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**MONACO COACH CORPORATION  
MOTORHOME LIMITED WARRANTY**

**LIMITED  
WARRANTY  
- 2002 Signature**

**What the Period of Coverage Is:**

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

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

**Limitations of Implied Warranties**

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

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**What the Warranty Covers**

Warrantor's Limited Warranty covers defects in the manufacture of your motorhome and defects in materials used to manufacture your motorhome. Also see the section "What the Warranty Does Not Cover" set out below.

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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 the defect; and (2) you deliver your Motorhome to Warrantor or Warrantor's authorized servicing dealer at your cost and expense. It is reasonable to expect some service items to occur during the warranty period.

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

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

If two or more unsuccessful repair attempts have been made to correct any covered defect that you believe substantially impairs the value, use or safety of your motorhome, you must, to the extent permitted by law, notify Warrantor directly in writing of the failure to successfully repair the defect so that Warrantor can become directly involved in performing a successful repair to the identified defect.

## **How to Get Service**

The Warranty Registration form must be returned to Warrantor promptly upon purchase to assure proper part replacement 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 (1-877-466-6226). The mailing address is 91320 Coburg Industrial Way, Coburg, OR 97408.

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

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

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

## **What the Warranty Does Not Cover**

**Events Discharging  
Warrantor from  
Obligation Under  
Warranty**

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

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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. THE EXCLUSION OF CONSEQUENTIAL AND INCIDENTAL DAMAGES SHALL BE DEEMED INDEPENDENT OF, AND SHALL SURVIVE, ANY FAILURE OF THE ESSENTIAL PURPOSE OF ANY LIMITED REMEDY. Some states do not allow the exclusion or limitation of consequential or incidental damages, so the above exclusions may not apply to you.**

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**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.**

**ATTN: Warranty Department  
91320 Coburg Industrial Way  
877-466-6226**

**LIMITED  
WARRANTY  
- ROADMASTER  
CHASSIS**

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

**ANY IMPLIED WARRANTIES ARISING BY WAY OF STATE LAW, INCLUDING ANY IMPLIED WARRANTY OF MERCHANTABILITY AND ANY IMPLIED WARRANTY OF FITNESS FOR A PARTICULAR PURPOSE, ARE LIMITED IN DURATION TO THE TERM OF THIS LIMITED WARRANTY AND ARE LIMITED IN SCOPE OF COVERAGE TO THOSE PORTIONS OF THE ROADMASTER CHASSIS COVERED BY THIS LIMITED WARRANTY.**

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

***Limitations of  
Implied Warranties***

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

***What the Warranty  
Covers***

**What We Will Do to Correct Problems**

Warrantor will repair and/or replace, at its option, any covered defect if: (1) you notify Warrantor or one of its authorized servicing dealers of the defect within the warranty coverage period and within five (5) days of discovering any such defect; and (2) you deliver the Roadmaster Chassis to Warrantor or Warrantor's authorized servicing dealer at your cost and expense. It is reasonable to expect some service items to occur during the warranty period.

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

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

If two or more unsuccessful repair attempts have been made to correct any covered defect that you believe substantially impairs the value, use or safety of your motorhome, you must, to the extent permitted by law, notify Warrantor directly in writing of the failure to successfully repair the defect so that Warrantor can become directly involved in performing a successful repair to the identified defect.

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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 (1-800-866-6226). The mailing address is 91320 Coburg Industrial Way, Coburg OR 97408.

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

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

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

**What the Warranty Does Not Cover**

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

**Events Discharging Warrantor from Obligation Under Warranty**

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

**Disclaimer of Consequential & Incidental Damages**

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

**Legal Remedies**

**ROADMASTER CHASSIS DIVISION  
MONACO COACH CORPORATION  
91320 COBURG INDUSTRIAL WAY  
COBURG, OREGON 97408**

*SIGNATURE*

**WARRANTY  
INFORMATION  
FILE**

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

**MONACO COACH CORPORATION'S WOOD FINISH**

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

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

***Monaco Coach Corporation***

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



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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 grey box inside the motorhome.

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

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

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# Signature

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## INTRODUCTION

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

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

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

The safety alert symbols of **CAUTION** or **WARNING** are "Personal Safety Instructions." It is important to thoroughly read and understand these safety instructions where the symbols are displayed throughout the manual. Failure to comply with specific instructions may result in personal injury or death. Many instructions are required by National Safety Associations.

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

**Monaco Coach Corporation  
Consumer Affairs Department  
91320 Coburg Industrial Way  
Coburg, Oregon 97408**

## CUSTOMER RELATIONS

## **REPORTING SAFETY DEFECTS**

If you believe that your motorhome has a defect which could cause a crash or could cause injury or death, you should immediately inform the National Highway Traffic Safety Administration (NHTSA) in addition to notifying Monaco. 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 Monaco. To contact NHTSA you may either call the Auto Safety Hot line toll-free at 1-800-424-9393 (or 1-202-366-0123 in the Washington D.C. area) or write to:

**NHTSA  
U.S. Department of Transportation  
400 Seventh Street  
Washington, DC 20590**

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## **TAKING DELIVERY *Monaco* *Responsibilities***

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

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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.

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 Monaco Limited Warranty. Maintenance services should be performed in accordance with this Owner's Manual, and any other applicable manuals. As the owner, it is your responsibility and obligation to return the motorhome to an authorized dealer for repairs and service (see the Limited Warranty). Since the authorized dealer where you purchased your new motorhome is responsible for its proper servicing before delivery, and has an interest in your continued satisfaction, we recommend that Inspection, Warranty and Maintenance Services be performed by the dealership. We suggest that you take your new motorhome on a weekend shakedown before leaving on an extended trip.

**Customer  
Responsibilities**

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.

**SERVICE  
SUGGESTIONS**

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

**Prepare for the  
Appointment**

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.

**Prepare a List**

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

**Be Reasonable  
With Your  
Requests**

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

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

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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**



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

**Motorhome** Serial Number \_\_\_\_\_

**Motorhome** Federal Vehicle Identification Number (VIN) \_\_\_\_\_

**Door Key** Number \_\_\_\_\_

**Range** Model & Serial Number \_\_\_\_\_  
(Located under top burner plate)

**Microwave** Model & Serial Number \_\_\_\_\_  
(Located behind door on case)

**Refrigerator** Model & Serial Number \_\_\_\_\_  
(Located inside refrigerator compartment)

**Generator** Model & Serial Number \_\_\_\_\_  
(Located in outside compartment on generator)

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

**Inverter** Model & Serial Number \_\_\_\_\_



FOR YOUR OWN REFERENCE

**OWNER'S RECORD - INSURANCE**

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

\_\_\_\_\_

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

\_\_\_\_\_

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

\_\_\_\_\_

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

\_\_\_\_\_

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

\_\_\_\_\_

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

\_\_\_\_\_

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

\_\_\_\_\_

\_\_\_\_\_

\_\_\_\_\_

\_\_\_\_\_

\_\_\_\_\_

## VENDOR LIST

### **Air Bags**

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

### **Air Conditioner - Dash**

SGM  
440-255-1190

### **Air Conditioner - Roof**

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

### **Air Filter**

Donaldson  
612-887-3131  
www.donaldson.com

### **Alternator**

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

### **Aqua-Hot**

Vehicle Systems Inc.  
800-685-4298  
www.hydro-hot.com

### **Awnings**

Carefree  
800-621-2617  
www.carefreeofcolorado.com

### **Girard Systems**

800-382-8442  
www.girardrv.com

### **Axles - Brakes**

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

### **Batteries**

Interstate  
800-272-6548  
www.interstatebatteries.com

### **AGM (All Electric)**

Lifeline Distributors Inc.  
800-527-3224  
www.lifelinebatteries.com

### **Battery Isolator**

Powerline  
800-443-9394  
www.hehrpowersystem.com

### **Battery Maintainer**

Lambert Enterprise  
800-853-3748  
www.lambertenterprises.8k.com

### **Brakes-Anti-Lock Brake System**

Eaton  
800-826-4357  
www.eaton.com

### **Brakes-Automatic Traction Control**

Eaton  
800-826-4357  
www.eaton.com

### **Carbon Monoxide Detector**

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

### **Citizen Band Radio**

Cobra  
733-889-3087  
www.cobraelec.com

### **Cooktop**

Seaward Products (110 Volt)  
562-699-7997  
www.seawoodproducts.com

### **Kitchenaid (LP-Gas)**

800-422-1230  
www.kitchenaid.com

### **Dash Radio**

Panasonic  
800-211-7262  
www.panasonic.com

### **DVD Player**

Sony  
800-222-7669  
www.sony.com

### **Engine**

Cummins  
800-343-7357  
www.cummins.com

### **Entry Step**

Kwikkee  
800-736-9961  
www.kwikkee.com

### **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  
www.parker.com/racor/

**Fire Extinguisher**

The Fire Extinguisher Co.  
919-563-4911

**Fuel Sender**

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

**Generator**

Onan  
800-888-6626  
www.onan.com

**Home Theater**

Bose  
800-288-2673  
www.bose.com

**Icemaker (Optional)**

U-Line  
800-779-2547  
www.prestolite.com

**Inverter**

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

**Keyless Entry**

Essex Electronics  
1-800-539-5377  
www.keyless.com

**Leveling Jacks - Hydraulic (Optional)**

RVA  
760-746-5732

**Leveling System - Air**

HWH Corporation  
800-494-3213  
www.hwh.com

**Liquefied Petroleum Protectors**

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

**LP Tank**

Brunner  
800-753-8625  
www.mantank.com

**Manabloc Water Manifold**

Vanguard Pipe  
800-775-5039  
www.vanguardpipe.com

**Microwave**

General Electric Co.  
800-432-2737  
www.geadvantium.com  
www.geappliances.com

**Mirror (Ceiling)**

Wilsonart  
800-433-3222  
www.wilsonart.com

**Navigation System**

Mito Corporation  
800-433-6486  
www.mitocorp.com

**Outside Mirrors**

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

**Power Cord Reel**

Glendinning Marine  
800-783-8871  
www.glendinning.com

**Rear Vision System**

Mito Corporation  
800-433-6486  
www.mitocorp.com

**Refrigerator**

Norcold  
800-543-1219  
www.norcold.com

**Satellite System**

Datron DBS 3000  
800-287-5052  
www.datrondb.com

**Security System (Optional)**

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

**Shock Absorbors**

Bilstein  
800-537-1085  
www.bilstein.com

**Slide-Out Motor - Electric**

Power Gear  
800-344-4712  
www.powergear.com

**Solar Panels**

RV Solar Consultants  
541-937-9812

**Slide-Out Motor - Hydraulic**

HWH Corporation  
800-494-3213  
www.hwh.com

**Steering Gear**

Sheppard  
717-637-3751  
www.rhsheppard.com

**Steering Wheel (Smart Wheel)**

Vehicle Improvement Products  
847-395-7250  
www.vipwheels.com

**Storage Trays**

Kwikkee  
800-736-9961  
www.kwikkee.com

**Television/VCR/Plasma**

Sony  
800-222-7669  
www.sony.com

**Television Antenna**

Winegard  
319-754-0600  
www.winegard.com

**Tires**

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

**Toilet**

Sealand  
800-321-9886  
www.sealandtechnology.com

**Transfer Switch**

ESCO  
219-264-4156

**Transmission**

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

**Trip Tek**

Sawtooth Embedded Systems  
208-658-0777  
www.triptek.net

**Washer/Dryer (Optional)**

Splendide  
800-736-4127  
www.splendide.com

**Water Filters**

Premier  
800-752-5582  
www.premier.h2o.com

**Water Pump**

Aquatec  
800-975-9995  
www.aquatec.com

**Wheels - Aluminum**

Accuride  
800-626-7096  
www accuridecorp.com

**Window Blinds**

Somfy  
800-637-6639  
www.diesequipment.com

**Windshield Wipers**

Diesel Equipment  
336-373-8331  
www.diesequipment.com

# Signature

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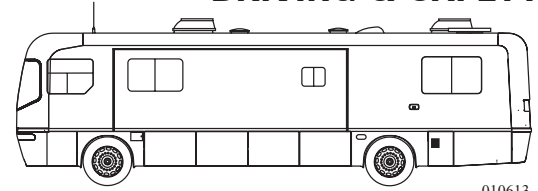






This section contains information on driving tips, emergency situations, towing, safety devices, weighing the motorhome and tires.

## DRIVING & SAFETY



010613

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

### Inspections

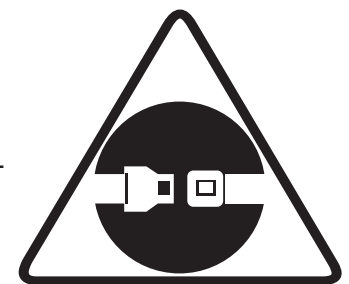
The location of the driver's seat in the motorhome is higher and further to the left than most vehicles. This creates a different perspective of the roadway. Rely on the outside mirrors to line up with the center of the road and to check the conditions behind the motorhome. The dashboard may contain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

### Familiarize Yourself

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

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

### Safety Seat Belts



SEATBELT



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



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

**Seat Belt Care:**

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

---

***Tips for Driving***

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

The motorhome will travel safely and comfortably at highway speed limits. However, it takes more time to reach highway speed. When passing another vehicle, allow extra time and space to complete the pass due to the added length of the motorhome. When descending a long hill, use the exhaust or engine brake. The transmission and engine will help control downhill speed and can extend the service life of the brake lining. The distance required to stop the motorhome is greater than an automobile. The brakes are designed for the (GVWR) Gross Vehicle Weight Rating. Practice stopping away from traffic to get the "feel" of the distance required to stop the motorhome.

When backing up, have the co-pilot stand at the road side rear corner so the co-pilot remains visible in the roadside mirror. The co-pilot can watch for any obstacles and give hand signals during the backing up process. When traveling, make sure bridges being crossed can support the weight of the motorhome. Check the tonnage limit of the bridges before crossing them. Signs should be posted at bridge entrances. Check the posted height of all overpasses or situa-

tions where overhead clearance is limited. Keep in mind, road surfaces may have been repaved or become packed with snow and therefore the actual posted clearance height would not apply in such conditions.

### Driving Cautions:

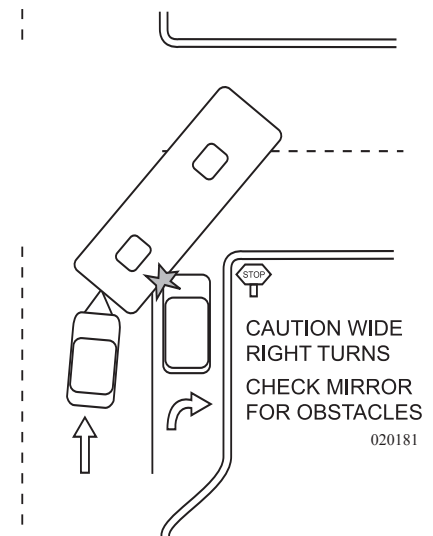
- Avoid getting too close to the edge of the road, a soft shoulder may not support the weight of the motorhome.
- Side spacing is best maintained by keeping the motorhome centered in the driving lane.
- Driving lanes in work zones can be uneven, congested and narrower than usual.
- Be cautious of road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



### Right Turns:

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

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

**Extreme Heat and Hot Weather Conditions:**

- Observe all gauges frequently. Any variations from the normal conditions should be evaluated promptly.
- Check tire pressure frequently when traveling in hot conditions. Tire air pressure increases with heat. It is not advisable to let air out of a hot tire. When the tires cool down they will return to the correct/previous tire pressure.
- Pay extra attention to hoses and belts which are more susceptible to fatigue in extreme heat.

**Winter and Cold Climate Conditions:**

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

**Wet Conditions:**

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

**Refueling:**

- Truck stops are good refueling points for motorhomes.
- Know which side the fuel port is on. There may not be adequate space to turn around in the parking lot 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 can get hung up on the motorhome, causing body damage.
- Use of gloves is recommended for refueling. Store the gloves in the outside compartment.
- To prevent grease and fuel deposits from being tracked into the motorhome when refueling, change shoes before entering the motorhome. Store the extra pair near the entry door.



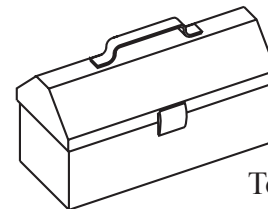
**WARNING: Avoid the risk of fire or explosion. Turn off all pilot lights and appliances before entering a refueling station.**

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

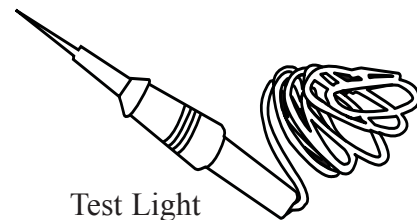
## CHECKLIST - PRETRIP PREPARATIONS

### Items To Carry:

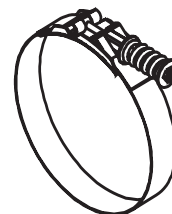
- Local, State and National Maps. Truck atlases can be useful for showing maps, refueling stations and truck repair facilities.
- An emergency road kit containing a flashlight, road flares, warning signs and a fire extinguisher.
- Potable/non-potable water hoses and a water pressure regulator.
- Hand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



Tool Box  
020064



Test Light



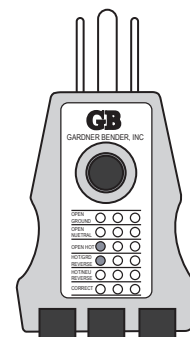
T-bolt  
Clamp



Height Control  
Link 090283

### Interior:

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



Polarity Tester  
020062

### Engine Checklist:

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

**Driving Preparations:**

- Check operation of all exterior lights, headlamps, taillights, brake and clearance lights.
- Inspect fluid level (if applicable) in oil bath hubs.
- Fill the fresh water tank. Disconnect and store the fresh water hose.
- Check all tire pressures.
- Check both house and chassis battery condition.
- If applicable, program the navigation system.
- Secure all awning locks.
- Check items in storage bays to prevent shifting or damage to items.
- Outside compartment doors should be closed and locked.
- Look around, above and under the motorhome for obstructions.
- Check fuel level gauge. Check all other dash gauges for operation and correct level indications.
- Secure and lock the entry door for travel.

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**HITCH -  
Using the  
Rear Receiver**

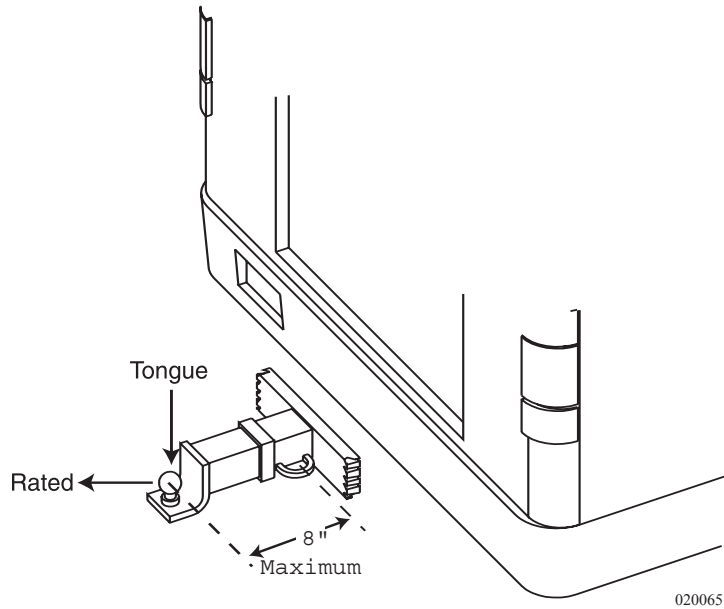
When using the rear hitch remember that the motorhome is intended for towing light loads. The motorhome is designed to be used primarily as a recreational vehicle. Towing will affect durability and economy. Safety and satisfaction require proper receiver use. Avoid excessive loads or other misuse. Do 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 10% of the hitch capacity. It is recommended to weigh the motorhome when fully loaded to ensure proper weight distribution of the GCVW (Gross Combined Vehicle Weight). When weighing the motorhome add all passenger weight to the GCVW total. The motorhome fully loaded, and any vehicle or trailer towed by it, must not exceed the GCVW.



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

**Tow Car or Trailer:**

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



 <b>MONACO</b> COACH CORPORATION	Coburg, Oregon	03211524
	Springfield, Oregon	<b>Do Not Cut, Weld or Modify</b>
	Wakarusa, Indiana	
	Elkhart, Indiana Nappanee, Indiana	
	<b>Do Not Exceed Vehicle Ratings</b>	
	Maximum Towing Capacity	10,000 Lbs. (4,536 Kg.)
	Maximum vertical Load	1,000 Lbs. (454 Kg.)

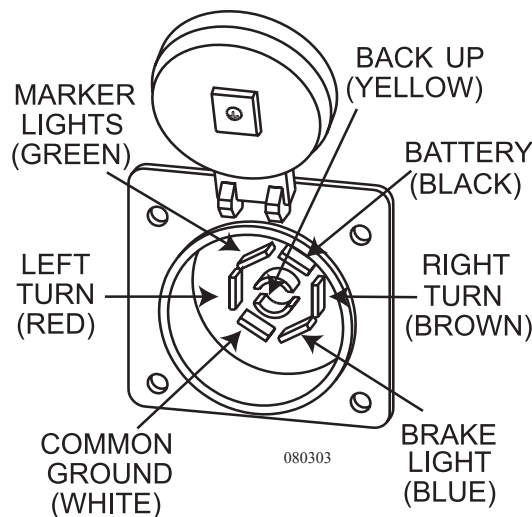
020144

## Tow Plug Connection

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

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

- Yellow, 14 gauge - Back Up
- White, 10 gauge - Ground
- Brown, 14 gauge - Right Turn Signal
- Red, 14 gauge - Left Turn Signal
- Blue, 14 gauge - Brake Light
- Green, 14 gauge - Marker Lights
- Black 10 gauge - Battery 30 Amp Circuit Breaker



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



**CAUTION: The positive terminal connection of the tow plug remains live at all times. When towing a trailer equipped with a battery be sure to unplug the electrical tow connection when parked. Failure to unplug the tow connection may result in discharged chassis batteries.**



**REAR VIEW  
SYSTEM**

This system has a 7" LCD screen that displays the rear vision, radio and navigation systems. The rear view vision feature provides the driver with a view of the rear of the motorhome. The monitor offers four different perspective views: **FULL**, **ZOOM**, **JUST** and **NORMAL**.



**NOTE: The radio system operates with the radio remote control or from the radio push buttons. The navigation system operates with the navigation remote only.**

**Power Requirements:**

- Main battery disconnect switch (located in the battery compartment) must be on.
- 12 Volt battery cut-off switch (located at the entry door) must be on.

**To View:**

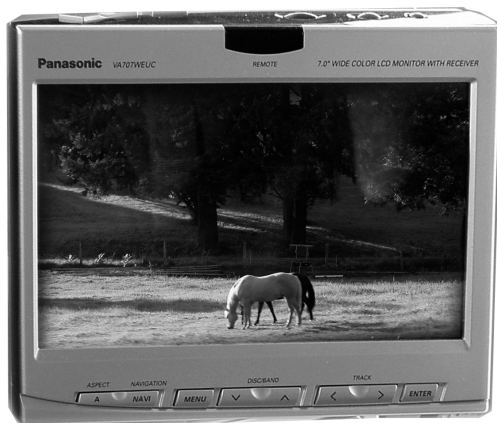
- Press the **OPEN** button. The monitor will automatically slide out and stop in a vertical position.
- Press the blue power button. Adjust vertical axis of monitor for optimum view. The monitor automatically switches to a rear vision system by placing the transmission in reverse. The monitor may be turned on manually by pressing the **MODE** button. Use the left or right button until the hand points to **CAMERA**. Press **ENTER** to select.
- Press the **ASPECT** button to toggle between **FULL**, **ZOOM**, **JUST** and **NORMAL** views.



**NOTE: Reset monitor angle position before stowing.**



**For more detailed instructions refer to the Panasonic Monitor's operations manual.**



monitor panasonic bu

## **BACKING UP A MOTORHOME**

Whether you are a long time owner of recreational vehicles or just starting out, backing up can be a challenge. Following some simple guidelines may help 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. Backing up is a team effort.

The backing up process should begin while the motorhome is in forward motion. Maneuver the motorhome to align with the chosen site. This allows straight alignment with the site. Aligning the motorhome with the site after the backing process begins 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.

If the destination does not have "pull-through" sites, try to pick a solid, level site. If possible, pick a site located on the left side. This is the preferred side. The driver will have a better field of vision by using the roadside mirror. If the site is on the right side, the driver will have to use the curbside 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 the particular criteria, prepare to back in carefully. Have the co-pilot guide you using the five hand signals.

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

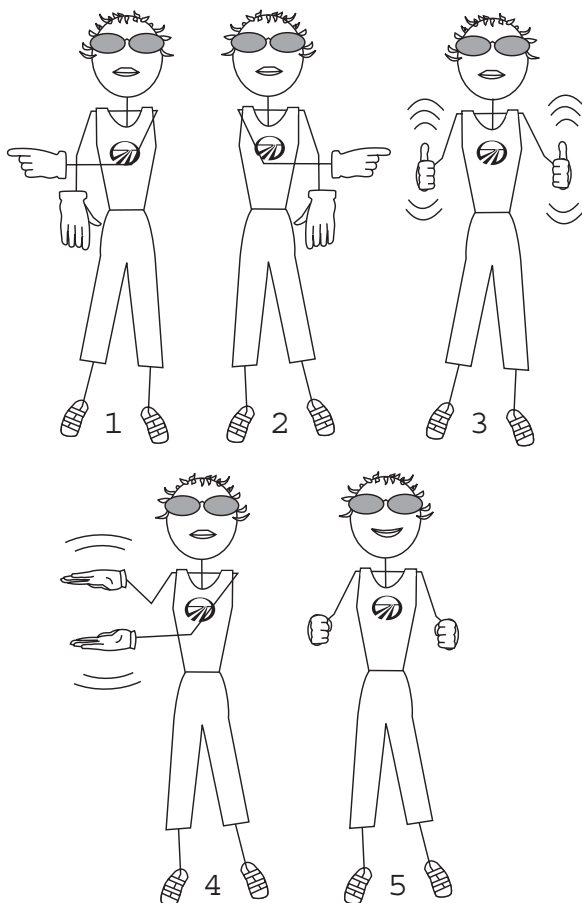
If the driver loses sight of the co-pilot, stop the backing up process until the co-pilot returns to view. To avoid mishaps, the co-pilot should be focused only on what the driver is doing, with brief observation moments. The driver should receive directions only from the co-pilot. If necessary, stop 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 the desired direction is left, the co-pilot points left. For example: The co-pilot will use his/her right arm and forefinger pointing distinctly left with arm and finger held on a horizontal plane, indicating desired direction of travel of the rear of the motorhome. 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 as follows:**

1. Co-pilot uses left hand and arm held horizontal, with forefinger pointing right, to direct rear of motorhome to the right.
2. Co-pilot uses right hand and arm held horizontal, with forefinger pointing left, to direct rear of motorhome to the left.
3. Co-pilot uses both arms and hands parallel with thumbs pointing up and to rear in a waving vertical motion. This signals driver to maintain a straight back direction.
4. Co-pilot holds arms horizontally, hands open with palms facing one another. Start with a wide separation, gradually closing distance of hands, in a rate appropriate to vehicle speed, to indicate amount of distance to the stop point.
5. Closed fists indicates STOP.



020082

### **Backing Up Trailers:**

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

The same rules for backing a motorhome may be applied when backing a trailer. When preparing to back a trailer into a space, maneuver the motorhome sweeping wide, then turn back to the opposite direction. This sets the motorhome and trailer in a position to maneuver the trailer into the space. When backing up a trailer, the driver may become disoriented with the direction of the steering wheel in relation to the direction of the trailer. The bottom of the steering wheel must be moved in the desired direction of the trailer. For example: If the desired direction of the trailer is left, rotate the bottom of the steering wheel left. If the trailer moves in an undesired direction, use a short “pull-up” method, pulling forward just far enough to align the trailer with the space. The co-pilot should stand safely at the left rear corner of the trailer within view of the driver in the roadside 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.

- 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.

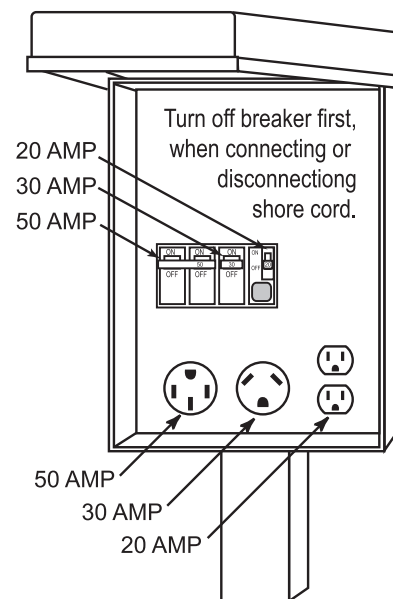


**CAUTION: Hot asphalt may not support the weight that is placed on the hydraulic jack pads. Place thick plywood under the jack pads to help disperse the weight. Never use the leveling system to support the entire weight of the motorhome. Damage from excessive torsional twists can result.**

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



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



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

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## DRY CAMPING TIPS

Plan ahead and conserve resources while dry camping.

Dry camping requires fully charged and properly maintained batteries (corrosion cleaned, terminals tightened, cables checked, etc.). If battery water is low, fill the batteries with distilled water only. Water containing a high concentration of minerals will alter the battery's chemistry reducing battery capacity and performance. Before arriving at your destination, fill up with fuel for the generator.

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

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

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

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

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

**Setting Up for Dry Camping:**

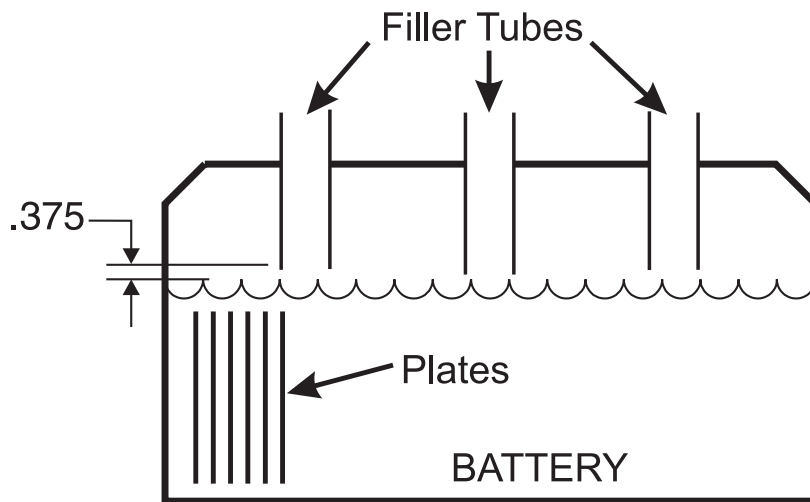
- Switch refrigerator operation from Auto to LP-Gas.
- Operate the water heater on LP-Gas. Turn it on about an hour before hot water is needed.
- If the furnace is needed during the nighttime, set the thermostat temperature a bit lower preventing the furnace from cycling all through the night.
- Check on small items that use battery power, such as the porch light, bay lights, the light under the step, generator compartment lights, engine compartment lights, etc. If the television is not being used, turn off the 12 Volt booster. Even one light accidentally left on, such as under the front cap, reduces battery reserves quickly.
- Some battery draw is unavoidable. The battery cut-off switch at the entry door must be on to operate many interior items such as lights or the furnace.
- Keep flashlights handy. Build a campfire when spending nighttime hours outdoors. Extinguish the flames before retiring for the evening. Many campgrounds place wood or cement barriers between the site space and fire pit. Illuminate any barriers or obstacles in the pathway to the motorhome.
- Place a large flashlight inside the front door for navigating through the coach during the night without having to use interior lights. If interior lighting is needed, use one light in a central location, such as the vanity.

- During the day it is still important to conserve on energy. Turn on the water pump only when using water. Turn the pump off when not in use. The water pump does not draw an abundance of power, however all battery amp hours are important and should be conserved.
- If it is too early in the morning or too late in the day to run the generator, use the inverter for AC power. Remember to turn off the inverter when not in use. When the rest of the campers are up and about, turn on the generator and run it for a couple of hours to help charge the batteries. The generator may seem loud, however, the noise is minimal just a short distance away from the coach. Run the generator during clean up and preparation for the day.
- Check the monitor panel frequently and keep track of water usage and battery consumption. Routinely check the LP-Gas level. Remember the furnace uses more gas in cold weather.
- Careful management of water is critical when dry camping. Know the motorhome tank capacities. Picture the amount of liquid in a gallon container. Visualize that amount each time you run the water. If you are dry camping for extended period, limit shower usage. Turn the water off when soaping down in the shower. If water conservation is critical, take a sponge bath. Conserve water while brushing your teeth. Chances are a campground without hookups will not have large comfortable shower rooms or bathrooms. It may only be equipped with primitive facilities, however, if it helps to economize on water, use them.
- Do not fill the sink full of water to wash a few dishes. Use disposable dishes whenever possible. Conserve propane by cooking dinner over the campfire. However, if cooking over the campfire is not desired, use the cook top or microwave. If you use the inverter to operate the microwave, battery power will be consumed quickly. If possible, use the generator to operate the microwave. It is healthy for the generator to operate under a heavy load such as the microwave.
- Allow the generator to power up for a couple of minutes before applying a load.
- To conserve on battery power, plan what is needed from the refrigerator prior to opening it. If weather does not permit eating at the picnic table, or if no picnic table is available, eat at the dinette table by candlelight.
- Leave shoes outdoors or at the entry step to avoid tracking in dirt. Open windows during the day instead of using the roof air conditioner.
- Get back to nature and still enjoy the comforts of the motorhome. With a little imagination, the ways to conserve available resources while dry camping are endless.



**Typical Current Draw:**

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



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

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<b>Battery State of Charge vs Voltage/Specific Gravity</b>			
<b>VOLTAGE</b>	<b>SPECIFIC GRAVITY</b>	<b>STATE OF CHARGE</b>	<b>DEPTH OF DISCHARGE</b>
<b>12.66</b>	<b>1.265</b>	<b>100%</b>	<b>0%</b>
<b>12.45</b>	<b>1.225</b>	<b>75%</b>	<b>25%</b>
<b>12.25</b>	<b>1.190</b>	<b>50%</b>	<b>50%</b>
<b>12.05</b>	<b>1.145</b>	<b>25%</b>	<b>75%</b>
<b>11.90</b>	<b>1.100</b>	<b>0%</b>	<b>100%</b>

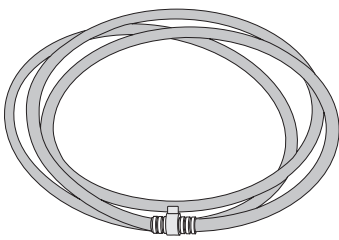
Battery Charge Voltage chart

## BREAKING CAMP

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

### Outside Checklist:

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



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

### Engine Checklist:

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

**Interior Checklist:**

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



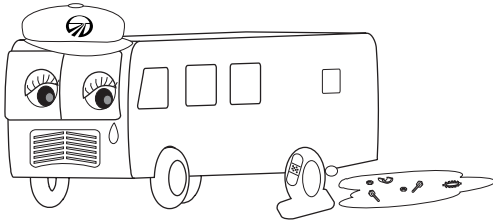
**NOTE: To operate the kitchen slide the ignition must be OFF, the park brake must be set and the bay doors under the slide room must be closed.**

- 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.
- Turn off interior lights.
- Turn off water heater, water pump and furnace.
- Walk through the interior and check for any unsecured items.
- Turn the interior lighting off.
- Check the fuel level gauge. Check all other dash gauges for operation and correct level indications.

**Departure Checklist:**

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

## EMERGENCY PROCEDURES - ROADSIDE



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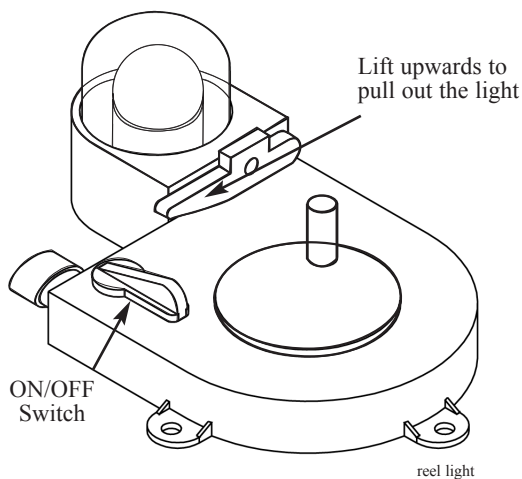
If an emergency situation occurs, use the appropriate braking technique and pull off the roadway a safe distance from traffic (if possible). Set the parking brake and turn on the hazard warning flashers, especially when parked alongside traffic lanes. In the event of an emergency stop due to a mechanical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

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

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

## Light - Retractable

The retractable light is located in places of limited lighting for emergency purposes. Normally one will be on the front firewall, the outside access of the rear engine compartment and the roadside electrical compartment. To use:



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

**Transmission  
- Rocking Out**

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



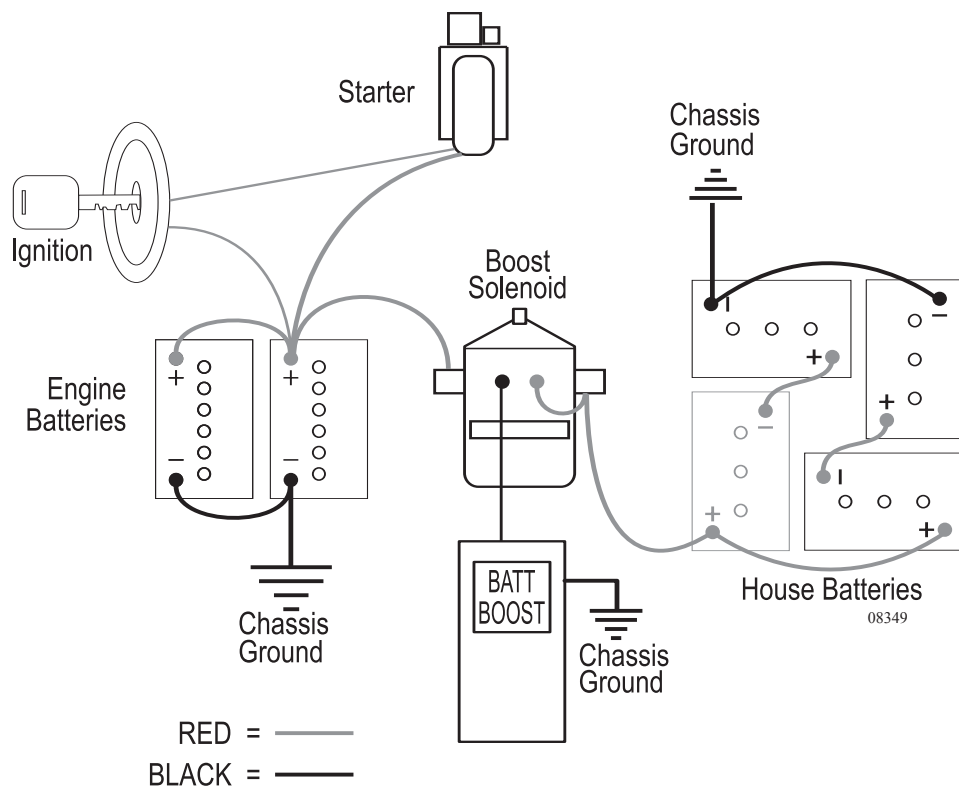
**NOTE: Sudden movements or lurching the motorhome with an open throttle can result in damage to the transmission. Avoid this condition by making shifts only when the throttle is closed and engine is at normal idle.**

**Alternative Starting Procedure:**

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

**Jump Starting**

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



### To Use the Solenoid

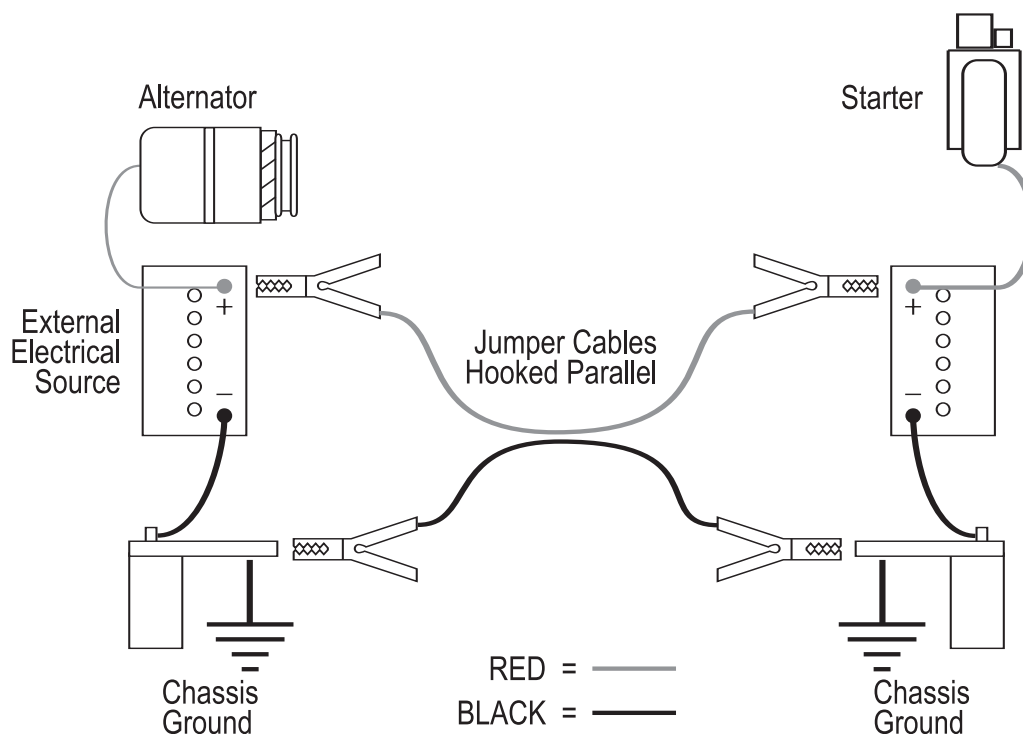
- With the ignition key off, press and hold the Battery Boost switch for 10 seconds. After 10 seconds, continue to hold the switch down and try to start the engine.
- If the engine fails to crank, or does not crank fast enough, discontinue the attempt. Continued attempts will only diminish any remaining surface charge in the chassis battery ending any future alternative attempts.
- Next, start the generator. This may require using the Battery Boost switch as the generator starts from the engine battery. When the generator is operating, the electrical combination of the generator, inverter and (if applicable) battery maintainer will charge the batteries.
- Allow the generator to run approximately ½ hour before attempting to start the engine.
- After ½ hour of generator operation, with the generator operating, hold the down the Battery Boost switch for one minute. Release the switch for one minute, then engage the switch for one minute. Alternate this cycle 3-5 times. This will avoid overheating the Boost solenoid.
- Next, hold the switch down for one minute and turn the key on. The battery voltage gauge on the dash should indicate at least 12 Volts. If voltage is sufficient with the Boost switch held down, try to start the engine.
- If the engine fails to crank, or fails to crank quickly, the chassis battery may be depleted and the motorhome will require jump-starting or an external charger hooked to the chassis battery. When using jumper cables to start the engine, the cables must connect in a parallel configuration. That is positive (+) to positive (+) and negative battery (-) to negative chassis (-). Always connect the positive (+) before connecting the negative (-). To prevent arcing when disconnecting the cables, disconnect the negative (-) before disconnecting the positive (+).



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



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



### Jump Starting

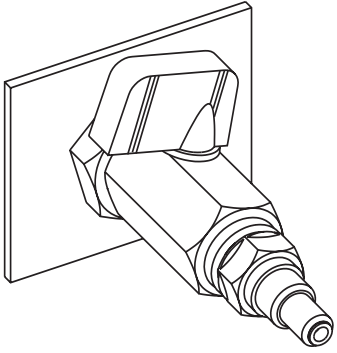
- When using an external electrical source to connect to the chassis battery, turn the main battery disconnect switches OFF prior to hooking up the jumper cables.
- Hook up the cables then wait several minutes to allow a surface charge to build in the chassis battery before attempting to start the engine.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

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



**WARNING: The gases around the battery can explode if exposed to flames, sparks or lit cigarettes. An explosion can result in injury or vehicle damage. Batteries contain sulfuric acid, which burns skin, eyes and clothing. Do not connect the end of the second cable to the negative (-) terminal of the battery to be jumped. A spark may cause an explosion of the gases that surround the battery. Connect only to the chassis, away from the battery.**

## TOWING PROCEDURES

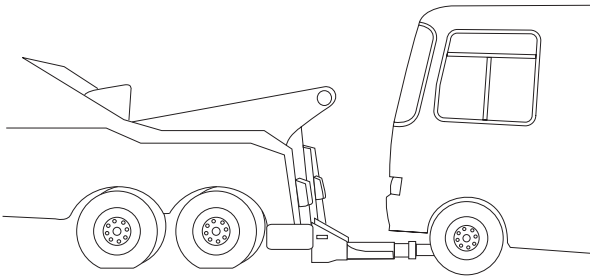


Air Nipple.

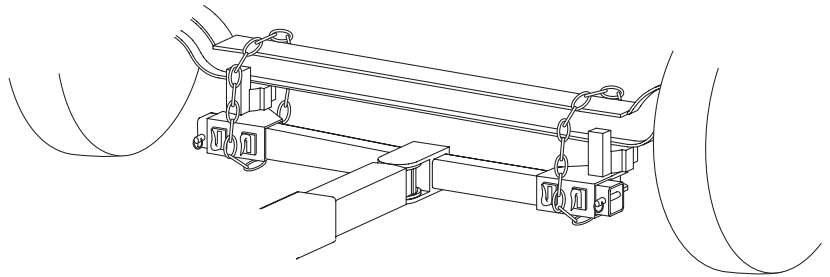
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If calling a towing company for service, it is recommended to use a lowboy/landall type of trailer. If a tow truck is used it needs to have a support arm that goes under the motorhome and secures to the front axle. Inform the tow company of the axle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

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



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- Secure any loose or protruding parts if the motorhome is damaged.
- Inspect the points of attachment on a disabled motorhome. If attachment points are damaged, select other attachment points at a substantial frame structural member.
- Never allow anyone to go under a motorhome while it is being lifted by towing equipment unless the disabled motorhome is adequately supported by safety stands.
- Do not tow the motorhome from the rear. Towing from the rear will severely overload the front tires and suspension possibly resulting in tire and/or front suspension failure. Rear frame extensions are not designed to support weight loads imposed by lifting the motorhome from the rear.
- If the rear wheels are disabled, place the motorhome on a flat bed trailer or use a heavy duty dolly under the rear wheels and tow the motorhome from the front.
- The drive shaft must be removed to prevent damage to the transmission. Secure the end caps to prevent losing or contaminating the needle bearings.
- The mud flap may need to be removed to prevent damage due to limited ground clearance.



- When towing a motorhome equipped with the HWH Air-Leveling System, the ignition **MUST** be left in the ON position so the air suspension will operate. If the ignition system is not functioning, or if chassis voltage is below specification, the motorhome must be placed on a lowboy/landall trailer to prevent suspension damage.



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

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

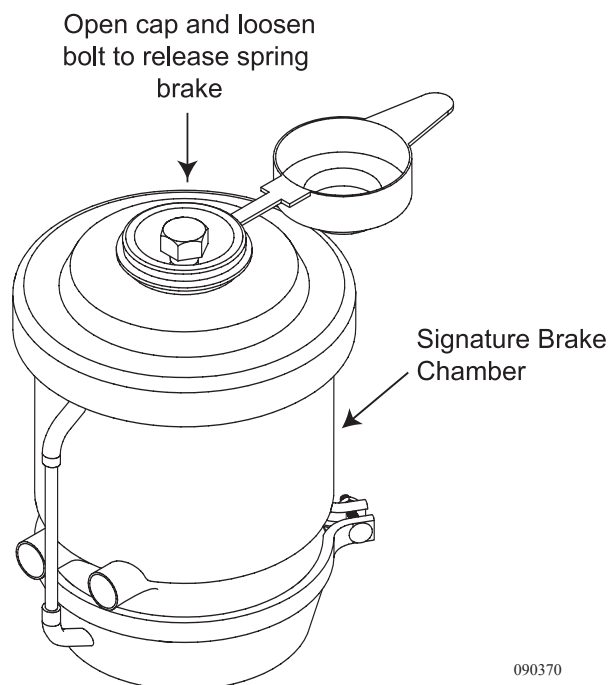
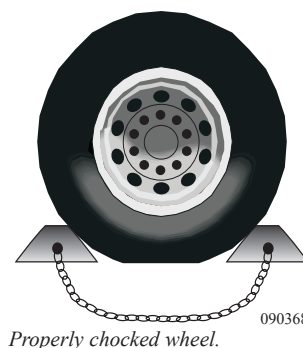
#### Disc Brake Models

- Place wheel chocks firmly against wheel before performing this procedure.
- Remove the cap from the center of rear brake chamber on the drive axle.
- Use a wrench to loosen the nut compressing the internal spring releasing the brake.
- Repeat procedure for the other side.
- After towing or when air pressure is again available tighten the nut and replace cap.
- Repeat for the other side.



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

#### Brake - Disabling Parking Brake



## 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 the 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 Importance of Air Pressure***

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

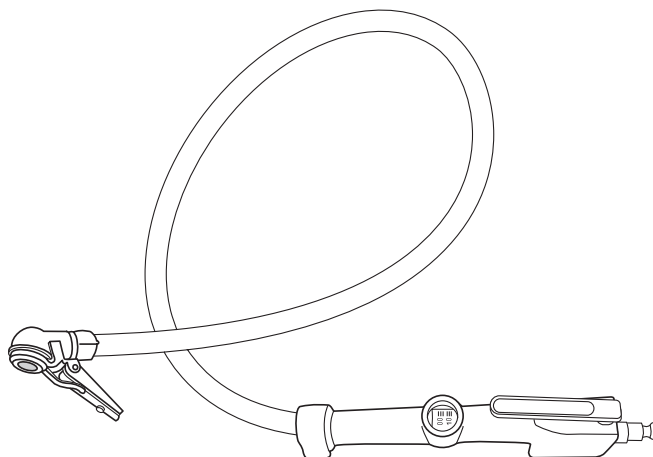
An under-inflated tire will build up excessive heat that may go beyond the design limits of the rubber and radial cords, which could result in sudden failure. An under-inflated tire will also cause poor motorhome handling, rapid and/or irregular tire wear and an increase in rolling resistance that results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

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

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



**WARNING: Driving on a tire that is under-inflated can exceed the design limits of the tire and may damage the sidewall. A damaged sidewall can burst upon inflation resulting in serious damage, injury or death. Aged tires are also susceptible to sidewall damage. For safety purposes clear the area of people and pets during tire inflation. Inflate the tires using a remote inflation device.**



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

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

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

***Tire Pressure  
Inflation Guideline***

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

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

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

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

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

## 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 recreational vehicle, even of the same make and model, will vary in actual loaded axle weights because of different options and personal loads.

While the actual loaded axle weight should be below the GAWR, the motorhome must be weighed in a loaded condition to know its actual weight. Weigh the front axle, the total unit and the rear axle. It is possible for a motorhome to be within the GVWR yet overloaded on an axle. It is even possible for one wheel position to be overloaded, even though the GAWR has not been exceeded. For this reason (if there is room to the sides of the scales) weigh each wheel position of the motorhome. This will give a clear indication of exactly how the weight of the motorhome is distributed. These instructions and diagrams are presented on the following pages. When the total weight, and the weight on each axle, is known the tire load data chart in this manual will show the correct cold inflation pressure per tire for each axle.

There are two important factors to consider when loading the motorhome: **total weight** and **balance**. When loading heavy objects keep them as low as possible, preferably on the floor. Load weight must be distributed as evenly as possible. The following is an explanation of commonly used weight abbreviations.

- **Gross Vehicle Weight Rating (GVWR):** GVWR means maximum permissible weight of this motorhome. GVWR is equal to or greater than the sum of UVW plus NCC.
- **Unloaded Vehicle Weight (UVW):** UVW means weight of this motorhome as built at factory with full fuel, engine oil and coolants. UVW does not include cargo, fresh water, LP-Gas, occupants or dealer installed accessories.
- **Net Carrying Capacity (NCC):** NCC means maximum weight of all occupants including driver, personal belongings, food, fresh water, LP-Gas, tools, tongue weight of towed vehicle, dealer installed accessories, etc., that can be carried by this motorhome. (NCC is equal to or less than GVWR minus UVW.)
- **Gross Combined Weight Rating (GCWR):** GCWR means value specified by motorhome manufacturer as maximum allowable loaded weight of this motorhome with its towed trailer or towed vehicle.
- **Gross Axle Weight Rating (GAWR):** GAWR means load-carrying capacity specified by manufacturer of a single axle system, as measured at tire ground interfaces.
- **Gross Combined Axle Weight (GCAW):** GCAW means the sum of the total weight of all axles when added together.
- **Sleeping Capacity Weight Rating (SCWR):** means the manufacturer's designated number of sleeping positions multiplied by 154 pounds.

## Weight Chart (Example)

MODEL YEAR: \_\_\_\_\_ 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.

weight label chart

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 roadside. The tire inflation pressure of the roadside tires determines the inflation pressure for all tire(s) on that axle. This is due to the weight transfer that occurs when cornering. Approximately the same weight load will be transferred to the curbside around left-hand corners.



**NOTE: When weighing a motorhome equipped with a slide-out room, each tire on any axle must be inflated to the same pressure. The wheel position carrying the most weight will determine the tire inflation pressure for each tire of that particular axle.**

#### **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 transferred to the front steering axle.

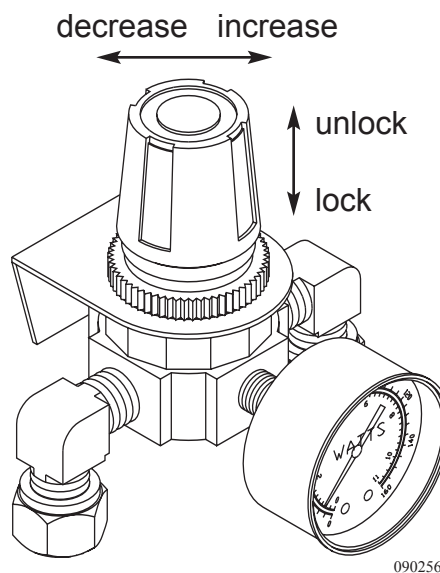
### Tag Axle Regulator Adjustment:

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.



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



**Scale:**

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

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

Weight scale types and weighing methods will affect the procedure used to determine proper tire inflation pressure and axle loading. 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. 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 an independent corner weigh method, divide the total weight by two to determine the weight carried by each tire. When weighing the entire drive axle, divide the total weight by four to determine the approximate weight carried by each tire.**

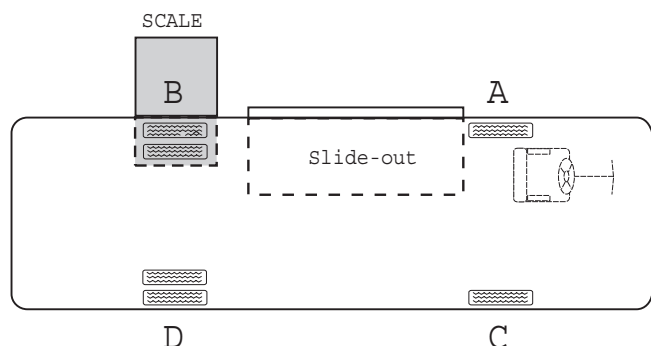
**Example:**

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

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



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



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**Rear**

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

**B** 2. GAW (5100)

+

=

1. GAWR (13,000)

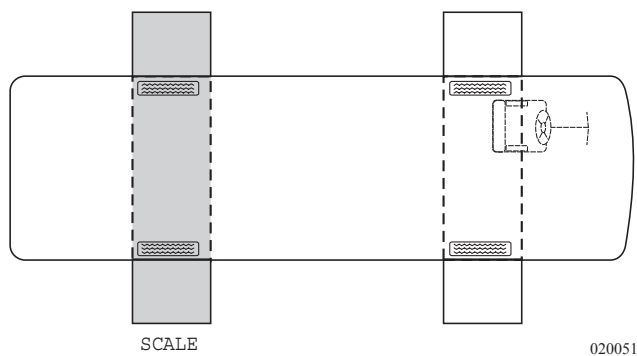
2. GCAW (10,000)

**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.



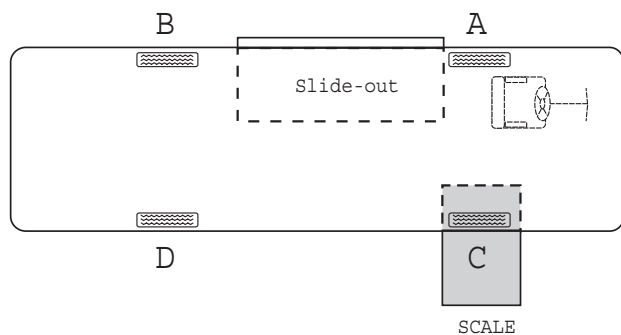
$$\underline{\text{GAWR (Rear)}} + \underline{\text{GAWR (Front)}} = \underline{\text{GCVW}}$$

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

SIGNATURE

**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.

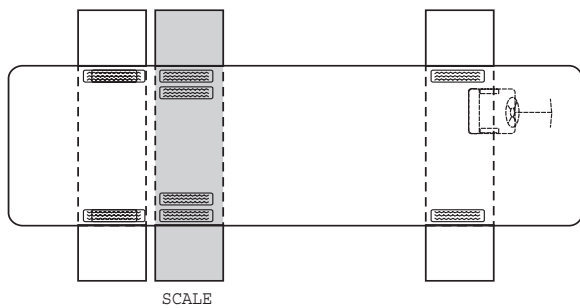


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Rear			Front		
<b>Scale</b>	$\frac{GAWR \div 2}{GAW}$		<b>Scale</b>	$\frac{GAWR \div 2}{GAW}$	
<b>B</b>			<b>A</b>		
	+	=		+	=
		$\frac{GAWR}{GCAW}$			$\frac{GAWR}{GCAW}$
<b>Scale</b>	$\frac{GAWR \div 2}{GAW}$		<b>Scale</b>	$\frac{GAWR \div 2}{GAW}$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

**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.



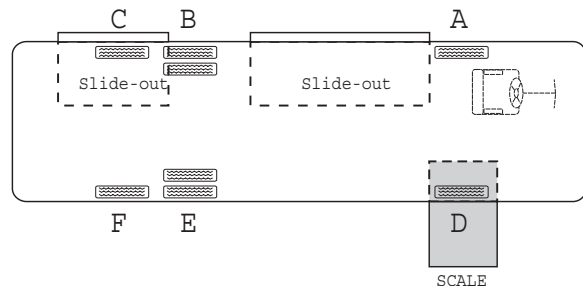
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$$\underline{\text{GAWR (Tag)}} + \underline{\text{GAWR(Rear)}} + \underline{\text{GAWR (Front)}} = \underline{\text{GCVW}}$$

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

**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.



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

SIGNATURE

**TIRE CHART** ↓

TIRE SIZE	MAX Speed Rating (MPH)	Dual (D) Single (S)	INFLATION PRESSURE - PSI													
			65	70	75	80	85	90	95	100	105	110	115	120	125	
8R19.5	75	D 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	<b>3875(F)</b> <b>4080(F)</b>	3940 4190	4075 4335	<b>4375(G)</b> <b>4545(G)</b>						
265/70R19.5	75	D S				3750 3970	3930 4180	4095 4355	4300 4540	4405 4685	4560 4850	4805 5070	4860 5170	<b>5070(G)</b> <b>5355(G)</b>		
9R22.5	65	D S	3120 3190	3270 3370	3410 3560	3550 3730	3690 3890	3820 4050	<b>3950(F)</b> 4210	4350	<b>4500(F)</b>					
10R22.5	65	D S	3690 3770	3870 4000	4040 4210	4200 4410	4375 4610	4520 4790	4670 4970	<b>4875(F)</b> <b>5150(F)</b>	4970 5320	5110 5490	<b>5250(G)</b> <b>5680(G)</b>			
11R22.5	75	D S				4760 4990	4950 5220	5120 5430	5300 5640	5470 5840	<b>5750(G)</b> <b>6175(G)</b>	<b>5800(H)</b> 6240	6430	<b>6610(H)</b>		
12R22.5	65	D S				5190 5450	5390 5690	5590 5920	5780 6140	5960 6370	6150 6590	6320 6790	6500 7010	<b>6750(H)</b> <b>7390(H)</b>		
245/75R22.5	75	D S		3260 3470	3425 3645	3640 3860	3740 3980	3890 4140	4080 4300	4190 4455	4335 4610	<b>4410(G)</b> <b>4675(G)</b>				
265/70R22.5	75	D S		3585 3815	3765 4005	3970 4190	4110 4370	4275 4550	4410 4675	4455 4895	4610 5065	4675 5205	<b>5070(H)</b> <b>5510(H)</b>			
265/75R22.5	75	D S			4040 4070	4205 4255	4370 4440	4525 4620	4685 4800	<b>4805(G)</b> 4975	5150	<b>5205(G)</b>				
275/70R22.5	75	D S				4535 4885	4750 5080	4960 5305	5165 5530	5370 5750	5575 5965	5775 6185	5975 6400	<b>6175(H)</b> <b>6610(H)</b>		
275/80R22.5	75	D S				4855 5265	5080 5515	5305 5755	5525 6000	5745 6235	5965 6475	6180 6710	<b>6395(H)</b> <b>6940(H)</b>			
295/75R22.5	75	D S		4690 4725	4885 4945	5070 5155	5260 5370	5440 5510	<b>5675(G)</b> 5780	5800 5980	<b>6005(H)</b> <b>6175(G)</b>	6370	<b>6610(H)</b>			
295/80R22.5	75	D S				4855 5480	5100 5750	5335 6020	5570 6285	5805 6550	6035 6810	6265 7070	6490 7320	<b>6720</b> <b>7580</b>	<b>7610(J)</b> <b>7830(H)</b>	<b>7390</b> <b>8820</b>
315/80R22.5	75	D S				5840 6415	6070 6670	6395 6940	6540 7190	6770 7440	6940 7610	7210 7920	<b>7610(J)</b> <b>8270(J)</b>			
285/75R24.5	75	D S			4740 4770	4930 4990	5205 5210	5310 5420	5495 5675	<b>5675(G)</b> 5835	6040	<b>6175(G)</b>				

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

tire chart update 0610

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

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

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

When checking the inflation pressure, use a high-quality truck tire air gauge. These have an angle dual head. This type of pressure gauge can check the pressure of the inner dual wheel that has the valve stem pointing outward and the outer wheel has the valve stem pointing inward. Nothing should restrict the ability to easily check the tire's air pressure daily when traveling in the motorhome. Use valve stem caps with a positive seal to prevent air escaping from the valve stem. If there are extension hoses on the valve stem, make sure they are good quality reinforced stainless steel braid. Attach hoses securely to the outer wheel.

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

**Higher than recommended pressure can cause:**

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



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

**Lower than recommended pressure can cause:**

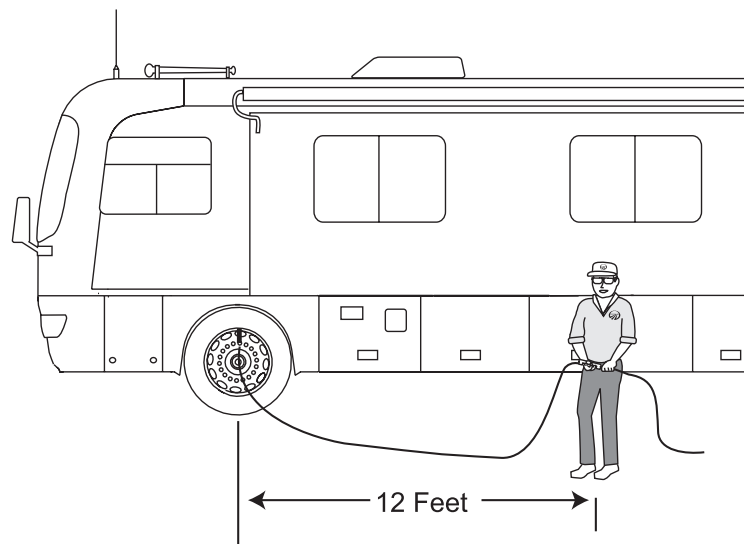
- Tire squeal on turns.
- Rapid and uneven wear on the edges of the tread.
- Tire rim bruises and rupture.
- Tire cord breakage.
- Excessive tire temperature.
- Reduced handling quality.
- High fuel consumption.

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

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



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



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## Tire Rotation

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

The tire rotation should be performed if there is any sign of uneven wear. After a tire rotation, check and adjust the inflation pressures for the actual loads of the wheel position accordingly.

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

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



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

### Proper Cleaning:

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

When cleaning any rubber product, proper care and methods in cleaning must be used to obtain the maximum service years out of the tires. Use a soft brush and a mild detergent to clean the tires. If a dressing product is used to "protect" the tires from aging, use extra care and caution. Tire dressings that contain petroleum products or alcohol may cause deterioration or cracking.

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

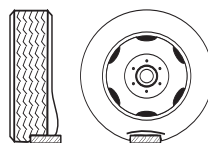
## Tires - Supporting When Leveling

### Tire "Support" Methods

#### INCORRECT

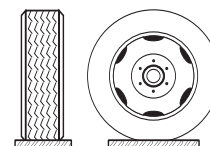
##### Singles

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



#### CORRECT

##### Singles

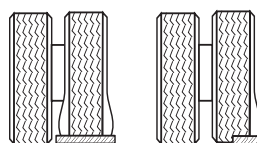


Tire Footprints

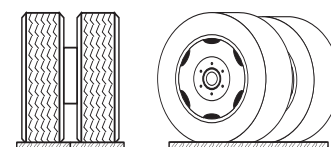


##### Duals

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

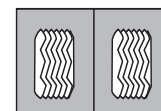
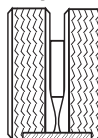


##### Duals



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

Dual Tire Footprints



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## Storage of Tires - Long Term

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

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 recreational vehicle out of a high ozone area. Failure to take these steps can cause early deterioration and shorten the life of the tires.

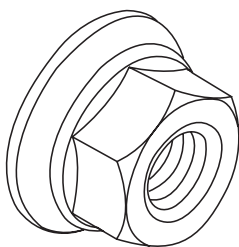
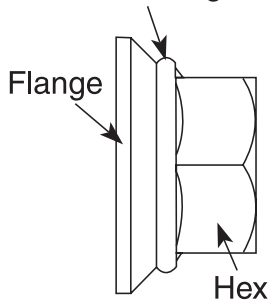


**NOTE: When the motorhome is stored the tires should be inflated to maximum inflation pressure as indicated on the sidewall of the tire.**

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

For used nuts: Add 2 drops of oil between Flange & Hex.



090268 copy 2

In the event of a flat tire, it is recommended to call for roadside assistance. The size and weight of the motorhome and its tires require the proper equipment to change the tire. A professional service technician will have the equipment and training needed to repair or replace the tire. In the case of sudden tire failure, avoid heavy braking. Hold the steering wheel firmly and gradually decrease speed. Slowly move to a safe off-road place, which should be a firm level spot. Turn the ignition off and turn the hazard flasher system ON. Goodyear Tire Company has an emergency number that offers 24-hour assistance. To contact **Goodyear** call **(877) 484-7376**. Save the old tire for any warranty coverage.

### Hub Piloted Mounting:

- Before using flange nuts that have already been used in service, apply two drops of oil at one point between the flange and hex. This will allow parts to rotate freely and provide the proper clamping force when tightened. Use any common lubricant typically used for fasteners. Examples are motor oil and general purpose lubricating oils. Excessive lubricant is not desirable, this will not improve the nut torquing performance. Excessive lubricant makes the nuts hard to handle, attracts dirt to the nuts and may cause unsightly appearance to the wheel. Only used nuts need to be lubricated.
- Since flange nuts generate higher clamping force always use grade eight studs with hub mount wheels.

- Before installing the wheels, lubricate the hub pilot pads with a drop of oil to prevent galling. Do not lubricate any other wheel or hub surface.
- For a hub with intermittent pilot pads, position a pad at the twelve o'clock position to center the wheel and reduce runout.



