

**MONACO® MOTORHOME LIMITED WARRANTY**

**WHAT THE PERIOD OF COVERAGE IS:**

This Limited Warranty provided by Monaco® (“Warrantor”) covers those components, assemblies and systems of your new motorhome not excluded under the section “What is Not Covered” and when sold by an authorized dealer, for twelve (12) months from the original retail purchase date or the first 24,000 miles of use, whichever occurs first. However, this Limited Warranty covers the internal steel or aluminum structural support frames inside the walls and roof (excluding slide-outs) for sixty (60) months from the original retail purchase date or the first 50,000 miles of use, whichever occurs first. If you use your motorhome for any rental, commercial or business purposes whatsoever, the Limited Warranty provided by Warrantor covers your new motorhome when sold by an authorized dealer for ninety (90) days from the original retail purchase date or the first 24,000 miles of use, whichever occurs first, and it covers the internal steel or aluminum structural support frames inside the walls and roof (excluding slide-outs) for twelve (12) months from the original retail purchase date or the first 24,000 miles of use, whichever occurs first. A conclusive presumption that your motorhome has been used for commercial and/or business purposes arises if you have filed a federal or state tax form claiming any business tax benefit related to your ownership of the motorhome. The above Limited Warranty coverage applies to all owners, including subsequent owners, of the motorhome. However, a subsequent owner must submit a warranty transfer form by filing the form through an authorized Monaco dealer. A subsequent owner’s warranty coverage period is the remaining balance of the warranty coverage period the prior owner was entitled to under this Limited Warranty. Warranty transfer forms can be obtained by contacting the Customer Relations Department. There is no charge for the transfer.

**LIMITATION AND DISCLAIMER OF IMPLIED WARRANTIES:**

**IMPLIED WARRANTIES, IF ANY, ARISING BY WAY OF STATE LAW, INCLUDING ANY IMPLIED WARRANTY OF MERCHANTABILITY AND ANY IMPLIED WARRANTY OF FITNESS FOR A PARTICULAR PURPOSE, ARE LIMITED IN DURATION TO THE TERM OF THIS LIMITED WARRANTY AND ARE LIMITED IN SCOPE OF COVERAGE TO THOSE PORTIONS OF THE MOTORHOME COVERED BY THIS LIMITED WARRANTY. WARRANTOR DISCLAIMS ALL IMPLIED AND EXPRESS WARRANTIES, INCLUDING THE IMPLIED WARRANTY OF MERCHANTABILITY AND THE IMPLIED WARRANTY OF FITNESS FOR A PARTICULAR PURPOSE, ON COMPONENTS AND APPLIANCES EXCLUDED FROM COVERAGE AS SET FORTH BELOW.**

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

**WHAT THE WARRANTY COVERS:**

Warrantor’s Limited Warranty covers defects in the manufacture of your motorhome and defects in materials used to manufacture your motorhome. “Defect” means the failure of the motorhome and/or the materials used to assemble the motorhome to conform to Warrantor’s design and manufacturing specification and tolerances. Also see the section “What the Warranty Does Not Cover” set out below.

**WHAT WE WILL DO TO CORRECT PROBLEMS:**

Warrantor’s sole and exclusive obligation is to repair and/or replace, at its option, any covered defect if: (1) you notify Warrantor or one of its authorized servicing dealers of the defect within the warranty coverage period and within five (5) days of discovering the defect; and (2) you deliver your Motorhome to Warrantor or Warrantor’s authorized servicing dealer at your cost and expense. It is reasonable to expect some service items to occur during the warranty period. The performance of warranty repairs shall not extend the original warranty coverage period. Further, any performance of repairs after the warranty coverage period has expired or any performance of repairs to component parts and appliances that are excluded from coverage shall be considered “good will” repairs, which shall not alter the express terms of this limited warranty. If the repair or replacement remedy fails to successfully cure a defect after Warrantor received a reasonable opportunity to cure the defect(s), your sole and exclusive remedy shall be limited to Warrantor paying you the cost of having an independent third party perform repair(s) to the defect(s). Warrantor may use new and/or remanufactured parts and/or components of substantially equal quality to complete any repair. Defects and/or damage to interior and exterior surfaces, trim, upholstery and other appearance items may occur at the factory during manufacture, during delivery of the motorhome to the selling dealer or on the selling dealer’s lot. Normally, any such defect or damage is detected and corrected at the factory or by the selling dealer during the inspection process performed by the Warrantor and the selling dealer. If, however, you discover any such defect or damage when you take delivery of the motorhome, you must notify your dealer or Warrantor within five days of the date of purchase to have repairs performed to the defect at no cost to you as provided by this Limited Warranty. If either three or more unsuccessful repair attempts have been made to correct any covered defect that you believe substantially impairs the value, use or safety of your motorhome, or repairs to any covered defect(s) which you believe substantially impairs the value, use or safety of your motorhome have taken 30 or more days to complete, you must, to the extent permitted by law, notify Warrantor directly in writing of the failure to successfully repair the defect(s) so that Warrantor can become directly involved in exercising a final repair attempt for the purpose of performing a successful repair to the identified defect(s).

