The current rating is usually stated on most electrical items. The current rating will either be rated in amps or watts. Current ratings stated on electrical items will change slightly with voltage fluctuations. As voltage increases current consumption decreases. As voltage decreases current consumption increases. This may explain why in some instances items operated at borderline voltage to current tolerances may seem fine in one location but problematic in another.



**NOTE: To calculate watts to amps simply divide the watt figure by the voltage of which the item operates from. For example: The electrical item is rated at 1,370 watts. Divide that by the operating voltage of 115 volts which equals 11.913 amps. Use this formula to calculate the amount of load to the available power supply.**

## GFCI BREAKERS & OUTLETS



GFCI Outlet.

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 electron-

ics 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). Electrical shocks resulting from ground faults can be felt, but such a shock is considerably less than one without ground fault protection. People with heart conditions or other conditions that make them susceptible to shocks can still be seriously injured. A GFCI outlet 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.**

The 12 Volt DC house distribution panel contains fuses (located in the bedroom) that protect the electrical circuits. These fuses are a standard automotive type. When a fuse is “blown,” the wire in middle of the plastic case will be burnt. A broken, bad or “blown” fuse must be replaced with a fuse of the same rating and type. Using a fuse with a different rating or type will defeat the circuit protection provided by that fuse and could result in damage to the motorhome’s electrical system.

## DISTRIBUTION PANEL - HOUSE 12 VOLT



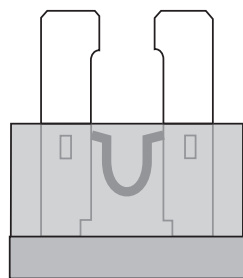
Fuse Panel Label located in bedroom.

## FUSES

The 12 Volt fuses, located in this distribution panel, service the interior house lighting, ventilation fans and monitor panel. 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 is used for makes it common 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 of this is when a magnetic field is generated, then collapses when the power supply is turned off. The result is an electrical discharge that can reach tens of thousands of volts for a short time period. Care should be used when working with this voltage as current values can be quite high, as in the case of a battery cables.

Shorting a battery cable to ground with a battery at a reasonable state of charge can result in a fire or serious personal injury from a burn.



ATO Fuse

AMPERAGE	COLOR
1	BLACK
2	GRAY
3	VIOLET
4	PINK
5	GOLD
7.5	BROWN
10	RED
15	BLUE
20	YELLOW
25	CLEAR
30	GREEN

Amperage Chart.

**Tools of the Trade**

One of the most widely used tools used for testing a 12 Volt problem is the test light. Many different types of test lights are available 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 VOM or Volt Ohm Meter 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 event of a charging system problem, where exact voltage values need to be obtained, 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.

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 may lead 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 become potentially dangerous if left to be repaired at a more convenient time?

**Knowing When to Say When**

**NOTE: Check all related fuses before assuming you have encountered an electrical problem or situation. Spare fuses should be kept on hand, and can be purchased from auto parts stores. A fuse description label is on the distribution panel cover.**



**WARNING: If a fuse blows, replace the fuse with same amperage rating and type. Installing higher amperage fuses can damage the wiring or the item the fuse is protecting, or may cause a fire. If the fuse repeatedly blows after replacing it, do not continue to replace it. Have the problem diagnosed and corrected by a qualified technician.**



## **BATTERY - HOW IT WORKS**

Batteries come in different sizes, types, amp hours, voltages and chemistries. There are nearly as many descriptions of battery types and how they should be used as there are people willing to offer advice on them. Although it is not possible to cover batteries in their entirety, there are guidelines that can be followed to ensure that the batteries are well maintained.

The operation of the battery is based on a chemical reaction. The battery is a container of lead plates, insulators and a solution of distilled water and sulfuric acid. 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.

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### **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.

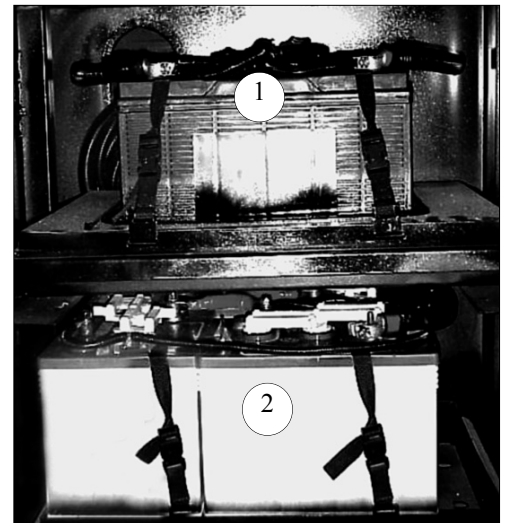


**NOTE: Tap water contains minerals which can alter battery chemistry and ruin the battery. Use only distilled water when refilling the battery.**

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. Over-filling the battery will allow the electrolyte solution to boil or gas out of the battery cap. Remember to use only distilled water to refill the battery. A battery with a low electrolyte level will 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.

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.

**Battery Maintenance**

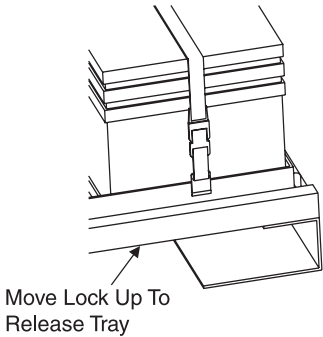
*The Chassis Battery (1) and the Domestic Batteries (2), located within the Battery Storage Compartment.*



**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.**

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## Battery Trays



The engine (chassis) and domestic (house) batteries are located in a curbside compartment. The slide-out battery trays are secured in place by a locking mechanism at the front of the trays. To slide the tray out, lift up on the handle and pull until the tray stops. To secure the battery tray, push it back in until the tray latches.

The battery tray slides will occasionally need to be lubricated. When performing maintenance to the batteries clean the old lubricant and dirt from the battery tray slide with solvent, brake cleaner or equivalent. Do not allow any of the cleaning solution or battery acid by-products to spatter onto the painted surfaces. Damage to the paint surface will result. Lubricate all moving parts of the battery tray slide with white lithium grease or Kwikol brand spray lubricant.



**NOTE: Driving without the tray secured can result in damages.**



**CAUTION: Many types of petroleum based products or battery by-products can damage the paint finish. Do not allow these types of chemicals to get on the paint finish. If the chemicals do get on the painted surfaces immediately rinse the surface using plenty of water with a mild automotive detergent.**

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## Testing the Battery

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 "ball park" 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 will be. 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.

If the low cell does not come up after charging, this battery can damage the rest of the battery bank and should be replaced. An accurate digital volt meter + - .5% will also give an indicator of the battery’s state of charge.

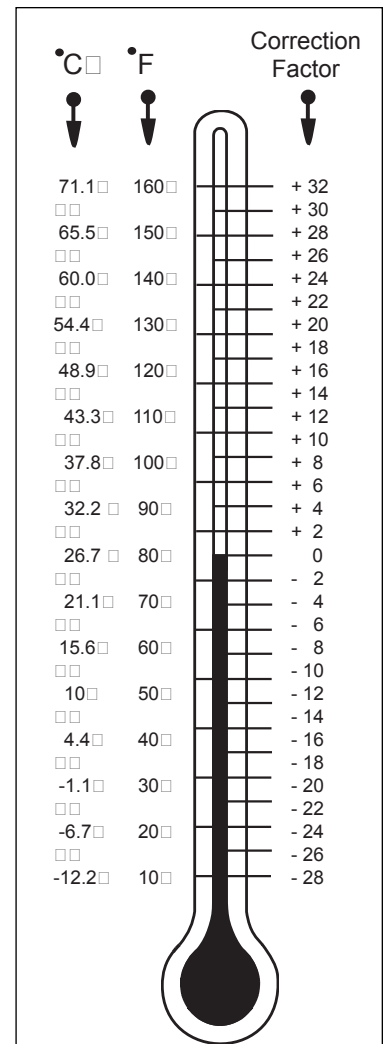
Another test that can be performed is to place a specific load on the battery for a predetermined length of time equal to that particular battery’s rating. This machine is usually an adjustable carbon pile that can vary the load being applied to the battery(s) while monitoring voltage to see if they will perform to their specific rated capacities



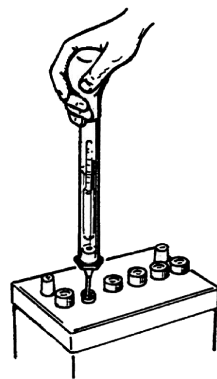
**NOTE: See the chart for temperature compensation. Liquid levels should be even between the cells of the battery being tested as it will affect the accuracy of the test.**



**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.**



Temperature Correction Chart.



Hydrometer (Cylinder Type).

## **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 you add more than one or two ounces of distilled water 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 overcharging.**

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. Let's 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,

## **Battery Voltage & Current**

pressure with voltage, volume with amps, outflow valve with a switch, water with electricity and the water tank with the battery electrolyte.

The level of the tank could be thought of as the rate of the reaction occurring in the electrolyte. When the battery is fully charged the electrolyte has an excess of reactions taking place to feed the battery terminals. This tapers off with time as the electrolyte is spent so maintaining voltage becomes possible. With no loads the discharged electrolyte will be capable of producing close to the rated voltage, but only after a period of time has elapsed for enough of a reaction to take place to bring the voltage back up. Hopefully, this explanation will clarify why a battery measured at rest can indicate close to its rated voltage but will not run a load.

---

### **Battery Charge Time & Consumption Rate**

**Calculating Run Times:** Calculating run time figures when operating 120 Volt AC electrical items with an inverter can be exponential. 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. Example: A deep cycle battery with a rated capacity of 100 Ahrs. is designed to release current at the rate of five 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° Fahrenheit 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.

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**

<b>STATE OF CHARGE</b>	<b>VS</b>	<b>SPECIFIC GRAVITY</b>
<b>100%</b>		<b>1.265</b>
<b>75%</b>		<b>1.225</b>
<b>50%</b>		<b>1.190</b>
<b>25%</b>		<b>1.155</b>
<b>Discharged</b>		<b>1.120</b>

<b>STATE OF CHARGE</b>	<b>VS</b>	<b>OPEN CIRCUIT VOLTAGE</b>
<b>100%</b>		<b>12.66v</b>
<b>75%</b>		<b>12.45v</b>
<b>50%</b>		<b>12.24v</b>
<b>25%</b>		<b>12.06v</b>
<b>Discharged</b>		<b>11.89v</b>

	<b>Ah (20hr)</b>	<b>CCA</b>	<b>RC (25A)min</b>
Chassis 12 Volt Chassis 31P-MHD (2 each)	240	950	450
<b>12 Volt Chassis 8D-MHD(1)</b>	<b>240</b>	<b>1400</b>	<b>450</b>
<b>6 Volt Domestic U2200 (4 each)</b>	<b>225</b>	<b>**</b>	<b>447</b>

*\*\*Battery connections are made in a Series/Parallel connection. Domestic batteries are not rated in Cold Cranking Amps (CCA). Figures reflect capacities per individual battery.*



## SOLAR PANEL (Optional)

The motorhome comes pre-wired to accept this optional solar battery charging system. The system consists of one 90 watt solar panel with mounts, a combiner box (that allows you to easily expand the system) and a charge controller that can handle up to four 90 watt solar panels.

### The Solar Panel:

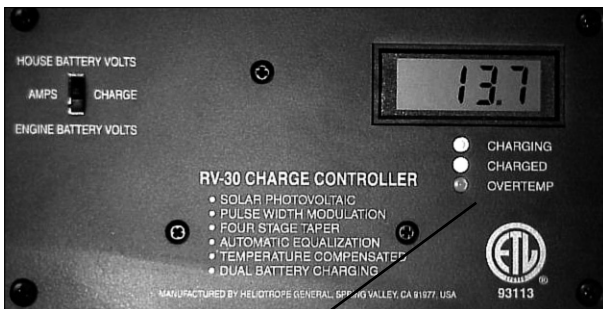
The Solar Panel is a Solec 90 watt panel that is capable of delivering about 5 amps of charge per hour, per panel, in full sunlight (usually between 9:30 a.m. and 2:30 p.m.). Extensive testing by the manufacturer has shown that one 90 watt solar panel delivers enough power to offset a normal day to day drain on batteries caused by various parasitic electrical loads. These parasitic loads are usually associated with transmission memories, alarm systems, natural self-discharge of batteries and other like items. This means that the first 90 watt solar panel is only intended to cover these parasitic loads. Adding a second, third or fourth solar panel (depending upon needs and electrical consumption), can replace what is drawn out of the batteries from the operation of lights, water pumps, inverters, etc., while dry-camping.



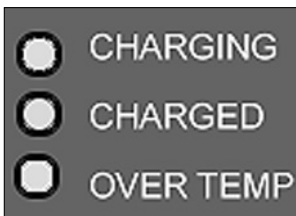
**WARNING: The Solar Panel needs to be cleaned monthly. The Solar Panel may need to be cleaned more frequently if weather conditions permit.**

### The Combiner Box:

The Combiner Box is located on the side of the refrigerator vent on the roof. It has four standard ½” knock outs to allow you to add any extra solar panels you may desire to meet your dry-camping needs.



RV-30 Charge Controller



Close-up of the Indicator Lights.

### The Charge Controller:

The Charge Controller was built specifically to meet the needs of Holiday Rambler motorhomes. The faceplate has a digital readout that will display one of three readings by means of a slider switch: House Battery Voltage, Amps Charge or Engine Battery Voltage.

There are also three indicator lights for at a glance status: Charging (which means the system is actively charging), Charged (which means the batteries have reached 14.2 Volts) and Over Temp (which means that the circuit board has reached a high temperature and has been turned off until it cools down, then it will turn back on automatically).

The faceplate of the controller is used as a heat sink for the electronics attached to it, and 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 Overtemp light) will be activated if it gets too warm.

**The RV-30 Charge Controller has many unique features which are listed and described below:**

## **Charge Controller Features**

- 1. Battery Charging** - The above mentioned parasitic loads affect both the House and Engine batteries. The controller automatically charges both the House and Engine batteries at the same time to deal with this issue.
- 2. Pulse Width Modulation** - This charging strategy has been found by the Sandi National Laboratories to maintain the highest state of charge with the least amount of battery water consumption. In effect, it delivers all the available charging amperage until the batteries reach 14.2 Volts (this stage is called bulk charging) and then it begins to taper off amperage (absorption stage) until it is reduced to all that is needed to simply hold the battery at 14.2 Volts (Float Stage).
- 3. Temperature Compensation** - The gassing threshold of the batteries is reached at around 14.1 to 14.4 Volts at room temperature (25° C). If the temperature of the batteries is hotter than 25° C, the gassing threshold is reached at a lower voltage. If the temperature of the batteries is colder than 25° C, the gassing threshold is reached at a higher voltage. This feature protects your batteries from excess water loss and/or plate sulfation by automatically compensating for these temperature changes and adjusting the charging voltage accordingly.
- 4. Automatic Equalization** - This feature is activated once per day to extend the life of your batteries by allowing the weaker cells a chance to catch up with the stronger cells. This assures that all cells will be at an equal state of charge. The first time domestic batteries reach 14.2 Volts during the day, a delay timer is activated that allows a short duration period (20 to 30 minutes) at a slightly higher voltage (14.5 to 14.7 Volts) and then falls back to the 14.2 Volt setting for the remainder of the day.

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A critical part of maintaining the solar electric battery charging system is to keep the panels clean. The amount of power which a panel will produce is directly related to the intensity of sunlight which reaches it. A dirty panel will allow less light to reach the panel resulting in less power produced. A single layer of dust or road grime can reduce the power output by 15 to 25%. Leaves and debris which can cover two or three of the 36 individual cells can reduce output power by 50 to 75%.

## **Solar Panel Care**

Use of the basic maintenance tips, regular inspections and regular cleaning will assure you of maximum charging from your solar electric system. A non-abrasive cleaner and paper towels are recommended. 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 to follow**

1. If you can see a film or a layer of dust on the windshield chances are your panels should be cleaned.
2. On a bright sunny day the charging amps should be 3.5 to 5 amp for each panel.
3. High winds blow dust and debris around causing dirt build up. Frequently inspect the panels and clean as necessary.



**CAUTION: Avoid damage to the solar panel controller. Cover the solar panel with a blanket when externally charging the batteries or performing battery cable maintenance.**

---

**BULB USAGE -  
INTERIOR**

<b>INTERIOR BULB CHART</b>	
<b>LOCATION</b>	<b>BULB NUMBER</b>
CEILING LIGHT	GE FI5T8 - CW
CLOSET LIGHT	SYLVANIA 1141
PORCH LIGHT	SYLVANIA 921, GE 92
DINETTE LIGHT	60 Watt
ROPELIGHT	Litco 31-120-40
WALL LAMP	27000k/PL9 Watt
BATHROOM LIGHT	F18X/SPC35/RS
VANITY LIGHT	12X 13W 9-019F

# NAVIGATOR

## SECTION 9 ELECTRICAL SYSTEM - CHASSIS

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**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 all the technological advancements 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 interconnections. For an example: While driving the motorhome, the alternator on the engine will charge the house batteries. Likewise, while the motorhome is plugged into shore power or the generator is running, the engine battery(s) are being charged. 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, taillights, dashboard functions, gauges, etc. The house battery(s) supplies 12 Volt DC power to the distribution panel located in the bedroom.

The main battery disconnect for the chassis battery turns the DC power on or off to the rear and front run boxes. 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. The security system requires a constant power source to remain operational when the disconnect switch is off. 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

**BATTERY  
DISCONNECT  
- CHASSIS**

help prevent the possibility of dead batteries. 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 switches off.



**NOTE: The solar panels 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.**
- 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.**

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## **BATTERY - CHASSIS**

The chassis battery operates only chassis and engine functions. The chassis battery is a crank type battery which produces 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 should remain 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**

	<b>Ah (20hr)</b>	<b>CCA</b>	<b>RC (25A)min</b>
Chassis 12 Volt Chassis 31P-MHD (2 each)	240	950	450
<b>12 Volt Chassis 8D-MHD(1)</b>	<b>240</b>	<b>1400</b>	<b>450</b>
<b>6 Volt Domestic U2200 (4 each)</b>	<b>225</b>	<b>**</b>	<b>447</b>

*\*\*Battery connections are made in a Series/Parallel connection.  
Domestic batteries are not rated in Cold Cranking Amps (CCA).  
Figures reflect capacities per individual battery.*

<b>STATE OF CHARGE</b>	<b>VS. OPEN CIRCUIT VOLTAGE</b>
<b>100%</b>	<b>12.66v</b>
<b>75%</b>	<b>12.45v</b>
<b>50%</b>	<b>12.24v</b>
<b>25%</b>	<b>12.06v</b>
<b>Discharged</b>	<b>11.89v</b>

<b>STATE OF CHARGE</b>	<b>VS SPECIFIC GRAVITY</b>
<b>100%</b>	<b>1.265</b>
<b>75%</b>	<b>1.225</b>
<b>50%</b>	<b>1.190</b>
<b>25%</b>	<b>1.155</b>
<b>Discharged</b>	<b>1.120</b>

**CUMMINS ENGINE COLD CRANKING AMPS REQUIREMENTS**

ISB 1100 CCA 12 VOLTS  
 ISC 1250 CCA 12 VOLTS  
 ISL 1500 CCA 12 VOLTS  
 ISM 1800 CCA 12 VOLTS  
 N14 1800 CCA 12 VOLTS

CCA Rating are at 0° F. These are the minimum requirements.



## FUSES & CIRCUITS - CHASSIS

### Distribution Panel - Front



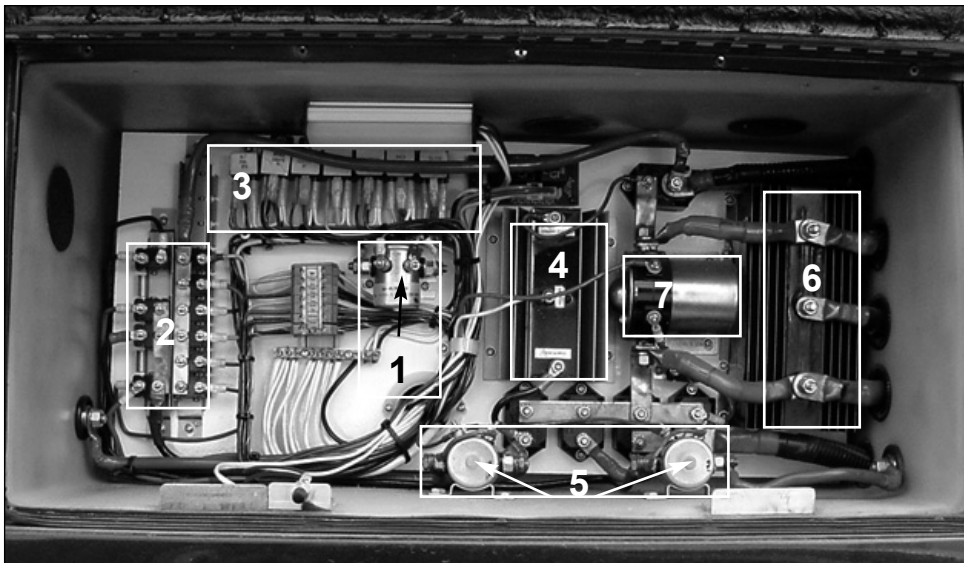
Front Run Panel.

The front electrical panel is located on the road-side, ahead of the front wheel. It contains the fuses, self resetting supply circuit breakers, solenoids 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.