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

**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).



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

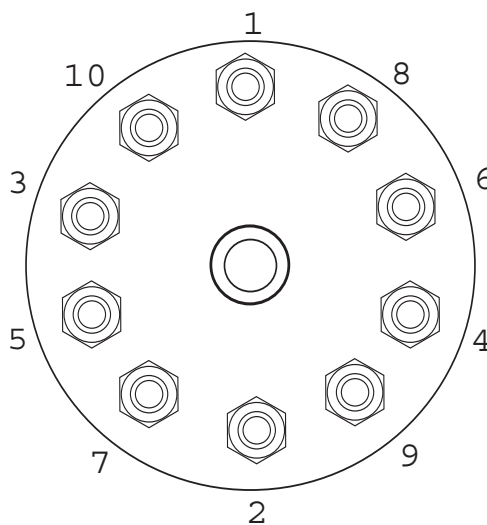
**Dual Rear Wheels:**

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

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

**Torque the Nuts Properly:**

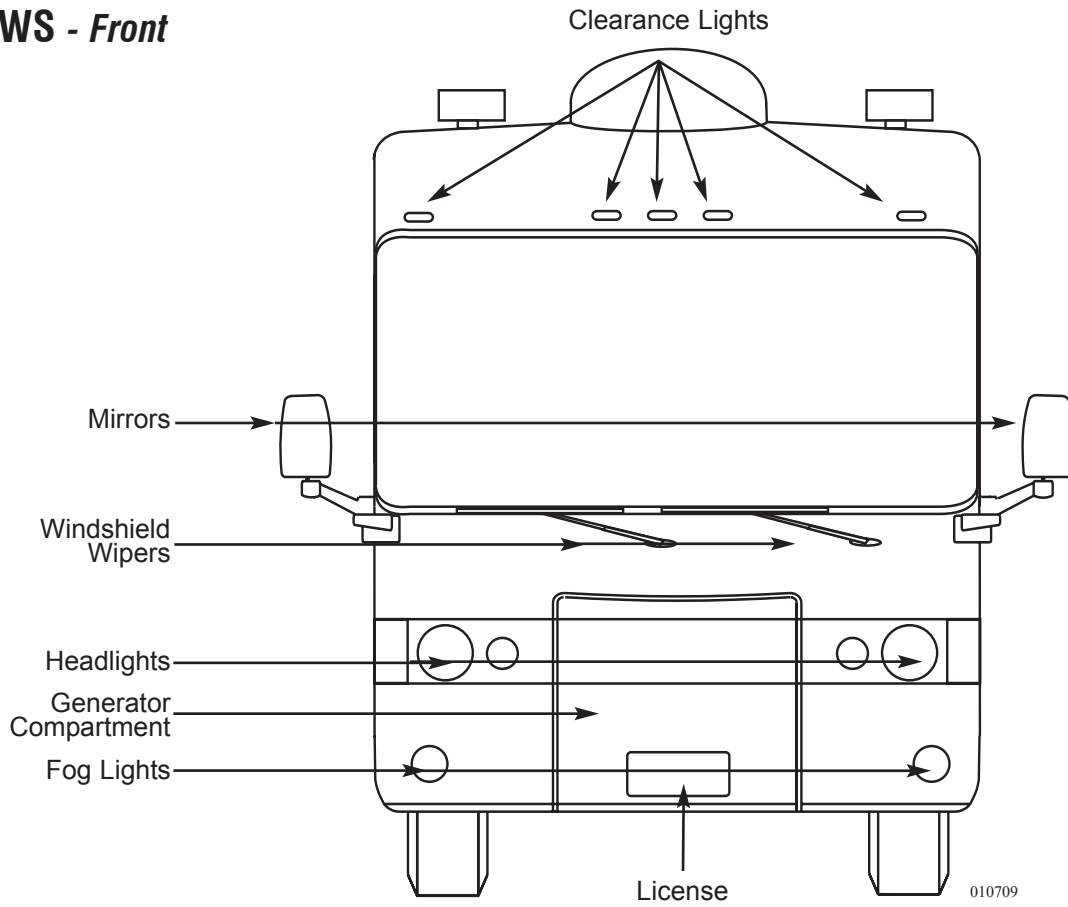
- Tighten the wheel nuts to the recommended lug nut torque. Do not over tighten.
- Maintain the nut torque at the recommended level through planned periodic checks or at 10,000 miles intervals, whichever comes first.
- If air wrenches are used they must be periodically calibrated for the proper torque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



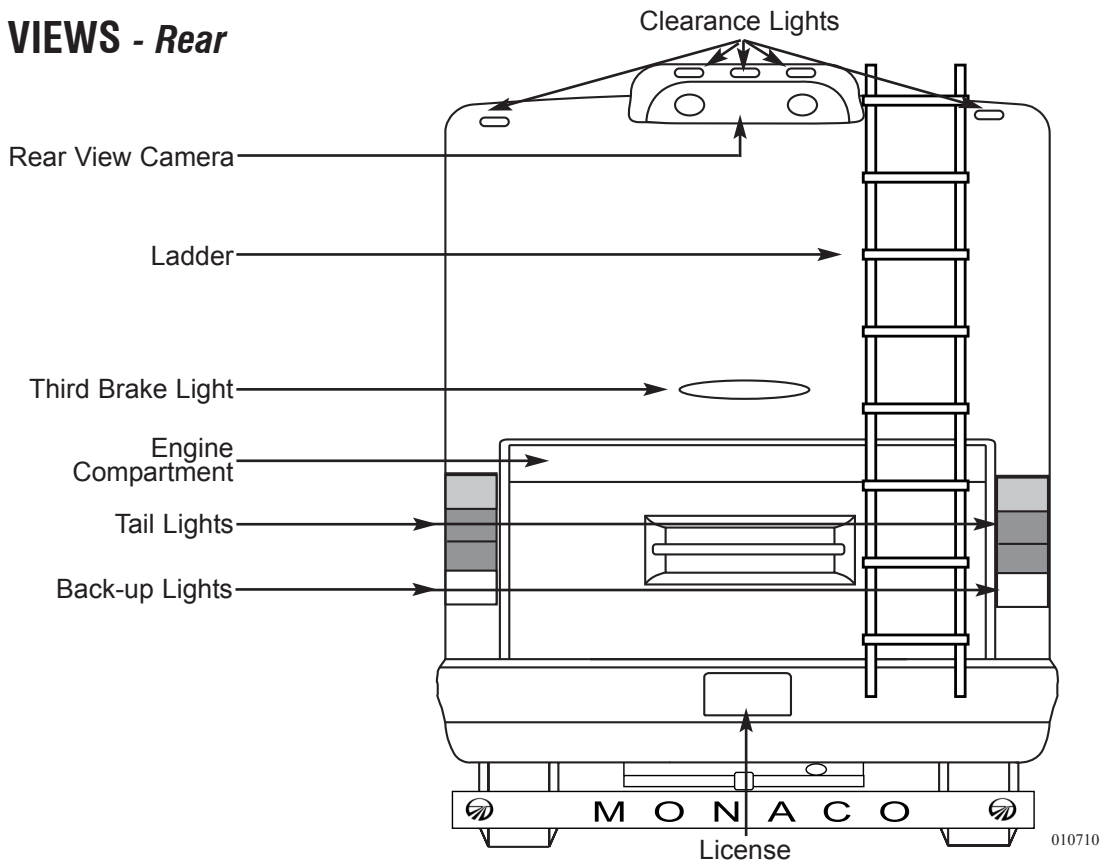
**Nut Tightening Sequence**

090268 copy 2

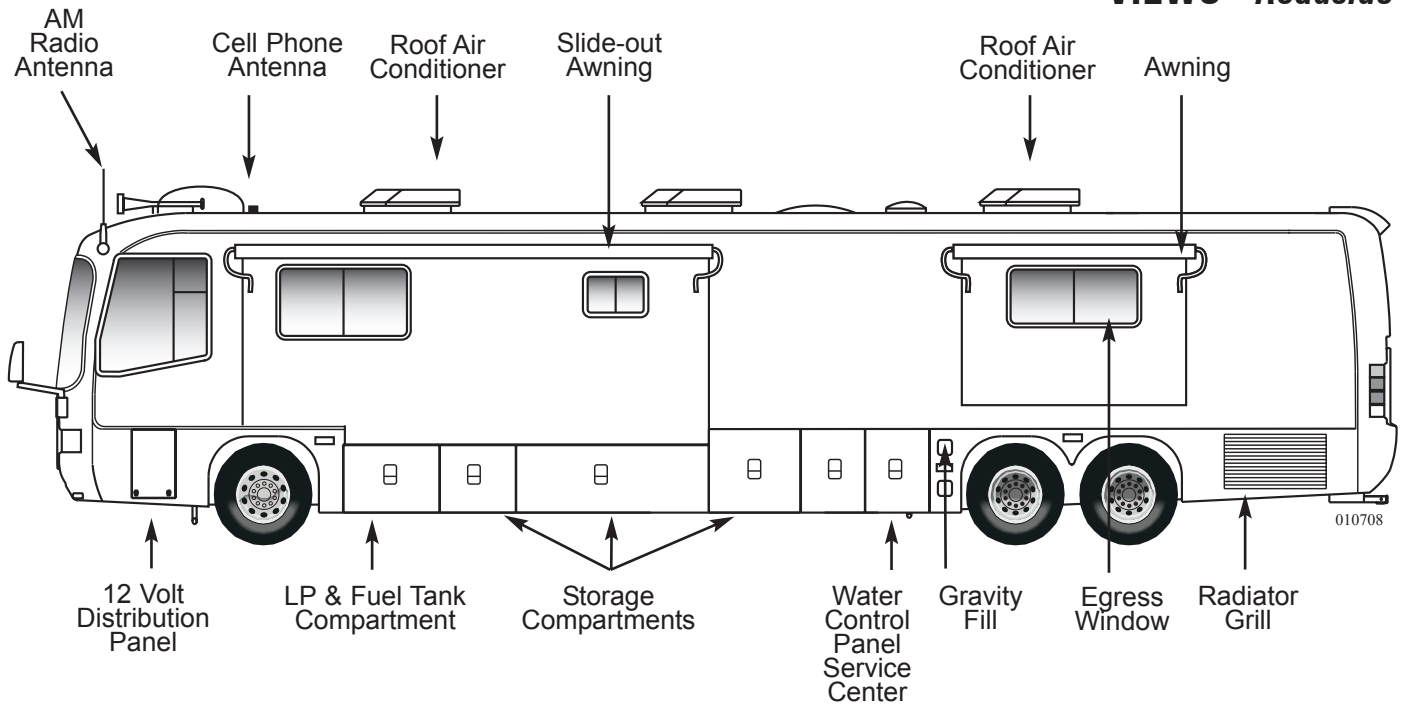
**VIEWS - Front**



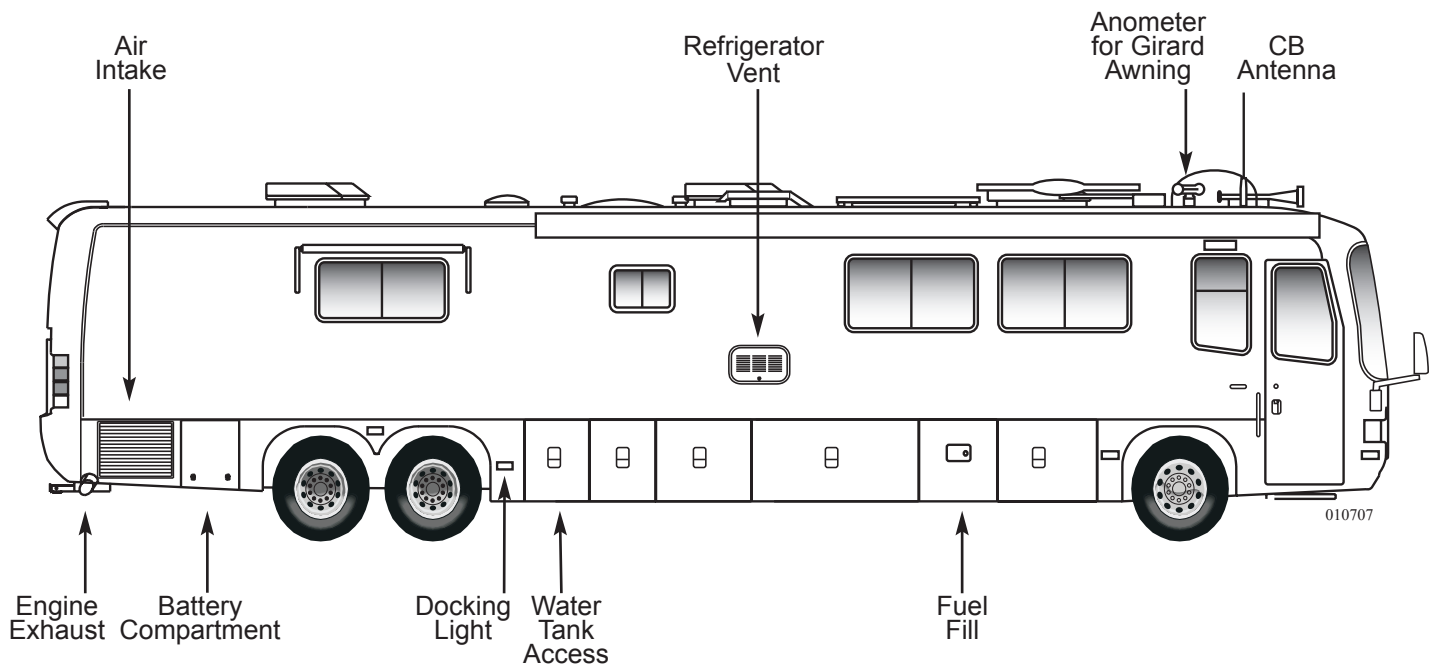
**VIEWS - Rear**



### IEWS - Roadside



### IEWS - Curbside



## SPECIFICATIONS - DIMENSIONS CHART

MODELS	40' Victorian	40' Centurion	40' Baroness	40' Flat Floor Dbl. S/O	42' Chancellor	42' Supreme	42' Tr. Crown	43' Flat Floor Dbl. S/O	43' Titan	45' Empress	45' General	45' T
Wheelbase	255	255	255	255	261	271	271	273	273	307	297	297
Overall Length	40'10"	40'10"	40'10"	40'10"	42' 4"	42' 4"	42' 4"	43' 4"	43' 4"	45' 4"	45' 4"	45' 4"
Overall Ht. w/AC	11' 10"	11' 10"	11' 10"	11' 10"	11' 10"	11' 10"	11' 10"	11' 10"	11' 10"	11' 10"	11' 10"	11' 10"
Interior Height	79"	79"	79"	79"	79"	79"	79"	79"	79"	79"	79"	79"
Interior Width	96"	96"	96"	96"	96"	96"	96"	96"	96"	96"	96"	96"
Exterior Width	100.5"	100.5"	100.5"	100.5"	100.5"	100.5"	100.5"	100.5"	100.5"	100.5"	100.5"	100.5"



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

### 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**

**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.



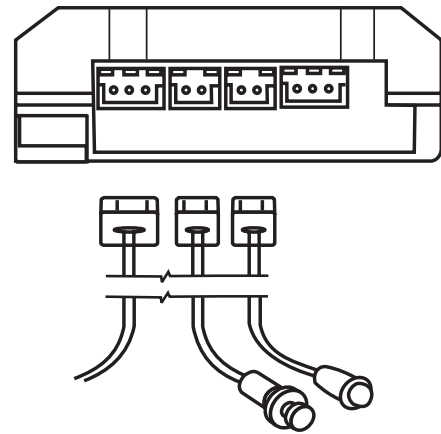
**Horn Button** - Controls the panic function.

Viper Key Fob Symbols

#### Arming the System:

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 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.



020049Viper front view

Valet/Program button &amp; Red LED status light.

### 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.

**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.

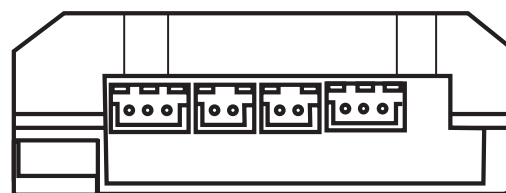
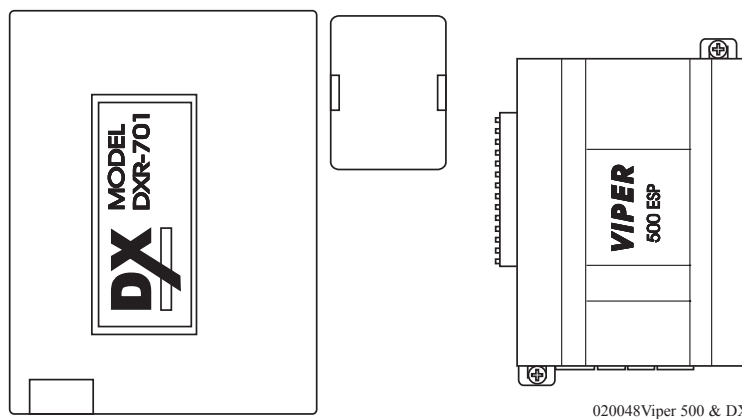
1. Open the door.
2. Turn ignition ON, then OFF.
3. For menu selection: Press and hold the Valet/Program button.
4. Select a feature.
5. Program a feature.
6. Release the Valet/Program button.

**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.



020048Viper front view

### 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 Feature 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.**

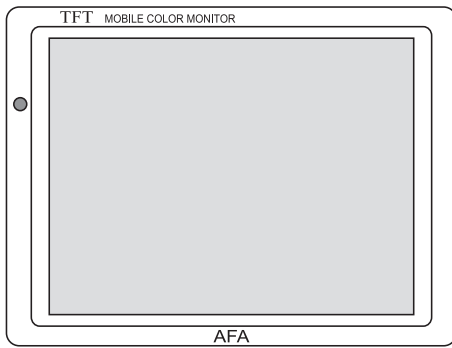
**Channel 3 Validity/Latched/Latched Rest with Ignition/30 Second.**

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



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

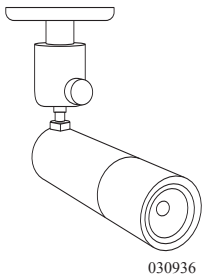
## MONITOR SYSTEM - BACK UP/SURVEILLANCE



The system uses four cameras. One mounted on each rear view mirror, one mounted in the front overhead with a view of the interior and one mounted in the rear on the exterior. The back up/surveillance system can be used while driving or when parked. A select button is used to alternate between camera views. When selecting a camera mounted on the mirror, the monitor defaults to the camera mounted on the roadside mirror. When activating the turn signal lever to the right, the monitor automatically switches to the curbside view, then switches back to the roadside view. The surveillance system may also be viewed through the bedroom television.

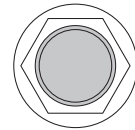


**NOTE: The early version of the surveillance system uses a separate monitor for the cameras.**

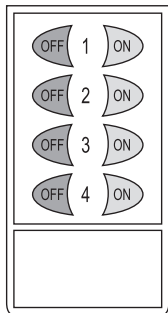


### To Use the System While Driving:

- Battery cut-off switch must be on.
- When a camera mounted mirror is selected, the system automatically changes from roadside view to curbside view with turn signal change.
- Select button alternates between the four cameras. When switching cameras, the monitor will remain on last camera selected.



Select button. 030935



### To Use the System When Parked:

- Battery cut-off switch must be on.
- AC power is supplied from shore power, generator or the inverter.
- Press the Video Input button on the bedroom television until Video 2 displays.
- Turn the switch (located on the TV cabinet) to On.
- Using the system remote press one of the On buttons, numbers 1-4.



**NOTE: Number 4 is not active on early versions.**



**NOTE: The monitor remains active whenever the battery cut-off switch is on.**

**Rear Vision System:**

The monitor is a 7" LCD screen that displays the rear vision, radio and navigation systems. The rear vision system provides the driver with a view of the rear of the motorhome. The monitor offers four different perspective views: FULL, ZOOM, JUST and NORMAL.



**NOTE: The radio system operates with the radio remote control or from the radio push buttons. The navigation system operates with the navigation remote only.**

**Power Requirements:**

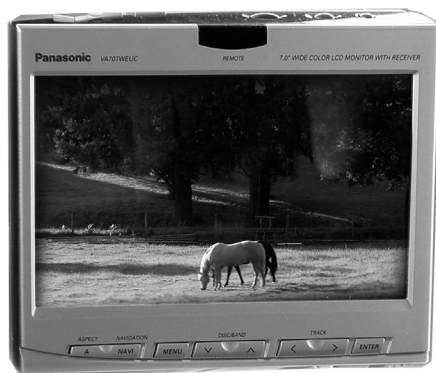
- Main battery disconnect switch (located in the battery compartment) must be on.
- The battery cut-off switch (located at the entry door) must be on.

**To View:**

- Press the OPEN button. The monitor will automatically slide out and stop in a vertical position.
- Press the blue power button. Adjust vertical axis of monitor for optimum view. The monitor automatically switches to a rear vision system by placing the transmission in reverse. The monitor may be turned on manually by pressing the MODE button. Use the left or right button until the hand points to CAMERA. Press ENTER to select.
- Press the ASPECT button to toggle between FULL, ZOOM, JUST and NORMAL views.

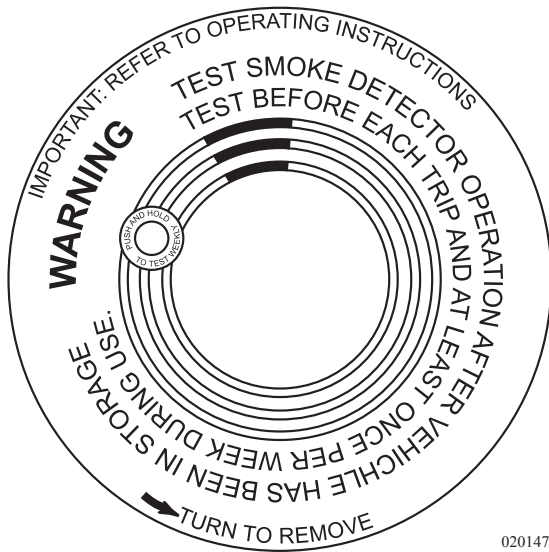


**NOTE: Reset monitor angle position before stowing. For more detailed instructions refer to the Panasonic Monitor's operations manual.**



monitor panasonic bu

## SMOKE DETECTOR



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



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

### Operation

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



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

### How to Test

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



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

**Maintenance**

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

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

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

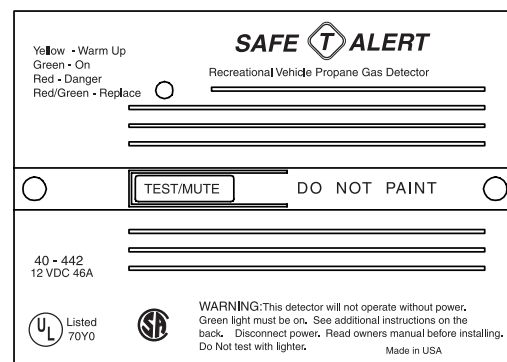
**Troubleshooting**

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

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

The LP-Gas detector is provided for safety. It detects both LP-Gas and methane gas. Liquefied Petroleum (LP) Gas is heavier than air; methane gas is lighter than air. LP-Gas will settle to the lowest point, generally the floor of the motorhome. Methane gas will rise. The gas detector is also sensitive to other fumes such as hair spray, of which most contain butane as the propellant. Butane, like propane, is heavier than air and will settle to the floor level where it will be detected. When this occurs, press reset button to stop the alert sound for 60 seconds.

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

**LP-GAS DETECTOR**

020043

## Operation

Upon first application of power the LED will flash **yellow** for three minutes while the detector is stabilizing. At the end of the start cycle the LED will turn **Green**, indicating full operation. If the detector senses unsafe levels of gas it will immediately sound an alarm. The gas detector operates on 12 Volt DC, with a current draw less than 1/10th of one amp.



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

---

## Testing

Press the **TEST** switch any time during the warm up cycle or while in normal operation. The LED should flash **red** and the alarm should sound. Release the switch. This is the only way the detector should be tested. The test feature checks full operation of the detector.



**WARNING: Test the operation of this detector after the motorhome has been in storage, before each trip and at least once per week during use.**

---

## Alarm

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

### Procedures To Take During An Alarm:

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



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

### Alarm Mute:

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

1. The **red** LED will continue flash and the alarm will beep every 30 seconds until the gas level has dropped to a safe level.
2. The LED will flash **green** until the end of the **MUTE** cycle.
3. If dangerous gas levels return before the end of the **MUTE** cycle, the alarm will beep four times and return to phase 1.
4. After two minutes the detector will return to normal operation (**solid green**) or resound the alarm if dangerous levels of gas remain in the area.



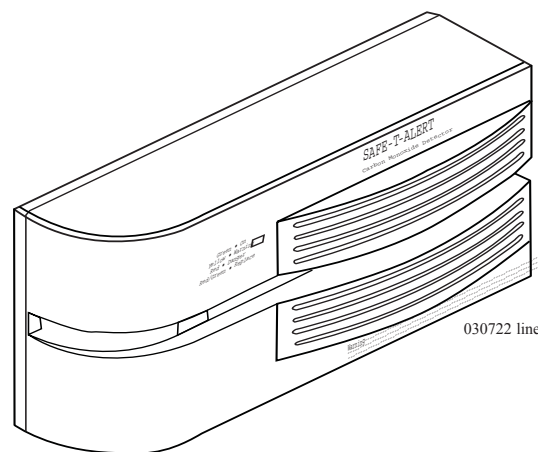
**Fault Alarm:**

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

1. Vacuum the dust off the detector cover weekly (more frequently in dusty locations) using the soft brush attachment of the vacuum.
2. Do not spray cleaning agents or waxes directly onto the front panel. This action may damage the sensor, cause an alarm or cause a detector malfunction.

**Care**

The motorhome is equipped with a carbon monoxide detector. Carbon monoxide (CO) is a colorless, odorless and tasteless gas. Even low levels of CO have been known to cause brain and other vital organ damage in unborn infants, with no effect on the mother. In cases of mild exposure the symptoms may include: a slight headache, nausea, vomiting and fatigue. Symptoms for medium exposure may include a severe throbbing headache, drowsiness, confusion and fast heart rate. Extreme exposure can result in unconsciousness, convulsions, cardio-respiratory failure and death. Young children and household pets may be the first affected. The CO detector is designed to detect the toxic CO fumes that result from vehicle exhaust and incomplete combustion sources like a furnace, gas stove or water heater. Consequently, it is uncommon for household smoke from cigarettes or normal cooking to cause the alarm to sound.

**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.**

## **Operating Instructions**

The detector is equipped with a self-cleaning CO sensor and requires a ten minute initial warm-up period to clean the sensor element and achieve stabilization. The green power light should be lit when the power is on. If the light is not lit, turn off the power and check all wire connections. If the power is on and the connections are correct but the indicator still does not light, the detector should be returned for service. Do not attempt to fix the detector. The indicator light displays a specific color to monitor the conditions as follows:

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

---

## **Alarm**

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

---

## **Testing**

Test the carbon monoxide detector operation after the motorhome has been in storage, before each trip and at least once a week during use. Test the alarm by holding the test button in until the alarm sounds. The alarm will stop beeping in about 30 seconds.

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## **Cleaning**

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

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

Inspect the fire extinguisher at least once a month. Do so more frequently if the extinguisher is exposed to weather or possible tampering. Do not test the extinguisher by partially discharging as this will cause a loss of pressure.

**Use the PASS word!**

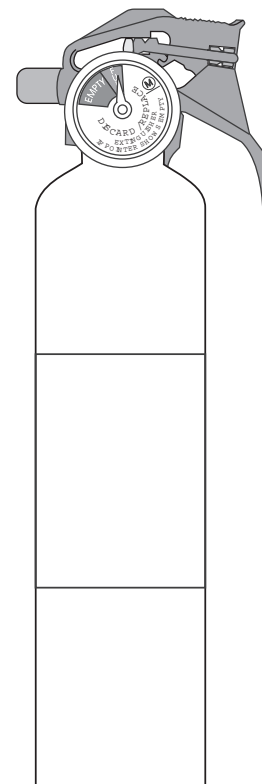
**Pull** the pin to unlock the extinguisher.

**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**

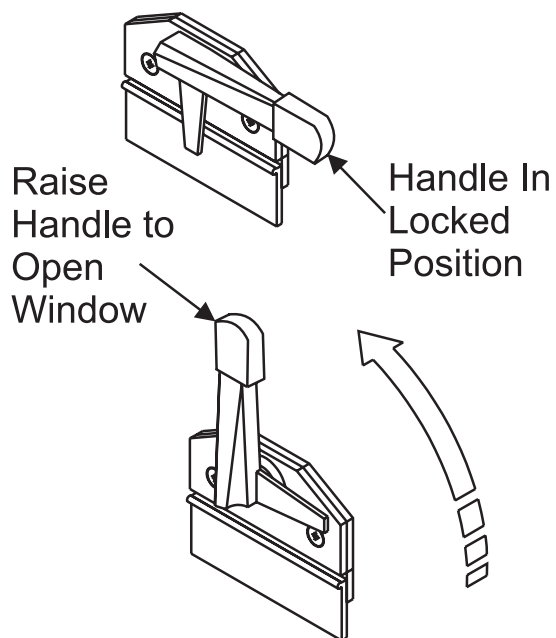


020073

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**



020029

Egress Window Handle

**NOTES**

# Signature

## SECTION 3 CARE & MAINTENANCE

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**EXTERIOR CARE**  
**Corrosion**

The most common cause of corrosion to the motorhome is the accumulation of road salts, grime and dirt. These elements, combined with moisture, may possibly cause early component failure. Salt air and fog from coastal trips can greatly accelerate the corrosion process. Corrosive materials collected from roadways accumulate on the undercarriage, around wheel openings and on the radiator charge air cooler package. These areas need to be cleaned periodically to help prevent component failure due to corrosion. If the motorhome is driven in areas where road salts are used it should be washed at least once a week. Otherwise, it is recommended to hose off the undercarriage area at least once a month to help minimize the corrosion process. High pressure washers or steam cleaners are the most effective way of cleaning off the underside and inside wheel openings. **Avoid directly spraying the painted surface with a high pressure washer.** Remove road debris and mud that has accumulated. Material left behind can intensify the corrosion problem.



**CAUTION: Exercise caution when cleaning the radiator charge air cooler package. Damage to the fins can result when using a high pressure washer or steam cleaner. Nozzle discharge pressure can exceed 1,800 psi. Avoid using high pressure steam cleaners on the exterior paint surfaces. Remove all spattered washing debris from the exterior paint surfaces as soon as possible.**

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

**Washing**

## Drying

Drying chamois cloths come in natural and synthetic materials. Either type is acceptable as long as the surface is clean. Soak the chamois in clean water until all chamois material has absorbed water. Wring excess water from chamois. Start at the top and work towards the bottom. Use a downward “S” pattern to remove water from the surface and wring out the chamois as needed. Using a chamois cloth to remove the rinse water is not necessary, but the effort can be worthwhile.

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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 Carnauba wax is a natural occurring wax from the leaves or fronds of the Carnauba palm tree. Mineral waxes have a paraffin base. There are also other topical application products which contain silicone.

**Polishes:** Polishes usually contain a combination of wax based substances with an abrasive, getting the two for one idea. These products can be too abrasive for clear coats and are not recommended for use.

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

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

Observe the test area from different angles checking for hazing or swirl marks. If an abnormal reaction to the finish occurs, discontinue product use and consult the



product's manufacturer. If the product is a paste, do not allow dried paste to be baked on by the sun. Remove paste shortly after drying. Clean, dry, 100% cotton cloths or cotton baby diapers are best suited for the removal of dried paste. Turn the cloth often. Use a separate clean cloth to buff. The surface should feel "slick" when rubbing the cloth lightly over it. Avoid repeated wax applications which can cause wax to build up. Some very fine scratches or swirl marks may be removed by an application of a glaze. These types of glazes fill the scratches or swirl marks.

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

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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 recreational vehicle 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.
    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***

### **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. Do not use any abrasive cleaners or compounds to clean the mirrors.



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

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### **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.

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### **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 recaulked as necessary. Special attention should be directed toward the roof air conditioning seals, ceiling and plumbing vents, skylights, roof mounted antennas, windows, door molding, clearance lights and the beltline molding. Specific sealant products should be used in the areas for which they were designed. These items can be obtained from recreational vehicle parts suppliers. Listed below are some of the more common sealants and the areas in which they are used. Approved sealants are available at service centers and authorized dealers.



**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:**

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

### **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.

## 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 upholstery fabrics:

- Water-based cleaners are not recommended.
- If a spill does occur, blot the soiled area. Do not rub it.
- Some solvents are not recommended since they may have an adverse reaction on 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 an overall cleaning.

### Fabric Cleaning Codes:

The codes listed below refer to cleaning instructions recommended by the fabric manufacturer for specific fabrics. The “Fabric Specification Charts” (located on the following pages) list specific fabric codes under “Cleaning Code.”

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

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



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

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

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

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

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

“**Wash Cycle**” - Use synthetic setting and high water level with mild agitation. A mild soap or detergent in water not to exceed 160° F.

**No bleach or fabric softener.**

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

“**Finishing**” - If necessary, press as following:

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

**Fabric Specification Charts**

FABRIC	CONTENT	CLEANING CODE	WHERE USED
<b>ROSE - CABERNET .454</b>			
35041 001 Birch	100% Polyester	S	Bedsread
Grandeur 2646 (w/Pearls)	100% Silk Organza	Dry Clean	BR Pillow
Apertif-RL Amethyst	100% Silk	Dry Clean	LR Pillow, Chair
Shalimar-SH Wisteria	52% Rayon, 48% Cotton	S	LR Pillow
Dragonfly Buzz 3002	39% Polyester, 61% Rayon	S	LR Pillow, FSD, Chair, Vanity
Vermiceli W-02	69% Rayon, 31% Polyester	S	Sofa, LR Val, HB, BR Pillow
<b>TAN - SAHARA SAND .455</b>			
Microsan Chateau 214	50% Cotton, 50% Polyester	S	LR & BR Val., Painted Pillow
Silkara Barley	100% Dacron Polyester	Dry Clean	Bedsread
Rope Bronze	100% Silk Organza	Dry Clean	BR Pillow
Darnton Mocha	33% Polyester, 67% Spun Viscose	S	LR & BR Val, Vanity BR Pill.
Feeney Sandcastle	60% Spun Viscose, 40% Polyester	S	LR Pillow, FSD, Chair
Sailing Wheat	38% Poly, 38% Spun Viscose, 24% Cotton	S	LR Pillow
Ricewine-H Linen	50% Rayon, 33% Cott., 16% Olefin, 1% Poly	S	Sofa, LR Pillow & Val, HB, BR Pillow, BR Pillow

FABRIC	CONTENT	CLEANING CODE	WHERE USED
<b>TAUPE SABLE .456</b>			
12524-79	78% Cotton, 22% Rayon	Dry Clean	LR Pillow, FSD, LR Valance
Famum-F Nutria	71% Flax, 29% Cotton	Dry Clean	BR Pillow
Modern Kuba Charcoal	69% Rayon, 31% Polyester	S	LR & BR Pill., Chair, Vanity, LR Valance
Krinkle 13 Taupe	100% Polyester VisalIntrinsic	W	Bedsread, BR Valance
Florina Washed Latte	72% Rayon, 28% Poly	S	Sofa, Headboard, BR Pillow
<b>GOLD - CREME BRULE .457</b>			
Shalini-F Tiger Eye	100% Silk	Dry Clean	BR Pillow, LR & BR Valance
Solimana Hazel	45% Polyester, 55% Rayon	Dry Clean	FSD, LR & BR Pillow
Kaylan-SH Linen	85% Rayon, 15% Polyester	S	LR & BR Pillow, Chair, Vanity, LR Val
Porcini-H Hazel	60% Rayon, 24% Cott., 16% Poly Properlin	W	Sofa, LR Pillow, Headboard
Kittery 31	100% Polyester	Dry Clean	Bedsread
<b>GRAY - ETCHINGS .458</b>			
Baird Jacquard R C R	100% Cotton	W/S	LR Pillow
Zebra 7	100% Cotton	W/S	BR Pillow
Hutton Pepper	70% Silk, 30% Cotton	Dry Clean	BR Pillow
Vestige-SH Birch	66% Cotton, 34% Poly	S	Sofa, HB, LR & BR Pillow, Vanity, LR Val.
Krinkle 16 Bone	100% Polyester VisalIntrinsic	W	Bedsread, BR Val.
F-67099666	41% Rayon, 59% Polyester	S	LR Pillow, FSD, Chair

FABRIC		CLEANING CODE	WHERE USED
<b>TAN - COUNTRY CLASSIC .109</b>			
At Ease Cream	39% Cott, 31% Rayon, 30%Poly.	W/S	LR Pillows, LR Valance, LR Slide
Baird Jacquard/Camel	100% Cotton	S	Bedsread, HB, BR Val, BR Pillow
Dressage Natural	100% Cotton	S	Bedsread/HB Accent, BR Pillow
Flora Cream	46% Chennile, 24% Rayon, 30% Poly	W/S	Sofa, Dinette.
Hampton Sq. Paisley Camel	100% Cotton	S	Chair, FSD, LR Val & Pill, Gally Val.
Yorkshire Plaid/Hunter	100% Cotton	S	BRPillows #2, BR Val, Vanity Stool
<b>GREEN - TIMBERLINE .502</b>			
Cobblestone Oatmeal	64% Rayon, 36% Cotton	W/S	Sofa
Kerchief Plaid Sage	100% Cotton	W/S	LR Pillow, BR Pillow
Glengariff Plaid Loden	100% Wool	W/S	FSD, LR Pillow
Baird Jacquard Olive	100% Cotton	W/S	LR Accent, BR Accent
Chester 0003 Almond	60% Cotton, 40% Polyester	W/S	LR Pillow, LR Val
Dupioni 12 Ivory	100% Polyester	W/S	Bedsread, Windshield Drape
Newton 2110 Autumn	89% Cotton, 11% Rayon	W/S	BR Accent
<b>GRAY - PARK AVENUE .184</b>			
Positano - 001 White	61% Cott, 39%Poly.	W/S	Bedsread, BR Val, Opt. Carousel
Cobblestone Oatmeal	64% Rayon, 36% Cotton	W/S	Chair, LR Slide, LR Pillow 1 & 2
Flora Coffie	46% Chennile, 24% Rayon, 30% Poly	W/S	BR Pillow 1 & 2, HB, BR Val.
Gridlock Ebony	46% Chennile, 24% Rayon, 30% Poly	W/S	LR Pillow 2, FSD
Linea Sand	100% Worsted Wool	W/S	Bedsread, BR VAI, Opt. Carousel
Shantung Tiger Eye	60% Rayon, 40% Cotton	W/S	BRPillows #2, LR/Galley Valance
Square One Ebony	52% Cotton, 48% Viscose	W/S	Sofa
Toray	Ultrasuede	--	LR Valance

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

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



<b>VINYL</b>	<b>WHERE USED</b>	<b>CLEANING</b>
<b>ROSE - CABERNET .454</b>		Follow cleaning instructions for <b>Vinyl</b> under <b>INTERIOR CARE.</b>
Tumbleweed New Oyster	Vinyl	
<b>TAN - SAHARA SAND .445</b>		
Tumbleweed New Oyster	Vinyl	
<b>TAUPE SABLE .456</b>		
Tumbleweed Taupe	Vinyl	
<b>GOLD - CREME BRULE .457</b>		
Tumbleweed New Oyster	Vinyl	
<b>GRAY - ETCHINGS .458</b>		
Tumbleweed New Oyster	Vinyl	
<b>TAN - COUNTRY CLASSIC .109</b>		
Brunswick/Tumbleweed Saddle	Vinyl	
<b>GREEN - TIMBERLINE .502</b>		
Tumbleweed Sand	Vinyl	
<b>GRAY - PARK AVENUE .184</b>		
Brunswick/Tumbleweed Taupe	Vinyl	
<b>LEATHER</b>	<b>WHERE USED</b>	<b>CLEANING</b>
<b>ROSE - CABERNET .454</b>		Follow cleaning instructions for <b>Leather</b> under <b>INTERIOR CARE.</b>
Tumbleweed New Oyster	All Leather	
<b>TAN - SAHARA SAND .445</b>		
Tumbleweed New Oyster	All Leather	
<b>TAUPE SABLE .456</b>		
Tumbleweed Taupe	All Leather	
<b>GOLD - CREME BRULE .457</b>		
Tumbleweed New Oyster	All Leather	
<b>GRAY - ETCHINGS .458</b>		
Tumbleweed Black /New Oyster	All Leather	
<b>TAN - COUNTRY CLASSIC .109</b>		
Saddle Leather CAX-8064	All Leather	
<b>GREEN - TIMBERLINE .502</b>		
Frontier Sand/Tumbleweed Sand	All Leather	
<b>GRAY - PARK AVENUE .184</b>		
Tuscany 12262 Putty (Distressed)/Tumbleweed Taupe CAX-7947	All Leather	

## Vinyl

Several areas of the motorhome such as the dash, ceiling and items of furniture may be covered in vinyl. The care and cleaning of these areas are outlined in the Morbern Vinyl section below.

### **Morbern Vinyl:**

Vinyl requires periodic cleaning to maintain its neat appearance and to prevent the buildup of dirt and contaminants that may permanently stain and/or reduce the life of the vinyl if 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:** Lacquer solvent will cause immediate irreparable damage to the vinyl. Do not use wax on any vinyl upholstery as it will cause premature embrittlement and cracking. Dilute chlorine bleach before using. Never use full strength bleach. If flammable solvents such as alcohol, turpentine or varsol are used for cleaning, use only small quantities while in a well-ventilated area. Exercise proper caution by notifying any persons in the area. Keep away from any ignition source. Always wear protective gloves.

**Ballpoint Ink:**

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

**Oil-Base Paint:**

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



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

**Latex Paint:**

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

**Tar or Asphalt:**

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

**Crayon, Mustard or Ketchup:**

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

**Chewing Gum:**

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

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

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

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

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

**Blood or Plant Residue:**

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



**NOTE: Vinyl requires periodic cleaning to maintain its appearance and to prevent the buildup of dirt and contaminants that may permanently stain or reduce the life of the vinyl if left untreated. 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 lacquers and cause the vinyl to become brittle and more difficult to repair.**

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**Leather**

**Spots & Spills:**

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

**Stubborn Spots and Stains:**

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



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

**Floors - Carpet Cleaning**

**Spot Removal Procedures:**

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

**Cleaning Solutions:**

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

Use the solution specified in order from 1-8 until stain is removed.	A	B	C	D	E	F	G	H	I
	DRY CLEANING FLUID	NAIL POLISH REMOVER	DETERGENT SOLUTION	WARM WATER	VINEGAR SOLUTION	AMMONIA SOLUTION	SPOT REMOVAL KIT	CALL PROFESSIONAL	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	*

**(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.**

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## **Floor - Tile**

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



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

### **Cleaning Tile:**

Use a damp sponge mop or a cloth to clean tiles and maintain their luster. If moderate staining occurs, cleaning with a window cleaner such as Windex should do the job. If 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. Do not use powdered cleaners on unglazed tile floors. Undissolved powder will dull the surface. Grout sealers are available that protect the porous surfaces. If a sealer is used, follow the sealant manufacturer guideline for application. Additionally, never use sealers 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.

### **Grout:**

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



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

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

## **Shower - Cleaning**

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

## **Ceilings**

### **Vinyl:**

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



**NOTE: Use care not to puncture the padded vinyl.**

### **Ozite:**

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



**NOTE: Do not oversaturate the Ozite surface as this may damage the ceiling.**

### **Hardwood Vinyl & Decorated Paneling:**

Hardwood vinyl and decorated paneling are sensitive and demanding materials. Certain cleaning agents will affect the surface on both printed and unprinted vinyl. Use only a mild, non-abrasive detergent and warm water with a soft cloth or sponge for cleaning to protect the material.

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

## **Mirror - Ceiling**

The non-distorted mirror reflective qualities make A-Look Decorative Metals perfect for ceilings. The A-Look Decorative Metals present a unique accent where a special mood or effect is desired. The surface of Decorative Metals is that of fine finished metal, where its special eye-catching properties add a definite prestigious appeal.

### **Care and Maintenance:**

Household cleaners, ammoniated detergents or glass cleaners may be used on the A-Look Mirror Decorative Metals. When cleaning A-Look Decorative Metals, use only a soft cloth and normal glass cleaners.

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## **Wall Coverings**

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

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

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

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

### **Normal Dirt:**

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

### **Nail Polish, Shellac or Lacquer:**

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

### **Ink:**

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

### **Chewing Gum:**

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



**Pencil:**

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

**Blood, Feces or Urine:**

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

**Care for the Tower Wall Covering:**

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

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Wood should be treated the same as a piece of fine furniture. Care and cleaning of the wood surface is essential in maintaining the natural beauty of wood. Keep in mind that wood finishes can vary widely. For added safety, test a new cleaning solution in an inconspicuous area to verify it will cause no damage.

**Wood Care**

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

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

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

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

left for a professionally trained individual.



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

**Sanding and Sandpaper:**

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

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

**Steel Wool:**

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

**Nail Holes and Small Cracks:**

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



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

**Fixing scratches in stained woodwork:**

"Quick and simple" rarely describes repairs to stained wood finishes. However, a few tricks can be tried.

When scratches appear lighter than the surrounding dark-stained woodwork, it usually means either that the scratch goes through the stain into the wood or that the varnish is flaking off.

**Dents:**

Dents are the results of wood fibers being crushed and compressed. They can be raised back to original level by steam. To raise a dent, place a damp cloth over the dent and hold a medium-hot iron on it. The steam will cause the wood fibers to swell back into place. It may be necessary to repeat this process until the dented area is level with the surface around it. Allow the area to dry.

### **Restoring the clear finish:**

Inspect the scratches carefully. If flaking varnish is visible with dark-stained wood underneath, only the clear finish may need to be restored. Rub the loose varnish with fine steel wool or fine synthetic steel wool until you have removed the flaking varnish and slightly roughened a small area of the finish surrounding the scratch.

With the tip of rag, a small brush, or even a cotton swab, apply a thin coat of a wipe-on finish. Apply finish to the damaged area only. You may need several coats to hide the scratch.

### **Re-staining the wood:**

If bare wood is visible at the bottom of the scratch, the wood will need to be re-stained. To remove damaged varnish, lightly roughen a small area around the scratch with sandpaper, steel wool or synthetic steel wool.

Find a stain that is a shade lighter than the wood finish. Stain the bare wood with a very small amount of stain on a rag, brush or cotton swab. If the color is too light, apply several coats. Rub away excess stain with a dry rag. If the wood becomes too dark, use a rag moistened in mineral spirits to lighten the wood. Then select a lighter color stain and continue.

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

Once the color is blended, patch the clear finish as described above and apply a wipe-on finish.

### **Scratches and Nicks:**

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

Light scratches will often disappear when carefully rubbed with furniture polish or paste wax. Deeper scratches can be hidden by carefully rubbing with a piece of oily nutmeat such as Brazil nut, black walnut or pecan. Be careful to rub the nutmeat directly into the scratch so it will not darken the surrounding wood.

Color the scratch with brown coloring crayon or liquid shoe dye (especially good on walnut).

Stain the scratch with iodine.

Mahogany--use new iodine

Brown or cherry mahogany-use iodine that has turned dark brown.

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

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

## Countertops

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

### **Routine Care:**

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

### **Cleaning Countertops:**

- Most dirt and stains: Use soapy water or ammonia-based cleaner.
- Water marks: Wipe with damp cloth and towel dry.
- Difficult stains: Use soft scrub and a Grey *Scotchbrite* Pad.
- Disinfecting: Occasionally wipe surface with diluted household bleach (one part water and one part bleach).

### **Cleaning Solid Surfaces Sink:**

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

### **Removing Cuts and Scratches:**

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

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

### **Preventing Heat Damage:**

The Solid Surface withstands heat better than ordinary surface materials; however, hot pans and some heat-generating appliances, such as frying pans or crockpots, can damage the surface. To prevent heat damage always use a hot pad or a trivet with rubber feet to protect the surface. In most cases the surface can be repaired if it is accidentally damaged.

### **Other Important Tips:**

Avoid using strong chemicals on the Solid Surface such as paint removers or oven cleaners. If these 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.**

**Water Spots:**

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

**Condensation:**

Condensation is a natural phenomenon. The amount of condensation will vary with climate conditions, particularly in relative humidity. Condensation occurs from water vapor present in the air. Each of us add more vapors by breathing, bathing, cooking, etc. Water vapor collects wherever there is available air space. When the temperature reaches the dew point the water vapor in the air condenses and changes to liquid form.

**Controlling Moisture Condensation:**

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

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

### **Mini-blinds**

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

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### **Day/Night Shades (Optional)**

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

- Vacuum with a brush attachment, or use a dusting tool on a regular basis.
- Use a weak solution of dish soap and water to spot clean the shades with a slightly damp cloth. Avoid soaking or saturating the shades with water. Over saturation will break down the finish of the shade.
- Leave Day-Night shades in the up position when not in use to help the shades hold their shape.
- String tension for the shades should be equal. The tension can be adjusted if the shades will not remain up.

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

**Checklist-Short Term Storage**

- If applicable, retract the slide room(s). Do not store the motorhome with slide room(s) extended.
- Shut off all appliances. Close the 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 switches 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 minimize moisture condensing at top of fuel tank.
- Vents and windows should be closed to prevent wind driven rain entrance.
- Tires should be stored at maximum inflation pressure.
- A full interior inspection for water leaks should be made bi-monthly, inspecting behind all cabinet doors and drawers.

## **STORAGE** **- Long Term**

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

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



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

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

- Turn off all the appliances.
- Turn the battery cut-off switches 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. When using preventative measures, taking the motorhome out of storage or moving the motorhome in case of an emergency is a much easier process.



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

**If AC power is available:**

Both main battery disconnect switches will remain ON. The inverter will charge both house and engine battery banks. A 30 amp shore power service will be more than adequate.



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



**Type of surface to park and store the motorhome on:**

- The type of surface the motorhome is parked upon will affect how much moisture accumulation occurs on the chassis and flooring. Moisture can eventually seep into the interior.
- Parking the motorhome on a grass surface, with the tires supported by blocks, is a perfect situation for moisture to accumulate.
- A gravel covered parking area still allows moisture to evaporate from the ground, through the gravel and to the underside of the motorhome.
- Concrete pads seal the surface allowing better ventilation under the motorhome.
- Storage buildings with concrete floors or heated storage facilities greatly reduce the amount of moisture accumulation and protects the motorhome from moisture damage.

**If the motorhome is stored outdoors:**

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

**Inspect the motorhome:**

- Perform a full interior inspection for water leaks every two weeks while the motorhome is in storage. Open all cabinet doors looking for signs of dampness or leaks. Inspect the ceiling areas around roof vents or other roof openings.
- The roof and sidewall seams should be inspected and cleaned at least twice a year. Inspect for exterior sealant gaps of all roof seams, vents, skylights, roof air conditioners and windows. If necessary, use the proper sealants and recommended application procedures.

**Fuel:**

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

**Brakes:**

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

**Engine:**

Internal combustion engines need to be “exercised” on a regular basis. 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.

**CHECKLIST**  
**- Winter Storage**

- **Plumbing Lines** - Drain and protect by filling with approved RV antifreeze.
- **Fresh Water Tank** - Drain.
- **Body** - Clean and wax. Oil locks and hinges. Repair roof seams as needed.
- **Countertop and Cabinets** - Wash with mild soap and water.
- **Curtains** - Remove and clean according to care specifications.
- **Windows** - To protect the interior fabric from fading, cover windows by pulling blinds, closing shades or using a separate cover such as a sheet.
- **Holding Tank** - Drain and rinse. Close valves.



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

- **Drain Traps** - Pour RV antifreeze down all drains.
- **Refrigerator** - Clean and leave both doors propped open. Cover the exterior panels and roof vents.
- **Batteries** - Add distilled water and recharge if needed. Disconnect the cables. Remove the batteries and store them in a cool dry place. Check and recharge as needed. Never park the coach where the battery door cannot be opened.
- **Air Conditioner** - Remove the air filters. Clean or replace.
- **Roof** - Keep clear of snow accumulation or damage may occur.
- **Interior/Exterior** - Storing under cover or indoors helps extend interior and exterior life.
- **Fuel Tank** - Diesel fuel tank should be full of fuel.

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

- Open cabinet doors and drawers inspecting for water leaks at joints or fittings. Repair as necessary.
- Operate all 12 Volt lights and accessories. If something does not work there may be a bad 12 Volt circuit breaker or blown fuse.

- Install new batteries in battery operated safety detectors or devices. Test the carbon monoxide, LP-Gas and smoke detectors for proper operation.
- Check that the monitor panel is functioning properly.
- Inspect the 120 Volt electrical system which includes the power cord, inverter/converter all outlets and exposed wiring.



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

- Start and run the generator.
- Confirm that the batteries are charging. Operate the 120 Volt appliances and air conditioners. If an electrical item or appliance is not functioning properly, contact the dealer or an authorized service center to have it evaluated.
- Have a qualified technician inspect the LP-Gas system and perform an LP Gas leak test. The leak test should also include an LP-Gas regulator adjustment (if needed). The test can also verify if the regulator is faulty and should be replaced. Have the LP-Gas tank inspected.
- Operate each LP-Gas appliance. Observe all burner/pilot flames for proper color and size.
- Inspect and clean the interior.
- Check the sealant around all roof and body seams and windows. Reseal if necessary.
- Lubricate all the exterior locks, hinges and latches with a graphite lubricant.
- Check the windshield wiper blade condition. Check the wiper/washer operation.
- Wash and wax the exterior. Inspect the body for scratches or other damage; touch up or repair as necessary. Flush the underside thoroughly.
- Run through the operational checks for steering, brakes, engine and transmission. Operate the motorhome slowly during these checks to allow sufficient circulation of fluids and resetting of the components.
- If desired, have the dealer or repair center double check preparation to make any necessary adjustments and/or correct defects.

**NOTES**

# Signature

## SECTION 4 APPLIANCES

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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 range, microwave, furnace, water heater, roof air conditioner and several optional appliances. Many of these appliances operate on AC or DC current, LP-Gas or a combination of all three.



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



**WARNING: Before entering any type of refueling station make sure all LP-Gas operated appliances are off. Most LP-Gas appliances used in recreational vehicles are vented to the outside. When parked close to a gasoline pump it is possible for fuel vapors to enter this type of appliance and ignite, resulting in an explosion or fire. Carbon monoxide gas may cause nausea, fainting or death. Operating an LP-Gas appliance with inadequate ventilation or partial blockage of the flue can result in carbon monoxide poisoning. Do not store flammable liquids such as lighter fluid, gasoline or propane in the outside refrigerator compartment.**

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

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

## REFRIGERATOR

## **Operation Specifics**

- The refrigerator operates from LP-Gas or 120 Volts AC electric.
- DC Voltage must be no higher than 15.4 volts DC or lower than 10.5 volts DC.
- AC voltage must be no higher than 132 Volts AC or lower than 108 Volts AC.
- It is important to operate the refrigerator only when level. Level the refrigerator (from front view) within 3° side to side and 6° front to back using a torpedo or bulls eye (fence post) level. Place the level on the freezer plate. The level should be within the circle by a half of a bubble. Generally, this is within comfortable living conditions.



**NOTE: Operating the refrigerator "off level" separates the chemicals that crystallize and block the circulation action of the cooling unit. Damage is cumulative and irreversible.**



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



**NOTE: To reduce the possibility of food spoilage, keep the interior box temperature at or below 54° F. The refrigerator will consume more energy to maintain low temperature, especially in hot, humid climates. Lower temperature may also lead to quicker frost build-up.**

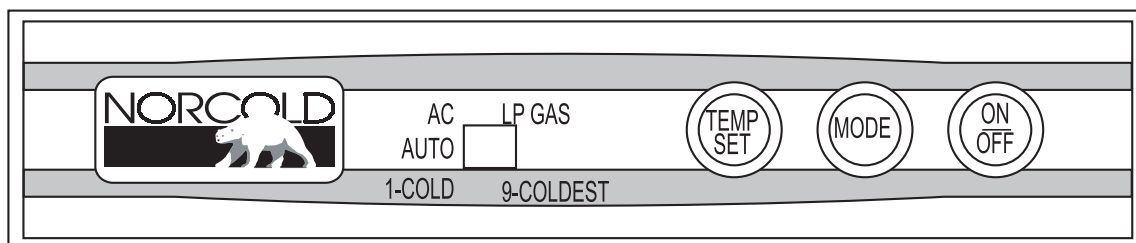
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## **Refrigerator Controls**

**In order for the refrigerator to operate:**

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

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

**Control Panel  
- Two Door**

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

**Manual Mode:**

When one of the two manual modes is selected:

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

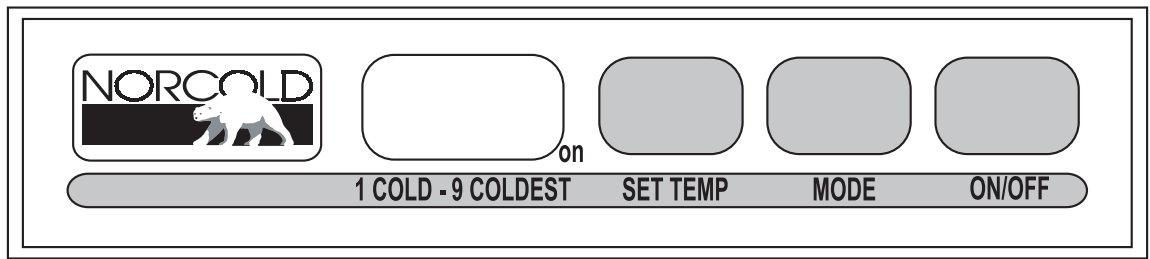
If the LP-Gas does not ignite within 30 seconds, the control changes to a different energy source or the gas safety valve closes and F displays. Turn the refrigerator off then back on. If the gas does not ignite after several attempts, consult a dealer or authorized Norcold service center.

**Automatic Mode:**

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

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

**Control Panel -  
Four Door**



The Refrigerator Control Panel requires 12 Volt DC to operate.

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

**Manual Mode:**

When one of the two manual modes is selected:

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

**Automatic Mode:**

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

- Press and hold the **MODE** button until **AUTO** displays, release the button.
- Press and hold the **TEMP SET** button until the desired temperature displays, release button.
- In **AUTO** mode, AC or LP will remain lit for 10 seconds or when a mode has changed.

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

**Tips**

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

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

**Ice Maker**

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



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

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

**Doors**

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

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

## Alarm

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

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



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

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



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

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## Service

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

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## Cooling Unit Fans (Four Door Models)

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

**Storage**

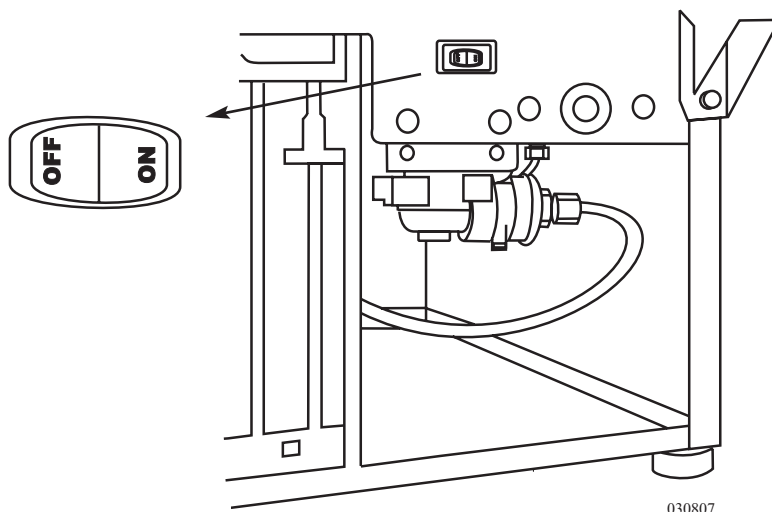
- Turn the refrigerator off and remove all items. Leave the drip tray under the cooling fins.
- Shorten defrost time by using trays of warm water. Do not use a heating gun, hair dryer or sharp objects to remove frost as these can damage the interior or cooling unit.
- Wash the interior using mild spray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



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

The ice maker operates from 120 Volt AC power, requiring either the generator or the inverter to be ON, or the motorhome must be connected to shore power. Water for the ice maker is supplied by the potable water system and requires the 12 Volt DC water pump to be on for water pressure or the motorhome to be connected to city water. The supply valve on the distribution manifold must be on in order for the icemaker to produce ice.

**ICE MAKER  
- STAND ALONE  
(Optional)**



*On/Off Switch Location.*

## Operation

Locate the **ON/OFF** switch on the lower front panel.

### If the Ice Maker fails to make ice or makes ice intermittently:

1. Be sure there is 120 Volt power available from either the generator, inverter or shore power.
2. Check if the water pump is ON or if there is city water.
3. Check if the water shut-off valve to the ice maker is open.



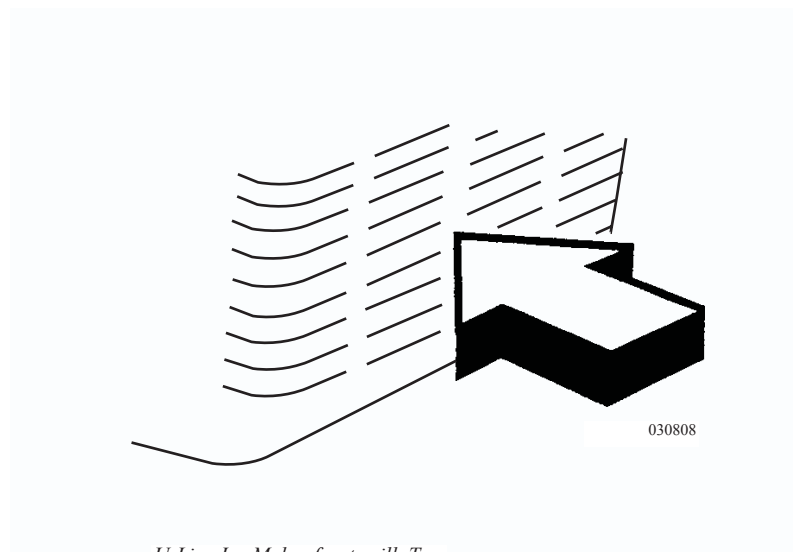
**NOTE: When the ice maker is not in use all ice should be removed and the door should be propped open about one (1) inch for ventilation.**

## Care & Cleaning

Clean the interior with mild detergent and warm water. Avoid the use of solvent cleaning agents or abrasives on the interior. These cleaners may transmit taste to the ice cubes and food, or damage and discolor the interior. The exterior may be cleaned with mild detergent and warm water. The front grill should be kept free of dust and lint to permit free air flow to the condenser. The condenser coil, located behind the front grill, should be cleaned three to four times each year. Clean more often if traveling with pets. Use a brush or vacuum cleaner to remove dirt, lint and other accumulations from the condenser coil.



**See the Manufacturer's Instructions located in the motorhome's Information File for specific operating instructions.**



*U-Line Ice Maker front grill. To remove front grill, unscrew the Philips screw.*

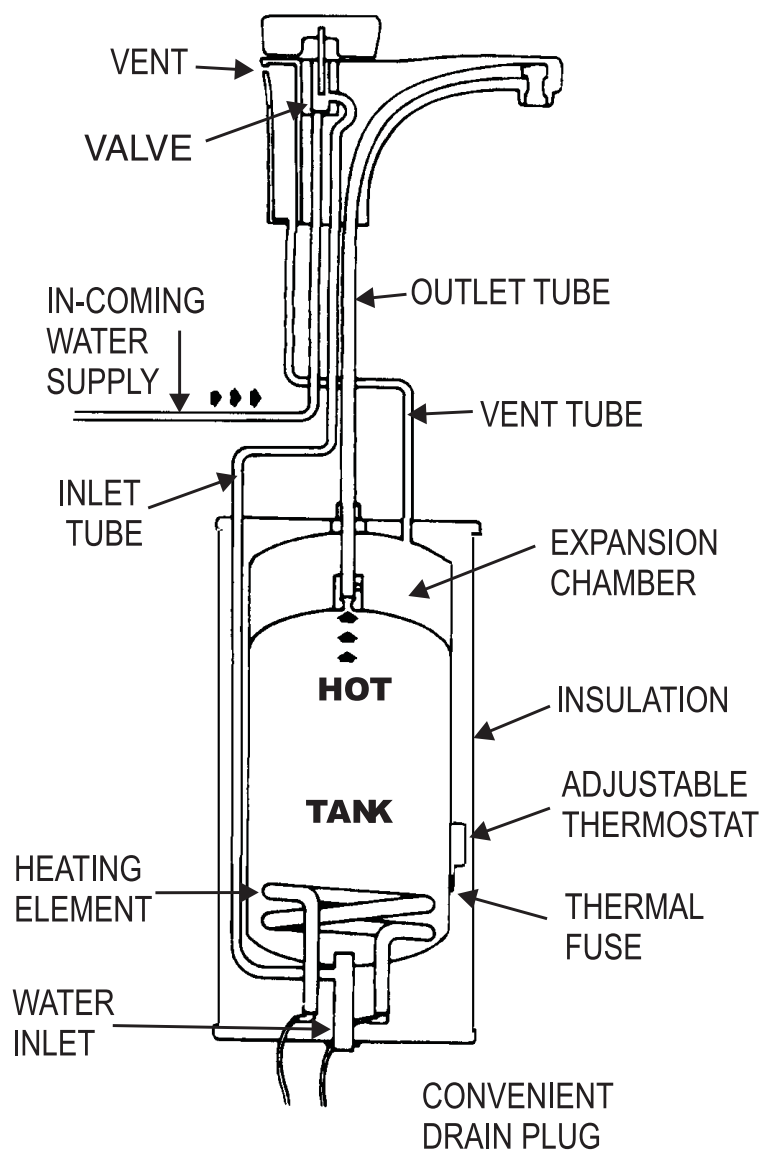


## HOT WATER DISPENSER

Water is electrically heated to the temperature of 190° F (88° C) by means of a compact tank mounted under the sink. A thermostat maintains the water temperature. When the tap is turned, 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 to the **ON** position. It takes approximately 10 to 15 minutes for the water to reach 190° F (88° C). **Use caution: steam or hot water may spurt from the faucet without turning it on.** After 10 to 15 minutes, turn the faucet on for about 20 seconds to release any steam that may have built up in the hot water tank. Allow the water in the tank to reheat. Repeat this step one or two times. When a steady steam is dispensed, the hot water is ready to use. To shut off the system, turn the switch to the **OFF** position.



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**WARNING:** 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.

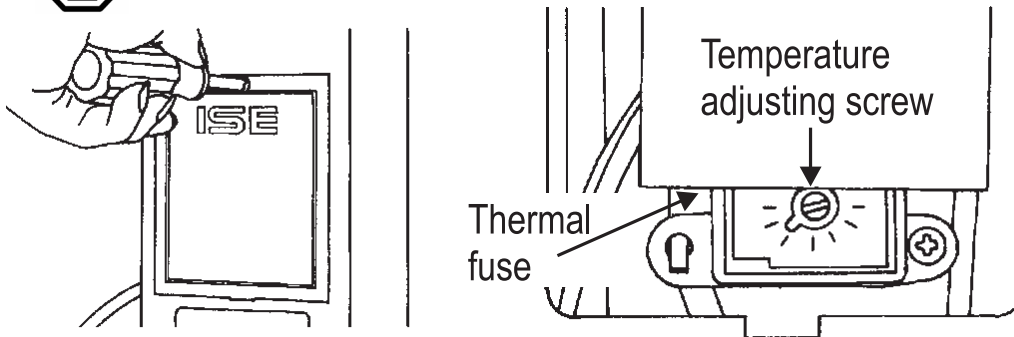
### Temperature Adjustment:

If the steam cannot be stopped, or if the water boils, adjust the 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  $\frac{1}{2}$  notch to increase the water temperature, or counterclockwise  $\frac{1}{2}$  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.**



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### 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.

### Draining the Insta-Hot Tank:

Drain the insta-hot tank before storage, or if interior temperature drops below freezing.

To Drain:

- Remove the nut retaining the bottom plate.
- Place a large pan or dish under the tank to catch leaks. Note that the insta-hot tank holds approximately  $\frac{3}{4}$  gallon.
- Remove the drain plug.



**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 burns.**

**MICROWAVE/  
CONVECTION OVEN**

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

The microwave offers many different features. Some include varied cooking times with different power settings: automatic sensor cooking, a kitchen timer, on screen programming help, childproof lockout and auto defrost cycles.

After placing the food in a suitable container, open the oven door and put it on the tray. The tray and roller guide must always be in place during cooking.

The microwave/convection oven operates from 120 Volt AC supplied by shore power.

- The microwave has a power output of 900 watts
- The convection heater uses 1475 watts.

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 sensor cooking. A brief overview may aide in the operation of the microwave/convection oven.



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

**Setting the Clock:**

- Select Time appears on the screen whenever power is available or interrupted.
- Rotate the knob to select the hour then push knob to set.
- Rotate the knob to select the minute then push knob to set.
- Rotate the knob to AM or PM then push knob to set.



**NOTE: The clock is a 12-hour clock only.**

**To Use the Microwave:**

- Press the Microwave button.
- Rotate knob counterclockwise to Time Cook then push knob.
- Rotate knob to set cook time in 15 second intervals then push knob.
- If cooking on High power press the Start/Pause button to start cooking or press the Power Level button to select a different power level. Rotate knob to select the power level, then press the Start/Pause button.

**Micro Express Button:**

- Press the Micro Express button to cook an additional 30 seconds on high power. Or add more time by repeat pressing of the button.

**Scrolling the Menu:**

- Press the Microwave button.
- Rotate knob clockwise to Bacon, Beverage, Defrost-Auto, Defrost Time, My Recipes, Popcorn, Reheat 1 Serv, Time Cook, Veg-Canned, Veggies-Fresh and Veggies-Frozen. Each item has subheadings. Press the knob to enter a heading. The menu will be your guide.

**Convection Cooking:**

- Press the Oven/Bake button.
- Rotate knob to set the oven temperature. Press the Start/Pause button.
- A beep will sound when the oven reaches the temperature setting.
- Place food in oven. Set the time using the knob. Press the Start/Pause button.

**Pre-programmed Recipes:**

Custom cook times and power levels can be added under the subheading of My Recipes.

- Press the Microwave button. Rotate knob to My Recipes the press knob to enter.
- Press knob when Enter appears or scroll until Enter appears.
- Select Cook Time appears use knob to adjust and set desired time. Use knob to set power level.
- Use knob to spell out name. Press the Start/Pause button to set. Press the Start/Pause button again to start cook time or press Clear/Off.

**Other Features:**

The microwave has many other features. Timers, nightlight, advanced time cooking, Childproof lockout and adjustable beeper volume. Refer to the microwave owner's manual about these features.

**Microwave Tips:**

- Turn the oven off before cleaning.
- Keep the inside of the oven clean. When food spatters or spilled liquids adhere to oven walls, wipe with a damp cloth. Mild detergent may be used if the oven gets dirty. The use of a harsh detergent or abrasive cleaner is not recommended.
- Clean the outside oven surface with soap and water. Wipe away any residue using a damp cloth. Dry with a soft cloth. To prevent damage to the operating parts inside the oven, do not allow water to seep into the ventilation openings.
- If the control panel becomes wet, clean with a soft, dry cloth. Do not use harsh detergents or abrasives on the control panel.
- If steam accumulates inside or around the outside of the oven door, wipe it away with a soft cloth. This may occur when the microwave oven is operated under high humidity conditions.
- It is occasionally necessary to remove the tray for cleaning. Wash the tray in warm sudsy water or in a dishwasher.
- The roller guide and oven cavity floor should be cleaned regularly to avoid excessive noise and odor. Wipe the bottom surface of the oven with mild detergent water or window cleaner and then dry. The roller guide may be washed in mild sudsy water.



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

**Microwave Facts:**

One of the most useful documents for the microwave is the owner's manual, located in the owner's information file box. Read it carefully and keep it for reference. Another useful item is a microwave cookbook. These manuals contain information about cooking principles, techniques, hints and recipes.

- Ensure food is in the microwave during operation to absorb the microwave energy. The magnetron, cycling on and off, may be heard at power levels less than 100%.
- Condensation is a normal occurrence in microwave cooking. The moisture within foods and the room humidity will influence how much moisture condenses in the microwave.
- Covered foods will not usually produce as much condensation as foods that are not covered.

**About Cooking:**

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

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

**Microwave Cooking Safety:**

- Always use a potholder to prevent burns when handling utensils that are in contact with hot food. Enough heat can transfer from food through utensils to cause skin burns.
- Stay near microwave when cooking and check frequently during cooking to prevent overcooking.
- Never use the cavity as a storage area for cookbooks or other items.
- Avoid steam burns by directing steam away from face and hands.
- Ventilation fan may continue operating after cooking is complete. Fan may also start automatically when the microwave is located over the cook top.

FOOD	DO	DO NOT
Eggs, Sausages, Fruits & Vegetables	<ul style="list-style-type: none"> <li>• Puncture egg yolks before cooking to prevent bursting.</li> <li>• Pierce skins of potatoes, apples, squash, hot dogs &amp; sausages to allow steam to escape.</li> </ul>	<ul style="list-style-type: none"> <li>• Cook eggs in shells.</li> <li>• Reheat whole eggs.</li> </ul>
Popcorn	<ul style="list-style-type: none"> <li>• Use specially bagged popcorn for use in the microwave.</li> <li>• Remove popcorn when popping slows to 1 or 2 seconds in between pops. Use the POPCORN setting.</li> </ul>	<ul style="list-style-type: none"> <li>• Pop popcorn in regular brown bags or glass bowls.</li> <li>• Exceed maximum time on popcorn package.</li> </ul>
Baby Food	<ul style="list-style-type: none"> <li>• Transfer baby food to small dish &amp; heat carefully. Stir often. Check temperature before serving.</li> </ul>	<ul style="list-style-type: none"> <li>• Heat disposable bottles.</li> <li>• Heat rubber nipple.</li> <li>• Heat baby food in original jar.</li> </ul>
General	<ul style="list-style-type: none"> <li>• Cut filled baked goods after heating to release steam.</li> <li>• Stir liquids before and after heating to avoid boiling over.</li> <li>• Use deep bowls for cooking liquids or cereals to avoid boiling out of the container.</li> </ul>	<ul style="list-style-type: none"> <li>• Heat or cook in closed jars or air-tight containers.</li> <li>• Use for Canning. Cooking and heating may not destroy bacteria.</li> <li>• Deep fat fry.</li> <li>• Dry wood, gourds, herbs or wet paper.</li> </ul>

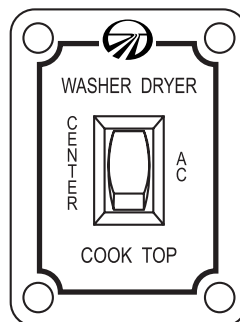
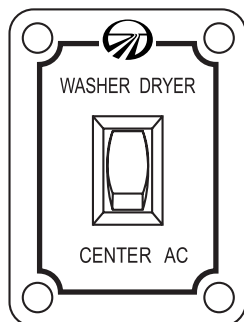
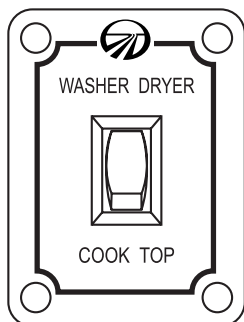
microwave food chart

The appliance selector switch limits the possibility of shore power overload allowing only one of the selected appliances to operate at any given time. The switch activates relays to interrupt the AC power supply to the affected appliance. Different models, floor plans and selected options have different switch configurations.

## APPLIANCE SELECTOR SWITCH

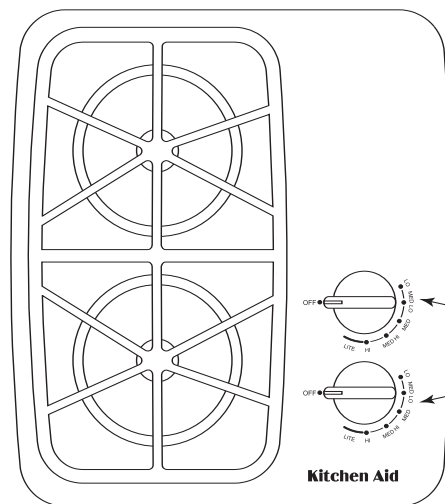


**NOTE: Appliances affected by the switch must be off to prevent contact flash when changing the switch position.**



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## COOKTOP



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Cooktop burners use 110 Volt AC electronic ignition to light the burners. To supply current to the cook top turn the inverter on, hook to shore power or start the generator.

To conserve energy preheat the pans only when recommended and shorten the cooking time by using the least amount of water possible. Do not let the flame extend beyond the cooking utensil. 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. Push down the knob and turn it counterclockwise to the ignite position.
3. Hold the knob down fully until the spark ignites the gas and until the thermocouple is heated (approximately 5 to 10 seconds). This will activate the safety magnet and keep the burner lit.
4. Release the knob and set the flame to the desired setting.
5. Turn the knob clockwise to turn it off.



**NOTE: All electric cook tops require burners to be heated 3-5 seconds before use.**

### Tips

- Allow extra cooking time while at a higher altitude.
- Yellow flame or tips indicate an improper air to fuel ratio in the fuel or that the burner port needs cleaning.
- Large burner is 12,500 BTU's. Small burner is 6,000 BTU's.



**LP - Gas Cooktop**

- Use a dry cloth or paper towel to clean spatters and spills while the surface is still warm.
- Regular cleaning with a soft cloth and a warm detergent solution is generally enough to keep the cooktop clean. This should be done when the cook top is cool.
- Wipe stainless steel surfaces in direction of grain.
- Avoid using oven cleaners or chlorine based cleaners.
- Clean burner caps with soap and water.
- If burner port is clogged remove the cap. Use a straight pin to clean burner ports. Do not damage or modify burner ports.

**Electric Cooktop**

- Wipe up spills and spatters immediately using damp cloth.
- Use a razor blade to scrape dried surface spills.
- Heavy duty cleansing powders will scratch cooktop surface. “Hope’s Cooktop Cleaning Cream” may be used on the cook top surface. To contact the Hope Co. call (800) 325-4026.

The electric cook top operates from 120 Volts AC supplied from either shore power or the generator. The appliance selector switch must be placed in the cook top position for the cook top to operate.

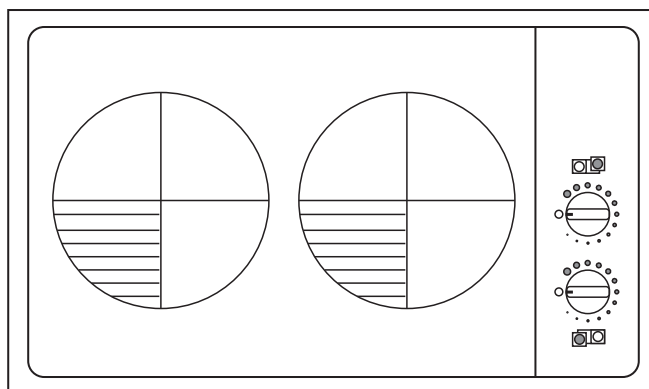
**All Electric Cooktop  
(Optional)**

**To operate:**

- Place appliance selector switch to the cook top position.
- Push down and rotate knob to the desired heat setting.
- Red indicator lamp glows when a knob is on.



**NOTE: All electric coaches require the appliance selector switch to be in the cook top position for operation.**



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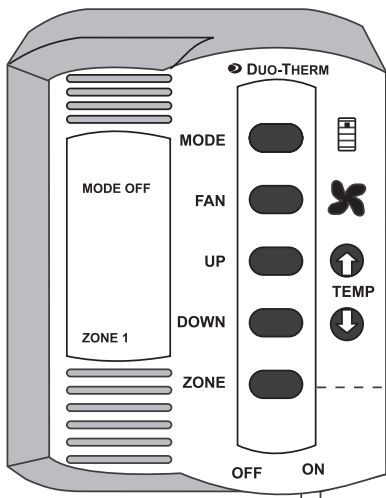
## WALL THERMOSTAT

Two comfort controls operate 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 show the current mode status.

There are five different functions of the HVAC system: Off, Fan, Cool, Heat Pump and Furnace. These are selected by repeat pressing of the MODE button. The FAN button controls the fan speed of the roof air conditioner. 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 with Auto Fan selected, only low or high blower speeds are 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. Pressing the ZONE button selects between the different zones available. The zone selected will flash. The Up or Down buttons control the temperature in any mode.



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**NOTE: The Comfort Control must be ON to operate any HVAC function. Do not select conflicting modes of operation. One zone cannot be on Cool while another zone is set to Furnace.**



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

**AIR CONDITIONER  
- ROOF**

The roof air conditioners operate from 120 Volts AC only, 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 style patch cord to send low voltage signals to the roof air conditioner's circuit board. The circuit board controls the desired roof air functions and Aqua Hot blower operation. The refrigeration 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 compressor pumps refrigerant into a condenser as high-pressure vapor. A condenser expels heat from the vapor into the atmosphere. Vapor condenses to high-pressure liquid. The liquid is forced through a metered capillary tube and then into the evaporator or low side pressure. The refrigerant changes from liquid to vapor as the refrigerant extracts heat. The compressor pumps the vapor to the condenser repeating the cycle. Operating the air conditioner in heat pump mode reverses the cycle. Reversing the refrigerant flow blows heated air into the interior of the motorhome. There are ambient temperature operating limitations in heat pump mode.