**HOW TO GET SERVICE:**

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

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

In the event the motorhome is inoperative due to malfunction of a warranted part, Warrantor will pay the cost of having the motorhome towed to the nearest authorized repair facility provided you notify Warrantor prior to incurring the towing charges to receive directions to the nearest repair facility. Because Warrantor does not control the scheduling of service work by its authorized servicing dealers, you may encounter some delay in scheduling and/or in the completion of the repairs.

**WHAT THE WARRANTY DOES NOT COVER:**

This Limited Warranty does not cover: any motorhome sold or registered outside of the United States or Canada; items which are added or changed after the motorhome leaves Warrantor’s possession; items that are working as designed but which you are unhappy with because of the design; normal wear and usage, such as fading or discoloration of fabrics, or the effects of moisture inside the motorhome; defacing, scratching, dents and chips on any surface or fabric of the motorhome, not caused by Warrantor; owner maintenance, including by way of example wheel alignments and resealing exterior sealant areas; the automotive chassis and power train, including, by way of example the engine, drivetrain, steering and handling, braking, wheel balance, muffler, tires, tubes, batteries and gauges; appliances and components covered by their own manufacturer’s warranty including, by way of example the microwave, refrigerator, ice maker, stove, oven, generator, roof air conditioners, hydraulic jacks, VCR, television(s), water heater, furnace, stereo, radio, compact disc player, washer, dryer, inverter and cellular phone; or flaking, peeling and chips or other defects or damage in or to the exterior or finish caused by rocks or other road hazards, the environment including airborne pollutants, salt, tree sap and hail. Component part and appliance manufacturers issue limited warranties covering those portions of the motorhome not covered by the Limited Warranty issued by Warrantor. To learn more on what specific component parts and appliances are excluded from the Limited Warranty issued by Warrantor please contact your selling dealership or Warrantor directly or review the warranty packet inside the motorhome.

**EVENTS DISCHARGING WARRANTOR FROM OBLIGATION UNDER WARRANTY:**

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

**DISCLAIMER OF CONSEQUENTIAL AND INCIDENTAL DAMAGES:**

**THE ORIGINAL PURCHASER OF THE MOTORHOME AND ANY PERSON TO WHOM THE MOTORHOME IS TRANSFERRED, AND ANY PERSON WHO IS AN INTENDED OR UNINTENDED USER OR BENEFICIARY OF THE MOTORHOME, SHALL NOT BE ENTITLED TO RECOVER FROM WARRANTOR ANY CONSEQUENTIAL OR INCIDENTAL DAMAGES RESULTING FROM ANY DEFECT IN THE MOTORHOME, INCLUDING BY WAY OF EXAMPLE FUEL AND TRANSPORTATION EXPENSES TO DELIVER THE PRODUCT TO THE SERVICING DEALER, HOTEL ROOMS, LOST WAGES AND MOISTURE DAMAGE SUCH AS MOLD AND MILDEW. THE EXCLUSION OF CONSEQUENTIAL AND INCIDENTAL DAMAGES SHALL BE DEEMED INDEPENDENT OF, AND SHALL SURVIVE, ANY FAILURE OF THE ESSENTIAL PURPOSE OF ANY LIMITED REMEDY.** Some states do not allow the exclusion or limitation of consequential or incidental damages, so the above exclusions may not apply to you.