### Distribution Panel - Rear

The wire distribution panel located in the rear operates mostly engine related functions.



Low Current Plate / High Current Plate.

1. The starter solenoid.
2. The auto re-set circuits breakers.
3. The various relays.

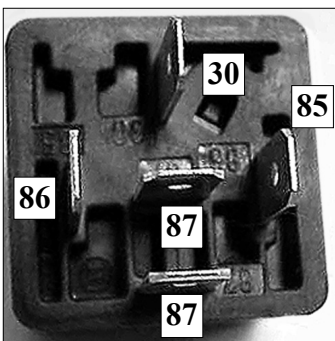
4. The battery maintainer.
5. The house disconnects solenoids.
6. The battery isolator.
7. Battery boost solenoid

**Relays**

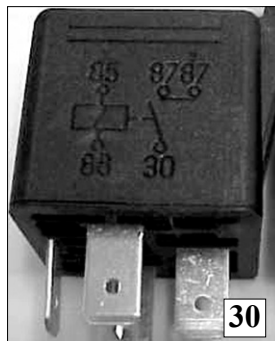
The coach uses different relays to operate different equipment. If a relay needs to be replaced, carefully record the location of each wire and its color.

The Bosch relays may look the same but they are completely different. Look at the side of the relay to determine whether you need an **87** relay or an **87a** relay. These relays can be easily mixed and your problem may increase if you change the wrong one. These two relays can be wired many different ways to operate different functions. Turn the relay over and look at the post. Each post is numbered. It is important to note these differences listed:

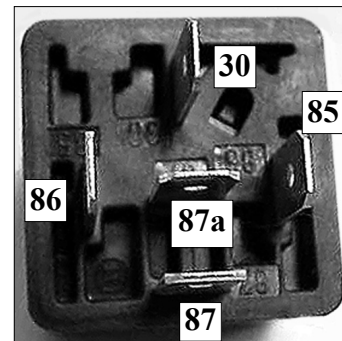
1. The 30 post is the incoming fuse and/or breaker power.  
Some relay applications supply power to the 30 post.  
Some use it for ground. The 30 post can be used many different ways.
2. The 85 post is one side of the coil, tripped different ways.
3. The 86 post is the opposite side of the coil, tripped different ways.
4. The 87 posts are not common to the 30 post until the relay is tripped. When the relay trips, both 87 posts are common to the 30 post.
5. Using an 87a relay, the 30 post and the 87a post are common. When the coil is tripped, the 87a becomes a dead post and then the 30 post becomes common to the 87 post located on the outside of the relay.



87-87 Relay.

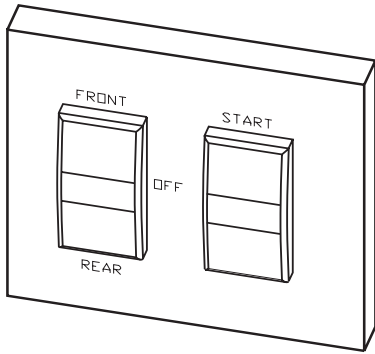


Bosch Relay.



87a Relay.

## REAR START BOX



Rear Start Box.

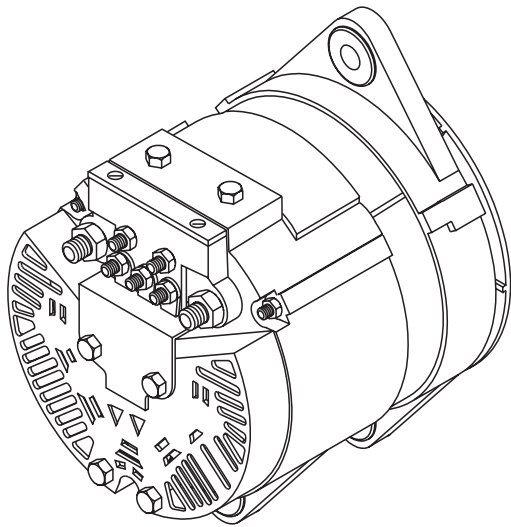
### To Start From the Rear:

- Turn ignition key to **ON**.
- Move rocker switch to **REAR**.
- Ensure everything is clear of rotating parts.
- Press the switch to **START**.
- Moving switch to the center **OFF** position will turn engine **OFF**.
- Return switch to **FRONT** for normal operation.
- Return the switch to **FRONT** run after use. If the motorhome will not start from the front, try to start it from the rear start box.



**CAUTION: When checking the engine compartment this switch should be placed in the rear start position. This will prevent accidental starting of the engine from the cab area.**

## ALTERNATOR



Part #s:  
LN 4884JB, M# 5994

The 200 amp Leece-Neville alternator with integral rectifier and regulator and remote voltage sensor is designed for reliable high output at all RPMs. This alternator offers high output over a broad range of operating speeds. The 4884JB deliver the same reliable, heavy duty performance all Leece-Neville alternators are known for. The 4884JB features an integral regulator and rectifier for compact installations.

The alternator should replace the amper-hours taken from the battery at start. The amount of charge given to a battery is dependent on engine run time. This allows to maintain a 75% level with enough energy to power the electrical systems. Driving the motorhome for a short distance or short periods of time, the battery may not get brought up to above 75% level.



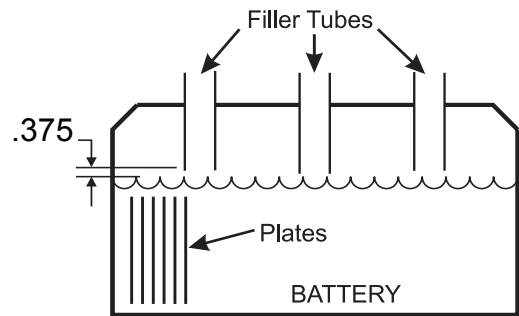
**NOTE: Standard - 200 Amp.**

**Specifications:**

- 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 8,000

- 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 vdc.
- Chassis battery voltage with the engine at idle should range 13.5 to 14.2 vdc.
- The output of the alternator range is 13.6 to 15.4 vdc. 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.

**Alternator Testing Procedure**



Battery State of Charge	Spec. Gravity	Voltage
100%	1.265	12.7
75%	1.225	12.4
50%	1.190	12.2
25%	1.155	12.0
Discharged	1.120	11.9 or Less

*The distilled water level should be 3/8" below vent tube.*

Remember the alternator is not a battery charger. It is designed to maintain the proper operating voltage level for the motorhome. A battery with a low charge or a dead battery may cause damage to the alternator.

## Battery Maintainer

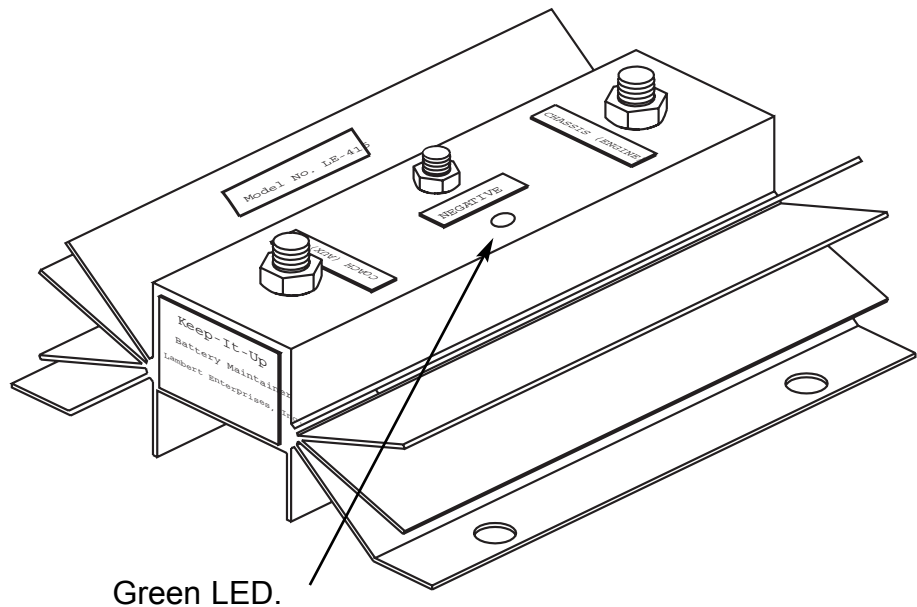
The battery maintainer is a fully automatic device that keeps the chassis battery fully charged whenever your motorhome is plugged into shore power, or when the generator is running.

- For easy reference, the battery maintainer has a green LED to indicate when it is active. It is illuminated whenever you are plugged into shore power, or when the genset is running. It is also illuminated when the engine is running, but that is of no consequence.



**NOTE: If the green LED is not illuminated when you are plugged into shore power, run the engine for a few seconds to activate the battery maintainer.**

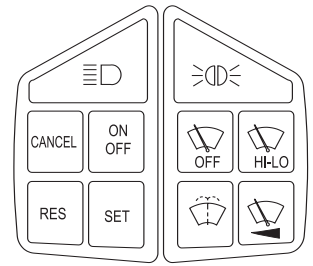
- The battery maintainer will provide up to 15 amps to the chassis battery.
- If the chassis battery voltage is low you may hear a clicking sound from the battery maintainer. This is normal and indicates that the chassis battery is trying to draw more than 15 amps. The sound will stop as soon as the battery has become recharged.
- While dry camping with the generator off, the battery maintainer becomes inactive and the green LED will go out.



The motorhome is equipped with a smart wheel. The “**HIGH IDLE**” feature can increase the idle with this procedure. (ISM 500 only.)

## STEERING COLUMN & SMART WHEEL

1. Cruise control off. To raise the idle push the resume switch. You can raise the idle in 25 rpm increments by pushing the switch seven different times. (ISL 370 will have an **idle up** idle down switch.)
2. To lower the idle use the set button on the smart wheel. Again, push downward to lower the idle.
3. With cruise control switch on: Push the set button and the rpm will raise at one time to 1,250 rpms. Push resume once idle drops to 1000 rpm. Push and hold resume button idle will raise to 1500 rpm.
4. Use cancel or turn the cruise control off to return the engine to an idle.



Smart Wheel Cruise Control.

**Horn:** The horn bar on the steering wheel will send the appropriate signal to cause horn output to be activated while the switch is pressed.

## Smart Wheel Operation

**Headlamp Flash:** If the headlamps are turned on, pressing the switch will cause them to go off while the switch is pressed. In a like manner, if the headlamps are turned off, pressing the switch will cause them to go on while the switch is pressed.

**Marker Lamp Flash:** If the marker lamps are turned on, pressing the switch will cause them to go off while the switch is pressed. If marker lamps are off, pressing this switch will cause them to temporarily illuminate.

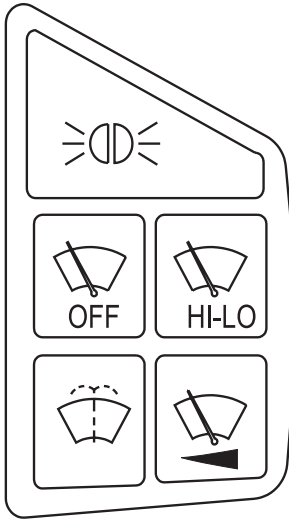
### Cruise Functions:

- **Cruise ON/OFF** - The operation of this switch cycles the Cruise system ON and OFF.
- **Cruise SET** - The operation of this switch actuates the Cruise Set function of the engine controller.
- **Cruise RES** - The operation of this switch actuates the Cruise Resume function of the engine controller.
- **Cruise CANCEL** - The operation of this switch signals the cruise system to disengage without losing the current speed memory setting.



**WARNING: Do not use cruise control in heavy traffic or on roads that are winding, slippery or unpaved. Do not shift the transmission into “N” (Neutral) with the cruise control on as high engine RPM run up will occur until the cruise control is turned off.**

## Wiper Functions



Smart Wheel Wiper Controls.

### Wiper Wash:

The operation of this switch activates the wash pump relay when the switch is pressed. In addition, if none of the latching wiper functions (Wiper LO/HI or Variable) had been previously selected, the Low Speed Wiper will be activated for a period of approximately three wiper cycles after the switch is released. If any of the latching wiper functions (Wiper LO/HI or Variable) had been previously selected, the wipers will continue to run in the selected mode after the wash switch is released.

### Wiper LO/HI:

The operation of this switch initially causes the Low Speed Wiper functions to activate. If the switch is pressed again the High-Speed Wiper will be activated. Subsequent presses of this switch will cause alternate operation of the wipers in the low or high-speed mode.

### Wiper Variable:

The operation of this switch initially causes the Low Speed Wiper function to activate for one wipe. If the switch is pressed again within approximately 30 seconds, the Low Speed Wiper function will be activated again and will repeat at an interval determined by the time between the last two operations of the switch. Additional switch operations will shorten the cycle. Activation of any wiper mode cancels the variable mode. The effect for the driver is thus: In light rain or mist conditions the driver presses the switch once when windshield first needs clearing. When the windshield again requires clearing, the driver presses button again-setting the time period between subsequent wipes to that required by the current conditions.

### Wiper OFF:

The operation of this switch causes all operation of wipers to be canceled. Turning off the ignition also resets this mode. Pull headlight switch to ON then back to off to cancel automatic headlight operation.



**NOTE: Headlights will come on when any wiper mode is selected.**

## Tilt & Telescope

Tilt and telescope steering wheel control lever is located on the steering column.

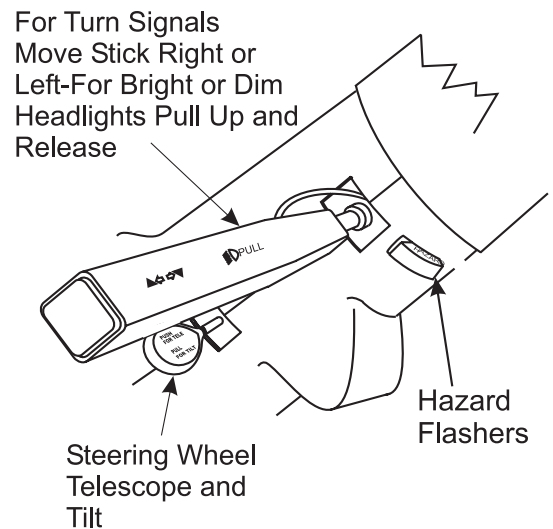
- To tilt the steering wheel, pull the lever up. Tilt the steering wheel where you want it. Release the lever and it will lock the steering wheel in the new position.
- To telescope the steering wheel, push and hold the lever down. Push down or pull up on the steering wheel until the wheel is where you want it. Release the lever and the steering wheel will lock in the new position.

Turn indicator and headlight high/low dimmer control lever is 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 head lights are ON.

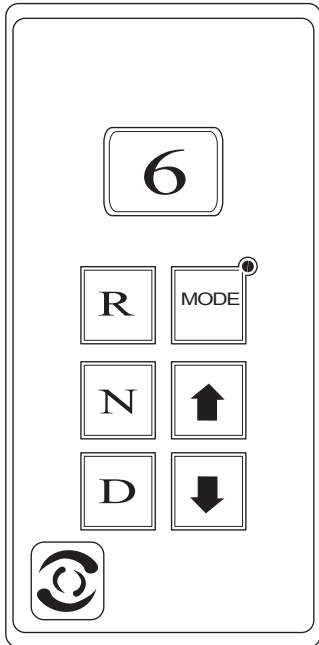
### Hazard Flashers:

- The flasher button is located on the steering column.
- To turn four way flasher on, pull out on flasher button.
- To shut off flasher, push button inwards.





## SHIFTER PANEL Transmission Shifter



### Transmission Key Pad:

The function of each position of the keypad push-button shifter is as follows:

- Select the REVERSE gear by pressing **R**.
- Select NEUTRAL by pressing **N**. The area around the **N** button is 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 on the **SELECT** display and the transmission will shift to the starting gear.
- 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 range selected by one range. 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 fluid level of the transmission can also be checked from the shift selector keypad. Press the up and down arrow button simultaneously while the motorhome is at a rest position. This activates the diagnostic circuitry of the transmission. To exit the diagnostics press **N**.



**NOTE: The oil level sensor method of checking the fluid level compensates for transmission fluid temperature between 60° C - 104° C (140° F to 220° F). Any temperature below 60° C (140° F), or above 104° C (220° F) will result in an Invalid for Display condition.**

The **MODE** button will enable the secondary shift point to be selected. The transmission shift point used will be 200 rpm lower. It is further used by a service technician to access diagnostic codes when troubleshooting. The diagnostic circuitry must be enabled to display the codes.

### To Enter Economy Mode:

Press the **MODE** button. The LED will illuminate.

### To Exit Economy Mode:

Press the **MODE** button. The LED will extinguish.



**CAUTION: Do not use the economy mode in heavy stop and go traffic or mountainous terrains. While in economy mode, using heavy throttle applications with frequent shifting will raise transmission fluid temperature. Exit economy mode until road conditions improve.**

The park brake system is activated when the push-pull control knob 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 and buzzer.

### Parking Brake

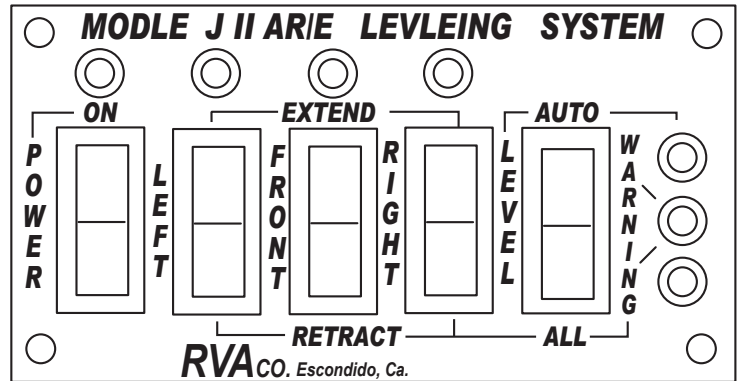


**WARNING:** If the air tank is not dumped, there is the possibility of an accidental release of the parking brake. Traveling with small children and/or pets may require a small block to be fabricated to prevent accidental release. The block should be placed under the knob and rested on the dash panel. A wooden clothes pin clasped at the base of the shaft will work.

### Leveling Controls

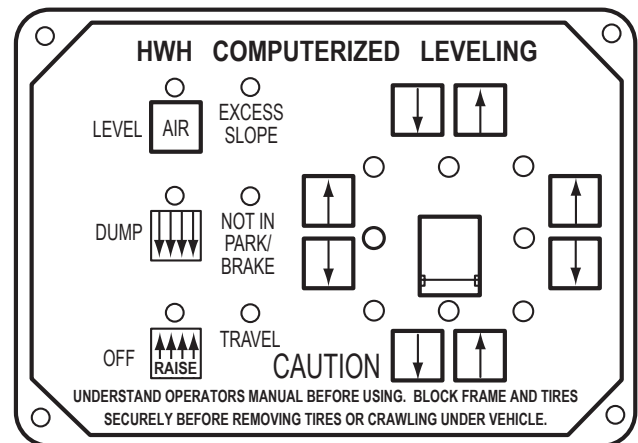
#### RVA Control (Hydraulic Systems):

The three point hydraulic leveling system is operated from the control module. You can manually or automatically level the motorhome. The control features a multiple warning system with flashing lights and a bong alarm to alert you of the jack down position.



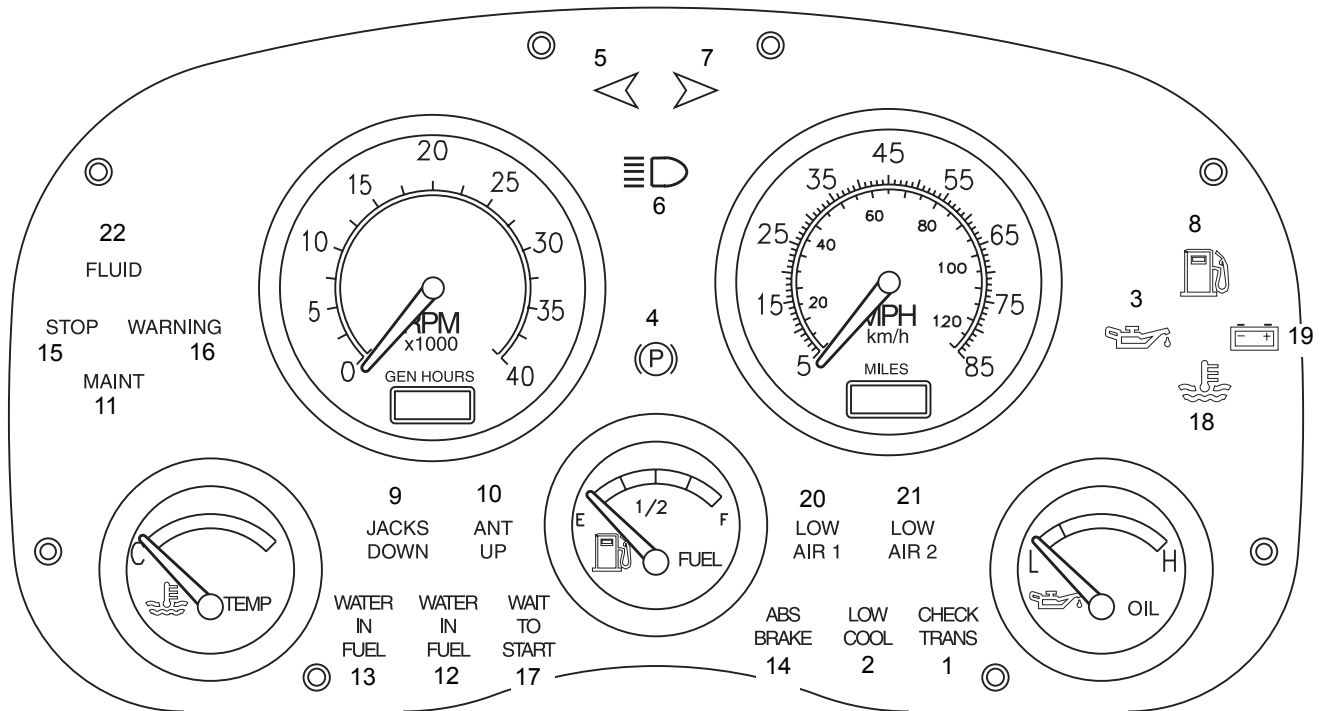
#### HWH Control (Air Systems):

The touch panel, computer controlled, four-point air leveling system is an option available for the motorhome. The keypad on the system controls the computerized air-leveling operations. The ignition must be ON in order for the suspension system to function.