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



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

### Aux Heat Mode

If the heat pump mode is selected when ambient temperature is approximately 30° F, or if operating in Heat Pump mode and temperature drops to approximately 30° F. The air conditioner will stop Heat Pump operation and Aux Heat operation begins. Aux Heat mode selects the furnace as the auxiliary heat source. Aux. Heat mode initiates automatically due to refrigerant limitations in cold temperatures. The furnace remains the primary heat source until ambient temperature rises above 30° F. When operating in Heat Pump mode with ambient temperature between 30-42° F, a defrosting cycle begins approximately every 40 minutes of compressor operation. During the defrost cycle, the blower motor will stop for five minutes and the display will indicate Defrost. After the defrost cycle Heat Pump operation will resume.

If equipped with an Aqua Hot this will need to be on when the Aux Heat cycle begins. Turn on the Aqua Hot control switches. The exchanger blowers automatically begin operation in the auxiliary heat mode.

## Return Air Filters

Clean the return air filters frequently. The filters are located inside the motorhome behind the intake vent covers. The covers hinge on the curbside with fasteners securing the roadside in place. Hook and loop strips hold the filters in place. Never run the air conditioner 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.

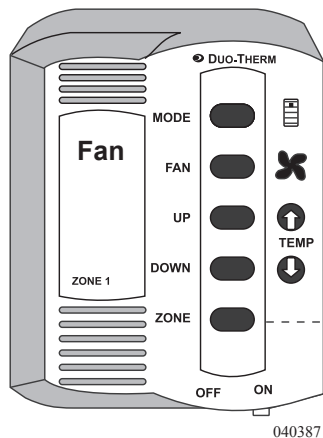
### To Clean:

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

## Operation

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.

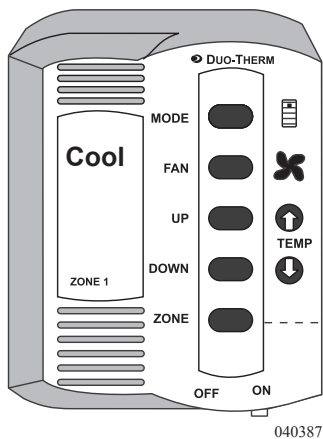


**Fan Operation:** This mode circulates the interior air by using the roof air conditioner blower. The fan speed will control the roof air conditioner blower speed in the following modes: Fan, Cool or Heat Pump.

- 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.
- Press 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.



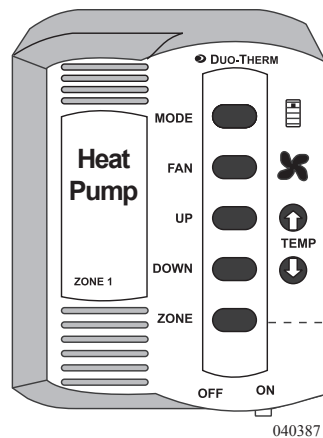
**NOTE:** The compressor will engage approximately two minutes after blower motor activation. This prevents accidental compressor activation against high pressure.

**Heat Pump Operation:** The 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.



## AQUA-HOT

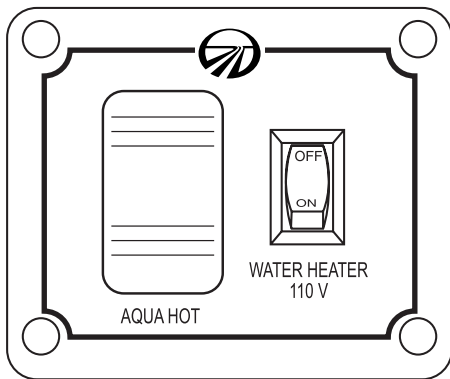
Specially designed for use in motorhomes, the Aqua-Hot is an appliance combining a water heater with a furnace. The Aqua-Hot provides an almost endless supply of hot water and heats the interior of the motorhome. A 50,000 BTU diesel fired burner and a 1,650-watt AC element heats a 60/40 solution of antifreeze to approximately 200° Fahrenheit. Using three pumps the antifreeze solution circulates through heat exchangers located throughout the motorhome. A fourth pump circulates engine coolant through the Aqua-Hot. Fresh water heats when pumped through a coil tube inside the Aqua-Hot.



**CAUTION: If not properly and thoroughly rinsed, bleach or other concentrated chlorine bearing chemicals can cause failure to the copper tubing inside the Aqua-Hot domestic Water Loop. The rating for the Aqua-Hot copper tubing is for fresh water and winterizing 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 winterizing 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.**



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### 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. Circulating pumps 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. When plugging into less than 50 amp service, exercise care not to overload the electric service provided. The rate of recovery of the electric element is slower than the diesel burner. When the switch is turned on a relay closes in the 120 Volt AC panel sending power 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.

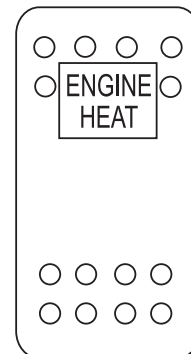
### Interior Heat Exchangers

The heat exchangers are small radiators with 12 Volt DC blower motors. Current consumption is approximately ½ amp per large heat exchanger. The small heat exchanger used in the private bath and for the holding tank bay is ¼ amp.

### Engine Preheat

The Aqua Hot system has an engine preheat feature to aid in starting in cold or frigid weather. Inside the Aqua Hot is an engine coolant loop and an engine coolant pump. The Aqua Hot will heat the engine coolant and the internal engine pump will circulate the heated coolant through the engine.

Turn the Aqua-Hot switch to the ON position. Turn the Engine Heat switch ON. This activates the engine pump, heating the engine coolant as it circulates through the Aqua-Hot. The time required to preheat the engine varies with ambient temperature.



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### Engine Heat Exchange System

When traveling, the water pump (on the engine) circulates heated engine coolant through the Aqua Hot. Through convection, the heat transfers to the Aqua Hot coolant, providing hot water and interior heating.



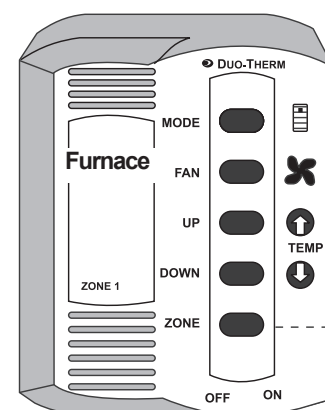
**NOTE: All zones must be in the same mode for the HVAC (heating, ventilating, air conditioning) system to function correctly. DO NOT set furnace mode in one zone and cool mode in another zone.**

### To operate the furnace:

- Select either diesel burner or electric element operation. Select both functions if desired.
- Turn living room and bedroom comfort controls to ON.
- Set the desired zone using the ZONE button.
- Press the MODE button repeatedly until furnace displays.
- Select desired temperature setting using the UP or DOWN buttons.



**NOTE: The switch in the private bathroom controls the blower motor of the heat exchanger in the private bathroom. When the switch is on, the bathroom blower motor will cycle on and off when Zone 2 exchanger blower cycles on or off.**



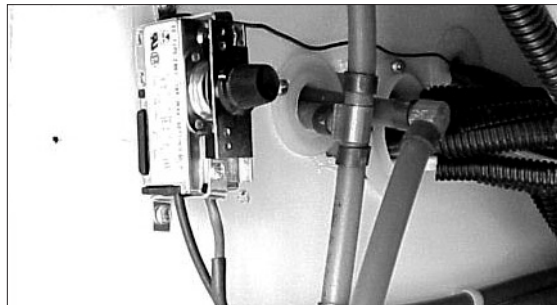
040387

## Bay Thermostat

If using the motorhome in cold weather, 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.



**NOTE: Turn the Aqua-Hot ON when heating the bay.**



Bay thermostat located next to Aqua-Hot.

aqua hot bay thermostat

## Maintenance Schedule

### Monthly:

Check the Aqua-Hot's 60/40 solution of water and antifreeze to ensure its proper level. Visually inspect the coolant level in Aqua-Hot's expansion tank 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 attains normal operating temperature. The expansion tank is located behind the fuel door.

### Annually:

Be sure to have the Aqua-Hot tuned up early. A tune up consists 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 or repair is required.



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



**NOTE: For more details about the Aqua-Hot system, see the Owner's Information Packet.**



**Aqua Hot Fuel Filter:**

The filter is located on the curbside of motorhome behind the fuel access door. Unlatch and securely position door open.

**Draining the Collection Bowl:**

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

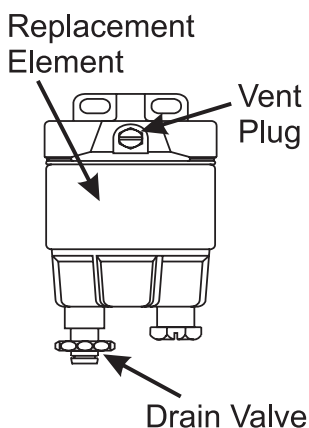
As a guideline, change the element every 500 hours, annually or at first indication of heat loss, whichever occurs first. Always carry an extra replacement element as one tank of contaminated fuel can plug a fuel filter.

Replacement filters must have a 10-micron rating.

Racor filter-aqua hot R2TRA000T ten micron

**To Replace the Element:**

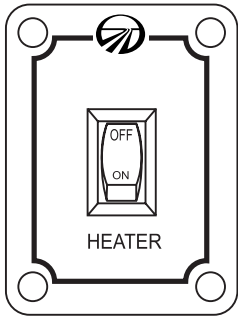
- Open the drain valve to drain the filter unit.
- Spin bowl/element from head and remove element.
- Coat new seals with motor oil and install the new element.
- Prime bowl/element with clean fuel.
- Spin bowl/element onto head and tighten firmly by hand.
- Start Aqua-Hot and check fuel filter for leaks.



030778

# ELECTRIC BASEBOARD HEATER

The baseboard heater operates from 120 Volts AC supplied by shore power or the generator. An adjustable thermostat and remote switch controls the operation of the heater.



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### To Operate the Heater:

- Hook to shore power or start the generator.
- Adjust thermostat to desired setting.
- Turn on the Heater switch.

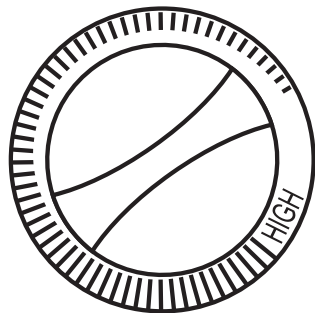


**NOTE: The heater is rated at 1000 watts or 8.8 amps. Use care when hooked to anything less than 50 amps service.**

### Tips

If heater operation discontinues or fails to operate, check the power supply. If the heater still does not operate, the Temperature Overload Switch may be tripped.

**BEFORE PUSHING THE BUTTON:** Allow 10 minutes for unit to cool, (2) Clean inside heater, (3) Push reset button. If heater does not turn back on after pushing reset button, the heater may be damaged. See Owner's Guide for more information.



### To Reset the Overload Switch:

- Turn off power supply.
- Remove grille to access the Overload Switch.
- Using a pencil or small screwdriver, press the Red reset button down.

**WARNING! TO AVOID ELECTRICAL SHOCK**  
Disconnect power at circuit breaker panel or fuse box before servicing.

CADET MANUFACTURING CO.

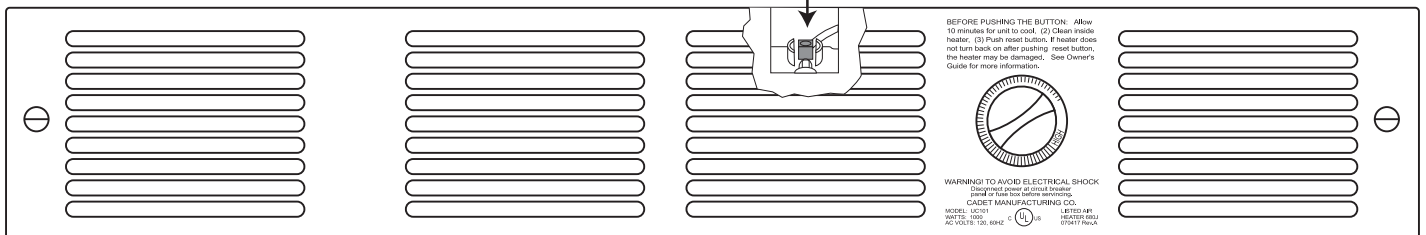
MODEL: UC101  
WATTS: 1000  
AC VOLTS: 120, 60HZ



LISTED AIR  
HEATER 680J  
070417 Rev.A

030940

RESET



**BEFORE PUSHING THE BUTTON:** Allow 10 minutes for unit to cool. (2) Clean inside heater. (3) Push reset button. If heater does not turn back on after pushing reset button, the heater may be damaged. See Owner's Guide for more information.



**WARNING! TO AVOID ELECTRICAL SHOCK**  
Disconnect power at circuit breaker panel or fuse box before servicing.  
CADET MANUFACTURING CO.  
MODEL: UC101  
WATTS: 1000  
AC VOLTS: 120, 60HZ



LISTED AIR  
HEATER 680J  
070417 Rev.A

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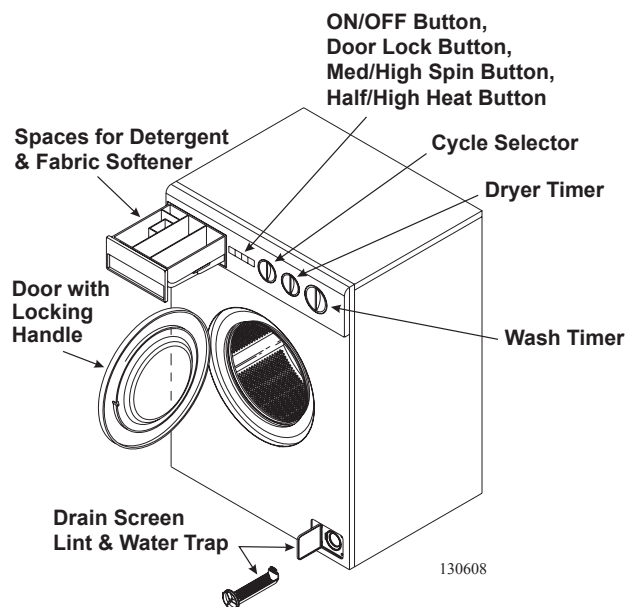
The automatic washer/dryer has a capacity of up to 10 lbs. (4.5 Kg.) of dry clothing. It is front loading with an extra large door opening for easier access. It has five wash cycles, in addition to extra rinse and spin cycles.

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



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

## WASHER/DRYER (Optional)



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

## Operating Instructions

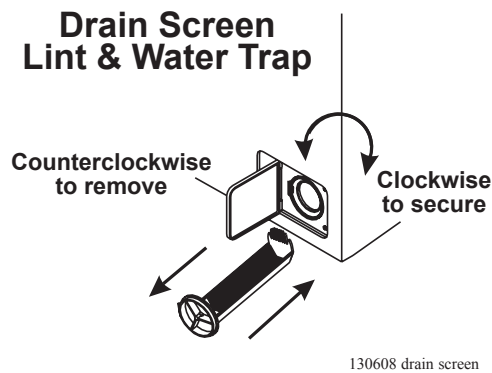
### To begin a wash load:

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



**WARNING: Do not wash or dry articles that have previously been cleaned, washed, soaked or spotted with gasoline, dry cleaning solvents or other flammable or explosive substances. They give off vapors that could ignite or explode. Do not add gasoline, dry cleaning solvents or other flammable or explosive substances to the wash water. Do not use heat to dry articles containing foam rubber or similar textured, rubber-like materials. Clean the lint screen if applicable (located on the back of the washer in the top left corner) after each use and keep the area around the exhaust opening and adjacent areas free from the accumulation of lint, dust and dirt.**

## Cleaning the Drain Screen



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



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

## Cleaning the Washer/Dryer

Occasionally wipe the exterior cabinet of the washer/dryer with a damp cloth or sponge. Wipe dry with a soft cloth. Do not use polish on plastic trim. Clean the interior with one cup of chlorine bleach mixed with two cups of granular detergent. Run the washer through a complete cycle using the hot water. Repeat the process if necessary. Remove hard water deposits using only cleaners labeled as washer safe. Wipe the inside of the washer/dryer door with a soft cloth to remove any moisture. Periodically apply a thin coat of paste wax to the inner door, especially to the area which is immediately next to the door window. This will protect the door finish from laundry spills and discoloration.



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

**Winterizing the Washer/Dryer**

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

1. 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 valve located at the manabloc water 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.

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

1. When putting antifreeze into the water system of the 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.**

**NOTES**

# Signature

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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.



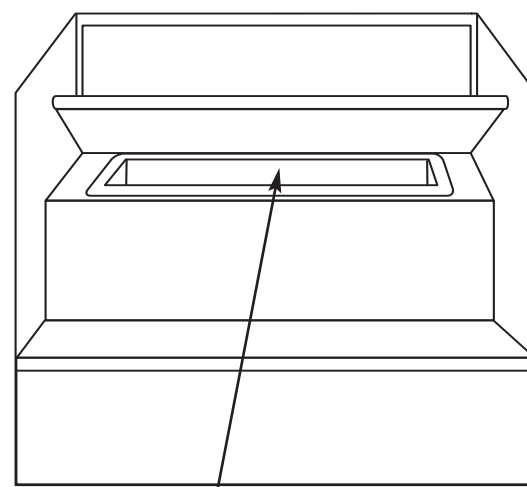
**Detailed information with CAUTION or WARNING instructions for the various electronics, other than what is provided in this section, can be found in the manufacturer's manual.**

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. The uppermost step has a **storage compartment** w/removable tray. The storage can be utilized to store frequently used items such as, gloves (for refueling), tire pressure gauge, flashlight or outside slippers.

### 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.

## ENTRY STEP - Operation



Storage Compartment.

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**Tips**

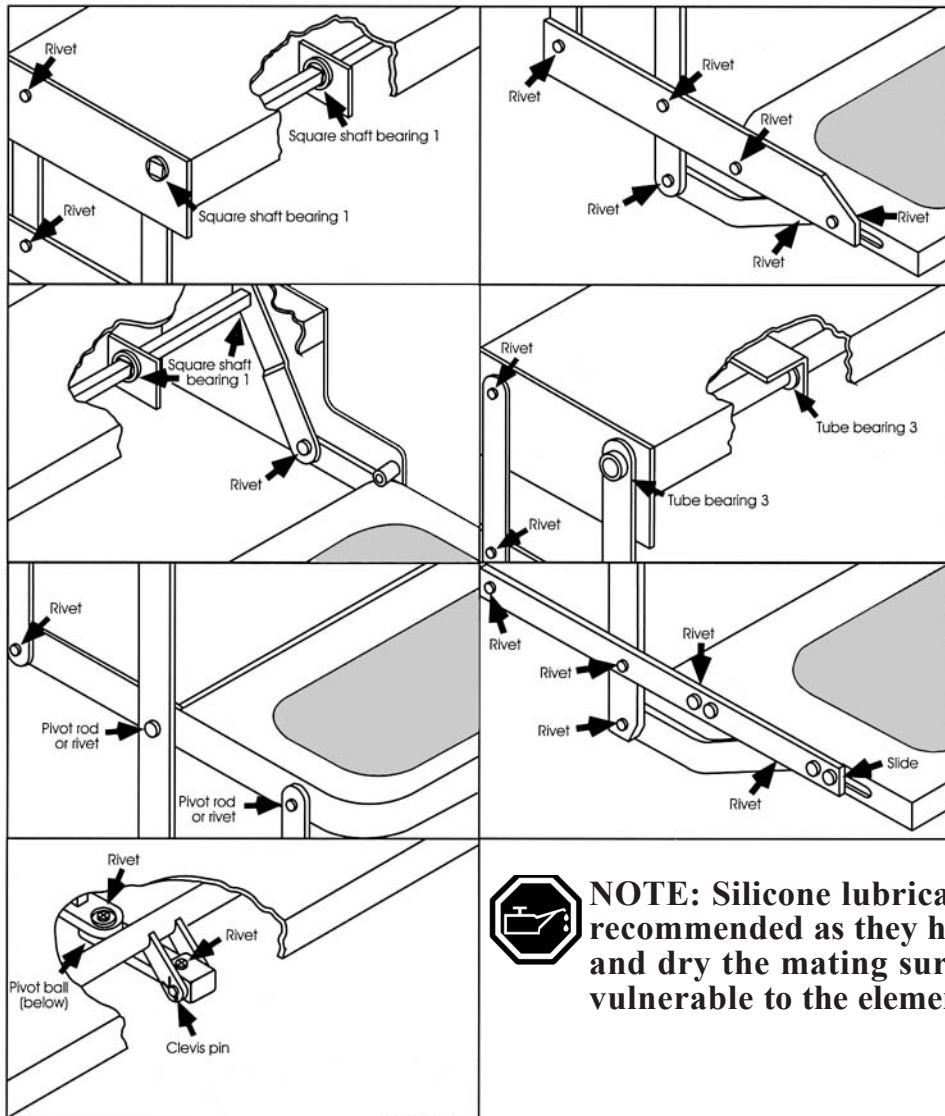
**If the step fails to operate:**

- Verify that the step switch is **ON**.
- Check the main power supply for the step. A 20 amp circuit breaker located on the low current plate.
- A magnetic door jam switch is used to control step operation. Use a separate magnet to apply a “trigger” to the door jam switch. Rotate test magnet to align polarity field.
- A 7 ½ amp ATO blade fuse is used to illuminate the **STEP OUT** dash warning light. The fuse is located on the front run box.



**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 **Kwikee Electric Steps** and it is also recommended for lubricating all moving parts. (Refer to the illustration.)



**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.**

entry step

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

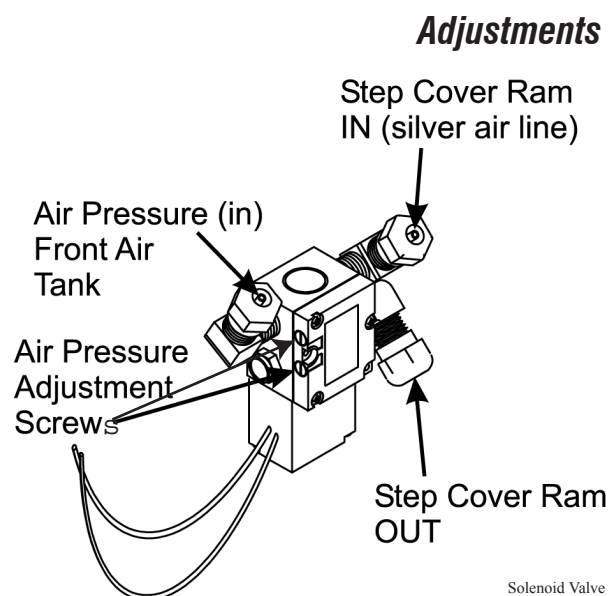
## STEPWELL COVER (Front Door Models Only)



**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.



**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.

## ENTRY DOOR

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

---

### ***Latch Adjustments***

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

- Determine which bolt needs adjustment.
- Slowly close the entry door observing the latch and strike bolt alignment. Do not attempt to latch if the alignment is off. If the alignment is correct, allow the latch to catch in the first (primary) position only.
- The latch should move to the second position with just slight pressure applied to the entry door. Upper and lower latches should be evenly timed. Press on the entry door to see if there is any further movement of the door.
- The entry handle should operate with little effort to open the entry door. An excessive amount of pressure indicates the bolts are set too far back.
- With a 5/8" inch box wrench or socket, loosen the movable strike bolt. Make all adjustments in small increments. Tighten the bolt firmly after making adjustments. The bolts should have slight up and down movement for vibration control in travel.
- Test the operation of the dead bolt lock to ensure proper functions.
- Silicone should be applied weekly to the entry door rubber gaskets to prevent squeaking while the motorhome is traveling. Use a one inch sponge paint brush, sprayed with silicone, for easy application.



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

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

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

**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**

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**Removable Screen:**

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

**Screen Door  
- Removing the Screen**

---

## Keyless Entry

The entry door and bay doors can be locked or unlocked using the touch keypad located adjacent to the entry door. Three lock codes are pre-assigned and not programmable. They cannot be assigned as unlock codes.

- **555** - Locks entry door and bay doors if connected.
- **557** - Locks entry door and bay doors if connected.
- **559** - Locks entry door and bay doors if connected and arms keypad (flashes momentarily once every 15 seconds).

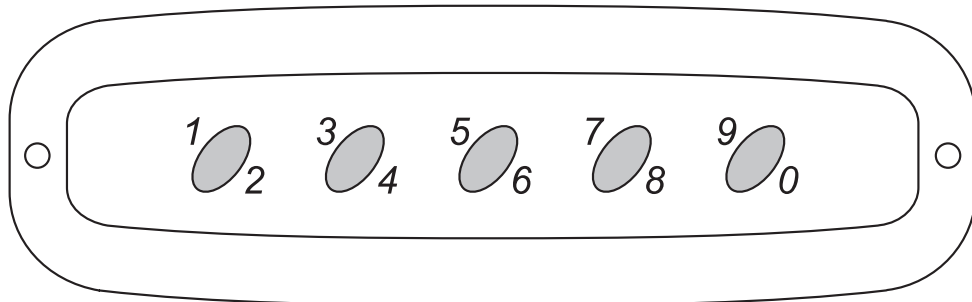
Unlock codes are programmable and should be personalized upon receipt.

Unlock codes are in two categories: **Master code** and **Optional codes**. Master code enables motorhome entry and auxiliary control. Deletion, adding or changing of optional codes are performed at the master code level. Optional codes only allow motorhome entry and auxiliary control.



**Consult the system owner's manual for further information.**

- To lock, shut the door, enter one of the three lock codes to lock the entry door and bay doors if bay doors are connected.
- To unlock, enter Factory Default master code or a three to eight digit personalized unlock code, if programmed.

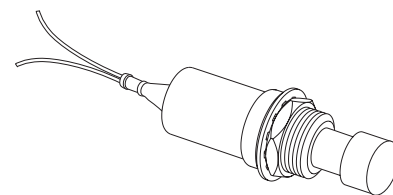


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All motorhomes equipped with the keyless entry are shipped from the factory with default settings. It is recommended the unlock code be personalized for security purposes.

**Use the following to program a personal number:**

1. Locate the programming switch, which is a small button with two 22-gauge wires connected: Yellow for power and Black for the ground. This switch is located in the curbside arm rest under the cup holder on certain models and behind the dash on others.
2. Press the programming switch until four (4) rapid beeps are audible.
3. Enter 1119 on the keypad; three (3) rapid beeps are audible. 1119 code opens the memory for accepting the master code.
4. Enter the new 3-8 digit master unlock code within five (5) seconds.
5. Wait five (5) seconds for two (2) rapid beeps.
6. Test the new Master Unlock code.
7. If the code was not accepted, repeat the procedure.



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**WARNING:** Ensure possession of entry door keys prior to testing new personal code.



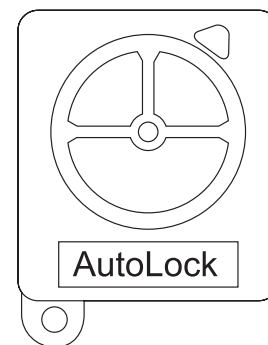
**NOTE:** These instructions are for motorhomes equipped with "keyless entry" only.



**NOTE:** During any service work, it is recommended all key fobs be left with the motorhome for thorough testing and check procedure.

If the remote does not respond, it may need authorization.

- Locate the keyless entry receiver box behind the instrument cluster.
- Unplug the receiver box. Plug receiver box back in.
- Within three seconds, press the lock button on one remote. The entry door should lock.
- Press the lock button on the other remote.



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**NOTE:** If the motorhome is factory equipped with an optional security system, the security system remote will lock or unlock the entry door and bay doors when the system is armed or disarmed. However, if the entry door is locked and armed with the security key fob, it must be unlocked with the security key fob to disarm the security system. Using the keypad to unlock will not disarm the security system.

## SLIDE-OUT OPERATION

Either the main slide-out room operates electrically or by electric switches controlling hydraulic cylinders. Slide-out room operation uses many safety features preventing mechanical damage or physical harm. The slide-out room(s) will not operate until all safety requirements are met.

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

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



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



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

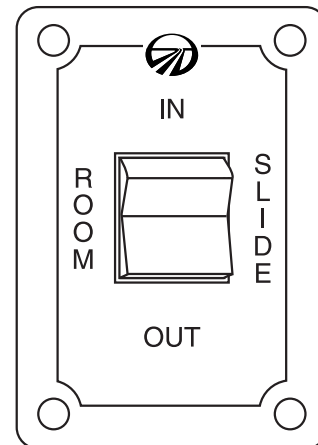


**CAUTION: Continuous operation of the slide-out room can drain the batteries and damage the motor by overheating.**



**Extending  
Main Room(s)****To Extend the Slide-Out Room:**

- Move the driver seat forward.
- Confirm that there is at least five feet of clearance outside the motorhome for the slide-out room to extend.
- Ensure the ignition key is in the OFF position.
- The park brake must be applied.
- The storage bay doors under the slide-out must be closed.
- The house batteries are fully charged.
- Ensure all people, pets and objects are clear of the slide-out room path.
- The control switch for the slide-out room is at the overhead compartment on the curbside of the motorhome.
- Press and hold the slide-out room switch in the OUT position. The slide-out room will slowly move to the OUT position. Release the switch to stop room movement. To continue the room movement, push and hold the switch in.
- Release the slide-out switch when the room is fully extended (a change in motor sound indicates extension). The slide-out drive motor will not stop automatically; the switch must be released.
- If equipped, extend the bedroom slide-out.
- Level the motorhome with the leveling system.



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



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

## **Retracting Main Room(s)**

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

- Check for sufficient clearance inside the motorhome before retracting the slide-out room.
- Clean the floor to ensure there is no dirt or grit that could result in floor damage during operation.
- Move the driver seat forward.
- Inspect the exterior to ensure all bay doors are closed and there are no sags in the awning material.
- Remove any debris from the top of the slide-out room.
- Prior to retracting the slide-out room, start the motorhome. Allow the air bags to fully inflate to normal travel height.
- Retract the leveling system or prepare the air leveling system for travel prior to operating the slide-out.
- Turn the ignition switch OFF. The slide-out room will not operate with the engine running.
- The house batteries are fully charged.
- The park brake must be applied.
- Ensure all people, pets and objects are clear of the slide-out room path.
- Press and hold the switch in the IN position. The slide-out room will move slowly in. To stop the slide-out room, release the switch. To continue the room movement, push and hold the switch in. The motor will change tone when the slide-out room is fully retracted.
- Release the switch.

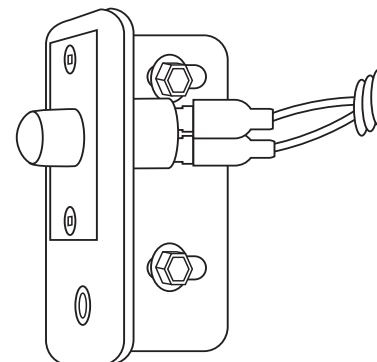


**NOTE: Be sure you have sufficient clearance on the inside of the motorhome (driver seat, etc.) before you retract the slide-out room. If the motorhome has ceramic tile floor ensure the floor is clean before you retract the slide-out room. Trapped dirt or grit under the slide-out room can scratch the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

**Manual Override Hydraulic-Emergency Procedures** - If the slide-out room does not respond from the switch, check that all the safety features are in place:

- The ignition key is off.
- The park brake is applied.
- Shut all bay doors under the slide-out room. If, after checking all the safety requirements, the room does not respond and the hydraulic pump does not operate, one of the bay doors below the slide may have faulty electrical connection at a safety switch or one of the safety switches is out of adjustment. If the pump motor operates but the room does not move, slide-out the generator, check the two fuses adjacent to the hydraulic pump. If the room does not operate it can be retracted manually. Several people (8) are needed to push in the room.

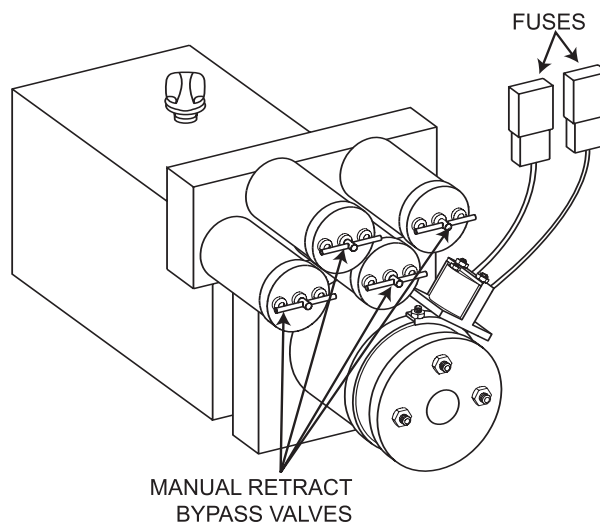
## Manual Override - Hydraulic



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To move the slide-out room manually, retract the motorhome leveling jacks (see "Leveling Jacks"). Locate the slide-out 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.

1. Line up equal distance along the outside wall. Do not push on the flange.
2. In synchronized movements, push the room in with repeated attempts.
3. Close the T-handles when the room is fully retracted.



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**NOTE: The slide-out room is heavy and will 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.**

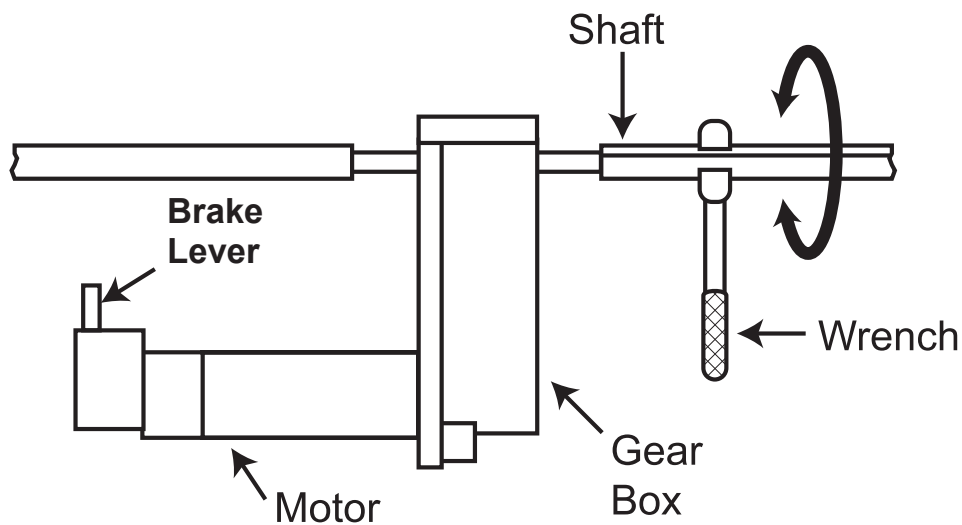
**Manual Override -  
Electric**

**Manual Override Electric Slide - Emergency Procedures** - To move the slide-out room manually, retract the motorhome leveling jacks (see "Leveling Jacks").

1. Open the outside storage compartment doors underneath slide-out room.
2. Remove plastic covers, if applicable, from top of compartments to gain access to drive shafts and motor assembly.
3. To move the slide-out room, move the brake lever on the drive motor counterclockwise to the Release position. Turn the shaft next to the gearbox using a 7/8" open-end wrench.
4. When the room is in apply pressure to the wrench so the room is sealed. Move the brake lever to the Engage position locking the room in place.
5. Take the motorhome to an authorized dealer for service.



**NOTE: The brake lever remains in the Engage position during normal operation.**



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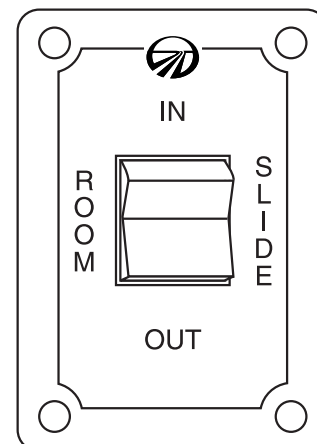
### Bedroom Slide-out-Extending

The bedroom slide-out operates electrically. The bedroom slide-out operates using many safety features to prevent mechanical damage or physical harm. Firmly latch any cabinet doors located adjacent to the bedroom slide-out. Damage to the door or fascia can occur.

#### To Extend the Bedroom Slide-out:

- Confirm that there is at least five feet of clearance outside the motorhome for the slide-out room to extend.
- Ensure the ignition key is in the OFF position.
- The house batteries are fully charged.
- The house battery cut-off switch must be on.
- Locate the control switch for the slide-out, usually on the vanity cabinet.
- Ensure all people, pets and objects are clear of the slide-out room path.
- Press and hold the slide-out room switch in the OUT position. The slide-out room will slowly move to the OUT position. Release the switch to stop room movement. To continue the room movement, push and hold the switch in.
- Release the slide-out switch when the room is fully extended (a change in motor sound indicates extension). The slide-out drive motor will not stop automatically; the switch must be released.
- Level the motorhome with the leveling system.

### Extending - Bedroom



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



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



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



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

**Retracting Bedroom**    **To Retract the Bedroom Slide-out:**

- Check for sufficient clearance inside the motorhome before retracting the slide-out room.
- Clear the floor to ensure there are no objects that could result in floor or slide-out damage during retraction.
- Remove any debris from the top of the slide-out room.
- Prior to retracting the slide-out room, start the motorhome. Allow the air bags to fully inflate to normal travel height.
- Retract the leveling system or prepare the air leveling system for travel prior to operating the slide-out.
- Turn the ignition switch OFF. The slide-out room will not operate with the engine running.
- The house batteries are fully charged.
- The house battery cut-off switch must be on.
- Locate the control switch for the slide-out, usually on the vanity cabinet.
- Ensure all people, pets and objects are clear of the slide-out room path.
- Press and hold the switch in the IN position. The slide-out room will move slowly in. To stop the slide-out before reaching the IN position, release the switch. To continue the room movement, push and hold the switch in. The motor will change tone when the slide-out is fully retracted.
- Release the switch.



**CAUTION: Continuous operation of the slide-out can drain the battery and damage the slide-out motor by overheating. Never move the motorhome without having the slide-out retracted.**

**Manual Override-Bedroom Slide-out**

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

- The ignition key is off.
- The battery cut-off switch is on.
- The house batteries are fully charged.

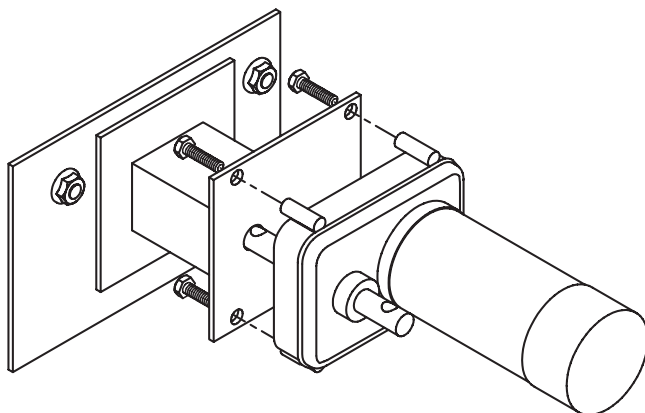
If the slide-out room will not operate after verifying the safety features, check the Slide-Out fuse in the fuse strip marked Domestic of the front electrical panel. If the fuse is good, the bedroom slide-out can be retracted manually.



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

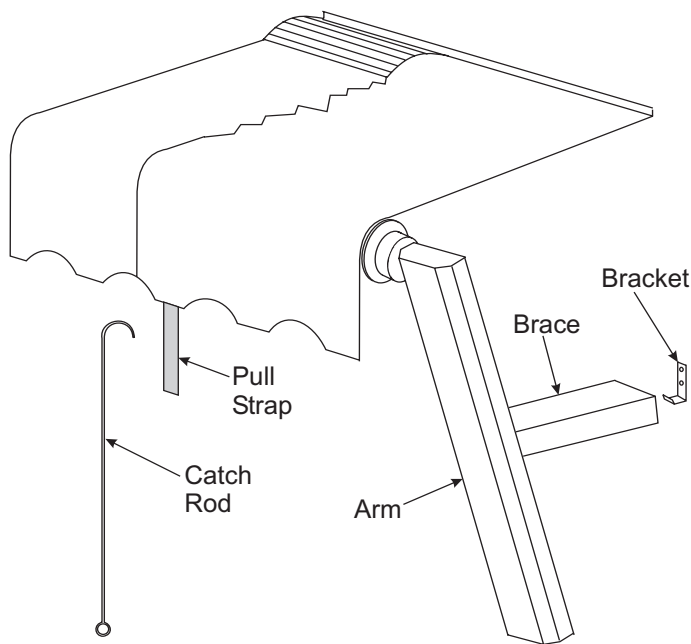
After the previous items have been checked and the room still does not move when the slide-out switch is pressed, follow these simple steps to manually override the slide-out room:

1. Lift up the mattress to gain access to the slide-out cover board.
2. Remove the cover screws and cover to access the motor and mechanism.
3. If the battery power to the slide-out motor needs disconnecting, mark the wire color and location.
4. Unbolt the four fasteners retaining the motor to the flange. Make sure everything is clear of the slide-out room path. Manually push the room into place. Install the motor to retain the room in place.
5. An alternative method is to move the brake lever to the Release position. Place a  $\frac{3}{4}$ " end wrench or socket to the nut at the opposite end of the drive shaft. Crank the room in. Move the brake lever to the Engage position.
6. Take the motorhome to an authorized dealer for service.



090340

## AWNINGS Front Door



020013

### 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.

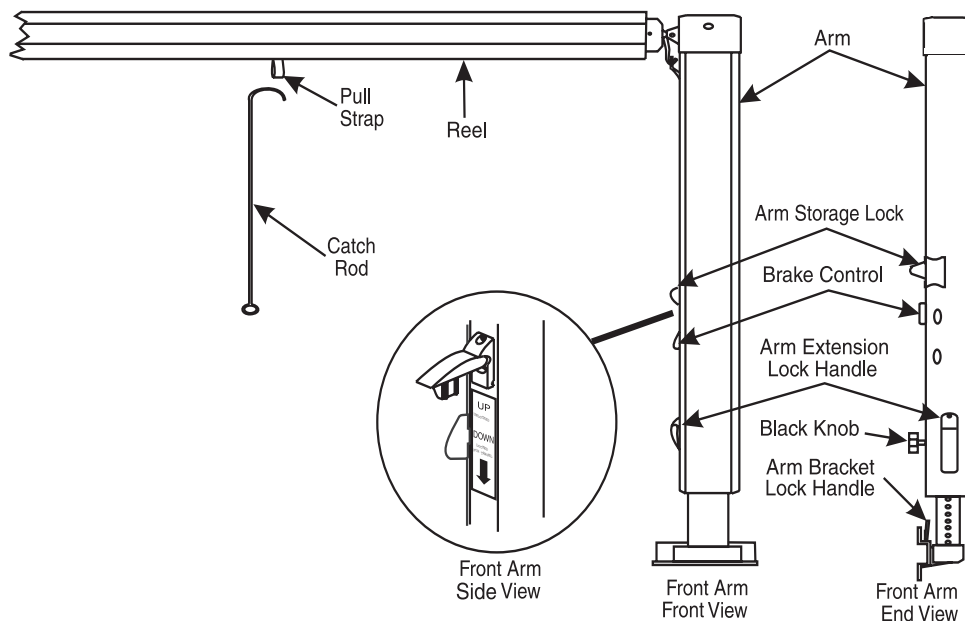


**NOTE: Allow the awning material to thoroughly dry before rolling the awning up. Metal surfaces should be cleaned with soapy water and thoroughly rinsed.**



**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.



020001

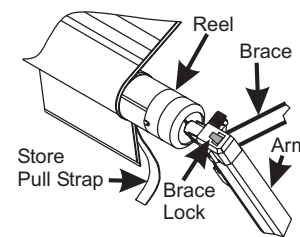
**To Extend The Patio Awning:**

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:**

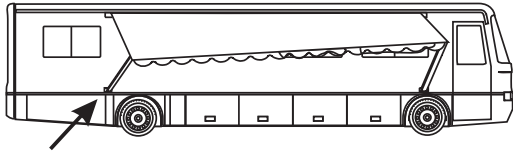
Retract the arms and lower the awning until the arms rest on the lower stop bolts and lock into position. Loosen the two black locking knobs. Release the locking tab on the end of the awning leg. Slide the pull strap to the center of the awning while holding on to the strap. Allow the awning to roll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



130044

### Rain Release Setting



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

020031

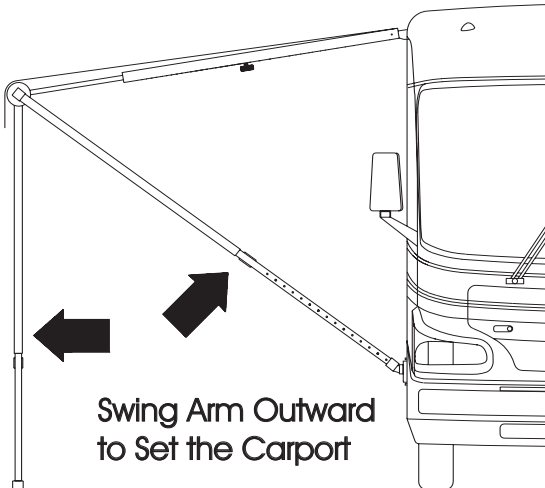
### Rain Release Setting:

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.



130045



**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 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 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 Girard  
(Optional - Not avail-  
able on Triple Slides)**

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.



**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.

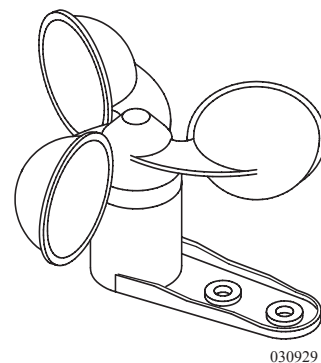
**Manual Operation:**

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

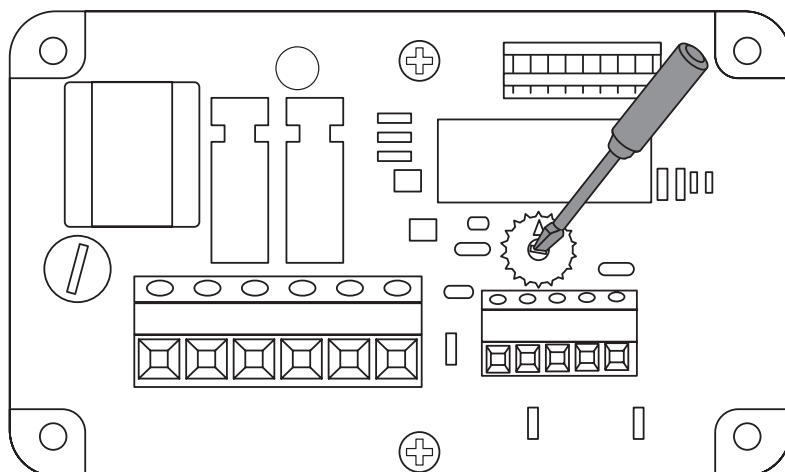
**Wind Sensor:**

To prevent damage, the awning uses a wind sensor that will retract the awning in case of high wind. The wind sensor must have unrestricted access to wind and 110 Volt availability. The wind sensor will override any push button command in case of excess wind. As the sensor rotates, information in the awning's control box interprets wind speed. If wind speed is excessive, the awning retracts. Inside the control box is a potentiometer. The potentiometer can vary the wind speed necessary to retract the awning.

Wind speed sensing is adjustable between 18 and 22 mph. The control box is located in the forward cabinet of the curbside living room overhead. The access panel must be removed to adjust the wind speed sensor.

**To adjust the sensor:**

- Unscrew the cover plate screws
- Adjust the potentiometer clockwise to increase the amount of wind speed needed to retract the awning.
- Adjust the potentiometer counter-clockwise to decrease the amount of wind speed needed to retract the awning.



When the wind sensor attains the predetermined speed, the awning will close completely. The awning will not re-open automatically. It must be opened using the extend button. This feature is intended to prevent possible damage to the awning and related components.

**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.

- 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 subside.

**Tips**

## Slide-out Awning

The motorhome is equipped with a slide-out awning that will automatically roll out when the slide-out room extends. With the slide-out room extended, the awning can be rolled out completely as a window 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.

### To Retract the Awning:

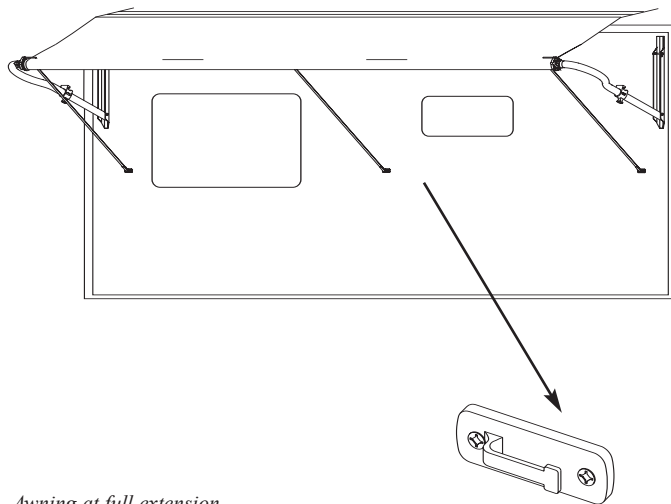
- With a strong grip unhook the awning strap and insert the awning wand into the loop of the strap.
- Carefully allow the spring tension to wind the awning fabric onto the awning roll tube. Do not allow the awning to snap back into place. Damage to the awning or the motorhome may result.
- Secure the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



**CAUTION:** The slide-out 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.



**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-out room and slide-out awning to be fully extended.



*Awning at full extension.*

030817

**SLIDE-OUT COVER**  
*(Triple Slide Only)*

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

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

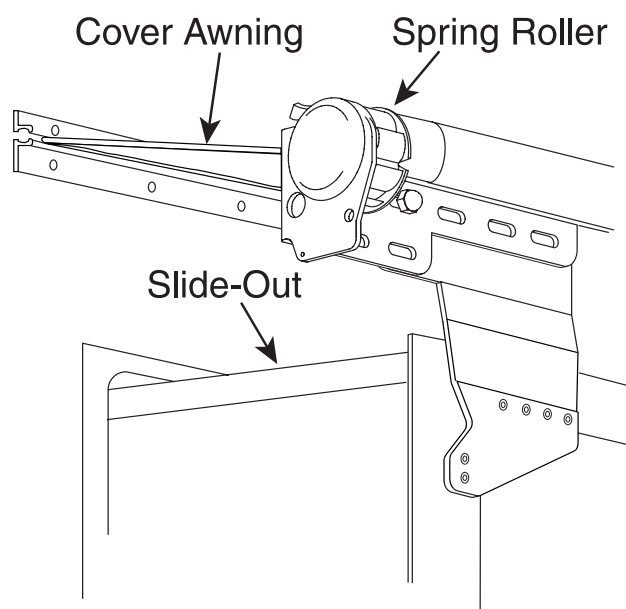


**NOTE: Water may pool on top of the extended cover. As the slide-out is retracted, the water is removed when the cover retracts.**

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



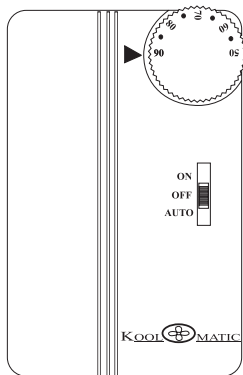
**NOTE: When retracting the slide-out, stop the room approximately halfway. Confirm that the fabric is rolling properly before fully retracting the slide-out.**



030924

## FANS Exhaust Fan

A wall thermostat controls the galley exhaust fan using House 12 Volt DC to operate.



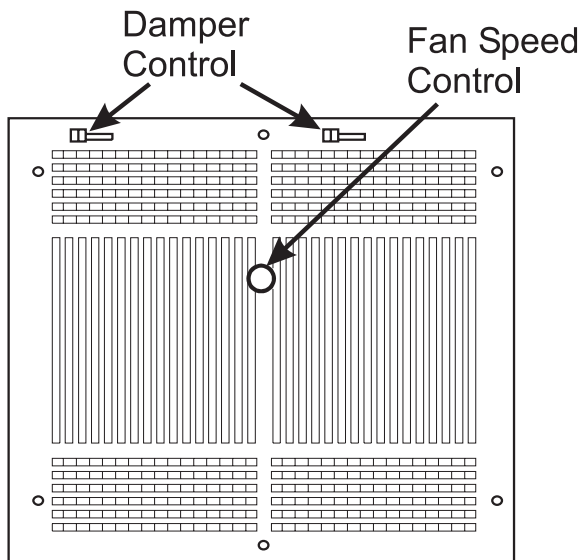
030771

### To Operate the Fan:

- Remove the ceiling grill cover.
- Open the grill dampers.
- Select one of three fan speeds using the round knob on the grill.
- Set the thermostat to ON for continuous airflow or set the thermostat to AUTO and set the desired air temperature for thermostatically controlled airflow.
- To turn the fan off set the thermostat to OFF. Close the grill dampers and install the ceiling grill cover.



**NOTE: Close the grill dampers before installing the grill cover. Failure to close the damper will result in the cover blowing off while the motorhome is moving.**

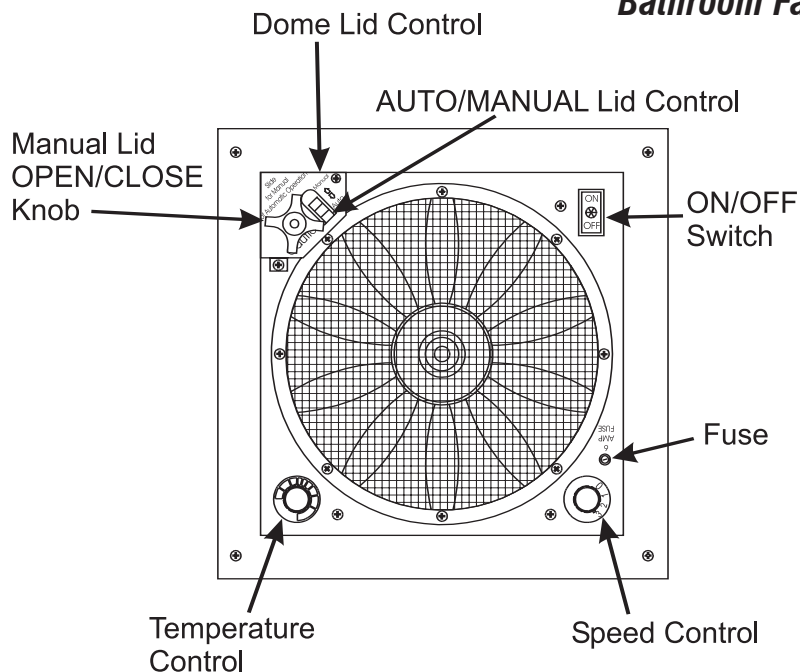


030762



**Bathroom Fan**

The bathroom fan has three speeds with a 0 or off position. A built in thermostat has an operating range of 22° F to 123° F. This is based on inside ambient air temperature. The dark blue zone on the thermostat is cool while the dark red zone indicates heat. The fan lid operates electrically during normal operations. When the lid opens approximately two inches, the fan motor will operate. The fan can be operated manually. Place the thumb switch to the manual position. Rotate the crank handle to close the lid. Return the thumb switch back to the AUTO position immediately after using the MANUAL position.



030761

**To Operate the Fan:**

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



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

**Tips:**

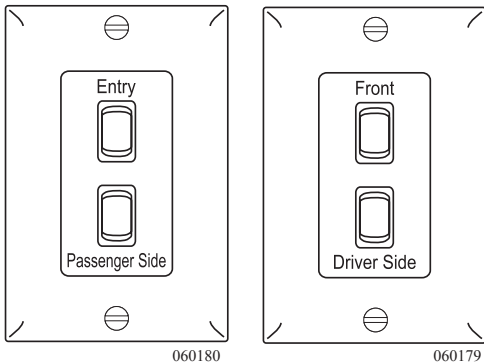
- To keep condensation from accumulating operate the fans when cooking. Condensation occurs naturally from fluctuations in interior and exterior temperatures, humidity and dew point changes, steam from cooking or boiling large amounts of water on the cook top. Shower use is another source of condensation.
- 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. Install the screen after cleaning.
- Slightly opened window(s) on the shaded side of the motorcoach creates the most airflow, especially on hot sunny days. Direct airflow by slightly opening selected windows. Position yourself between the open window and the Fantastic Vent for maximum comfort.

**Tips**

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

## BLINDS - COCKPIT

The cockpit blinds are 12 Volt DC operating from the house batteries. One blind assembly is used for each window located in the cockpit area.



### To Operate the Blind:

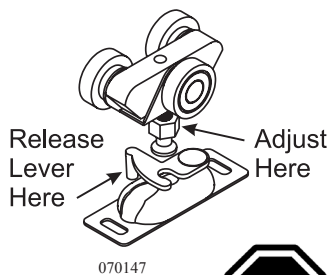
- The house battery cut-off switch must be on.
- Push the switch down to lower the desired blind.
- Push the switch up to raise any blind.



**NOTE: Do not attempt to move or drive the motorhome with any blind in the lowered position.**

## DOOR - SLIDING

The sliding pocket door uses two rollers at the top of each door. During the life of the motorhome the sliding door may need adjusting. The sliding pocket door can be adjusted to close tight against the wall. Locate the small wrench and turn the adjusting screw upward or downward.



If, for any reason, the pocket door needs to be removed, locate the portion that is secured to the top of the pocket door and rotate the small lever outward to release the latches.



**The pocket door rollers should be lubed with just a small drop of oil once a year to help increase the life of the rollers and improve the sliding of the door.**

## SOFA BED CONVERSION

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

### *Sofa to Sleeper*

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

### *Sleeper to Sofa*

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

## DINETTE BED CONVERSION (OPTIONAL)

The booth dinette easily 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.



**WARNING: Do not occupy the booth dinette, if not equipped with safety belts, or the dining chairs while the motorhome is in motion. To avoid personal injury to occupants in case of a crash or sudden stop, chairs must be stored in an enclosed area or secured with tie down straps while the motorhome is in motion.**

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.

## STORAGE - UNDER BED



**NOTE: Do not over stress gas struts by rapidly opening or closing the bed access cover, as this action can damage the struts or mounts. In extreme cold gas struts may not hold the mattress platform in the open position.**

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

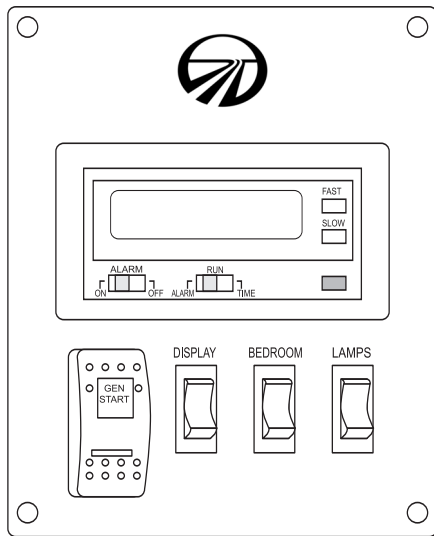
## SUPER SLIDE (OPTIONAL)

- The motorhome must be level before opening.
- There are two latch releases: lift and hold up to release one, pull outward while pulling on the super slide to release the other.
- 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.**

## CLOCK PANEL (BEDROOM)



The clock panel contains various switches and a clock. The clock operates from house battery power.

### To Activate the Panel:

- Turn On the battery cut-off switch.

### Switches:

- GEN ON/OFF = Starts and stops the generator. Also displays generator fault codes.
- Display = Turns on the backlights.
- Bedroom = Turns on the bedroom lights.
- Lamps = Turns on the wall lamps.

### Setting the Clock:

- Slide switch to Time. Use Fast or Slow buttons to set clock time.
- Slide switch to Run.

### Setting the Alarm:

- Slide switch to Alarm. Use Fast or Slow buttons to set alarm time.
- Slide switch to Run. Slide Alarm switch to On. Dot at bottom right of display indicates alarm is active.
- Slide Alarm switch to Off to cancel alarm.



**NOTE: Clock time and Alarm time are erased when the battery cut-off switch is turned Off.**

## RADIO & NAVIGATION SYSTEM (Optional)

The system combines a radio, back-up camera and navigation system. A 7" LCD screen is used as a display for the back-up camera and navigation system programming. The radio screen may be stowed when not in use.



**NOTE: It is recommended to thoroughly read all of the following instructions before attempting to program the system. These instructions are a simple guide to some of the features and are not intended as a replacement for the systems manual. For ease of operation, have a partner read the instructions while programming the system.**



**NOTE: The navigation system is widely used in Europe. Some information services are not available in the United States. Certain screens will not apply.**

**Radio Features Include:**

- Navigation map display.
- On screen programming.
- Back-up camera automatically displays when the motorcoach transmission is placed in reverse.
- CD changer operation.
- Adjustable color and brightness settings.
- Twelve AM and eighteen FM preset stations.
- Adjustable tilt angle.

**Navigation Features:**

- Virtual map of the United States.
- Instant location display.
- Alternate route planning.
- A 12 or 24 hour clock.

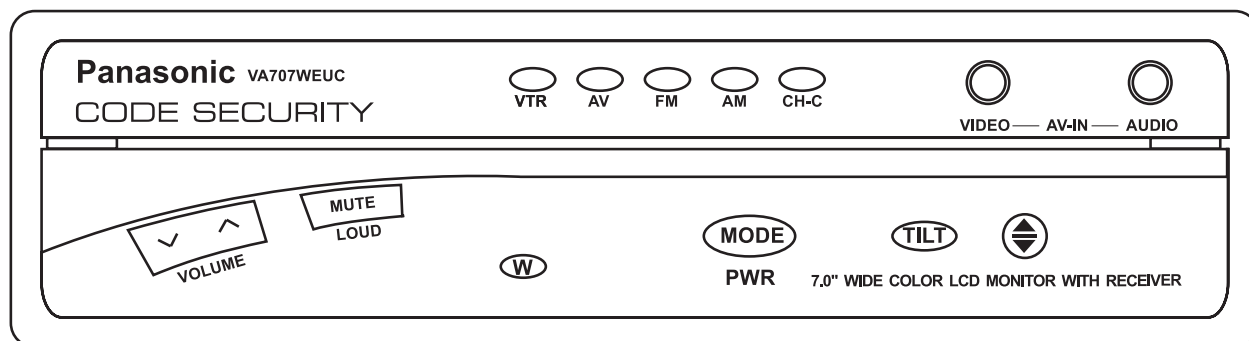


**NOTE: The radio system will operate either with the radio remote control or from the radio push buttons. The navigation system operates with the navigation remote only.**

**Power Requirements:**

- Main battery disconnect switches, located in the battery compartment, must be **ON**.
- House battery cut-off switch, located next to the entry door, must be **ON**.

Operation for the monitor is done from the Panasonic remote or the Panasonic monitor. Push the **OPEN/CLOSE** button. The radio will extend then tilt to an upright position. Press the blue **POWER** button to turn the monitor on. Press the **MODE** button to select between the Radio and CD changer. **VTR** (Video Tape Recorder) and **AV** (Audio/Video) are not used.

**Operation**

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## Back-up Camera Operation

The back up camera displays automatically when the motorcoach is placed in reverse.

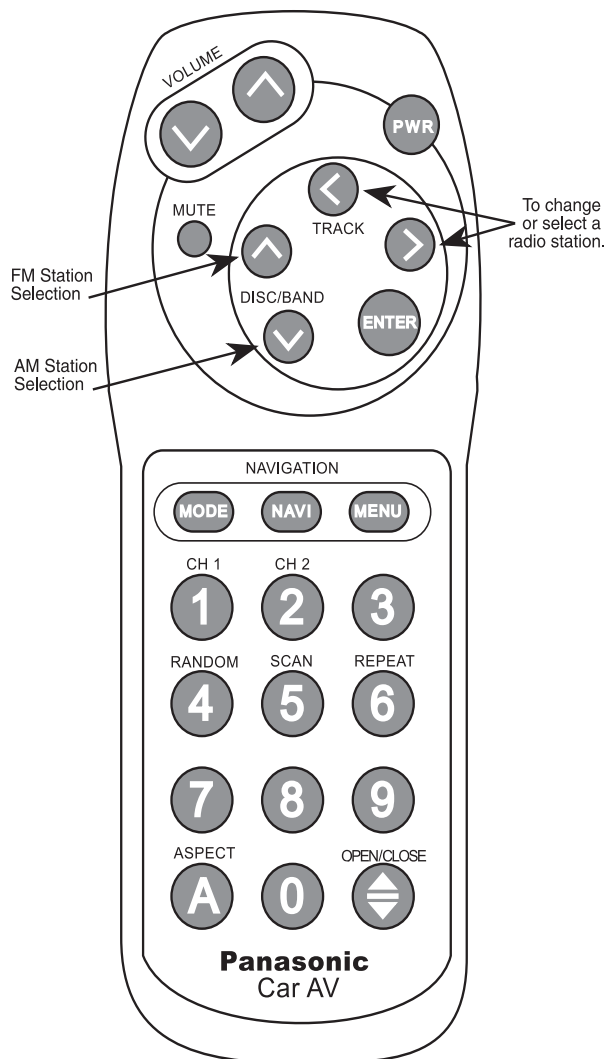
To display the camera continuously, momentarily press the menu button. Use the **LEFT** or **RIGHT** arrows until the hand points to camera. Then press **ENTER**. The selection will be highlighted in yellow.

There are four different aspect ratios of the camera lens, which is displayed in the upper left hand corner of the screen.

1. **FULL**
2. **ZOOM**
3. **JUST**
4. **NORMAL**

Press the **ASPECT** button to change the camera lens ratio, which will obtain a different perspective.

## Radio Operation



### Radio Station Select and Preset:

To display the radio, press the **MODE** or **MENU** button. The **UP** and **DOWN** (**DISC/BAND**) buttons select between the AM or FM library.

- **UP** button is the FM library.
- **DOWN** button is the AM library.

The **LEFT** or **RIGHT** (**TRACK**) buttons change the radio station. Press and hold either button to scroll or press either button momentarily to select an individual station.

### To enter a selected station into memory:

Press and hold any number between 1 and 6 on the radio remote for three seconds.

### To enter programming mode:

Push and hold the **MENU** button approximately two seconds to enter the programming menu. Three categories are available:

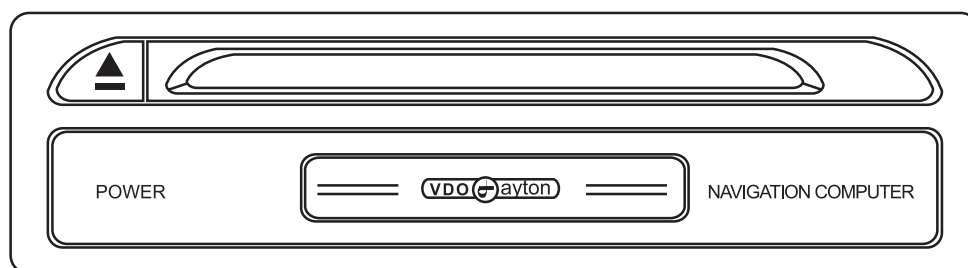
1. **USER**
2. **SOUND**
3. **SCREEN**

Use the **UP**, **DOWN**, **LEFT** or **RIGHT** buttons to scroll through the categories and features. Press **ENTER** to select any area (highlighted in pink) or to select a setting.

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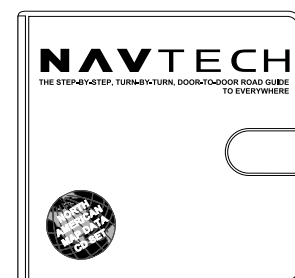
**To set the radio clock:**

- The clock is located under the **USER** section. Continue to scroll up or down to the **CLOCK** section.
- Scroll to the section **CLOCK OFF**: Press **ENTER** to turn the clock display on or off.
- Scroll down to the **ADJUST** section, then press **ENTER**. Use the **LEFT** arrow to set the hour. Use the **RIGHT** arrow to set the minute. Press the **MENU** button when done.
- Scroll down to **SEC RESET**. Press **ENTER** to reset the clocks internal seconds to the beginning of the minute.
- Exit the programming mode by pressing the **MENU** button.

**Navigation System**

020099

The navigation system uses a seven-disc map library to operate. The library is located in the owner's information packet. The system remote control is used to program settings and retrieve information. Only areas that are highlighted are accessible. A planned destination, point of interest from the virtual map and an alternate route may be programmed. When a destination has been programmed, it may be necessary to change map discs while in route. An audio voice will provide instructions.



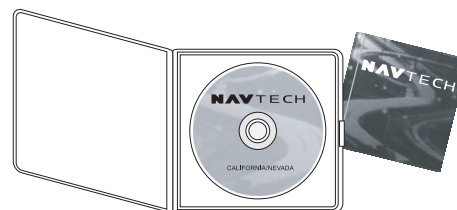
020121



**NOTE: It is recommended to thoroughly read all of the following instructions before attempting to program the navigation system. These instructions are a simple guide to some of the features. It is not a replacement for the system manual. It may be easier to have a partner read the instructions while programming the system.**

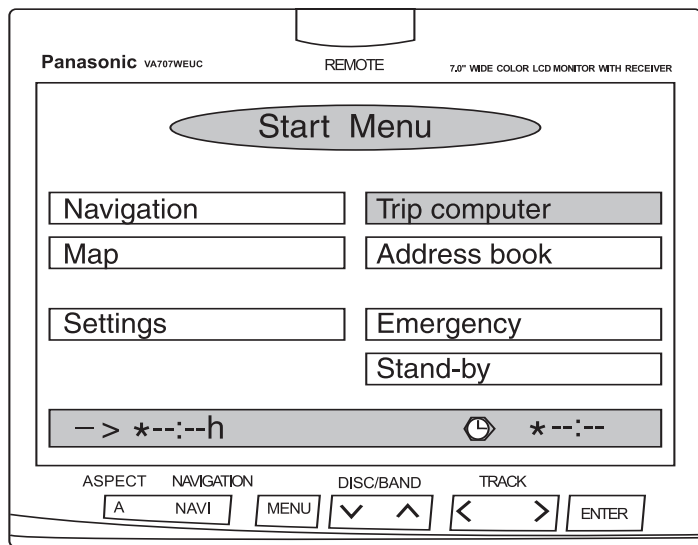
Before beginning navigation system programming, ensure the radio screen is programmed to display the navigation system.

- With the monitor **ON**, enter the radio programming mode by pressing the **MENU** button for two seconds.
- Under the **USER** section scroll up or down to the **NAVI IN** section. Press **ENTER**.
- Using the **LEFT** or **RIGHT** buttons move the hand cursor to **VTR**. Press **ENTER** to select. Selection will be highlighted in yellow.
- Press **MENU** to exit programming mode.
- The navigation system is now able to be viewed.



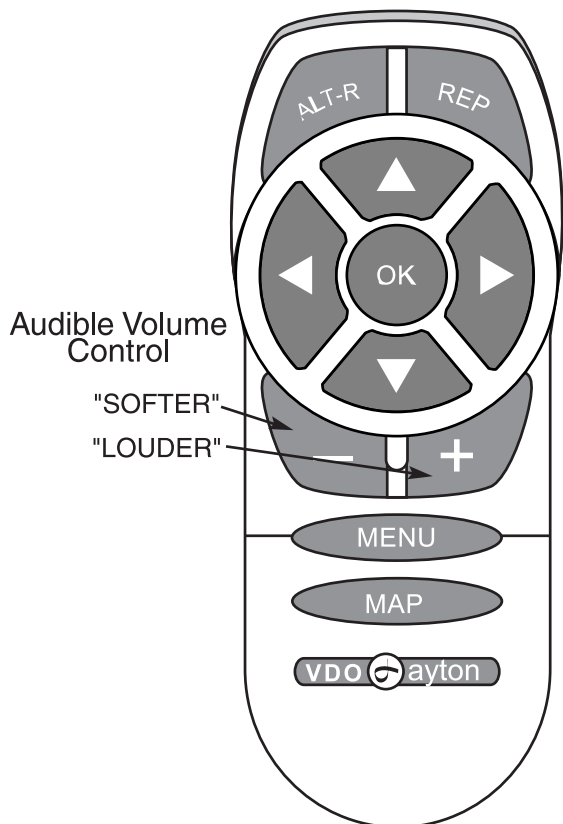
020122

Familiarize yourself with how the system functions; experience is the best teacher. Be patient. The system, in many cases, will select the correct dialogue box automatically. Press **OK** on the navigation remote to enter any dialogue box. The **RETURN** box will return to the previous screen.



020103

- Using the Panasonic remote or the monitor, select **NAVI**.
- A warning statement will appear. **Read and understand this warning.**
- Press the **OK** button on the navigation remote to accept this warning. A statement will appear indicating to install a map disc. Press **OK** to advance to the next screen. A map disc will be installed later.
- To experiment with the Start Menu use the **UP, DOWN, LEFT** or **RIGHT** buttons to highlight the available fields. Only highlighted fields are accessible.
- Press the **OK** button to enter information or to select a different field that is highlighted.
- Proceed to the next step.

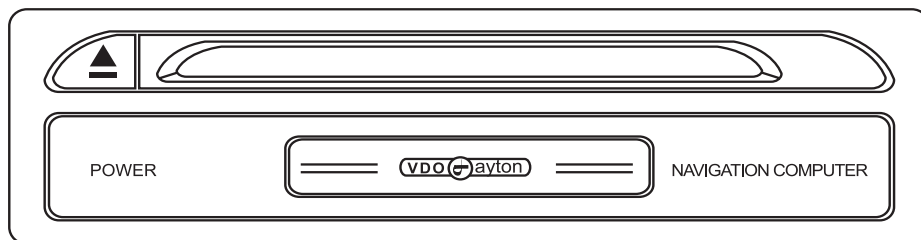


020102



**WARNING: Do not attempt to program, alter or retrieve information while the vehicle is in motion. An accident resulting in injury or death may occur.**





020099

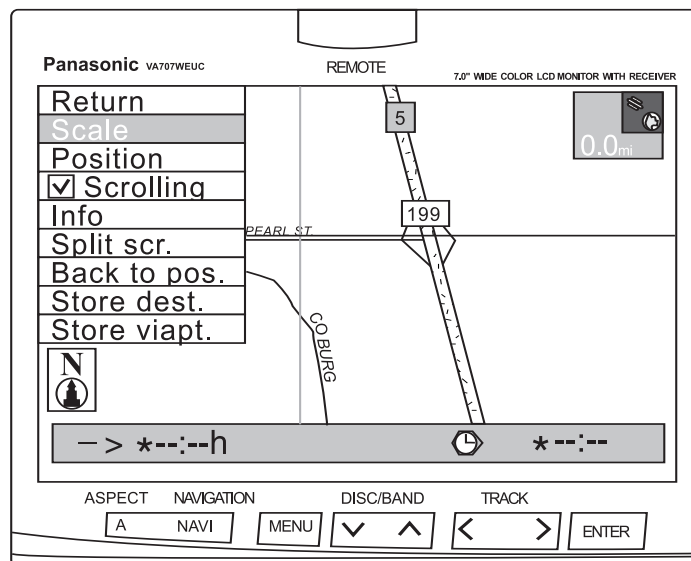
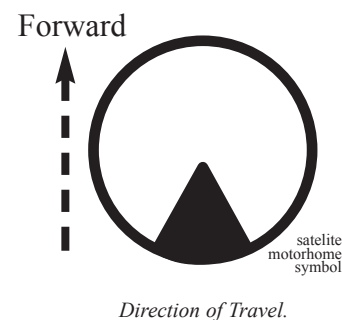
### Programming Guidance to Point of Interest Using Map:

- Insert a map disc with the area of interest or destination, with label up, into the navigation system.
- Using the navigation remote, press the **OK** button.
- Highlight the **NAVIGATION** text box and press **OK**.
- Select **MAP** from the menu and press **OK**.