**LEGAL REMEDIES:**

**THESE LIMITED WARRANTIES ARE NOT INTENDED TO, AND DO NOT “EXTEND TO FUTURE PERFORMANCE”. ANY ACTION SEEKING REMEDIES FOR BREACH OF WARRANTY OR SEEKING TO ENFORCE THIS LIMITED WARRANTY OR ANY IMPLIED WARRANTIES SHALL NOT BE COMMENCED MORE THAN ONE (1) YEAR AFTER THE EARLIER OF: (i) THE EXPIRATION OF THE WARRANTY COVERAGE PERIOD DESIGNATED ABOVE; (ii) THE FAILURE OF THE WARRANTOR TO REPAIR THE DEFECT AT ISSUE; OR, (iii) THE DATE ON WHICH THE BUYER’S ACTION ACCRUED UNDER APPLICABLE LAW. IF YOU USE YOUR MOTORHOME FOR COMMERCIAL OR BUSINESS PURPOSES, ANY ACTION SEEKING REMEDIES FOR BREACH OF WARRANTY OR SEEKING TO ENFORCE THIS LIMITED WARRANTY OR ANY IMPLIED WARRANTIES SHALL NOT BE COMMENCED MORE THAN ONE YEAR AFTER THE EARLIER OF (i) THE EXPIRATION OF THE WARRANTY COVERAGE PERIOD DESIGNATED ABOVE; (ii) THE FAILURE OF THE WARRANTOR TO REPAIR THE DEFECT AT ISSUE; OR (iii) THE DATE ON WHICH THE BUYER’S CAUSE OF ACTION ACCRUED UNDER APPLICABLE LAW. UNLESS PROHIBITED BY LAW, THE PERFORMANCE OF REPAIRS SHALL NOT SUSPEND THIS LIMITATIONS PERIOD FROM EXPIRING. THESE TERMS AND ALL WRITTEN AND IMPLIED WARRANTY DISPUTES BETWEEN WARRANTOR AND PURCHASER SHALL BE GOVERNED BY THE SUBSTANTIVE LAWS OF THE STATE OF OREGON, WITHOUT REGARD TO CONFLICTS OF LAW RULES.** Some states do not allow the reduction in the statute of limitations, so the above reduction in the statute of limitations may not apply to you.

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

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

**ROADMASTER® CHASSIS LIMITED WARRANTY****WHAT THE PERIOD OF COVERAGE IS:**

This Limited Warranty provided by Roadmaster® (“Warrantor”) covers your Roadmaster Chassis for thirty-six (36) months from the original retail purchase date or the first 50,000 miles of use, whichever occurs first. If you use the Roadmaster Chassis that your motorhome is mounted upon for any rental, commercial or business purposes whatsoever, this Limited Warranty covers your new Roadmaster Chassis for Ninety (90) days from the original retail purchase date or the first 24,000 miles of use, whichever occurs first. A conclusive presumption that the Roadmaster Chassis has been used for commercial and/or business purposes arises if you have filed a federal or state tax form claiming any business tax benefit related to your ownership of the motorhome. This Limited Warranty applies to all owners, including subsequent owners, of the Roadmaster Chassis. However, a subsequent owner must submit a warranty transfer form. A subsequent owner’s warranty coverage period is the remaining balance of the warranty coverage period the prior owner was entitled to under this Limited Warranty. Warranty transfer forms can be obtained by contacting the Customer Relations Department. There is no charge for the transfer.

**LIMITATION AND DISCLAIMER OF IMPLIED WARRANTIES:**

**IMPLIED WARRANTIES, IF ANY, ARISING BY WAY OF STATE LAW, INCLUDING ANY IMPLIED WARRANTY OF MERCHANTABILITY AND ANY IMPLIED WARRANTY OF FITNESS FOR A PARTICULAR PURPOSE, ARE LIMITED IN DURATION TO THE TERM OF THIS LIMITED WARRANTY AND ARE LIMITED IN SCOPE OF COVERAGE TO THOSE PORTIONS OF THE MOTORHOME COVERED BY THIS LIMITED WARRANTY. WARRANTOR DISCLAIMS ALL IMPLIED AND EXPRESS WARRANTIES, INCLUDING THE IMPLIED WARRANTY OF MERCHANTABILITY AND THE IMPLIED WARRANTY OF FITNESS FOR A PARTICULAR PURPOSE, ON COMPONENTS AND APPLIANCES EXCLUDED FROM COVERAGE AS SET FORTH BELOW.**

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

**WHAT THE WARRANTY COVERS:**

Warrantor’s Limited Warranty covers defects in the manufacture of the Roadmaster Chassis and defects in materials used to manufacture the Roadmaster Chassis. “Defect” means the failure of the Roadmaster Chassis and/or the materials used to assemble the Roadmaster Chassis to conform to Warrantor’s design and manufacturing specification and tolerances. Also see the section “What the Warranty Does Not Cover” set out below.