**NOTE:** The suspension on the air leveling system will NOT operate unless the ignition is ON.

## DASH - Indicator Lamps

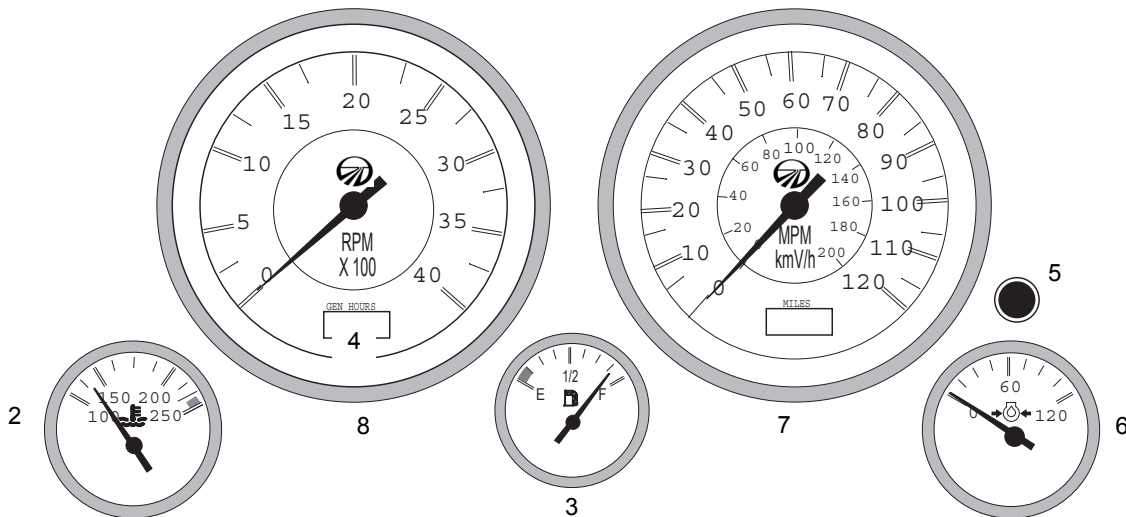


### Listed from left to right:

- 1. CHECK TRANS:** Alerts of problems related to the Allison Transmission. The light should momentarily illuminate when the ignition is switched ON. When starting the lamp will extinguish indicating the circuits are working properly. If the lamp fails to illuminate or remains on, the transmission needs to be checked immediately. Contact the nearest Allison dealer.
- 2. LOW COOL:** Indicates coolant level in the overflow tank is below acceptable level.
- 3. LOW OIL PSI:** Indicates low oil pressure. Stop coach. Check oil pressure gauge and oil level.
- 4. PARK BRAKE:** Indicates parking/emergency brake is applied.
- 5. LEFT ARROW - Audible Turn Indicators:** Indicates left turn indicator circuits active. Audible indicator cancels when the brake is applied.
- 6. HEADLIGHT BEAM:** Indicates high beams when illuminated.
- 7. RIGHT ARROW - Audible Turn Indicators:** Indicates right turn indicator circuits active. Audible indicator cancels when the brake is applied.

- 8. LOW FUEL:** Indicates fuel level is becoming low.
- 9. JACKS DOWN:** Indicates the jacks are down.
- 10. ANT UP:** Indicates the antenna is up.
- 11. MAINT:** Indicates out of range condition exists within the engine protection circuits. Stop coach and check all fluids. Contact your nearest Cummins dealer.
- 12. WATER IN FUEL:** Indicates water in fuel, applies to an ISL engine.
- 13. WATER IN FUEL:** Indicates water has been detected in fuel. Use the fuel filter system to purge water from the fuel. This light applies to the ISM engine.
- 14. ABS BRAKE:** Indicates ABS possible fault in the ABS Brake system. Indicates fault codes for service technicians.
- 15. STOP:** Alerts of severe out of range condition within the engine protection circuits. Pull over and stop as soon as possible. Shut-off engine to avoid engine damage.
- 16. WARNING:** Indicates out of range condition exists within the engine protection circuits. Stop coach, check all fluid levels.
- 17. WAIT TO START:** Not used.
- 18. HIGH WATER TEMP SYMBOL:** Indicates high water temperature. Check water temperature gauge. Stop coach and check coolant level.
- 19. ALT FAIL SYMBOL:** Indicates a failure within the alternator charging system.
- 20. LOW AIR ONE:** Indicates air tank pressures are out of operating range. Check air pressure gauge.
- 21. LOW AIR TWO:** Indicates air tank pressures are out of operating range. Check air pressure gauge.
- 22. FLUID:** Not used.

## Gauges



**1. Air Pressure Gauge:** (Diagram on next page) This gauge uses two needles to indicate air system pressures. One needle indicates air pressure of the front air tank. The other needle indicates air pressure of the rear air tank. The normal air system operating pressures are 90 to 120 psi. These air pressures are preset at the factory. If a problem occurs with either air system not maintaining normal operating pressure, it is an indication of a malfunction in the air system. Use caution and stop the motorhome in a safe area. Contact 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, also affecting operation of the air brake system.

**2. Coolant Temp:** Under average conditions the gauge will read between 180° F and 205° F. Monitor this gauge frequently when CLIMBING HILLS, TOWING OR IN HIGH AMBIENT TEMPERATURES. If the gauge shows that an over-heating condition exists (the needle moving above the 212° F area) IMMEDIATE ACTION should be taken to avoid engine damage.

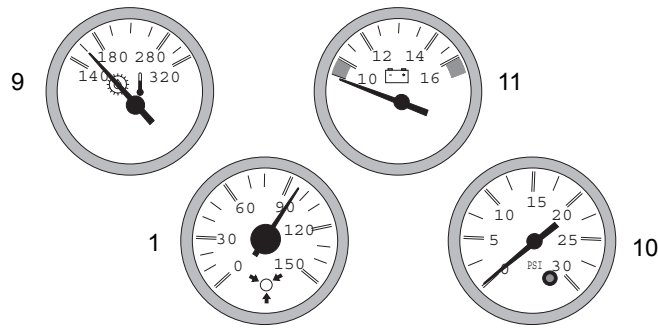
**Overheating may be a result of any of the following conditions:**

- 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.

**3. Fuel:** Fuel gauge will register approximate fuel level in tank, when ignition switch is in 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 and the Aqua-Hot system both use fuel from main tank and will affect fuel mileage figures. Diesel Generators and Aqua-Hot will not operate below 1/4 tank to insure there is enough fuel to run main engine.



**4. Gen Hours:** Displays the total number of hours accumulated on the generator. Use the hour meter as a reference for recommended service intervals.

**5. Odometer/Trip Meter:** This button is used to toggle between the odometer and trip meter. Holding the button down for two seconds will reset the meter.

**6. Oil Pressure:** Indicates oil pressure, not the amount of oil in the engine. Please refer to manufacturer's instructions for specific pressure recommendations.

**7. Speedometer:** Indicates the speed of the motorhome. The gauge indicates MPH and KPH. Located on right side of instrument cluster.

**8. Tachometer:** Displays engine speed in revolutions per minute (RPM).

**9. Trans Temp:** Shows 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.

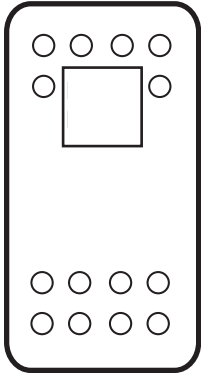
**10. Turbo Boost:** Indicates boost pressure produced by the engine turbocharger.

**11. 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 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 Volts, usually indicates a battery or electrical system problem.



**NOTE: Layouts will vary with difference in models or options.**

## SWITCHES



### **Back up Monitor:**

Used with the back up camera and will display the rear view of the motorhome.

### **Batt Boost:**

The Battery Boost switch is used in the event the motorhome chassis battery has been drained or is at a low charge level where the engine cannot start. This switch momentarily “jumps” the house battery to the motorhome domestic battery to assist in starting the engine. The boost switch used in conjunction with engine starting procedures should not be held for more than 30 seconds. This time period is long enough to prevent the boost solenoid from overheating. The system works this way: A ground wire comes off the front firewall to the battery boost switch. When the battery boost switch is activated by pressing you will be sending a ground signal to the rear of the coach through the 12 gauge orange wire to the 1,000 amp solenoid. You should hear a loud clicking noise as the solenoid is being activated. If the boost solenoid is inactive, locate the molex plug and start the troubleshooting process by removing the cover on the dash. It may be necessary to remove the wire from the battery boost solenoid and perform a continuity check from the front to the rear of the motorhome.

### **Block Heat:**

The length of time that the block heater must be on to be effective depends on the length of time that the engine has been shut down and what the ambient air temperature is. For example: If the engine has been shut down overnight in sub freezing temperatures, the block heater may need to be on for a minimum of two to three hours. With lower ambient temperatures and longer shutdown periods, time required to heat the block increases substantially.

### **Cty/Hwy:**

Selects either electric or airhorn.

### **Dock LTS:**

Operates the side docking lights to increase visibility parking or backing.

### **Drvr Shade:**

Operates the power sun visor located drivers side.

**Engine brake Switch:**

This switch activates the control solenoid for the engine brake system.

**Engine Heat (Optional):**

The engine preheat loop is an integral part of the Aqua-Hot heating system. In cold ambient temperatures, use this feature to preheat the engine. The Aqua-Hot will also supply supplemental heating to the interior using the heat created by the engine. While traveling, the water pump on the engine coolant will pass through the Aqua-Hot. When using the supplemental heating feature, use the Comfort Control thermostat to activate the desired heat exchangers.

*To Enable Engine Preheat:*

- Turn Aqua-Hot switch on.
- Turn the engine heat switch ON. This activates the engine pre-heat circulation pump. Circulating the engine's coolant through the engine pre-heat loop will adequately warm the engine to operate for easy starting.
- Allow approximately one to two hours (longer for colder, ambient temperatures) of engine preheating run time. The pump can be operated overnight if desired.
- Turn the engine heat switch OFF when engine preheating is not desired.



**NOTE: Layouts may vary with difference in models and options.**

**Fans HI/LO:**

Operates the driver's two speed dash fan for use with windshield defrosting and cooling.

**Fans HI/LO:**

Operates the passenger's two speed dash fan for use with windshield defrosting and cooling.



**Fog LTS:**

Operates the fog lights with the ignition key on and the headlights in the low beam position. The fog lights will go off when the headlights are switched to high beam.

**Gen ON/OFF:**

Starts and stops generator from the dash area.

**Gen IN/OUT:**

Operates hydraulic slide out for generator access. The switch will illuminate when the generator door is open.



**NOTE: The Generator IN/OUT switch is deleted on motorhomes with an acrylic front protective mask.**

**Idle Up/Down Switch:**

This switch will increase and decrease the engine idle in 25 rpm increments. There are limits to the idle speed, about 700 to 875 rpm. (ISL Engine only)

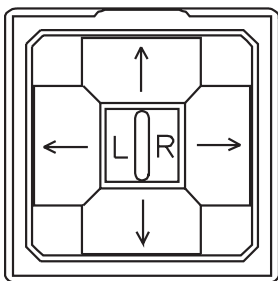
**Mirr Heat:**

This switch turns on the heaters in outside rear view mirrors. The mirror heaters should be used when defogging or deicing is needed. Mirror heat should not be left in the ON position unless continuous fogging conditions occur.

The outside mirrors have been placed so they can be easily adjusted with an Allen wrench. After taking delivery of the new motorhome it will be necessary to sit in the drivers seat and have the mirrors adjusted for accurate visibility. Make sure you can see out of both the driver and the passenger side mirrors before heading out on the road.

**Mirror Control:**

Using your left hand you can make the adjustments to the mirrors. When using the mirror heat switch, just turn the switch to the on position. Only use the mirror heat long enough to defrost the mirror.



Top Mirror = convex glass.  
Middle Mirror = flat glass.  
Bottom Mirror = convex glass.

**Mon:**

Turns on the back up monitor.

**Pass Shade:**

Operates the power sun visor located passengers side.

**Pedal In/Out:**

After sitting in the drivers seat and making adjustments to the mirrors and steering wheel, use the **Pedal In/Out** switch to adjust the brake and throttle pedal to be either closer or farther away. Locate the switch on the left hand shifter panel marked Pedal Adjusts. The switch moves the pedal inward or outward approximately three inches. If you need to move the pedal inward, just push the same switch in the opposite direction. When the pedal come to the end of their traveling distance you will hear 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 fuses may result if operation of the switch continues after reaching the fullest extend or retract position.

**Step Cover:**

The front door models are equipped with a sliding Step-Well Cover that is extended and retracted by two switch locations. One switch is located just inside the entry door to the right, next to the passenger seat. The second switch is located on the left portion of the shift panel marked “Step in/out”.



**NOTE: Layouts will vary with difference in models and options.**

**Tag Axle (Optional):**

Switch raises and lowers tag axle. When headlight switch is off, switch light is not illuminated. In certain situations tag axle may require to be in up position. Raise the tag axle when making sharp turns under 5 mph.

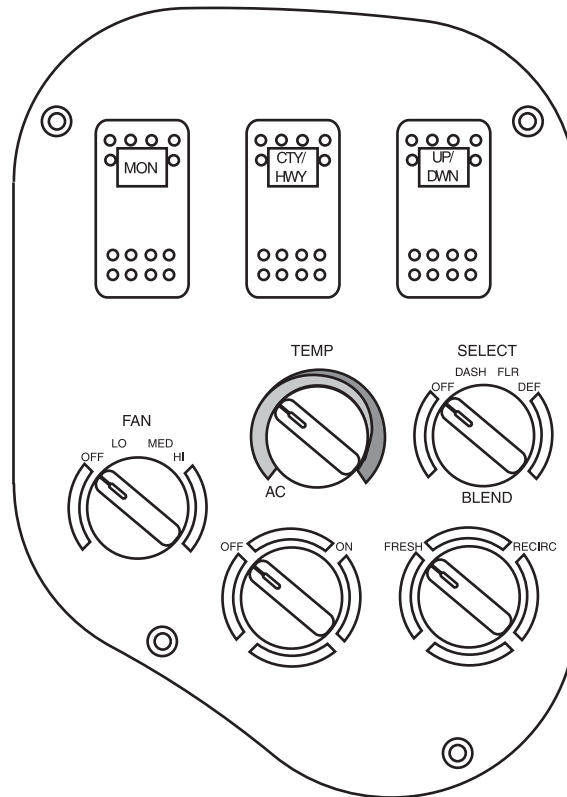
**When using tag axle switch:**

- Tag axle down when switch is not lighted.
- Tag axle in up position, when switch is lighted.
- Tag axle switch will illuminate when tag axle is raised or headlights are on.



**NOTE: DO NOT drive the motorhome over five MPH with the tag axle raised. The manufacturer will not be held responsible for any damage that may occur from driving with the tag axle raised.**

## AIR CONDITIONER & HEATER CONTROLS



### Dash AC and Heater Control:

The system is designed to provide heating, defrost and cooling for the pilot and co-pilot area. The system is not capable of heating or cooling the entire motorhome.



**NOTE: To aid the dash A/C and heat system close the pocket door. This will reduce the amount of the area being heated/cooled.**

### Blower Operation:

The blower has three speeds. The blower is shut off by placing the blower control switch in the "OFF" position.

### A/C Operation:

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 the 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.

**Dash:** Air is drawn in and discharged throughout the dash and defrost louvers.

**Floor :**

Fresh air is drawn in and discharged through the floor louvers.

**Defrost:**

Air is drawn in and discharged through the defrost louvers. The A/C compressor is engaged to help dehumidify the air discharged from the defrost ducts.

**Temperature Control Switch:**

This switch controls an electric water valve which regulates the amount of engine coolant passing through the heating coils in the system. Rotating to the red area provides warmer air; rotating to the blue area provides cooler air.

**Operating tips and hints:**

Air intake and discharge temperatures are greatly affected by ambient temperature and relative humidity. A large amount of cooling capacity is used to dehumidify air as well as cool it. After three to five minutes of A/C operations the discharged air temperature should be approximately 30° F cooler than the fresh or recirculated air entering the A/C system.

**Winter Use:**

- De-ice the windshield using the DEFROST mode.
- Higher temperature discharge air will occur with the blower set to a lower speed setting until the engine has reached normal operating temperature.

**Summer Use:**

- Close all windows and vents to hot, humid outside air.
- MAX A/C and HI blower will provide quick cool down.
- Using a lower blower speed will produce cooler discharge air.

## **Components**

**Compressor:** The compressor is belt driven from the engine and uses an electric clutch pulley. The electric clutch is controlled by the thermostat switch. 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 air conditioning condenser is mounted in front of the radiator. The coils and fins provide a rapid transfer of heat from the refrigerant as external air passes over the coils. Then the high pressure gas is changed to a high pressure liquid.

**Condenser Fan:** A steady flow of cooling air is maintained across the condenser using the hydraulic fan 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 effect 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. The blower will draw air from the cab area and force the air over the evaporator coils and fins. This forced air will ensure continuous vaporizing of the R134a.

**Relays and Switches:** Both electronic and vacuum switches are used in the control and operations of the system.

**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 by-passes the heater core. In either position the air flow is felt at the discharge vents.

**Diagnosis of Electric Water Valve:** Theory of Operation: 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 cool air.

**No Heat:**

- Check the blower and air mode operations. Fix or repair prior to proceeding.
- Verify the engine has obtained normal operating temperature. (Check with engine manufacturer for the proper procedure.)
- Check the temperature of the inlet hose at the water valve. The inlet water hose temperature should be approximately the same temperature as the engine water temp.
- With the temp control on set to the full hot position, check the outlet hose of the water valve. The outlet hose should be the same temperature as the inlet hose.

**Vacuum Generator:** The air plenum box contains the heater core, the air conditioning evaporator and internal doors which direct the air flow. The doors are controlled by vacuum operated dash pots. The vacuum generator uses compressed air from the front air tank to oscillate a diaphragm creating vacuum creating approximately 15 inches of vacuum. The vacuum is then stored in a reservoir. The vent control knob applies or removes vacuum to the dash pots opening or closing the doors. The vacuum generator will operate when the ignition is ON and the system is operating.

## About Refrigerants

### Chemical Stability:

The air conditioning system life and efficient operations depends upon the chemical stability of the refrigeration system. The refrigeration system uses the refrigerant R134a and Polyakylene Glycol (PAG) a 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 amount of PAG within the refrigerant system is approximately 18% of the total refrigerant in the system.

How much refrigerant is in the system or how much should be used when charging?

The system uses 1 oz. of PAG oil for each 7 feet of hose after the first initial 15 feet. Roughly, a 40 foot motorhome will use a total of 92 feet of refrigerant hose. Subtracting the initial 15 feet from the total measurement the net amount amount of hose is 77 feet. Divide 77 feet of hose by 7 to obtain the total which equals 11 ozs of PAG oil required. Carrying the formula one step further, the 11oz. equal approximately 18% of the entire system. The total amount of refrigerant in the system is approximately 61 oz. or 3.8 lbs. of R-134a.

High pressure readings are another way to determine the amount of correct amount of refrigerant charge. Ambient temperature affects the high pressure readings. The ambient temperature is measured one inch away from the condenser. Record the temperature reading then add 40° F. Use the temperature/pressure chart to adjust the amount of refrigerant being introduced into the system.

### 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 BTU is the standard measurement of an air conditioner system. 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).

**Safety and Handling 134A and Pag Oil:**

- When working with any refrigerant system wear eye 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 must be performed in a well ventilated work area.
- Extinguish all open flames in the service area. The discharge of a refrigerant gas near an open flame can produce a very 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.**

EXAMPLE: 90° F measured  
1 inch from condenser +40°F  
equals 130°F. The high pressure should not exceed 198.90

TEMP F/ PSIG	TEMP F/ PSIG	TEMP F/ PSIG
16 15.69	60 57.47	112 151.30
18 17.04	65 64.10	114 156.10
20 18.43	70 71.19	116 161.10
22 19.73	75 78.75	118 166.10
24 21.35	80 86.80	120 171.30
26 22.88	85 95.40	122 176.60
28 24.47	90 104.40	124 182.00
30 26.10	91 106.30	126 187.50
32 27.79	92 108.20	128 193.10
34 29.52	93 110.20	130 198.90
36 31.32	94 112.10	135 213.70
38 33.17	95 114.10	140 229.40
40 35.07	100 124.30	145 245.80
42 37.03	102 128.50	150 263.00
44 39.05	104 132.90	155 281.00
45 40.09	106 137.30	160 300.10
50 45.48	108 141.90	165 320.00
55 51.27	110 146.50	170 340.80



## **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

The motorhome compressed air tank must have adequate pressure to operate the vacuum generator or the damper doors will not function. Also, the blower motor must be switched on to provide electric current to the relays, vacuum switches, etc. The dash A/C and heater system should be used monthly so the internal components of the compressor remain lubricated.