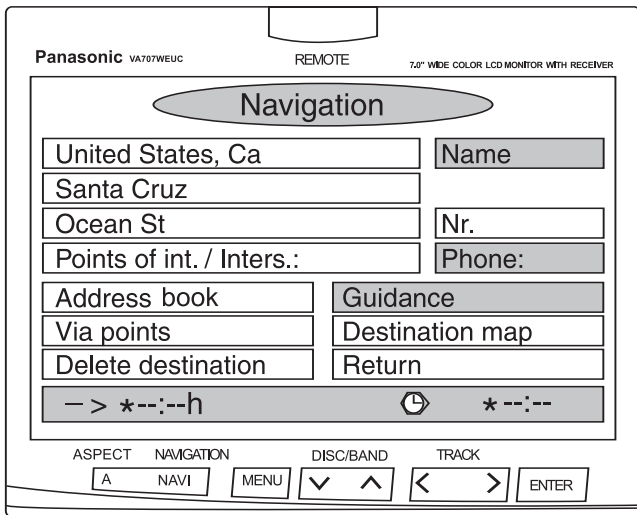
The location of the motorcoach appears as a circle. The black area inside the circle is displaying the forward direction of the motorcoach.

- Browse the current map by using the **UP**, **DOWN**, **LEFT** or **RIGHT** buttons on the remote.
- Press **OK** to open the Function option in the map area (upper left).
- Scroll down and select the Scale option to increase or decrease the field of view from 400 feet to 50 miles. To change the scale use the **UP** or **DOWN** buttons then press the **OK** button. Cities are best displayed with the map scaled to 10 miles.
- When an area of interest is selected from the map, press **OK** and enter the Function option. Scroll down to **DESTINATION** or **STORE DESTINATION**. Press **OK**.
- Press **OK** again and enter the function option. Scroll up and select **RETURN** by pressing **OK**. The system will return to the **NAVIGATION** menu. Scroll to highlight **NAVIGATION**. Press **OK**.

- The Guidance box is automatically highlighted. Press **OK**. The map returns to the screen. The circle indicates your current location. Miles to go and general direction to the location is displayed in the upper right-hand corner. Begin driving. Audio guidance will instruct you to the destination. Adjust volume as necessary.



020113



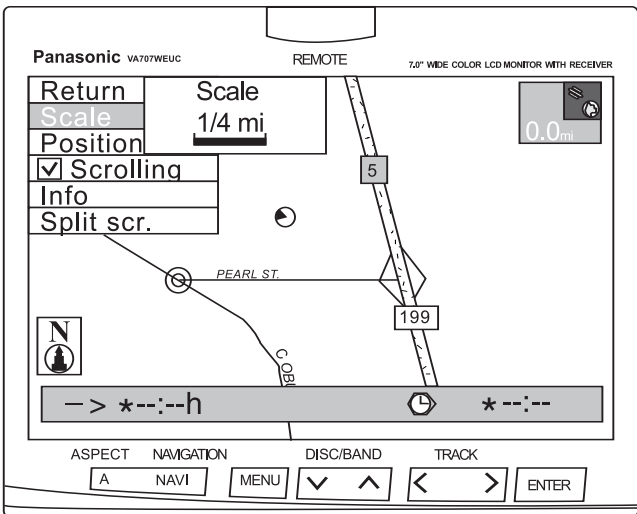
020106

**Programming a known location:**

- Insert a map disc containing the desired location.
- Start from the Main Menu. Use the **OK** button on the remote to enter Navigation dialogue box.
- Enter the **Country** dialogue box. Enter the United States for the location and press **OK**.
- Enter the **City** dialogue box. The alphabet will appear. Use the **UP**, **DOWN**, **LEFT** or **RIGHT** buttons to orient the correct letter. Select each letter. If a mistake is made, press **Delete**. If the name of the city is more than one word, use the **Space** button. If the List box is highlighted after the city name is entered, the system will ask which city as there may be more than one city with that name.
- Enter the **List** box and scroll to the correct city and select by using the **OK** button.



**NOTE:** The system will automatically narrow the field of search by eliminating non-essential letters. Some roads or small cities may not be listed. If this is the case try scrolling the map to locate the desired location. If the location is mapped use the Map set of instructions to obtain guidance.



020104

- Enter the Road dialogue box. Select each letter. If the name of the road is more than one word use the Space button.
- If the street number is known enter the **Nr** dialogue box. The number screen will appear. Enter the address.
- Select the Guidance dialogue box. It will be returned to the map. The circle indicates current location. Miles to go and the general direction to the location is displayed in the upper right-hand corner. Begin driving. Audio guidance will instruct you to the destination.
- The Destination Map will display the preset destination with the map scaled to ¼ mile.
- Enter the Function dialogue box. Use the Scale feature to scale down the map size increasing map definition.



**NOTE:** Complete and return the warranty registration form located in the map library. Map discs will be updated periodically. When any or all updated discs are released, one full set will be sent free of charge to the registered owners.

## **CITIZEN BAND RADIO (CB)**

The Citizens Band Radio (CB) is used for two-way, short-distance business and personal communications. The CB radio can be useful when traveling if operated properly.

Some limitations may apply to the use of the CB radio. The CB radio is actually a low-powered transmitting device that works well when within a line of sight of the person being spoken to. Many factors can limit the range of the CB radio, including the following items: terrain, trees, other vehicles, weather conditions and/or the power of the radio and its antenna. As was previously stated, only one radio can occupy the same airwaves at one time. Consequently, the radio with the greatest power and best antenna will always overpower the weakest one.

Some motorhome owners turn on the CB radio first thing and leave the CB on the entire trip. An obvious reason for doing so is the ability to be informed during transit of potential road hazards. Truckers or other CB owners can inform a motorcoach driver of these types of hazards. The CB can be a very useful tool if, for example if there are problems with the tow car.

### **The CB Radio can assist in the following:**

1. Warn of traffic tie-ups ahead.
2. Provide weather and road information.
3. Provide help fast in event of emergency breakdown.
4. Suggest good spots to eat and sleep.
5. Make long trips more interesting and fight driver's fatigue.
6. Provide direct contact with office or home.
7. Make friends during travel.
8. Provide "local information" to find your destination.
9. Communicate with friends and family during outdoor activities.
10. Help law enforcement officers by reporting drunk and reckless drivers.

### **Volume Control:**

The radio has an off/on volume control switch. It must be turned on and the volume adjusted to a comfortable range. The volume control deals strictly with the volume level in receiving (what is audible) and has no effect on the transmission level (how loud it will transmit over the airways).

### **Squelch:**

Squelch control is also available. This control is first turned up to a point where static or background noise is heard and then reduced to a point where the static disappears.

## ***CB Components***

**Channel Selection:**

There is also a channel selector which is used to select the channel of operation (1 through 40). For most highway uses, channel 19 is used. This channel is used by most truck drivers. It is useful to monitor channel 19 to obtain information concerning traffic delays, construction, lane closures, etc. When traveling with other CB users, it is wise to use a channel other than 19 to allow for conversations to be made without interruptions.

**CB Microphone Function:**

The microphone is the key to using the CB radio. A push button switch is located on the side the microphone. When the button is pressed, the CB radio switches from a listening device to a transmitter. Anything spoken into the microphone is transmitted over the airway of the channel selected. To carry on a conversation, after each outgoing transmission, release the push button switch in order for a reply to be received. The radio cannot receive and transmit at the same time. Conversations should be brief as only one CB radio can occupy the airwaves at one time.

---

**Operating Procedures**

**Operating Procedure for Emergency Communications:**

1. For emergency communications, set the CB radio to Ch. 9. For non-emergency communications, select the desired channel by pressing the Channel up/down-tuning buttons until reaching the channel desired.
2. When asking for emergency aid on Channel 9, request a React base (if available) to respond by saying "Break Channel 9 for a React base" and provide the CB Distress Data (called "**CLIP**"):

**CLIP**

**CALL SIGN** - Identify yourself and vehicle.

**LOCATION** - Be exact.

**INJURIES** - Number. Type. Are persons trapped?

**PROBLEM** - Give details and be specific about the assistance needed. Transmit the "CLIP" repeatedly so the nearest monitor may be of assistance.



**NOTE: Channel 9 is for emergency use only.**

**CB Radio Rules of Use:**

1. Do not carry on a conversation with another station for more than five minutes at a time without taking a one-minute break to give others a chance to use the channel.
2. Do not blast others off the airway by overpowering them with illegally amplified transmitter power or illegally high antennas.
3. Do not use the CB to promote illegal activities.
4. No profanity allowed.
5. Do not transmit music over the CB airway.
6. Do not use the CB to sell merchandise or professional service.

**CB Transmission Range:**

***Transmission***

All CB radios transmit using the maximum FCC allowable power output of four watts. The type of antenna used, its condition, location and physical length, and the proper matching of the Standing Wave Ratio or SWR can effect the amount of power that actually goes out.

Other factors that can enhance or detract from the effective range include: the environment that the CB is used in, interference from other CB radios, tall buildings or trees and certain atmospheric conditions.

If all negative environmental factors were eliminated, a properly set up base station could transmit up to 10 to 15 miles. A mobile unit could transmit five to seven miles, and a hand held unit up to approximately two miles with the only variable being the type of antenna used with the unit. Unfortunately, optimum conditions do not always exist and the range of the unit will be less dependent on the conditions it is operated in.

**CB Radio Antenna:**

A good antenna is necessary for optimum performance of the CB radio. The type of antenna used depends upon the type of CB and its intended use. Purchase the best quality antenna for the greatest impact on the overall performance of the CB radio.

Mobile CB antenna come in many different sizes and configurations for just about any need or application. In general, the longer the antenna the better the performance, although the longer lengths of 102 inches may not be practical for most people. Different types of antenna mounts are available. Some antennas mount to the roof gutter or the mirror mount. Some mount to the vehicle bumper. Some have a magnet mount that attaches to any metal surface on the vehicle body. If the mobile radio is equipped for weather reception, a center-loaded antenna will fit that requirement. If good weather reception and regular CB distance is a priority, a dual band antenna is recommended. For distance only, a base loaded antenna is recommended. If the vehicle does not have a metal body, a groundless plane antenna is recommended. These antennas are designed for special applications where grounding the antenna is a problem.

## **Standing Wave Ratio**

### **SWR (Standing Wave Ratio):**

In order to set the SWR (Standing Wave Ratio) on the unit, the CB radio must be equipped with a built-in SWR meter or an external SWR meter. Using an external SWR meter will also require a short piece of co-axial cable with CB plugs on both ends. Attach the external SWR meter according to the instructions included with the meter.

### **To Set the SWR (Standing Wave Ratio):**

- Make sure the antenna is properly mounted and grounded. If setting the SWR on a mobile antenna, make sure all vehicle doors are closed, all other accessories are turned off and the vehicle is in an open area away from any obstructions when setting the SWR.
- Set the CB radio to the CB mode and to channel 20. On Cobra radios with built in SWR meter set the S slash RF, SWR, Cal switch to the Cal setting.
- Push and hold the "push-to-talk" button on the microphone. This causes the needle on the SWR meter to swing to the right. Adjust the needle to the calibration mark on the meter by turning the Cal knob.
- Continue pressing the push button on the microphone and move the "S" slash RF, SWR, Calibration knob to the SWR setting. External SWR meters will have to be set to the SWR setting. This will cause the SWR meter's needle to swing to the left. A reading of 3 or above will impact the performance of the radio and should be adjusted downward. A reading of 1.5 is average and acceptable under most conditions. A reading of 1 is ideal.

### **Adjusting the SWR Setting:**

To adjust the SWR setting, try either extending or retracting the antenna in small increments while repeating procedure after each change until the best setting available is reached. If retracting the antenna is necessary to obtain a better reading, it is acceptable to clip the whip in small increments to obtain the proper length. Do not cut more than  $\frac{1}{4}$  of an inch at any given time, as the adjustment needed may be very small.

Check the SWR reading on channel 40 and channel 1. If either of these channels is above 1 to 3.0, adjust the antenna so that the SWR setting is acceptable for that channel while maintaining the lowest possible reading on channel 20. It is important to note that adjustments made for the optimum SWR setting on one channel will affect the SWR setting of another channel on the other side of the dial. If channel 1 is optimized, channel 40 will suffer. Try to balance adjustments to optimize across all channels.

If an acceptable reading cannot be obtained, recheck the antenna mounting and grounding. A properly ground antenna is necessary to obtain an acceptable SWR reading.

**Weather Alerts****Weather Alerts:**

A Weather Alert warns of a weather emergency as defined by the National Oceanic and Atmospheric Administration of the U.S. Department of Commerce commonly known as NOAA.

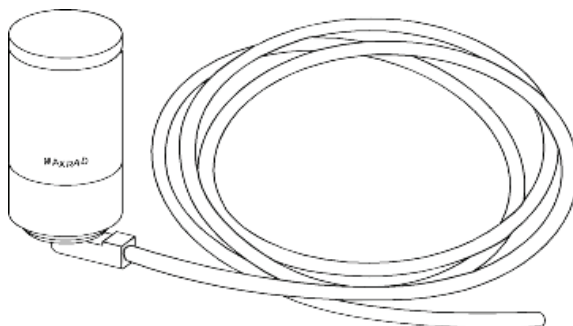
NOAA maintains a system of approximately 380 stations throughout the United States that transmit continuous broadcast of the latest local weather conditions 24 hours a day, 7 days a week. A broadcast is announced on one of seven high-banded, FM frequencies. It is tailored to suit the needs of local listeners.

During severe weather the normal NOAA forecast is interrupted with special warning messages. The NOAA then transmits a 10 second signal that can be picked up on CB radios equipped with the Weather Alert feature. This signal can be picked up whether the radio is turned on, off or in the CB mode. During the transmission of a weather emergency, the radio will emit a high pitched tone to alert the user to tune in to one of the weather channels and listen for emergency information.



**NOTE: It is normal for a Weather Alert CB Radio to beep for a second when the unit is turned on or when power is first applied to the unit. This is only a self-check tone.**

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 driver's side window and the windshield. The coiled antenna lead should be located toward the front firewall, directly behind the instrument cluster.

**CELL PHONE  
ANTENNA**

030866

## ENTERTAINMENT SYSTEMS

### Television (front) w/Lockout Feature

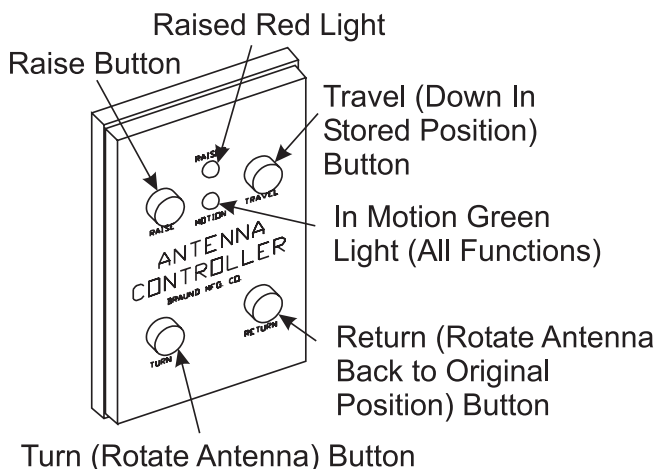
The motorhome is equipped with a remote control color television located above the pilot seat. The ignition switch controls the outlet for front TV so that the front TV can only be viewed while the vehicle is at rest. The TV operates from 120 Volt AC provided by shore power, the generator or the inverter. 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.

### Television Antenna

The motorhome is equipped with a power television antenna with built in electronics that uses 12 Volt DC to "boost" signal strength. Weak or fuzzy signals can be amplified by turning on the antenna boost switch. The antenna and booster work together providing the best possible picture for most situations. Signal amplification under certain conditions can make the picture worse. The television station sends 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.



**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 an ANT UP warning light on the dash panel. When this light is lit lower the antenna before moving the motorhome.**



030747

#### 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 illuminates when the antenna is in motion. The red light illuminates 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.

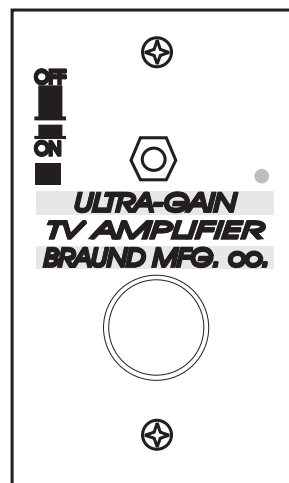


**Antenna Booster Operating Instructions:**

- 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 amplifier may not improve the signal.
- 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.



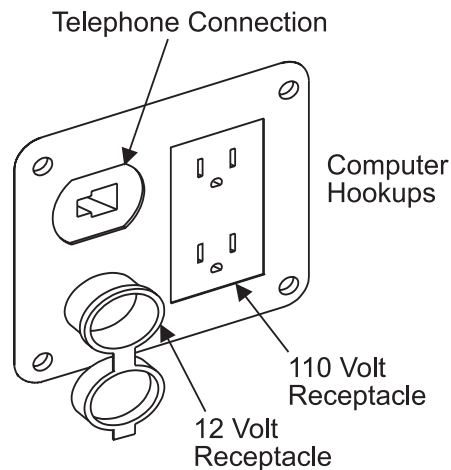
030752

**Troubleshooting the Coax Wire:**

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

## Hook-ups TV Cable, Computer & Telephone

The motorhome is equipped with cable TV and telephone hook-ups, located in the electrical service center. For convenience, there are auxiliary outlets located at the co-pilot seat and on the optional computer desk. This connection is set up for a telephone or laptop computer.



## TV OPERATION

### Video Selector Box (AVS200)

The televisions have many different input signals available. Depending on preference these can vary from selecting between a satellite dish, DVD (Digital Video Disc) player and a roof antenna just to name a few. A video selector box interfaces these different input signals from the various components to the televisions and VCR.

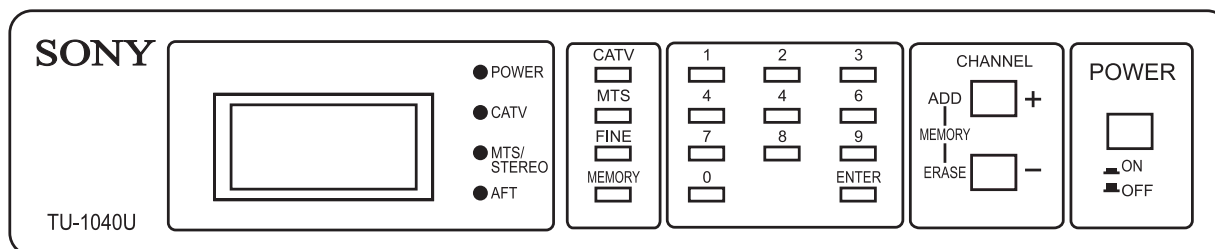
The video selector box requires 120 Volt AC supplied from shore power, generator or the inverter. The red LED will illuminate when the system is on. These instructions are a quick start guide and not a replacement for the individual component manuals. For detailed component operating instructions refer to their respective manual.



**NOTE: The entertainment system requires 120 Volts AC to operate. Hook to shore power, start the generator or turn on the inverter. The satellite system requires 12 Volt DC to operate. Turn on the battery cut-off switch.**



**NOTE: It is recommended to become familiar with the individual components.**

**Channel Selector Box**

030824

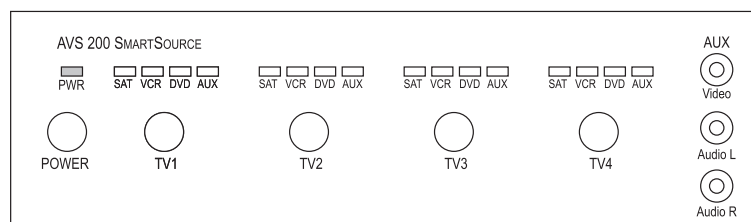
This is the Channel Selector Box. It can be used for audio/video input when viewing the TV from the Roof Antenna or Bay Service Cable. When using the Channel Selector Box for audio/video operation select Composite using the Y/C button on the TV remote.

- When changing channels on the box, select the desired channel then press enter immediately, otherwise the channel selected will not be entered.



**NOTE: The DSS remote works best for changing channels.**

This is the Video Selector Box. It interfaces the different input signals (VCR and DVD) to the televisions. The Video Selector Box has 4 sections TV numbers 1-4. Number 4 is not used. Above each TV section are the different inputs available from the different components. An additional set of A/V jacks (3) is located on the front of the Selector Box. These may be used hook-up a video game box or a video camera.

**Video Selector Box**

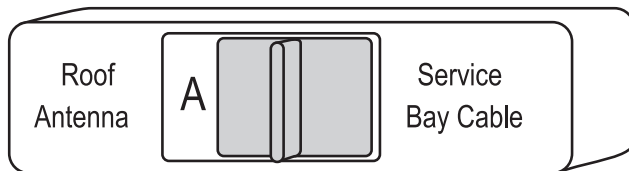
030922

- Power button turns the power on or off.
- TV1 - Selects the input for the front television.
- TV2 - Selects the input for the rear television.
- TV3 - Selects the input for the optional bay entertainment system.
- TV4 - Not Used.
- A/V Jacks (3) - Video input (Yellow), Right channel (Red) and Left channel (White) are inputs for audio hook-up.

Listed above each of the TV sections are the input select buttons:

- SAT - Satellite
- VCR - Video Cassette Recorder
- DVD - Digital Video Disc
- AUX - A/V Input Jacks

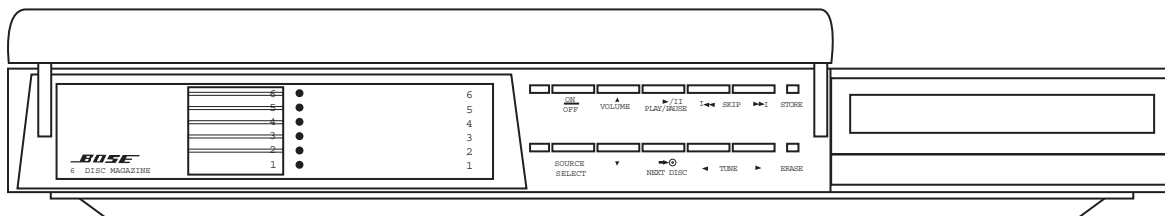
### A/B Selector Switch



030920

This is the A/B selector switch. The A/B switch is used to select between the Roof Antenna and Service Bay Cable (Shore Cable).

### Home Theater System



030860

#### Bose Lifestyle 30:

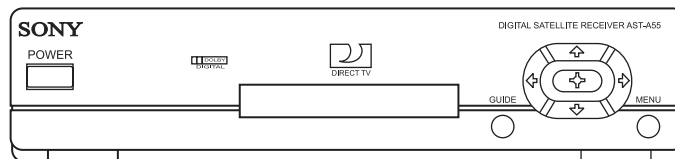
This is the Bose Lifestyle 30. It is used exclusively for audio of the Home Theater System. All audio signals from each of the individual components VCR, DVD and Satellite Receiver go to the Bose system. The Bose system also has AM, FM and Compact Disc. Two sound Zones are available. Zone 1 is the interior speakers. The system automatically defaults to Zone 1 when turned on. Zone 2 is the Bay Entertainment speakers.



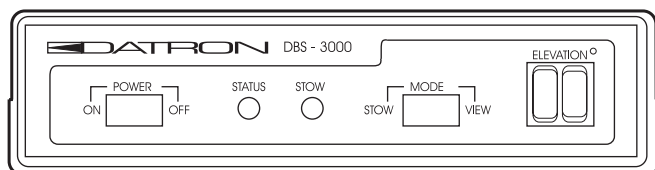
**NOTE: Zone 1 and Zone 2 will not operate the same time.**

### Satellite Equipment

The satellite receiver is the same component used with either the DBS 3000 or the DBS 4500 in-motion system. The receiver must be turned on for the system to function.



030932



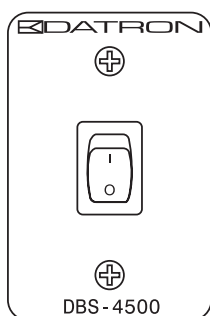
030806B

### DBS 3000 Antenna Control Unit:

This device raises or stows the satellite antenna. Adjust the elevation angle to speed the process of the satellite dish obtaining the signal. Instructions on how to obtain the correct elevation angle for a given location are in the DSS manual.



**NOTE: The status light flashes rapidly while the dish is in motion.**



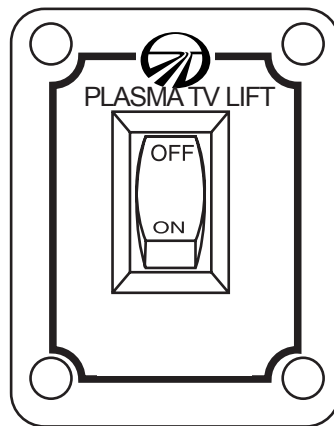
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### DBS 4500 In Motion System:

Turn on the switch to activate the dish inside the dome. If the motorhome is parked, the switch can be turned off after the system has obtained the signal.

These components are easily recognized. The DVD player works much the same as a Compact Disc Player. The VCR can also be used for audio/video operation for the TV. Using the VCR audio/video operation will simplify TV operation especially when operating other components in the Home Entertainment System. The VCR will automatically turn on when a tape is inserted. Refer to the component manual for detailed features and instructions.

### VCR & DVD



060147

**To Lower or Raise the Television:**

An on/off switch controls TV movement.

- Turn the switch on to lower the TV.
- Turn the switch off to raise the TV.



**NOTE: Instructions are referenced to the front TV. Select the proper input signal for the TV viewed.**



**NOTE: Refer to each component manual for in-depth operating instructions.**

**To Watch the Television from the roof antenna or shore cable:**

- Turn the On/Off switch to On lowering the television. Turn on the TV.
- Raise the antenna.
- Using the Bose remote turn on the Bose home theater and select Tape.
- Select either Roof Antenna or Service Bay Cable (Shore Cable) on the A/B switch.
- Turn on the Video Selector Box. Set TV 1 to VCR.
- Turn on the VCR. Using the VCR, select the desired channel for the TV.
- Adjust volume using the Bose remote.



**CAUTION: Turn the TV off before stowing.**



**NOTE: The flat screen TV requires an adequate signal for proper operation. Audio is through the home theater system only.**

**To Play a Video Tape:**

- Turn the On/Off switch to On lowering the television. Turn on the TV.
- Using the Bose remote turn on the Bose home theater and select Tape.
- Turn on the Video Selector Box. Set TV 1 to VCR.
- Insert tape. If necessary, push Play.
- Adjust volume using the Bose remote.

**To Watch the Satellite:**

- Turn the On/Off switch to On lowering the television. Turn on the TV.
- Turn on the Bose home theater and select Video 2.
- Turn on the Video Selector Box. Set TV 1 to SAT.
- Turn on the Satellite Receiver.
- (DBS 3000) Set the proper elevation angle. Turn on the ACU (Antenna Control Unit) Switch to View.
- (DBS 4500) Turn on the DBS 4500 switch.
- Adjust volume using the Bose remote.

**To Play a DVD:**

- Turn the On/Off switch to On lowering the television. Turn on the TV.
- Using the Bose remote turn on the Bose home theater and select Aux.
- Turn on the Video Selector Box. Set TV 1 to DVD.
- Turn on DVD player. Open tray and insert disc. Push play.
- Adjust volume using the Bose remote.



**NOTE: The satellite remote can be programmed for Infrared (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: Inclement weather conditions may adversely affect the acquisition of a satellite signal. Degraded audio and video signals through the receiver will result.**

## TELEVISION - EXTERIOR (OPTIONAL, BAY )

The optional bay television is a monitor only. All tuning is accomplished through the VCR. If desired the stereo system may be played through the outside speakers. It is important to become familiar with all components and how they function.



**NOTE: The entertainment system requires 120 Volts AC to operate. Hook to shore power, start the generator or turn on the inverter. The satellite system requires 12 Volt DC to operate. Turn on the battery cut-off switch.**

### **Antenna or Service Bay Cable:**

- Turn on the bay television. Press the Input button on the front of the television until Video 1 displays.
- Turn on the Video Selector Box. In the TV 3 group select VCR.
- Select Antenna or Service Bay Cable on the A/B switch.
- Turn on the VCR. Using the VCR remote select the desired channel. The VCR remote can be used outside for command functions.
- Adjust the volume on the bay television.
- If necessary raise and rotate antenna to obtain best picture or hook to shore cable.

### **Playing a VCR tape:**

- Turn on the bay television. Press the Input button on the front of the television until Video 1 displays.
- Turn on the Video Selector Box. In the TV 3 group select VCR.
- Insert a tape into the VCR. If necessary push Play. The VCR remote can be used outside for command functions.
- Adjust the volume on the bay television.

### **Watching the satellite dish:**

- Turn on the bay television. Press the Input button on the front of the television until Video 1 displays.
- Turn on the Video Selector Box. In the TV 3 group select SAT.
- Turn on the Satellite Receiver.
- (DBS 3000) Set the proper elevation angle and switch ACU (Antenna Control Unit) to View.
- (DBS 4500) Turn on the DBS 4500 switch.
- Adjust the volume on the bay television.



**Playing a DVD:**

- Turn on the bay television. Press the Input button on the front of the television until Video 1 displays.
- Turn on the Video Selector Box. Set TV 3 to DVD.
- Turn on DVD player. Open tray and insert disc. Push play.
- Adjust the volume on the television.

**Using the external speakers:**

All stereo functions can operate the external speakers. The external speakers are referenced as Zone 2 in the display of the stereo system. An additional stereo remote operates Zone 2 functions. Zone 2 can also be obtained using the On/Off button.

- Using the second remote press the desired function or press and hold the On/Off button until Zone 2 displays on the stereo. Use the Source button to obtain the desired source. All sequences of operation in Zone 2 are the same as Zone 1. Refer to the instructions above when using the DSS, DVD and VCR.



**NOTE: Operation of the Video Selector Box in Zone 2 is the same as Zone 1.**

**NOTES**

# Signature

## SECTION 6 WATER SYSTEMS

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## INTRODUCTION

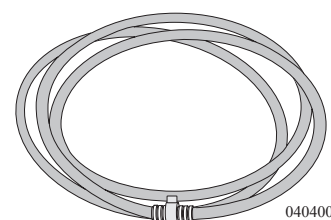
This section contains information and knowledge for the operation and care of the various water system equipment found in the motorhome. The motorhome is equipped with two separate water systems. Optional water equipment will also be discussed, so not all information may be applicable to the motorhome. More detailed information with **CAUTION** or **WARNING** instructions for the various equipment, other than what is found in this section, can be found in the manufacturer’s manual in the owner information box.

It is hard to imagine how much water is used by the average person every-day. Newcomers to a self-contained motorhome soon discover water does not last very long unless consumption is drastically reduced. For example, less water can be used for showering if the shower is turned off while soaping down, then turned back on to rinse. This way a good shower uses a two gallons or less of water. There is plenty of water to meet personal needs when you modify habits.

### Fresh Water System:

The fresh water system consists of the fresh water tank, water pump, gravity fill connection, water filter and a city/fresh water connection.

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



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

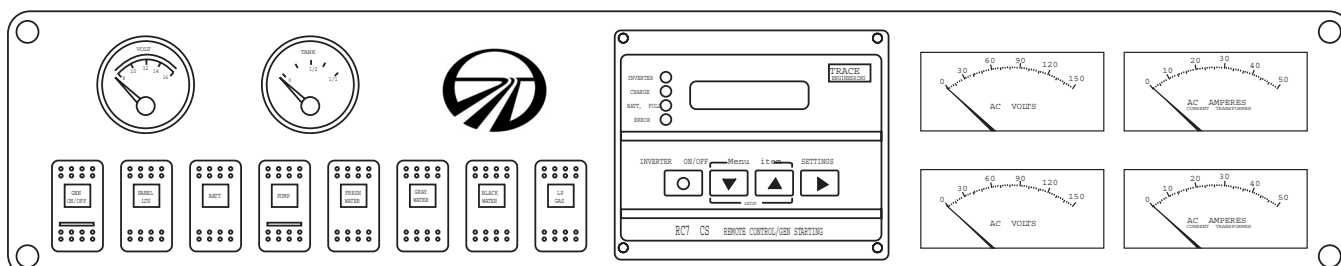
### Waste Water System:

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

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. AC and DC voltage indicators, water pump on/off switch, generator start/stop switch and the RC7GS inverter remote panel.

## MONITOR PANEL Measurement & Calibration

**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.

080243

**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:**

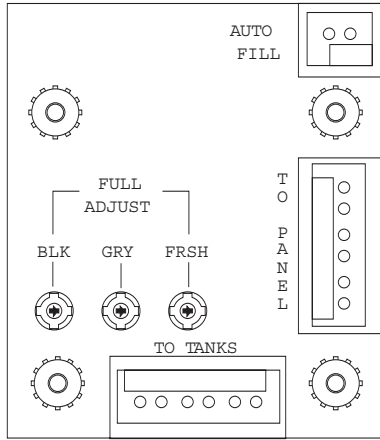
To measure the level of any holding tank, push the switch on the monitor panel corresponding to the tank you wish to measure.



**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.



080245

Test Points on Monitor Panel



monitor adjuster

Monitor Adjustment Tool.

- 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 SENSORS

- Connect a potable water hose to the city/fresh water hook-up located in the service center on the roadside of the motorhome.
- Turn the city water/tank fill valve to the Fresh Water Fill -Open position.
- Turn on the water supply.
- The water pump should be off.
- The water tank is full when water comes from the vent opening located on the curb-side of the motorhome. Shut the water supply off as soon as possible.

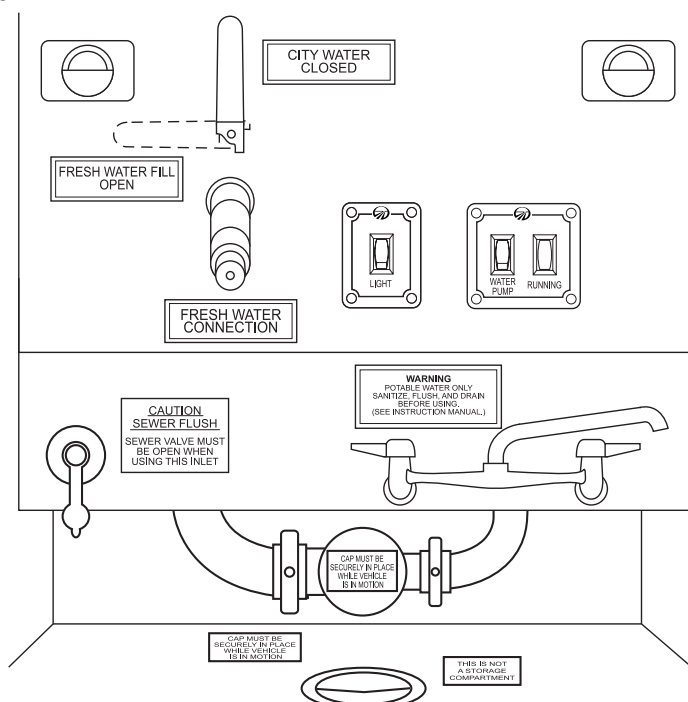


**NOTE:** When connecting the motorhome to fresh water be sure to use a hose manufactured and labeled for potable water to ensure that the hose will not flavor the water. Monitor the tank filling process at all times. Use the inside monitor panel as a tank fill guide.



**NOTE:** When filling tank do not leave hose unattended.

## WATER TANK - FRESH FILL



The valve must be in the "Fresh Water Fill Open" position (as pictured) for fresh tank fill.

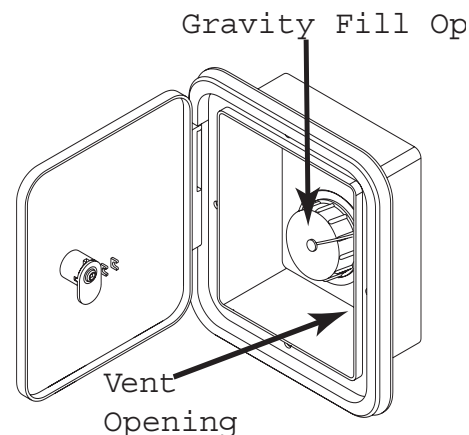
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The gravity fill inlet allows fluids to be introduced directly into the fresh water tank. When dry camping, water can be poured directly from a container into the fresh water tank. The gravity fill inlet can be used to pour disinfecting solution into 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:

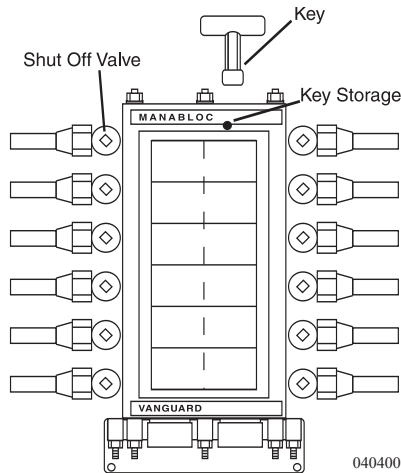
1. Unscrew fill cap taking care to keep cap and inlet clean.
2. Insert potable water hose into inlet.
3. Fill tank until water overflows from the vent opening.

## WATER TANK - (FRESH) GRAVITY FILL



040393

## PLUMBING MANIFOLD



Use the key to turn off each of the water lines.

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.

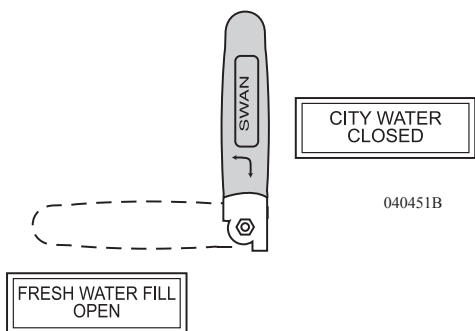
Each faucet or appliance water line may be turned off individually. The hot water valves are located on the left and the cold water valves are on the right. Use the key provided to turn on or off any water line. When key is horizontal the water line is open. Turning the key to the vertical position shuts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

## WATER - CITY HOOK-UP

- Connect a potable water hose to the City Water Hook-up located in service center on the roadside of motorhome.
- Turn the city water/tank fill valve to the City Water-Closed position.
- Turn on the water supply.
- The water pump can either be off or on. It will not affect the water pump to leave it on.
- The City Water Hook-up in the service center has a built in pressure regulator and one way check valve. The pressure regulator limits the water pressure to approximately 45 lbs.



**CAUTION:** Some outside water sources develop high water pressure, particularly in mountainous regions. High water pressure is anything over 55 psi (pounds per square inch). Excessive water pressure may cause leaks in water lines and/or damage the water heater. An additional pressure regulator can be connected to the city water faucet to regulate the pressure to the potable water hose. Excess pressure on a hot day can cause the water hose to swell and burst.

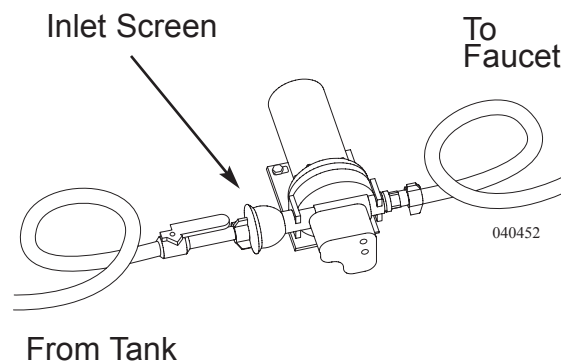


The valve must be in the City Water position for city water use.



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

## WATER PUMP



**WARNING:** Before leaving the motorhome 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 circuitry of a latching controller 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 water pump switch illuminates when the water pump is on.



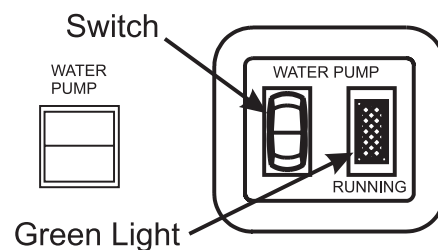
**NOTE:** The latching controller is located next to the water pump.

The water pump can 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.



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

Use the following procedure to operate the water pump after unhooking from the city water supply or after storage:

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

## **Water Pump - Troubleshooting**

Vibration induced by road conditions can cause the plumbing or pump hardware to loosen. Check the water pump system for components that are loose. Many symptoms can be resolved by tightening the hardware. Check the following items:

### **The water pump will not start or 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 on the pump? If voltage is present the pressure switch may be faulty. As a test, temporarily 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 a seized or locked diaphragm assembly (water frozen).

### **The water pump will not prime or sputters: (No discharge/motor runs):**

- Is the pump inlet strainer clogged with debris?
- Is there water in the tank or has air collected in the water heater?
- Is the inlet tubing and plumbing sucking in air at plumbing connections (vacuum leak)?
- Check for proper voltage with the pump operating.
- 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 or continues to run when the faucet is closed:**

- Check to see if the fresh water/tank fill valve is completely closed.
- Check the output (pressure) side plumbing for leaks and inspect for a leaky toilet or valves.
- Look for a loose drive assembly or pump head screws.
- Are the valves on the pump 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 that may have vibrated loose.
- Does the mounting surface multiply noise (flexible)?
- Check for mounting feet that are loose or compressed too tight.
- Look for loose pump head to motor screws.

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

- Look for restrictive water flow in the faucets or shower heads.

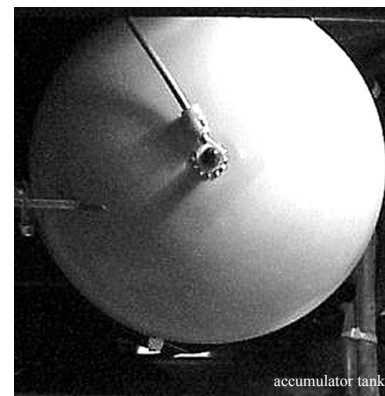
The pressure accumulator tank mounts in the water bay near the water pump. The pre-charge pressure in the accumulator tank should be checked monthly.

**The accumulator features:**

1. Smooth flow from the faucets.
2. Reduced water pump cycling.
3. A pre-charged air cushion.
4. Elimination of pulsation and water hammer.
5. Water pressure at faucets.

The accumulator tank has a tire valve that is used to pre-charge the tank with air pressure. The pre-charge 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 of 40 psi. The pre-charge pressure of the accumulator tank is 18 to 22 psi. To check the air pressure in the accumulator tank the water pump and city water will need to be off. Open a faucet to relieve the water pressure. Using a tire air pressure gauge, one that reads low air pressure, check the accumulator tank pressure monthly. Use a hand-operated pump to add air pressure to the accumulator tank. The amount of airflow and high-pressure from a compressed air system can quickly overcharge the tank causing the internal bladder or tank to rupture.

## PRESSURE ACCUMULATOR TANK



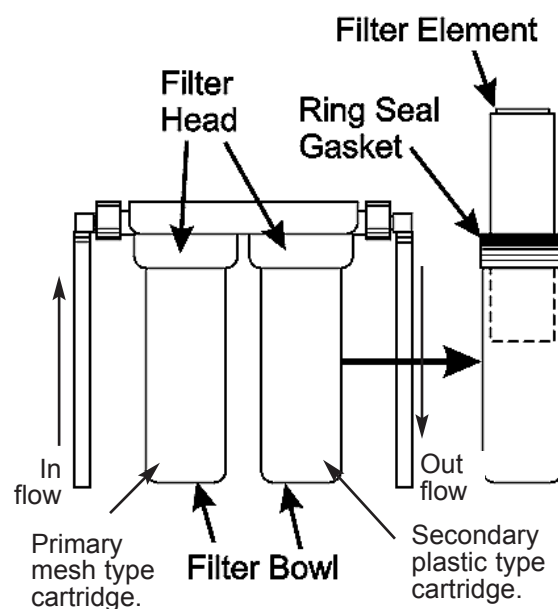
Remove tank valve cap to check air pressure.

## WATER FILTERS

The 2-stage filtration system will filter up to 1350 gallons (approx. 6 months of water) between filter changes. The 2-stage filtration system uses the following filters:

- **First Stage** - Five 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 interval of six months to one year depending on usage and incoming water quality.
- **Second Stage** - 56 Cubic Inch Granular Activated Carbon Filter: Improves water quality by reducing volatile organic chemicals, chlorine, tastes and odors. Recommended change interval of six months to one year depending on usage and incoming water quality.

(continued)



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Water Filter Removal Wrench.

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

**Removal:**

- 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.

**Installation:**

- 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.

First Stage	Premier 5M-10
Second Stage	Premier GAC-10-56

**WATER SYSTEM -  
Troubleshooting**

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

Check all plumbing connections for leaks at least once a year. If the water pump runs when a faucet is not open, check for a water leak. Be sure the tank drain valves are closed. If the system continues to leak take the motorhome to an authorized dealer for service.

**WATER SYSTEM -  
Disinfecting  
Fresh Water**

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

**When to Disinfect the Fresh Water System:**

- If the motorhome is new.
- If the motorhome has not been used in a long time.
- Every **three** months.



**NOTE: An independently operated water pump with garden hose connections and a container to hold the prepared solution can be used to perform this task. The gravity fill may also be used to pour the mixture into the fresh water tank.**

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

- Remove the filter elements from the filters and reassemble the filters without the elements (see "Water Filter").
- Prepare a chlorine bleach solution using one gallon water and ¼ cup of chlorine bleach. Use 1 gallon of solution for every 15 gallons of tank capacity. For 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.
- Turn on one of the water pumps in the motorhome.
- Open each faucet and run the water until you smell a distinct chlorine bleach odor.
- Turn off all faucets allowing the system to stand for four hours.
- Drain the fresh water tank of the mixed solution.
- Fill the water tank with fresh water. Flush hot and cold lines thoroughly with fresh water. Repeat this process until the chlorine bleach smell is no longer detectable in the water system.
- Install new water filters.



**CAUTION: 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 winterizing 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 winterizing 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. Do not use vinegar to disinfect the water system. Vinegar will deteriorate the copper tubing inside the Aqua-Hot's Domestic Water Loop.**

## **WASTE WATER SYSTEMS - Proper Waste Disposal**

Most State Parks have strict regulations about discharging wastes except into authorized disposal systems. Dumping raw sewage from toilet holding tanks, except at authorized dumping stations, is universally prohibited.

Most National, State and private parks have either a central dump facility or campsite hook-up for sewage. Many of the modern rest areas along the interstate now have dump stations available. You will find a list of dumping stations from coast to coast in Woodall's Campground Directory, Trailer Life's RV Campgrounds and Services Directory, Rand McNally's Campground and Trailer Park Guide, Good Sam Park Director (Good Sam Club), and other similar publications. Some major oil companies offer dump facilities at selected stations. With a little planning you will find few inconveniences in proper and legal disposal of holding tank waste.

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

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



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

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### **Waste Drain & Sewage Tanks**

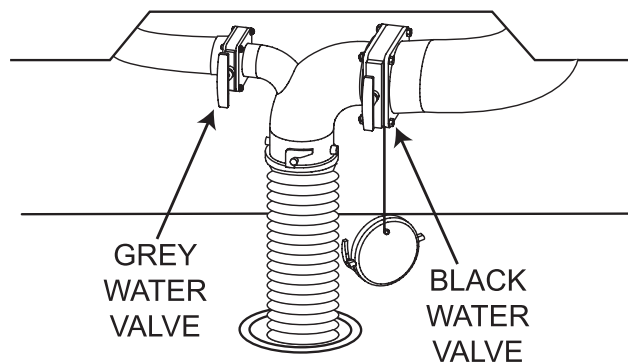
The waste drain system provides adequate and safe storage and/or discharge of waste materials. The drain system uses ABS plastic piping and fittings connected to sinks, shower, toilet and holding tanks draining to an outside termination. The motorhome should be reasonably level for optimum operation of the systems. The wastewater holding system consists of a wastewater holding tank (grey tank). The grey water tank stores the sink, shower and clothes washer drain water. A sewage holding tank (black tank) stores waste from the toilet only.

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

**Waste Drain Hose**

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

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

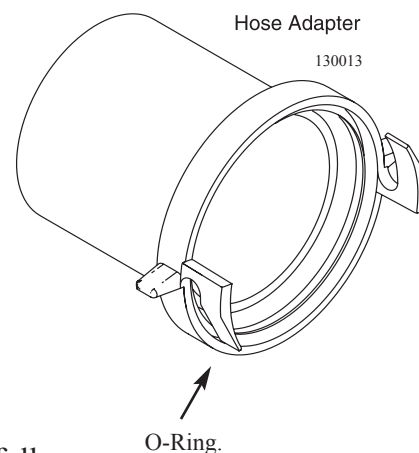


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**To Attach the Hose:**

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

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



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

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

Before using the toilet, treat the sewage holding tank with water mixed with an odor-controlling chemical. These chemicals are readily available at most RV supply stores. Pour the chemicals into the holding tank through the toilet. Add approximately three gallons of water to the holding tank first. Next, mix the chemicals, in accordance with the manufacturer instructions, with approximately one gallon of water. Pour mixture through toilet to the holding tank. Be careful not to spill the chemical on your hands, clothing, toilet bowl or carpet as it can cause a permanent stain. Extremely hot weather areas may require adjusted amounts of chemical to help with odor control. Repeat the chemical pre-charge to the holding tank each time the tank is cycled.



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

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

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

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

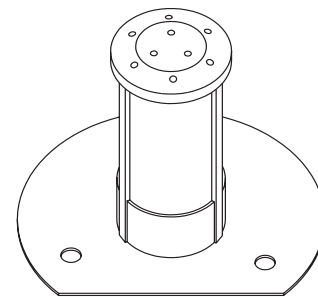


**Black Tank Flush**

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

**Dumping the Tanks:**

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



Nozzle.

040392



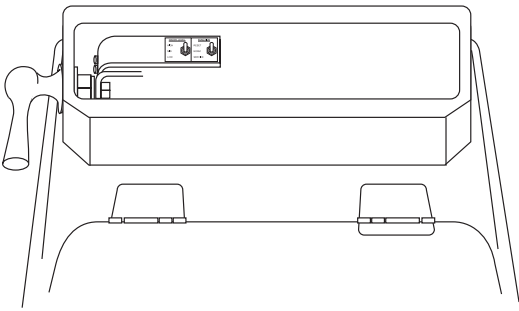
**WARNING: Never operate the flush system unattended. Flooding may occur. Use the tank flush system each time the holding tanks are cycled. Failure to routinely use the flush system will result in a clogged spray nozzle. Turn off the water supply when finished flushing the tank.**

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



**NOTE: Dump the black tank before driving.**

## TOILET - Operating Instructions



040449

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

- To add water to the toilet, lift the flush lever until the desired water level is obtained. Generally, more water is required when flushing solids.
- To flush the toilet, momentarily push the lever down. Holding the lever down will not increase flush time or water flow. The flush cycle is a timed event controlled by a microprocessor. Water pressure and flow rates vary with locations. It may be necessary to adjust the water level.



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

WATER LEVEL	FUNCTION
HIGH	RESET
MID	NORM
LOW	SERVICE

040450

### Control switches:

Under the lid are two switches.

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

### Water Level Switch:

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



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

### Function Switch:

If the toilet malfunctions try resetting the microprocessor.

- Push and hold the switch to Reset for 3 seconds then back to Norm.
- Pushing the switch to Service will hold the ball valve open. This feature is useful when adding chemical to the sewage tank.



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

**Cleaning**

The toilet should be cleaned regularly for maximum sanitation and operational efficiency. Clean the toilet bowl with a mild bathroom cleaner. Do not use chlorine or caustic chemicals, such as drain opening types, as they will damage the seals.

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

**Checking for leaks:**

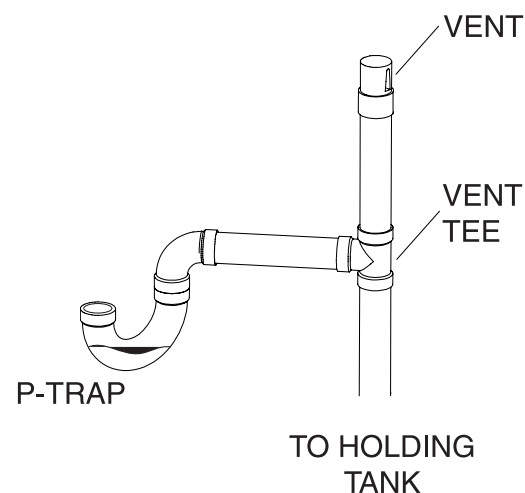
- Back of toilet: check water supply line connection. Toilet tissue works well to find leaks. The tissue changes texture when it contacts moisture.
- Between closet flange and toilet: Check flange screws making sure they are snug. Do not over tighten screws. If leak continues, remove toilet and check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



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

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.

**Drain Traps & Auto Vents**

070152 Water Trap

## 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 potable antifreeze.

### Storage:

If the motorhome is stored where freezing temperatures may occur, drain the domestic fresh water loop completely of water. When draining the domestic fresh water system begin with draining the fresh water tank by opening the point drain lever for the fresh tank and allowing the water to drain.



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

The method chosen to winterize the motorhome and water lines is up to the motorhome owner. The lines can be air blown to remove standing water or the lines can be filled with approved FDA RV antifreeze. Either way, all interior and exterior faucets need to be opened and closed, one at a time, to be checked. Open all low point drains and drain the holding tanks.

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## STORAGE - COLD WEATHER

If the motorhome is stored where freezing temperatures may occur, drain the domestic fresh water loop completely of water. When draining the domestic fresh water system begin with draining the fresh water tank by opening the point drain lever for the fresh tank and allowing the water to drain.



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

Ten gallons of FDA 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 faucets, low point drains (next to the Aqua-Hot) and drain valves for the fresh water tank, water heater tank, holding tanks and fresh water lines.
3. Close all faucets, drain valves and low point drains.
4. If the motorhome has a water heater, remove the anode to drain the internal tank. At the back of the water heater turn the water valve to the "by-pass" mode.
5. Pour the antifreeze into the fresh water tank using the fresh water gravity fill.
6. Turn ON the system water pump and operate each faucet (hot and cold valves) individually until a small amount of antifreeze is present.
7. Close off the faucets.
8. Open the shower faucets and toilet valve to allow a small amount of antifreeze to run into the holding tanks.
9. Use a soft cloth to wipe out the sinks and shower to protect surfaces from antifreeze stains.
10. Open the exterior faucet using the same procedure as the interior faucets.
11. If the motorhome is equipped with an icemaker, remove the  $\frac{3}{4}$ " fitting and flush antifreeze through the water line.
12. Disconnect the power supply line affecting water pump operation.

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



**WARNING: Use only specifically designed non-toxic RV antifreeze for potable water systems. Automotive antifreeze, if ingested, can cause blindness, deafness or death.**



**WARNING: It is recommended that a qualified RV service technician familiar with motorhomes, such as an authorized dealer, do this procedure.**

## **WINTERIZING - Using Air Pressure**

To use air pressure to winterize the motorhome you will need access to an air compressor and an adapter to connect the air line to the water system. Adapters can be found at any RV supply store. When hooked to the water lines the pressure should not exceed 40 psi. Higher pressure can damage the lines.

1. Remove 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. Open the low point drains to clear the water out of the hot and cold water lines. Leave the low-point valves open until the motorhome is used 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 40 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 the 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 or 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 the motorhome. Pour 1 pint into both the kitchen and bath shower drains. Pour 2 pints into the bath sink drain, with some of the antifreeze going into grey tank to protect the drain valve. While holding down the flush pedal, pour another 3½ pints into the toilet, letting the antifreeze run into the black tank to protect the valve located there. Pour the last pint of antifreeze into the toilet after you have released the flush pedal. Use a soft cloth to wipe out the sinks and shower (after the antifreeze is poured in) to protect the surfaces from stains.
10. Leave the low-point drains open until the motorhome is used again.



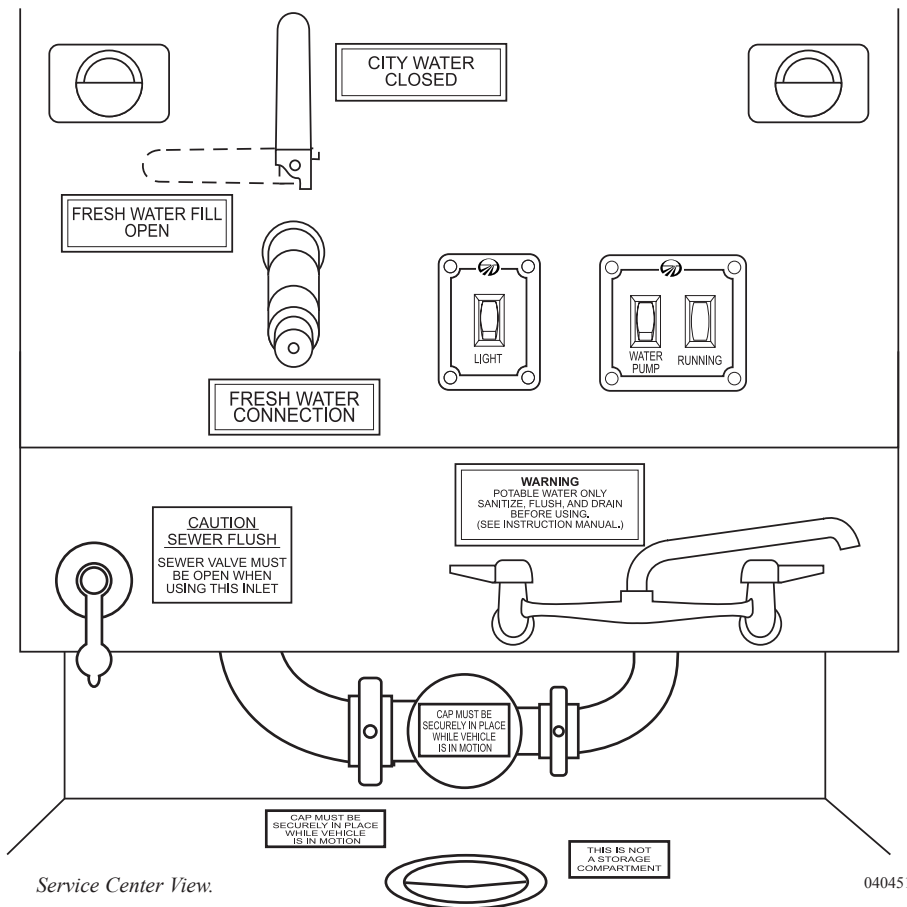
**WARNING: When draining the low water drain lines and the water heater be sure the water is not hot. Hot water from the lines can burn or injure skin.**

## TANK CAPACITIES - CHART

Tank Capacities (Approximate Gallons)	
Aqua Hot	16 gal.
Grey Holding Tank	60 gal.
Black Holding Tank	40 gal.
Fresh Water Tank	100 gal.

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

## SERVICE CENTER



**NOTES**



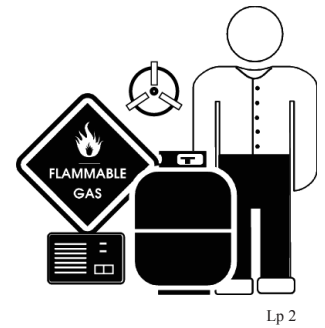
# Signature

## 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 all motorhomes. More detailed information with **CAUTION** or **WARNING** instructions for the various equipment, other than what is found in this section, can be found in the manufacturer's manual in the owner's information box.

All components for the motorhome LP-Gas systems are approved for use in recreational vehicles by a nationally recognized testing laboratory. When properly handled, LP-Gas is a clean-burning dependable fuel for heat producing components. The LP-Gas tank mounted in the motorhome contains liquid petroleum gas that is under high pressure. As the fuel is used, liquid gas vaporizes and passes through the tank valve to a regulator that automatically reduces pressure. Low-pressure gas is then distributed to components through a pipe manifold system.

Component lighting problems are commonly caused by an improperly adjusted gas regulator. Do not attempt to reset the regulator. Adjustments need to be made by a dealer or an authorized service person.

In higher elevations or extreme cold weather (10° F/-21° C or lower) a shortage of LP-Gas may be experienced. Usage can be modified by running only one component at a time. For example, turn off the furnace while using the range. If LP-Gas is going to be used in higher elevations or cold climates for a long period of time, have an authorized service person adjust the LP-Gas regulator for these conditions.

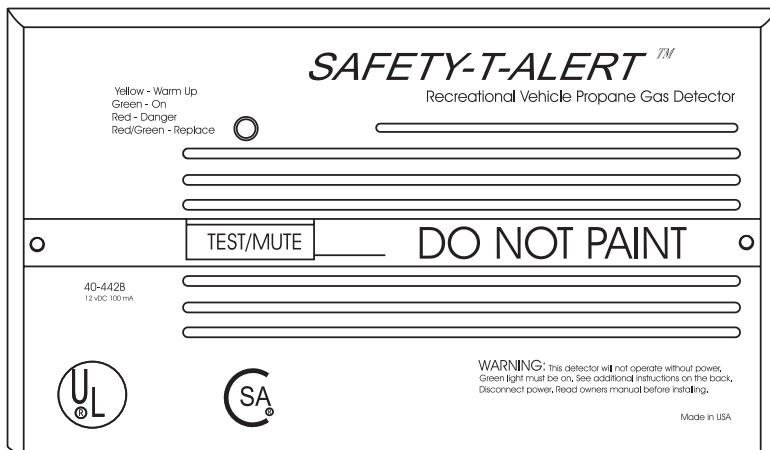
Have the LP-Gas system checked by an authorized dealer at least once a year, and thereafter before every extended trip. Although the manufacturer and the dealer test the system carefully for leakage, travel vibrations can loosen fittings.

Leaks can be easily found by applying a leak detector solution on all connections. Leaks can usually be repaired by tightening the fittings. If not, shut off the main gas valve at the tank. Immediately see an authorized dealer for repairs. Hand tighten the tank valves only. Do not use a wrench or pliers as over tightening may damage valve seats and cause leaks. If a leak is suspected (which can be easily identified by the odor of rotten eggs or sulfur) never light a match, have an open flame or use any spark producing equipment or appliance.



**WARNING: LP-Gas is highly volatile and extremely explosive. Do not use matches or a flame to test for leaks. Use only approved LP-Gas leak testing solution for leak detection. Unapproved solutions can damage copper tubing and brass fittings. Never attempt to adjust LP-Gas regulators. Only qualified personnel should perform any maintenance or repair to the LP-Gas system.**

## LP-GAS DETECTOR



030646

The LP-Gas detector is provided for safety. The gas detector detects both LP-Gas and Methane Gas. Liquefied Petroleum Gas (LP-Gas) is heavier than air and Methane Gas is lighter than air. LP-Gas will settle to the lowest point (generally the floor) of the motorhome. Methane Gas will rise. The LP-Gas detector is also sensitive to fumes such as hairspray, most of which contain butane as a propellant. Butane, like propane, is heavier than air and will settle to the floor level where it will be detected. When this occurs, press the reset button to stop alert sound for 60 seconds and allow the air to clear.

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

### Operation

Upon first application of power the LED will flash **yellow** for three minutes while the detector is stabilizing. At the end of the start cycle the LED will turn **green** indicating full operation. If detector senses unsafe levels of gas it will immediately sound an alarm. The gas detector operates on 12 Volts, with a current draw less than 1/10th of one amp.



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

### Testing

Press the **TEST** switch any time during the warm up cycle or while in normal operation. The LED should flash **red** and the alarm should sound. Release the switch. This is the only way you should test the detector. The test feature checks full operation of the detector.



**WARNING:** Test the operation of this detector after the motorhome has been in storage, before each trip and at least once per week during use.

The **red** LED will flash and the alarm will sound whenever a dangerous level of propane or methane gas is detected. The detector will continue to alarm until the gas clears or the **MUTE** switch is pressed.

**Procedures to Take During an Alarm:**

1. Turn off all gas appliances (stove, heaters, furnace). Extinguish all flames and smoking material. Evacuate the motorhome, leaving all doors and windows open.
2. Turn off the propane tank valve.
3. Determine and repair the source of the leak. Contact a qualified service professional if additional repairs are necessary or if the source of the leak cannot be determined.



**WARNING: If the alarm sounds and there is no immediate danger open all doors and windows to air out the motorhome. Exit the motorhome and turn off the gas at the LP tank. Do Not re-enter the motorhome until the alarm stops sounding. If the alarm sounds again after the gas is turned back on, turn the gas off. Leave the gas off and contact a qualified service technician to find and repair the leak. Do not re-enter the motorhome until the problem is corrected.**

**Alarm Mute:**

Press the **TEST-MUTE** button when the detector is in alarm.

1. The **red** LED will continue flash and the alarm will beep every 30 seconds until the concentration of LP-Gas has dispersed to a safe level.
2. The LED will flash **green** until the end of the MUTE cycle.
3. If dangerous gas levels return before the end of the MUTE cycle the alarm will beep four times and return to phase 1.
4. After two minutes the detector will return to normal operation (**solid green**) or resound the alarm if dangerous levels of gas remain.

**Fault Alarm:**

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

1. Vacuum the dust off the detector cover weekly (more frequently in dusty locations) using the soft brush attachment of the vacuum.
2. Do not spray cleaning agents or waxes directly onto the front panel. This action may damage the sensor, cause an alarm or cause a detector malfunction.

**Care of  
the Detector**

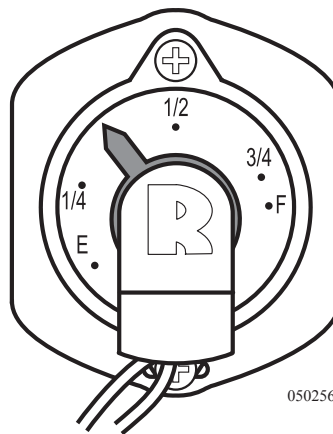
## MONITOR PANEL MEASUREMENT

**Tank Measurement** - To measure level of a tank simply push button on display panel corresponding to tank you wish to measure. Observe the gauge.

**Calibration** - The monitor panel comes factory calibrated for accuracy and should not need to be adjusted.



**NOTE: The LP-Gas gauge is not adjustable.**



LP Tank Gauge

## 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 as this can produce a spark and could ignite the gas.
- Open windows and doors.
- Evacuate the motorhome. Stay clear of the surrounding area.
- Keep open flames, spark producing devices and smoking material out of the area.
- Contact a qualified service technician to find the source and repair the gas leak.



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

**LP-GAS TANK**

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

When storing portable LP-Gas tanks that are not connected to an LP-Gas system, install an approved plug in the tank outlet holes to prevent leaks. Do not transport or store LP-Gas tanks, gasoline or other flammable liquids inside the motorhome.



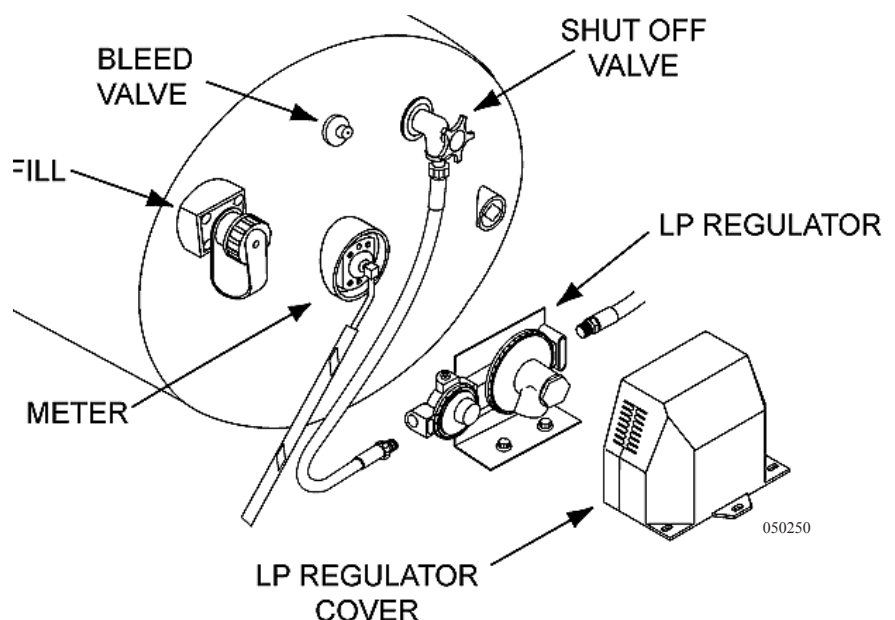
**WARNING: Do not store or transport empty LP-Gas tanks, portable tanks, gasoline or other flammable liquids inside the motorhome. Keep open flame and spark producing materials away from the LP-Gas area. Shut off all appliances and LP-Gas tank valve (located on side of LP-Gas tank underneath the motorhome) when the motorhome is in storage. If this warning is ignored a fire or explosion could result.**



**CAUTION: Pressure inside LP-Gas tanks can reach over 200 psi when exposed to direct sunlight. A high pressure safety relief valve will purge excess high pressure if necessary. LP-Gas will stop vaporizing as the LP-Gas tank temperature approaches -40° F. Appliances that consume large amounts of LP-Gas, such as the water heater or furnace, will need to be operated in sequence in extremely cold environments.**

**Operation**

- Manually open the main shut-off valve located on 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

SIGNATURE

## LP-Gas Tank Filling

*Woodall's Campground and Trailer Guide* and other similar publications list refueling stations. Many travel parks sell LP-Gas. Shut off the pilot lights, appliances and igniters before filling the LP-Gas tank to prevent a fire or explosion. Have a trained service person fill the LP-Gas tank.

The LP-Gas tank fill is located in the LP-Gas tank access outside compartment. Caution the service technician, if the tank is new and being filled for the first time, to purge any air from the tank before filling. When the tank is filled to the proper level there is space available for the conversion of liquid into gas. If a tank is over-filled it may vent pressure. When this happens a strong rotten egg odor near the tank and/or hear a hissing noise may be detected.



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



**NOTE: Actual tank capacity is 80% of listing.**

## 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 ( $F^{\circ} - 32 \div 1.8 = C^{\circ}$ )

11 in. Water Column = 6 1/4 ozs. per sq. in. pressure.

27.7 in. Water Column = 1 lb. per sq. in. pressure.

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

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



**LP-Gas Statistics:**

Pounds Per Gallon	4.24
Specific Gravity of Gas	1.50
Specific Gravity of Liquid	.504
Cubic Feet Gas Per Gallon of Liquid	36.38
Cubic Feet Gas Per Pound	8.66
BTU Per Gallon	91,502
BTU Per Pound	21,548
Dew Point in Degrees Fahrenheit	- 44° F
Vapor Pressure at 0° F	31
Vapor Pressure at 70° F	127
Vapor Pressure at 100° F	196
Vapor Pressure at 110° F	230
Flash Point	842° F

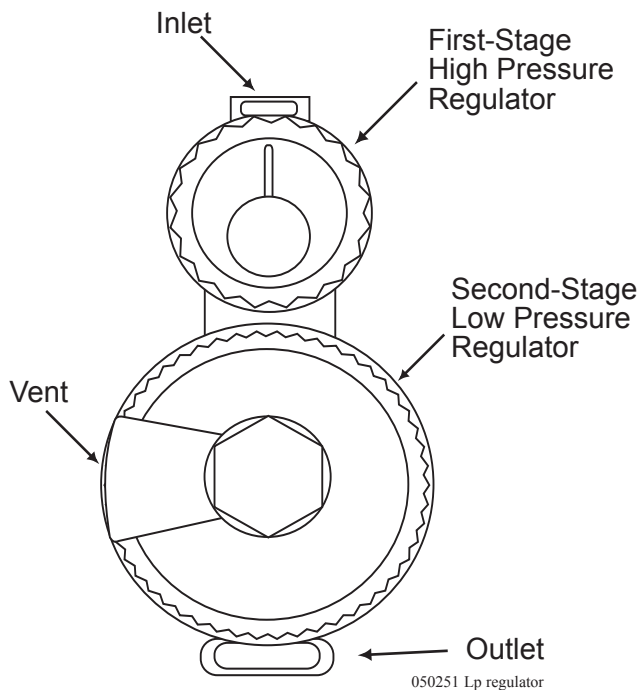


**NOTE: The above information is not a complete guide for the use of LP-Gas tanks or appliances. In cold climates keep fuel levels above 50% in order to keep vaporization of LP-Gas at the highest level.**

**Basic Facts About LP-Gas:**

- LP-Gas detectors are a federal requirement on all LP-Gas equipped recreation vehicles.
- LP-Gas is a by-product produced by refining oil.
- Odor is added to LP-Gas after the refining process.
- Each liquid gallon of LP-Gas produces 91,502 BTU (British Thermal Units).
- Temperature effects pressure of LP-Gas.  
Internal tank pressure can exceed 200 psi.
- Tanks or valves contain pressure relief valves.  
The relief valve opens at 125% above tank rating.
- LP-Gas stops vaporizing at -44° F.
- Standard LP-Gas operating pressure is 11" of Water Column or approximately 6 ¼ ounces per square inch.
- An inch of Water Column is a measurement of applied pressure to one side of a U-Tube ½ filled with water at sea level. The amount of pressure required to raise the water level 11", represents 11" of Water Column.

## LP-GAS REGULATOR



Typical two-stage LP-Gas Regulator.

The regulator is the heart of an LP-Gas system. The LP-Gas in the tank is under high pressure. The regulator reduces the pressure of gas so that it is safe to use with various appliances. The regulator on the motorhome is a two-stage regulator. The first stage regulator reduces the full tank pressure down to a range of 10-13 psig (pounds per square inch gauge). The second stage further reduces the pressure down to an outlet pressure of 0.4 psig (11 inches of water column). The regulator is equipped with a vent that allows it to breathe. It is important to keep the vent clean and clear of obstructions or corrosion. If the vent becomes clogged, pressure from LP tank could cause a failure of the components. If there is any corrosion, contact a qualified LP-Gas service technician. The regulator is mounted so that the vent faces downward. If the vent becomes clogged clean it with a toothbrush.

Under normal atmospheric conditions an LP regulator will not freeze, nor will the LP-Gas. The gas passing through the regulator will expand and cool creating moisture in the gas. This moisture will turn to ice which can build up and partially or totally block the orifice. The possibilities of freeze up is greatly reduced with the two stage regulator.

### To prevent freeze up:

1. Ensure the LP tank is totally free of moisture prior to filling.
2. Ensure the tank is not overfilled.
3. Keep the valve closed when the tank is empty.
4. If a freeze up occurs, have an LP-Gas distributor purge the tank.
5. Have the LP-Gas distributor inject methyl alcohol in the tank.