**WHAT WE WILL DO TO CORRECT PROBLEMS:**

Warrantor’s sole and exclusive obligation is to repair and/or replace, at its option, any covered defect if: (1) you notify Warrantor or one of its authorized servicing dealers of the defect within the warranty coverage period and within five (5) days of discovering the defect; and (2) you deliver your Roadmaster Chassis to Warrantor or Warrantor’s authorized servicing dealer at your cost and expense. It is reasonable to expect some service items to occur during the warranty period. The performance of warranty repairs shall not extend the original warranty coverage period. Further, any performance of repairs after the warranty coverage period has expired or any performance of repairs to component parts and appliances that are excluded from coverage shall be considered “good will” repairs, which shall not alter the express terms of this limited warranty. If the repair or replacement remedy fails to successfully cure a defect after Warrantor received a reasonable opportunity to cure the defect(s), your sole and exclusive remedy shall be limited to Warrantor paying you the cost of having an independent third party perform repair(s) to the defect(s). Warrantor may use new and/or remanufactured parts and/or components of substantially equal quality to complete any repairs. Defects and/or damage to interior and exterior surfaces, trim, upholstery and other appearance items may occur at the factory during manufacture, during delivery of the motorhome to the selling dealer or on the selling dealer’s lot. Normally, any such defect or damage is detected and corrected at the factory or by the selling dealer during the inspection process performed by the Warrantor and the selling dealer. If, however, you discover any such defect or damage when you take delivery of the motorhome, you must notify your dealer or Warrantor within five days of the date of purchase to have repairs performed to the defect at no cost to you as provided by this Limited Warranty. If either three or more unsuccessful repair attempts have been made to correct any covered defect that you believe substantially impairs the value, use or safety of your motorhome, or repairs to any covered defect(s) which you believe substantially impairs the value, use or safety of your motorhome have taken 30 or more days to complete, you must, to the extent permitted by law, notify Warrantor directly in writing of the failure to successfully repair the defect(s) so that Warrantor can become directly involved in exercising a final repair attempt for the purpose of performing a successful repair to the identified defect(s).

**HOW TO GET SERVICE:**

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

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

In the event the Roadmaster Chassis is inoperative due to malfunction of a warranted part, Warrantor will pay the cost of having the motorhome towed to the nearest authorized repair facility provided you notify Warrantor prior to incurring the towing charges to receive directions to the nearest repair facility. Because Warrantor does not control the scheduling of service work by its authorized servicing dealers, you may encounter some delay in scheduling and/or in the completion of the repairs.

**WHAT THE WARRANTY DOES NOT COVER:**

This Limited Warranty does not cover: modifications and alterations to the Roadmaster Chassis by others; the motorhome that is mounted upon the Roadmaster Chassis, including by way of example the motorhome manufacturer's design, manufacture, assembly and/or installation of the side walls, roof, windows, flooring, electrical system, plumbing system, LP-Gas system, appliances and slide outs; items that are working as designed but which you are unhappy with because of the design; normal wear and usage; routine maintenance including by way of example wheel alignments; component parts covered by their own manufacturer's warranty, including by way of example the engine, radiator, transmission, tires, tubes, batteries, exhaust system and the emission control systems; and, flaking, peeling rusting and chips or other defects or damage in or to the frame and frame cross members caused by rocks or other road hazards and the environment including airborne pollutants and salt. Component part manufacturers issue limited warranties covering those portions of the Roadmaster Chassis not covered by the Limited Warranty issued by Warrantor. To learn more on what specific component parts are excluded from the Limited Warranty issued by Warrantor please contact your selling dealership or Warrantor directly or review the warranty packet inside the Motorhome.