The following information is provided to assist in troubleshooting common operational problems which may occur.

### **No Heating:**

1. Check unit fuses.
2. A/C switch is turned off.
3. Blower switch is turned off.
4. Verify the proper engine coolant level.
5. Verify that the engine is reaching operating temperature.
6. Verify engine coolant is reaching water valve attached to unit.
7. Verify operation of water valve to permitting engine coolant to pass through the water valve and heater core.
8. Check power supply to water valve and grounding.
9. Check wiring.
10. Engine thermostat faulty.

### **No Cooling:**

1. Check system fuses.
2. Check blower motor operation, A/C switch is in A/C or Max position, temperature control is turned to max cooling (blue area).
3. Condenser fan is operating.
4. Check power supply to compressor.
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 blower and select switch.
5. Motor shaft seized.
6. Blower wheel out of alignment.

**Damper Doors Do Not Operate:**

1. Front air tank must be over 60 psi.
2. Check vacuum generator is being powered and producing vacuum.
3. Check vacuum line entering unit for vacuum.
4. Check that the vacuum solenoids mounted on unit are 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.

## **NAVIGATION SYSTEM (Optional) Global Positioning System (GPS)**

The navigation system can be a very powerful tool in daily traffic. The automatic route planning and guidance enables you to concentrate more on the increase of traffic and ever changing road conditions. The mess from road maps laying around and time consuming route planning is a thing of the past. Simply enter your destination prior to starting out and the visual and audio guidance will assist you. This all can be accomplished is in part from the Global Positioning System (GPS). The GPS is comprised of 24 satellites 13,000 miles above the earth.

Signals from only four of these satellites will enable a sufficient, accurate position. The accuracy is between 20 to 40 feet with eight satellites maximum reception.

### **Remote Control:**

A small, hand held, remote control will control the navigation system. The control requires two AA batteries. The batteries will have to be replaced when the system does not respond to a key input or the battery icon illuminates in the status line. When any key is pressed on the remote control the keypad will illuminate. After five seconds of inactivation the keypad will automatically shut off.

- **ALT-R** = Plan an alternative route.
- **REP** = Repeat current audible guidance advice.
- **UP arrow** = Cursor key up, selects options.
- **LEFT arrow** = Cursor key left, selects options.
- **RIGHT arrow** = Cursor key right, selects options.
- **DOWN arrow** = Cursor key down, selects options.
- **OK** = Enter or OK confirms a selection.
- **(Minus) -** = Decreases the volume of the guidance system.
- **(Plus) +** = Increases the volume of the guidance system.
- **MENU** = Displays main menu.
- **MAP** = Enter or exit the route map.

The system is wired to operate in conjunction with the domestic power. The battery cut-off switch must be ON. When the system is powered ON, a safety notification for the system will appear. Read and accept this notification with the **OK** key. Once the **OK** key is pressed the main menu will appear. The **STAND-BY** in the main menu will enable you to switch off the display. You will still have audible guidance advice. Any key on the remote, when pressed, will switch the display back on. The main menu offers various options and other menus for use with the system. You need only press the arrow keys to highlight your desired option. Confirm all selections with the **OK** key.



**NOTE: Information entered into the navigation system should only be done when the motorhome is at a safe stop point. Attempting to operate the system while driving can distract your attention from the road and possibly cause an accident. It is more important to keep your eyes on the road and your hands on the wheel.**

**Keeping Updated:**

The highways are changing constantly. A 100% correspondence of the digital map cannot be achieved in all circumstances. Contact Navigation Technologies 1- (888) NAV-MAPS for additional maps, new maps or for difficulties with a current map.



**Consult the owners manual in your information box for more detailed information.**

## **TRIP TEK (OPTIONAL)**

The Trip Tek system is fairly simplistic in design. The system is comprised of a keypad, a computer and will utilize the rear vision monitor for display. The key pad has five function keys each with a single function. The system is virtually maintenance free.

- The **VIEW** enables the display on the rear vision monitor.
- The **SCREEN** will enable or disable the display from the rear vision system.
- The **REST** will zero out the screen for TODAY and new information to be input.
- The Arrow **UP** will scroll the numbers to be input.
- The Arrow **DOWN** will scroll the numbers down to be input.

### **Today Screen will provide daily information:**

- **Miles to Go** displays the remainder of miles to the scheduled destination.
- **Time to Go** displays the approximate time to the scheduled destination based upon miles to go and MPH Average.
- **Miles Traveled** displays the miles traveled since last screen reset.
- **Fuel Range** displays approximate miles available with the remaining fuel based upon MPG Average and Gal in Tank. This will be less when other fuel equipment is used.
- **MPG Average** displays the average fuel consumption per gallon since last screen reset.
- **MPG Current** displays current fuel consumption per gallon.

### **Leg Screen will provide information from fill to fill:**

- **MPG Average** displays the average fuel consumption per gallon since last reset.
- **Time Traveled** displays the time traveled since last screen reset.
- **Miles Traveled** displays the miles traveled since last screen reset.
- **Gallons Used** displays the gallons of fuel used by the engine since the last screen reset.
- **MPG Average** displays the average fuel consumption per gallon since last screen reset.
- **Gal in Tank** displays approximate gallons of fuel in the tank.

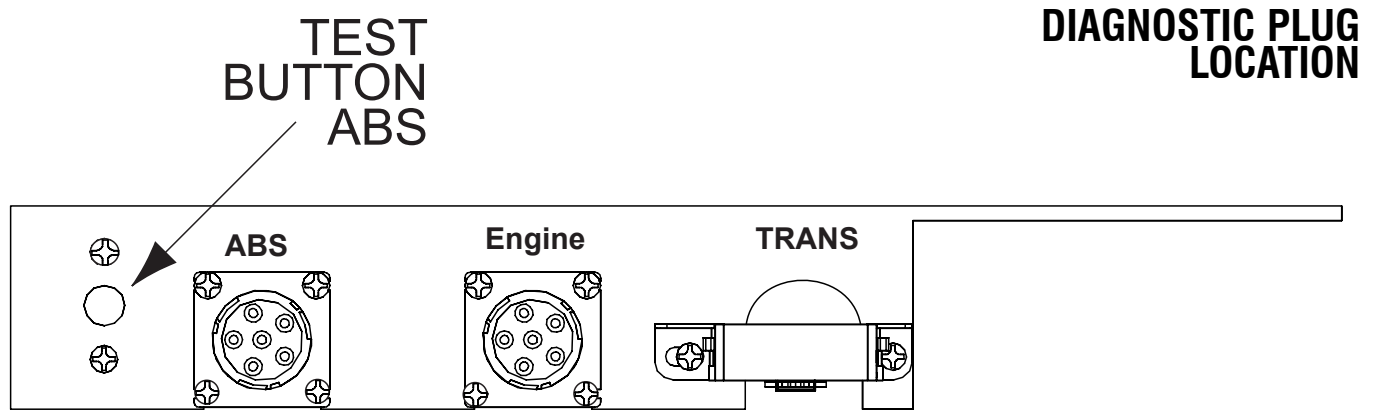
### **Trip Screen displays long term data for a complete trip or longer:**

- **MPG Average** displays the average fuel consumption per gallon since last screen reset.
- **HR Traveled** displays the hours traveled since the last screen reset.
- **Mi Traveled** displays the miles traveled since last screen reset.
- **Gallons Used** displays the gallons of fuel used by the engine since the last screen reset.
- **MPG Average** displays the average fuel consumption per gallon since last

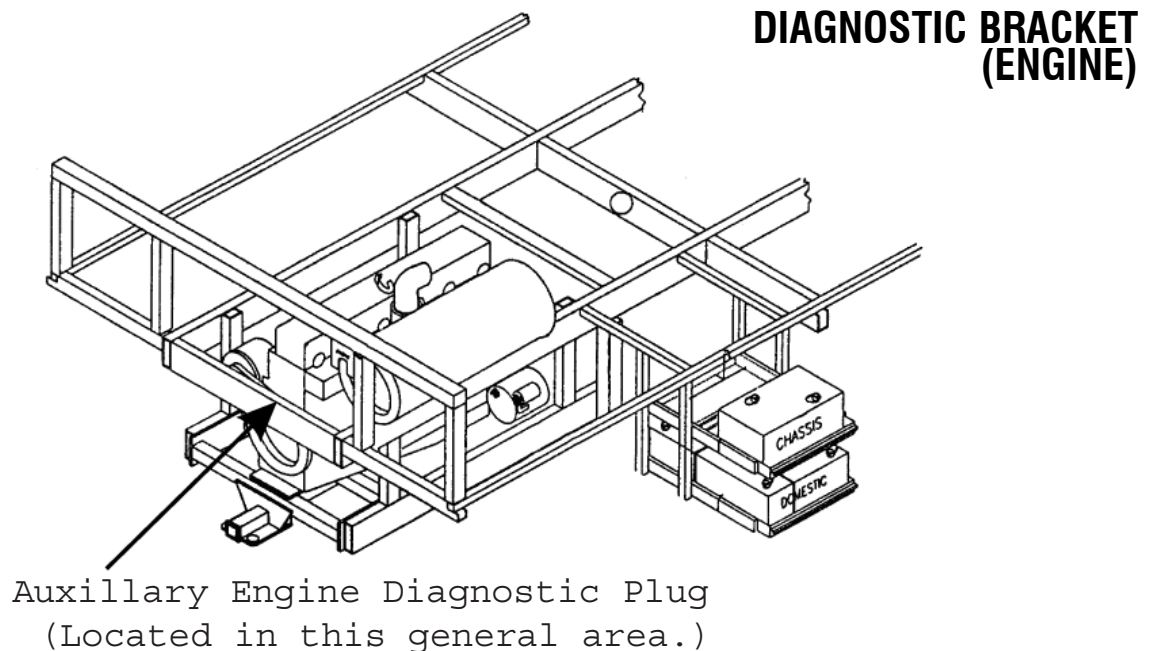
screen reset.

**Coach Data Screen displays information for the motorhome and engine performance:**

- **MPG Average** displays the average miles per gallon for the life of the motorhome.
- **Odometer** displays the total distance traveled for the life of the motorhome.
- **Eng Load** displays the percentage of the engine load.
- **Eng Temp** displays the coolant temperature.
- **Manifold** displays the intake manifold temperature.
- **Road SPD** display the current speed of the motorhome. This indication is NOT intended to replace the motorhome's speedometer.



Eaton, Cummins and Allison diagnostic plugs are located under the left side of the dash.



**BULB USAGE -  
EXTERIOR**

<b>EXTERIOR BULB CHART</b>	
<b>LOCATION</b>	<b>BULB NUMBER</b>
HIGH/LOW BEAM	HELLA H32 #279
HIGH BEAM	HELLA P45
FOG/DRIVING LIGHTS	HELLA #469 VDH2U
TURN SIGNAL - FRONT	SYLVANIA 3157
TAIL/STOP - REAR	SYLVANIA 1157
TURN - REAR	SYLVANIA 1141
BACK UP	SYLVANIA 1141
LOWER & UPPER MARKER LIGHTS	GE #59

# NAVIGATOR

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This section contains knowledge and information on various components of your motorhome chassis. Following the guidelines and procedures will help you to understand and operate your motorhome. Complete instructions for various components can be located in the operators manual included in the Owners Information File box.



**WARNING: When frame or other welding is involved for motorhome repair or modification the following precautions are required to protect electric 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. The welding ground cable should be attached no more than 2 feet from the part to be welded.**

The Roadmaster chassis has been designed to provide exceptional balance, handling and braking characteristics. The Roadmaster rear engine chassis is an engine and frame unit featuring a semi-monocoque tubular all steel frame design, providing greater structural integrity and more uniform stress distribution. Incorporated in the Roadmaster chassis is the exclusive air glide suspension system using eight outboard mounted air bags and shock absorbers. Tag axle models will also incorporate two inboard mounted air bags and shock absorbers. The design and set up is intended to provide the smoothest ride, best handling and troublefree service while delivering top notch drivability. The chassis will also incorporate a three point hydraulic leveling system or air leveling system. The Roadmaster chassis design offers unsurpassed ease of maintenance and service.

The towing system incorporated in the construction of the frame is rated at 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 is provided for each axle to control side motion. Each axle is mounted to a wide platform H-frame which carries the coach body on eight outboard mounted air bags (4 front and 4 rear). Each of the eight air bags is coupled with a Bilstein gas shock absorber. The suspension control arms are attached to the frame through bushings, which require no lubrication.

The suspension ride height is preset and will maintain the proper ride height automatically throughout the load range.

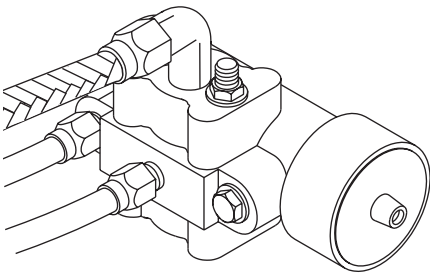
## AIR SUPPLY SYSTEM

The air compressing system on the motorhome is comprised of several items: an air compressor, air governor, air dryer, a 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



The air governor is located in the engine compartment and performs two functions. It regulates the air compressor to cut-in and cut-out, keeping the air system in the specified operating range of 105-120 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 underneath the motorhome next to the transmission. 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.

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, the water is expelled and the dry air flows back through the dryer, drying the desiccant for the next cycle.

## ***Air Dryer Operation***

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.

## ***Air Dryer Cycle***

When the compressor unloads the purge valve opens. The governor turns the compressor off when system reaches cutout pressure (approximately 120 psi).

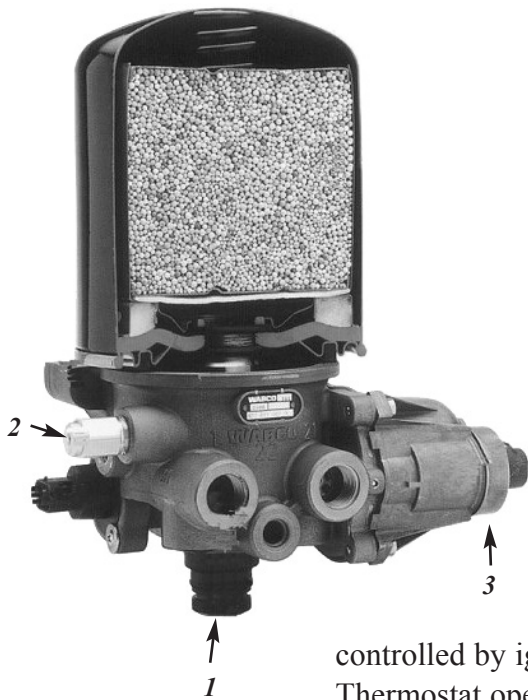
- The dryer purges and expels water collected in the dryer base.
- When the regeneration valve opens, the dry system air flows back through the dryer. A small charge of air from the front tank backflows through the filter. The backflow dries the desiccant, preparing it for the next cycle.

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.

## ***Importance of the 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 into water before it enters the dryer.
  - Warm air condenses into water 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 the regeneration phase, the regeneration valve and pressure-controlled check valve remove water from the desiccant bed with a backflow of dried, expanded system air.

## ***Desiccant-Type Air Dryer***



**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:** A valve that protects the air dryer from over-pressurization.

**3. Regeneration Valve:** The valve that 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.

**Extreme Cold:** Make sure 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. Thermostat operating range is On below 45° F and Off when the temp is above 86° F. The fuse is located in the front electric bay outside, beneath the drivers window.



**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

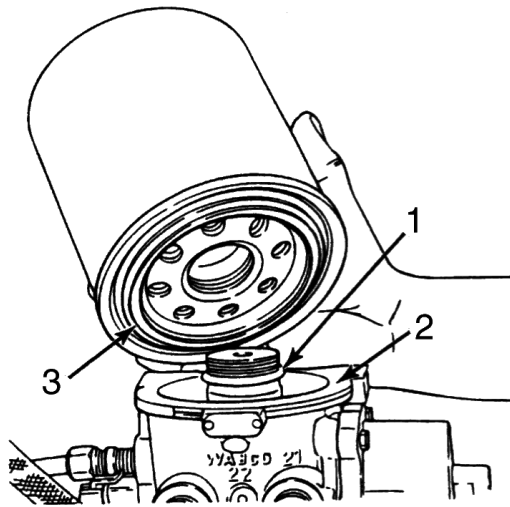


**NOTE:** If the seats are damaged so badly that a tight seal cannot be maintained, replace the air dryer.

1. Replacement kit contains one cartridge and one O-ring.
2. Loosen and remove the old cartridge. Use strap wrench, if necessary.
3. Remove and discard O-ring from dryer base.
4. Inspect and clean seal seat. Repair any minor damage.

5. Lubricate O-Ring on stem with a thin layer of grease.
6. Lubricate cartridge seal with a thin layer of grease.
7. Thread the replacement cartridge onto the base until the seal touches the base. Tighten the cartridge ONE additional turn. DO NOT OVERTIGHTEN.

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 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 is set to release at approximately 130 psi.

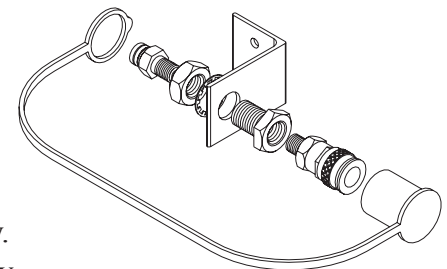
## AIR STORAGE TANKS

Provided for convenience is a remote air supply coupler. This is located in the roadside LP Tank compartment. This universal female fitting will accept several types of 1/4" ID male air fittings, including type C automotive. This auxiliary air fitting may be used to inflate tires, air mattresses or other pneumatic items.

## 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.



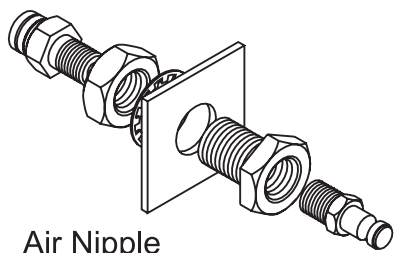
**To remove fitting:**

- With a firm grip hold 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.

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. Due to the small air pressure restriction of the pressure protection valve, maximum supply pressure is approximately 95 psi with air system on the motorhome charged to 120 psi.

---

**AIR SYSTEM - CHARGING  
(EXTERNAL)**



Air Nipple

The air system on the motorhome can be charged from an external air supply source. Located in the generator compartment is a type C automotive male fitting. Caution should be used when charging the air system from this fitting. The air supplied from an external source may contain moisture. Compressed air introduced into the air system on the motorhome from this fitting is not filtered by the air dryer. The auxiliary air charge fitting will charge the front and rear air tanks. A 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.**

---

**RIDE HEIGHT  
VALVES  
-Adjusting**

The ride height valves inflate or deflate the air bags keeping the motorhome at proper suspension height throughout the load range. There are three ride height control valves used on the motorhome. Two are used on the rear drive axle, these control rear suspension height and left or right tilt of the motorhome. Only one valve is used to control front axle suspension height. The ride height control valves are mounted to the main frame of the motorhome just above the axles. Each valve has a linkage rod connected the axle. The valves make small air adjustments to the air springs while traveling. The amount of system air used depends on the type of road surface and driving styles.

Should it become necessary to check the suspension ride height, start with having the air system fully charged and the suspension at a normalized height. The motorhome must be on a flat level surface. Suspension height distance is measured from the top of the H-Frame to the bottom of the Main Frame Rail. Specified distances may vary plus or minus 1/4". Small offset adjustments to the rear valves may be necessary to compensate for slight tilt. Example: Adjusting curbside rear height control valve up will pivot roadside front corner down.

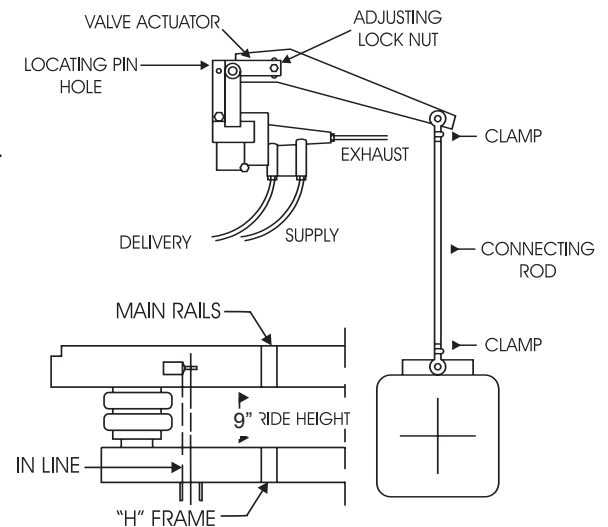


**NOTE: Driveline angle is affected by the suspension ride height. Improper driveline angle can damage suspension or shorten the life of universal joints. Shock absorbers and air springs are in travel centers at proper ride height.**

**To adjust suspension ride height begin with:**

- Motorhome on flat level surface.
- Air system fully charged.
- Suspension at normalized ride height.