**WARNING: Do not attempt to adjust the regulator, it is 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 enter the motorhome until the problem has been corrected!**

## LP-GAS CONSUMPTION

Each gallon of LP-Gas produces 91,502 BTU's of heat. One 27 gallon tank produces two million BTU's. Total consumption depends on the rate of usage by each appliance and the operating time. The stove and heating systems typically use the most gas. With sub-freezing temperatures and high winds, consumption by the furnace (LP-Gas) can be very high. Check the tank level often in cold weather.

### Determine Fuel Consumption:

To determine approximately how long or how many hours an LP-Gas appliance will operate on one gallon of LP use the following formula:

- LP-Gas appliances are rated in Input BTU (British Thermal Units). The rating is usually stamped or printed on a tag affixed to the appliance. For example: the Input rating of the appliance is 10,000 BTU's.
- One gallon of LP-Gas produces 91,502 BTU's.
- Divide the amount of BTU's of one gallon of LP-Gas (91,502) by the rating on the appliance (in this example 10,000). Net continuous operation time for one gallon of LP Gas for this appliance would be approximately 9.2 hours.

The above formula can be useful when trying to determine the approximate length of time a tank of LP-Gas will last. Generally, LP-Gas appliances do not operate continuously. An example would be the typical cycling of the furnace or water heater.

### Determining how long a tank of LP-Gas will last:

- Combine the BTU input totals of all appliances and the approximate length of time these appliances operate per day.
- Multiply the number of liquid gallons in the LP tank by 91,502.
- Divide the total of BTU's of the LP tank by the total number of BTU's the appliances consume equals the approximate number of hours of operation before refueling.

### Typical Appliance BTU Ratings

#### Cooktop

Large Burner 12,500 BTU  
Small Burner 6,000 BTU

#### Refrigerator (Norcold)

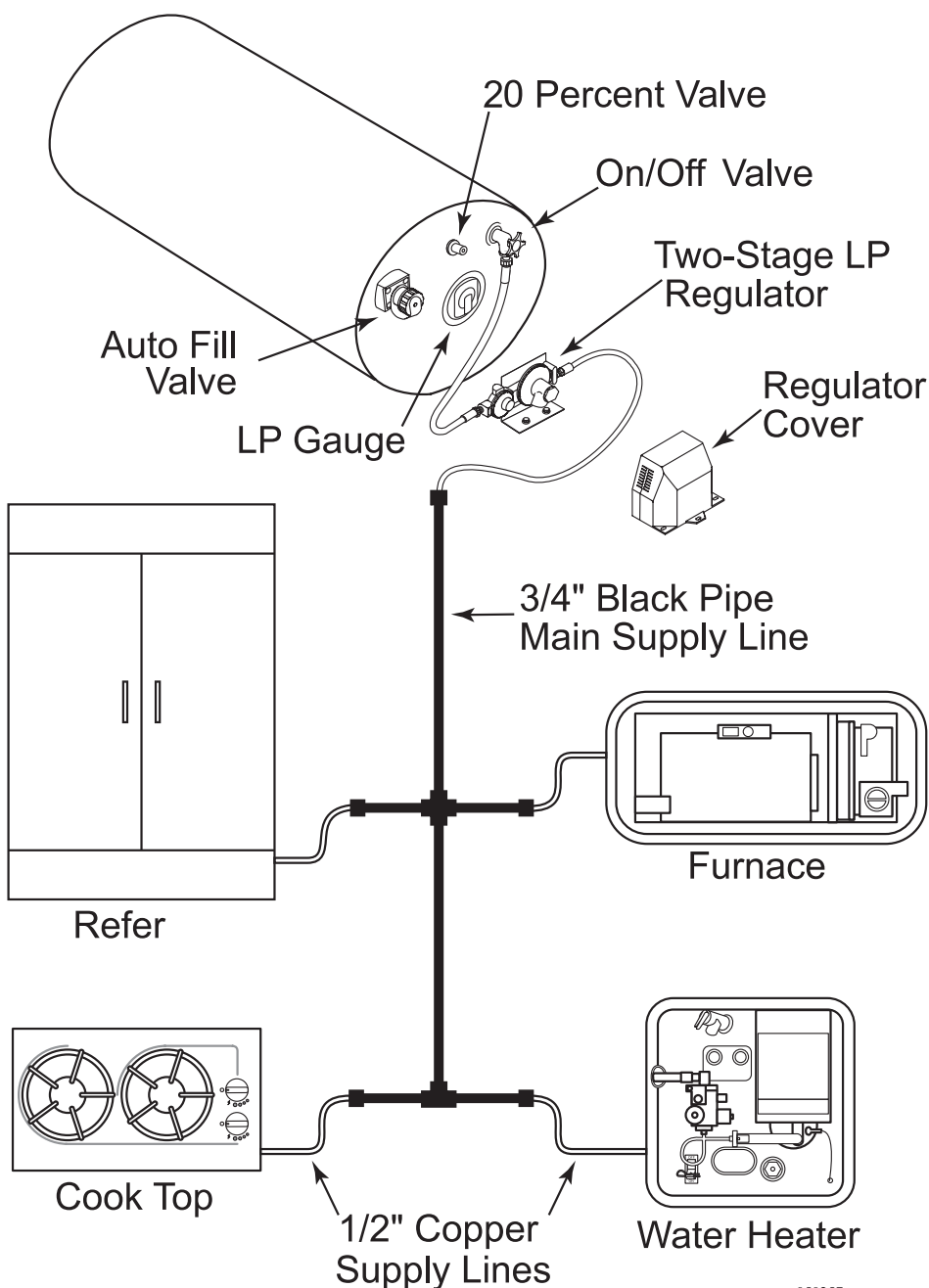
2-door 1500 BTU  
4-door 2200 BTU



**WARNING: LP-Gas is highly volatile and extremely explosive. Never use matches or open flame to test for leaks. Use only approved LP-Gas leak testing solution to test for leaks. Unapproved solutions can damage copper tubing and brass fittings. Never attempt to adjust LP-Gas regulators without the use of proper equipment. Improper LP-Gas regulator adjustment will affect the performance of LP-Gas operated appliances. Incorrect flame or explosion can occur. Only qualified personnel should perform any maintenance or repair to the LP-Gas system.**

## LP-GAS DISTRIBUTION LINES

A primary manifold black steel pipe running throughout the motorhome distributes LP-Gas to secondary lines. All secondary lines leading to gas appliances are made of copper tubing with flared fittings. If any lines rupture do not attempt to splice them. Always run a new line. We recommend gas distribution work be performed by an authorized dealer or an authorized service technician. When removing or servicing any gas appliance, manually close the 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 a gas leak is suspected, get the system inspected and repaired by a qualified service technician as soon as possible.



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Liquid Propane gas is one of the safest and most reliable fuels available on the market if it is handled properly. LP-Gas, however, does have a great explosive "potential" if handled improperly. Danger is minimized by becoming familiar with and following a few safety precautions, and by learning how to properly operate LP-Gas appliances. Use of LP-Gas requires the responsibility to enforce extra safety measures.

The motorhome is equipped with many LP-Gas operated appliances because it is a convenient and efficient source of fuel. LP-Gas appliances must be operated and maintained in accordance with the product manufacturer's instructions.

The National Propane Gas Association (NPGA) has a special service program offered called GAS<sup>®</sup> (Gas Appliance System) Check. The GAS<sup>®</sup> Check program is aimed at educating the users in the association about the convenience of propane use with safety and peace of mind. For information on the **NPGA Gas<sup>®</sup> Check program, call (630) 515-0600 or visit [www.npga.org](http://www.npga.org).**

### **LP-Gas Tanks and Cylinders:**

Tanks are built to American Society of Mechanical Engineers (AMSE) Code. The cylinders are built to DOT (Department of Transportation) Code. The major difference between cylinders and tanks is in required testing and inspection procedures and in the construction of the containers. Both tanks and cylinders are required to undergo pressure testing and inspections; however, the procedures for how they are tested and inspected differ.

The difference between the two codes are that the valves, fittings and brackets are located only on the ends of the DOT cylinders; however, on the ASME tanks they may be located on ends, as well as the sides. There is also a difference in how the tanks are rated. Required tank ratings are in gallons (ASME ratings) or pounds (DOT) water capacity. The Federal DOT (Department of Transportation) regulations require periodic inspections and re-qualifications of cylinders.

American Society of Mechanical Engineers (AMSE) tanks or bulk containers are generally used in the motorhomes and motorized products. These tanks are permanently mounted on to the unit.

An alloy steel two-piece welded and brazed tank is used on all towable products. The marking on the collar, DOT 4BA240, identifies the DOT specifications and service pressure. Other pertinent information included on the collar is the water capacity (WC) and the tare weight (TW), both which are measured in pounds, and the Manufacture date (one of the most important items). There is a required 12 year re-qualification. The final piece of information is for the Dip Tube (DT) length. This is part of the overfill protection and maximum liquid allowance in the cylinder.

**Maintenance and Safety Tips for the LP-Gas Refrigerator:**

- Have the refrigerator, furnace and venting inspected annually by an authorized service center.
- Before firing up the refrigerator, or using the propane gas furnace for the first time each season, have the venting system checked for blockage. Insects may have built nests that will obstruct flow.
- At the first indication of incomplete combustion (yellow flame instead of a blue flame or soot is present) contact a service technician immediately. Improper combustion can cause carbon monoxide buildup, which is potentially fatal!

**Maintenance and Safety Tips for the Propane Range:**

- Burner flame should be a blue color, indicating complete combustion. If not, have the unit serviced by a qualified technician.
- Do not cover the oven bottom with foil. Air circulation will be restricted.
- Never use gas ranges or ovens for heating purposes.
- Always have pot handles turned inward.
- Ensure children understand never to turn or play with the knobs on the front of the propane gas range.

# Signature

## SECTION 8 ELECTRICAL SYSTEMS - HOUSE

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## INTRODUCTION

The motorhome 120/240 Volt AC system can be operated from three different power sources: shore power, the on-board generator or the inverter/charger. Shore power is the most efficient and should be used whenever possible. The on board generator can be used when shore power is unavailable. The inverter/charger supplies silent AC power using the house batteries of the motorhome. This source has limited AC power output and should be used sparingly.

Two different sources supply the main AC circuit breaker panel with power: the 50 Amp shore power cord or the on board generator. The power source used is selected automatically by an automatic electrical switching device known as a transfer switch. The inverters supply AC power to the sub-panel.



**WARNING: The electrical system is engineered and tested for complete safety. Circuit breakers and fuses protect the electrical circuits from overloading. If you plan modifications or additions to the electrical system, we strongly recommend consulting your dealer for assistance to ensure continued integrity and safety of the electrical system. Please note that any modifications may void the warranty.**

The motorhome is equipped with a shore power cord. The electrical cord connects the motorhome to outside electrical services. Shore power service is the most efficient source of electrical power. Use this as the primary power source. The plug end of the shore power cord is 50 Amp 220 Volt. Many facilities are equipped with this power service. When this type of power service is not available electrical adapters will be required to allow a proper and safe connection to the electrical service supply.

### *Shore Power*



**NOTE: In instances when 50 Amp shore service is not available, care will have to be used when operating the appliances and using the outlets so the shore power service will not be overloaded.**

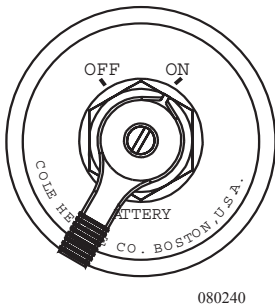
The generator can be selected for use when AC shore power is not available. The generators maximum amount of output power, measured in watts, is calculated at an elevation of 500 feet above sea level. This figure will decrease slightly with a higher altitude. Ambient temperature also effects total maximum output. The amount of AC electrical load applied to the generator determines fuel consumption.

### *Generator*

## **Inverter/ Converter**

The inverter/charger can be used for silent AC power if shore power is not available, and using the generator is not going to be selected as a secondary power source. This device has limited AC power output, measured in watts. It operates only selected appliances and outlets. The inverter/charger is two components in one. First is as an auxiliary 120 Volt AC power source that uses 12 Volt DC house battery power to invert to 120 Volts AC. The second function of the inverter/charger is to use 120 Volts AC power, supplied from either shore power or the generator, and convert it to 12 Volts DC power to recharge the batteries. When dry camping, the inverters may be used to supply AC power to most outlets.

## **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(s). 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 switches off.**

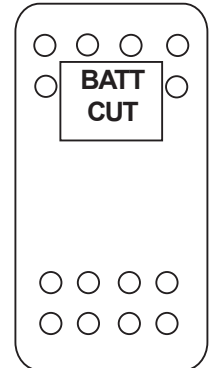


**WARNING: When the frame or other welding is involved for motorhome repair or modification, the following precautions are required to protect electronic components in the motorhome chassis:**

- 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



non-lighted dash switch

Located at entry door.

The power requirement for the motorhome is 50 AMP 120/240 Volt AC single phase. The shore cord is stored in the roadside compartment. If 50 amp shore power service is available, all that is necessary is to connect the supplied shore power cord. If 50 amp service is not available, electrical adapters will be required.

## SHORE POWER HOOK-UP



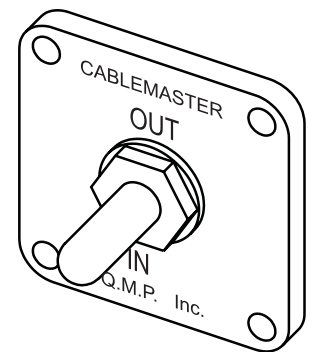
**CAUTION: Avoid flash damage to the electrical system contacts. Before plugging the motorhome into shore power, starting the generator or using the inverter make sure all the appliances are off.**



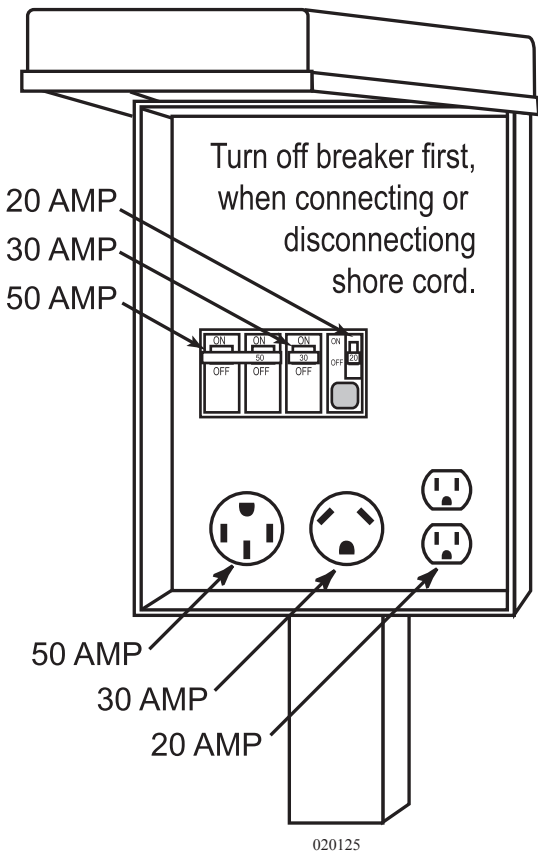
**WARNING: Keep fingers away from metal contacts of the shore plug end. Avoid standing in water when making electrical connections. Serious electrical shock and personal injury can occur. To avoid the risk of an electrical shock, turn the circuit breaker off for the power supply outlet before making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

### Plugging in the Shore Cord:

- Located in the roadside compartment is the shore power cord. Open the compartment door and locate the power cord switch.
- Unscrew the deck plate and extend a sufficient amount of cable to reach the power supply. If 50 amp service is not available, install the proper electrical adapters to the cord.
- Always turn off the shore power breaker to the power supply before connecting or disconnecting the shore cord. This will prevent an accidental shock and flashing of electrical contacts.
- After the connection is made, turn the shore power breaker on. The transfer switch should make an audible click.
- Go inside the motorhome and check the AC Volt gauges verifying proper voltage.



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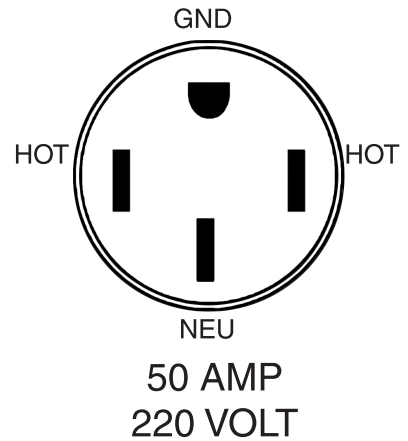
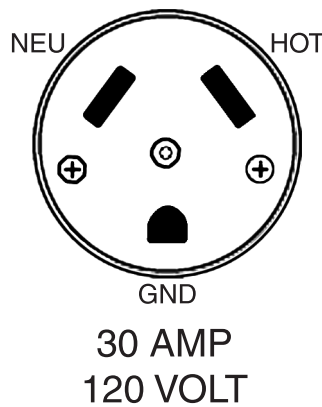
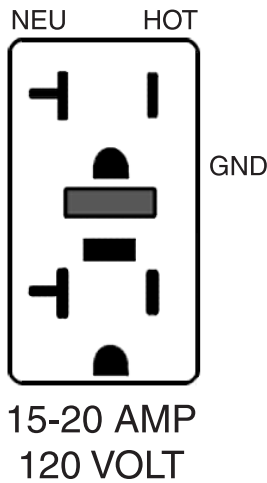
After connecting the motorhome to shore power, wait approximately one minute for the inverter to "stabilize" charging of the batteries before starting air conditioners or other large AC loads. In the instance 50 amp service is not available, use caution not to overload the supplied shore service breaker. Operate appliances and outlets in sequence rather than all at the same time.



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



**CAUTION:** Avoid the risk of electrical shock or component damage by disconnecting from shore power during electrical storm activity. Use the inverter or start the generator if AC power is needed.



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**NOTE:** Shown is the three types of shore power outlets most commonly used.

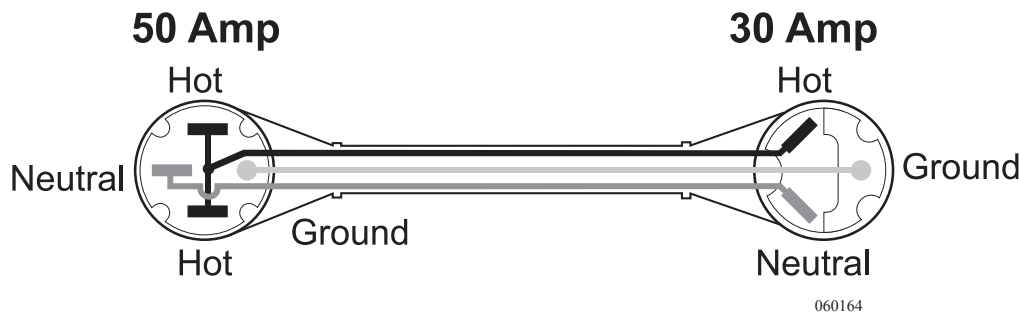
**Power Supply:**

Different amperage supplies vary greatly in the amount of available current.

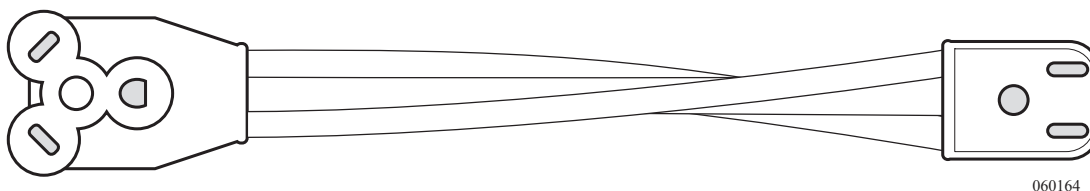
- The continuous amount of current through a breaker or fuse is only 80% of its rated capacity.
- 50 Amp 220 Volt AC shore power service consists of two power supply conductors, a neutral and a safety ground. The 50 Amp breaker simultaneously limits each power supply conductor to no more than a short-term maximum of 50 Amps for each conductor. The 50 Amp 220 Volt service actually provides 80 continuous amps.
- Use care when hooked to anything less than 50 Amp shore service. Shore power service less than 50 Amps consists of one power supply conductor, a neutral and a safety ground. 30 Amp shore service is limited to 24 continuous amps. 20 Amp shore service is limited to 16 continuous amps.

**Electrical Adapters:**

There are many different electrical adapters available to suit a variety of needs. Only UL approved adapters should be used. The most common adapter is a 50-30 Amp adapter. The type of connector adapts the 50 Amp shore cord to a 30 Amp shore power outlet. Always install the adapter to the cord prior to making the connection to the outlet.

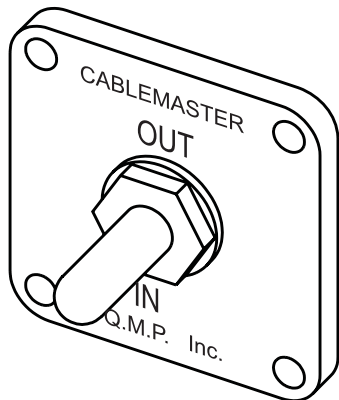


Typical 50-50 Amp Adapter.



30-15 Amp adapter. Adapts the 30 Amp shore cord to a 20 Amp shore power outlet.

## Power Cord Reel



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The power cord reel is a 12 Volt DC motorized assembly that mechanically coils and stows the shore cord. The 12 Volt battery cut-off switch must be ON for the power cord reel to operate. The 50 Amp power cord reel is located in the roadside compartment of the motorhome. The other end of the cable 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 extending or retracting the cable.

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 to reach the shore power outlet. When the cord is connected to shore power, the cord should 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 the cable to kink. To relieve this condition, routinely extend the cable full distance. Straighten the power cable on the ground. It is important the cable remains clean. Accumulated dust and dirt on the cable may cause difficulty in retracting the cord. After cleaning and straightening the cable, allow the cablemaster to retract the cable into the motorhome.

Check all AC and DC wiring connections at least once a year. 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.



Power Cable Reel.

Power cord reel



**WARNING: Before working on the electrical system. Disconnect from shore power and turn off the inverter/charger. Disconnect the negative 12 Volt DC battery cables at the inverter. Remove rings, metal watchbands and other metal jewelry before working around batteries and connectors. Use caution when working with metal tools. If the tool contacts a battery terminal or metal connected to it, a short circuit could occur causing personal injury, explosion or fire.**

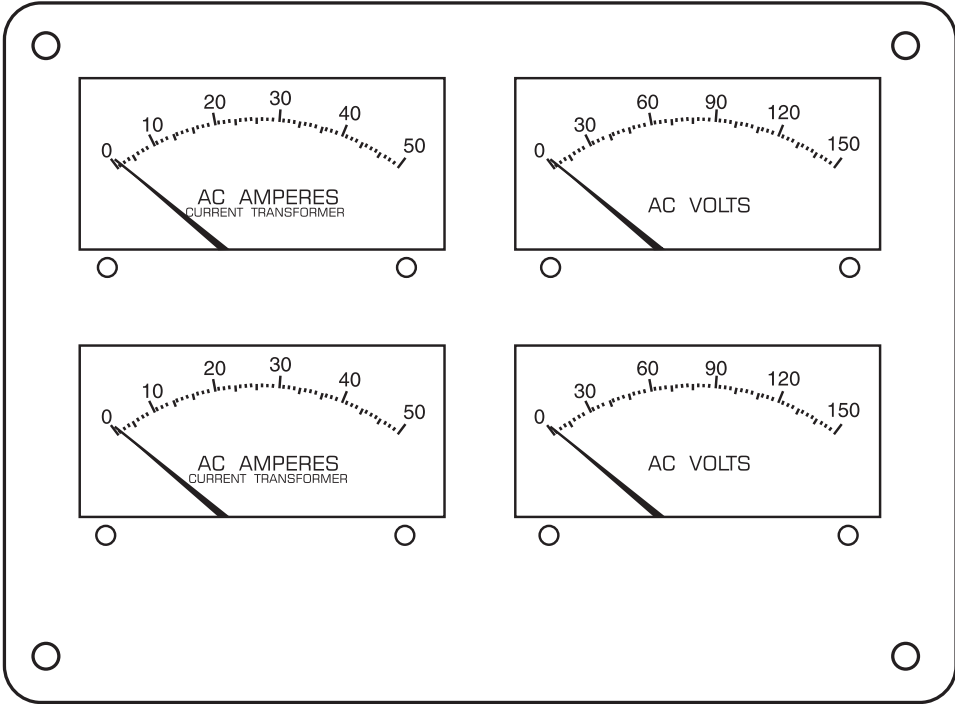
### AC Volt & Amp Meter

The meters for voltage and amperage monitor AC voltage values when hooked to shore power or operating from the generator. 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 main AC breaker panel. These meters are useful guides indicating correct, high or low AC voltage conditions.

Monitor current consumption when using appliances and hooked to anything less than 50 amp service. The meters are non-functional when using the inverters for AC power.

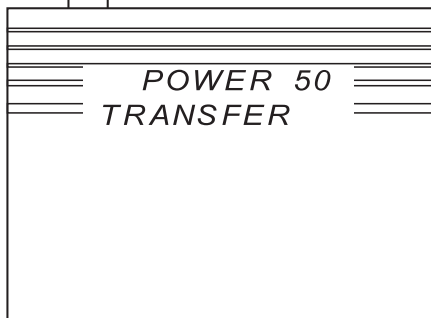
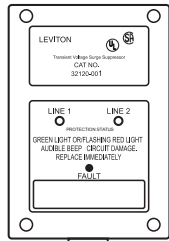


**NOTE: When operating from the inverter, use the inverters remote display to monitor AC and DC voltage or amperage.**



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## TRANSFER SWITCH



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The transfer switch automatically transfers AC power from the shore power cord or generator through the transfer switch to the 110/220 Volt AC breaker panel. When using the generator as the power source, the transfer switch has a time delay built into it before transferring power to the AC breaker panel. This allows the generator time to warm up before applying an AC load. When starting the generator while hooked to shore power, the transfer switch automatically selects generator power as priority over shore power.

### Surge Protector

If the transfer switch has a surge protector, electronics are added to the transfer switch that monitor voltage input for high or low voltage cutout. If the incoming voltage exceeds 138 Volts, or if voltage drops below 105 Volts, the transfer switch automatically disconnects from the electrical service. This prevents damage to voltage sensitive equipment.

A surge protector with line sensors mounts to the transfer switch. The surge protector prevents the motorhome from receiving a sudden "spike" of incoming voltage. This may be from a lightning strike or a power spike during storm activity.

The line sensor monitors the two "hot" conductors supplying the main AC panel. If the two incoming conductors have power, the two green lights illuminate. If only one of the supply conductors has power, the respective green light extinguishes and the red fault light illuminates, accompanied by an alarm.



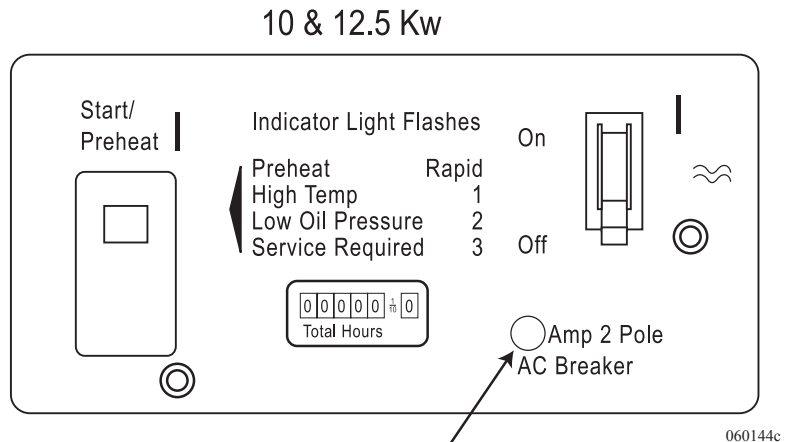
**NOTE: To prevent damage to the transfer switch contacts do not have appliances on or AC loads plugged into outlets when hooking up to shore power or starting the generator. If the motorhome is equipped with a standard transfer switch, the transfer switch will begin to disengage at approximately 90 Volts AC. Operation at this voltage may damage the transfer switch, appliances or other items plugged into outlets. Start the generator and disconnect from shore service until the shore service supply voltage stabilizes.**



# GENERATOR - 120 AC

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

- The generator remote switch on the dash.
- The generator control panel located on the generator.
- The monitor panel.
- The bedroom control panel.
- The inverter panel.



45 Amp = 10 kw  
50 Amp = 12.5 kw

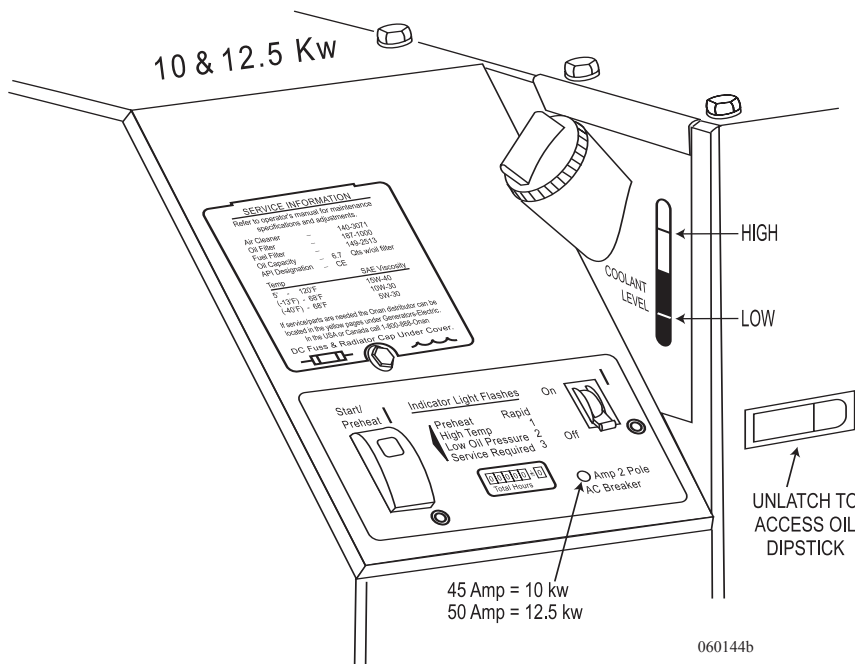
Generator control panel.

Prior to the first start of the day perform a general inspection including oil and coolant levels. Keep a maintenance log on number of hours in operation since the last service. Perform any service or maintenance that may be due.

## Prestart Checks

### Before starting the generator:

- People and animals must be clear of hazards of electrical shock and moving parts.
- All appliances and other large AC electrical loads must be off.



45 Amp = 10 kw  
50 Amp = 12.5 kw

## Starting the Generator

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



**NOTE:** Diesel models may require priming. To prime the 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.



**CAUTION:** An exhaust extension adds weight and stresses the generators exhaust system. Damage to the exhaust piping or exhaust manifold can result allowing Carbon Monoxide gases to accumulate under or leak into the motorhome.

---

## Stopping the Generator

Turn off the appliances and disconnect other AC loads being used. Allow the generator to run unloaded for at least one minute before shutdown. 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.

The AC output of the generator powers the motorhomes 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 approximately 3% of the rated power each 1,000 feet (305M) of increase in elevation above sea level. It may be necessary to operate fewer appliances at the same time when the camping location is at a higher elevation. For example: 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.**

When refueling there is always a possibility the fuel may be contaminated. Contamination of fuel effects the performance of the generator. Diesel fuel may contain water or a microbe growth (black slime). Propane, due to the refining process, may contain light-weight oil. Any contamination of fuel greatly reduces the total output of the generator and may cause erratic AC output.

**Generator Fuel**

AVERAGE FUEL CONSUMPTION	DIESEL 12,500 WATTS (gal./hr.)
No Load	.11
Half Load	.75
Full Load	1.33

\* 4.5 lbs. = one liquid gallon of LP-Gas.



**NOTE: The motorhome manufacturer does not cover damage to the generator caused by fuel contamination, or to appliances due to erratic AC Voltage.**

### Resetting the Circuit Breaker

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

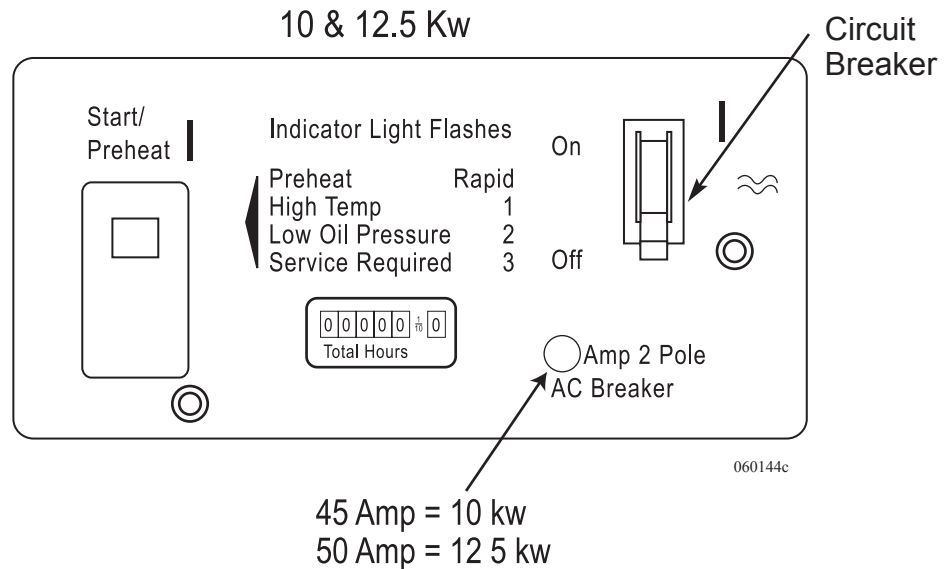


**NOTE: The generator will continue to run after a circuit breaker trips.**

If a circuit breaker trips, disconnect or turn off as many loads as possible. To reset the circuit breaker, switch the circuit breaker to **OFF**; then switch back to **ON** to reconnect the circuit. If the circuit breaker immediately trips, the electrical distribution system has a short or the circuit breaker is faulty. Call a qualified electrician. If the circuit breaker does not trip, reconnect a combination of loads that will not overload the generator or cause the circuit breaker to trip again. Remember to compensate for elevation and temperature changes when reconnecting loads.



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



### Generator Exercise

If use of the generator is infrequent, “exercise” the generator once a month by operating it at approximately half the maximum rated output for two hours. This “exercise” will help promote better starting, more reliable operation and longer engine life. This procedure drives off moisture, 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.



**NOTE: Avoid short run periods of the generator set. Run the generator set under a load for a minimum of one-half hour.**

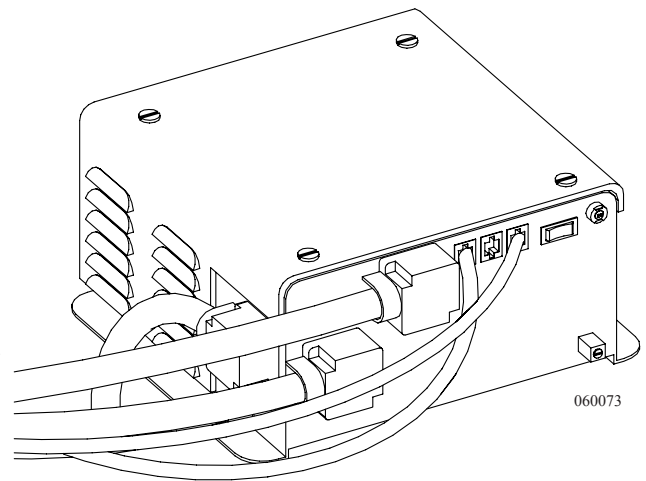
**INVERTER/CONVERTER**

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 available features include:**

- 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.

*Inverter*

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 will simultaneously access the programming field. The settings button is used to set or scroll through a particular programming field.

**RC7 GS Remote**

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

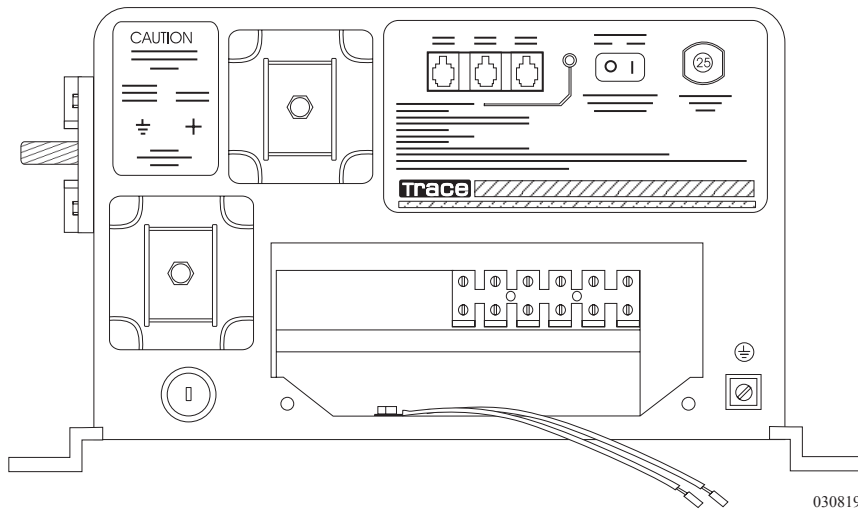
## Stand-by Operation

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: Disable stand-by operation when not in use. House battery power may accidentally be consumed, causing the house batteries to be drained.**

## Battery Charging with the Inverter



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.

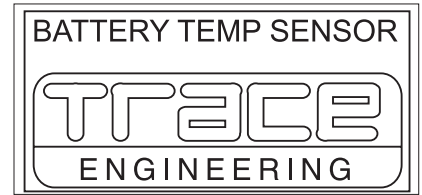
The inverter uses a three stage charging cycle. The first stage is “bulk” charge. The bulk charge will bring the DC voltage up high, initially between 14.2-14.6 Volts, actual bulk charge voltage depends on which battery type has been selected in the programming menu. The bulk charge cycle is controlled 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)**



060085

Incorporated in the inverter is a double pole “pass-through” relay that 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**

This field is a general overview of system status. This is the primary screen of the RC7 GS remote. This field area includes the Main Menu. Use the Up or Down arrows to scroll the menu.

**Operating Display**

**Main Menu:**

**Waiting for AC:** System inactive waiting for AC power to be supplied.

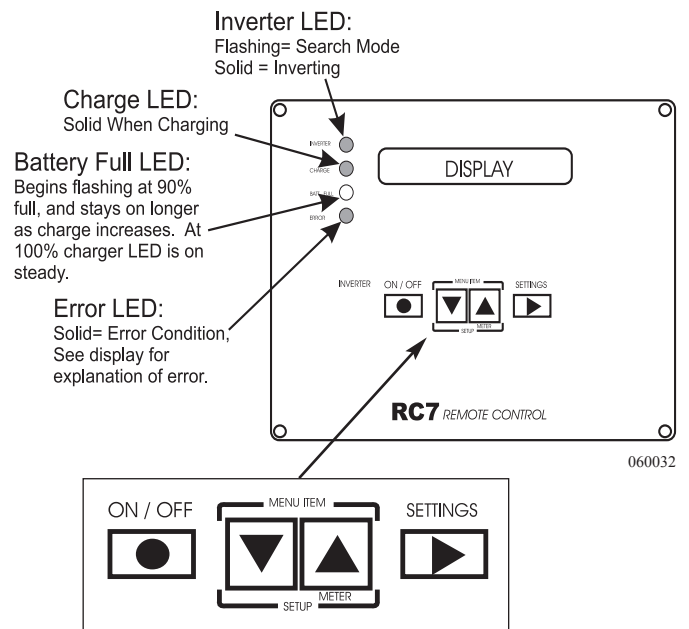
**Inverting:** Unit is inverting.  
Charging Cycle Status: Bulk, Absorb or Float mode.

**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, press and hold the **UP** arrow button for five seconds. The RC7 GS remote will beep. Release the button. The Avg Shunt Amps will be displayed. Use the Up or Down arrows to scroll the field. 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.

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## **Programming the RC7 GS**

**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 (**right-pointing** arrow) to scroll through available settings for selected field.



**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.**

**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.

**Adjustable Field Settings**

**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 fully 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 turned 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.**

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.

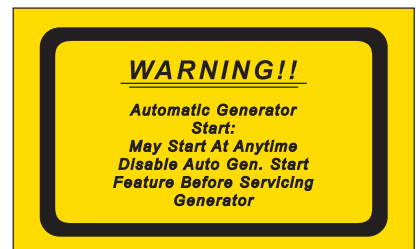
For example: The inverter can be programmed to start the generator when house battery voltage falls to 11.4 Volts. As the battery voltage rises the inverter can be programmed to stop the generator when the house battery voltage obtains a percentage of state of charge (SOC). When selecting the field reference 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.**

### Automatic Generator Start



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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 using the On/Off button.

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%, 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%, 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. For 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 hour 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 Automatic Generator Operation:**

- Set Generator Start and Generator Stop points back to manual ON/OFF positions or switch off the house and chassis main battery disconnects to erase the clock time and generator start/stop programming.

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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:

***Equalize Charging***

**Equalization cycle precautions:**

- 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 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 during the equalize charge cycle.

#### **To Equalize Charge:**

- Press and hold the Settings button on the remote (**right-pointing arrow**) 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 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.

Use the inverter when shore power is not available and not using the generator as a secondary power source. The inverter/charger has limited power output, exercise care when operating from the inverter. It may be necessary to operate items in sequence rather than everything all at once. Remember operating from the inverter quickly consumes house battery power.

When hooked to shore power, or operating from the generator, the inverter charges the house battery bank. The inverter will not automatically begin charging when hooked to shore power or operating the generator. **A charge mode must be selected.** The amount of time to charge the batteries to a full state of charge will vary with the depth of discharge when the charge cycle begins and any additional DC loads, such as lights.



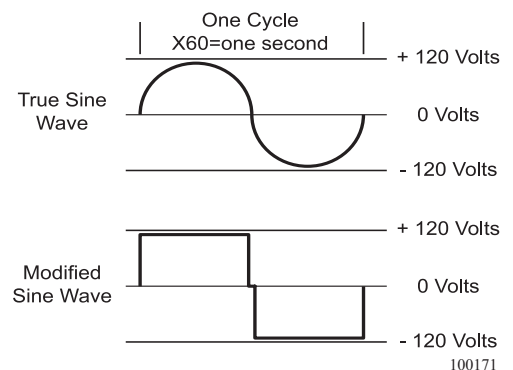
**NOTE: This is not a substitute for the owner's manual for the inverter. The inverter is comprehensive with many variables. Not all the programming details are covered.**



**NOTE: When hooked to shore power or operating the generator, press the red button to enter a charge mode by selecting "On" or "Chg" in the main menu. Failure to enter the charge mode will result in dead batteries.**

**Sine Wave Cycle Patterns:**

Inverters use battery power to make AC power. AC is Alternating Current, meaning the power signal alternates from positive to negative 60 (cycle) times a second. The term "sine wave" refers to the oscillating characteristic of the cycle. Inverter output cycles commonly come in two configurations **Modified Sine Wave** or **True Sine Wave**. The



output cycle of a true sine wave inverter closely mimics the electrical wave pattern of a utility company or generator when observed with electronic equipment.

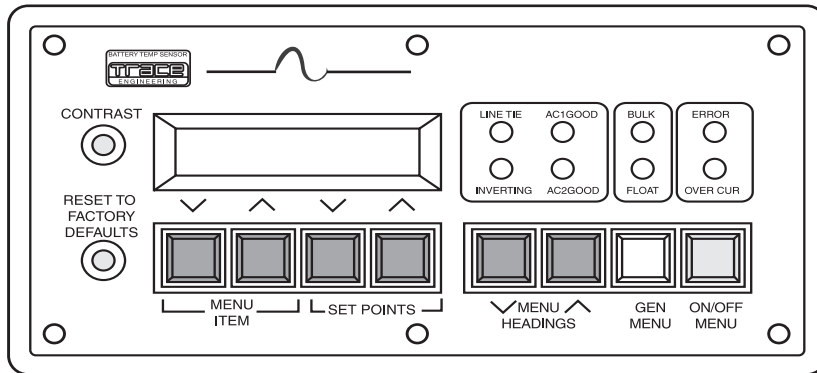
When AC power is available, the inverter will time itself to follow the incoming wave pattern. If the inverter is in stand-by operation when AC power discontinues, the inverter will provide a constant AC supply to the loads.



**NOTE: The main switch on the inverter remains ON.**

## Remote

The sine wave inverter is fully programmable with many features. Use the remote control to change or add features and set variable parameters. The inverter remote may also be used to start and stop the generator.



### Features of the remote:

- Automatic generator start.
- Manual generator start.
- Fully adjustable battery charge rate.
- Adjustable charging curves for different battery types.
- Adjustable power sharing.
- Meters menu.

The remote control uses a liquid crystal display (LCD) and light emitting diode (LED) lights for operation status and programming. The LED lights give inverter status, AC input, charge status and error indications at a glance. The LCD screen displays various meter readings, automatic generator operation status, programming field and error messages.

There are 14 main headings listed in the programming field. These are referred to as Menu Headings. Most of the Menu Headings have several subheadings. The subheadings are referred to as Menu Items.

- Pressing one of the **Menu Headings** buttons enters **Menu Heading** numbers 1 to 8, the **User Menu**.
- Pressing the **Red** and **Green** buttons simultaneously accesses **Menu Heading** numbers 9 to 20, the **Setup Menu**.
- Use the **Menu Headings UP** or **DOWN** arrows to scroll the various main headings. A number in the lower right hand corner of the screen indicates the number of the heading.
- Use the **Menu Item UP** or **DOWN** arrows to scroll the various subheadings of a **Menu Heading**.
- Use the **Set Points UP** or **DOWN** arrows to change the values of a subheading.



**NOTE: A complete description of the Menu Headings and Menu Items are listed in the inverter manual. Refer to the list when accessing the menu or changing program values.**



**Red Button:**

Press the **red** button to exit programming mode or to return to the **Menu Heading number 1, Inverter Mode**. An underscore of the first letter indicates the selected mode. Press the **red** button to scroll the cursor.

**OFF** - Turns the inverter and charger off. The charger will not activate in this mode when AC is available.

**SRCH (Search)** - Turns the inverter on when a specified load, rated in watts, is applied to the inverter. Generally, there are enough loads to turn the inverter on in this setting.

**ON** - Turns the inverter on regardless of load. When AC is available the charger turns on and places the inverter in Stand-by mode.

**CHG** - Turns the charger on only when AC is available. If AC power discontinues, the charger will stop.



**NOTE: When hooked to shore power or operating the generator, use the red button to enter a charge mode by selecting either On or Chg in the main menu. Failure to enter a charge mode will result in dead batteries.**

**Green Button:**

Press the **green** button to exit programming mode or to return to **Menu Heading number 2, Generator Mode**. An underscore of the first letter indicates the selected mode. Press the **green** button to scroll the cursor.

**OFF** - Turns off the inverter control over any generator function.

**AUTO** - Enables the automatic generator start function.

**ON** - Overrides the automatic start program and starts the generator.

**EQ** - Starts an Equalize Charge to the house batteries on the next start cycle of the automatic generator start.



**WARNING: An Equalize Charge uses a significantly higher than normal voltage. This voltage can damage sensitive electronic equipment. Several precautionary measures are required when performing an Equalize Charge.**

The inverter factory default settings are of optimum values in most situations. Slight adjustments may be necessary depending on the amperage available from shore power, personal habits and battery type. If the programming was altered, it is easily reset to the factory default values.

**Programming  
& Resetting**

**To Reset the Inverter:**

- Press the Menu Headings down button on the remote until Trace Engineering heading 3 displays.
- Using the Menu Item buttons, scroll down until Press Reset Now For Default displays on the screen.
- Using the eraser end of a pencil or a pen, press the Reset to Factory Default button on the remote.
- If necessary, repeat the procedure for the other remote.

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**Stand-by Operation**

The inverter can be set-up for stand-by power operation. For example: If AC input is discontinued to the motorhome, the inverter will automatically provide AC power. When AC power resumes, the inverter will automatically return to "STAND-BY" mode. Battery charging is not effected by STAND-BY operation. When AC power resumes the inverter will automatically return to "STAND-BY" mode.

**To Activate Stand-by Mode:**

- Press the red "ON/OFF" button until the cursor indicates **ON**.



**NOTE: Remember to disable stand-by operation when not in use. House battery power may be accidentally consumed.**



**NOTE: The inverters supply the power necessary to operate the refrigerator if shore power is not available or not operating from the generator.**

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**Battery Charging**

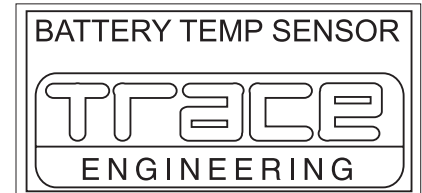
Whether hooked to shore power or operating from the generator, the internal battery charger of the inverter will charge the house batteries. Battery charging does not begin automatically when AC power is available. The inverters must be turned on to begin battery charging. The time it takes to charge the batteries to a full state of charge varies greatly. It can take several hours or even days depending on the actual state of charge of the batteries and DC power consumption.

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 depending on ambient temperature. Voltage and current control the bulk charge cycle. 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 voltages in the absorb cycle are 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 menu item Set Absorption Time under the menu heading number 9, Inverter Setup. The final charging stage is the "float" charge cycle. Approximately 80% of the charging cycle is completed by this time. The float charge voltage is generally around 13.3-13.7 Volts. The last 20% of the charge cycle requires the most amount of time.

**To Begin Battery Charging:**

- Hook to shore power or start the generator.
- Press the **red** button on the inverter remote until the cursor indicates either **CHG** or **On**.

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

**Battery Temperature Sensor**

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Incorporated in the inverter is a double pole "**pass-through**" relay that trips when supplying AC power to the input terminals. This relay transfers AC power through the inverter to the AC sub panel supplying power to outlets and appliances. When AC power is supplied to the inverter, the internal battery charger will "ramp up" battery charging voltage. A time delay allows pass through AC power to the sub panel before ramping up the battery charge.

**Pass-through Power**

The meter heading number **4** in the user section displays various voltage and amperage readings.

**Meters Menu****To access the meters:**

- Scroll the menu using the **Menu Headings** buttons until meters heading number **4** displays on the screen.
- Use the **Menu Items** buttons to view the available meters.



**NOTE: The meters do not display a (+) symbol for positive values.**

**Explanation of the Meters****Inverter/Charger:**

**Amps AC** - Displays the total number of AC amps used by the internal charger when hooked to shore power or operating from the inverter. This meter also displays the AC amp load when using the inverter.

**Input Amps AC** - Combined total of AC amps including the internal charger and pass through relay amps.

**Load Amps AC** - Displays the total number of AC amps of the pass through relay.

**Battery Actual Volts DC** - Displays the DC battery voltage at the inverter when hooked to shore power or operating the generator.

**Battery Temp/Comp Volts DC** - Displays the bulk voltage setting in the menu item Set Bulk Volts DC under the menu heading Battery Charging number 10. Actual charge voltage will differ depending on ambient temperature. This is due to battery temperature compensation.

**Inverter Volts AC** - Displays the inverter's AC output voltage.

**Grid (AC1) Volts AC** - Not used.

**Generator (AC2) Volts AC** - Displays the incoming line voltage from either shore power or generator to the inverter.

**Read Frequency Hertz** - Displays the number of cycles per second of incoming power to the inverter.

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### ***Automatic Generator Start Programming***

This section covers the procedure to program the automatic generator start function. There are several variables to the program. Some settings may work fine in one location, but not in another. The order of instructions will follow the sequence of the headings. Read all instructions thoroughly. This is not a substitute for the inverter manual.

#### **Setting the Clock (24 hour):**

1. Using the **Menu Headings** buttons scroll to menu number “6 Time of Day.”
2. Press the **DOWN** button on the **Menu Items** button, **Set Clock Hour** will display. Use the **Set Point** buttons to set the hour. Time changes in ten minute increments. The clock is a 24 hour clock. For example: 9:00 a.m. would be 09:00, 3 p.m. would be 15:00 and 7 p.m. would be 19:00.
3. Press the **DOWN** button on the **Menu Items** button, “Set Clock Minute” will display. Use the **Set Point** buttons to set the minute.
4. Press the **DOWN** button on the **Menu Items** button, “Set Clock Second” will display. Use the **Set Points** buttons to set the second.

#### **Setting Generator Timer:**

5. Press the **Menu Headings DOWN** button, Menu Heading number “7 Generator Timer” will display.

6. Press the **DOWN** button on the **Menu Items** button, “Start Quiet Time h:m” will display. **Start Quiet Time** is the time you want the generator to stop running or not start at or after quiet time begins. Using the **Set Point** buttons to set the hour and minute (24 hour clock) the generator will start quiet time.
7. Press the **DOWN** button on the **Menu Items** button, “End Quiet Time h:m” will display. **End Quiet Time** is the time you want the generator to begin operation. Using the **Set Points** buttons to set the hour and minute (24 hour clock) will end quiet time.



**NOTE: If desired the quiet time may be disabled. Set the Start and End Quiet Times to the same hour and minute.**

The next set of instructions covers many variables to program the starting or stopping events of the generator. Many different starting conditions, length of operation or stopping conditions are available. If in doubt about changing any settings, the factory default settings are average settings and will work in many situations.



**WARNING: Use caution when programming the automatic generator start function. When this feature is enabled the generator may start at any time. Disable this feature when performing service to the generator or when stored in an enclosed building.**

#### **Gen Auto Start Setup:**

8. Press the **red** and **green** buttons simultaneously to continue the generator **autostart** programming. Heading number “9 Inverter Setup” should appear.
9. Press the **Menu Headings DOWN** button to scroll to heading number “12 Gen Auto Start” setup. Press the **Menu Items DOWN** button to advance through the next set of variables. Read all options first before setting any values of the **Menu Items** in Menu Heading number “12.”
10. Press the **Set Point** buttons to change the settings of a Menu Item.  
**Menu Items in Menu Heading 12 Gen Auto Start Setup:**

**Set Load Start Amps AC** - Starts the generator when the AC current on the pass through relay of the inverter meets or exceeds the preset number of amps. For example: Setting the preset number of amps to 15 when hooked to a 20 Amp service starts the generator when the total current exceeds 15 Amps on the pass through relay.

**Set Load Start Delay Min** - This is the time delay period used with Set Load Start amps AC menu item. Example; setting the time period to 00:00 starts the generator immediately when the total number of amps exceeds the setting of menu item Set Load Start amps AC.

**Set Load Stop Delays Min** - This is the time period the generator continues to operate after the generator started from the setting in the Set Load Start amps AC menu item.

**Set 24 hr Start Volts DC** - Starts the generator if the voltage drops below the setting for a consecutive 24 hour period. For example: If the voltage is set for 12.5 Volts DC and house battery voltage drops below 12.5 Volts for a continuous 24 hour period the generator will start. This setting is helpful when storing the motorhome.



**CAUTION: It could be several days before the generator starts from the 24 hour voltage setting. Do not use this setting when storing the motorhome inside a storage building. Do not park the motorhome near dry grass.**

**Set 2 hr start Volts DC** - Starts the generator if the voltage drops below the setting for a consecutive two hour period. For example: If the voltage is set for 12.0 Volts DC and house battery voltage drops below 12.0 Volts for a continuous two hour period the generator will start. This voltage setting is usually lower than the 24 hr start voltage setting. Primarily used when dry camping. An example would be a light loads on the house batteries over time. Voltage drops at relatively steady rate until obtaining the preset voltage for two continuous hours.

**Set 15 min start Volts DC** - Same operating principal as the previous two menu items. This voltage setting is used when applying heavy loads to the house batteries. An example: Using many lights and the inverter to watch the television and operating the microwave. These types of loads rapidly deplete battery reserves. Battery voltage drops quickly when applying heavy loads to the house batteries.

**Read 30 sec LBCO start VDC** - Used with the menu item Set Low Battery Cut Off VDC under menu heading number “9 Inverter Setup.” If house battery voltage drops to this point, the inverter waits 30 seconds before starting the generator.



**NOTE: This start setting overrides quiet time.**



**NOTE: The generator will operate until the bulk and absorption cycle are complete if the generator started from one of the low battery settings.**

**Set Exercise period days 30** - Starts the generator regardless of any other setting. Periodically starts the generator for maintenance reasons. The generator should be operated at least every 30 days to lubricate the internal engine components.

**Set Maximum run time h:m** - Displays an error message if the generator operates longer than the time period set. This is only a message. To cancel the message return to heading number “2 Generator Mode.” Use the green button to scroll to Off. Setting the time and minute to 00:00 defeats this function.

### **Gen Starting Details:**

11. Use the down arrow on the Menu Headings button to scroll to menu heading number 13, Gen Starting Details.
12. Use the **Menu Items** button to scroll down to “Set Gen warm-up seconds.” Use the **Set Points** buttons to set the time to 90 seconds. If it is not set to 90 seconds, the generator will shut down prematurely.
13. Use the **Menu Items** button to scroll down to “Set Post Crank seconds.” Use the **Set Points** buttons to set the time to 90 seconds. If it is not set to 90 seconds, the generator will shut down prematurely.

### **To Enable or Disable the Auto Gen Start Program:**

After completing the programming schedule, use the green button to return to heading number “2 Generator Mode.”

- **To Enable the Automatic Generator Start Feature:** Press the **green** button and scroll to “Auto.”
- **To Disable the Automatic Generator Start Feature:** Press the **green** button and scroll to “Off.”

## Inverter Facts

### Important Facts About the Inverter:

- The inverter will not charge automatically unless the remote is set to **CHG** or **Qn** by using the **red** button.
- With AC available, if for any reason battery voltage dropped below 8.5 Volts DC, before the remote was set to **CHG** or **Qn**, the inverter will not charge the batteries. The inverter requires at least 8.5 Volts DC to operate the internal "brain." Use an alternate method of inducing a charge voltage to the house batteries.

#### If this situation occurs:

1. Hook to shore power or start the generator.
2. Start the engine. The alternator on the engine should supply a charge to the house batteries.
3. The LCD screen should display. Press the **red** button until the cursor is under **CHG**.
4. After the remote indicates the inverter is charging, the engine can be shut off.
5. If this method does not work a battery charger may be used. Observe polarity when hooking up cables. Reverse polarity will damage the inverter.



**WARNING: The gases around the battery can explode if exposed to flames, sparks or lit cigarettes. An explosion can result in injury or vehicle damage. Batteries contain sulfuric acid, which burns skin, eyes and clothing. Do not connect the end of the second cable to the negative (-) terminal of the battery when being jumped. A spark may cause an explosion of the gases that surround the battery. Connect only to chassis, away from the battery.**

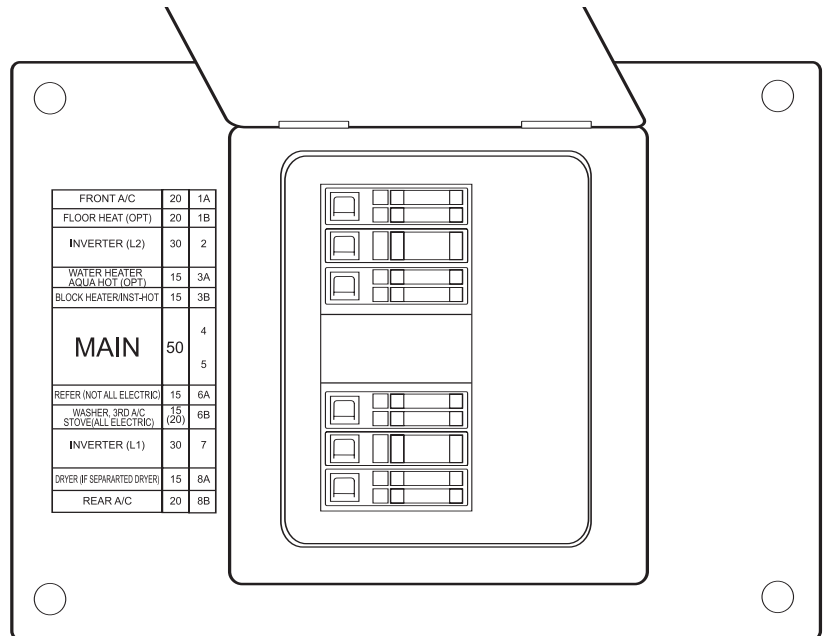
- When the main battery disconnect switch is turned off, or if battery power to the inverter is removed, all program settings are lost. When battery power is restored, the inverter will need to be programmed.



## DISTRIBUTION PANEL - HOUSE 110

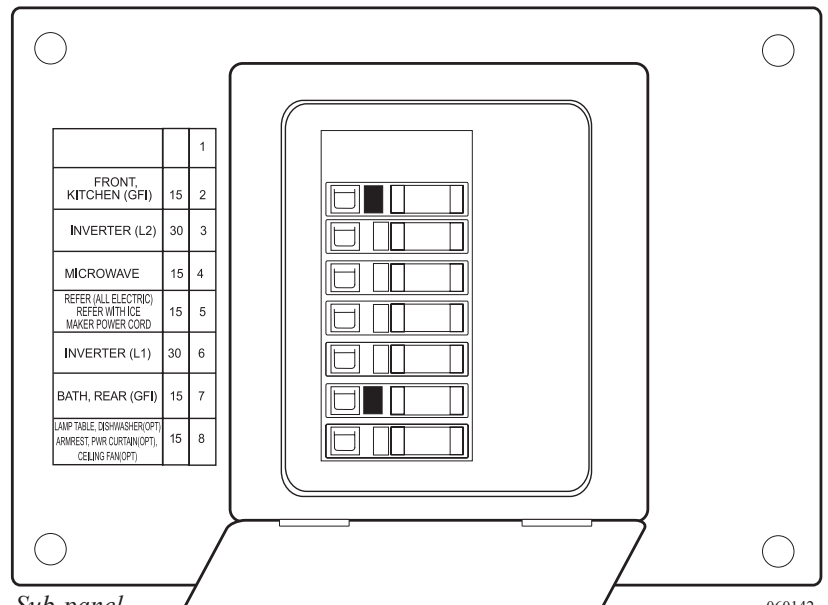
The AC distribution panels are located in the bedroom. The main 120 Volt AC panel receives power from the transfer switch, which is supplied by either shore power or the generator. The AC power is supplied to the 50 Amp main breaker first, then the power is supplied to the individual branch circuit breakers. 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.



Main Panel.

060143



Sub-panel.

060142



**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 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.

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## **Circuit Breaker**

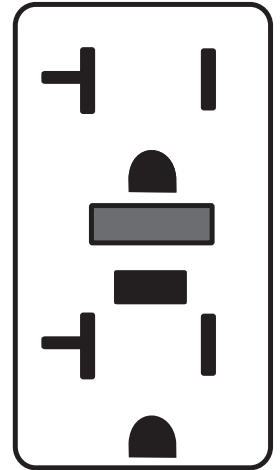
Breaker current ratings are current set points in which the breaker is designed to operate. The internal configuration of the circuit breaker is designed to trip when excess current is drawn through the breaker. The breaker will heat up from the excess current causing the breaker to trip. The trip action 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 decrease. The AC current load then falls back into the breaker’s rated 80% set point. This electric principle should be kept in mind when using anything other than 50 Amp shore service and using appliances with electric motors, such as air conditioners. When using outlets, care should be considered when applying loads such as electric motors, heaters, coffee makers, toasters, hair dryers or other large current consuming loads. The current rating is usually stated on most electrical items. The current rating will either be rated in amps or watts. Current ratings stated on electrical items will change slightly with voltage fluctuations. As voltage increases, current consumption decreases. As voltage decreases, current consumption increases. This may explain why in some instances items operated at borderline voltage to current tolerances may seem fine in one location but problematic in another.



**NOTE: To calculate watts to amps simply divide the watt figure by the voltage of which the item operates from. For example: The electrical item is rated at 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.**

A ground fault circuit interrupter “GFCI” can be found in two different types of applications. One type is incorporated in a breaker used in 120 Volt AC breaker panels, the other is incorporated in an outlet. The GFCI, whether it is a breaker or an outlet, offer two types of protection. One type of protection is from over-current or shorts. It also provides protection for persons against hazardous ground fault currents which can result in injury or death. Ground fault currents are currents that flow from the “HOT” or power terminal through a person to the ground. For example, touching a faulty appliance while standing on or making contact with an electrical ground such as a water fixture, bath tub or the earth. If the device has been properly installed it will offer protection against the type of shock that can result from faulty insulation, wet wiring from inside an appliance, or any device or equipment plugged in or wired to that circuit. The “ground fault” portion of the outlet or breaker uses sensitive electronics inside the outlet or breaker to detect a ground fault problem. The electronics monitor the normal current of power, flowing to the “hot” or black wire through the load (eg. a light bulb or appliance) and coming back on the “neutral” or white wire. If just a small amount of the current comes back on the safety ground wire, the electronics will “trip” the breaker or outlet, stopping the flow of electricity. The amount of current it takes to trip the device from a ground fault varies slightly from the different outlet or breaker manufacturers (approximately 30 mils or less). 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.

## GFCI BREAKERS & OUTLETS



GFCI Outlet.

060072



**WARNING:** If a breaker or outlet trips continually **DO NOT** continue to reset breaker or outlet until the problem has been identified and corrected.

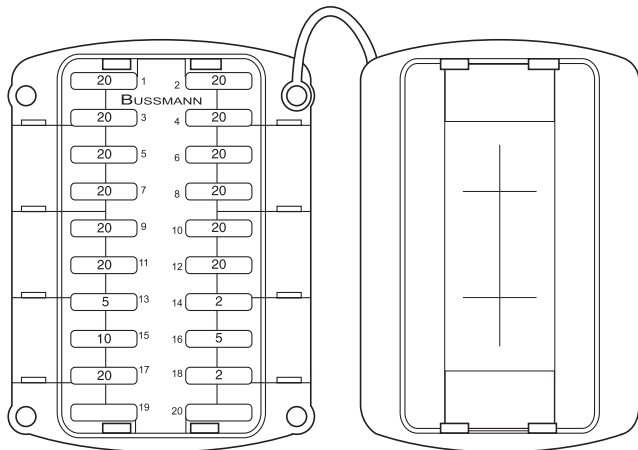


**NOTE:** The ground fault outlet or breaker should be tested once a month to ensure it is working properly. Use the “TEST” button on the outlet or breaker. It should trip with an audible “click.” The breaker or outlet will not trip if no AC power is present to the device. If power is present and the device will not “trip,” replace it before using that circuit.



**NOTE:** One mil is 1/1000 of one amp.

## DISTRIBUTION PANEL - HOUSE 12 VOLT



Fuse Panel Label located in bedroom.

060151B

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.

## FUSES

AMPERAGE	COLOR
1	BLACK
2	GRAY
3	VIOLET
4	PINK
5	GOLD
7.5	BROWN
10	RED
15	BLUE
20	YELLOW
25	CLEAR
30	GREEN

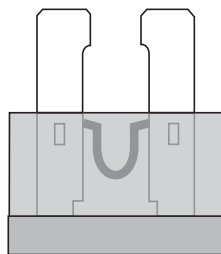
Amperage Chart.

amperagechart

The 12 Volt fuses, located in this distribution panel, service the interior house lighting, ventilation fans, monitor panel, furnace and water heater. Should a fuse blow it will be evident by the broken metal strip located in the center of the fuse. Replacement fuses should be of the same amperage. If a higher rated fuse is installed it can damage the wiring. Fuse current set points follow much of the same electrical principle as the 120 Volt AC breakers. Using 12 Volt DC as the electromotive force can make it more susceptible to outside influences, such as corrosion from weathering or oxidation.

The large variety of applications this voltage can be used in makes it a diet staple for most of the recreational vehicle and automotive industries. The danger from shocks with this voltage is minimized, but can still occur. A good example is when a magnetic field is generated, then collapses when the power supply is cut. The result is a discharge that can reach tens of thousands of volts for a short time period. Care should be used when working with this voltage as current values can be quite high, like in the case of a battery 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

060086

**Tools of the Trade**

One of the most widely used tools for testing a 12 Volt problem is the test light. Test lights come in a host of varieties, 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 case of a charging system problem the meter may be the tool of choice. In any situation the testing tool is an invaluable piece of equipment when it comes to determining an electrical problem.

**Knowing When to Say When**

Should it become necessary to use testing tools take certain precautions and consider three things. First, recognize when the problem is beyond your skill level. Nothing will create more mayhem than being armed with tools and going in an unknown direction. Good intentions have led to major problems. The second item to keep in mind is if something will cause more grief by being dealt with now than if it were left alone and repaired by a professional at a more convenient time. How many times have you said to yourself, "Oh this will only take a few minutes," only to find it is taking an entire day and you wished you had not touched it? The third item to consider is whether or not the current situation may be potentially dangerous if left to be repaired at a more convenient time.



**NOTE: Check all related fuses before assuming you have encountered an electrical problem or situation. Spare fuses should be kept on hand and can be purchased from 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 placed between the positive and negative terminals, the electrons move from the negative plate to the positive plate through the “load” and then back to the ground terminal. At this time the sulfuric acid leaves the water and adheres onto the plates of the battery. The electrolyte solution keeps the electrons from flowing while the battery is in the “at rest” position.

Charging the battery moves the sulfuric acid back into solution with the distilled water. A battery left in a low or discharged state will cause the acid to “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).

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### ***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.

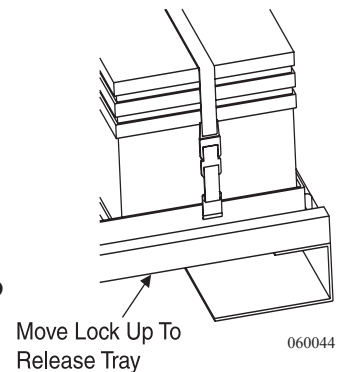


**NOTE: Tap water contains minerals which can alter battery chemistry and ruin the battery. Use only distilled water when refilling the battery.**

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 *Kwiklee* brand spray lubricant.

### Battery Trays



**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.**

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

### Battery Maintenance



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. The battery cable to battery terminal connections should be metal to metal. Coat the terminals with petroleum jelly or an anticorrosion grease.

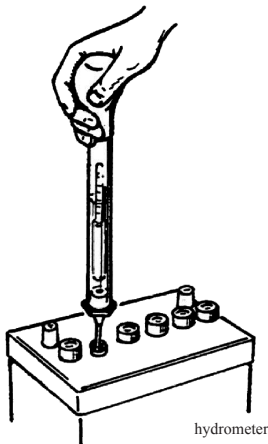
Periodically check the batteries for corrosion. Look for cracks and check the vent plugs. Replace them if they are cracked or missing. Keep the top of the batteries clean. The accumulation of electrolyte and dirt may permit small amounts of current to flow between the terminals, which can drain the battery.



**WARNING: Liquid lead acid batteries produce hydrogen gas while being charged. This is highly explosive. Do not smoke around batteries. Extinguish all flames in the area. The hydrogen gas may explode resulting in fire, personal injury, property damage or death.**

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## Testing the Battery



Hydrometer (Cylinder Type).

There are several ways in that a battery can be tested and monitored. The motorhome uses a monitor panel which shows the status of the house batteries at a quick glance. Pressing and holding the test button, the power level will be displayed on the battery scale.

The most efficient way of testing the batteries is to check the electrolyte solution. The only way to test a battery's electrolyte solution is with a hydrometer. Many styles are available, from types with cylinder graduation (shown here) to types with floating balls. Hydrometers can be purchased from most auto parts stores. The hydrometer tests the battery's electrolyte solution which is measured in specific gravity. Distilled water has a specific assigned gravity of 1,000. The hydrometer is calibrated to this mark. Pure sulfuric acid has a specific gravity reading of 1,840. The acid is 1.84 times heavier than water. The electrolyte solution is about 64% water to 36% acid (fully charged battery). Hydrometers with cylinder graduation are graphed and the exact state of specific gravity can be determined.



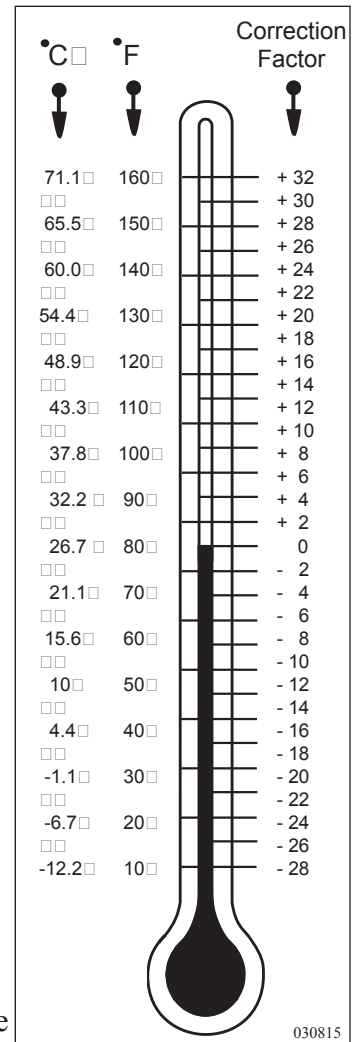
Temperature and recent battery activity (charging or discharging) affect the hydrometer readings. It is best to check the battery when it has been “at rest” for at least three hours, although readings taken at other times will give a “ballpark” figure. When using the hydrometer, draw the electrolyte solution up into the tube. Allow the hydrometer to attain the same temperature as the electrolyte solution. Note the reading for that cell. Complete the same test for the rest of the cells on that battery bank.

The hydrometer is calibrated at 80° F. Temperature affects the hydrometer readings. The higher the electrolyte temperature, the higher the specific gravity reading. The lower the temperature, the lower the specific gravity reading. Add or subtract four points for each 10° variance from the 80° F chart. Readings between cells should not vary more than 50 points.

If one cell in a particular battery bank being tested is at a 50% state of charge while the others are indicating a full charge, charge only that battery to see if the low cell will come up. At the same time, do not over charge the “healthy” cells.

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.



Temperature Correction Chart.



**NOTE:** See the chart for temperature compensation. Liquid levels should be even between the cells of the battery being tested as it will affect the accuracy of the test.



**WARNING:** Sulfuric acid in the batteries can cause severe injury or death. Sulfuric acid can cause permanent damage to eyes, burn skin and eat holes in clothing. Always wear splash-proof safety goggles when working around the battery. If the battery electrolyte is splashed in the eyes, or on skin, immediately flush the affected area for 15 minutes with large quantities of clean water. In case of eye contact, seek immediate medical aid. Never add acid to a battery once the battery has been placed in service. Doing so may result in hazardous splattering of electrolyte.

## **Reasons Why Batteries Fail**

### **1. Physical Condition:**

Active material flakes off the plates and falls to the bottom of the cell.

This is normal, but sediment accumulation under the plates can short out a cell. The plate separators fail to insulate positive and negative plates in a cell and the cell becomes shorted, ruining the battery.