**EVENTS DISCHARGING WARRANTOR FROM OBLIGATION UNDER WARRANTY:**

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

**DISCLAIMER OF CONSEQUENTIAL AND INCIDENTAL DAMAGES:**  
**THE ORIGINAL PURCHASER OF THE ROADMASTER CHASSIS AND ANY PERSON TO WHOM THE ROADMASTER CHASSIS IS TRANSFERRED, AND ANY PERSON WHO IS AN INTENDED OR UNINTENDED USER OR BENEFICIARY OF THE ROADMASTER CHASSIS, SHALL NOT BE ENTITLED TO RECOVER FROM WARRANTOR ANY CONSEQUENTIAL OR INCIDENTAL DAMAGES RESULTING FROM ANY DEFECT IN THE ROADMASTER CHASSIS, INCLUDING BY WAY OF EXAMPLE FUEL AND TRANSPORTATION EXPENSES TO DELIVER THE PRODUCT TO THE SERVICING DEALER, HOTEL ROOMS, LOST WAGES AND WATER DAMAGE. THE EXCLUSION OF CONSEQUENTIAL AND INCIDENTAL DAMAGES SHALL BE DEEMED INDEPENDENT OF, AND SHALL SURVIVE, ANY FAILURE OF THE ESSENTIAL PURPOSE OF ANY LIMITED REMEDY.** Some states do not allow the exclusion or limitation of consequential or incidental damages, so the above exclusions may not apply to you.

**LEGAL REMEDIES:**

**THESE LIMITED WARRANTIES ARE NOT INTENDED TO, AND DO NOT "EXTEND TO FUTURE PERFORMANCE." ANY ACTION SEEKING REMEDIES FOR BREACH OF WARRANTY OR SEEKING TO ENFORCE THIS LIMITED WARRANTY OR ANY IMPLIED WARRANTIES SHALL NOT BE COMMENCED MORE THAN (1) ONE YEAR AFTER THE EARLIER OF: (i) THE WARRANTY COVERAGE PERIOD DESIGNATED ABOVE; (ii) THE FAILURE OF THE WARRANTOR TO REPAIR THE DEFECT AT ISSUE; OR, (iii) THE DATE ON WHICH THE BUYER'S ACTION ACCRUED UNDER APPLICABLE LAW. IF YOU USE YOUR MOTORHOME FOR COMMERCIAL OR BUSINESS PURPOSES, ANY ACTION SEEKING REMEDIES FOR BREACH OF WARRANTY OR SEEKING TO ENFORCE THIS LIMITED WARRANTY OR ANY IMPLIED WARRANTIES SHALL NOT BE COMMENCED MORE THAN ONE YEAR AFTER THE EARLIER OF (i) THE EXPIRATION OF THE WARRANTY COVERAGE PERIOD DESIGNATED ABOVE; (ii) THE FAILURE OF THE WARRANTOR TO REPAIR THE DEFECT AT ISSUE; OR (iii) THE DATE ON WHICH THE BUYER'S CAUSE OF ACTION ACCRUED UNDER APPLICABLE LAW, UNLESS PROHIBITED BY LAW. THE PERFORMANCE OF REPAIRS SHALL NOT SUSPEND THIS LIMITATIONS PERIOD FROM EXPIRING. THESE TERMS AND ALL WRITTEN AND IMPLIED WARRANTY DISPUTES BETWEEN WARRANTOR AND PURCHASER SHALL BE GOVERNED BY THE SUBSTANTIVE LAWS OF THE STATE OF OREGON, WITHOUT REGARD TO CONFLICTS OF LAW RULES.** Some states do not allow the reduction in the statute of limitations, so the above reduction in the statute of limitations may not apply to you.

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

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

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

**MANUAL ADDENDUMS & TECH TIPS**

**[www.monaco-online.com](http://www.monaco-online.com)**

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

# 09 Camelot

## *General Information — Section 1*

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## WARRANTY INFORMATION FILE

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

### Additional Information:

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

It may also be helpful to browse the "Tech Tips" menu for the other product lines. The tips may not completely apply to your particular model, but information contained therein can be useful.

## REPORTING SAFETY DEFECTS

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

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

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

## SAFETY TERMS

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

### WARNING:

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

### CAUTION:

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

### POISON:

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

### NOTE:

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

### INSPECTION:

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

### LUBE:

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

### ASSEMBLE or REPAIR:

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

### INFORMATION:

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



**TIP:**

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

**GLOSSARY OF TERMS**

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

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

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

**Alternating Current (AC)** - A current that varies periodically in magnitude and direction. A battery does not deliver alternating current. Also referred to as shore power, utility power, inverter power, generator power, etc.