Start with front control valve. Loosen the adjusting locknut at the eccentric slot on the valve. Move the plastic arm up to raise suspension height, this will inflate air springs. Move the plastic arm down to lower suspension height, this will deflate air springs. Make adjustments in small increments. When the desired height is obtained, 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 locknut between 60-80 in/lbs. Check adjustments made by using Air Dump switch to deflate air springs. Start the engine and allow the air system to become fully charged. Allow suspension to adjust and come to a neutral setting. Re-check suspension height measurement. Follow same procedure for rear control valves. Re-check front suspension height when adjustments are made to rear height control valves.

**Checking Ride Height**

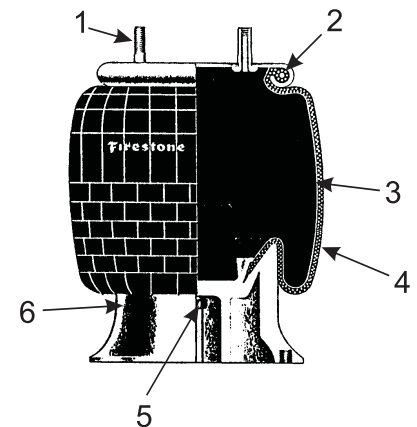
Measurement for the Navigator: Front 9", Rear 9".



**NOTE: Do not modify length of the linkage rods. Make necessary adjustments using eccentric slot on ride height control valve.**

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 vehicle's suspension.
- 2. BEAD PLATE.** Crimped onto bellows at 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: inner layer, two plies of cord-reinforced fabric and an outer cover. Natural rubber construction provides functional properties to - 65° F.
- 4. BUMBERS.** A solid rubber or engineered plastic device designed to prevent significant damage to vehicle or 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.

**SUSPENSION AIR RIDE BAGS**



## 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 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 1/4". 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.

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## BRAKE SYSTEMS - AIR BRAKES

The motorhome is equipped with air brakes using much the same system as over the road trucks. This type of braking system is efficient. 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 linings. Avoid overheating the brakes. Hot brakes have less stopping power. When maneuvering the motorhome around in 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 slot 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 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 needles. Listen for the air dryer to purge, indicating full air pressure has been obtained and air dryer is functioning. Look and

**BRAKE -  
PARK &  
EMERGENCY  
SYSTEMS**

listen for any abnormalities. Abnormal air pressure readings by either needle of the air gauge should alert the operator. Have the air system checked to avoid an untimely failure.

Should a failure occur in the air system, preventing the air pressure from building, it may become necessary to “cage” the spring brakes. This is an emergency procedure only. Caging the rear air brake chambers manually overrides the spring brakes and allows the vehicle to move. This procedure does not affect normal service braking. The brake disabling procedure is located in Section 2.



**NOTE: When the park brake is released the Park illumination lamp will remain lit until air system pressure is above 65 psi.**

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## **BRAKE ADJUSTMENT/ SLACK ADJUSTER**

The motorhome is equipped with automatic slack adjusters. As brake linings wear, the slack adjusters will automatically ratchet on the return stroke as needed. This ratchet action will keep the brake linings at proper adjustment. Brake adjustment should not be necessary. Indications of a vehicle needing a 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.**

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## **ABS SYSTEM (Anti-lock Brakes)**

The motorhome is equipped with an anti-lock braking system (ABS). The ABS system monitors wheel rotation speeds by using a 100 tooth magnetic tone ring mounted to the hub. Revolving with the wheel, the magnetic tone ring is polarized giving positive and negative pulsations. A stationary sensor is mounted adjacent to the tone ring monitoring the magnetic pulses. The pulses are monitored by the ABS electronic control unit (ECU).

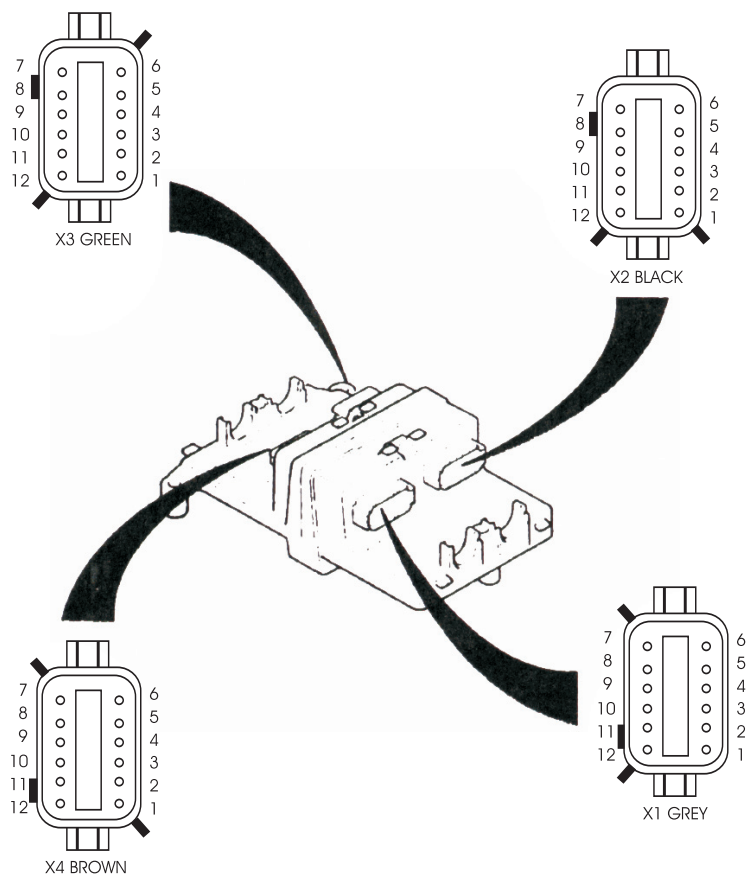
The ECU monitors all available wheel sensors at the rate of 100 times per second. The ECU controls Pressure Modulator Valves. Pressure Modulator Valves have two electric over air solenoids, a hold solenoid and a release solenoid. The modulator valves are open under normal braking, allowing a straight through air signal from the treadle valve to the brake chamber. Should a wheel lose traction under a braking application, the ECU will energize the hold solenoid of the Pressure Modulator Valve to interrupt the air signal from the treadle

valve to the brake chamber, while the release solenoid vents the existing air signal 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.

### 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 Light:

The ABS will perform a diagnostic indicator lamp check and self diagnostic test each time the ignition is switched to the on position. The ABS dash indicator light will illuminate momentarily (2.2 seconds) verifying the self check test. If the ABS indicator light remains on, or illuminates while the motorhome is being operated, there is a fault in the antilock brake system only. 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 left of steering column below dash board, 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.

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**BRAKE  
SYSTEMS-  
Back-Up**

The motorhome air braking system is equipped with several back-up safety systems and warning alarms in the event of an 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 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 and tag axle brakes if equipped with a tag axle. This tank division gives reassurance in the event of one tank having 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) will reserve remaining air pressure of 65 psi for braking. This will leave the motorhome with one air tank fully charged for a safety back up.

Another situation, in which 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 allows use of all the brakes, allowing the operator to bring the vehicle to a safe stop. In the event of all compressed air charge escaping from the front air tank, the operator will still have full use of the rear brakes.

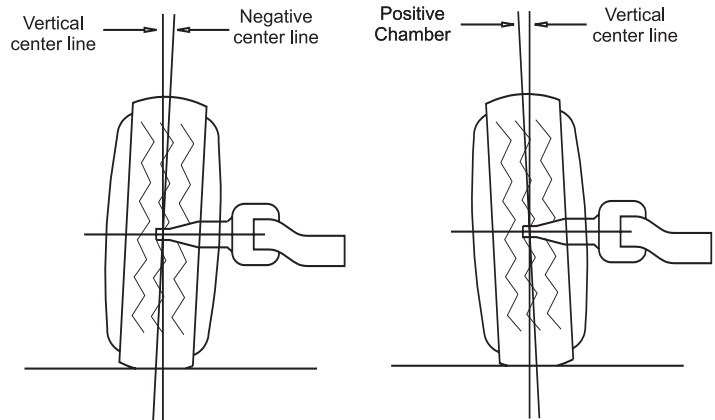
The correct wheel alignment promotes longer tire wear and ease of handling while minimizing the strain on the steering system and the axle components.

## ALIGNMENT SPECIFICATIONS

### 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 centerline of the tires).

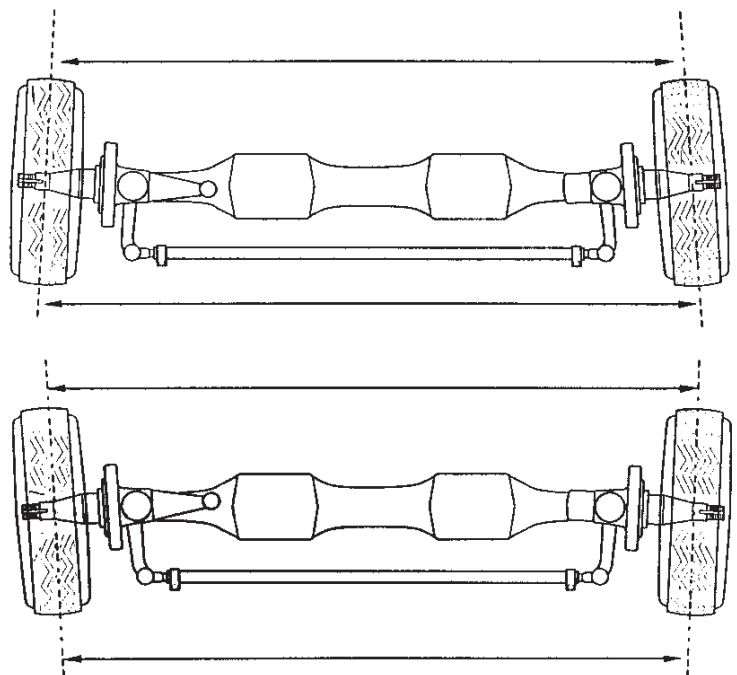
Toe-in occurs when the tire front distance is less than the tire rear distance.

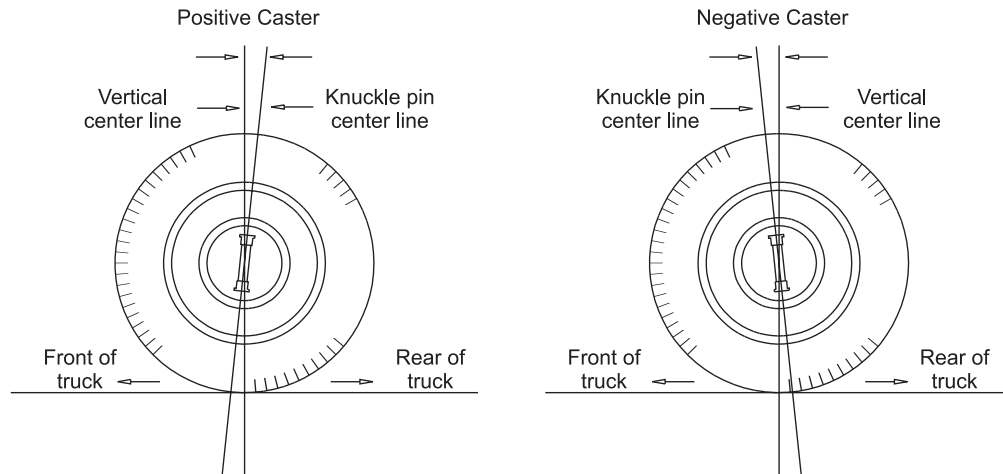
Toe-out occurs when the tire front distance is greater than the tire rear distance.

Wheels are generally set with initial toe-in. As the vehicle operates tires tend toward a toe-out condition. By starting with an initial toe-in setting, a desirable “near zero toe-in” can be achieved when the vehicle is in motion.

Incorrect toe settings, where toed-in or toed-out, can have a significant effect on tire wear. The toe setting is adjusted by lengthening or shortening the cross tube.

The toe setting is .03 degree.





**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.

A caster angle more positive than specified may result in excessive steering effort and/or shimmy. An angle less positive may result in vehicle wander or poor steering return to center. The caster angle is determined by the installed position of the steer axle.

**VEHICLE SPECIFICATIONS**

<b>Front</b>	<b>Spec.</b>	<b>Tol.</b>
Left Camber	-0.24	0.41
Right Camber	-0.24	0.41
Cross Camber	4.80	0.25
Caster	0.03	1.00
Cross Caster	----	0.50
Total Toe	----	0.12
Left SAI	----	----
<b>Rear</b>		
Camber	----	----
Total Toe	----	----

**TAG AXLE**

The tag axle is optional equipment on all motorhomes which are 40 foot. The tag axle design allows for more carry weight, thus making it possible to create a wider variety and range of floor plans.

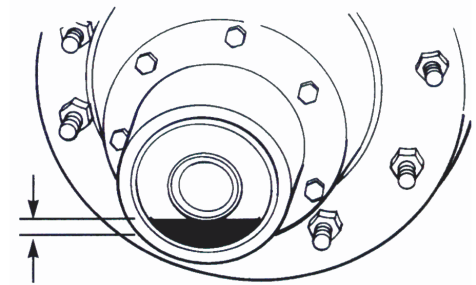
While the tire should be off the ground there is no specific height requirement for the tag axle in the up position. If the tag axle requires being raised higher, adjustments can be made by taking up one chain link on the tag axle.

The tag axle switch is located on the left hand shifter panel. There are two lights on this switch: One to be lit when the headlights are turned to the on position. The other to be lit when the tag axle switch is turned on. The tag axle should only be in the raised position when severe maneuvering in your motorhome is performed under 5 mph.

If the tag axle switch is in the raised position while you start your coach a beeping alarm will sound. The tag axle will raise only in the following moses: when the switch is turned on and the transmission is either in neutral, reverse or first gear.

When a tag axle switch is turned on in a motorhome with air leveling the following will take place: The 12 Volt power will be in the 14 gauge yellow with green stripe wire, which will go all the way to the rear mac valve for the tag axle located on the roadside rear. Once the rear mac valve has been activated the air pressure will go through the orange air line to both tag axle brake chambers to lift the tag. The air in the air bags will be released to the outside air. The tag axle will remain in the raised position until the switch is turned to the off position.

The amount of weight carried by the tag axle may be adjusted by changing the amount of downward force applied to the tag axle. Changing the amount of weight carried by the tag axle affects how the weight is distributed between the tag, drive and steering axles. The amount of down force applied to the tag axle is controlled by the amount of air pressure in the tag axle air bags. The amount of air pressure in the tag axle air bags is set by an adjustable pressure regulator located in the engine compartment. The tag axle regulator pressure is preset at the factory and may require adjustment to obtain the proper weight distribution on all axles. To determine the correct setting of the pressure regulator the motorhome will need weighed after it has been loaded for travel.



*Remove the center hub cap to inspect the tag axle oil level.*

All tag axles will use the oil bath hubs on the tag axle only. The tag axle has a chrome hub cap that will need to be removed before the inspection can take place. You can locate the full and add mark on the outside of the plastic see-through cover. You will be able to see the oil level. You should inspect the oil level before every trip or every 5,000 miles.

**Oil Bath Hubs  
(Rear Only)**



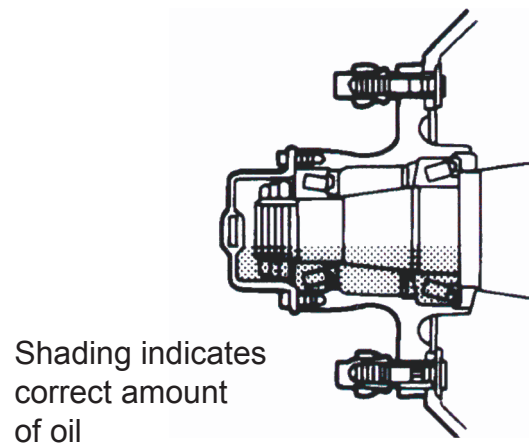
## Oil Lube Intervals

The frequency of lubricant changes depends upon the individual operating conditions, speeds and loads. Change whenever the seals are replaced, the brakes are relined or at 30,000 miles (48,000km). If yearly mileage is less than 30,000 miles, change it twice a year (spring and fall).

For low mileage operations the grease may not need changing until every 50,000 miles (80,500km) or two years. However, check the grease twice a year (spring and fall) for contamination. Change if required.

Your tag axle has come to you with Shell Hypoid gear oil, GL-5, S.A.E. 80w/90. Specifications, minimum outside temperature -15°F (-26.1°C). There is no upper limit on these outside temperatures of oils and greases. The axle sump temperature must never exceed 250°F (+121°C).

The recommended oil change interval is based on the operating conditions, speeds and loads. Limited service applications may allow the recommended interval to be increased. Severe applications may require the recommended interval to be reduced. For more information contact a Meritor service representative.



### Lubricating the Camshaft Bushings:

Apply the specified grease at the grease fitting on the spider. Apply grease until new grease purges from all the seals. Greasing intervals will be once a year, or every 30,000 miles. Use a multi-purpose grease NLGI Grade 1 or 2. The grease classification should be lithium 12-hydroxy stearate or lithium complex.



**NOTE: Under no circumstance should you ever drive the motorhome over 5 mph when the tag axle is raised. The manufacturer will not be held liable for any damage that may occur while driving over 5 mph with a raised tag axle.**

**SHOCK  
ABSORBERS**

The shock absorber by definition is a hydraulic device used to dampen suspension/body movement. The road surface irregularities or roughness is compensated for by the shock absorber. The roadmaster chassis incorporates the “Bilstein” shock in the design of the exclusive air glide suspension system. This shock absorber is a telescopic, monotubed 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.

The 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 spring or hinge pins to wear out, get weak or deteriorate.



*Normal shock absorber  
appearance after long service period.*

## LEVELING SYSTEM -Hydraulic Leveling System (RVA)

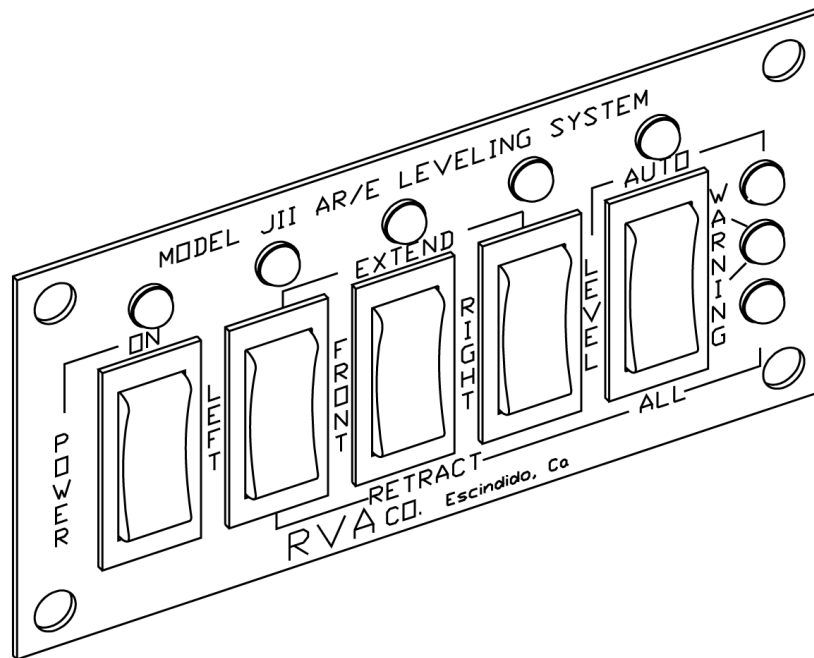
The three point leveling system features a multiple warning system with flashing light and a bong alarm to alert you of the jack position. The system also features a remote control panel located next to the driver seat. The torsion stress is significantly reduced during proper operating procedures. Damage resulting from improper procedures can range from windshield damage to entry doors jamming.

The model 35 J-II leveling system pump is located curbside front with easy access from the generator door. The valve assembly manifold is mounted on the the pump motor, providing easy access to the manual retract valves. The system is designed to be self bleeding in the event any component of the hydraulics has been removed or repaired. Fully extend and retract each jack twice. The remote rocker switches will operate with a minimum of 7.5 vdc. Optimum requirements for operating the system are voltages above 9.6 vdc.

The Auto leveling system consists of two primary control components: a transmitter module located in the first storage compartment overhead and the remote control panel located next to the driver's seat. The remote control panel is compromised of the various retract/extend switches for the jack legs, a switch for automatic leveling and all retract and the power ON/OFF switch.



**NOTE: The leveling system jacks are not designed for use in changing tires. This can cause problems with the suspension system, frame alignment and damage to the windshields. Never use the jacks to elevate any wheel position off the ground.**



When manually operating the leveling system always lower the front jack first. The front jack acts as a pivot point for chassis and reduces torsion stress on the body of the motorhome.



**NOTE: In the event the front of the motorhome is high and does not require elevating it will be necessary to raise front of motorhome a minimum of 1/2 inch to allow jacks to act as a pivot point.**

The leveling system was designed to reduce site selection problems. If possible, park the motorhome with the front facing downhill. If the ground is soft place a wooden 2 x 8 board under the foot of each jack pad to prevent sinking.

The front jack will be the pivot point for the chassis and is always lowered first. This reduces the torsion stress on the body of the motorhome. The Bong alarm will activate when any jack is extended more than 2" to 6" from fully retracted position and will indicate low fluid level for the pump motor. The Bong alarm may momentarily activate when driving over rough roads, or negotiating curves and corners. Usually this indicates low fluid level.