### **2. Insufficient Electrolyte:**

This allows exposed portions of the plates to sulfate rapidly. This reduces the battery's ability to accept a charge and the battery capacity is reduced. Accelerated erosion of the lower portions of the plates occur from higher than normal acid content due to water loss. Only the water evaporates, not the acid. The battery also has a higher internal resistance when low on water. Add only distilled water. Fill each cell to the bottom of the vent well when the battery is warm. Filling a very cold battery with water to the bottom of the vent well will cause overspill when the battery warms up and the plates expand. A Battery Formula For Failure: the battery has a higher internal resistance when low on water, therefore: *high resistance = more heat = shorter battery life!*

### **3. Sulfation:**

When a battery remains discharged for too long the accumulated lead sulfate in the plate material solidifies and cannot reenter the electrolyte.

When a battery is left in a discharged state the lead sulphate will crystallize. Charging the battery does not move the crystallized lead sulphate off the battery plate. The battery is damaged.

### **4. Overheating:**

The chemical reaction inside of the battery is increased when the battery temperature rises above 125° F. This increases the corrosion of the plates and reduces the battery life. When overheated, the battery plates tend to buckle and destroy the structural integrity of the battery.

### **5. Freezing:**

When the electrolyte freezes, ice formed dislodges the active material from the plates. The battery case may crack and the electrolyte will leak out when thawed. It is especially important to keep a battery at full charge in cold weather to prevent freezing. The high specific gravity of a fully charged battery does not freeze as easily. Never attempt to charge a frozen battery. Warm it up first.

**6. Corrosion:**

Corrosion from spilled or splashed electrolyte form deposits that can conduct electricity and can cause battery drain. Clean off all corrosion, especially around the battery terminals and on the top of the battery. Prevent accumulation by coating the terminals and the exposed metal cable connectors with high temperature grease.

**7. Overcharging:**

Overcharging rapidly converts water to gas and decreases the electrolyte's water content as the water evaporates. The electrolyte level drops and becomes more acid in content. This subjects the plates to a higher concentration of sulfuric acid and results in early battery failure.



**NOTE: Any time more than one or two ounces of distilled water is added per-cell per-thousand miles, check the motorhome charging system for overcharging. Prolonged overcharging generates excessive heat inside the battery, which buckles the plates and destroys the battery. It is a fact that over 50% of battery failures are caused by 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. 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

## **Battery Voltage & Current**

in the tank drops. Think of siphoning water from a bucket. As the level of the water drops, the volume of water exiting the siphon slows down.

When the tank is full it is capable of feeding more “pressure” to the pump inlet due to gravity, and the pump always has enough water available to maintain its rated pressure and volume. However, if the water tank gets low the pump will not have enough water volume coming in to maintain 12 psi at 15 GPM. If the loads are removed from the pump by closing the valve on the outflow, even with low pressure in the tank the pump will eventually pressure up to 12 psi. It will just take it longer to get there. When the valve is opened the pump will sustain 12 psi for a brief period, but since the tank is no longer feeding the pump as fast as needed the pressure will eventually drop. This analogy can be restated by replacing the pump with a battery, pressure with voltage, volume with amps, outflow valve with a switch, water with electricity and the water tank with the battery electrolyte.

The level of the tank could be thought of as the rate of the reaction occurring in the electrolyte. When the battery is fully charged the electrolyte has an excess of reactions taking place to feed the battery terminals. This tapers off with time as the electrolyte is spent, so maintaining voltage becomes possible. With no loads the discharged electrolyte will be capable of producing close to the rated voltage, but only after a period of time has elapsed for enough of a reaction to take place to bring the voltage back up. Hopefully, this explanation will clarify why a battery measured at rest can indicate close to its rated voltage but will not run a load.

---

## ***Battery Charge Time & Consumption Rate***

### **Calculating Run Times:**

Calculating run time figures when operating 120 Volt AC electrical items with an inverter can be exponential. This is due to battery characteristics. Flow characteristics of electrons vary with different battery types and chemical compositions. Deep cycle batteries are generally designed to slowly release a majority of their charge capacity. Deep cycle batteries are rated in amp hours (Ahrs) with the discharge occurring over an extended period of time before the battery is charged. Engine starting batteries are designed to quickly release large amounts of current for short durations, without depleting battery reserves. Commercial type batteries bridge the gap of deep cycle and engine batteries. Commercial batteries release medium amounts of current over a longer period of time but they are not designed to cycle their charge capacity.

The working range of a deep cycle battery is between 50 and 100% state of charge (SOC). Deep cycle batteries should not be cycled below 50% state of charge. Discharging a deep cycle battery below 50% state of charge shortens the life of the battery. Deep cycle batteries use an amp hour rating which is usually calculated over a 20 hour discharge interval. For example: A deep cycle battery with a rated capacity of 100 Ahrs. is designed to release current at the rate of 5 Amps per hour. Multiply a 5 Amp load over a 20 hour discharge

period equals the rated 100 Ahr. capacity. These discharge figures are calculated with the battery starting at 100% state of charge with the battery at 80° F when the discharge cycle begins. However, increasing the discharge load applied to the battery from five amps to ten amps on a 100 Ahr battery does not yield 10 hours of discharge time. This is due to the internal reactions which occur when a battery is discharging. Actual discharge time for a 10 Amp load may be closer to eight hours of discharge time. Increasing the load applied to the battery to 20 Amps will not yield five hours discharge time but may be less than three hours. It might be understood as a point of diminishing return.

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 maintain the batteries in their proper operating range.

**Battery Specifications**

CHASSIS	AH (20HR)	CCA	RC (25A) MINUTES
Chassis 12 Volt Chassis 31P-MHD (2 each)	240	950	450
6 Volt Domestic U2200 (4 each)	450*	**	447
12 Volt Domestic GPL-8D (All Electric)	255*	**	1350

\*Total battery bank capacity. \*\*Battery connections are made in a Series/Parallel connection. Domestic batteries are not rated in Cold Cranking Amps (CCA).

Approximate Hours at Ampere Load					
	5 AMPS	10 AMPS	15 AMPS	20 AMPS	25 AMPS
<b>U2200</b>	<b>55.0</b>	<b>22</b>	<b>12.5</b>	<b>9.1</b>	<b>7.0</b>

Approximate Hours at Ampere Load				
	5 AMPS	8 AMPS	15 AMPS	25 AMPS
<b>AGM GPL-8D</b>	3130	1627	801	461

Battery State of Charge vs Voltage/Specific Gravity			
VOLTAGE	SPECIFIC GRAVITY	STATE OF CHARGE	DEPTH OF DISCHARGE
12.66	1.265	100%	0%
12.45	1.225	75%	25%
12.25	1.190	50%	50%
12.05	1.145	25%	75%
11.90	1.100	0%	100%

Cummins Enging Cold Cranking Amp Requirements				
ISM	1800	CCA	12	VOLTS

CCA Rating are at 0° F. These are the minimum requirements.

## SOLAR PANEL

The motorhome comes pre-wired to accept this optional solar battery charging system. The system consists of one 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 85 watt solar panels.

### The Solar Panel:

The solar panel is a laser-grooved, buried-grid 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 has shown that one 85 watt solar panel delivers enough power to offset the normal day-to-day drain on batteries caused by various parasitic electrical loads. These parasitic loads are usually associated with transmission memories, alarm systems, natural self-discharge of batteries and other like items. This means that the first 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 depending on weather conditions.

### The Combiner Box:

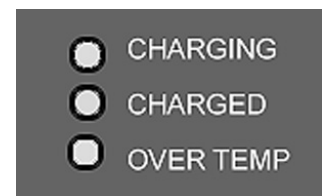
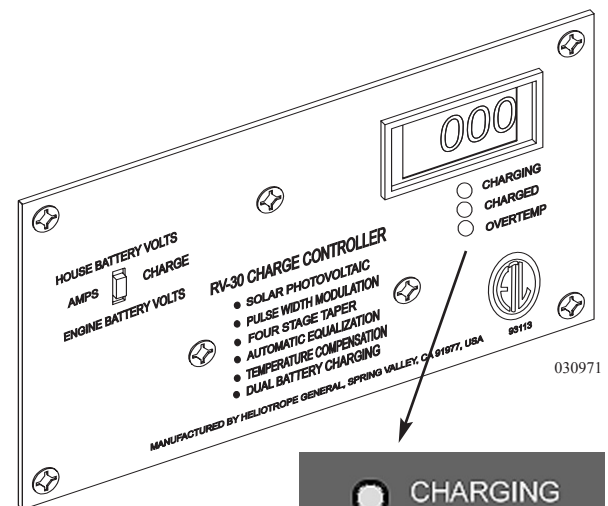
The Combiner Box is located on the side of the refrigerator vent on the roof. It has four standard "knock outs" to allow extra solar panels to be added to meet dry-camping needs.

### The Charge Controller:

The Charge Controller was built specifically to meet the needs of motorhomes. It can be set to accommodate either Flooded Lead-Acid batteries or Absorb Glass Mat (AGM) batteries.

A digital readout on the faceplate displays one of three readings by means of a slider switch: **House Battery Voltage**, **Amps Charge** or **Engine Battery Voltage**. Three indicator lights are also there for at-a-glance status: **Charging** (the system is actively charging), **Charged** (the batteries have reached their charged set point) and **Over Temp** (the circuit board has reached a high temperature and automatically turns off; it will turn back on automatically when properly cooled).

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 Over Temp light) will be activated if it gets too warm.



charge control zoom  
Close-up of the Indicator Lights. Charging and Charged indicates with a green light. Over Temp indicates with a red light.

## **Charge Controller Features**

The RV-30 Charge Controller has many unique features which are listed and described below:

- 1. Dual Battery Bank 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 Sandia 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 their set point voltage (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 batteries at their set point voltage (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 the 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 (Only when set to Flooded Lead-Acid Batteries)** - This feature is activated once per day to extend the life of the 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 the house 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 15.0 Volts) and then falls back to the 14.2 Volt setting for the remainder of the day.
- 5. Automatic Float (Only when set to Absorbed Glass Mat Batteries)** - This feature resets the charge parameters to work with AGM batteries. It removes the equalization cycle (AGM batteries are sealed and don't like the higher voltage reached during equalization), and changes the Float setting from 14.2 to 13.4 Volts, which is what the AGM battery manufacturer recommends.



**CAUTION: The Charge Controller Panel may be hot to the touch. This is a normal function of the Charge Controller.**



**Solar Panel Care**

A critical part of maintaining the solar electric battery charging system is to keep the panels clean. The amount of power that a panel will produce is directly related to the intensity of sunlight that 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 that can cover two or three of the 36 individual cells can reduce output power by 50 to 75%.

Use of the basic maintenance tips, regular inspections and regular cleaning will assure maximum charging from the 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. The panels should be cleaned if a film or a layer of dust is on the windshield.
2. On a bright sunny day, the charging amps should be 3.5 to 5 Amps 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 replacing the batteries or performing battery cable maintenance.**

INTERIOR BULB CHART	
LOCATION	BULB NUMBER
CEILING LIGHTS (Fluorescent)	GE F15T8 - CW
CLOSET LIGHT	SYLVANIA 1141
VANITY/COSMETIC LIGHT	12 Volt 13 Watt 9-019F
BEDROOM OR LIVING ROOM LAMP	SYLVANIA 1076
BEDROOM WALL LAMP	1383
ROPE LIGHT	LITCO 31-120-40
DASH LAMP	161
ENTRY HANDLE LIGHT TUBE	MP# 16615157
DASH LIGHTS	161
HALOGEN CEILING LIGHT- 3"	12V 10 Watt FC 2585
WALL LIGHT	25 Watt 25616CL3

**BULB USAGE  
- INTERIOR**

## ALL ELECTRIC (Optional Only)

This material in this section covers items that are particular to the All Electric motorhome. This is meant to augment the rest of the manual and therefore is not a substitute. The key for the All Electric motorhome electrical system to function properly is understanding how the AC and DC electrical systems interface. Become familiar with the inverters and programming the remotes. The generator must be operating properly for of the Automatic Generator Start feature to function. The charge condition of the house batteries is equally important. Keep the inverters owner's manual in the motorhome. It will be needed for reference.

The motorhome does not have propane so it operates much differently than the standard propane equipped motorhome. All appliances operate from AC, DC, diesel or a combination thereof. For the electrical system to function properly the 120 Volt AC and 12 Volt DC power supply sources must be operating properly, especially the generator. When shore power is not available, appliance operation relies exclusively on the generator, inverter or batteries for power. The inverter Automatic Generator Start feature should be enabled when shore power is not available to help prevent dead house batteries. Using the inverter as the 120 Volt power source can quickly consume battery power. Do not allow the batteries' to discharge lower than 50% SOC (State of Charge). The batteries ability to obtain a full state of charge, and the number of discharge cycles, reduces each time a severe discharge occurs. Eventually the batteries will no longer accept a charge, resulting in electrical system malfunction or total system failure.

The SOC of the batteries determines the length of time the inverter can operate from the batteries. Use arithmetic to calculate inverter run time or DC power loads. When dry camping closely monitor interior light use. Some lights operate only from 120 Volt AC.



**NOTE: One inverter will need to remain on to operate the refrigerator when dry camping**

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### Overview

The motorhome is equipped with two inverters. The two inverters and the house battery bank supply an ample amount of power if the system is used wisely. When dry camping, turn the inverters on only if they are needed. The inverters use battery power to supply 120 Volt AC power to operate most of the appliances, outlets and the entertainment system.

The Automatic Generator Start feature should be enabled to start the generator so the battery bank does not severely discharge. When house battery voltage does get low, the generator will start and supply 120 Volt AC power to the main load center and the inverters. The inverters charge the battery bank. The generator will continue to operate until the pre-programmed stop point. The generator stops and the inverters supply 120 Volt AC power, repeating the cycle.



**NOTE: This is not a replacement for the inverter manual. Keep the inverter manual in the motorhome as it will be needed for reference.**

The two inverters are electrically linked together with an external shunt that monitors AC and DC current. A shunt allows a majority of the current to flow through the shunt on heavy conductors, while some of the current flows through on light conductors. The external shunt is what the Master inverter uses to monitor DC charging or discharging current. An internal shunt monitors AC current. When hooked to anything less than 50 Amp service, or particularly when dry camping, use the Master remote to monitor AC and DC current consumption and charging values. The AC and DC meters are located in the Meters Menu. Analog meters are available for quick AC reference when hooked to shore power or operating from the generator. Use the inverter meters to calculate the amount of DC power the inverter requires to operate the refrigerator, cook top and microwave. Write down the figures to approximate discharge time of the battery bank.



**NOTE: When using the inverters as the power source the analog meters do not operate.**

In the All Electric motorhome each inverter has its own remote control panel. The RC7 GS remote panel located in the monitor panel is the Master remote. The RC7 panel located adjacent to the monitor is the Slave remote. All programming and monitoring values are established through the Master remote. Programming the inverters, or changing program values, have a significant effect on the performance of the electrical system. The remotes for the All Electric motorhome use a different programming schedule. These different values are Shunt Selection, Battery Type and Battery Capacity. These must be programmed correctly for the electrical system to function properly.



**NOTE: When programming the inverters make sure the correct shunt option, battery type and battery capacity are programmed. All remote programming information is stored in the inverter. The remote is a display of stored information only.**

#### **Accessing the Program Menu:**

There are several settings available in the programming menu. Care should be used when selecting or changing a program setting.

- Press the Menu Set-Up (up and down arrows) buttons simultaneously for three seconds. When the control panel beeps, release the buttons immediately.
- The programming menu is successfully entered when Search Sense appears on the screen. Use the Up or Down arrows to scroll the programming menu.
- The Settings button will change the value or option.
- Press the Menu Set-Up buttons to exit the programming mode.

**External Shunt:  
This Inverter**

**External Shunt:  
Other Inverter**

**Shunt Selection** - When programming the shunt option, the Master inverter remote in the monitor panel will be programmed "**External Shunt: This Inverter.**" The Slave inverter adjacent to the monitor panel will be programmed "**External Shunt: Other Inverter.**" The Slave remote will then be used as a display only. All AC and DC voltage and current values are viewed through the Master remote.

**Auto-Genstart** - The Auto-Genstart feature can be programmed to start the generator from either a specific voltage or a percentage of state of charge. The Auto-Genstart feature can be programmed to stop the generator at a point of the charge cycle or a percentage of state of charge.

If the Auto-Genstart feature is programmed to start or stop the generator from a specific state of charge, the voltage setting of Fuel Gauge Cutout will effect at what point the generator starts or stops.

For example: If the Fuel Gauge Cut-out voltage is set to 11.8 Volts with the generator set to start at 80% SOC (state of charge), actual voltage when the generator would start would be approximately 12.5 Volts.

**Battery Type  
AGM**

**Battery Type** - Charge voltage is automatically selected when programming the Battery Type of the Master remote. In the programming menu under **Battery Type: select Battery Type: AGM.** This setting uses a lower charge voltage than the Liquid Lead Acid setting.

**Battery Capacity  
1000Ahr**

**Battery Capacity** - The amount of time in the Bulk and Absorb charge cycles are automatically selected when programming the Battery Capacity of the Master remote. In the programming menu under **Battery Capacity: select Battery Capacity 1000Ahr.**

#### **While Traveling:**

While traveling, the refrigerator may be operated keeping the refrigerator contents cool. The electrical combination of the engine's alternator and the inverters AC output supplies the power necessary to operate the refrigerator on 120 Volts AC. Disable this feature when the engine is 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 enable the Automatic Generator Start feature. To conserve house battery power, turn the inverter off when not in use.



**NOTE: All Electric coaches will come standard with two solar panels installed on the roof.**

**House Batteries**

The battery bank consists of five Type 8-D 255 amp hour AGM (Absorb Glass Mat) batteries. The batteries are hooked in parallel. Voltage readings are the only way to accurately determine the state of charge of the AGM batteries as they are a sealed battery. Voltage readings are most accurately measured after three hours of battery inactivity. The length of time it takes to charge the battery bank to a full state of charge will vary with the following conditions:

- How deep were the batteries discharged?
- What other DC loads are applied during the charge cycle?
- What is the actual physical condition of the batteries?
- Inverter remote programming.

It may take a number of hours or days, with the motorhome hooked to shore power 24 hours a day, to charge the batteries to a full state of charge. During the charge cycle, one inverter may be in Bulk charge while the other is in Float. This is normal, as the two inverters though electrically linked through a common shunt, do not have a common link between their internal chargers.

Discharge and recharge time of the house batteries will vary depending on the type of load and voltage during the charge or discharge cycle. Discharging the batteries at a slow steady rate to a specific voltage, then charging the battery bank for the same amount of amp hours removed during the discharge cycle, will not yield a charged battery bank. The AGM battery bank, though very efficient, is not a perfect trade with amp hours discharged and charged. In addition, the type of discharge load depends on the charge time. A rapid and heavy discharge cycle yields less available amp hours than a slower discharge rate. Conversely, a rapid discharge cycle, though equivalent in the same amount of amp hours as a slow discharge cycle, requires a longer charge time. Regardless of the type of discharge cycle, it always requires more amp hours to charge the batteries than what the batteries have discharged.

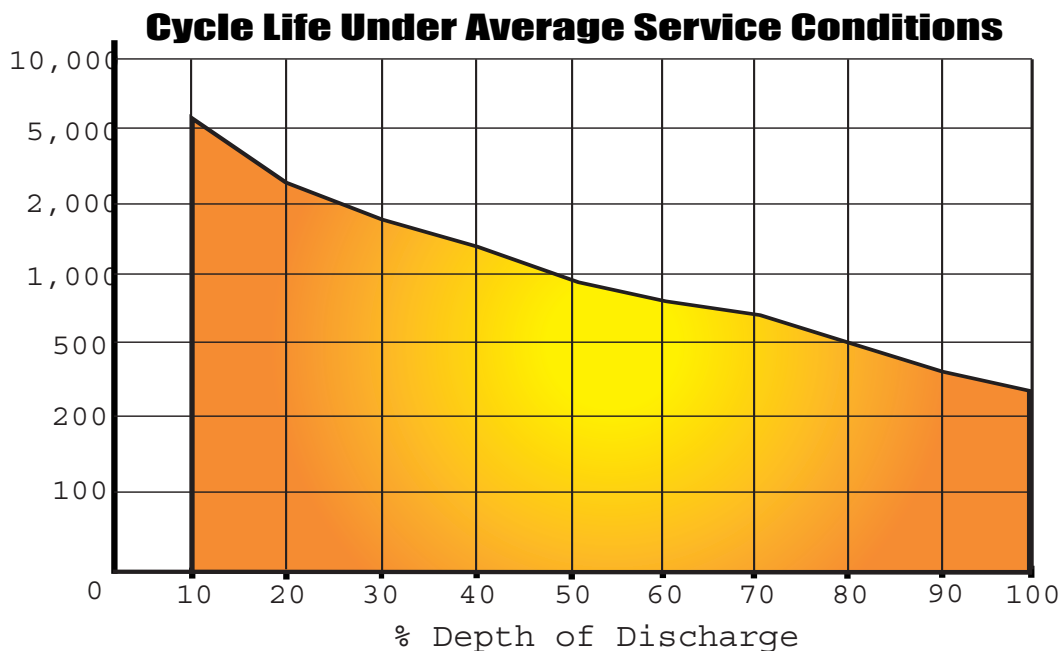
State of Charge (%)	O.C.V./Cell	O.C.V./12 Volt Battery
100	2.13	12.8 or greater
80	2.10	12.6
60	2.05	12.3
40	2.00	12.0
20	1.97	11.8
0	1.93	11.6 or less

These voltage levels are approximate and give an indication of the state of charge of a battery at rest. As the battery ages these voltage measurements will be lower.

The life of the battery bank will greatly decrease when the Depth of Discharge (DOD) is below 50%. Charge the batteries whenever they have been discharged. Batteries left in a discharged condition will eventually no longer accept a full charge or may not accept a charge at all. Never store the motorhome with a discharged battery bank. It is better to make several small discharge and full charge cycles than a few deep DOD cycles.



**NOTE: For optimum battery life, the batteries should not be cycled lower than 60% state of charge.**



**Test Conditions:** 1. Discharge Voltage = 1.75 V/Cell. 2. Charge Voltage = 2.4 V/Cell. 3. Duration = 1 Hr. Rate. 4. Temperature = 25°C. 5. End of Life = 80% Capacity.

Battery Depth Discharge % Chart

#### Equalization Charge:

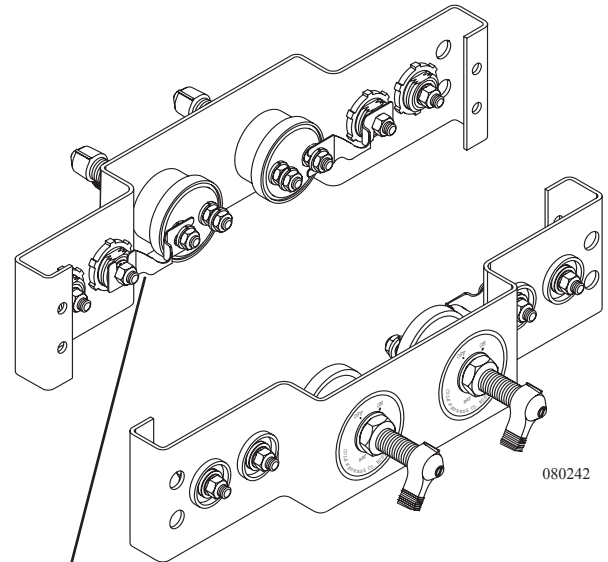
Many battery manufacturers recommend that an Equalize charge cycle is initiated on some periodic basis. How often the batteries should be Equalize charged is strictly up to the battery manufacturer. An equalize charge cycle is a timed event with the Equalize charge voltage generally one volt higher than a Bulk charge voltage. The high voltage of an Equalize charge cycle can damage sensitive electronic equipment. Before performing an Equalize charge cycle, several electronic items need to be disconnected.



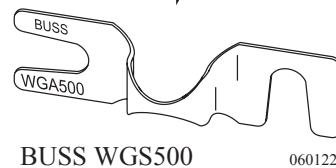
**NOTE: For more information, refer to the Equalize Charging procedure.**

Located in the battery bay are two main battery disconnect switches for the house batteries. On the back of each disconnect switch is a 500 Amp fuse. The pair of fuses protect against a shorted battery cable or other over current condition. A weatherproof fuse holder with a 20 Amp ATO fuse for the solar panel is attached to one of the battery disconnects switches.

## Main Battery Disconnect



**CAUTION: When working on the batteries use protective measures against short circuits. Place an insulating material over the batteries when working on or near the battery area. Remove any rings or watches. Use extreme caution when working with hand tools. Do not allow the tool to short circuit any battery connection. Always mark cable routing and location before servicing, removing or replacing batteries.**



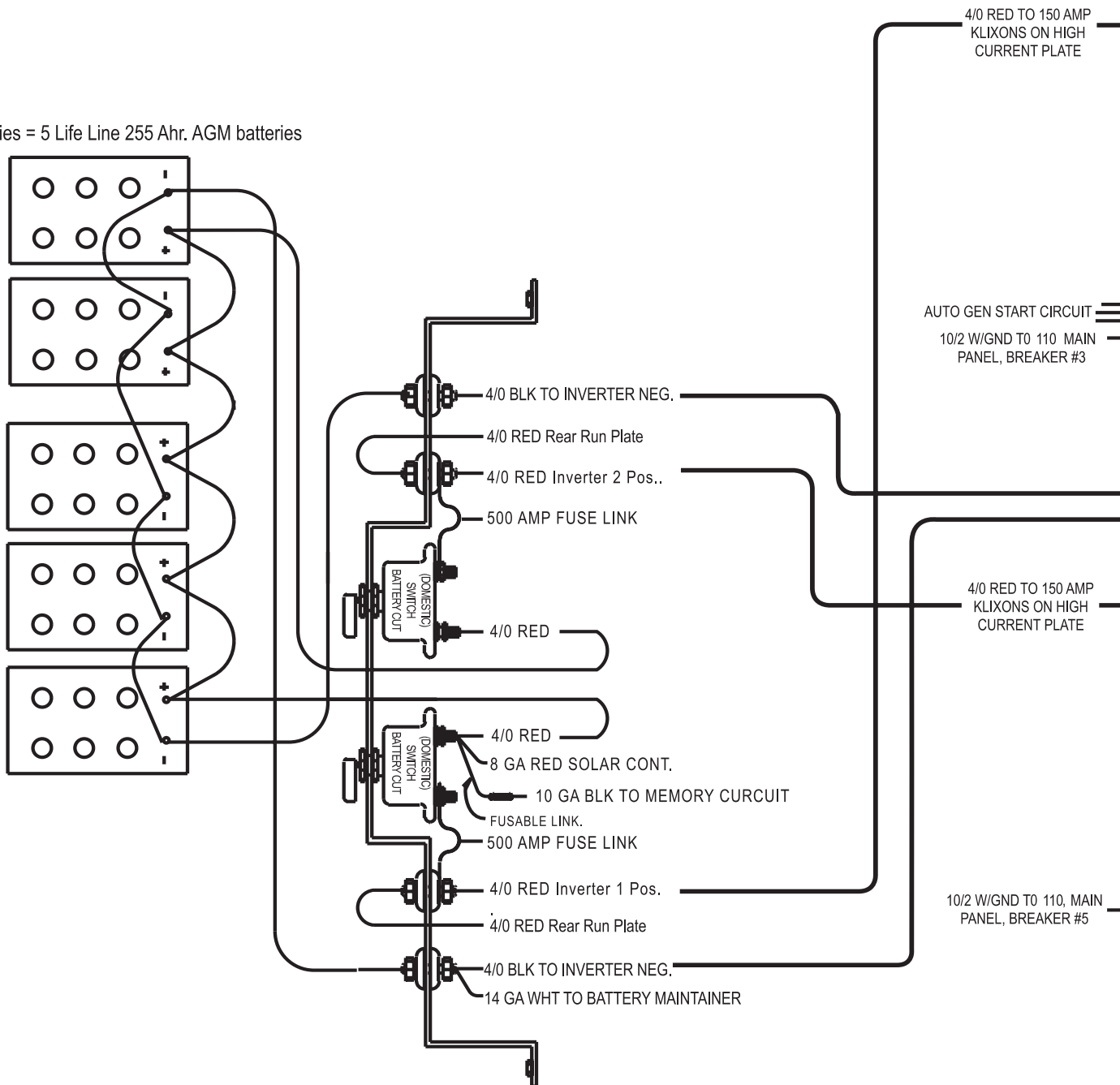
The engine alternator is a 270 amp Leece/Neville. The alternator is not designed to charge the house batteries from a complete discharge to a full state of charge. The alternator will maintain the battery charge during travel supplying the DC current necessary to operate running lights or other DC loads.

Due to the increased DC current demands of the all electric motorhome, a larger alternator was installed. To accommodate the output of the alternator a higher capacity battery isolator was also installed. The 300 amp battery isolator allows the output of the alternator to maintain a charge current to the house and engine batteries when the engine is running. The battery isolator allows DC current to flow in one direction only. Diodes prevent a backward flow of DC current, keeping the chassis and house battery systems separate. There is a typical voltage loss of .09 to 1.1 Volts DC between the input and output terminals of the isolator.

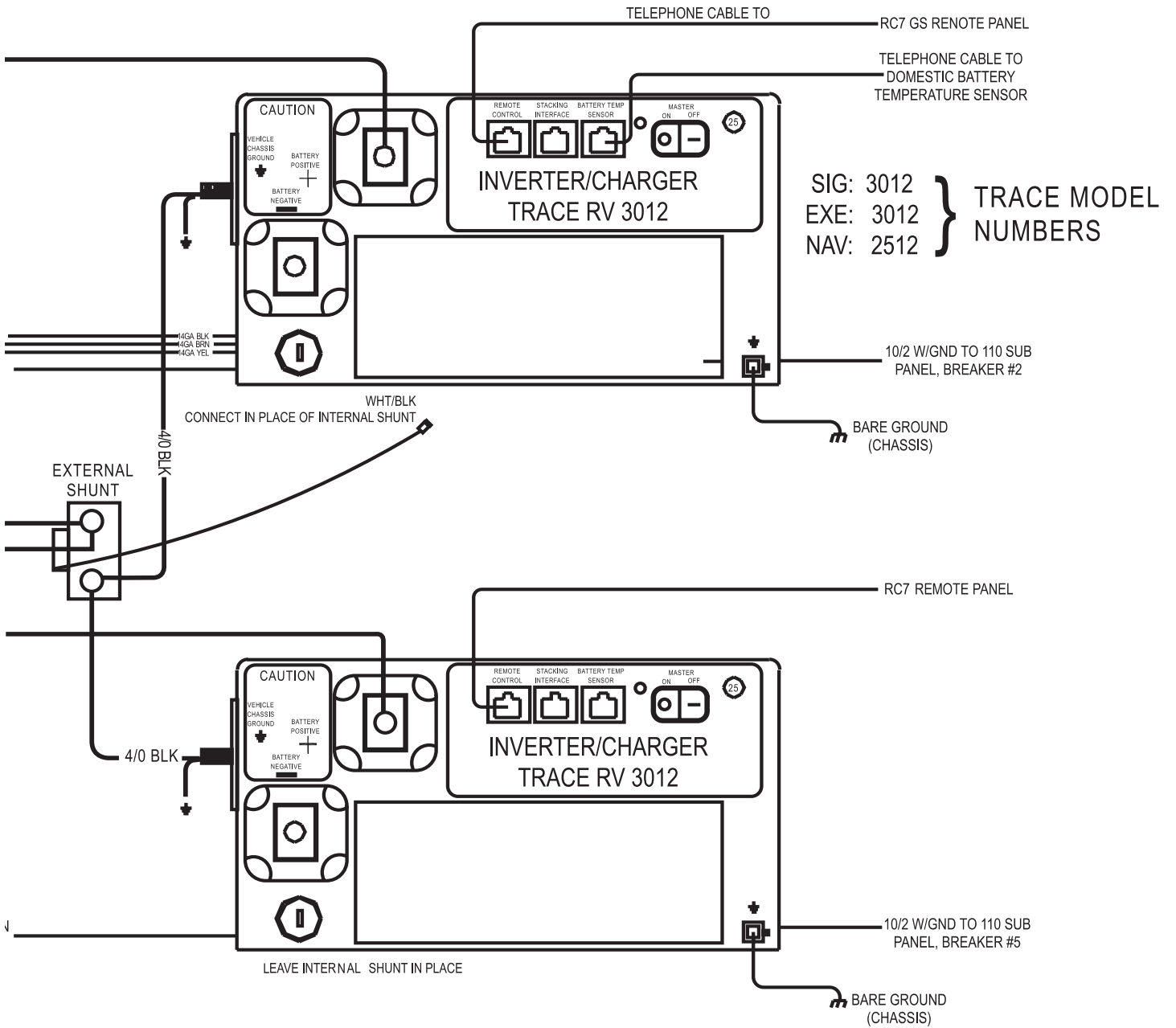
## Alternator & Battery Isolator

# WIRING SYSTEMS INTERFACED (All Electric)

Batteries = 5 Life Line 255 Ahr. AGM batteries







060123

**NOTES**

# Signature

## SECTION 9 ELECTRICAL SYSTEMS - CHASSIS

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	<b>ENGINE “NO START”- FLOW CHART • 335</b>





**INTRODUCTION**

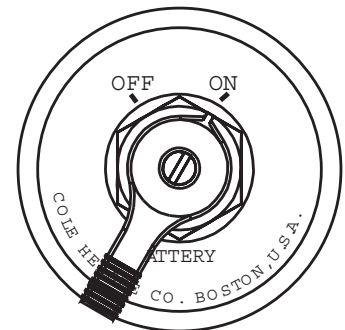
A majority of the lighting and appliances are designed to operate from 12 Volt DC (direct current) power. This is why the batteries play such an important role in the function of the motorhome. There are exceptions with appliances such as the microwave or television; however, indirectly they still operate from 12 Volt DC power, as they can be operated from the inverter. The chassis functions (engine, transmission, dash air, etc.) are also 12 Volt DC.

With the all technological advancements taking place in the past several years manufacturers have now incorporated electronics into these systems. It is important to keep the 12 Volt system(s) in good working order. These systems, with their incorporated electronics, are voltage sensitive. Some items can be damaged if the DC voltage is not maintained within the designed specifications.

There are two separate 12 Volt systems. One is the chassis system; the other is the house system. These two systems, for the most part, are separate from one another. The house system does not operate engine functions; as the engine system does not operate house functions. However, within the two systems there are some inner connections. For example: While the motorhome is driven the alternator on the engine will charge the house batteries. 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 roadside 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 roadside front wheel. This panel contains mostly engine system fuses and wiring such as headlights, taillight, dashboard functions, gauges, etc. The house battery(s) supplies 12 Volt DC power to the distribution panel located in the bedroom. This panel contains fuses for the house, interior lighting and appliances, such as the furnace and water heater.

The main battery disconnect for the chassis battery turns the DC power on or off to the front electrical bay. Most chassis and engine functions are interrupted when the battery disconnect is turned off. Some electronic items require a constant power source for memory retention such as the dash and CB radios. Some electronic components of the engine and transmission require a constant power source. Turn the main battery disconnect switch off when the motorhome is going to be stored, or when performing electrical maintenance. If possible, leave the motorhome plugged into an AC source with the battery disconnect switch on. This will help

**BATTERY DISCONNECT  
- CHASSIS**

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 switch off.



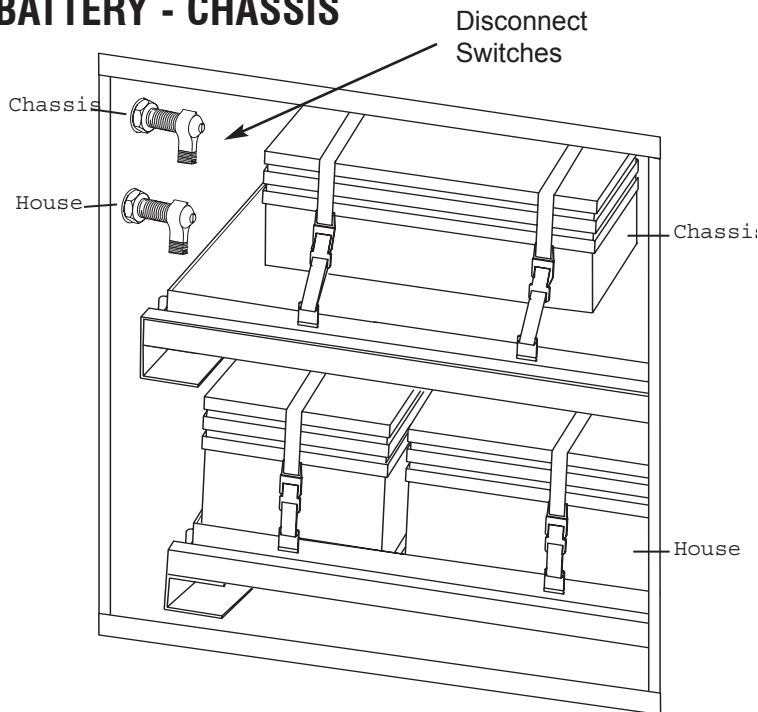
**NOTE: The solar panels will charge the batteries with the disconnect switches off.**



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

- 1. Disconnect the (+) positive and (-) negative battery connection and any electronic control ground wires connected to the frame or chassis.**
- 2. Cover electronic control components and wiring to protect from hot sparks.**
- 3. Disconnect the wiring harness connectors at the transmission electronic control unit. Open bed storage compartment, open engine access door. The ECU is located above the transmission.**
- 4. Do not connect welding cables to electronic control components.**
- 5. The welding ground cable should be attached no more than two feet from the part to be welded.**

## BATTERY - CHASSIS



The chassis battery operates only chassis and engine functions. The chassis battery is a crank type battery, producing the high amperage needed to start the engine. Engine starters initially require a large amount of current to crank an engine. Initial starter amperage draw exceeds 1200 amps. The type of application in which the engine battery is used differs from the house battery application. The engine battery state of charge remains consistent. Maintenance is still required to the 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	AH (20HR)	CCA	RC (25A) MINUTES
Chassis 12 Volt Chassis 31P-MHD (2 each)	240	950	450
6 Volt Domestic U2200 (4 each)	450*	**	447
12 Volt Domestic GPL-8D (All Electric)	255*	**	1350

\*Total battery bank capacity. \*\*Battery connections are made in a Series/Parallel connection. Domestic batteries are not rated in Cold Cranking Amps (CCA).

Approximate Hours at Ampere Load					
	5 AMPS	10 AMPS	15 AMPS	20 AMPS	25 AMPS
<b>U2200</b>	<b>55.0</b>	<b>22</b>	<b>12.5</b>	<b>9.1</b>	<b>7.0</b>

Approximate Hours at Ampere Load				
	5 AMPS	8 AMPS	15 AMPS	25 AMPS
<b>AGM GPL-8D</b>	<b>3130</b>	<b>1627</b>	<b>801</b>	<b>461</b>

Battery State of Charge vs Voltage/Specific Gravity			
VOLTAGE	SPECIFIC GRAVITY	STATE OF CHARGE	DEPTH OF DISCHARGE
12.66	1.265	100%	0%
12.45	1.225	75%	25%
12.25	1.190	50%	50%
12.05	1.145	25%	75%
11.90	1.100	0%	100%

Cummins Enging Cold Cranking Amp Requirements				
ISM	1800	CCA	12	VOLTS

CCA Rating are at 0° F. These are the minimum requirements.

## FUSES & CIRCUITS - CHASSIS

### Distribution Panel - Front



Front Run Panel.

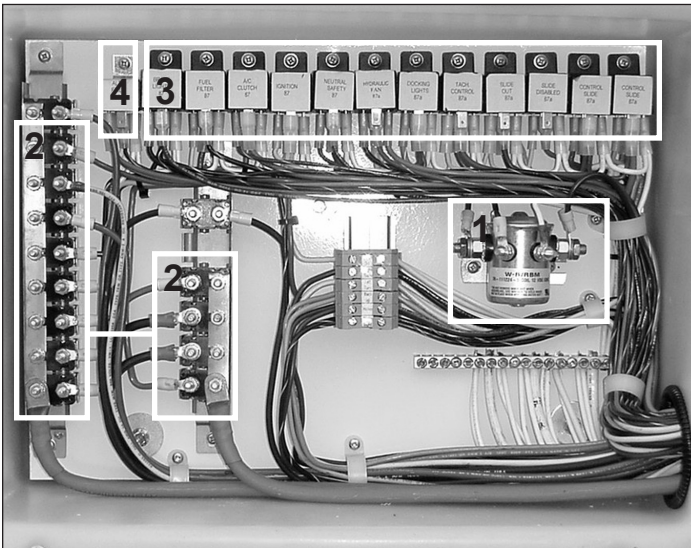
FRB

The front electrical panel is located on the roadside, ahead of the front wheel. It contains the fuses, self resetting supply circuit breakers, solenoid and relays.

The automotive fuses and emergency flashers are located in the front electrical panel. The fuses are the standard plug-in type (ATO). When a fuse “BLOWS,” the wire in middle of the plastic case will be broken. A bad or blown fuse must be replaced with a fuse of the same rating and type. Using a fuse of a different type rating will defeat the circuit protection provided by the fuse, which could result in damage to the motorhome’s electrical system. If a fuse has been replaced and it “BLOWS” repeatedly, that may be an indication that a fault exists or an electronic component has failed. It is recommended that the motorhome be taken to a qualified RV technician before any future use to diagnose and repair the problem. Circuits are identified on the fuse label located on the inside of the electrical compartment door.

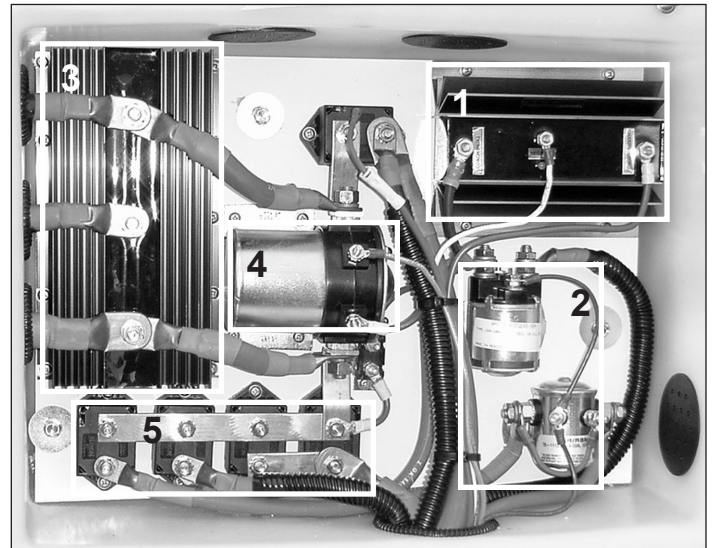
### Distribution Panels - Rear

The electrical panel has been separated in two separate panels. The panels are located in the engine compartment.



Low Current Plate.

FRB



High Current Plate.

FRB

**The low current plate located on the left side has:**

1. The starter solenoid.
2. The auto re-set circuit breakers.
3. The various 12 Volt relays.
4. 6 Volt relay.

**The high current plate located on the right side has:**

1. The battery maintainer.
2. The house disconnects solenoids.
3. The battery isolator.
4. Battery boost solenoid.
5. Various amperage automatic reset circuit breakers.

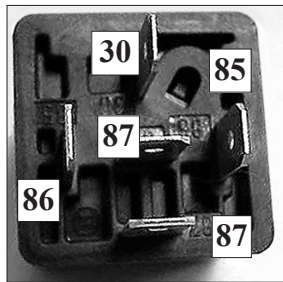


**Relays**

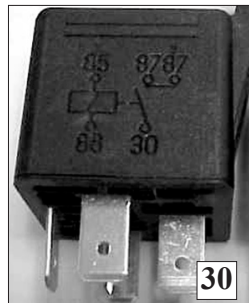
The coach uses different relays to operate different equipment. If a relay needs to be replaced, carefully record the location of each wire and its color.

The 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 the problem may increase if the wrong one is changed. 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:

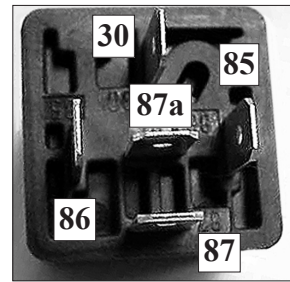
1. The 30 post is the incoming fuse and/or breaker power. Some relay applications supply power to the 30 post. Some use it for ground.  
The 30 post can be used many different ways.
2. The 85 post is one side of the coil, tripped different ways.
3. The 86 post is the opposite side of the coil, tripped 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 Relay.

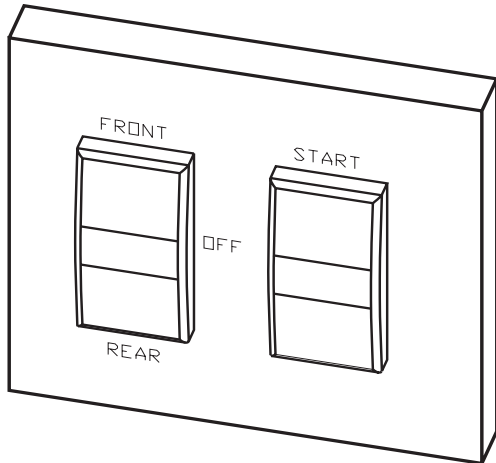


Bosch Relay.



87a Relay.

## REAR START BOX



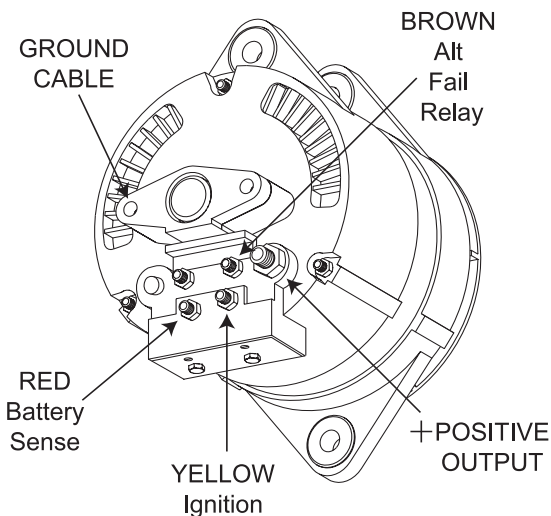
### To Start From the Rear:

- 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



200 amp alternator.

The Leece-Neville alternator with integral rectifier, regulator and remote voltage sensor is designed for reliable output throughout the engines operating range. When traveling, keep an eye on the voltmeter in the dash area. Normal readings should be between 13 to 14.5 Volts. Voltage indications higher or lower indicate a problem with the charging system. If the alternator output drops below an acceptable level, a charge indication warning lamp will illuminate.

The alternator replaces the amp hours the chassis battery uses to start the engine. The amount of charge to the batteries is dependent on the amount of time the engine is operated. Repeatedly starting the engine and driving the motorhome for a short distance, or short periods, may not be enough operating time to adequately replace the amp hours used to start the engine.

The alternator also maintains a charge to the house batteries. The function of the alternator is an electrical system voltage maintainer, not a battery charger. When traveling the alternator maintains electrical system voltage relative to any loads, such as headlights and windshield wipers. When a heavy load is placed on the alternator, such as trying to charge dead batteries, the operating temperature of the alternator increases dramatically. Excess operating temperature of the alternator for extended periods of operation can lead to premature failure of the alternator.

If the house batteries are in a low state of charge, or dead, before traveling it is recommended to charge the house batteries with the inverter or an auxiliary battery charger.



**NOTE: Standard - 200 Amp. All Electric Option -270 Amp.**

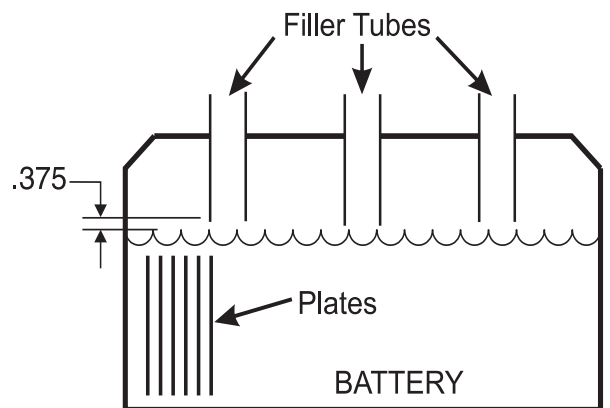
**Specifications:**

- 200 amp standard
- 270 amp All Electric
- 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

**Alternator Testing Procedure:**

- Check all wiring for burnt or loose electrical connections. Repair as needed.
- Check all grounds and electrical connections to be sure 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.

**Alternator Testing Procedure**



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

- 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 Volts DC.
- The output of the alternator range is 13.6 to 15.4 VDC Volts DC. Connect a volt meter to the (B+) terminal of the alternator and chassis ground. Idle the engine up to 1200 rpm.
- Connect a clamp-on amp-meter, if available, to the positive battery cable to verify the battery state/rate of charge.

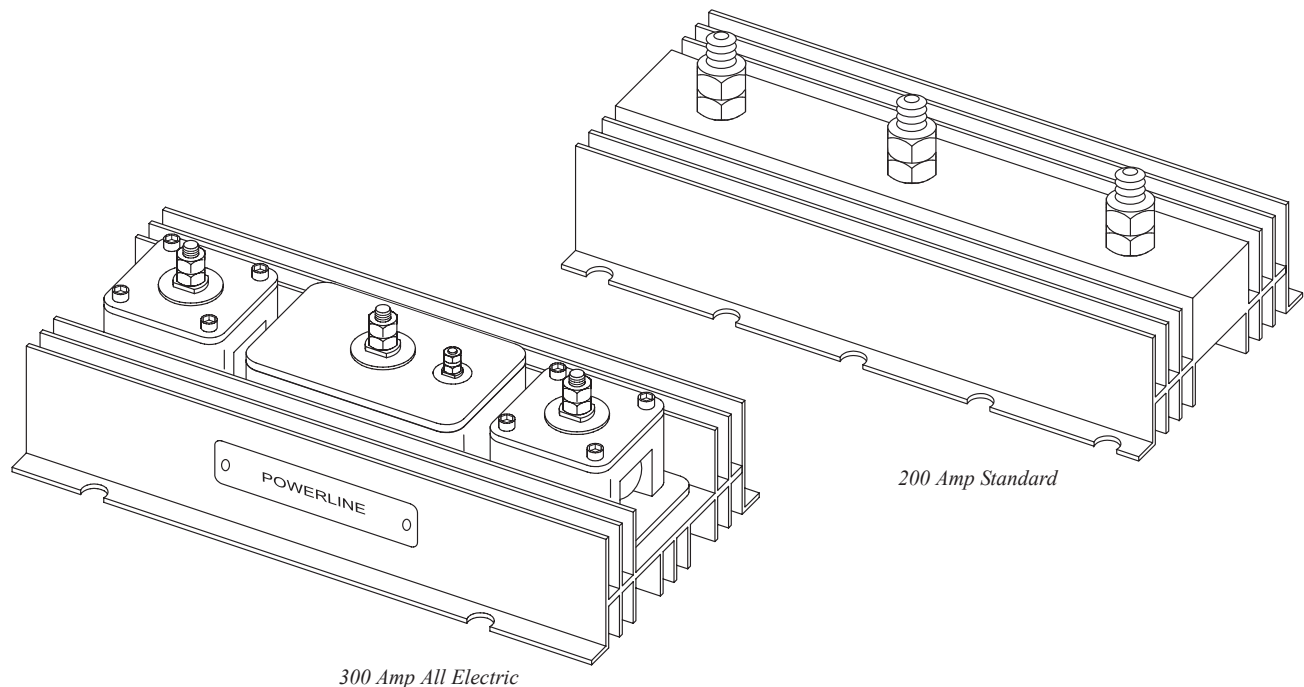


**NOTE: Remember the alternator is not a battery charger. It is designed to maintain proper electrical system voltage. A battery with a low state of charge, or a dead battery, may overheat and damage to the alternator.**

### **Battery Isolator**

The battery isolator distributes the charge current of the alternator to the house and engine batteries when the engine is running. Diodes in the isolator allow DC current to flow in one direction only preventing a backward flow of DC current. When the engine is off the chassis and house battery systems are separate. There is a typical voltage drop of .09 to 1.1 Volts DC between the input terminal and the output terminals of the isolator when the engine is running.

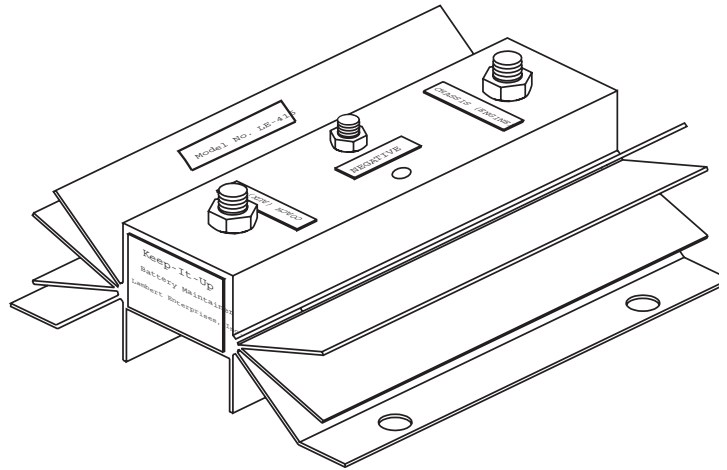
Due to the increased DC current demands of the All Electric motorhome, a larger alternator was installed. To accommodate the higher output of this alternator, a larger capacity battery isolator was also installed



The battery maintainer is a fully automatic device that sends a charge voltage to the chassis battery whenever the motorhome is plugged into shore power, or operating from the generator.

## Battery Maintainer

- For easy reference, the battery maintainer has a green LED to indicate when it is active. The LED illuminates whenever the motorhome is plugged into shore power, or operating from the generator. It is also illuminated when the engine is running.



**NOTE: If the green LED does not illuminate when hooked to shore power, run the engine for a few seconds to activate the battery maintainer.**

- The battery maintainer activates when house battery voltage rises above 13.5 Volts DC. The battery maintainer deactivates when house battery voltage drops below 12.9 Volts DC.
- The battery maintainer provides up to a 15 amp charge to the chassis battery.
- If the chassis battery voltage is low a clicking sound may be heard from the battery maintainer. The clicking sound is an automatic reset circuit breaker inside the maintainer. The clicking sound is normal and indicates that the chassis battery is trying to draw more than 15 amps. The clicking sound will stop as soon as the chassis battery has recharged.
- While dry camping with the generator off, the battery maintainer is inactive and the green LED does not illuminate.

The Smart Wheel Steering Wheel System offers control of the horn, head-lamp and marker lamp flash, cruise control, and wiper functions from switch panels mounted on the steering wheel. The system consists of electronic modules enclosed in the steering wheel and the Master Controller typically located in the front run box.

## STEERING COLUMN & SMART WHEEL

Two wires utilizing a "clock-spring" connector in the steering column accomplish the communication between the steering wheel and the Master Controller as the steering wheel rotates. The two wires carry a multiplex communication signal from the steering wheel to the master controller. The Switch Panels generate unique signals as each switch closes and will then transmit them to the Master Controller. The Master Controller decodes the signal for the closed switch and operates the corresponding outputs for that function. Two additional wires provide power and ground for the steering wheel backlighting.

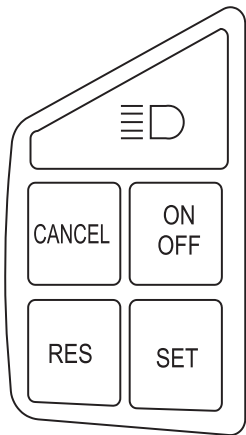
The 3 Amp fuse on the Master Controller is for backlighting the switch panel. LEDs accomplish backlighting with the ignition ON and should last the life of the motorhome. The LEDs only draw about 20 Ma.

Another function of the smart wheel for an ISM 500 engine is the "**HIGH IDLE**" feature. This feature increases the idle when using the following procedure.

1. Cruise control OFF. To raise the idle, push the **resume** switch. The idle can be raised 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. Push the switch 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 rpm. Push **resume** once, idle drops to 1,000 rpm. Push and hold **resume** button, idle will raise to 1,500 rpm.
4. Use **cancel** or turn the cruise control OFF to return the engine to an idle.

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### Smart Wheel Operation



Functions and an operational description for the smart wheel are as follows:

#### **HORN:**

The horn bar on the steering wheel will send the appropriate signal to the Master Controller causing the HORN output to be active while the switch is pressed.

#### **HEADLAMP FLASH:**

This function is the ICC courtesy lamp. When the headlights are ON, pressing the switch causes them to go off as long as the switch is pressed. Similarly, when the headlamps are OFF, pressing the switch causes them to illuminate as long as the switch is pressed.

#### **CRUISE FUNCTIONS:**

- **CRUISE ON/OFF** - Operation of this switch cycles the Cruise Control system On and Off.
- **CRUISE SET** - Operation of this switch actuates the Cruise Set function of the engine controller.
- **CRUISE RESUME** - Operation of this switch actuates the Cruise Resume function of the engine controller.
- **CRUISE CANCEL** - 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.**

The wiper control circuitry synchronizes both wiper motors. For that reason the faster wiper will pause at the end of each cycle and wait for the slower wiper to complete its cycle before resuming.

Any wiper function activation generates a "**Headlamp On**" signal from the Master Controller. This will only reset by turning off the ignition or by activating then deactivating the dashboard headlamp switch.

#### **WIPER WASH:**

Operation of this switch activates the wash pump relay while the switch is pressed. Additionally, 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:**

Operation of this switch initially causes the **Low Speed** Wiper function to activate. If the switch is pressed, again the **High-Speed** Wiper function will be activated. Subsequent presses of this switch will cause alternate operation of the wipers in the low or high-speed mode.

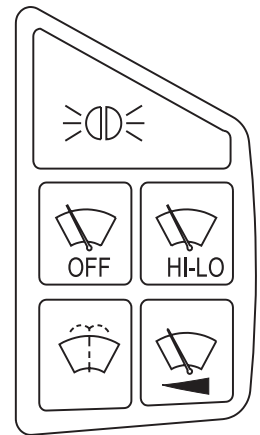
#### **WIPER VARIABLE:**

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 activates again and repeats 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 other wiper mode cancels the variable mode. The effect for the driver is this: In light rain or mist conditions, the driver presses the switch once when the windshield first needs clearing. When the windshield requires clearing for the second time, the driver presses the button again setting the timed interval between subsequent wipes required by the current conditions. To extend the wipe interval, switch the wipers off then use the same method to set the desired interval.

#### **WIPER OFF:**

This switch causes cancellation of all wiper operations. Any time the ignition is off this mode goes active.

### **Wiper Function**



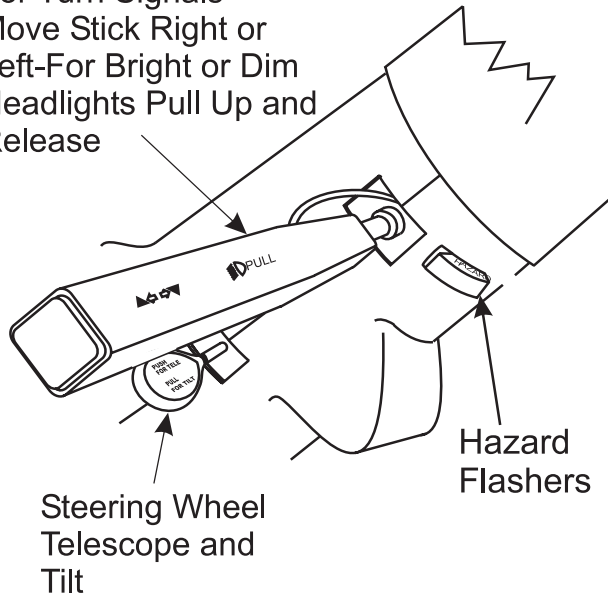
**MARKER LAMP FLASH:**

When the marker lights are ON, pressing the switch causes them to go off as long as the switch is pressed. Similarly, when the marker lights are OFF, pressing the switch causes them to illuminate as long as the switch is pressed.

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**Tilt & Telescope**

For Turn Signals  
Move Stick Right or  
Left-For Bright or Dim  
Headlights Pull Up and  
Release



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 headlights are ON.

**Hazard Flashers:**

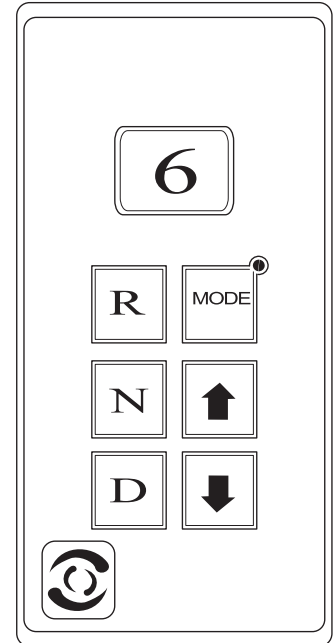
- The flasher button is located on the steering column.
- To turn four way flasher on, pull out on flasher button.
- To shut off flasher, push button inwards.



**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**.

**TRANSMISSION  
- Shift Selector**

*Transmission Key Pad.*



**NOTE: 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.**

- 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.

- When the Auxiliary Braking device is used, the display will change to default reading of two or three. This default is pre-selected at the factory and can only be reprogrammed by an authorized Allison Service center. The transmission is not actually in second or third gear. This is only the reference for the rpm shifts points to optimize the braking capacity.



**CAUTION: Do not use the economy mode in heavy stop and go traffic or mountainous terrains. Frequent shifting occurs when in economy mode while using heavy throttle, increasing transmission fluid temperature. Exit economy mode until road conditions improve.**

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### **Parking Brake**

The parking brake system is activated when the push-pull control knob (located on the driver's left console panel) is pulled. When the knob is pushed, the brake is released. Prior to driving, allow time for the air compressor to build up sufficient air to shut off the air warning lamp.



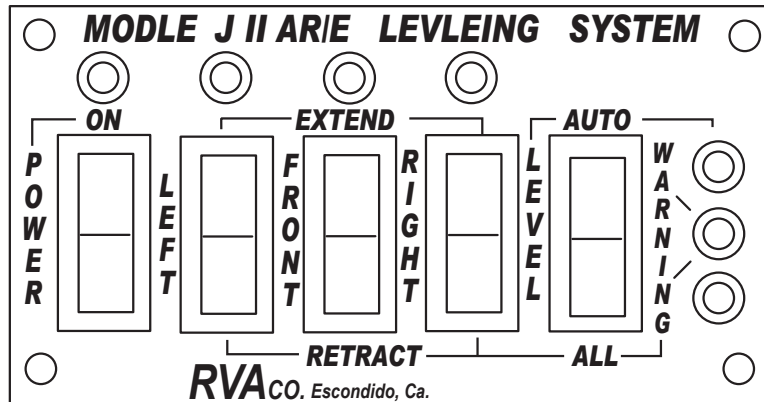
**WARNING: If the air tank is not dumped, there is the possibility of an accidental release of the parking brake. Traveling with small children and/or pets may require a small block to be fabricated to prevent accidental release. The block should be placed under the knob and rested on the dash panel. 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 of a jack down.

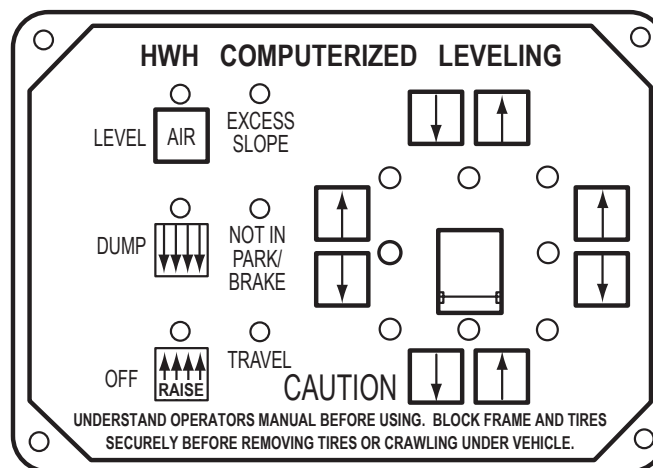


### HWH Control (Air Systems):

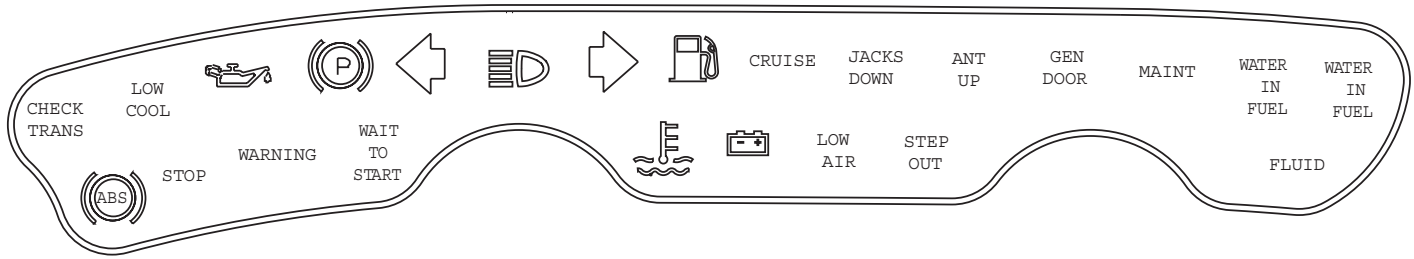
The touch panel, computer controlled, four-point air leveling system controls the computerized air-leveling operations. The ignition must be ON in order for the suspension system to function.



**NOTE:** The suspension on the air leveling system will NOT operate unless the ignition is ON.



## DASH - Indicator Lamps



### Listed from left to right:

**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.

**LOW COOL:** Indicates coolant level in the overflow tank is below acceptable level.

**LOW OIL PSI:** Indicates low oil pressure. Stop coach. Check oil pressure gauge and oil level.

**PARK BRAKE:** Indicates parking/emergency brake is applied.

**LEFT ARROW - Audible Turn Indicators:** Indicates left turn indicator circuits active. Audible indicator cancels when the brake is applied.

**HEADLIGHT BEAM:** Indicates high beams when illuminated.

**RIGHT ARROW - Audible Turn Indicators:** Indicates right turn indicator circuits active. Audible indicator cancels when the brake is applied.

**LOW FUEL:** Indicates fuel level is becoming low.

**CRUISE:** Indicates the cruise control is on.

**JACKS DOWN:** Indicates the jacks are down

**ANT UP:** Indicates the antenna is up.

**GEN DOOR:** Indicates the generator door is open.

**MAINT:** Indicates out of range condition exists within the engine protection circuits. Stop coach and check all fluids. Contact your nearest Cummins dealer.

**WATER IN FUEL: Not used.**

**WATER IN FUEL:** Indicates water has been detected in fuel. Use the fuel filter system to purge water from the fuel.

**ABS BRAKE:** Indicates ABS possible fault in the ABS Brake system. Indicates fault codes for service technicians.

**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.

**WARNING:** Indicates out of range condition exists within the engine protection circuits. Stop coach, check all fluid levels.

**WAIT TO START:** Not used.

**HIGH WATER TEMP SYMBOL:** Indicates high water temperature. Check water temperature gauge. Stop coach and check coolant level.

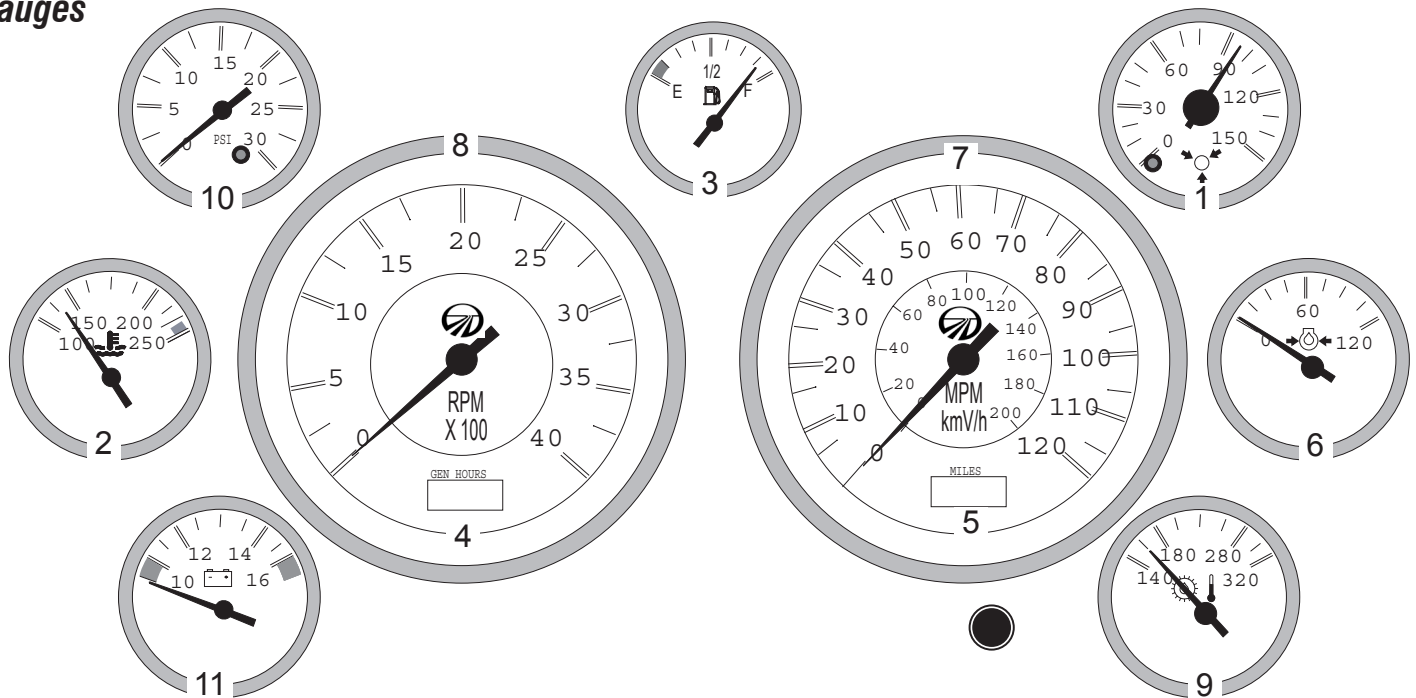
**ALT FAIL SYMBOL:** Indicates a failure within the alternator charging system.

**LOW AIR:** Indicates air tank pressures are out of operating range. Check air pressure gauge.

**STEP OUT:** Indicates the step is in the extended position. Alerts the driver to possible problem with the entry step.

**FLUID:** Not used.

## Gauges



**1. Air Pressure Gauge:** 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 tankfull 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). Tachometer reads output pulse of alternator. If tachometer quits, or indicates irrationally, have alternator checked immediately.

**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.

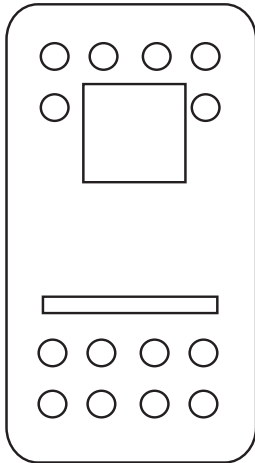
**10. Turbo Boost:** Indicates boost pressure produced by the engine turbocharger.

**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.

### Dock LTS:

Operates the side docking lights to increase visibility while parking or backing.



**Drvr Shade:**

Operates the power sun visor located driver's side.

**Engine brake 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 preheat circulation pump. Circulating the engine's coolant through the engine preheat 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.



**NOTE: The Generator IN/OUT switch is deleted on motorhomes with an acrylic front protective mask.**

**Idle Up/Down Switch:**

Will increase and decrease the engine idle in 25 rpm increments. There are limits to the idle speed, about 700 to 875 rpm.

**Mirr Heat:**

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 driver's 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.

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.

**Pass Shade:**

Operates the power sun visor located passengers side.

**Pedal In/Out:**

After sitting in the driver's seat and making adjustments to the mirrors and steering wheel, use the **Pedal In/Out** switch adjust the brake and throttle pedal to be either closer or farther away. Locate switch on the left hand shifter panel marked Pedal Adjusts. The switch moves the pedals inward or outward approximately three inches. If you need to move the pedals inward, just push the same switch in the opposite direction. When the pedals 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:**

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.

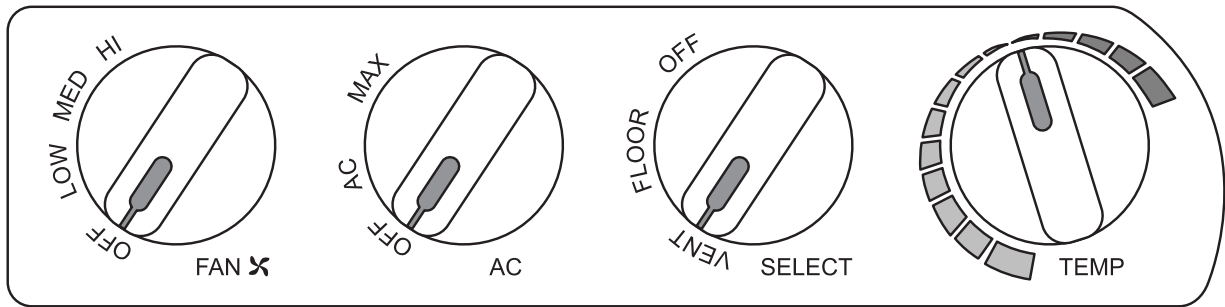
**When using tag axle switch:**

- 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. Monaco Coach Corporation 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.

**Vent** - Fresh air is drawn in and discharged throughout the dash and defrost louvers.

**Floor** - Fresh air is drawn in and discharged through the floor louvers. A small amount of air is used to defrost the windshield.

**Defrost** - Fresh 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 effected 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: Monaco models with a center dial temperature control use a potentiometer at the control head for input of desired temperature. The water valve which controls the water flow to the heater core is opened and closed by a stepper motor mounted on the water valve. A control module compares the output voltage from the control to that of the feedback for the stepper motor of water valve. The control module then drives the motor to within one-half volt of the control potentiometer voltage.

**Functional Test:**

- Start and operate the engine until the water reaches normal operating temperature.
- Set the HVAC temperature control to the full hot position.
- The discharge air outlets should have hot air.
- Rotate the temperature control to full cold position.
- Allow 10 minutes for the temperature to stabilize.
- The discharge air outlets should have 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 effects 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.**

<b>TEMP F/ PSIG</b>	<b>TEMP F/ PSIG</b>	<b>TEMP F/ PSIG</b>
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:**

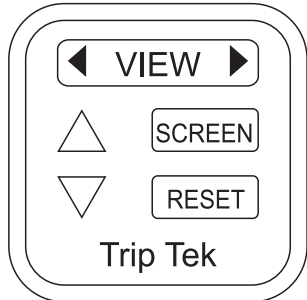
1. Check fuses.
2. Check for loose or corroded connection.
3. Check wiring.
4. Check blower and select switch.
5. Motor shaft seized.
6. Blower wheel out of alignment.