**Ampere (Amp)** - The unit of measure of electron flow rate of current through a circuit.

**Ampere-hour (Amp-hr. AH)** - A unit of measure for a battery electrical storage capacity, obtained by multiplying the current in amperes by the time in hours of discharge. *Example:* A battery which delivers 5 amperes for 20 hours, delivers 5 amperes times 20 hours, or 100 Amp-Hr. of capacity.

**ANSI** - American National Standards Institute.

**ASTM** - American Society for Testing and Materials.

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

**CCA** - Cold Cranking Amperage is the amount of current a battery can deliver for 30 seconds at 0° F without dropping below a specified voltage, usually 10.5 Volts DC.

**Chassis Battery** - Powers chassis 12 Volt accessories and starts engine.

**Circuit** - An electric circuit is the path of an electric current. A closed circuit has a complete path. An open circuit has a broken or disconnected path.

**City Water** - A term associated with the water supply that you hook-up to at campgrounds. It is called city water because water is pulled from a central source (like in a city) and not the fresh water tank.

**Compressor Load Cycle** - The time during which the air compressor is building pressure.

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

**Curbside** - This refers to the side of the motorhome which faces the curb when it is parked. Often called the door side or the passenger side.

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

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

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

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

**Desiccant** - A granular substance with a high affinity for water used to retain moisture from the air stream flowing through the air dryer cartridge.

**Direct Current (DC)** - Power that is stored in a battery bank or supplied by photovoltaics, alternator, chargers and DC generators. Direct current is also known as battery power. Current only flows one way.

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

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

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

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

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

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

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

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

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

**LED (Light Emitting Diode)** - Indicator light.

**Liquid Lead Acid 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.

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

**OEM** - Term for Original Equipment Manufacturer.

**OHM** - A unit for measuring electrical resistances.

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

**Potentiometer** - A device for measuring an unknown potential difference or electromotive force.

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

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

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

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

**Roadside** - This refers to the side of the motorhome which faces the road when it is parked. Often called the off-door side or the driver side.

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

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

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

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

**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.



# OWNER'S MANUAL SURVEY: 2009 CAMELOT

Your suggestions are very important to us and we are continually striving to improve the quality of our manuals. After becoming familiar with your new recreational vehicle and the accompanying manual, please take the time to answer the following questions. When you are finished please return the survey via mail to our Technical Publications Department, or you may fax the survey to: **(541) 681-8031 Attention: Technical Publications Department**. Feel free to attach an additional page if you desire.

1. Is this your first recreational vehicle? YES / NO (circle one)

2. If no, what was your previous recreational vehicle brand/model? \_\_\_\_\_

\_\_\_\_\_

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

\_\_\_\_\_

\_\_\_\_\_

\_\_\_\_\_

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

\_\_\_\_\_

\_\_\_\_\_

\_\_\_\_\_

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

\_\_\_\_\_

\_\_\_\_\_

\_\_\_\_\_

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

\_\_\_\_\_

\_\_\_\_\_

\_\_\_\_\_

NAME: \_\_\_\_\_

PHONE: ( \_\_\_\_\_ ) \_\_\_\_\_

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

\_\_\_\_\_

SERIAL # \_\_\_\_\_

**TEAR OFF PAGE AND MAIL TO:**

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



# LIMITED WARRANTY TRANSFER APPLICATION/CHANGE OF OWNER INFORMATION

Mail to:

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

*Please read terms and representations below before signing.*

**Submitted By:**

Name: \_\_\_\_\_

Address: \_\_\_\_\_

City: \_\_\_\_\_ State: \_\_\_\_\_ Zip: \_\_\_\_\_

Phone: ( \_\_\_\_\_ ) \_\_\_\_\_

Limited Warranty Transfer

Address Change

**A. Current Owner Information:**

\_\_\_\_\_  
First Name                      Initial                      Last Name

\_\_\_\_\_  
Vehicle Identification Number      Unit # (15 digits)      (6 digits)      Model/Year

---

**B. New Owner Information, Transfer Coverage To:**

\_\_\_\_\_  
First Name                      Initial                      Last Name

( \_\_\_\_\_ )  
Phone Number                      Street Address                      City                      State                      Zip

\_\_\_\_\_  
Date of Transfer (If Applicable)      Odometer Reading at Transfer (If Applicable)

---

**C. Signatures:**

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

### Terms & Representations

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

1. That you have received and read a copy of the Limited Warranty.
2. You understand that the unit is to be used only for family camping and cross country travel on improved roads.