**NOTE: Air will automatically dump from air bags when leveling cycle begins. This will lower the motorhome and require less extension by the jacks. To expedite the air dumping the motorhome is equipped with a manual air bag release switch located on the dash panel.**

- Place the gear selector in neutral.
- Apply the parking brake.
- Turn the ignition switch to the ON position.
- Engage switch labeled POWER on jack control console.
- Each yellow light and switch combination corresponds to each jack as positioned on the chassis and is labeled as such.
- To extend a particular jack, push rocker switch to extend the side and hold until the desired extension is reached.
- To retract a particular jack, simply push rocker switch to the retract position and hold until the desired retraction is reached.
- When the yellow light goes off, that particular jack is in the level position.
- Turn off the switch labeled POWER on the jack control panel.
- Turn off the ignition switch.

## Automatic Leveling System

The ALL JACKS RETRACT mode or MANUAL mode can be engaged at any time during automatic leveling operation.

Prior to automatic leveling it is essential that there is no movement in the motorhome. To extend the jacks automatically proceed as follows:

- Place gear selector in NEUTRAL.
- Apply the parking brake.
- Turn ignition switch to the ON position.
- Switch the main jack control power switch ON.
- Press the AUTOMATIC LEVELING/ALL JACKS switch.

If the yellow lights illuminate, press down the rocker switch labeled AUTOMATIC LEVELING and release. The top green light will start blinking. After a ½ second delay, pump motor will come on and all jacks will extend downward. The system will attempt complete leveling in one operation. The motorhome is level when all yellow lights, as well as green lights, go out.

If leveling is unsuccessful on the first phase the system will attempt to level four subsequent times at seven second intervals.

If both green lights start flashing alternately the motorhome has reached maximum extension on one or more jacks. One or more yellow lights will blink, indicating that additional height is required under one of the jack pads. This can be attained by moving motorhome to another location or getting additional height by placing a 2x8 block under one of the jack pads.

If you block under a jack pad ONLY ONE JACK SHOULD BE BLOCKED AT A TIME. If blocking a rear jack pad while motorhome is on a slope, opposite set of rear wheels must be chocked to prevent rolling.



**WARNING: Once jacks are extended down a red JACKS DOWN warning light will blink and an alarm will sound. An alarm will sound again if jacks are down and ignition switch is turned ON.**

Once motorhome is level turn off POWER switch on control console and turn off ignition switch. BEFORE DRIVING OFF ALWAYS PERFORM A VISUAL INSPECTION TO INSURE THAT JACKS ARE UP.

### Automatic Retract:

Prior to retracting levelers it is advisable to start engine and build air pressure.

- Gear selector should be in NEUTRAL.
- Parking brake applied.
- Turn ignition switch to ON position.
- Engage power switch to ON position on jack control console.
- Press down rocker switch labeled ALL JACKS RETRACT and release.



**CAUTION: Do not move motorhome while jacks are still in contact with ground or extended, damage to jacks can occur. Do not raise any wheels off the ground, which could result in damage to the motorhome.**

Bottom green light will begin blinking and all jacks will retract. This operation is on a four minute timer. The green light will stop blinking and go out.

Hydraulic pressure, in all jacks, is automatically released when ALL JACKS switch is engaged. Jacks are retracted by the weight of motorhome and retract springs on each jack.

#### **Manual Retract Valves:**

In the event of mechanical or electrical failure that would prevent the leveling jacks from being automatically retracted, the motorhome is equipped with manual emergency retract valves. These valves are located inside the front generator access.

This manual system will release fluid under pressure in each jack and allow fluid to return to the reservoir. The jacks will then retract.

To operate the manual system turn all three T-handle valves counterclockwise until they stop.

Once the jacks are fully retracted, rotate all the valves fully clockwise. In the event one of the jacks is not holding pressure, check the position of the retract valve.



**NOTE: Do not move the motorhome until the jacks are fully retracted.**



**CAUTION: The motorhome will raise or lower if the bypass valves are opened. Do not crawl under the motorhome to access the valves. Make sure there is ample room to open the valves safely.**

#### **Maintenance:**

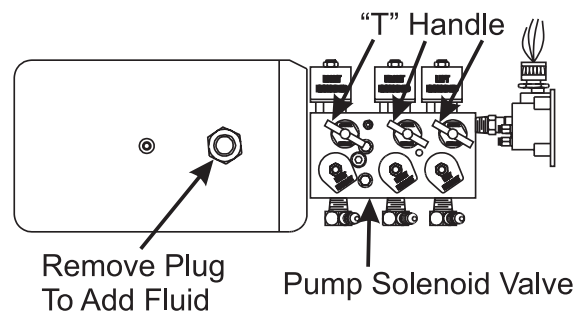
Occasionally, while the jacks are fully extended, wipe dirt from the jack rod. This will help lengthen the life of the jacks. This can vary from the amount and type of usage of the jacks. Dexron III will serve as a solvent as well as a lubricant. Occasional oil or grease on the extended jack ram is normal and aids in the lubrication of the ram. It helps to learn the sound of the normal pumping and gurgling sounds of the pump when it is low on fluid.

#### **Calibration:**

The transmitter module may require recalibration to ensure an accurate level is obtained. The recalibration procedure requires two persons for convenience and accuracy. This should only be performed by qualified service technicians.

### Adding Fluid:

1. An indication of a system needing fluid is a chime sounding when turning corners. Use Dexron III automatic transmission fluid.
2. Extend any jack 6 inches from the full retracted position. All other jacks should be fully retracted.
3. Unscrew the reservoir cap from the top of the pump.
4. Turn the ignition switch to the ON position. Turn the power ON rocker switch. Open the window so the bong alarm is audible from outside the motorhome. Slowly fill the reservoir with fluid until the bong alarm stops sounding.
5. Replace the reservoir cap.
6. Push the retract button, to retract the extended jack.
7. Turn the ignition switch and the remote panel OFF.



### LEVELING SYSTEM -Air (Optional)

A touch panel, computer controlled, four point or six point air leveling system is optional on all models. Models which are equipped with the air leveling system must remember the ignition has to be ON for the suspension to operate. This is critical to note in the event the motorhome requires emergency towing.

#### Automatic Air Leveling:

- Air leveling will operate faster if engine is running.
- Set parking brake.
- Transmission must be in neutral. (Important: No movement in motorhome while leveling.)
- Press AIR button once to enter air mode. AIR indicator light and four AIR BAG warning lights will glow steady.
- Press AIR button a second time. AIR indicator light will start flashing and air leveling will begin.
- When all four yellow LEVEL SENSING lights are out leveling is complete. AIR indicator light will stop flashing and turn steady red. Processor is now in a SLEEP MODE for 30 minutes. Engine may now be turned off. Every 30 minutes processor will check motorhome's level condition, make any corrections and return to SLEEP MODE. This will continue until system is turned off by pushing OFF button or transmission is taken out of neutral position and parking brake released.

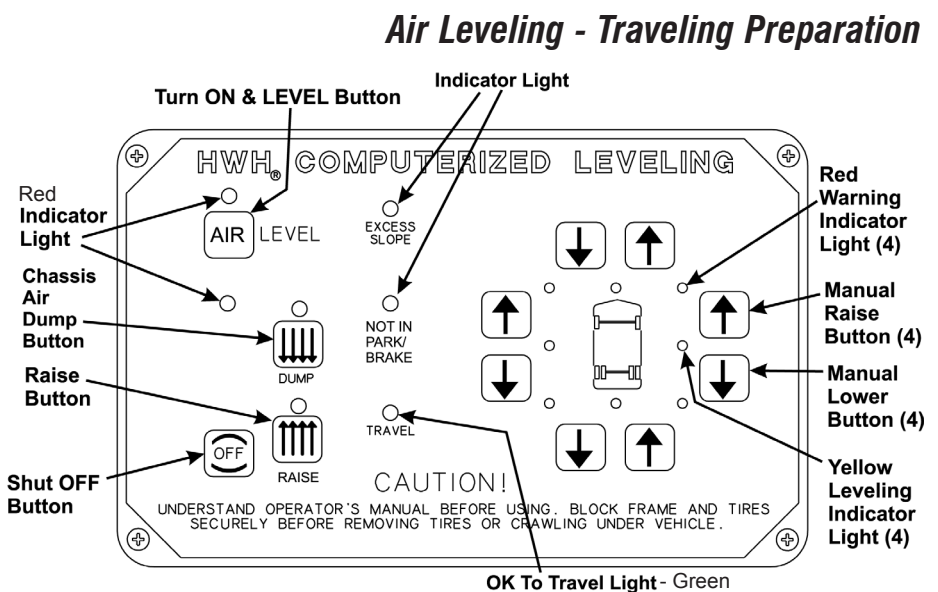
**Excess Slope:**

If system was unable to level motorhome, one or two yellow LEVEL SENDING indicator lights will remain on and EXCESS SLOPE light will come on. System will remain on but will not go into SLEEP MODE.

**Manual Air Leveling Operation:**

- Air leveling will operate faster if engine is running.
- Set parking brake.
- Transmission must be in neutral.
- Press the AIR button once. AIR indicator light will glow steady.
- Individual RAISE and LOWER buttons (UP or DOWN ARROWS) will add or dump air from suspension air bags to raise or lower coach for leveling.
- These are momentary buttons. Function will stop when button is released. Yellow LEVEL lights indicate a side, end or corner of motorhome is low. Lower opposite side or end of motorhome to achieve leveling. If a level position cannot be achieved by dumping air, raise motorhome according to lighted yellow LEVEL lights.
- IMPORTANT: Always give preference to any side light before leveling motorhome front to rear.
- Turn ignition switch OFF. Turn air leveling system OFF.

Start engine and allow air pressure to build to recommended pressure for travel. Push system OFF button and allow motorhome to return to travel position. All red indicator lights must be OFF and travel indicator light must be lighted before traveling. Ensure that the motorhome is at the proper ride height before moving. DO NOT solely rely upon the warning lights.



**CAUTION:** Do not rely solely upon warning lights. It is the operator's responsibility to check that the motorhome is at the proper ride height before moving the motorhome.



## 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 compression measured in lbs./in<sup>2</sup>. 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 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 over-speeding where an engine (due to its application) might operate in a combustible environment, such as fuel spills or gas leaks. Equipment owner and operator is responsible for safe operation of engine. Consult your engine authorized repair location for future information.**

## ISL ENGINE

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 grid heater. The grid heater helps engine starting in cold weather. Intake manifold air temperature is monitored by the Electronic Control Module 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.**

With throttle in idle position, turn ignition to the ON position allowing WAIT TO START lamp to extinguish. Turn 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 the fuel temperature. Allow engine to idle with no load for 3-5 minutes. The engine coolant temperature should be up to normal operating range (140° F / 60 ° C to 212° F / 100° C) before operating engine under full throttle.

## ENGINE STARTING PROCEDURE (ISL Normal)



**NOTE: It is not recommended to idle the engine for long periods of time. This will simply waste fuel and annoy neighbors. Consistent periods of long idle may cause damage to the engine.**

With the throttle in the idle position, turn the key to the start position. When the engine has started release the key. Allow the engine to idle with no load for 3-5 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 STARTING PROCEDURE (ISM Normal)



**NOTE: The ISM engine does not have a “wait to start” feature.**

The engine block heater may need to be plugged in 2 to 3 hours prior to starting. The engine block heater is rated at 1500 watts, 110 Volts AC and requires the motorhome be plugged into shore power or have the generator running. It is not necessary to leave the block heater plugged in for long periods of time. The block heater requires about 13 amps to operate.

## STARTING PROCEDURE -COLD WEATHER

The maintenance guidelines found in the Cummins O & M 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.

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 monitor-

## OIL RECOMMENDATIONS (ENGINE)

ing of the lubricating oil condition by means of a 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 can not 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.

#### **Function of Engine Oil:**

If a lubricating oil is to work in an engine it must be capable to perform 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 you have 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-like 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 are filled to react as a combustion seal within the cylinder liner and other internal components.

#### **Synthetic Engine Oil:**

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. 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 are 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 reducing 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 and 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***

**NOTE: Refer to the Operations and Maintenance Manual for more detailed information.**

**WINTER (32° to -25° F) (0° to -32° C):** Use a 50 antifreeze / 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 percent antifreeze / 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.

## ENGINE SHUTDOWN

General guidelines for shutting the engine down are fairly simplistic. Allow the engine to idle 3 to 5 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 3 to 5 minutes is not necessary.

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## 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 Operations and Maintenance Manual for guidelines on troubleshooting low oil pressure, or contact a qualified service technician. Allow the engine to idle for 3 to 5 minutes before operating under a load.

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## COOLANT

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 percent 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 O&M 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.**

The coolant fluid freeze point should be checked with every oil change interval at 15,000 miles, 500 hours or 6 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 6000 hours or 2 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, and 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 above the appropriate mark on the reservoir tank when the system is cold.

- 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. You will need to stop and check for coolant loss before driving.
- The coolant level to remain between the MAX and MIN level in the reservoir.



*The coolant capacity, when changing the antifreeze, is approximately 11½ gallons.*

### 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 mile/6 months.

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 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.

### **Coolant - Additive (SCA)**



**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 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.**

Use the correct Fleetguard coolant filter to maintain the recommended SCA concentration in the system. Maintain the correct concentration by changing the service coolant filter at each oil drain interval. The oil pressure gauge, temperature gauge, warning lamps and other safety lamps should be checked daily to ensure proper operations.



**NOTE:** The correct filter is determined by the total cooling system capacity. If you have any questions refer to the Cummins manual.



**NOTE:** The engine does not require a “break-in” procedure.

## FUEL REQUIREMENTS

Low sulfur #2 diesel fuel or #1 and #2 commercial winter blend diesel fuels are the most common commercially available and recommended for use. The 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 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 injectors. Fuel additives for lubricity are not recommended. There are numerous diesel fuel additives to help remove moisture from fuel, prevent microbe growth and to prevent 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.

**BRAKE - ENGINE**

The "Jake" brake is an engine-braking device that operates on a different principal than an exhaust brake. An engine brake functions by releasing the engine's compression. The effect of the engine brake increases with engine speed. When the engine brake is activated the Allison transmission automatically downshifts, utilizing the gear selected and maximizing the engine braking effect.

When the foot switch is activated, an electrical signal is sent to the engine's ECM (electronic control module). The ECM controls a hydraulic circuit that then opens the exhaust valves near the end of the compression stroke. The potential engine braking power depends on turbocharger boost pressure, engine speed, compression ratio, injector timing and when the exhaust valves open.

Located on the driver's left console is a High/Low switch. This switch allows for the selection of different levels of engine braking power. Selecting "LOW" activates the engine brake on three cylinders. Selecting the "HI" setting activates the engine brake on six cylinders.



**NOTE: The ISL engine does not have a HIGH/LOW switch. All six cylinders are activated when the engine brake is used**

The engine brake will not be enabled when:

- The cruise control is active.
- The engine speed goes below 850 rpm.
- An electronic fault code is active.

The throttle sensor is component part of the accelerator pedal assembly and deactivates the engine brakes when the throttle is applied. Applying the service brakes while in cruise control will disengage the cruise control and enable the engine brakes. The Jake Brake foot switch will not disengage the cruise control. Use the Jake Brake when going down a hill, freeway or off ramp. The engine brake will allow the engine temperature to drop while going downhill.



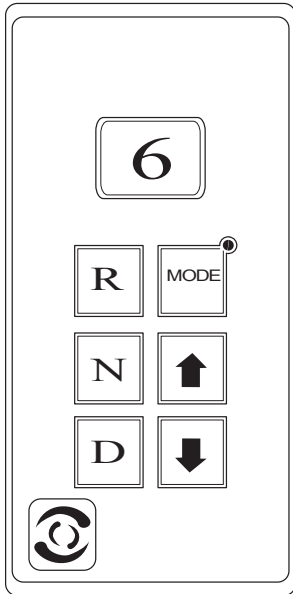
**NOTE: Idle the engine 3 to 5 minutes at approximately 1000 rpm to warm the engine before activating the engine brakes. Do not operate the engine brakes until the engine oil temperature is above 30 degrees C (86 degrees F).**



**WARNING: The engine brake is designed to assist the motorhome service brakes.**



## TRANSMISSION - Shift Selector



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 (keypad) and the control module. The ECU will process 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 RPM during a shift to an established desired profile within the ECU.

The system is monitored within the first 30 seconds of each engine start. This is referred to as “autodetect.” Autodetect searches for presence of data inputs or transmission components. The autodetect enables the ECU functional or diagnostic response to the items which 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 in shifting under varied conditions will be required before optimizing the shift quality. Generally five typical shifts of a shift type is needed for shift calibration.

The range selection is accomplished via the remote push button selector. The selector is simplistic in appearance. The controls are R, N, D, arrow up, arrow down, MODE buttons and a digital display window. Under normal operations the “D” button is pressed and the digital display shows the highest forward range attainable for the 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 this display indication is not visible there is no power to the selector and may indicate electrical problems with the batteries.

- Digital display window enables information requested to be easily read.
- Select the Reverse gear by pressing “R”.
- Select NEUTRAL by pressing “N”. The area around the “N” button is 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 will appear on the SELECT display and the transmission will shift to the starting gear.
- 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 range selected by one range. 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 will enable 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.

The electronic control system is programmed to inform the operator of a problem with the transmission system and automatically take action to protect the operator, motorhome and transmission. When the Electronic Control Unit (ECU) detects a DO NOT SHIFT (DNS) condition the ECU restricts shifting, turns the CHECK TRANS light on the instrument panel and registers a diagnostic code.

## **Transmission - Check Light**



**NOTE: For some problems, diagnostic 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 for diagnostic codes and to correct problems which arise.**

Each time the engine is started the CHECK TRANS will light, then turn off after a few seconds. This momentary lighting is to show that the status light circuits are working properly. If the CHECK TRANS light does not illuminate during start up, or if the light remains on after start up, the system should be checked immediately.

Continued illumination of the CHECK TRANS light during vehicle operation (other than start up) indicates that the 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 with 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 for damage to the transmission.

When the CHECK TRANS light comes on and the ignition switch is turned off the transmission will remain in N (Neutral) until the condition causing the CHECK TRANS light is corrected. Generally, while the CHECK TRANS light is on upshifts and downshifts will be restricted and direction changes will not occur. Lever and push-button shift selectors do not respond to any operator shift request while the CHECK TRANS light is illuminated. The lockup clutch is disengaged when transmission shifting is restricted or during any critical transmission malfunction.

### **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.

- 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 sensor information.
- 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 3 seconds. Some codes are self clearing while others will require service or ignition cycles to clear.

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### **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 you notify an Allison Transmission distributor or dealer when one of these conditions occur:

1. The shifting feels odd.
2. The transmission leaks fluid.

3. 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. It is important that the proper fluid level be maintained at all times. If the fluid level is too low the converter and clutches do not receive an adequate supply of fluid. If the fluid level is too high the fluid can aerate. Aerated fluid can cause the transmission to shift erratically or overheat.

The MT 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, using the Pro-Link, has been accomplished.

### **Fluid Level Check with the Keypad:**

- Park the motorhome on a level surface with the engine running, 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 delayed fluid level check will display in the digital display window. The display will be 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.

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.**

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## TRANSMISSION LUBRICATING FLUID

Any fluid meeting DEXRON-III specifications are acceptable for use in the transmission. Transmission performance, reliability and durability are important influences in the type of fluids used. Change the fluid internal filters after the first 8000km (5000 miles). The dipstick/oil fill is located between the engine and transmission underneath the engine access door in the bedroom. Change the transmission fluid and internal filters every 40,000km (25,000 miles) or 18 months, whichever occurs first.

### Fluid and Internal Filters Change Interval Recommendations:

The fluid and internal filters may require changing earlier depending on the severity of operating conditions. The fluid must also be changed whenever there is evidence of dirt or high temperature conditions 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.

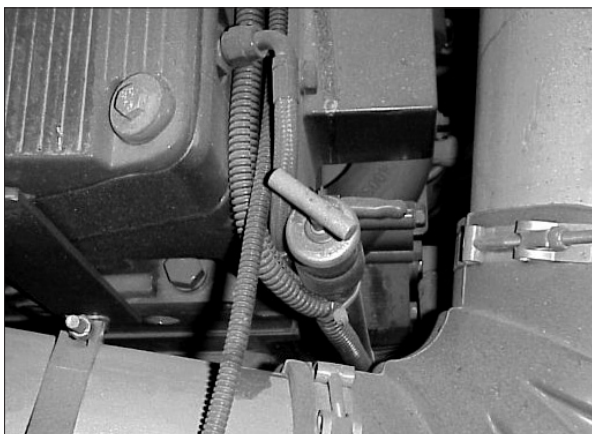
**Manual Check Procedures:**

The concept of a cold check is to determine adequate fluid level for safe operating until hot check can be performed.