**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.

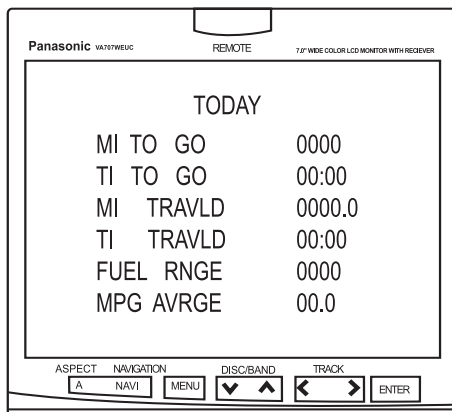
## TRIP TEK (OPTIONAL)

The Trip Tek system is simplistic in design. Three resettable screens help manage trips, monitor engine/transmission status, displays fuel level and calculated range. The system component consists of a keypad, a computer and utilizes the rear vision monitor for display. The keypad has five function keys each with a single function. The system is virtually maintenance free.



### To Obtain the Trip Tek Screen:

- Turn the battery cut-off switch on.
- Use the Camera Select button to cycle through the three views.
- The fourth view is used for Back-up camera display and the Trip Tek screens.
- Press the Screen button on the Trip Tek panel to toggle the Back-up camera On or Off.
- Press the View button to toggle between Trip Tek screens: Coach Data, Trip, Leg and Today.
- Pressing the View button again returns display to Back-up camera.



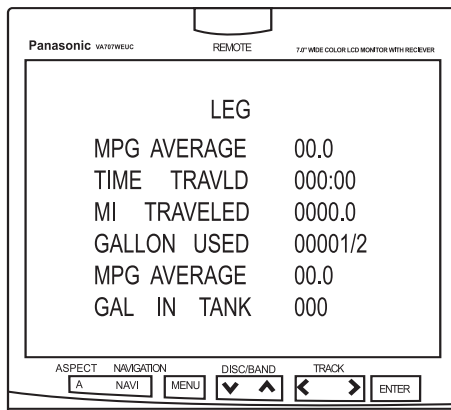
### Key Pad:

- **View** enables the Trip Tek display on the rear vision monitor.
- **Screen** enables or disables the rear vision system.
- **Rest** zeroes out the screen for **TODAY** and new information for inputting.
- **Arrow Up** scrolls the numbers for inputting.
- **Arrow Down** scrolls the numbers down for inputting.

### Screen Displays:

#### 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.
- **Mi. Traveled** displays the miles traveled since last "Today" screen reset.
- **Time Traveled** displays the time traveled since last "Today" screen reset.
- **Fuel Range** based upon **MPG AVERAGE** and **GAL IN TANK**, displays approximate miles available for remaining fuel.
- **MPG Average** displays the average fuel consumption per gallon since last "Today" screen reset.

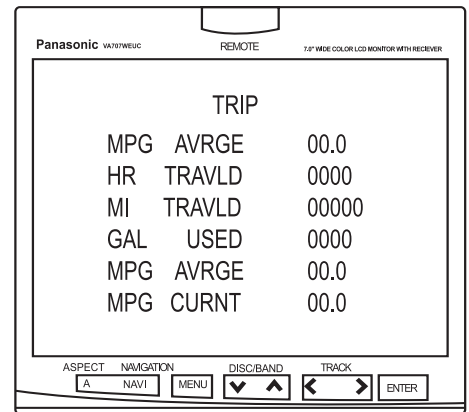


#### Leg Screen provides information from fill to fill.

- **MPG Average** displays the average fuel consumption per gallon since last "Leg" screen reset.
- **Time Traveled** displays the time traveled since last "Leg" screen reset.
- **Mi. Traveled** displays the miles traveled since last "Leg" screen reset.
- **Gallons Used** displays the gallons of fuel used by the engine since the last "Leg" screen reset.
- **MPG Average** displays the average fuel consumption per gallon since last "Leg" screen reset.
- **Gal in tank** displays approximate gallon in fuel tank.

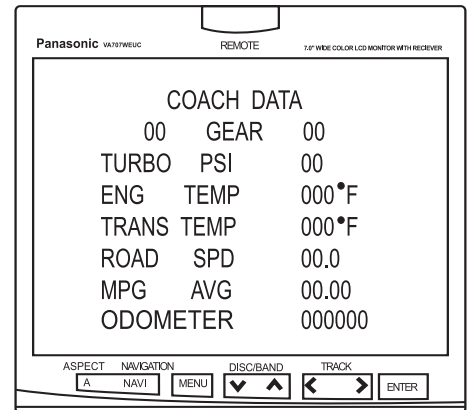
**Trip Screen display long term data for a complete trip or longer.**

- **MPG Average** displays the average fuel consumption per gallon since last "Trip" screen reset.
- **HRS Traveled** displays the hours traveled since the last "Trip" screen reset.
- **Mi. Traveled** displays the miles traveled since last "Trip" screen reset.
- **Gal Used** displays the gallons of fuel used by the engine since the last "Trip" screen reset.
- **MPG Average** displays the average fuel consumption per gallon since last "Trip" screen reset.
- **MPG Current** instantaneous display of current fuel consumption in miles per gal.

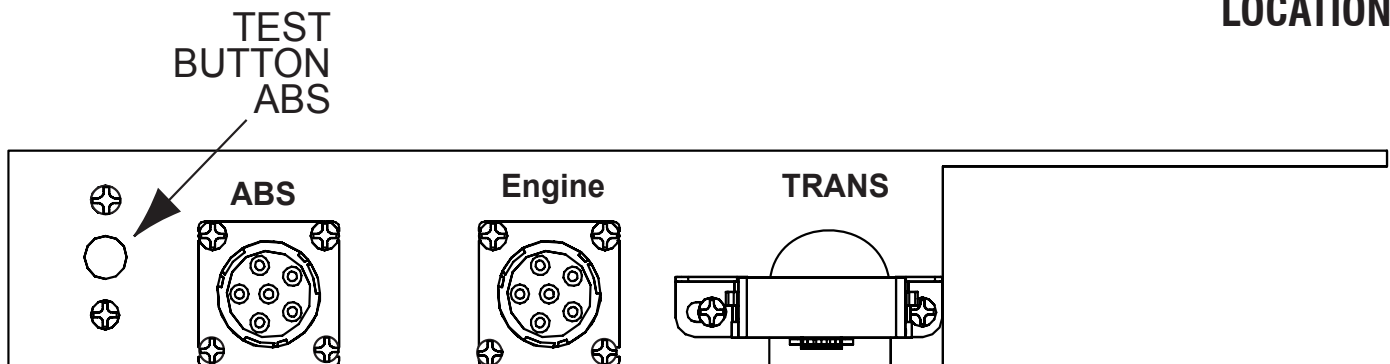


**Coach Data Screen displays information for the motorhome and engine performance.**

- **Gears** displays the gears selected and attained.
- **Turbo PSI** displays the Turbocharger boost pressure.
- **Eng. Temp** displays the coolant temperature.
- **Trans Temp.** displays the transmission oil temperature.
- **Road SPD** displays the current speed of the motorhome. This indication is NOT intended to replace the motorhome speedometer.
- **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.

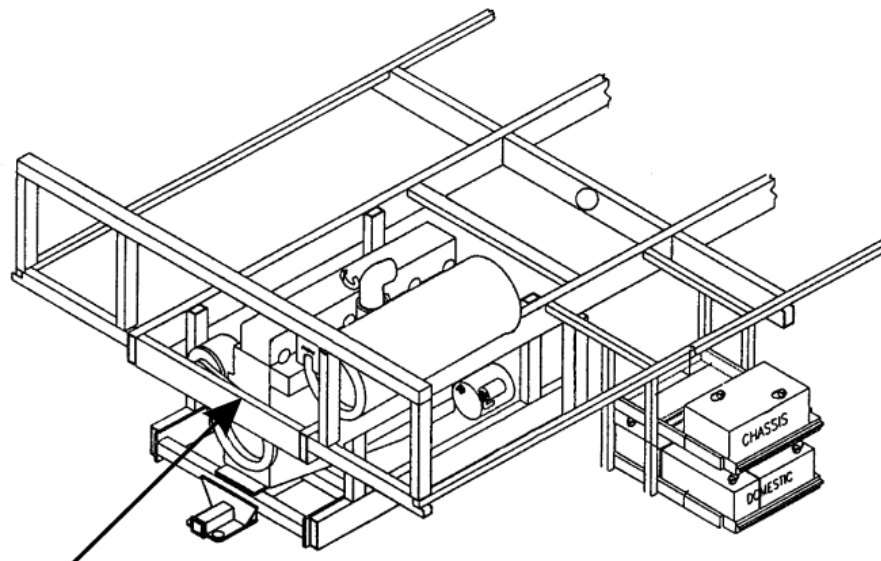


**DIAGNOSTIC PLUG LOCATION**



Eaton, Cummins and Allison diagnostic plugs are located under the left side of the dash.

## DIAGNOSTIC BRACKET (ENGINE)

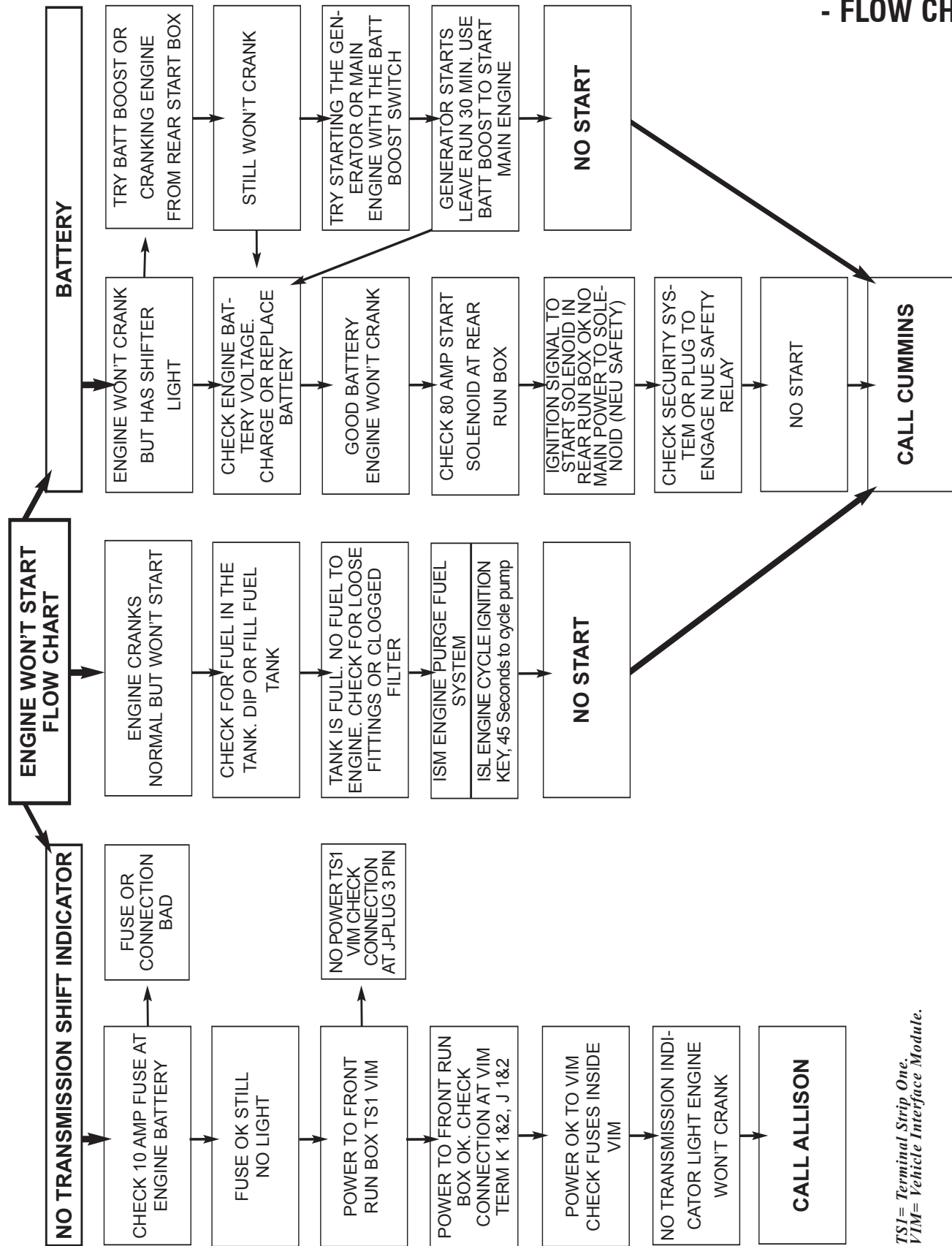


Auxillary Engine Diagnostic Plug  
(Located in this general area.)

## BULB USAGE - EXTERIOR

EXTERIOR BULB CHART	
LOCATION	BULB NUMBER
HEADLIGHT - LOW BEAM	Hella H32 #279
HEADLIGHT - HIGH BEAM	Hella P45
FOG/DRIVING LIGHTS	HELLA #469 VDH2U
PARK/TURN - FRONT	SYLVANIA 3157
TAIL/STOP LIGHT - REAR	SYLVANIA 1157
BACK-UP LIGHTS	SYLVANIA 1141
THIRD BRAKE LIGHT	FORD F85B13A825 P260H OR MP#13782
CLEARANCE LIGHTS	GE 194
LICENSE PLATE	GE 194
DOCKING LIGHTS	150P
TROUBLE LIGHT	R1910YF
TURN SIGNAL - MIRROR	GROTE 4641 AMBER
PORCH LIGHT	F8T5CW
COMPARTMENT BAY LIGHTS	GE FE F15T8-CW

# ENGINE "NO START" - FLOW CHART



TS1= Terminal Strip One.  
VIM= Vehicle Interface Module.

**NOTES**



# Signature

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**INTRODUCTION**

This section contains knowledge and information on various components of the motorhome chassis. Following the guidelines and procedures will help you to understand and operate your motorhome. Complete instructions for engine and transmission are located in their respective operator's manual included in the Owner's Information File box.



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

- 1. Disconnect the (+) positive and (-) negative battery connection, and any electronic control ground wires connected to the frame or chassis.**
- 2. Cover electronic control components and wiring to protect from hot sparks.**
- 3. Disconnect the wiring harness connectors at the transmission electronic control unit.**
- 4. Do not connect welding cables to electronic control components.**
- 5. Attach the welding ground cable no more than 2 feet from the part to be welded.**

The Roadmaster chassis design provides 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 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 incorporate two inboard mounted air bags and shock absorbers. The design and set up is intended to provide the smoothest ride, best handling and trouble free service while delivering top notch drivability. The chassis has either a three point hydraulic leveling system or air leveling system. The Roadmaster chassis design offers unsurpassed ease of maintenance and service.

The towing system rating incorporated in the construction of the frame is 10,000 lbs. towing and 1,000 lbs. tongue weight.

The Roadmaster's exclusive cushion air glide suspension consists of **front and rear axles**, with leading and trailing arms in a parallel four link arrangement. A panhard bar on each axle controls side motion. Each axle mounts to a wide platform H-frame that carries the coach body on eight outboard mounted air bags (4 front and 4 rear). Each of the eight air bags couples with a Bilstein gas shock absorber. The suspension control arms attach to the frame through bushings, which require no lubrication.

The preset suspension ride height automatically maintains the proper suspension height throughout the load range.

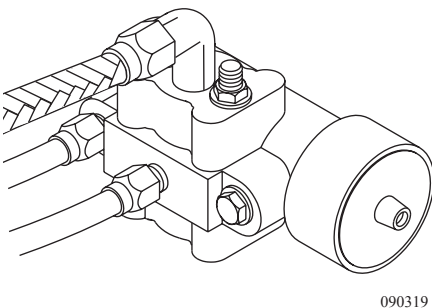
## AIR SUPPLY SYSTEM

The air compressing system on the motorhome is comprised of several items: an air compressor, air governor, air dryer, 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.

## **Air Dryer Operation**

During system pressure build-up compressed air passes into the air dryer where the filter system removes contaminants and passes the air into the drying stage. Initially, moisture that condenses out collects in the base of the dryer. Moisture-laden air passes through the desiccant bed in the air dryer cartridge and is dried. When the compressor unloads, the water is expelled and the dry air flows back through the dryer, drying the desiccant for the next cycle.

## **Air Dryer Cycle**

The governor turns the compressor on when supply tank pressure drops below cut-in pressure. Compressed air passes into the air dryer at the inlet port:

- Moisture-laden air and contaminants pass through the desiccant.
- Moisture is retained by the desiccant. Moisture also collects in the base of the dryer.

When the compressor unloads the purge valve opens. The governor turns the compressor off when the system reaches cutout pressure (approximately 120 psi).

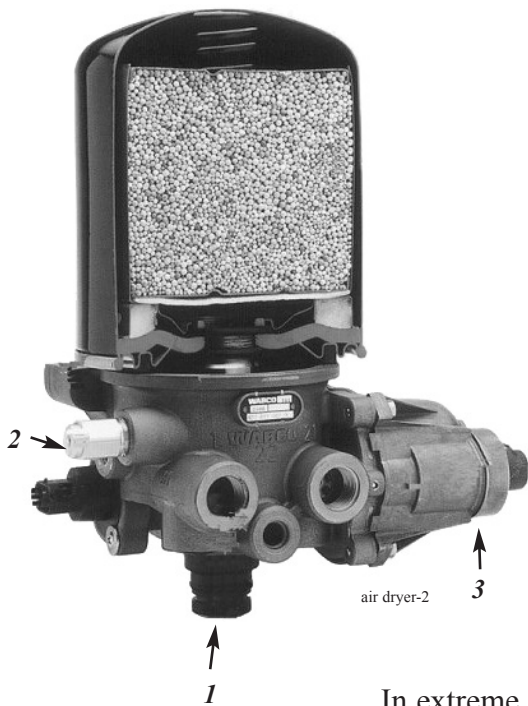
- The dryer purges and expels water collected in the dryer base.
- When the regeneration valve opens, the dry system air flows back through the dryer. A small charge of air from the front tank backflows through the filter. The backflow dries the desiccant, preparing it for the next cycle.

## **Importance of the Air Dryer**

1. When air is compressed the compressor intakes water vapor with the air, compresses the water vapor and puts it into the system as liquid water.
2. Liquid water that accumulates in air lines can damage seals and valves and wash away lubricants.
3. In cold weather water can freeze, block air lines and damage air system components.

## **Desiccant-Type Air Dryer**

1. Warm, humid air from the compressor condenses into either liquid water or water vapor before entering the air dryer.
2. A desiccant-type air dryer protects the motorhome air brake system by drying moisture-laden air before it passes through the air reservoirs and into the brake system.
3. Water collects in the base of the dryer when warm air condenses the water before it enters the dryer, or inside of the dryer before the water reaches the desiccant.
4. The desiccant material then removes additional water vapor, further drying the air.
5. During 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.



### Air Dryer Components:

- 1. Purge Valve:** A valve located on the bottom of the air dryer base that remains open during a compressor unload cycle. The purge valve allows collected moisture, condensation and contamination to be expelled from the air dryer during a purge cycle.
- 2. Pressure Relief Valve:** 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.

In extreme cold, verify that the air dryer heater is in good working order. The heater in the air dryer is a 100-watt heater controlled by ignition power and turned off when the ignition is switched off. The heater turns on below 45° F and off when the air dryer temperature is above 86° F. The fuse is located in the front electric bay, roadside.



**WARNING: Remove all pressure from the air system before disconnecting any component, including the desiccant cartridge. Pressurized air can cause serious personal injury.**

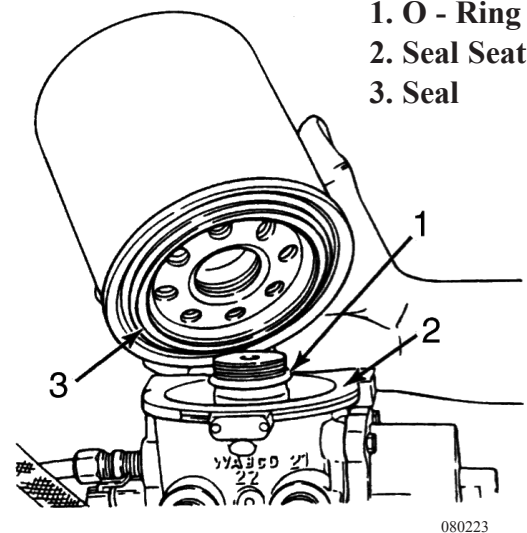
### Desiccant Cartridge



**NOTE: If the seats are damaged so badly that a tight seal cannot be maintained, replace the air dryer.**

1. The replacement kit contains one cartridge and one O-ring.
2. Loosen and remove the old cartridge. Use a strap wrench, if necessary.
3. Remove and discard the O-ring from the dryer base.
4. Inspect and clean the seal seat. Repair any minor damage.
5. Lubricate the O-Ring on the stem with a thin layer of grease.
6. Lubricate the cartridge seal with a thin layer of grease.
7. Thread the replacement cartridge onto the base until the seal touches the base. Tighten the cartridge **ONE** additional turn. **DO NOT OVERTIGHTEN.**

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).



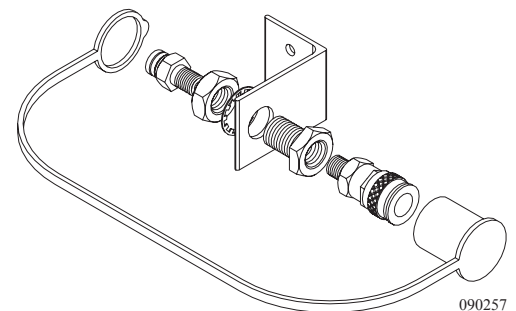
080223

The front and rear air tanks should be manually drained once a month, or more, depending on operating conditions where humidity is high. The front air tank has a drain valve for both the wet and dry side. The rear air tank only has one drain valve. Open the drain valves until all air is purged from the tanks, allowing five extra minutes for moisture to be expelled. Remember to close the tank drain valves. Both air tanks have a pressure relief valve which are set to release at approximately 130 psi.

## AIR STORAGE TANKS

Provided for convenience is a remote air supply coupler. This is located in the roadside 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. This fitting is not designed to charge the air system on the motorhome. The air supply for the auxiliary air fitting is charged from the front air tank through a pressure protection valve.

## AIR COUPLER - UNIVERSAL



090257

### 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.

(Continued)

**To remove fitting:**

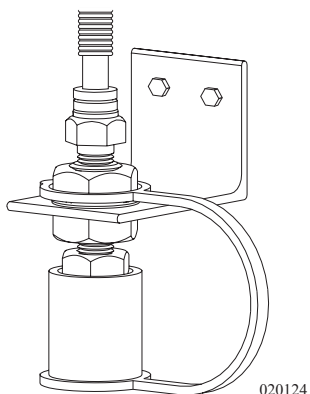
- Firmly grip the air hose near the fitting to prevent recoil.
- Slide the locking collar back to release fitting. The collar will lock into the open position when fully retracted.
- Replace the protective dust cap when finished.



**NOTE: There are small air pressure restrictions in the pressure protection valve and tire stem valve. Due to this restriction, the maximum amount of tire pressure achieved when the system is used to fill a tire is approximately 95-105 psi with air system on the motorhome charged to 120 psi. Maximum outlet air pressure is achieved when the air system completes the fill cycle indicated by the purge cycle of the air dryer.**

---

**AIR SYSTEM -  
CHARGING (External)**



The air system on the motorhome can be charged from an external air supply source. Located in the 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**

Three ride height valves inflate or deflate the air springs keeping the motorhome at the proper suspension height throughout the load range. Two valves are used on the rear drive axle. These two valves control rear suspension heights and left or right tilt of the motorhome. Only one valve controls the front suspension height. The ride height control valves mount to the main frame of the motorhome above the axles. Each valve has a linkage rod connecting the axle. The valves make small air adjustments to the air springs while traveling. The amount of system air the valves use depends on the type of road surface and driving styles.

The air springs mount between the H-frame assembly and the two main frame rails. The axles mount to the H-frame and the main frame rails support the house. Should it become necessary to check the suspension ride height, start by having the air system fully charged and the suspension at normal ride height. The motorhome must be on a flat level surface.

There is a specified distance between the air spring mounting plates. These plates support the air spring between the main frame and the H-frame. Other than specified ride height distances affects the shock absorbers, drive shaft angle and various other running gear components, as well as compro-



mising ride quality and handling. 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 the curbside rear height control valve up will pivot the roadside front corner down.



**NOTE: Drive shaft angle is affected by the suspension ride height. Improper drive shaft angle can damage suspension or shorten the life of universal joints. Shock absorbers and air springs are in travel centers at proper ride height.**

**To adjust the suspension ride height begin with:**

- The motorhome on flat level surface.
- Air system fully charged.
- Suspension at normal ride height.

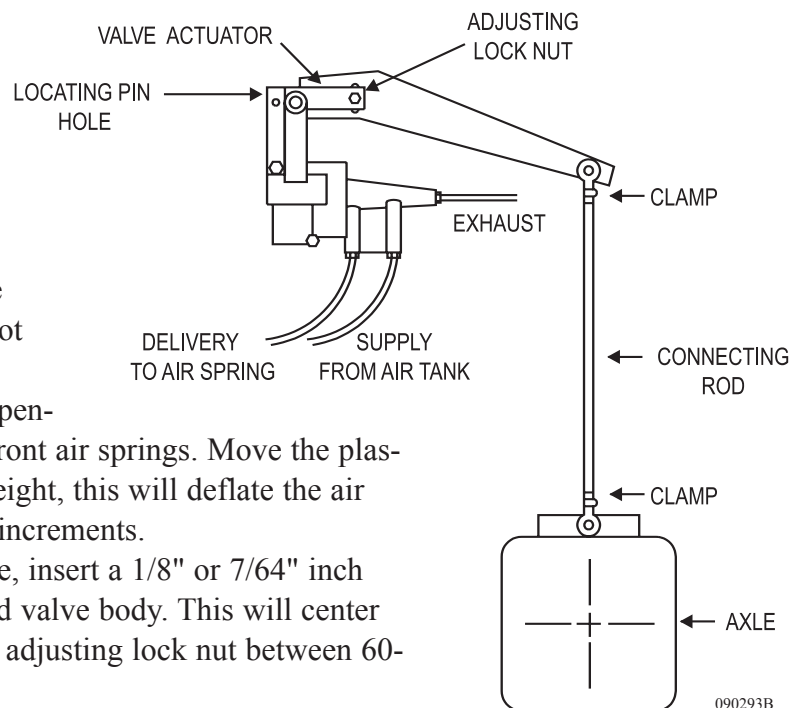
**Start by checking the distance in the front.**

1. Measure the distance between the mounting plates of the air springs.
2. If the measurement is off, loosen the adjusting lock nut at the eccentric slot on the valve.
3. Move the plastic arm up to raise suspension height, this will inflate all the front air springs. Move the plastic arm down to lower suspension height, this will deflate the air springs. Make adjustments in small increments.
4. After obtaining the specified distance, insert a 1/8" or 7/64" inch twist drill bit into the plastic arm and valve body. This will center the travel of internal piston. Tighten adjusting lock nut between 60-80 in/lbs.
5. Check adjustments made by using the Air Dump switch to deflate air springs. Start the engine and allow the air system to become fully charged. Allow the suspension to adjust and come to a neutral setting.
6. Re-check the suspension height measurement. Follow the same procedure for each rear control valve.
7. Re-check the front suspension height after adjusting the rear height control valves.

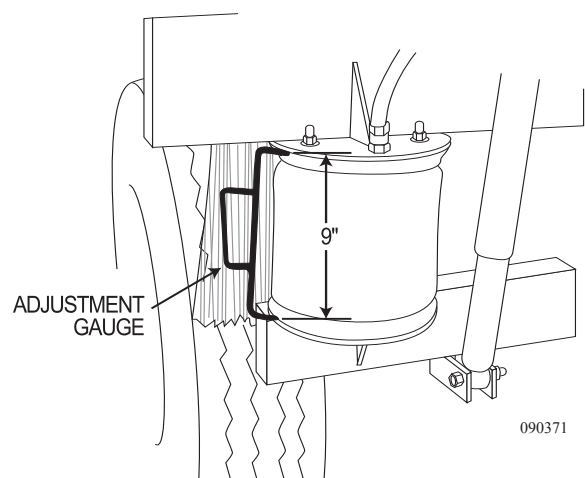


**NOTE: Do not modify length of the linkage rods. Make any necessary adjustments using eccentric slot on the ride height control valve.**

## Checking Ride Height

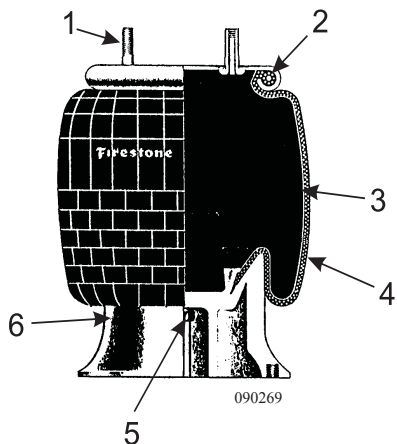


**Measurement is:  
Front = 9 in., Rear = 9 in.**



## SUSPENSION AIR RIDE BAGS

Air ride springs are available in single, double and triple convolution types plus reversible sleeve models for virtually every conceivable heavy-duty vehicle suspension application.



- 1. STUD:** Manufactured as a permanent part of bead plate assembly for maximum strength and durability. Used to attach spring to the vehicle's suspension.
- 2. BEAD PLATE:** Crimped onto bellows at the factory for a durable design and maximum quality control. Allows 100% leak proof testing prior to shipment.
- 3. BELLOWS:** "Air bag" includes four plies of material: an inner layer, two plies of cord-reinforced fabric and an outer cover. Natural rubber construction provides functional properties up to - 65° F.
- 4. BUMPERS:** A solid rubber or engineered plastic device designed to prevent significant damage to the vehicle or its suspension in event of a sudden loss of air pressure in spring.
- 5. PISTON:** Provides a lower mounting arrangement for air spring. Controls characteristics of spring under changing pressure loads.
- 6. PISTON BOLT:** Attaches piston to bellows. Sometimes extended as a means of attaching spring to vehicle suspension.

### Checklist - Air Bag Inspections

Listed below are items that can be checked when the motorhome is in for periodic maintenance.



**NOTE: Never attempt to service the air suspension on a motorhome with the air bags inflated.**

- Inspect the O.D. of the air springs. Check for signs of irregular wear or heat cracking.
- Inspect the air lines to make sure contact doesn't exist between the air line and the O.D. of the air springs. Air lines can rub a hole in an air spring very quickly.
- Check to see that there is sufficient clearance around the complete circumference of the air spring while at its maximum diameter.
- Inspect the O.D. of piston for buildup of foreign materials. (On a reversible sleeve style air spring, the piston is the bottom component of the air spring.)
- The correct ride height should be maintained. All motorhomes with air springs have a specified ride height established by the manufacturer. This height should be maintained within ¼ in. This dimension can be checked with the vehicle loaded or empty.

- The leveling valves (or height control valves) play a large part in ensuring that the total air spring system works as required. Clean, inspect and replace if necessary.
- Make sure to check shock absorbers for leaking hydraulic oil and worn or broken end connectors. If a broken shock is found, replace it immediately. The shock absorber will normally limit the rebound of an air spring and keep it from overextending.
- Check the tightness of all mounting hardware (nuts and bolts). If loose, tighten. Do not over-tighten.

### **Cleaning:**

The approved cleaning method is to use soap and water, methyl alcohol, ethyl alcohol and isopropyl alcohol. Unapproved cleaning methods include all organic solvents, open flames, abrasives and direct pressurized steam cleaning.

---

The motorhome is equipped with air brakes using the same efficient system as over the road trucks. Proper maintenance and lubrication is the key to keeping the brake system in proper working order. The brake system on the motorhome is designed to accommodate the weight of the vehicle and towing loads. This system differs from a conventional automotive hydraulic braking system and should be treated differently.

When operating a vehicle equipped with air brakes consideration needs to be given to stopping distances and air system pressures. The heavier the vehicle, the greater the kinetic energy. The motorhome requires longer stopping distances. Each brake application uses air from the air system. Give attention to the air gauge as well as the surroundings. Engine speed is directly proportional to how fast the air system is replenished. Prepare for downhill grades. Grades are generally posted in percentages. It may be necessary to select a lower gear. Make use of the engine or exhaust brake. When making brake applications use individual short applications down long hills rather than “riding” the brakes. This will extend the life of the brake 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

## **BRAKE SYSTEMS - AIR BRAKES**

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.

---

## **BRAKE - PARK & EMERGENCY SYSTEMS**

The park and emergency brake systems are combined and apply to the rear drive axle only. These are called spring brakes. When the park brake is applied, air is released from the rear brake chambers allowing the large spring in each rear brake chamber to manually push against the automatic slack adjuster. This rotates the S-cam applying the brake shoes against the drum. The air system must be charged above 35 psi so the park brake will remain released. Pushing down on the park brake handle charges the rear brake chambers with air pressure, overriding the emergency brake springs and releasing the brakes. In the event of air loss, while the vehicle is under operation, the park brake will automatically apply (this occurs at approximately 30 psi) acting as an automatic emergency brake system.

When preparing to depart, allow the air system to achieve full air pressure. This is indicated by the air gauge needles. Listen for the air dryer to purge, indicating full air pressure has been obtained and the air dryer is functioning. Look and listen for any abnormalities. Abnormal air pressure readings by 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.



**WARNING:** When parked, if the air tank is not depleted there is the possibility of an accidental release of the parking brake. Traveling with small children and/or pets may require a small block to be fabricated to prevent accidental release. The block should be placed under the knob on the dash panel. A wooden clothes pin, clasped at the base of the shaft, will work.

## **BRAKE ADJUSTMENT/ SLACK ADJUSTER**

The motorhome is equipped with automatic slack adjusters. As brake 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.**

## **ABS/ATC SYSTEM (Anti-lock Brakes)**

The motorhome is equipped with an anti-lock braking system (ABS) and automatic traction control system (ATC). The ABS system monitors wheel rotation speeds by using a 100-tooth magnetic tone ring mounted to the hub. Revolving with the wheel, the magnetic tone ring is polarized giving positive and negative pulsations. A stationary sensor is mounted adjacent to the tone ring 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:**

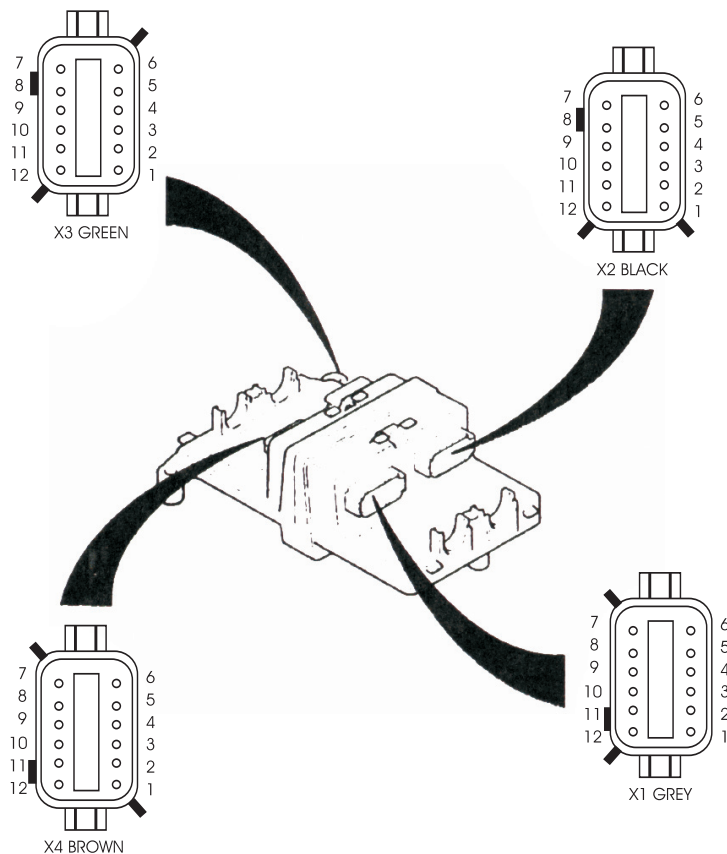
The ABS will perform a diagnostic indicator lamp check and self diagnostic test each time the ignition is switched to the on position. The ABS dash indicator light will illuminate momentarily (2.2 seconds) verifying the self check test. If the ABS indicator light remains on, or illuminates while the 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:**

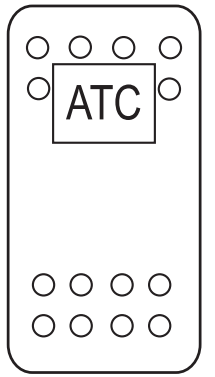
The ABS dash indicator light can be used to obtain system faults by displaying a blink code.

**To a 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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**ATC System:**

The ATC system improves traction on slippery or unstable surfaces by preventing excessive wheel slip. During periods of wheel slip the ECU enters an automatic traction control mode. There are various modes of ATC operations:

- Speed above 25 mph. The engine is throttled back to control rear wheel slip.
- Speed below 25 mph. The engine is throttled back and drive axle brake controls are activated to control wheel slip. If the brake control activates, it remains active regardless of road speed.
- Turning on the ATC switch allows greater torque and wheel slip. The amount of torque and wheel slip varies with the amount of rear wheel slip versus road speed. This mode is intended for off road adverse conditions.
- The ATC system is active regardless of road speed or switch position.

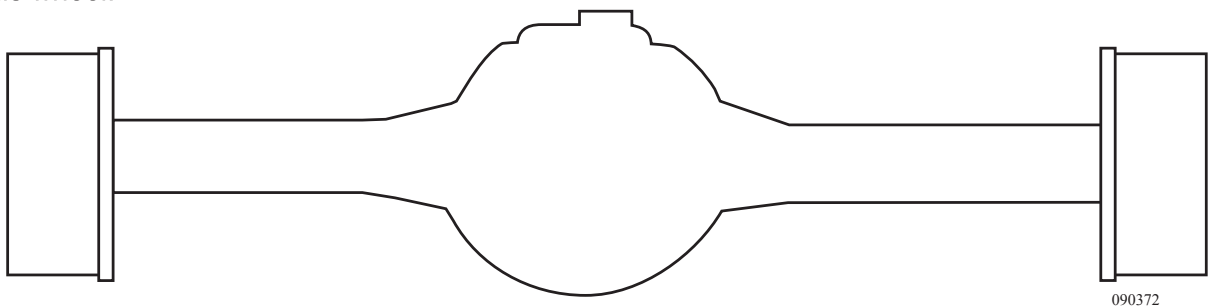
**ATC Indicator Light:**

The ATC indicator light will illuminate steady when the ignition key is turned ON. The light remains illuminated until the first brake application. The indicator light flashes slowly when the ATC switch is on. The indicator light will flash quickly when an ATC event occurs.

**How Automatic Traction Control (ATC) Works**

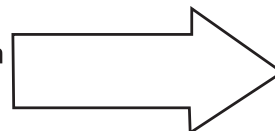
If this wheel is spinning due to slippery surface or wheel off the ground, the ABS system with ATC applies the brake to this wheel.

This wheel then delivers torque to the ground.



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Torque is then transferred through the differential to the other wheel.





**BRAKE SYSTEMS  
- BACK-UP**

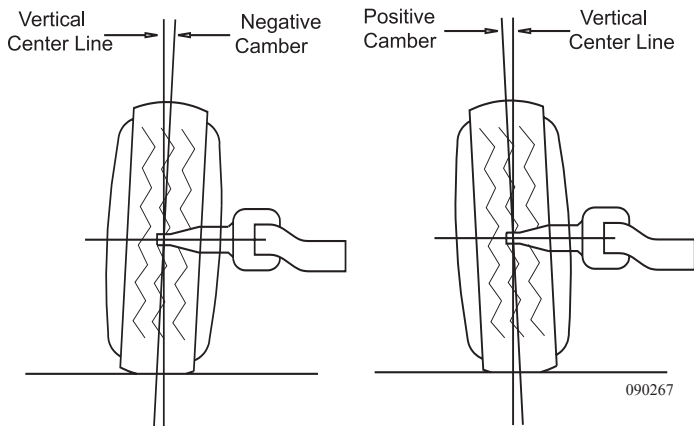
The motorhome air braking system is equipped with several back-up safety systems and warning alarms in case of an air system failure. Refinements to air braking systems have been instituted with safety as top priority. For example: should the air compressor fail to charge the air system and the low air 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 case 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) reserves the remaining air pressure of 65 psi for braking. This will leave the motorhome with one air tank fully charged for a safety back up.

In another situation, whereby all compressed air has escaped from the rear air tank, a pneumatic back-up safety valve is installed. This is the safety inversion valve. The inversion valve senses the absence of rear air tank pressure. In this case the inversion valve will allow the operator to make a modulated spring brake application, made in conjunction with the emergency spring brake relay valve. The inversion valve allows the front air tank pressure to recharge the rear brake chambers after the modulated spring brake application has been made. This back-up system implements use of all the brakes, allowing the operator to bring the vehicle to a safe stop. In case of all compressed air charge escaping from the front air tank, the operator will still have full use of the rear brakes.

# ALIGNMENT SPECIFICATIONS

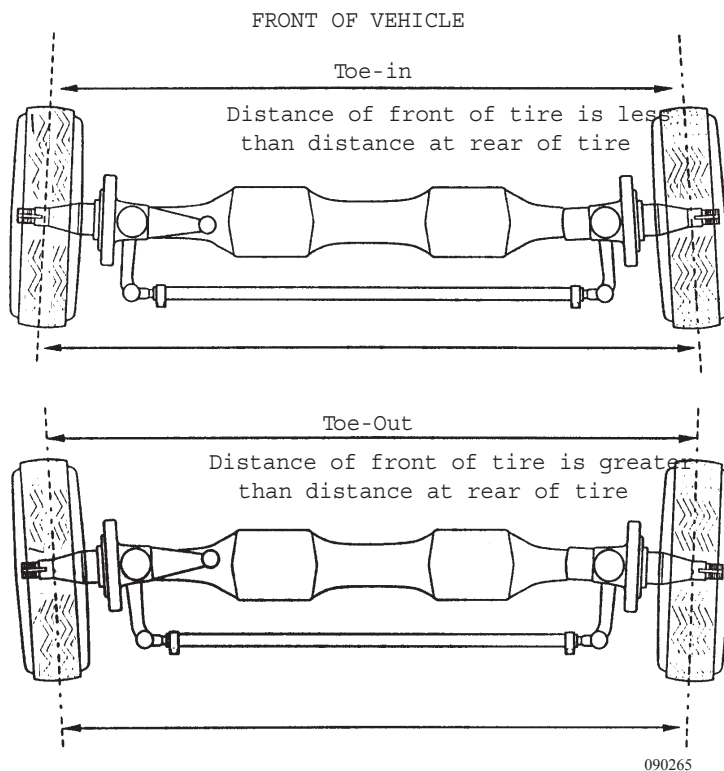
The correct wheel alignment promotes longer tire wear and ease of handling while minimizing the strain on the steering system and the axle components.



## Camber:

Camber, as shown, is vertical tilt of wheel as viewed from the front of the vehicle. This is machined into the axle when manufactured and is not adjustable.

- “Positive” camber is an outward tilt of the wheel at the top.
- “Negative” camber is an inward tilt of the wheel at the top.



## Toe Setting:

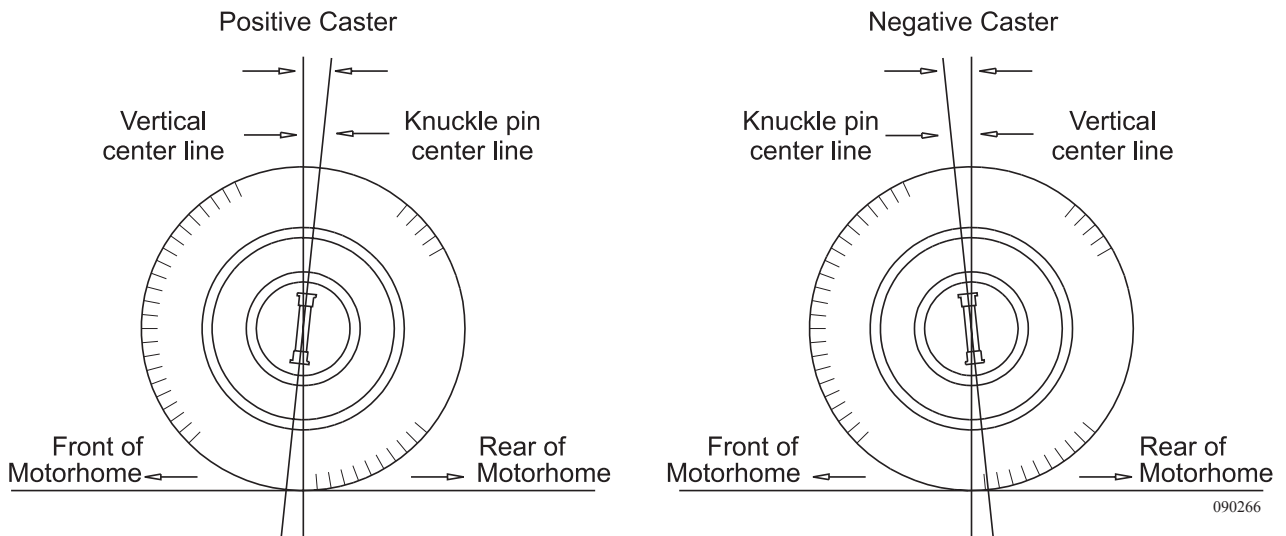
The toe setting represents different distances between the front and rear of the tires (measured at the vertical center line of the tires).

Toe-in occurs when the tire front distance is less than the tire rear distance.

Toe-out occurs when the tire front distance is greater than the tire rear distance.

Wheels are generally set with initial toe-in. As the vehicle operates tires tend toward a toe-out condition. By starting with an initial toe-in setting, a desirable “near zero toe-in” can be achieved when the vehicle is in motion.

Incorrect toe settings, where toed-in or toed-out, can have a significant affect on tire wear. The toe setting is adjusted by lengthening or shortening the cross tube.



**Caster Adjustments:**

Caster is the fore and aft tilt (toward the front or rear of the motorhome) of the steering kingpin as viewed from the side of the motorhome.

“Positive” caster is the tilt of the top end of the kingpin toward the rear of the motorhome.

“Negative” caster is the tilt of the top end of the kingpin toward the front of the motorhome.

Setting the caster angle more positive than specified may result in excess steering effort and/or shimmy. Decreasing the angle may result in vehicle wander or poor steering return to center. The caster angle is determined by the installed position of the steer axle.

FRONT	SPEC.	TOL.
<b>Left Camber</b>	<b>-0.24°</b>	<b>0.41°</b>
<b>Right Camber</b>	<b>-0.24°</b>	<b>0.41°</b>
<b>Cross Camber</b>	<b>---</b>	<b>0.25°</b>
<b>Caster</b>	<b>4.80°</b>	<b>1.00°</b>
<b>Cross Caster</b>	<b>-0.35°</b>	<b>0.50°</b>
<b>Total Toe</b>	<b>0.03°</b>	<b>0.12°</b>

## TAG AXLE

The tag axle is standard equipment on all motorhomes that are 40 foot or greater in length. The tag axle design allows a greater weight carrying capacity, thus making it possible to create a larger variety of floor plans.

The switch for the tag axle is located on the left hand shift panel. There are two lights on the switch: One will light when the headlights are turned on. The other will light when the tag axle switch is on. Raise the tag axle when performing severe or tight maneuvering under 5 mph to prevent scuffing the tag axle tires. A beeping alarm sounds when the switch is on.

### **The tag axle raises in the following modes:**

- When the switch is on and the transmission is in neutral, reverse or first gear.
- With the tag axle in the up position there is not a specific height requirement other than the tire should be off the ground. If extra clearance is desired, moving the lift chain up one link on each side can increase ground clearance with the tag axle in the raised position.

### **A description of what occurs in a motorhome equipped with air leveling when the tag axle switch is on:**

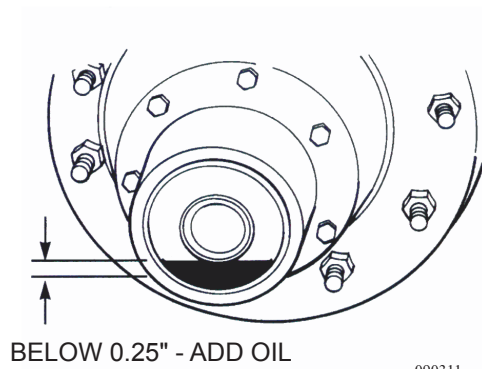
- The tag axle switch supplies 12 Volt DC to the 14 gauge yellow with green stripe wire to the mac valve located at the roadside rear.
- The rear mac valve applies air pressure to the orange air line at both tag axle brake chambers to lift the axle.
- Air pressures in the tag axle air bags is released. The tag axle remains up until the switch is turned off.

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 weight distribution 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. An adjustable pressure regulator located in the engine compartment sets the amount of air pressure in the tag axle air bags. 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.

All tag axles use oil to lubricate the wheel bearings. The oil is drained and refilled without removing the wheel end assembly. Remove the hubcap to access the bearing cover and drain plug.

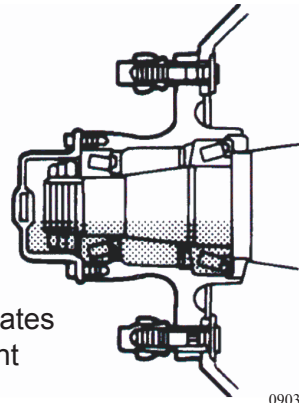


**Inspect the oil level before every trip or every 5,000 miles.**



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Shading indicates  
correct amount  
of oil



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### To inspect the oil level:

- Remove the chrome hubcap.
- Locate the full and add mark on the outside of the clear plastic cover.
- If the lubricant level is low, add the recommended fluid until full.

The recommended oil change interval is based on the operating conditions, speeds and loads. Limited service applications may allow the recommended interval to be increased. Severe applications may require the recommended interval to be reduced. For more information, contact a Dana/Eaton service representative.

## Oil Lube Intervals

### Recommended Interval Change:

- Change the fluid whenever the seals are replaced, the brakes are relined or at 30,000 miles (48,000km). However, check the lubricant twice a year (spring and fall) for contamination. Change as needed.
- If yearly mileage is less than 30,000 miles, change it twice a year (spring and fall).

### Lubricant Type:

- Shell Hypoid gear oil, GL-5, S.A.E. 80w/90. Specifications, minimum ambient temperature -15°F (-26.1°C). There is no maximum ambient temperature. Lubricant temperature must never exceed 250°F (+121°C).

### To Drain:

- Place a suitable container below the bearing cover and remove the drain plug. If the cover does not have a drain plug, remove the screws retaining the cover plate to drain the lubricant.
- Replace plug or cover plate and fill bearing assembly with the recommended lubricant.

## SHOCK ABSORBERS



Normal shock absorber appearance after a long service period.

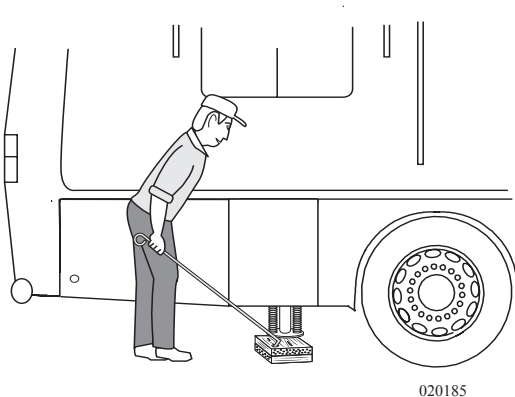
The shock absorber by definition is a hydraulic device used to dampen suspension/body movement. The road surface irregularities or roughness is compensated for by the shock absorber. The Roadmaster chassis incorporates the “Bilstein” shock in the design of the exclusive air glide suspension system. This 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.

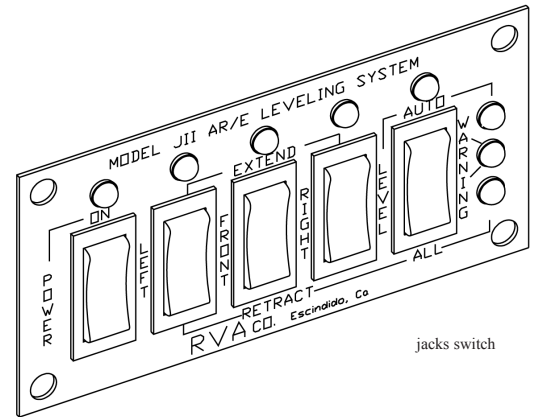
## LEVELING SYSTEM Hydraulic Leveling (Optional)

The leveling system uses three hydraulic cylinders to level the motorhome, two cylinders located in the rear and one located in the front. The leveling system was designed to reduce site selection problems. A remote control panel located next to the driver seat operates the system. There are some essential steps to follow when operating the leveling system:



- Select a level site if possible. If the site is not level, park the motorhome with the front facing downhill.
- Before operating the system, lower the air suspension by making several brake applications, then push the Air Dump switch.
- This can be attained by moving the motorhome to another location or gain additional height by placing a 1' x 1' cut plywood. Use two ¾" pieces stapled together to equal 1½" thick.
- Drill a hole in one end, and use the awning hook to slide the block under the jack pad.

- If operating the system manually, lower the front jack first. The front jack will be the pivot point for the chassis. This reduces torsional stress on the chassis and body of the motorhome. Torsional stress is significantly reduced when operating the system properly. Damage resulting from improper leveling procedures and excess torsional twist can range from windshield damage to the entry door jammed closed.
- The remote control switches will operate with a minimum of 7.5 Volts DC. Optimum requirements for operating the system are voltages above 9.6 Volts DC.



### Warning Features Include:

- A warning system consisting of flashing lights and a bong alarm when the system is on or a jack is down.
- The Bong alarm may activate momentarily when driving over rough roads, or negotiating curves and corners. Usually this indicates low fluid level.

### Remote:

The remote control panel is compromised of 3 retract/extend switches, a switch for Automatic Leveling, a Retract All switch and a power ON/OFF switch.

### Indicator Lamps:

- A yellow lamp above any rocker switch indicates a low level condition.
- A flashing green lamp indicates the system is in Automatic Leveling mode or Jacks All Retract mode.



**CAUTION:** If blocking up a rear jack pad to gain added clearance while motorhome is on a slope, place a chock at the opposite set of rear wheels to prevent the motorhome from rolling.



**WARNING:** Using an improper leveling process can result in applying excess torsional stress to the chassis and body resulting in damage to the windshield or entry door malfunction. The leveling system jacks are not designed for changing tires. This can cause problems with the suspension system, frame alignment and damage to the windshields. Never use the jacks to elevate any wheel position off the ground.



**NOTE:** In the event the front of the motorhome is high and does not require elevating, it will be necessary to lower the front jack and raise the front of motorhome a minimum of 1/2". This allows the front jack to act as a pivot point.



**NOTE:** Air will automatically release from the air bags when the leveling cycle begins. This will lower the chassis of the motorhome and require less extension by the jacks.

## Manual Leveling

### Manual Operation:

When manually operating the leveling system always lower the front jack first. The front jack acts as a pivot point for chassis, reducing torsion stress on the body of the motorhome.

- Apply the parking brake.
- Turn the ignition switch ON, do not start the engine. Be sure the transmission is in neutral.
- Lower the air suspension by making several brake applications until system air pressure is below 60 psi. With the ignition on, push and hold the Air Dump switch to lower the suspension.
- Turn on the jack control Power switch.
- Each yellow light and rocker switch combination corresponds to each jack as positioned on the chassis.
- To extend a particular jack, push and hold the corresponding rocker switch to Extend until the yellow light goes off. That particular jack is in the level position.
- To retract a particular jack, push and hold the corresponding rocker switch until the jack fully retracts.
- Turn off the Power switch.
- Turn off the Ignition switch.



**CAUTION: Damage to the mud flap may occur if the mud flap is located over a raised area when the suspension is lowered.**



**CAUTION: Do not move motorhome while the jacks are still in contact with the ground or extended, damage to the jacks can occur. Do not use the jacks to raise any wheels off the ground. Damage to the motorhome may occur.**

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## Automatic Leveling System

### Automatic Operation:

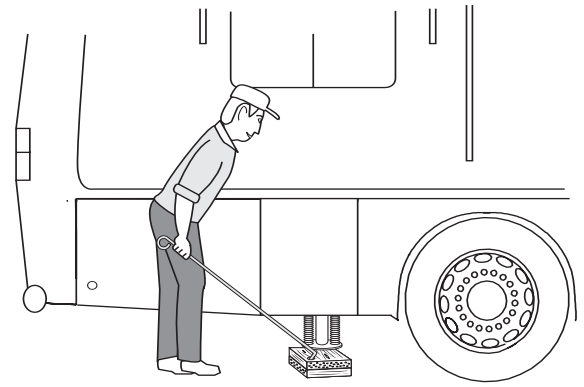
The ALL JACKS RETRACT mode or MANUAL mode can be engaged at any time during automatic leveling operation. Prior to and during the automatic leveling process, it is essential that there is no movement in the motorhome.

### To begin automatic operation:

- Apply the parking brake.
- Turn the ignition switch to the ON position. Be sure the transmission is in neutral.
- Turn the jack control Power switch on.
- Press the AUTOMATIC LEVELING/ALL JACKS switch.
- The top green light will start blinking. After a ½ second delay, the pump motor will activate and all jacks will extend.



- The system will attempt to complete the leveling process 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 cycle the system will attempt to level four subsequent times at seven second intervals.
- If both green lights start flashing alternately the system has reached maximum extension on one or more jacks. One or more yellow lights will blink, indicating additional height is required under one of the jack pads.
- When the leveling process is complete turn off the jack control Power switch.
- Turn off the ignition switch.



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**WARNING:** When the jacks are extended, a red JACKS DOWN warning light will blink and the bong alarm will sound. The alarm will sound if the jacks are down and ignition switch is turned ON.

#### Automatic Retract:

Prior to retracting the jacks, it is advisable to start engine and build air pressure.

- Turn the ignition switch on. Place the transmission in neutral.
- Be sure the parking brake is applied.
- Turn the jack control power switch on.
- Momentarily press down the rocker switch labeled ALL JACKS RETRACT and release.

#### Retracting Leveling Jacks



**INSPECTION:** Before moving the motorhome always perform a visual inspection to be sure that all jacks have fully retracted.

Hydraulic pressure, in all jacks, is automatically released when the All Jacks Retract switch is pressed. The jacks retract by the weight of motorhome and the retract springs on each jack. The bottom green light will begin blinking and all jacks will retract. This operation is on a 4 minute timer. After 4 minutes the green light will stop blinking and go out.

## **Manual Retract Valves**

### **Manual Retract Valves:**

The hydraulic pump is located at the curbside front with easy access through the generator compartment. The manifold and valve assembly is mounted on the pump motor, providing access to the manual retract valves.

In case of mechanical or electrical failure that would prevent the leveling jacks from being automatically retracted, the motorhome is equipped with manual emergency retract valves. The manual retract system releases fluid that is under pressure in each jack and allows the fluid to return to the reservoir.



**CAUTION: The motorhome will raise or lower when the manual retract valves are opened. If it becomes necessary to manually retract the jacks, do not crawl under the motorhome to access the valves. Make sure there is sufficient clearance so the valves may be opened safely.**

### **To operate the manual system:**

- Turn all three T-handle valves counterclockwise until they stop. When the jacks are fully retracted, rotate all the valves fully clockwise. In case one of the jacks is not holding pressure, one of the manual retract valves may not be fully tightened.

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## **Maintenance**

### **Maintenance:**

Occasionally, when the jacks are fully extended, wipe off the dirt from the jack rod. This will help lengthen the life of the jacks. How often this is done can vary from the amount and type of usage of the jacks. 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 seals.

### **Component Replacement Model JII-45S:**

The system is designed to be self purging in the event any component of the hydraulic system has been removed or repaired.

### **To purge the system:**

- Fully extend and retract each jack twice.

### **Calibration:**

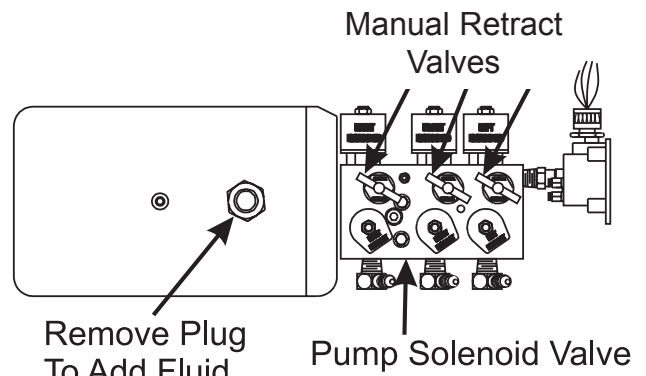
The transmitter module may require calibrating to obtain an accurate level indication. The calibration procedure requires two persons for convenience and accuracy. This should only be performed by qualified service technicians.

**Adding Fluid:**

An indication of a system needing fluid is the bong alarm intermittently sounding when turning corners or the pump whining or gurgling. Use Dexron III automatic transmission fluid to fill the reservoir.

**To fill the reservoir:**

1. Turn the ignition switch to the ON position. Turn the jack control Power switch on.
2. Extend any jack 6 inches from the full retracted position. All other jacks remain fully retracted.
3. Unscrew the reservoir cap from the top of the reservoir.
4. Open a window or the entry door so the bong alarm is audible from outside the motorhome. Slowly fill the reservoir with fluid until the bong alarm stops sounding.
5. Replace the reservoir cap.
6. To retract the extended jack push the retract button.
7. Turn the jack control Power switch off.
8. Turn off the ignition switch.



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A touch panel, computer controlled, four point or six point air leveling system uses the air springs to level the motorhome. Models that are equipped with the air leveling system must have the ignition **ON** for the suspension to operate. This is critical to note in the event the motorhome requires emergency towing.

**LEVELING SYSTEM - AIR****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 automatic 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.



**NOTE: The control pad remains on until ready for travel or storage.**

**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:**

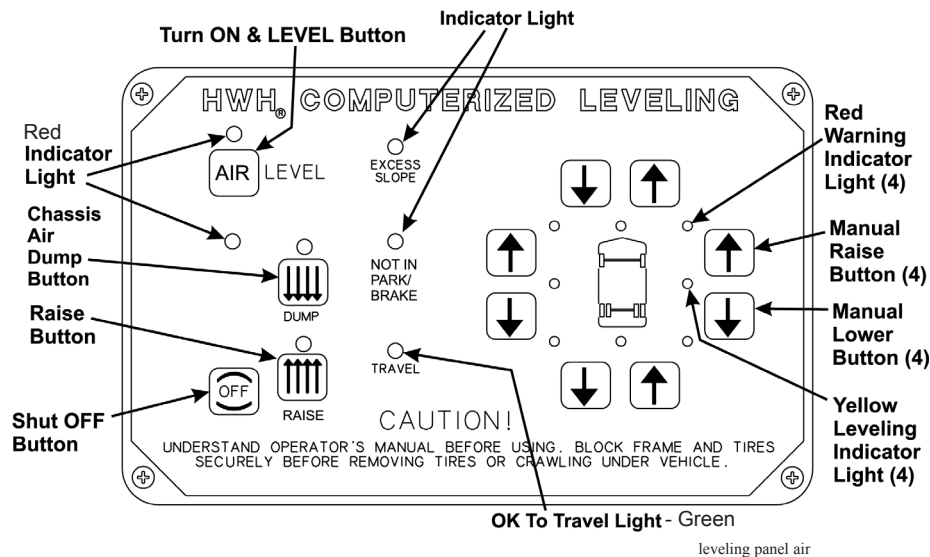
- Air leveling will operate faster if engine is running.
- Set parking brake.
- Transmission must be in neutral.
- Press the AIR button once. AIR indicator light will glow steady.
- Individual RAISE and LOWER buttons (UP or DOWN ARROWS) will add or dump air from suspension air bags to raise or lower 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.

**Air Leveling -  
Traveling Preparation**

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.

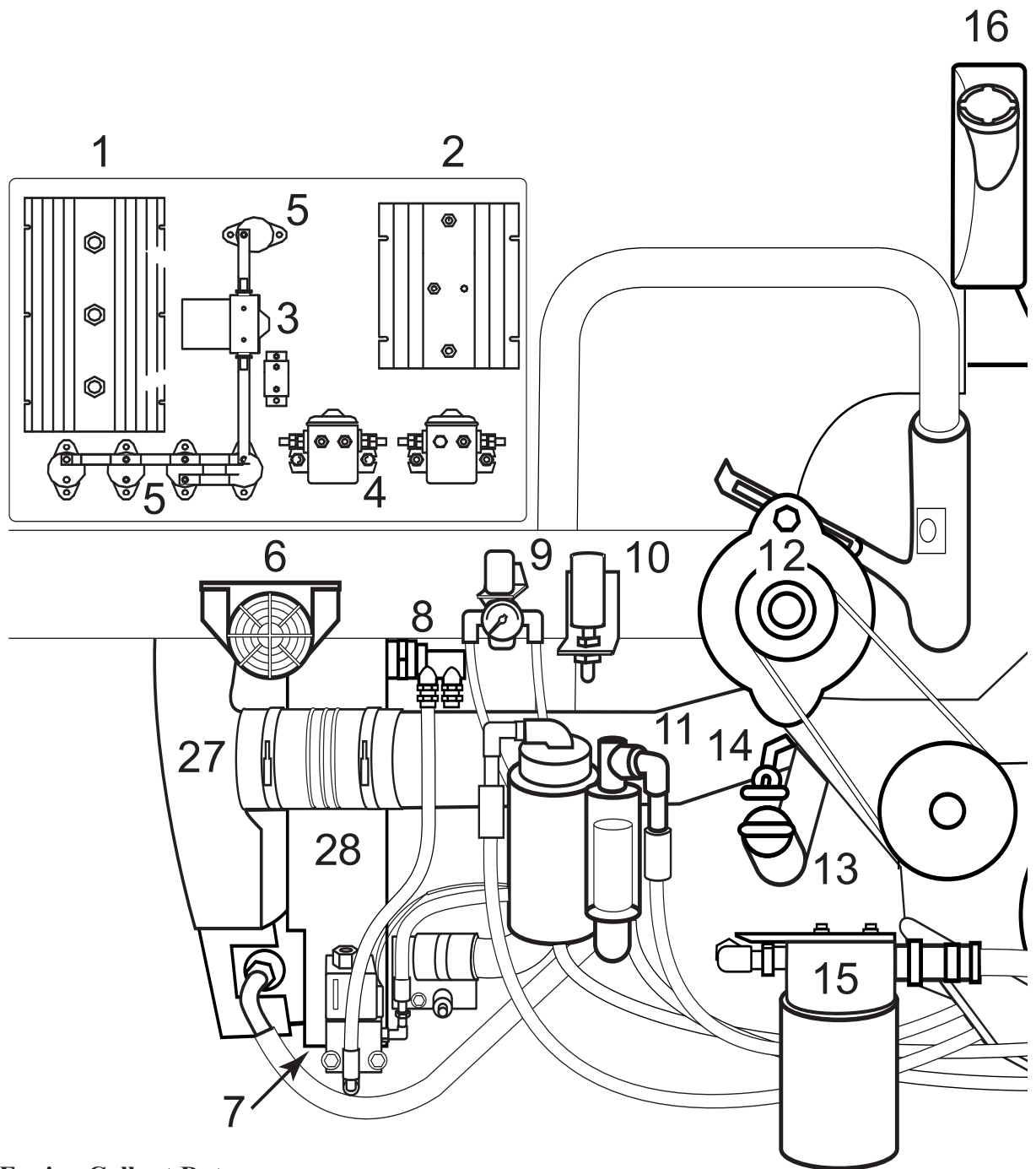
The diesel engine in the motorhome controls engine speed by varying fuel supply only. No throttle plates are used. An exhaust driven turbine system (turbocharger) compresses the fresh air supply into the engine. The fuel is injected under pressure into the combustion chamber. Ignition of fuel/air charge occurs from heat generated by rapid high compression. The turbo boost gauge registers amount of intake manifold pressure 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.



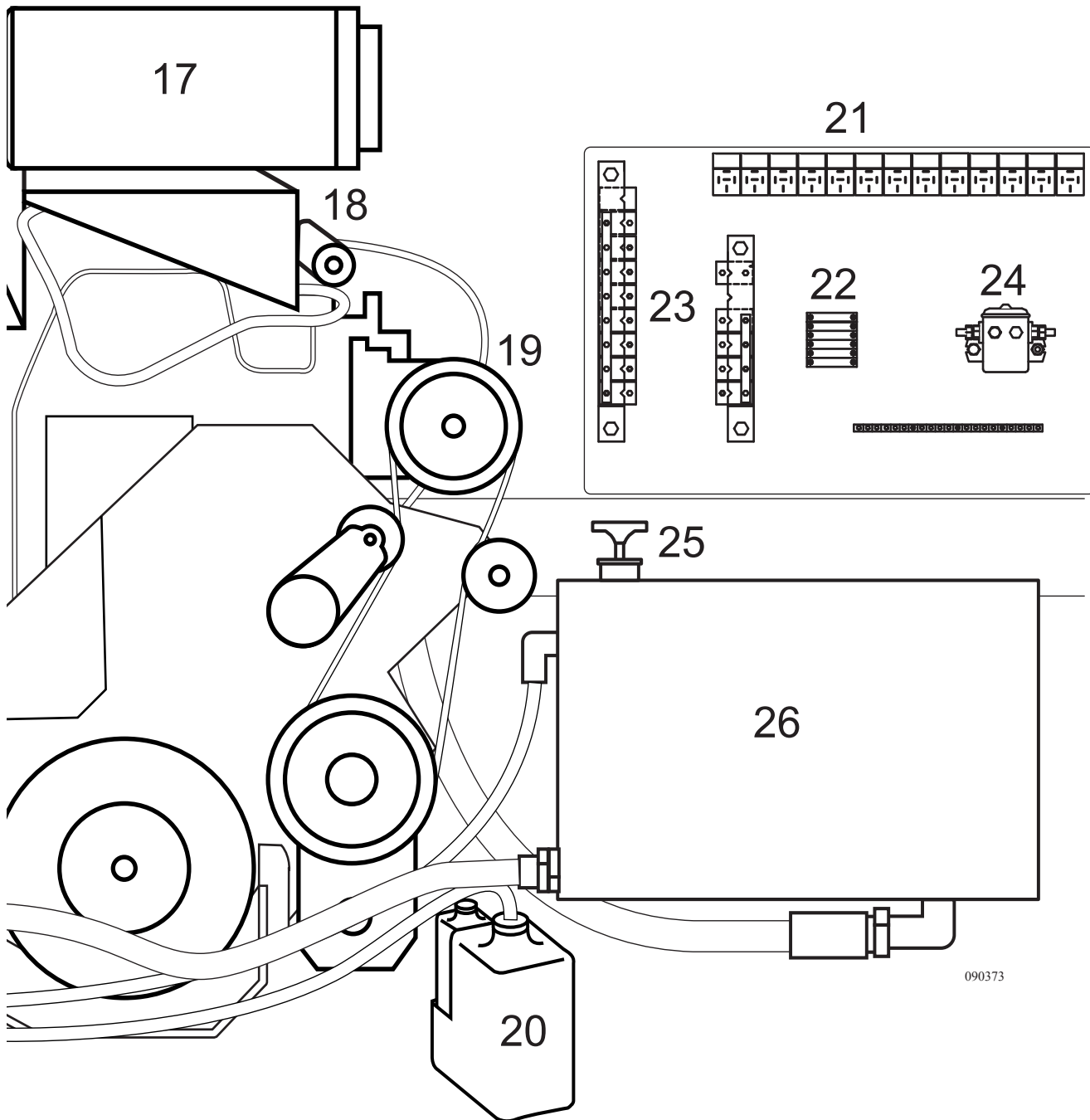
**WARNING: Do not operate a diesel engine where there are or can be combustible vapors. Vapors can be drawn through the air intake system and cause engine acceleration and over-speeding, resulting in fire, explosion and extensive property damage. Numerous safety devices are available, such as air intake shutoff devices, to minimize risk of an engine over-speeding where an engine (due to its application) might operate in a combustible environment, such as fuel spills or gas leaks. The equipment owner and operator is responsible for safe operation of engine. Consult your engine authorized repair location for future information.**

# ENGINE- DIAGRAM



### Engine Callout Data

- |   |                          |
|---|--------------------------|
| 1. Battery Isolater                               | 9. Tag Axle Regulator    |
| 2. Battery Maintainer                             | 10. Air Filter Minder    |
| 3. 1000 Amp Battery Boost Solenoid                | 11. Primary Fuel Filter  |
| 4. House Battery Cut-off Solenoids                | 12. Alternator           |
| 5. High Amperage Circuit Breakers                 | 13. Engine Oil Fill Tube |
| 6. Back-up Alarm                                  | 14. Engine Oil Dipstick  |
| 7. Electric Override Valve for the Hydraulic Fans | 15. Hydraulic Oil Filter |
| 8. Radiator Thermovalve                           | 16. Coolant Reservoir    |



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- 17. Air Filter
- 18. Air Governor
- 19. Air Conditioning Compressor
- 20. Fuel Purge Overflow Bottle
- 21. Various Relays
- 22. Terminal Strip
- 23. Low Amperage Circuit Breakers

- 24. Engine Starter Solenoid
- 25. Hydraulic Oil Dipstick
- 26. Hydraulic Oil Reservoir
- 27. Radiator
- 28. Charge Air Cooler

## STARTING PROCEDURE (ISM Normal)

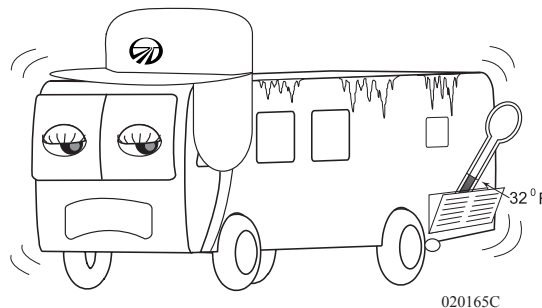
With the throttle in the idle position, turn the key to the start position. When the engine has started release the key. Allow the engine to idle with no load for 3-5 to five minutes. The engine coolant temperature should be up to normal operating range (140° F / 60° C to 212° F / 100° C) before operating the engine under full throttle.



**NOTE: The ISM engine does not have a “wait to start” feature.**

## STARTING PROCEDURE - COLD WEATHER

The engine block heater may need to be plugged in two to three hours prior to starting. The engine block heater is rated at 1,500 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.



## OIL RECOMMENDATIONS (Engine)

The maintenance guidelines in the Cummins Operation & Maintenance Manual are the recommendations for the engine. When followed it will help extend engine life, improve performance resulting in cost efficient operations. A good maintenance schedule begins with a daily awareness of the engine and its various systems.

A high grade 15W-40 multiviscosity heavy duty lubricating oil meeting Cummins Engineering Specification CES 20071 or CES 20076, American Petroleum Institute (API) specification CH-4 which can be used as an alternative to CES 20071 is recommended. Lubricating oils meeting API CG-4 specifications may be used at a reduced drain interval. The engine uses Pennzoil 15W-40 heavy duty engine lubricating oil that meets Cummins specifications. A critical factor in maintaining engine performance and durability is the use of high grade multigrade lubricating oil and strict adherence to the maintenance service intervals.