3. All information provided by you on face side of this form is true and correct.
4. You understand that you are purchasing a pre-owned recreational vehicle and Monaco Coach Corporation does not make any representation as to its present condition.

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





# 09 Camelot

## Driving & Safety – Section 2

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## DRIVING & SAFETY

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

### NOTE:

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

### Inspections

Differences between a passenger automobile and a motorhome are significant. Always be aware of these differences when traveling. The key to safely operating a motorhome is inspection. Undetected problems could cause problems on the road and may result in lost time and increased repair costs. Several states require a special license endorsement and motorhome inspection prior to registration. Know and observe the laws of the states in which you are traveling. Laws may vary from state to state.

A systematic inspection conducted prior to moving the motorhome can help ensure nothing is overlooked and will assist in familiarizing the owner with the motorhome.

Prior to moving the motorhome perform a general inspection. Examine the condition and surrounding area. Look high and low when walking around the motorhome.

### Familiarize Yourself

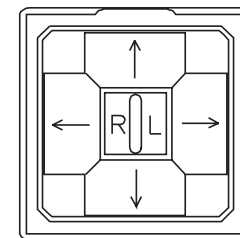
Because the driver's seat location in the motorhome is higher and farther to the left than most vehicles, a different perspective of the roadway is created. Rely on the outside mirrors to line up with the center of the road and to check conditions behind the motorhome. The dashboard may include more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

### Mirror Adjust

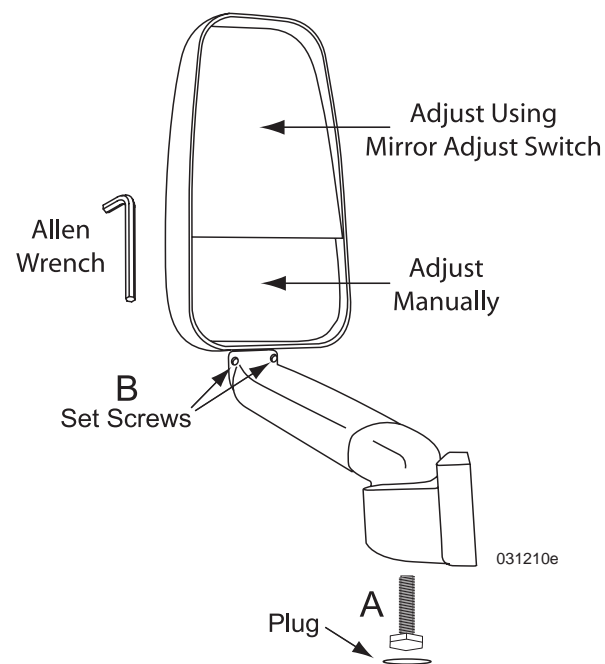
Adjust the mirrors prior to starting out. Have an assistant help to simplify the mirror adjustment process.

### Mirror Adjust:

- ◆ Adjust the driver seat to travel position.
- ◆ Use a flat tip screwdriver to remove the plug at the mirror arm base (See A on illustration).
- ◆ Use a ½" socket to loosen the bolt (see A on illustration).
- ◆ Tighten the bolt when properly adjusted.
- ◆ Use a 3/16" allen wrench to loosen the set screws at point B.
- ◆ Adjust the mirror. Tighten set screws.
- ◆ Manually adjust the bottom section of the mirror.
- ◆ Fine tune upper mirror placement with the mirror adjust switch on the driver's console.



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## Safety Seat Belts

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

To fasten the seat belt, pull the belt out of the retractors and insert the tab into the buckle; a click will sound when the tab locks into the buckle. Seat belt lengths automatically adjust to your size and sitting position. **DO NOT** route belts over armrest or under the arm.