- Park the motorhome on a level surface.
- The engine is operated at a low idle. Put the transmission in N (Neutral).
- Apply the parking brake and chock the wheels to prevent the motorhome from moving.
- Allow the engine to run at idle (500-800 rpm) for one minute.
- Apply the service brakes and shift to D (Drive), then to N (Neutral) and next to R (Reverse) to fill the system. Finally shift to N (Neutral) and release the service brakes. Allow the engine to continue to run at idle (500-800 rpm).
- Remove the dipstick and wipe clean. Reinsert the dipstick fully into the tube and remove to check fluid level. Repeat this to verify the reading if needed.
- Safe operating level is anywhere within the COLD CHECK band on the dipstick. The fluid level is sufficient enough to operate until a HOT CHECK can be run.
- If the level is not within this band, add or drain the fluid as necessary to bring the level to the middle of the COLD CHECK band.
- Perform the HOT CHECK 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 Oil Level Dipstick.*

## Hot Check

- The fluid level rises as the temperature increases, the fluid must be hot to ensure an accurate check.
- Be sure the fluid has reached normal operating temperature (160° to 200° F/71°-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 (500-800 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 1 quart of fluid at normal temperature range.
- If the level is not within this band, add or drain the fluid as necessary to bring the level within the HOT RUN band.
- Be sure that the fluid level checks are consistent. Check the level more than once. If the readings are not consistent check to be sure that the transmission breather is clean and not clogged. If the readings are still not consistent, contact the nearest Allison distributor or dealer.

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## FUEL TANK

The diesel fuel tank is made of 160 thousands aluminum. The capacity of the tank is 150 gallons. The engine pickup tube is cut at a 45° angle to allow good flow to the engine.



**NOTE: If the coach 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.

The Centroid fuel sender has no moving parts. It 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 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 counterclockwise until the full mark 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, when you have a constant above-full reading, is that you have water at the bottom of the fuel tank.
- C. Contact Centroid:** Probably 90% of the returns Centroid tests work okay on the bench. If you have incorrect readings contact Centroid (telephone: 800-423-3574, or (preferable) fax: 904-423-3709) with your symptoms. You will be provided with a short “fill in the blanks” troubleshooting test appropriate to your 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.

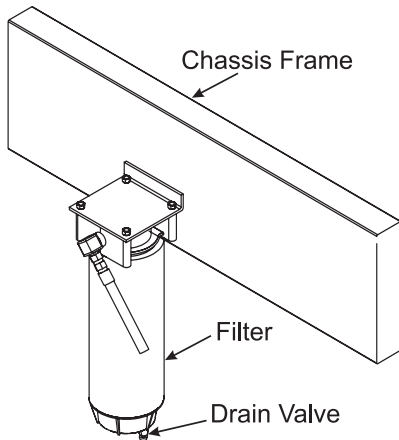
## FUEL SENDING UNIT



*Fuel Sending Unit.*



## FUEL/WATER SEPARATOR (ISL Engine)



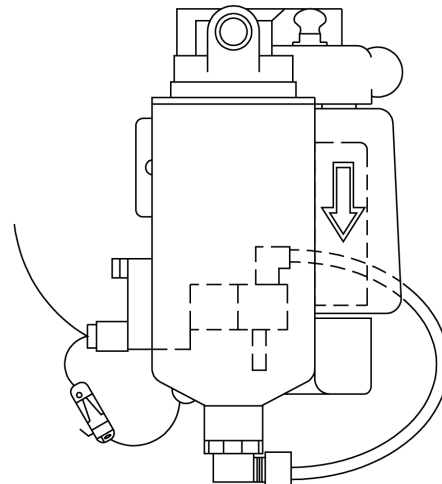
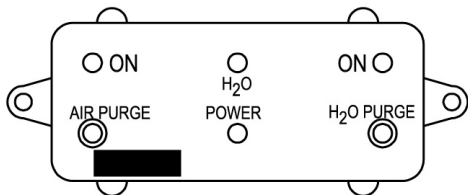
Fuel/Water separator is located in the rear engine compartment on the left or right side of the frame. If “water in fuel” light is illuminated, fuel filter will need to be drained. Shut off engine and open drain valve. Turn the valve counterclockwise approximately 1-1/2 to 2 turns until draining occurs. Drain fuel/water separator of water and sediment until clear fuel is visible. Turn valve clockwise to close drain valve.

In the event the engine runs out of fuel, the lift pump on the fuel pump will run for approximately 1 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-DIESELS for Cummins Customer Assistance Center.

## FUEL/WATER SEPARATOR (ISM Engine)

### Operation/Restart After Running Out Of Fuel:

- Turn the ignition switch to the ON position.
- The green power light on the control panel should illuminate.
- Remove the cap from the Schrader air valve and press and release the “AIR PURGE” switch on control panel. The yellow “AIR PURGE” lamp will illuminate. Depress and hold the Schrader air valve open to release the excess air from the system. The electronics will maintain the pump operation for 50-60 seconds. Recycle the pump and when the fuel is observed from the Schrader valve release (so the fuel no longer leaks from it).
- The internal pump will continue to run, pressurizing the fuel system while forcing fuel through the fuel lines.
- It may require recycling the “AIR PURGE” about 6 times before getting enough fuel from the tank to filter.





**NOTE:** The engine may run rough for a few minutes while the remaining air, if any, is forced through the fuel system.

- If the water in fuel light is illuminated on the dash, follow the same procedure using the H<sub>2</sub>O button on the control panel. It may be necessary to change the fuel filter.



**NOTE:** Always carry an extra Racor element as one tank full of excessively contaminated diesel fuel can plug a filter.

### **Servicing Reusable Pre-Filter**

- Remove the thumb bolt, washer and top block. Remove the pre-filter and o-rings.
- Clean the pre-filter in a solvent bath or with compressed air as necessary. Remember to wear safety goggles.
- Inspect the O-rings for cuts or damage. Replace if needed, otherwise lube with motor oil or clean with fuel and replace.
- Install the pre-filter back into the bottom block (the pre-filter arrow points down), and replace the top block making sure the O-rings are properly seated.
- Replace the thumb bolt and tighten by hand. Using pliers, turn the bolt 3/4 of one turn firmly to seat the O-ring seals.



**NOTE:** Over tightening may result in damage to the unit.

- Activate the “AIR PURGE” switch, start and operate the engine at high idle for about 3 minutes.



1. Schraeder valve.  
2. Thumb screw.  
3. Reusable filter.

## HYDRAULIC SYSTEMS

The motorhome uses an engine driven hydraulic pump to operate both the power steering system and the engine hydraulic cooling fan system. The hydraulic pump is a dual stage pump that uses one half of the pump to supply pressurized hydraulic fluid to the power steering. The other half of the pump supplies the engine cooling fan motors. The hydraulic system uses the same fluid for both systems, sharing one common reservoir. The hydraulic fluid used is an automatic transmission fluid (Dexron III) which has a wide ambient temperature operating range.



**CAUTION: If ambient temperatures approach 0° F, Pennzoil Arctic Blue hydraulic fluid, or equivalent hydraulic fluid, should be used. Using incorrect hydraulic system fluid weights in cold or arctic temperatures will raise the hydraulic system operating pressure and may damage the hydraulic cooler.**

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### Hydraulic Pump

The hydraulic pump creates pressure by meshing sets of gears together inside a close tolerance housing. A filtered supply of hydraulic fluid from the hydraulic reservoir enters the intake side of the pump. The meshing gear assembly "squeezes" the oil through the pump to the output side delivering the pressurized fluid to the power steering gear and the switching valve of the engine cooling system. Each half of the pump is equipped with an internal by-pass pressure relief spring. If the hydraulic pressure should exceed the specified pressure limit, the internal by-pass relief valve will be forced open to keep the hydraulic fluid at operating pressure. The hydraulic pressure generally is not rated in psi but is rated in the term bar. One bar is equivalent to approximately 14.5 psi. Hydraulic system pressures with a system at no load may be as low as eight bars on the output side of the pump. This is due to the hydraulic fluid flow of the pump. When a load is placed on the hydraulic pump such as turning the steering wheel, hydraulic fluid flow slows from hydraulic fluid restriction and creates pressure.

This may be understood as a faucet with a garden hose attached. Crimping the hose with the faucet on will create pressure from the restriction. This principle applies to the hydraulic system. The hydraulic pump is the supply, the load would be the power steering gear or the hydraulic fan motors. Hydraulic system pressure at full load can exceed 130 bar or 2000 psi. Hydraulic system pressure falls dramatically after the load. The return line pressure may be as low as six to eight bars. The fluid enters the hydraulic cooler where the heat is dissipated.

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### Hydraulic Cooler

The hydraulic cooler is an important part in the hydraulic system. This helps keep the hydraulic fluid from overheating. When a load is placed on the hydraulic system, heat is created in the fluid. The hydraulic pump builds pressure that creates heat in the fluid. The restriction from the loads applied also creates heat. This heat must be dissipated to keep the hydraulic fluid from overheating and breaking down. After cooling, the fluid is filtered before returning to the reservoir.

Care must be used when starting an engine in very cold or arctic climates. As with any oil, lower temperatures thicken the oil. Hydraulic system pressures increase due to the thickness of the fluid. Although the hydraulic pump is equipped with pressure relief valves, the thick oil on the return line can exceed the operating pressure of the hydraulic cooler.

The hydraulic fan drive system cools the radiator, charge air cooler, hydraulic fluid cooler, transmission cooler and the dash air conditioning condenser. The components of the hydraulic fan system are: hydraulic reservoir, filter, pump, two hydraulic fan motors (ISM), one hydraulic fan motor (ISL) hydraulic switching valve and thermostatic valve. Cooling fan speed is proportional to engine speed and radiator temperature. When radiator temperature rises above 185° Fahrenheit, the wax thermostatic valve slowly closes off the bypassing hydraulic fluid from the switching valve. As radiator temperature rises, a spool valve begins to move in the switching valve. This directs the pressurized hydraulic fluid to the fan motors. The higher the radiator temperature, the further the spool valve is moved in the switching valve, providing a higher volume of pressurized hydraulic fluid to the fan motors. Fan motor speed is increased to meet the demand for cooling. The action of the thermostatic valve is designed to move the spool in the switching valve to ramp up fan motor speed. This design saves horsepower and increases fuel mileage by precise control of hydraulic fan motor speed. The fan motors will increase in speed when the motorhome is ascending long hills or operating in high ambient temperatures. It is normal for the fans to "roar" when they are operating. Fan motor speed and engine rpm are approximately the same with the switching valve at full engagement.

## **Hydraulic Fan System**

The wax filled thermostatic valve is mounted at the top of the radiator sensing coolant temperature. The thermostatic valve controls the action of the switching valve. When the radiator is cool, the hydraulic fluid is allowed to flow through the inlet and outlet ports of the thermostatic valve and return to the hydraulic reservoir. As the coolant temperature inside the radiator rises to approximately 185° Fahrenheit, the wax inside the thermostatic valve begins to melt and expand. This begins to restrict hydraulic fluid flow through the thermostatic valve. The restricted hydraulic fluid pressure then begins to move the internal spool valve of the switching valve. This process will continue until coolant temperature inside the radiator reaches approximately 199° Fahrenheit. At this temperature hydraulic fluid flow through the thermostatic valve is stopped, moving the spool valve to full open position.

## **Thermostatic Valve**



**NOTE: The ISM series engine has a piloted orifice at the inlet port of the switching valve. This allows the fan motors to spin at a low rpm, even when the radiator is cool. This is to keep the dash air conditioning compressor at proper operating temperatures. It is normal for the engine fans to spin when the engine is idling even at cool radiator temperatures.**

### **Switching Valve**

The switching valve is mounted to the fan motor. This valve controls direction of high pressure hydraulic fluid flow. High pressure hydraulic fluid comes from the hydraulic pump to the switching valve before returning to the reservoir. Either the thermostatic valve or the electric override valve directs the fluid to the spool in the switching valve. When the radiator is cool, pressurized hydraulic fluid will bypass the fan motors and return to the fluid reservoir. As radiator temperature rises, the thermostatic valve signal is slowed or stopped to the switching valve. High pressure fluid is then directed to the fan motors, cooling the radiator.

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### **Electric Override Valve**

Motorhomes equipped with an ISM engine have an electric over hydraulic override control valve. The override valve is located at the lower rear corner of the radiator package. This valve is a normally closed valve that is plumbed parallel with the thermostatic valve. It performs the same hydraulic signal function as the thermostatic valve, but is electrically controlled by the ISM engine. The ISM engine monitors intake manifold temperature. The electronics of the ISM engine control an 87a relay located in the rear run box marked Hyd. Fans. When intake manifold operating temperatures are normal, the electronic engine energizes the coil of the relay. This energizes the coil of the override valve and the hydraulic fluid signal flows through the override valve to the thermostatic valve. If the ISM engine detects an over temperature condition of the intake manifold, the coil of the 87a relay is deactivated. Power to the override valve is removed, hydraulic fluid flow signal is stopped and internal spool of the switching valve moves to full open position. The high pressure fluid is directed to fan motors cooling the radiator.

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### **Fan Motor**

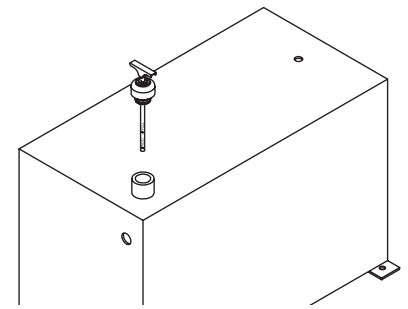
The fan motors are driven by hydraulic fluid pressure from the switching valve. The fan motors work on the same mechanical principal as a hydraulic pump only the mechanical principal when applied to the fan motors is reversed. Instead of creating hydraulic pressure by meshing gears together in a close tolerance housing, the fan motors receive hydraulic pressure. The hydraulic fluid drives the fan motor's internal gear assembly, spinning the fan motors and the attached fan blades. The switching valve is mounted to one fan motor. The fluid is directed to the input of that motor first. The output of the first motor is hooked to the input of the second motor. The hydraulic fluid is then cooled and filtered before returning to the reservoir.

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### **Hydraulic Reservoir**

The hydraulic reservoir is located in the engine compartment. It is made from aluminum so the tank will not be affected by any moisture that may condense. The oil level in the reservoir should be checked when the hydraulic fluid is at operating temperature. This should be done every 6000 miles or three months. The oil dipstick/oil fill is located on top of the reservoir. The oil level should be kept between the full and add marks on the dipstick. When performing fluid

level checks, inspect fittings and hoses for signs of leakage. Look underneath the motorhome for any signs of fluid leakage. Avoid untimely and costly failures by having leaks repaired. Change the hydraulic oil filter every 15,000 miles or once a year. Total system capacity is approximately 46 quarts.



Hydraulic Fluid Reservoir.

The Interceptor series hydraulic filter system located in the engine compartment has special features to protect the precision tolerance hydraulic components. The filter head assembly has a built in sight gauge that indicates fluid flow through the filter. A specially designed media filter absorbs harmful contaminants such as moisture and dirt. When the engine is running, use the sight gauge to check the filtering process. The green zone indicates the hydraulic fluid is being properly filtered and flowing unrestricted through the filter and head assembly back to the reservoir. As the filter traps harmful debris and contaminants, the indicator will move into the red zone. When the indicator is in the red zone, it is indicating filter is clogged and fluid is bypassing the element returning to the reservoir. The filter head is equipped with a built in bypass valve. This prevents a clogged filter from developing a leak due to excess hydraulic fluid pressure inside a clogged filter.

The filter is rated at ten micron\*. Change the filter before the built in sight gauge is operating in the red zone. This will ensure the hydraulic fluid is properly filtered.

Filter number: Parker IN HC 5720 (ten micron)

\*One micron is one millionth of one meter.

## Hydraulic Filter



Hydraulic filter for the power steering and hydraulic cooling fans.

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.

## STEERING GEAR

## LUBRICATING THE CALIPER

The disc brake components need to be lubricated to ensure proper brake operation. The calipers and slack adjusters need to be lubricated two or four times during the life of the brake pad lining or every six months. The lubricating procedure involves mechanically adjusting the brakes and will require an assistant. The motorhome must be parked on a flat level surface during the lubrication process. The drive axle spring brakes will need to be charged by releasing the emergency brake or an alternate method of releasing the spring brakes is by caging the spring brake chambers. If the spring brake chambers are going to be caged, the caging procedure is explained in the section under Towing Procedures. To ensure safety prior to releasing the spring brakes, special precautionary procedures are required to prevent the motorhome from rolling. Use at least four wheel chocks located at two separate wheel positions. Place each wheel chock snug against the forward side and backside of each tire with the wheel chocks facing opposite directions. The wheel chocks will remain in place until the brakes are adjusted and the proper brake pad to rotor clearance has been verified.

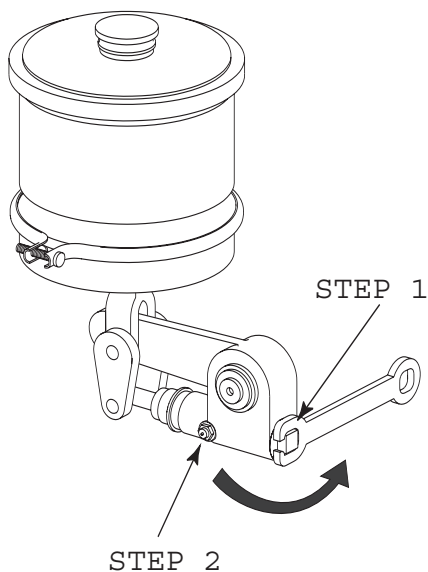
Lubricate the brake components at each wheel position. The lubricant required is a special high temperature grease. Refer to the grease chart (at the end of this article) for the lubricant specifications.



**WARNING:** Use wheel chocks prior to the lubrication procedure. Use at least four wheel chocks located at two separate wheel positions. Place each wheel chock snug against the forward side and the backside of each tire with the wheel chocks facing opposite directions. The wheel chocks will remain in place until the brakes are adjusted and the proper brake pad to rotor clearance has been verified. Failure to use wheel chocks can result in property damage, severe injury or death.

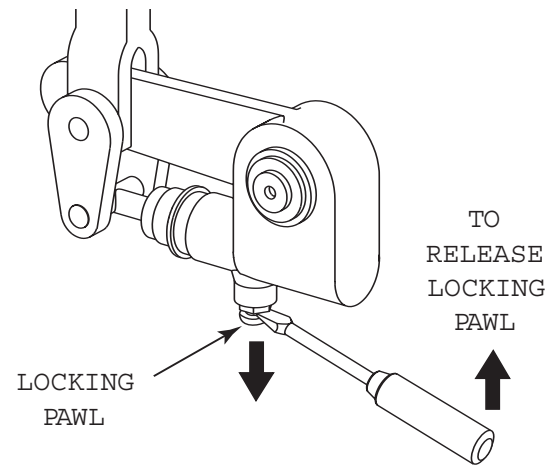


**NOTE:** Lubricate the brake actuating components inside the caliper at least two to four times during the life of the lining or every six months. Use only high temperature lubricant which meets or exceeds the required specifications.



Lubricate the caliper camshaft first then lubricate the slack adjuster. To ensure the grease thoroughly lubricates the camshaft, the slack adjuster will be manually adjusted full distance in each direction. Manually adjusting the slack adjuster will move the camshaft through the entire range of motion ensuring proper lubrication.

1. Begin the lubrication procedure by first installing the wheel chocks. Release the spring brakes.
2. Rotate the adjusting nut on the slack adjuster counterclockwise, this will move the inboard brake pad against the rotor.
3. The poppet on the caliper pressure relief valve will need to be held closed to prevent the grease from escaping during the lubrication process. With a finger holding the poppet valve closed, apply the high temperature grease through the grease fitting closest to the rotor first. Stop greasing when the lubricant begins to be forced out of the camshaft dust cover which is located between the caliper and slack adjuster.
4. Remove the pressure relief valve from the caliper.

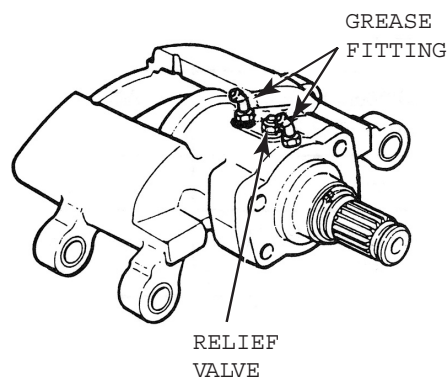


**CAUTION: Failure to remove the pressure relief valve will leave excess grease in the caliper. This will cause the brakes to drag due to the excess grease pressing on the caliper camshaft. Reduced brake pad life will result.**

5. Using a flat blade screwdriver hold the adjusting nut locking pawl open and rotate the adjusting nut on the slack adjuster clockwise until the caliper piston is fully retracted. As the caliper piston is retracted the excess camshaft lubricant will be forced out through the pressure relief hole.
6. With a finger covering the pressure relief hole, grease the fitting on the caliper closest to the slack adjuster. Stop when the excess grease begins to be forced out of the camshaft dust cover. Remove the excess grease from the camshaft dust cover and caliper.
7. Install the pressure relief valve.
8. Lubricate the slack adjuster grease fitting until the new lubricant is forced out of the locking pawl.



**NOTE: Use only specifically designed products such as a brake cleaner to remove any lubricant from the brake surfaces.**





Proper clearance between the rotors and brake pads is necessary for correct brake operation. Brake pad clearance which is too small will result in overheated brake linings. Brake pad clearance which is too large will result in insufficient braking force and improper parking brake operation. A static brake adjustment procedure will approximate the proper brake pad to rotor clearance. The spring brakes remain released throughout the static brake adjustment process. After the static brake adjustment procedure verify the brake pad clearance by measuring how far the brake chamber rod extends when the brakes are applied.