A straight weight or monograde lubricating oil is not recommended. Shortened drain intervals may be required as determined by a close monitoring of the lubricating oil condition by means of an oil sampling program. The use of oil analysis to extend drain interval is not recommended. There are numerous variables which is the basis of the recommendation.



Synthetic oils API category III specifications are recommended for extreme cold temperatures only.

Low viscosity oils, used for winter operations, will aid in starting. Synthetic oils, or oil with adequate low temperature properties used for Arctic operations where the engine cannot be kept warm when shut down, will aid in starting.

The use of synthetic oils should not be used to extend drain intervals. Extended oil change intervals can decrease engine life and possibly affect the engine warranty.

Oil additives should not be used unless the oil supplier or oil manufacturer has been consulted and provided positive evidence or data establishing satisfactory performance in the engine.



**NOTE: The engine does not require a “break-in” procedure.**

#### **Function of Engine Oil:**

If a lubricating oil is to work in an engine it must be capable of performing various functions. Lubrication of the moving parts is the primary function. The lubricating oil should be able to form a film between metal surfaces preventing metal to metal contact and reducing friction. When there is a metal to metal contact, friction heat is generated. Welding of the part can occur and metal transfer will result in scuffing or seizing. The film of oil contacting the surfaces will provide cushioning and shock dampening as well.

Cleaning is another function. The oil should perform as a cleaner in the engine by flushing contaminants from critical components. These contaminants should be removed in the filtration system or during the course of an oil change. Oil will provide a protective barrier to prevent corrosion of non-ferrous metals.

Internal components of the engine require cooling. The primary coolant system cannot provide this cooling. Oil will transfer heat by contacting the various components then transferring to the primary cooling system at the oil cooler. The uneven surfaces in the combustion chamber are filled to act as a combustion seal within the cylinder liner and other internal components.

#### **Synthetic Engine Oil:**

In extreme environments, where ambient temperatures can be as low as 45° C (-50°F), a petroleum based oil will not perform satisfactorily in diesel engines. Synthetic oils were developed for these type applications. These synthetic oils are blend from ether and/or hydrocarbon based oils. These base oils are produced by chemically reacting lower molecular weight materials to manufacture lubricants of desired properties. All synthetic based oils must meet the API category III classifications and SAE viscosity grades.



**NOTE: Synthetic oils and petroleum based oils should never be mixed.**

### Viscosity:

Viscosity is simply a measure of resistance of molecule layers moving relative to an adjacent layer. All fluid viscosity is affected by temperature. A multigrade lubricating oil tends to be less sensitive to temperature changes due to formulation. Lubricating oils are generally selected for use with viscosities appropriate for the expected operating temperature. The correct selection of a lubricating oil of correct viscosity is critical for optimum performance. Some effects of incorrect viscosity when the oil is too thick range from difficulty in starting, to increasing fuel consumption and reduced power output. When the oil is too thin, oil consumption is increased as well as wear from the metal to metal contact. This will also increase engine noise.

Low temperature viscosity specifications are identified by a “W” (winter). High temperature viscosity that meets the 100° C (212° F) requirements have no suffix. When a lubricating oil meets both high and low temperature requirements they are classified as multi-viscosity or multigrade.

### Routine Maintenance Recommendations:

1. Check oil level daily.
2. Replace oil filter at every oil drain interval.
3. Cummins Engine Company, Inc. recommends the use of high quality, API (American Petroleum Institute) licensed CH-4 or CES20071, 15W-40, multiviscosity oil or premium oil.
4. The recommended oil drain interval is defined by the API oil performance classification and the engine duty cycle. Refer to the Cummins Operation & Maintenance Manual for complete details.

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### ***Oil Recommendations - Cold Weather***

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**.

**WINTER (32° to -25° F) (0° to -32° C):** Use a 50% antifreeze to 50% water coolant mixture, use multi-viscosity oil meeting Cummins specifications and fuel to have maximum cloud pour points 10° F (6° C) lower than the ambient temperature in which the motorhome operates.

**ARCTIC (-25° to -65° F) (-32° to -52° C):** Use a 60% antifreeze to 40% water coolant mixture. Use oil meeting Cummins specifications and fuel to have maximum cloud pour points 10° F (6° C) lower than the ambient temperature in which the motorhome operates.



**Refer to the Operations & Maintenance Manual for more detailed information.**

General guidelines for shutting the engine down are fairly simplistic. Allow the engine to idle three to five minutes after a full load operation. This allows adequate cool down of pistons, cylinders, bearings and turbocharger components. Under normal driving conditions, exiting the highway is generally lighter engine operation and the need for the three to five minutes is not necessary.

## ENGINE SHUTDOWN

When the motorhome has been sitting for extended periods, 30 days or more, verify all the fluid levels are correct. Follow the normal starting procedures. If the oil pressure gauge does not register within 15 seconds, shut off the engine immediately to avoid damage. Consult the Cummins Operation & Maintenance Manual for guidelines on troubleshooting low oil pressure, or contact a qualified service technician. Allow the engine to idle for three to five minutes before operating under a load.

## ENGINE SHUTDOWN -Extended

A fully formulated antifreeze or coolant containing a precharge of Supplemental Coolant Additives (SCA) is recommended. The use of either will significantly simplify coolant system maintenance. The difference between a fully formatted antifreeze and a fully formatted coolant is the percentage of water. Both contain balance amounts of antifreeze, SCA, buffering compounds and a percentage of good clean quality water. The antifreeze of coolant must meet ethylene glycol or propylene glycol recommendations. A good clean quality water in a 50/50 ratio (40 to 60% working range) mixed with fully formatted antifreeze will provide protection from -34° F to 228° F. The 50/50 mix ratio must be premixed prior to being put in the system. Placing antifreeze and water in the cooling system is not recommended. Consult the Cummins Operation & Maintenance Manual for more details.

## COOLANT



**NOTE:** An over concentration of antifreeze, or the use of high silicate antifreeze, can cause damage to the coolant system and engine. Antifreeze is essential in every climate.



**WARNING:** Do not continue engine operation when engine temperature rises above 220° F. At 220° an engine warning light will illuminate and the engine will begin to de-rate in power output. Continued operation will result in engine damage.

The coolant level and fluid freeze point should be checked with every oil change interval, at 15,000 miles, 500 hours or six months, whichever comes first. Also change the coolant filter at the same interval unless SCA concentration is over three units. The coolant should be drained and flushed at 6,000 hours or two years of service, whichever comes first.

### **Engine Coolant Reservoir:**

A “see-through” plastic reservoir, similar to the familiar windshield washer jar, is connected to the radiator by a hose. As the motorhome is driven, coolant is heated and expands. A portion of fluid displaced by this expansion flows from the radiator into the reservoir tank. When the engine is stopped, the coolant cools and contracts. Displaced coolant is drawn back in the radiator by a vacuum. Thus, the radiator is kept filled with coolant to the desired level at all times resulting in increased cooling efficiency. The coolant level should be at or slightly above the appropriate mark on the reservoir tank when the system is cold.

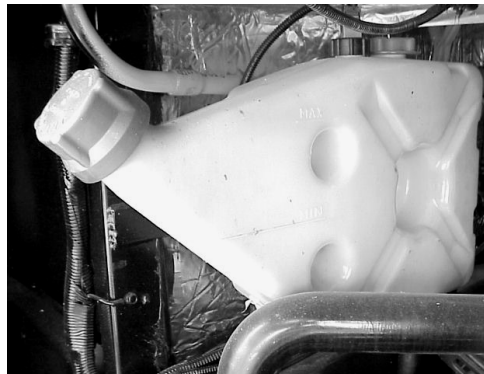


**CAUTION: To avoid scalding hot steam or coolant from being released from the engine cooling system, never remove the reservoir cap while the engine is running or hot. Failure to follow this warning may result in damage to the engine’s cooling system and possibly cause severe personal injury.**

- Check the coolant level daily or when refueling.
- Drain and flush the coolant system every 60,000 miles or two years, and refill with a heavy-duty coolant (50/50 mix of water and anti-freeze).
- If the coolant is below the MIN mark, the low coolant alarm will sound and the low coolant light will appear on the dash.
- The coolant level remains between the MAX and MIN level in the reservoir.



**INSPECT: Stop the motorhome and inspect the coolant level before continued operation.**



*The coolant capacity, when changing the antifreeze, is approximately 11½ gallons.*

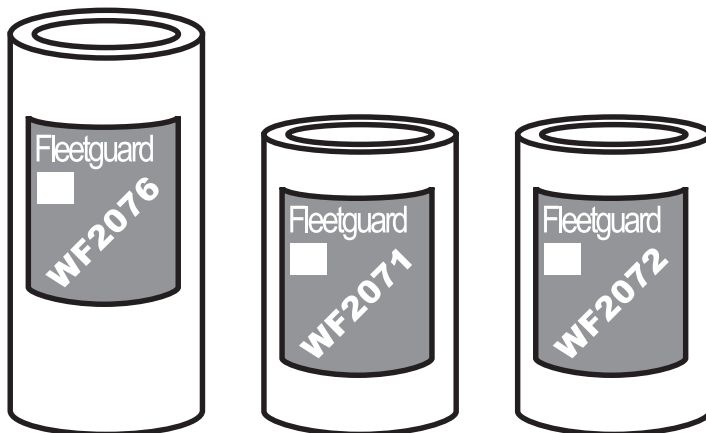
**Routine Maintenance Recommendations:**

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 miles/6 months.

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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.

**Coolant - Additive (SCA)**



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Supplement coolant additives, or equivalent, are used to prevent cylinder liner pitting, corrosion and scale deposits in the cooling system. Use the correct Fleetguard coolant filter to maintain the recommended SCA concentration in the system. Maintain the correct concentration by changing the service filter at each oil drain interval.



**NOTE: The correct filter is determined by the total cooling system capacity and oil drain interval. Refer to the Coolant Capacity Specifications in this section.**

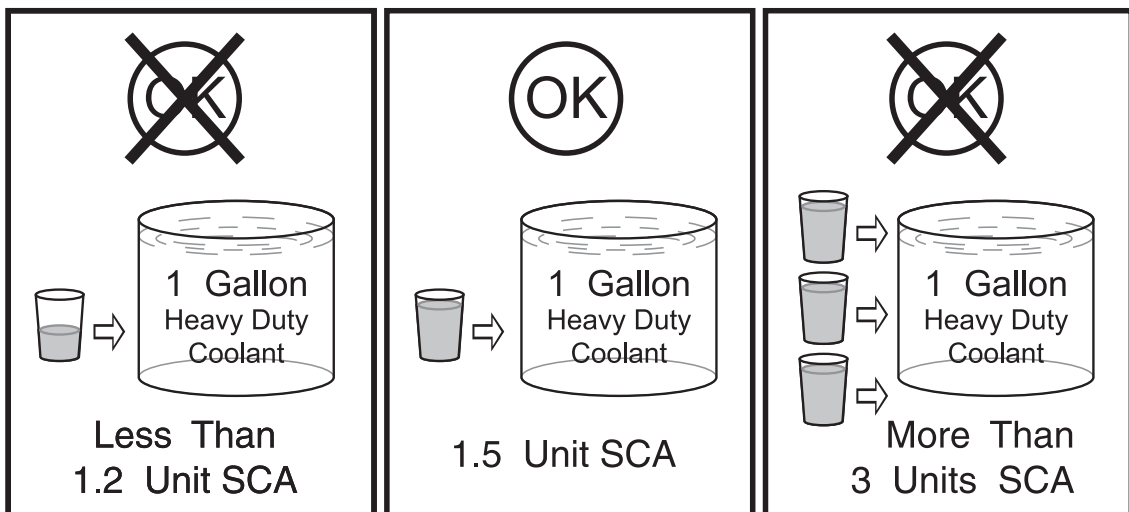


**CAUTION: Insufficient concentration of the coolant additives will result in cylinder liner pitting and engine failure. The SCA concentration must not fall below 1.2 units or exceed 3 units per gallon of cooling system capacity.**

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.**



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## Coolant Hoses

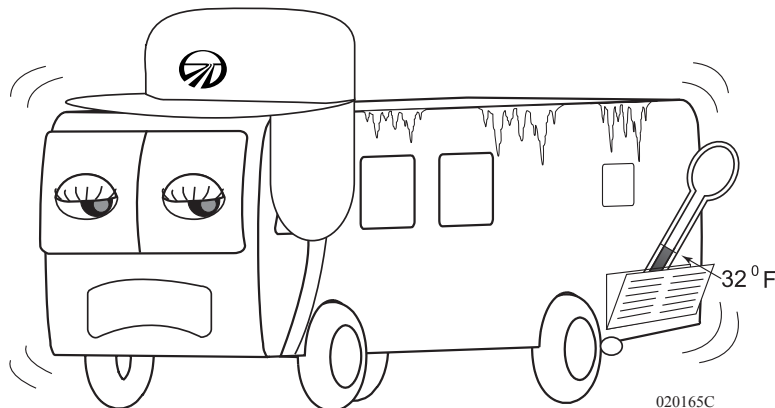
Rotten, swollen and worn hoses, as well as loose connections, are frequent causes of coolant system problems. Overheating can be caused by an collapsed hose or a clog caused by rubber shedding from a rotten hose. Replace any hose found to be cracked, swollen or damaged. Connections should be inspected periodically and hose clamps tightened.

## Coolant System - Thawing

If the coolant system becomes frozen solid, place the motorhome in a warm area until the ice is completely thawed. At this point the motorhome must be towed. If the engine is operated when the cooling system is frozen it will result in engine overheating due to insufficient coolant circulation.

Once thawed, check engine, radiator and related components for damage caused by expansion of frozen coolant.

If the engine is overheated, never pour cold coolant into a hot engine. The sudden change in temperature may crack the cylinder head or block. If the engine is hot, fill slowly to prevent rapid cooling and distortion of engine castings.



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## **BRAKE - AUXILIARY**

Auxiliary braking systems are designed to supplement the standard wheel braking system. These devices are not designed to bring the motorhome to a complete stop; however, they can assist in controlling the speed of the motorhome. Use of the engine braking system can save on costly service brake repairs.

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### **Brake - Engine**

The "Jake" brake is an engine-braking device that operates on a different principle 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 engine brake activates, an electrical signal is sent to the engine's ECM (electronic control module). The ECM controls a hydraulic circuit that 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.

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 a 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 brake. The Jake Brake foot switch (some models) 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 brake. Do not operate the engine brake 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 processes information received from the throttle position sensor, speed sensor, pressure switch and shift selector to activate solenoids on the control module in the transmission. The solenoids control oncoming and off going clutch pressure to provide closed loop shift control. This is accomplished by matching transmission and engine RPM during a shift to establish a desired shift profile within the ECU.

The system is monitored for the first 30 seconds of each engine start. This is referred to as “autodetect.” Autodetect searches for presence of data inputs of transmission components. The autodetect enables the ECU functions and diagnostics to respond to items that are detected.

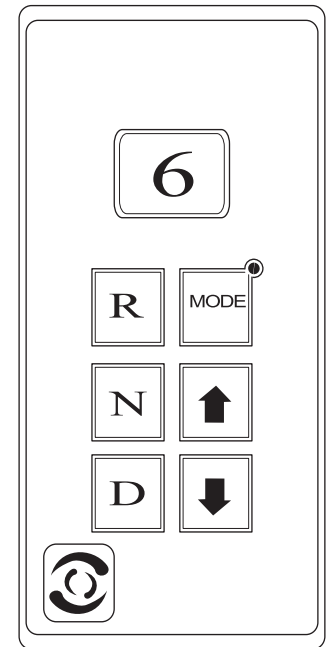
Another feature of the transmission is the ability to “learn” or “adapt.” The electronic control system optimizes shift quality by using “Adaptive Shifting.” A wide variety of varied shift conditions is required before optimizing shift quality. Generally, five typical shifts of a consistent shift type is needed to optimize shift quality.

The range selection is accomplished via the remote pushbutton selector. The controls are **R**, **N**, **D**, arrow **UP**, arrow **DOWN**, **MODE** button and a digital display window. Under normal operation press the “**D**” button and the digital display shows the highest forward range attainable for shift selection in use. The digital display window will also indicate codes for abnormal conditions, and can even be a useful troubleshooting aid. When the ignition is turned ON, the display should be visible. This display indicates the presence of neutral start command. If the display indication is not visible, there is no power to the selector and the transmission will not allow the engine to start. This is an indicator of electrical problems with the engine batteries, ECU on shift selector keypad.

The window displays gear selection, various transmission modes, oil level and transmission fault codes.

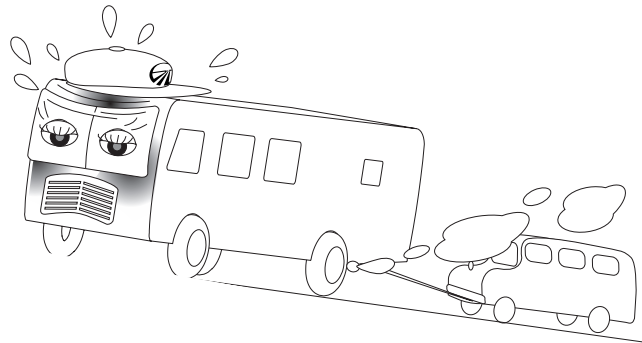
### Keypad Functions:

- Select the **REVERSE** gear by pressing “**R**”.
- Select **NEUTRAL** by pressing “**N**”. The area around the “**N**” button has a raised ridge so the driver can orient his hand to the push buttons by touch, without looking at the display.
- Select **DRIVE** range by pressing “**D**”. The highest forward gear appears in the display and the transmission will shift to first gear though 6 is displayed.



trans shifter w mode light

- The **UPSHIFT** and **DOWNSHIFT** arrow buttons are used to select a higher (if not in “**D**”) or lower (if not in “**1**”) forward range. These buttons are not functional in **NEUTRAL** or **REVERSE**. One press changes the gear range selected by one. If the button is held continuously, the selected range will continue to change up or down until the button is released or until the highest/lowest possible range of gears is selected.
- The **MODE** button enables a secondary shift point to be selected. This is commonly referred to as “Economy.” It is further used by the service technician to access diagnostic codes when troubleshooting. The diagnostic circuitry must be enabled to display.
- When the Auxiliary Braking device (Jacob or Exhaust brake) is used, the display changes to a default reading of 2 or 3. This default is pre-selected at the factory and can only be reprogrammed by an authorized Allison Service Center. The transmission is not in second or third gear. This is only a reference for the transmission downshift points to optimize the engine braking effect.
- Engine temperature may rise when ascending long grades using full throttle. Towing a load will increase the demand on the engine. If this occurs manually shift the transmission down to the next lower gear and use less throttle. The engine will use less fuel and RPM should increase.



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**NOTE: The transmission will not accept a manually selected gear change to occur if the gear selected is out of the specified operating range.**



**NOTE: The transmission will not shift into gear if the engine rpm is at or above 900. The display will flash 6 indicating the engine rpm is excessive. Select N and lower the engine rpm.**

**Transmission -  
Check Light**

The electronic control system of the transmission is programmed to inform the operator of a problem with the transmission system and reacts automatically to protect the operator, motorhome and transmission. When the Electronic Control Unit (ECU) detects a **DO NOT SHIFT** (DNS) condition the ECU restricts shifting, turns on the **CHECK TRANS** light in the instrument panel and registers a fault code.



**NOTE: For some problems, fault codes may be registered without the ECU activating the CHECK TRANS light. An Allison Transmission authorized service outlet should be consulted whenever there is a transmission related concern. They have the equipment to check diagnostic codes and correct problems which may arise.**

Each time the engine is started the **CHECK TRANS** icon will light, then turn off after a few seconds. This momentary lighting is to indicate that the status light circuit is working properly. If the **CHECK TRANS** light does not illuminate during start up, or if the light remains on after start up, the transmission system should be checked immediately.

Continued illumination of the **CHECK TRANS** light during vehicle operation (other than start up) indicates that the ECU has signaled a diagnostic code. Illumination of the **CHECK TRANS** light is accompanied by a flashing display from the shift selector. The shift selector display will show actual range attained and the transmission will not respond to shift selector requests.

Indications from the shift selector are provided to inform the operator that the transmission is not performing as designed and is operating at reduced capabilities. Before turning the ignition off, the transmission may be operated for a short time in the selected range in order to “limp home” for service assistance. Service should be performed immediately in order to minimize potential damage to the transmission.

When the Check Trans icon illuminates the keypad will not respond to command and the transmission generally will downshift to 4th gear. The torque converter will not “lock-up” and engine speed is automatically reduced. Direction changes (i.e. forward to reverse) will not be allowed. Locate a safe secure place to park the motorhome. If the engine is shut off then restarted after a Check Trans indication, the transmission remains in Neutral until the fault causing the Check Trans light has been corrected.

### **Diagnostic Codes:**

The diagnostic codes are numerical representations of malfunctions in the transmission operations. Each code is a two digit main code and a two digit sub code. The codes, when detected, are logged in the ECU memory. These codes will fall in two classes: active and inactive. Active codes are codes currently effecting the ECU process. Inactive codes are retained but may not effect the ECU process. The diagnostic mode must be entered. A maximum of five codes, **D1** to **D5**, may be listed at one time. The highest priority code will be listed in **D1**. The **MODE** button will enable selection of sequential codes.

### **To Enable Diagnostic Code Selection Display:**

- Stop the motorhome at a safe location.
- Apply the parking brake.
- Simultaneously press the **UP** and **DOWN** arrows twice to enter the stored codes. The first time the arrows are pressed will indicate the oil level display. Press the **Up** and **Down** arrows again.
- The codes will display one digit at a time.
- The mode button is pressed to scroll through the codes.
- Any code obtained should be noted and reported to an Allison Service Center for evaluation and possible repair.
- Inactive codes can be cleared by holding the **MODE** button for approximately three seconds. Some codes are self clearing while others will require service or ignition on/off cycles to clear.

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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 an Allison Transmission distributor or dealer is notified when one of these conditions occur:

1. The shifting feels odd.
2. The transmission leaks fluid.
3. There are unusual transmission-related sounds (changes in sound caused by normal engine thermostatic fan cycling, while climbing a long grade with a heavy load, have been mistaken for transmission-related sounds).
4. The **CHECK TRANS** light comes on frequently.

**The Importance of Proper Fluid Levels:**

The transmission fluid cools, lubricates and transmits hydraulic power. Proper fluid levels must be maintained at all times. If the fluid level is too low, the converter and clutches do not receive an adequate supply of fluid. If the fluid level is too high, the fluid can aerate. Aerated fluid can cause the transmission to shift erratically or overheat.

The MH Series oil level sensor (OLS) allows the operator to obtain an indication of sensor fluid level from the keypad shift selector. Frequently check for the presence of oil level diagnostics in the transmission. If the OLS has not been detected, troubleshooting of the OLS circuit is required. This will have to be performed by an Allison Service Center. After the OLS circuit is repaired, ensure that reset of the “autodetect” or manual selection of the OLS function by using a Pro-Link transmission diagnostic center.

**Fluid Level Check with the Keypad:**

- Park the motorhome on a level surface, place the transmission in “N” and set parking brake.
- The transmission should be at normal operating temperature.
- The motorhome should be stationary for approximately two minutes to ensure fluid is stabilized.
- Simultaneously press the arrow **Up** and arrow **Down** buttons one time.
- The fluid level will display in the digital display window. The display will indicate one character at a time. The “o,L” represents oil level check mode. This will be followed with fluid level indication readings. The “o,K” indicates a correct fluid level. Reading between the OLS and the dipstick may not agree because the OLS compensates for fluid temperatures. Abnormal indications of the OLS will be “Lo” representing a low fluid level, “HI” for a high fluid level or “oL” for invalid information and system problems. All indications will be followed by numeric values. The “Lo” and “HI” followed by the numeric value represents the quarts of fluid required for the system. The invalid code numbers represent specific symptoms.

**Common Oil Level Fault Codes:**

- 0,5 settling time too short.
- 5,0 speed RPM too low.
- 5,9 speed RPM too high.
- 7,0 sump temperature too low.
- 7,9 sump temperature too high.
- 9,5 OLS FAILURE.



**NOTE:** Exit the fluid level display by pressing any range button on the keypad.



**NOTE:** To correctly check the transmission fluid level using the dipstick, the transmission fluid must be at operating temperature. The oil level sensor method of checking the fluid level compensates for transmission fluid temperature between 60° C - 104° C (140° F - 220° F). Any temperature below 60° C (140° F), or above 104° C (220° F), will result in an Invalid for display condition.

## TRANSMISSION LUBRICATING FLUID

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 transmissions internal filters after the first 8,000 km (5,000 miles of operation). The dipstick/oil fill is located between the engine and transmission underneath the engine access door in the bedroom. Change the transmission fluid and internal filters every 40,000 km (25,000 miles) or 18 months thereafter, 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 operation as indicated by discoloration, strong odor or fluid analysis. Local conditions, severity of operation or duty cycle will dictate more or less frequent service intervals.

### **Transmission Fluid Levels - Cold Check**



Transmission Oil Level Dipstick.

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### **Cold Check - Manual Check Procedures:**

The concept of a cold check is to determine adequate fluid level for safe operating until hot check can be performed.

#### **To Check the Fluid When Cold:**

- Park the motorhome on a level surface. Set the parking brake.
- With the engine operated at a low idle. Put the transmission in **N** (Neutral).
- Chock the wheels to prevent the motorhome from moving.
- Allow the engine to run at idle (500-800 rpm) for one minute.
- Apply the service brakes and shift to **D** (Drive), then to **N** (Neutral) and next to **R** (Reverse) to fill the system. Finally shift to **N** (Neutral) and release the service brakes. Allow the engine to continue to run at idle (500-800 RPM).
- Remove the dipstick and wipe clean. Reinsert the dipstick fully into the tube and remove to check fluid level. Repeat this to verify the reading if needed.

- Safe operating level is anywhere within the **COLD CHECK** band on the dipstick. The fluid level is sufficient enough to operate until a **HOT CHECK** can be performed.
- If the level is not within this band, add or drain the fluid as necessary to put the level to the middle of the **COLD CHECK** band.
- Perform the **HOT CHECK** at the first opportunity after reaching normal operating temperatures (160° - 200° F/71° - 93° C).



**CAUTION: Low or high fluid level can cause overheating and irregular shift patterns. These conditions can damage the transmission if not corrected.**

- The fluid level rises as the temperature increases. The fluid must be hot to ensure an accurate check.
- Be sure the fluid has reached normal operating temperature (160° - 200° F/71° - 93° C). If a transmission temperature gauge is not present, check the fluid level when the engine water temperature gauge has stabilized and the transmission has been operated under the load for at least one hour.
- Park the motorhome on a level surface and shift to **N** (Neutral). Apply the parking brake and allow the engine to idle (500-800 rpm).
- After wiping the dipstick clean, check the fluid level. Safe operating level is anywhere within the **HOT RUN** band on the dipstick.
- The width of the **HOT RUN** band is approximately one quart of fluid at normal temperature range.
- If the level is not within this band, add or drain the fluid as necessary to put the level within the **HOT RUN** band.
- Be sure that the fluid level checks are consistent. Check the level more than once. If the readings are not consistent check to be sure that the transmission breather is clean and not clogged. If the readings are still not consistent, contact the nearest Allison distributor or dealer.

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### ***Transmission Fluid Level - Hot Check***

## FUEL REQUIREMENTS

Low sulphur #2 diesel fuel or #1 and #2 commercial winter blend diesel fuels are the most common commercially available and recommended for use. The Cummins Engine Company Inc. recommends the use ASTM #2D fuel. The use of #2 diesel fuel will result in optimum engine performance.

**WARNING: Do not mix gasohol with diesel fuel. This mixture can cause an explosion.**



**NOTE: Due to the precise tolerances of diesel injection systems, it is extremely important that fuel be kept clean and free of dirt or water. Dirt or water in the system can cause severe damage to both the fuel pump and the fuel injector. Fuel additives for lubricity are not recommended. There are numerous diesel fuel additives to help remove moisture from fuel, prevent microbe growth and to prevent freeze-up during cold weather. Any fuel additives product should show supporting data for performance and benefits. Engine failures caused by incorrect fuel are not covered under warranty.**

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## FUEL TANK

The diesel fuel tank is made of 160 thousands aluminum. The engine pickup tube is cut at a 45° angle to allow optimum flow to the engine.



**NOTE: If the motorhome has been stored for any length of time you should check the vent for blockage. It is not uncommon for insects to plug the vent tube. If the tank appears to be pressurized the vent tube may be blocked. To inspect the vent tube check on the roadside of the fuel tank, near the bottom. Always store the motorhome with a full fuel tank.**

### **Routine Maintenance Recommendations:**

1. Change the fuel filter at every oil change interval.
2. Change the fuel-water separator filter every 12-18 months or every 25,000 miles.



**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 pump operation for 50-60 seconds. Cycle the pump when fuel is observed from the Schrader valve. Release the valve (so the fuel no longer leaks from it).
- The internal pump will continue to run, pressurizing the fuel system forcing fuel through the fuel lines.
- It may require cycling 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.**

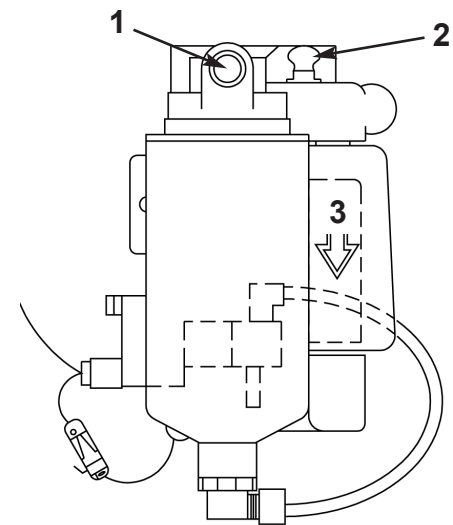
- If the water in fuel light is illuminated on the dash, follow the same procedure using the H<sub>2</sub>O button on the control panel. It may be necessary to change the fuel filter.



**NOTE: The H<sub>2</sub>O purge will operate only when water is detected.**

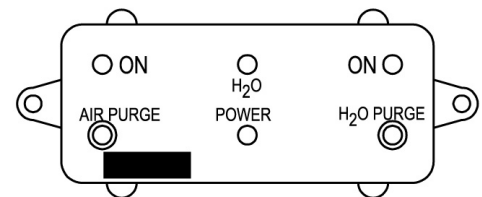


**NOTE: Always carry an extra Racor element as one tank full of excessively contaminated diesel fuel can plug a filter.**

**FUEL/WATER SEPARATOR (ISM ENGINE)**

1. Schraeder valve.  
2. Thumb Screw.  
3. Reusable filter.

090261



090261

**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). 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 to firmly 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.

## FUEL SENDING UNIT

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.

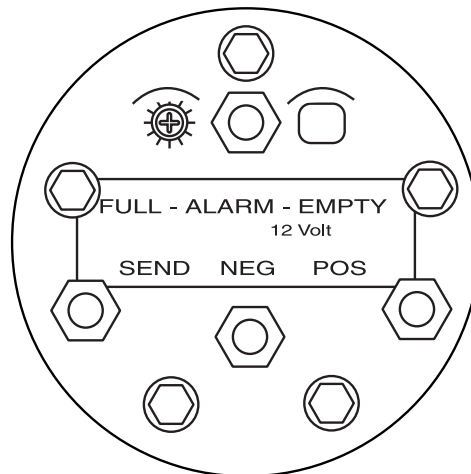
**Connections: The “Centroid” sender has four connections:**

- **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 the fuel gauge is reading about 1/8 tank). This turns on the alarm light on the dash. It is not adjustable.

**Adjustments: The “Centroid” sender has two adjustments:**

- **Empty:** Adjusts for length of sender. It has been set at the factory and covered with a sealant. It should not be changed.
- **Full Adjustment:** The full adjustment can be used to correct for slight differences between fuel meters. During installation, it has been calibrated for your meter and should not need readjustment.

The correct adjustment technique, with a full tank of fuel, is to start with the full adjustment screw completely clockwise. This should cause the reading to be above full. Adjust slowly, rotate counterclockwise, until the full mark on the gauge is reached. The intent is to always adjust downscale rather than upscale.



Fuel Sending Unit.

090318

**Troubleshooting:**

- A. Electronic output:** The sender has a transistorized output. This prevents an ohmmeter from getting a correct reading of its output resistance.
  
- B. Fuel Only:** The sender will not work correctly in conducting fluids such as water (it will read above full all the time in water). One possibility is that when there is a constant above-full reading there may be water in the bottom of the fuel tank.
  
- C. Contact Centroid:** Probably 90% of the return Centroid tests work okay on the bench. If you have incorrect readings contact Centroid (telephone: 800-423-3574 or, preferably, fax: 904-423-3709) with the symptoms. A short, “fill in the blanks” troubleshooting test is provided, to test the sender. It is easier to find the problem that way than after the sender has been removed from the system, since the problem is not necessarily with the sender.

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Make a visual check for fuel leaks at all engine-mounted fuel lines and connections and at the fuel tank pick-up and return lines. Leaks in this area may best be detected by checking for accumulation of fuel under the tank. Engine performance and auxiliary equipment is dependent upon the ability of flexible hoses to transfer lubricating oil, air, coolant and fuel oil. Diligent maintenance of hoses is an important step in ensuring efficient, economical and safe operation of engine and related equipment.

**Fuel Lines & Hoses**

Check hoses daily as part of the pre-start-up **inspection**. Examine hoses for leaks. Check all fittings, clamps and ties carefully. Make sure that the hoses are not touching shafts, couplings and heated surfaces, including exhaust manifolds, sharp edges or other obvious hazardous areas. Since all machinery vibrates and moves to a certain extent, clamps and ties can fatigue with age. To ensure continued proper support, inspect fasteners frequently and tighten or replace them as necessary.



Engine oil levels above the dipstick full mark, or a decrease in lube oil consumption, may indicate internal fuel leaks into the crankcase. Check oil level frequently for fuel contamination.

## 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 pressure increases.

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 pressure increases due to the viscosity 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 thermovalve. Cooling fan speed is proportional to engine speed and radiator temperature. When radiator temperature rises above 185° Fahrenheit, the wax thermovalve 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. The spool valve 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 thermovalve 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 thermovalve is mounted at the top of the radiator sensing coolant temperature. The thermovalve 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 thermovalve and return to the hydraulic reservoir. As the coolant temperature inside the radiator rises to approximately 185° Fahrenheit, the wax inside the thermovalve begins to melt and expand. This begins to restrict hydraulic fluid flow through the thermovalve. 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 thermovalve is stopped, moving the spool valve to full open position.

## **Thermovalve**

## 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 thermo 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 thermo 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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## 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 Filter



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.

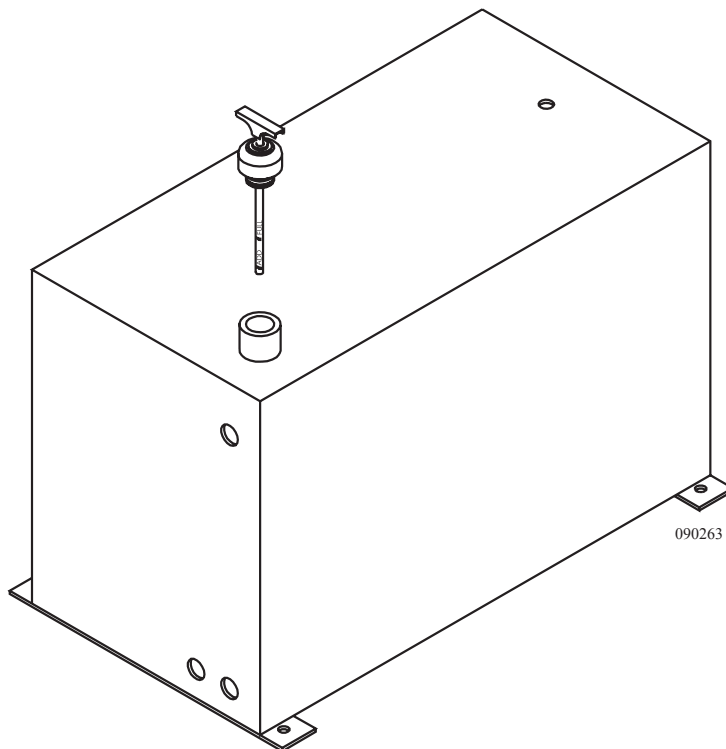
The filter is rated at ten micron\*. Change the filter before the built in sight gauge is operating in the red zone. This will ensure the hydraulic fluid is properly filtered.

Filter number: Parker IN HC 5720 (ten micron)

\*One micron is one millionth of one meter.

## Hydraulic 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.

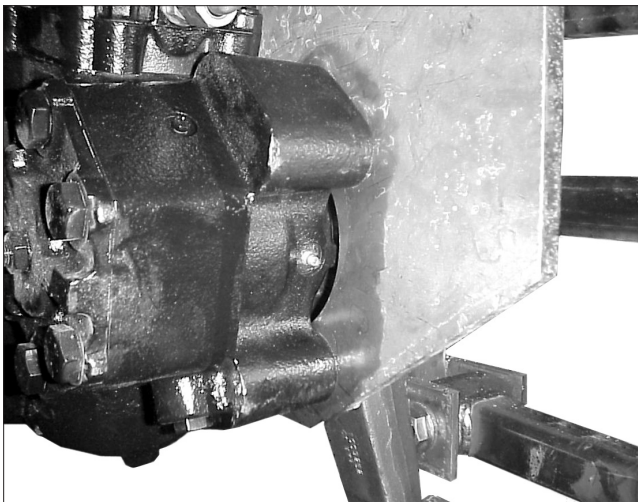


*Hydraulic Fluid Reservoir.*

## STEERING GEAR

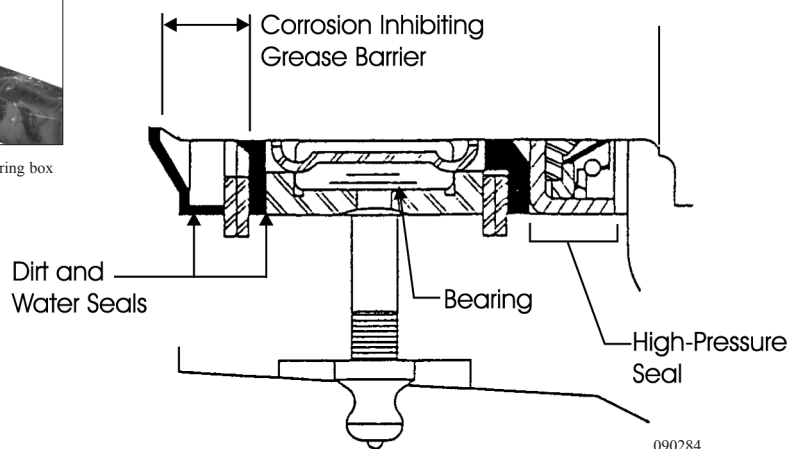
Maintain the grease pack behind the output shaft's dirt and water seal as a general maintenance procedure at least twice a year. The grease fitting is provided in the housing trunnion. Use NLGI grade 2 or 3 multipurpose chassis lube and use only a hand operated grease gun on the fitting. Add grease until it begins to extrude past the sector shaft dirt and water seal.

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. The worm drive threads in the center of the spool. When in the center position, pressurized hydraulic fluid bypasses the spool. When a turn is made, the poppet valve shifts to one direction or the other, directing the hydraulic pressure to one side of the spool depending on turning direction. The hydraulic fluid is then cooled before returning to the reservoir. Inspect for signs of leakage when performing fluid level checks. Changing the hydraulic filter at regular intervals will help ensure trouble free operation.



Signature Steering Gear.

sig steering box



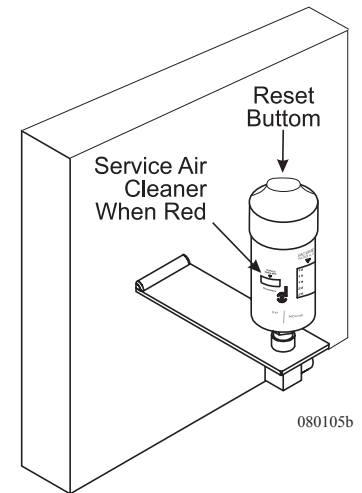


The air filter minder is a precision overflow restriction gauge designed to take the guesswork out of air cleaner replacement.

The air filter minder is located in the engine rear compartment. Its operation is simple and virtually foolproof. As dirt captured by filter cartridge slowly builds up, vacuum between the filter and engine increases as indicated by the filter minder on an easy to read scale. The indicator locks at the point of maximum restriction so readings can be taken with or without the engine running.

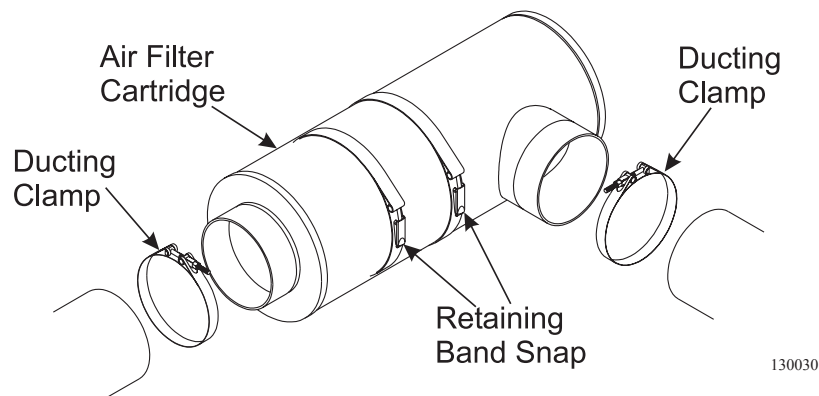
When the desired change-out point is reached, the air filter should be replaced and the service indicator is easily reset by pushing the button on the top of the minder.

## AIR FILTER MINDER



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.

## AIR FILTER-CHANGING



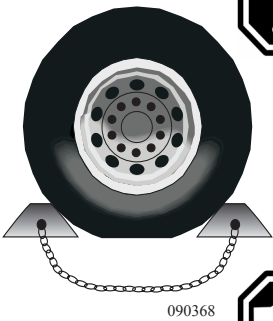
## LUBRICATING THE CALIPERS

Depending on the type of caliper and actuating components, certain disc brake systems require lubrication to ensure proper brake operation. The calipers and slack adjusters need lubricating 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. Park the motorhome on a flat level surface during the lubrication process. The drive axle spring brakes will need to be charged by releasing the emergency brake. 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, refer to Section 2. To ensure personal 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 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 special high temperature grease. Refer to the grease chart (at the end of this article) for lubricant specifications.



**WARNING:** Wheel removal may be necessary to gain access to lubrication points of the calipers and slack adjusters. Proper jacking methods and frame stabilization is essential to prevent frame damage and maintain personal safety. If access to lubrication fittings is limited because of wheel to caliper clearance, it is recommended to have the maintenance performed by trained personnel with the proper equipment.



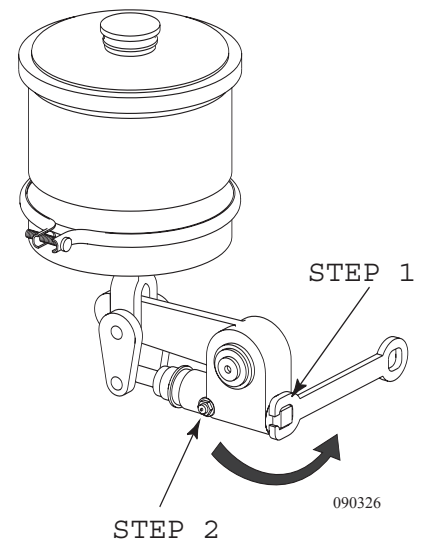
**WARNING:** Use wheel chocks prior to the lubrication procedure. Use at least four wheel chocks located at two separate wheel positions. Place each wheel chock snug against the forward side and the backside of each tire with the wheel chocks facing opposite directions. The wheel chocks remain in place 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 that meets or exceeds the required specifications.

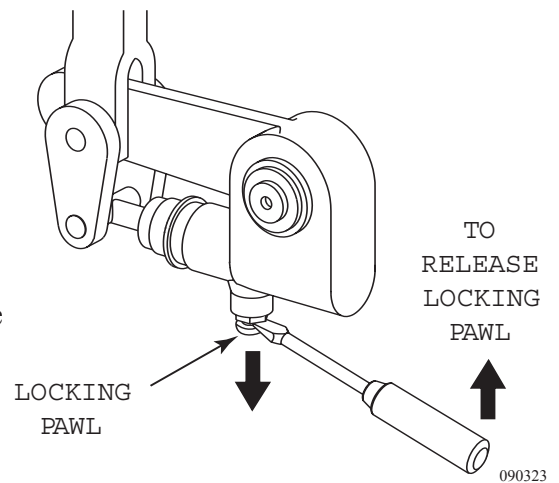
First lubricate the caliper camshaft. Next, lubricate the slack adjuster. To ensure the grease thoroughly lubricates the camshaft, the slack adjuster will need to be manually adjusted full distance in each direction. Manually adjusting the slack adjuster will move the camshaft through the entire range of motion and ensure proper lubrication.

1. Begin the lubrication procedure by installing the wheel chocks. Release the spring brakes.
2. Rotate the adjusting nut (Step 1) on the slack adjuster counterclockwise, to move the inboard brake pad against the rotor.
3. The poppet (Step 2) on the caliper pressure relief valve will be held closed by spring pressure to prevent the grease from escaping during the lubrication process. With a light touch hold the poppet valve closed. Apply the high temperature grease through the grease fitting closest to the rotor first. Stop greasing when the lubricant begins extruding out of the camshaft dust cover located between the caliper and slack adjuster.
4. Remove the pressure relief valve from the caliper.



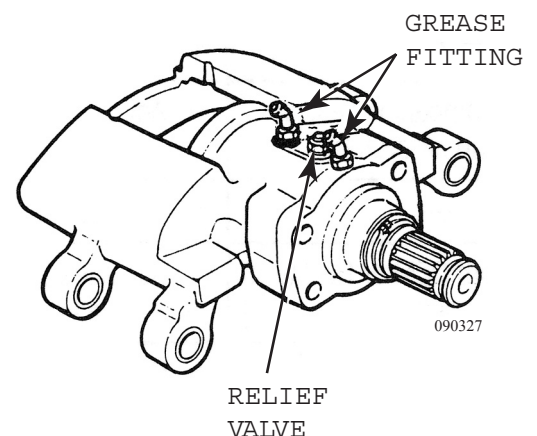
**CAUTION: Failure to remove the pressure relief valve will leave excess grease in the caliper. This will cause the brakes to drag due to the excess grease pressing on the caliper camshaft. Reduced brake pad life will result.**

5. Use a flat blade screwdriver on the slack adjuster to 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 retracts, excess camshaft lubricant forces 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 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 contaminated brake surfaces.**

Proper clearance between the rotors and brake pads is necessary for correct brake operation. Brake pad clearance that is insufficient will result in overheated brake linings. Brake pad clearance that is excessive results in insufficient braking force and improper parking brake operation. A static brake adjustment will approximate the proper brake pad to rotor clearance. The spring brakes remain released throughout the static brake



adjustment. After completing the static brake adjustment 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. Chock the wheels for safety. 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. With 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.

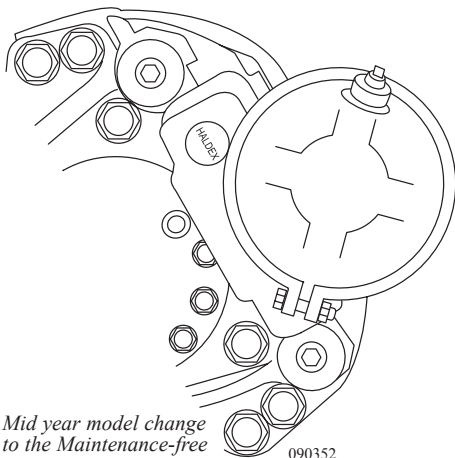
**Verifying the Brake Adjustment:**

The proper clearance of the brake pads should be verified. The brake chamber rod extends when making a brake application. 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. With 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 an assistant make a brake application. With a tape measure, record the distance between the flat surface of that same brake chamber and the clevis pin on the slack adjuster.
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 1 from the distance measured in line 3. Record the measurement. Stamped on each brake chamber is the 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 rod extension length. If the distance does not meet or exceeds the specification, adjust the slack adjuster to obtain the correct extension length.



Mid year model change to the Maintenance-free Disc Brake (new style).

<b>AIR DISC BRAKE GREASE SPECIFICATIONS</b>				
Component	Meritor Specification	NLGI Grade	Lubricant Specification	Outside Temperature
Caliper	0-616-A	1	<p><b>Clay Base</b></p> <ul style="list-style-type: none"> <li>• Special Brake Grease, Meritor 0-616-A, part # A-1779-W-283 or equivalent.</li> <li>• Rockwell, Monaco part #18547.</li> <li>• Texaco Thermatex Ep #1 or equivalent.</li> <li>• Texacy Hytherm EP #1 or equivalent.</li> <li>• Shell Darina #1 or equivalent.</li> <li>• Aral Aralub 3837 or equivalent.</li> </ul>	Operating temperature at or above -40°F (-40°C)
	0-645	2	<p><b>Synthetic Oil Clay Base</b></p> <ul style="list-style-type: none"> <li>• Special Low Temperature Brake Grease, Meritor Specification 0-645 part #2297-X-4574 or equivalent.</li> <li>• Mobilgrease 28 or equivalent.</li> <li>• Mobilgrease 32 or equivalent.</li> </ul>	Operating temperature below -40°F (-40°C)
Slide Pin Retainers	0-637* 0-641	1-1.5	Calcium Base Anti-Seize	Refer to the grease manufacturer's specs. for the temperature 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

## DRIVE AXLE LUBRICANT

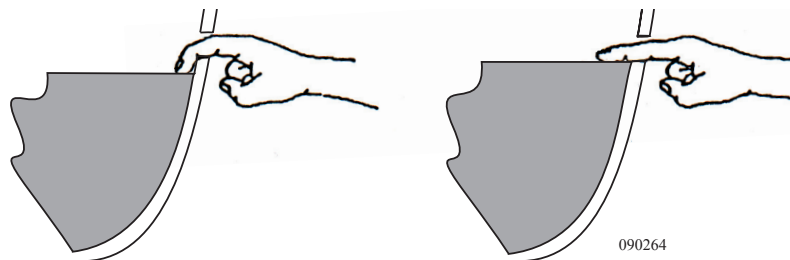


### Proper Drive Axle Lubricant Level:

- Regular **inspection** of the drive axle lube levels is an essential maintenance procedure.
- The lubricant should be level with bottom of the hole.
- Important: The lube level close enough to the hole to be seen or touched is not sufficient. The lube must be level with the hole.
- The differential is filled with API GL-5 or MT-1 type gear lubricant, Pennzoil Gear Plus Super-EW 75w-90.



**NOTE: When checking the lube level also check the housing breathers. Clean the breathers if dirty or replace them if damaged.**



*Incorrect Oil Level.*

*Correct Oil Level*

## DRIVELINE

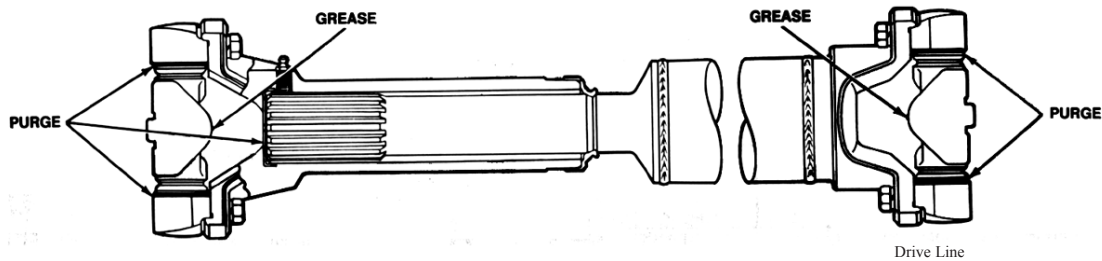
The drive shaft transfers the power produced by the engine to the drive axle. A worn or out of balance driveline causes chassis vibration that generally increases in intensity with road speed.

### Greasing the Drive Shaft Universal Joints:

1. Check the drive shaft for looseness. If loose or worn, repair the drive shaft as necessary.
2. Apply the specified grease at the grease fitting on the universal joint. Apply new grease until new grease purges from all the seals.
3. If new grease does not purge at the seals, loosen the bearing cap bolts and re-grease until all four caps purge. If new grease still does not purge, disassemble and clean or replace the universal joint.

### Greasing the Drive Shaft Slip Yoke and Splines:

1. Check the drive shaft for looseness. If loose or worn, repair the drive shaft as necessary.
2. With finger, cover the rear air hole so grease flows to the front seal. Apply the specified grease at the grease fitting on the slip yoke. Apply grease until new grease purges and forces finger away from the air hole in the end of the slip yoke. Greasing interval is 10,000 miles or annually.



**WARNING: Rotating shafts can be dangerous. Rotating shafts can snag clothes, skin, hair, hands, etc. causing serious injury or death. Do not work on or near a shaft "with or without a guard" when the engine is running.**

Correct U-joint working angles, U-joint phasing, and driveline balance is vital to maintaining a quiet-running drivetrain and long life of drivetrain components (including driveline components).

When in phase, the slip yoke lugs (ears) and tube yoke lugs (ears) are in line. Normally this is the ideal condition and gives the smoothest running shaft. There may be an alignment arrow stamped on the slip yoke and on the tube shaft to assure proper phasing when assembling these components. If there are no alignment marks, they should be added before disassembly of the shaft to assure proper reassembly.

Phasing is relatively simple on a two-joint set, be sure that the slip yoke lugs and the tube yoke lugs are in line.

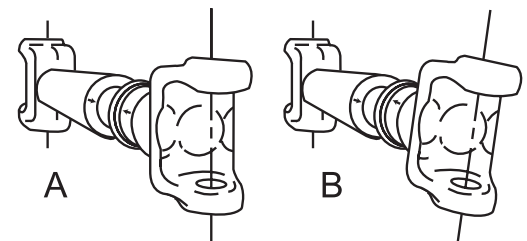
The U-Joint working angle is the angle formed by the intersection of the driveshaft centerline and the extended centerline of the shaft of any component to which the U-joint connects. Because the double oscillating motion of a U-joint that connects angled shafts causes a fluctuating speed difference between the shafts, the effect created by the U-joint at one end of the shaft must cancel the effect created by the U-joint at the other end. This is done by making U-joint working angles at both ends of the driveshaft approximately equal, with the U-joints in phase. If the yoke lugs at both ends of the shaft are lying in the same plane (a plane which bisects the shaft lengthwise), the U-joints will be in phase.

Any condition which allows excessive movement of a driveshaft will cause driveline imbalance: loose end yoke nuts, loose U-joint bearing cap retaining capscrews, worn U-joint trunnions, bearings and worn slip-joint splines.

Among the most common causes of U-joint and slip joint damage is lack of lubrication.

To keep the motorhome operating smoothly and economically, the driveline must be carefully checked and lubricated at regular intervals.

### ***U-Joint Angles, Phasing and Driveline Balance***

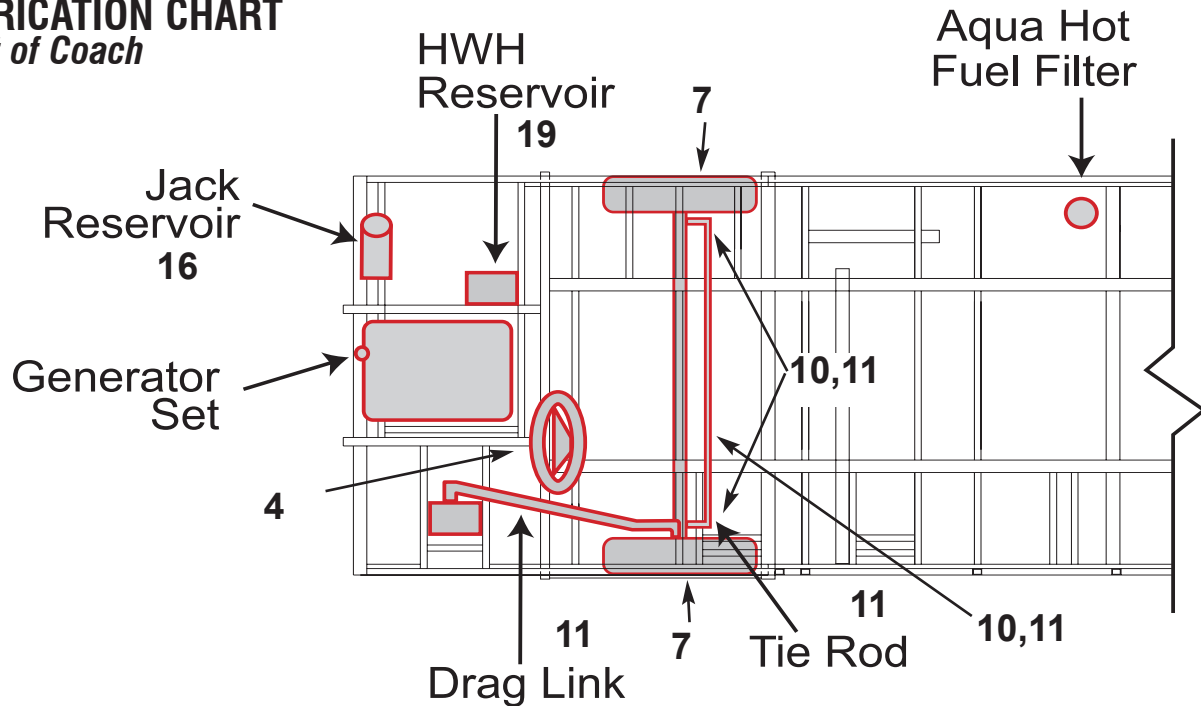


A. In Phase

B. Out of Phase

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**LUBRICATION CHART**  
*Front of Coach*

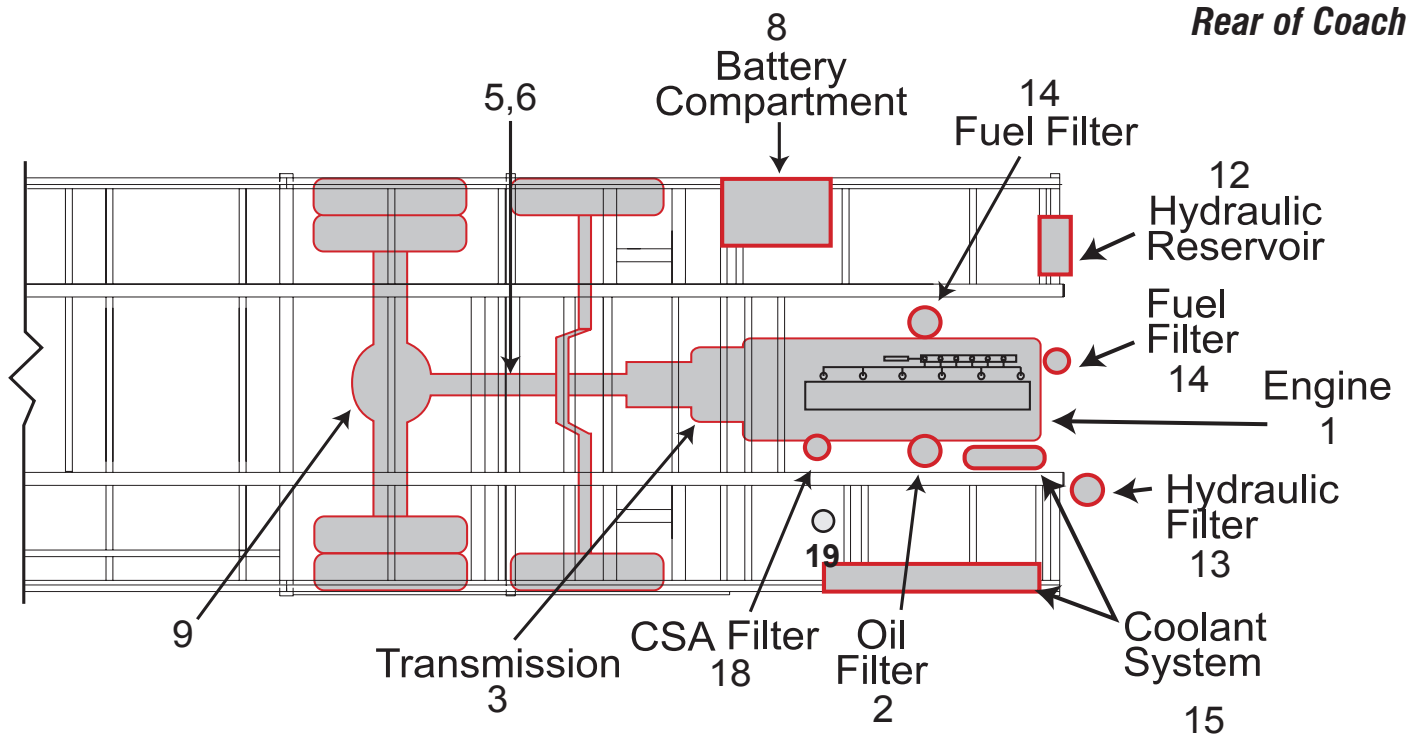


**Lubrication Chart:**

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 bi-monthly.

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 (Inside Coach)	3 Fittings	Every 2 Years	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. Battery Terminals	Apply Coating	10,000 or Annually	P
9. Rear Axle Differential	To Filler Plug	250,000 or Every 3 Years	MP
10. King Pins & Knuckles	2 Fittings Each End	30,000 or Annually	CL
11. Drag Link/Tie Rod	4 Fittings	30,000 or Annually	CL
12. Hydraulic Fluid Reservoir	Keep To Full	Check Daily	TF
13. Hydraulic Fluid Filter (if applicable)	Replace	15,000 or Annually	TF
14. Fuel Filter	Replace	At oil change	FF
15. Engine Coolant Capacity	Replace	Every 2 Years	AF
16. Hydraulic Leveler Reservoir	Replace	Every 36 Months	TF
17. Generator Set	Refer to Service Manual	Refer to Onan	EO
18. Hydraulic CSA Water Coolant Filter	Refer to Service Manual	Refer to Cummins	
19. Air Dryer Filter	Replace	Every 2-3 Years	



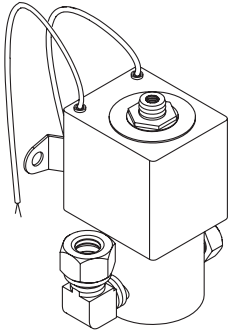
**Rear of Coach****Lubrication Chart Code:**

- CL-4** U-Joints located inside the coach under the steering column cover
- EO** Engine oil as recommended by engine manufacturer
- OP** Refer to operator's 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 Owner's manual for antifreeze type
- TF** Transmission fluid. Use Dexron III transmission fluid only
- FF** Fuel Filter



**NOTE:** It is important to remember the generator lubrication interval is based on hours of usage. Consult the O & E manual for the generator service interval.

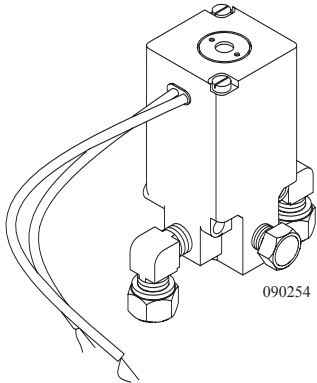
## PARTS - COMMON SOLENOIDS & SENDERS



090255

### Rear Bag Dump Solenoid:

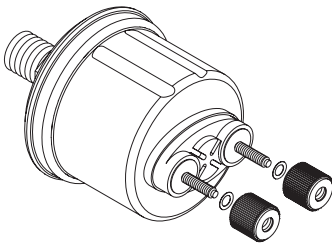
- Used on hydraulic level and air level systems.
- Dumps air in air bags on hydraulic level units and is used to dump air from tag axle on air level units.
- Located in the engine compartment on the roadside, attached to frame below alternator.
- Type- Allen Air 36BXA-HB



090254

### Front Bag Dump or Tag Axle Solenoids:

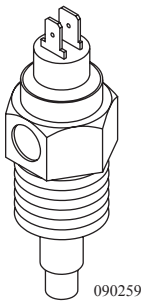
- Used on hydraulic level and tag axle units.
- Dumps air in front air bags and is used to raise or lower tag axle.
- Located in the generator compartment on the curbside.
- Type- MAC 225B-601BAAA



090258

### 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



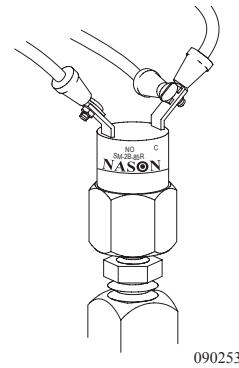
090259

### 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

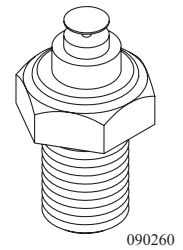
**Low Air Switch:**

- 1/8-27 NPT thread.
- Normally closed until approximately 65 psi.
- Located behind dash panel.
- Type- Masson sm-2B-85R, MP# 16616389



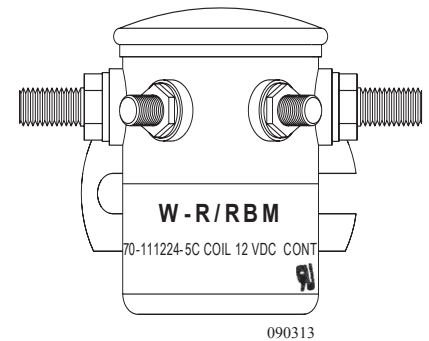
**Transmission Sending Unit:**

- Located on the bottom of the tailshaft housing, between hoses.
- Type- VDO 323 0868



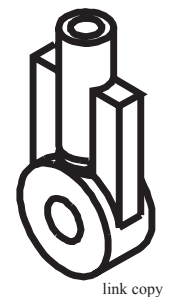
**House Disconnect and Starter Solenoid:**

- Solenoid interfaces start signal to Cummins starter.
- Solenoid interrupts DC power to the house fuse panel.
- Four post solenoid with isolated coil.
- Located in high and low current plates.
- MP # 8206



**Link Assembly:**

- Located on ends of connecting rod between axles and ride height valve.
- Secures connecting rod with hose clamp.
- Type Hadley Products HPB450-3.
- MP# 2057.



## CHART - FILTERS & BELTS

FILTER & BELT	MANUFACTURER	ISM 400
Coolant Filter	Fleetguard	WF2071
Oil Filter	Fleetguard	LF 9001
Fuel Filter Primary	Parker	200200 (25 micron)
Fuel Filter (Secondary)	Fleetguard	FS 1000
Aqua-Hot Fuel Filter	Raycor	R2TRA000T (10 micron)
Hydraulic Filter	Parker	IN HC 5720 (10 micron)
Alternator Belt	Cummins	3028521
A/C Belt	Dayco	3401283
Air Filter	Donaldson	P53744802 (MP 2329)
Air Dryer Filter	Meritor Wabco	R950011
Transmission Filter	Allison	29526889
A/C Filter Drier	--	MP 05400001

MP= Manufacturer 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.

## CHART - SPECIFICATIONS

MODELS	40' Victorian	40' Centurion	40' Baroness	40' Flat Floor Dbl. S/O	42' Chancellor	42' Supreme	42' Tr Crown	43' Flat Floor Dbl. S/O	43' Titan	45' Empress	45' General	45' T
Wheelbase	255	255	255	255	261	271	271	273	273	307	297	297
Overall Length	40' 10"	40' 10"	40' 10"	40' 10"	42' 4"	42' 4"	42' 4"	43' 4"	43' 4"	45' 4"	45' 4"	45' 4"
Overall Ht. w/A/C	11' 10"	11' 10"	11' 10"	11' 10"	11' 10"	11' 10"	11' 10"	11' 10"	11' 10"	11' 10"	11' 10"	11' 10"
Interior Height	79"	79"	79"	79"	79"	79"	79"	79"	79"	79"	79"	79"
Interior Width	96"	96"	96"	96"	96"	96"	96"	96"	96"	96"	96"	96"
Exterior Width	100.5"	100.5"	100.5"	100.5"	100.5"	100.5"	100.5"	100.5"	100.5"	100.5"	100.5"	100.5"
GVWR	47,000	47,000	47,000	47,000	47,000	47,000	47,000	47,000	47,000	47,000	47,000	47,000
GCVW	57,600	57,600	57,600	57,600	57,600	57,600	57,600	57,600	57,600	57,600	57,600	57,600
Front GAWR	14,600	14,600	14,600	14,600	14,600	14,600	14,600	14,600	14,600	14,600	14,600	14,600
Rear GAWR	23,000	23,000	23,000	23,000	23,000	23,000	23,000	23,000	23,000	23,000	23,000	23,000
Tag Axle	10,000	10,000	10,000	10,000	10,000	10,000	10,000	10,000	10,000	10,000	10,000	10,000



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

<b>ENGINE SPECIFICATIONS</b>	<b>ISM 500 HP</b>
Cubic Inch Displacement	10.8 L/661 CI
Engine HP	500 HP @1800 RPM
Engine Torque	1,550 lbs./ft. @1200 RPM
Governed Speed	1800 RPM
Firing Order	153624
Rear Axle Ratio	4:78:1
Alternator Amp Size	200 Standard/270 Electric
<b>CHASSIS LIQUID CAPACITIES</b>	<b>ISM 500 HP</b>
Engine Oil	38 Qts.
Transmission Oil (initial amount)	39 Qts.,
Transmission Oil (with service)	36 Qts. w/ filter
Radiator Coolant (initial amount)	50-55 Qts.
A/C Refrigerant (initial amount)	4 lbs. 134 A
Hydraulic Oil	50-55 Qts. (Aluminum Tank)
Rear End	15 Qts. approx.
<b>Tank Capacities (Approximate Gallons)</b>	
<b>MODELS (ALL)</b>	
Grey Holding Tank	64 gal.
Black Holding Tank	44 gal.
Fresh Water Tank	100 gal.
LP-Gas Tank*	38 gal.
Fuel Tank	190 gal. (useable)

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

10 & 12.5 Kw

**SERVICE INFORMATION**

Refer to operator's manual for maintenance specifications and adjustments.

Air Cleaner	—	140-3071
Oil Filter	—	187-1000
Fuel Filter	—	149-2513
Oil Capacity	—	6.7 Qts w/oil filter
API Designation	—	CE

Temp	SAE Viscosity
5° - 120°F	15W-40
(-13°F) - 68°F	10W-30
(-40°F) - 68°F	5W-30

If service/parts are needed the Onan distributor can be located in the yellow pages under Generators-Electric. In the USA or Canada call 1-800-888-Onan  
**DC Fuss & Radiator Cap Under Cover.**

060148

## CHART - METRIC CONVERSION

U.S. Customary to Metric			Metric to U.S. Customary			
Measurement	Multiplied By	Equals/Measurement	Multiplied By	Equals		
<b><u>Length</u></b>						
inches (in)	25.4	millimeters (mm)	0.03937	inches (in)		
inches (in)	2.54	centimeters (cm)	0.3937	inches (in)		
feet (ft)	0.3048	meters (m)	3.281	feet (ft)		
yards (yd)	0.9144	kilometers (km)	1.094	yards (yd)		
miles (mi)	1.609		0.6215	miles (mi)		
<b><u>Area</u></b>						
square inches (in <sup>2</sup> )	645.16	square millimeters (mm <sup>2</sup> )	0.00155	square inches (in <sup>2</sup> )		
square inches (in <sup>2</sup> )	6.452	square centimeters (cm <sup>2</sup> )	0.15	square inches (in <sup>2</sup> )		
square feet (ft <sup>2</sup> )	0.0929	square meters (m <sup>2</sup> )	10.764	square feet (ft <sup>2</sup> )		
<b><u>Volume</u></b>						
cubic inches (in <sup>3</sup> )	16387.0	cubic millimeters (mm <sup>3</sup> )	0.000061	cubic inches (in <sup>3</sup> )		
cubic inches (in <sup>3</sup> )	16.387	cubic centimeters (cm <sup>3</sup> )	0.06102	cubic inches (in <sup>3</sup> )		
cubic inches (in <sup>3</sup> )	0.01639	liters (L)	61.024	cubic inches (in <sup>3</sup> )		
fluid ounces (fl oz)	29.54	milliliters (mL)	0.03381	fluid ounces (fl oz)		
pints (pt)	0.47318	liters (L)	2.1134	pints (pt)		
quarts (qt)	0.94635	liters (L)	1.0567	quarts (qt)		
gallons (gal)	3.7854	liters (L)	0.2642	gallons (gal)		
cubic feet (ft <sup>3</sup> )	28.317	liters (L)	0.03531	cubic feet (ft <sup>3</sup> )		
cubic feet (ft <sup>3</sup> )	0.02832	cubic meters (m <sup>3</sup> )	35.315	cubic feet (ft <sup>3</sup> )		
<b><u>Weight/Force</u></b>						
ounces (av) (oz)	28.35	grams (g)	0.03527	ounces (av) (oz)		
pounds (av) (lb)	0.454	kilograms (kg)	2.205	pounds (av) (lb)		
U.S. tons (t)	907.18	kilograms (kg)	0.001102	U.S. tons (t)		
U.S. tons (t)	0.90718	metric tons (t)	1.1023	U.S. tons (t)		
<b><u>Torque/Work Force</u></b>						
inch-pounds (lbf.in)	11.298	Newton-centimeters (N.cm)	0.08851	inch-pounds (lbf.in)		
foot-pounds (lbf.ft)	1.3558	Newton-meters (N.m)	0.7376	foot-pounds (lbf.ft)		
<b><u>Pressure/Vacuum</u></b>						
inches of mercury (inHg)	3.37685	kiloPascals (kPa)	0.29613	inches of mercury (inHg)		
pounds per square inch (psi)	6.895	kiloPascals (kPa)	0.14503	pounds per square inch (psi)		
Measurement	Subtract	Divide By	Equals/Measurement	Multiply By	Add	Equals
<b><u>Temperature</u></b>						
degrees Fahrenheit (°F)	32	1.8	degrees Celsius (°C)	1.8	32	degrees Fahrenheit (°F)











# *Signature*

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**SURVEY • END**



**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.

**AGM** - Absorbed Glass Matte. A battery construction type differing from a liquid electrolyte solution and vented caps. AGM batteries are completely sealed. Constructed using a very fine weave of fiberglass mat absorbing the electrolyte solution increasing efficiency and output.

**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 hook-up when you are at campgrounds. It is called city water because you receive 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 (grey) 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 (grey) tanks).

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

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

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

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

**LED** - (Light Emitting Diode) Indicator light.

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

**OHM** - A unit for measuring electrical resistances.

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

**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.

**Rpm** - The speed at which the engine crankshaft rotates.

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

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

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

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

**TS1** - Terminal Strip One.

**VIM** - Vehicle Interface Module.

**Volt** - The unit of measure for electric potential.

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

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



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## 2002 SIGNATURE

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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