**NOTE: If the emergency brake has automatically set due to low air pressure, start and run the engine until full air system pressure is obtained. Release the emergency brakes.**

#### **Static Brake Adjustment:**

1. Set the static distance between the brake pad and rotor by rotating the adjusting nut on the slack adjuster counterclockwise until the nut stops. The brake pad should be firmly against the rotor.
2. Using a flat blade screwdriver hold the adjusting nut locking pawl open. Rotate the adjusting nut clockwise  $\frac{3}{4}$  turn.
3. If applicable, uncage the spring brakes and return the caging tool to the storage position.

#### **Verifying the Brake Adjustment:**

The proper clearance of the brake pads should now be verified. The brake chamber rod will extend when a brake application is made. The distance the rod extends must fall within specification. Measure the distance on each brake chamber rod.



**WARNING: Keep all fingers and loose clothing clear from moving brake components.**

1. Using a tape measure, record the distance between the flat surface of one brake chamber and the slack adjuster clevis pin.
2. With wheel chocks in place, start and run the engine until the air system is fully pressurized. If necessary, charge the spring brakes by releasing the emergency brake. Stop the engine.
3. Have the assistant make a brake application. Using a tape measure, record the distance between the flat surface of that same brake chamber and the slack adjuster clevis pin.
4. Repeat this procedure for all the brake chambers. Start the engine if the air system pressure drops to 80 psi.
5. Subtract the distance measured in line 2 from the distance measured in line 3. Record the measurement. Each brake chamber is stamped with a numerical Type/Size rating. Record the brake chamber type with the distance measured for that brake chamber. Use the brake chamber chart to compare the measured distance against the correct brake chamber rod extension length. If the distance does not meet or exceeds the specification, adjust the slack adjuster until the correct extension length is obtained.

**AIR DISK BRAKE GREASE SPECIFICATIONS (1540, 1560, 1760)**

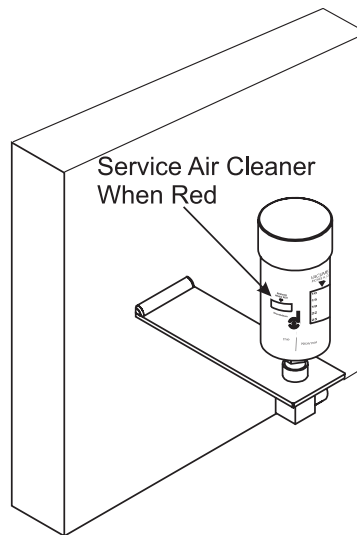
Component	Meritor Specifications	NLGI Grade	Grease Description	Outside Temperature
Caliper	0-616-A 0-645	1 2	Clay Base Synthetic Oil, Clay Base	to -40° F to -65° F
Slide Pin Retainers	0-637* 0-641	1-1½ ---	Calcium Base Anti-Seize	Refer to the grease manufacturer's specs. for the temp. service limits
Powershaft Splines	Any of Above	See above	See Above	See Above

**“Standard Stroke” Clamp-Type Brake Chamber Data**

TYPE	OUTSIDE DIAMETER	BRAKE ADJUSTMENT LIMIT (INCHES)
16	6-3/8	1-3/4
20	6-25/32	1-3/4
24	7-7/32	1-3/4
30	8-3/32	2
36	9	2-1/4

## AIR FILTER MINDER

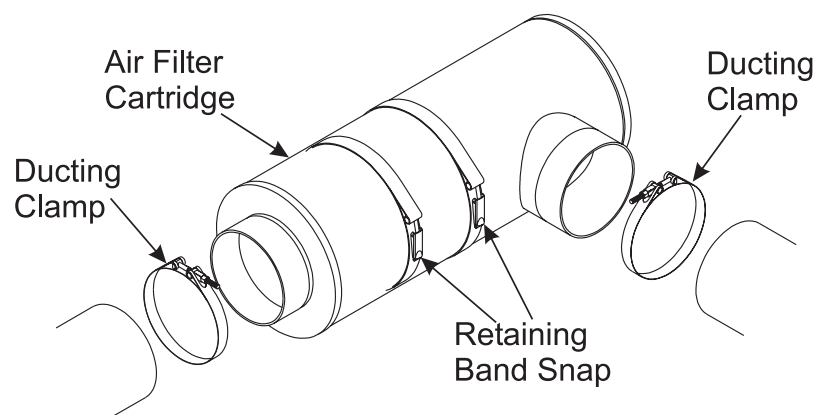
The air filter minder is a precision airflow restriction gauge designed to take the guesswork out of air cleaner replacement. The air filter minder is located in the engine rear compartment. Its operation is simple and virtually fool proof. As dirt captured by filter cartridge slowly builds up, the system 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. The service indicator is easily reset by pushing the button at the bottom of the minder.



*Located in the engine compartment.*

## AIR FILTER- Changing

When the air filter needs to be changed, the entire air filter cartridge is discarded and replaced by loosening the inlet and outlet ducting clamps and releasing the retaining band snaps. The air filter is located in the rear engine compartment. Changing the air filter may need to be performed from the bed deck access.



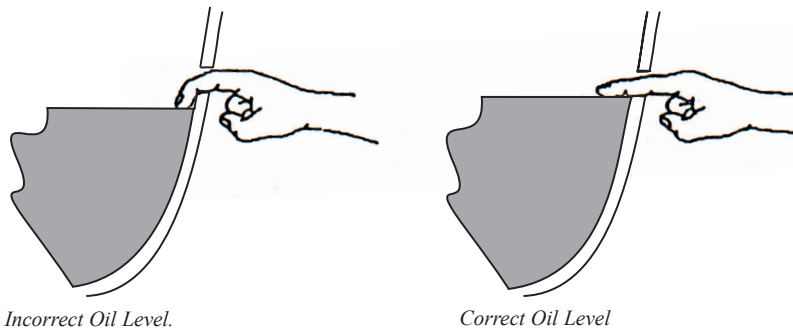
## Proper Drive Axle Lubricant Level

## DRIVE AXLE LUBRICANT

- 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.
- Your differential is filled with API GL-5 or MT-1 type gear lubricant, Pennzoil Gear Plus Super-EW 75w-90, synthetic lubricant.



**NOTE:** When checking the lube level, also check the housing breathers. Clean the breathers if dirty, or replace them if damaged.



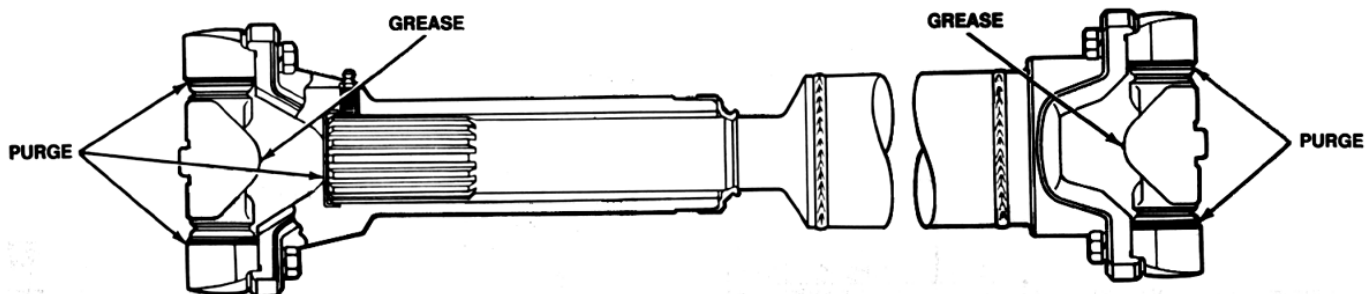
## Greasing the Driveline Universal Joint:

## DRIVELINE

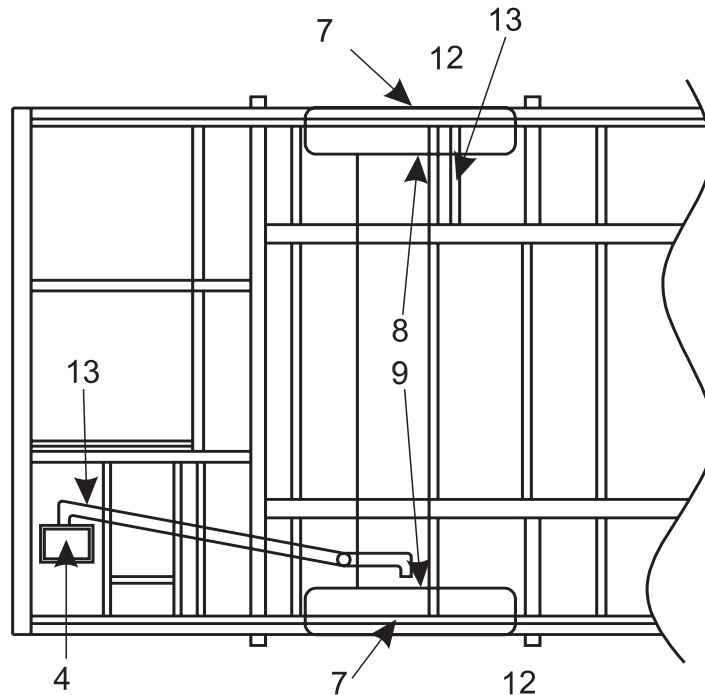
1. Check the driveline for looseness. If loose, service the driveline as necessary.
2. Apply the specified grease at the grease fitting on the universal joint. Apply grease until the new grease purges from all the seals.
3. If the new grease does not purge at the seals, loosen the bearing cap bolts and re-grease until all four caps purge. If the new grease still does not purge, replace the universal joint.

## Greasing the Driveline Slip Yoke and Splines:

1. Check the driveline for looseness. If loose, service the driveline as necessary.
2. Cover the air hole so that grease can flow easily to the seal. Apply the specified grease at the grease fitting on the slip yoke. Apply grease until new grease purges from the air hole in the end of the slip yoke. Greasing Intervals-10,000 miles or annually.



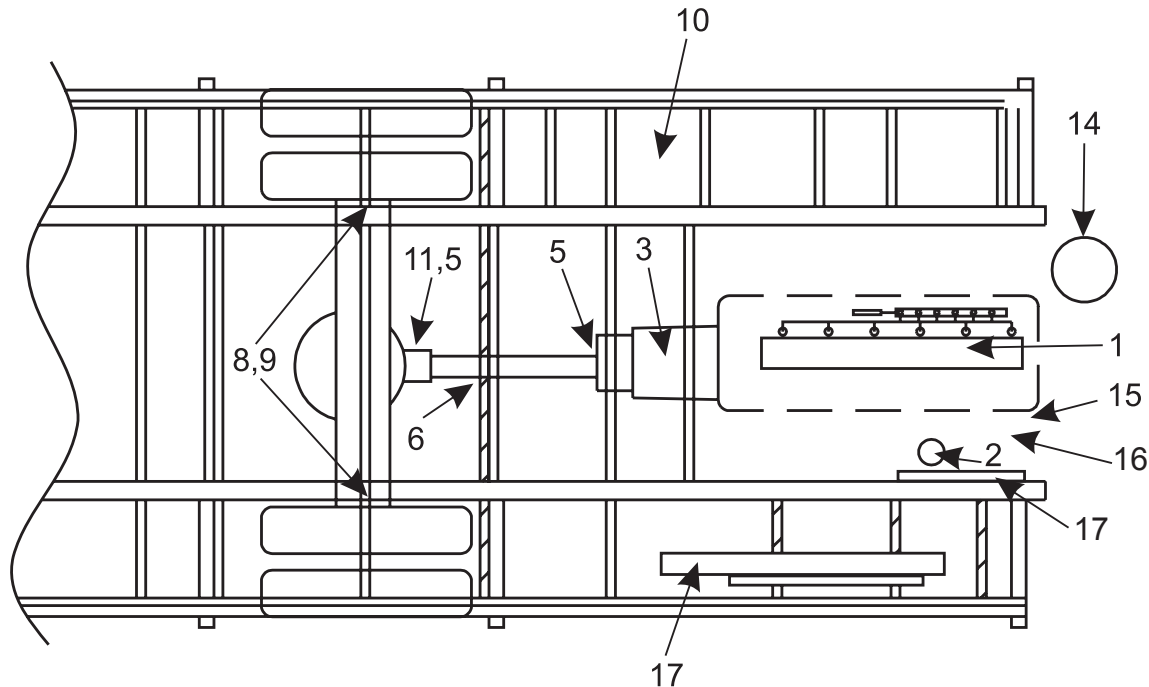
**FRONT of COACH**



**LUBRICATION CHART**

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 bimonthly.-0\*--\*\*-

1. Engine Oil	Keep To Full Mark	Check Daily	EO
2. Engine Oil Filter	Replace At Oil Change	Refer to Cummins	OP
3. Transmission	Refer To Service Manual	Check Daily	TF
4. Steering Shaft	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	Repack	30,000 or Annually	HT
8. Brake Cam Shaft	One Fitting Each Wheel	30,000 or Annually	CL
9. Brake Adjuster	One Fitting Each Wheel	30,000 or Annually	CL
10. Battery Terminals	Apply Coating	10,000 or Annually	P
11. Rear Axle Differential	To Filler Plug	100,000 or Annually	MP
12. King Pins & Knuckles	2 Fitting Each End	30,000 or Annually	CL
13. Drag Link/Tie Rod	4 Fittings	30,000 or Annually	CL
14. Hydraulic Fluid Reservoir	Keep To Full	Check Daily	TF
15. Hydraulic Fluid Filter (if applicable)	Replace	15,000 or Annually	TF
16. Fuel Filter	Replace	At oil change	FF
17. Engine Coolant Capacity	Replace	Every 2 Years	AF

**Rear of Coach**

## Lubrication Code Chart

CL-4 U-Joints located inside the coach under the steering cover

EO Engine oil as recommended by engine manufacturer

OP Refer to operators manual

MP API GL-5 or MT-1 type gear lubricant - Pennzoil Gear Plus SUPER-ew 75w-90, Synthetic

HT High temperature bearing grease

CL Chassis lubricant should be a high quality noncorrosive multipurpose lithium soap pressure gun lubricant that is water resistant and designed to withstand extremely high operating temperatures

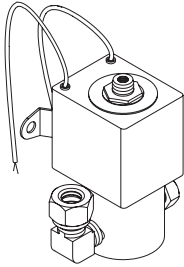
P Petroleum jelly, or a commercial battery terminal corrosion inhibitor

AF Consult Cummins Owners manual for antifreeze type

TF Transmission fluid. Use Dexron III transmission fluid only

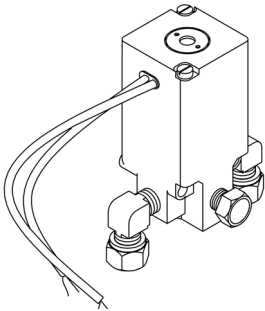
FF Fuel Filter

## PARTS - COMMON SOLENOIDS & SENDERS



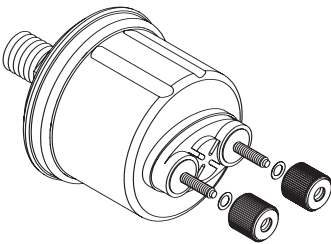
### Rear Bag Dump Solenoid:

- Used on hydraulic level and air level systems.
- Dumps air in air bags on hydraulic level units and is used to dump air from tag axle on air level units.
- Located in the engine compartment on the roadside, attached to frame below alternator.
- Type- Allen Air 36BXA-HB



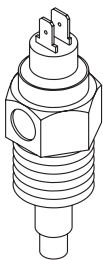
### Front Bag Dump or Tag Axle Solenoids:

- Used on hydraulic level and tag axle units.
- Dumps air in front air bags and is used to raise or lower tag axle.
- Located in the generator compartment on the curbside.
- Type- MAC 225B-601BAAA



### Oil pressure Sending Unit:

- One post is used for the oil pressure gauge and one post is for the warning light.
- Type- VDO 360 0238NDO 0-100 Ohm

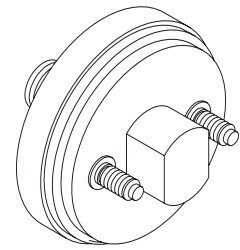


### Water Temperature Sending Unit:

- One post is used for the water temperature gauge and one post is used for the warning light.
- Type- VDO 323 0998

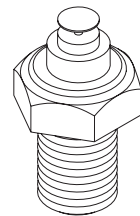
**Low Air Switch:**

- 1/8-27 NPT thread.
- Normally closed until approximately 65 psi.
- Located behind dash panel.
- Type- Merritor Wabco 89404 16062



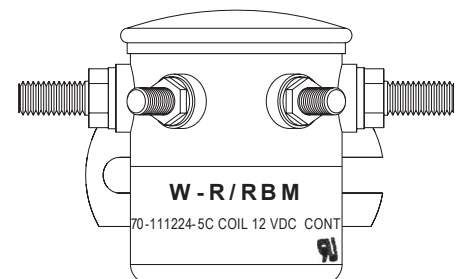
**Transmission Sending Unit:**

- Located on the bottom of the tailshaft housing, between hoses.
- Type- VDO 323 0868



**House Disconnect and Starter Solenoid:**• Solenoid interfaces start signal to Cummins starter.

- Solenoid interrupts DC power to the house fuse panel.
- Four post 80 amp solenoid with isolated coil.
- Located in high and low current plates.
- MP # 8206





## CHART - FILTERS & BELTS

	MANUFACTURER	ISL 370	ISM 500
Coolant Filter	FLEETGUARD	WF 2071	WF 2071
Oil Filter	FLEETGUARD	LF 9009	LF 3000
Fuel Filter Pri	RAYCORE	S 3201 T	S 3201 T
Fuel Filter Sec	FLEETGUARD	FS 1022	FS 1022
Aqua Hot Fuel	RAYCORE	R 12 T	R 12 T
Hydraulic Filter	PARKER	INHC5710	INHC5710
Alternator Belt	DAYCO	3911581	3911581
A/C Belt	DAYCO	17475	17475
Air Filter	DONALDSON	P53744802 (MP*-2329)	P53744802 (MP*-2329)
Hydraulic Filter	PARKER	IN HC 5720 (10 micron)	IN HC 5720 (10 micron)
Air Dryer Filter	MERITOR/WABCO	R950011	R950011

\*MP = Monaco Part #



**NOTE: Filter and belt numbers were correct at the time of printing. Verify the numbers at time of removal. The manufacturer will not be responsible for incorrect filter or belt usage. Please refer to the engine manufacturer's operating instructions for specific maintenance information.**

### AIR DISK BRAKE GREASE SPECIFICATIONS (1540, 1560, 1760)

Component	Meritor Specifications	NLGI Grade	Grease Description	Outside Temperature
Caliper	0-616-A 0-645	1 2	Clay Base Synthetic Oil, Clay Base	to -40° F to -65° F
Slide Pin Retainers	0-637* 0-641	1-1½ ---	Calcium Base Anti-Seize	Refer to the grease manufacturer's specs. for the temp. service limits
Powershaft Splines	Any of Above	See above	See Above	See Above

**CHART - SPECIFICATIONS****CHASSIS SPECIFICATIONS**

	<b>40PBS</b>	<b>40WDS</b>	<b>40PBD</b>	<b>42CDS</b>	<b>42DSS</b>	<b>43PBD</b>
GVWR	36,000 lbs.	36,000 lbs.	46,000 lbs.	46,000 lbs.	46,000 lbs.	46,000 lbs.
GCWR	46,000 lbs.	46,000 lbs.	56,000 lbs.	56,000 lbs.	56,000 lbs.	56,000 lbs.
GAWR - Front	13,000 lbs.	13,000 lbs.	13,000 lbs.	13,000 lbs.	13,000 lbs.	13,000 lbs.
GAWR - Rear	23,000 lbs.	23,000 lbs.	23,000 lbs.	23,000 lbs.	23,000 lbs.	23,000 lbs.
TAWR - Tag Axle	N/A	N/A	10,000 lbs.	10,000 lbs.	10,000 lbs.	10,000 lbs.
Wheel Base	262"	262"	245"	262"	262"	271.5"
Exterior Overall Height w/AC	12'	12'	12'	12'	12'	12'
Exterior Width	101.5"	101.5"	101.5"	101.5	101.5	101.5

**TANK CAPACITIES (Approximate Gallons)**

	<b>40 PBS</b>	<b>40WDS</b>	<b>40PBD</b>	<b>42CDS</b>	<b>42DSS</b>	<b>43PBD</b>
Diesel Fuel	150	150	150	150	150	150
Water Heater	10	10	10	10	10	10
Grey Holding Tank	60	60	60	60	60	60
Black Holding Tank	46	46	46	46	46	46
Fresh Water Tank	100	100	100	100	100	100
LP Gas Tank*	45	45	45	45	45	45

\* Actual filled LP - Gas capacity is 80% of listing due to safety shut-off required at tank.





## CHASSIS LOG

Date	Mileage	Dealer Address	Service/Remarks

**CHASSIS LOG**

<b>Date</b>	<b>Mileage</b>	<b>Dealer Address</b>	<b>Service/Remarks</b>

## GLOSSARY OF TERMS

**AC Electricity** - Alternating current also known as household power.

**Air Compressor** - A device that pumps air to and builds air pressure in an air system.

**Air Dryer** - A device that cools, filters and dries the air delivered by an air compressor.

**Air Governor** - A device that 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 12V 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** - 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.

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

**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** - Sites where you can drain your waste (gray) and sewage (black) tanks. In most states it is illegal to drain your tanks anywhere except at dump stations.

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

**Gray 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 12V 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.

**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 camp ground 120 volt electrical supply.

**Shore Line Plug** - This is the 120 volt outlet that you can plug your motorhome into a camp-ground.

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

**Volt** - The unit of measure for electric potential.

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

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

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