### **WARNING:**

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

### **WARNING:**

**Only seats equipped with seat belts are designed for occupancy while the motorhome is in motion.**

## Child Passenger Safety:

Child restraint requirements are determined by age *and* weight. According to NHTSA (National Highway Traffic Safety Administration), there are four stages to child restraint safety.

### **CAUTION:**

**Always refer to the child seat manufacturer's instructions for recommended use and installation.**



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### **Step 1:**

For the best possible protection place infants in a back seat, in a rear-facing child safety seat, as long as possible up to the height or weight limit of the particular seat. At a minimum, keep infants rear-facing until a minimum of age 1 and at least 20 pounds.



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### **Step 2:**

When children outgrow their rear-facing seats (at a minimum age 1 and at least 20 pounds) they should ride in forward-facing child safety seats, in the back seat, until they reach the upper weight or height limit of the particular seat (usually around age 4 and 40 pounds).



### **Step 3:**

Once children outgrow their forward-facing seats (usually around age 4 and 40 pounds), they should ride in booster seats, in a back seat, until the vehicle seat belts properly fit. Seat belts properly fit when the lap belt lays across the upper thighs and the shoulder belt fits across the chest (usually at age 8 or when they are 4' 9" tall).



### **Step 4:**

When children outgrow their booster seats, (usually at age 8 or when they are 4' 9" tall) they can use the adult seat belt in the back seat, if it fits properly (lap belt lays across the upper thighs and the shoulder belt fits across the chest). All children under age 13 should ride in the back seat.



### **NOTE:**

**The motorhome manufacturer is not the author of the above information. The information in this chart is reprinted from the National Highway Traffic Safety Administration website. Visit NHTSA's website at [www.nhtsa.gov](http://www.nhtsa.gov) for the most recent and up to date information.**

**Tips:**

- ◆ Go to [www.nhtsa.gov](http://www.nhtsa.gov) and choose “Child Safety Seat Information” from the menu or click on the child passenger safety icon. The site includes child safety seat installation tips, product ratings, recalls and other useful information.
- ◆ For more information about child safety seats, booster seats, inspection/fitting stations in your area, seat belts, air bags, and other highway safety issues, call the DOT Vehicle Safety Hotline at: **1-888-327-4236**.
- ◆ A certified child passenger safety technician can check your installation and answer questions. To find a technician or an inspection station near you, go to [www.nhtsa.gov](http://www.nhtsa.gov), click on the child passenger safety icon, and then click on the Fitting/Inspection Station link, or go to [www.seatcheck.org](http://www.seatcheck.org).

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

**NOTE:**

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

**NOTE:**

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

**WARNING:**

**DO NOT transport children unrestrained. Infants must be placed in approved safety seats - small children must be restrained in child safety seats. DO NOT use a single seat belt on more than one child. Failure to comply with these rules can lead to injury or death.**

**WARNING:**

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

**Seat Belt Care:**

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

**DRIVING TIPS**

The motorhome is a complex vehicle that requires increased driving awareness because of its size and various components. Due to the motorhome length the turning radius will be much wider than that of a standard automobile. Always pay close attention to the perimeter of the motorhome including front, sides, rear, roof and undercarriage. Ensure the surrounding area is clear of obstacles. Utilize the driving mirrors to observe traffic conditions as well as the motorhome exterior including tires, bay doors, blind spots, etc.

Use a push-pull method of steering, with both hands parallel on the steering wheel.

The motorhome is heavier than an automobile and has a higher center of gravity, which affects reaction time of the motorhome. Swerving and sharp turning, especially performed at high speeds, could result in loss of control. Keep the size of the motorhome in mind and drive with extra caution to avoid situations that might require quick momentum changes. Increase reaction time by paying attention to traffic and road conditions 12 to 15 seconds ahead of the motorhome’s position.

The motorhome will travel safely and comfortably at highway speed limits. However, it takes more time to reach highway speed. When passing another vehicle, allow extra time and space to complete the pass due to the added length of the motorhome.

The transmission and engine will help control downhill speed and can extend the service life of the brake lining. When descending a long hill, manually shift to a lower gear and begin the descent at a slow speed. **DO NOT** allow the motorhome to gain momentum before trying to slow down. Use the exhaust brake in conjunction with the service brakes to help maintain a slow, safe descent. Distance required to stop the motorhome is greater than an automobile. Practice stopping away from traffic to get the feel of distance required to stop the motorhome.



downhill.eps

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

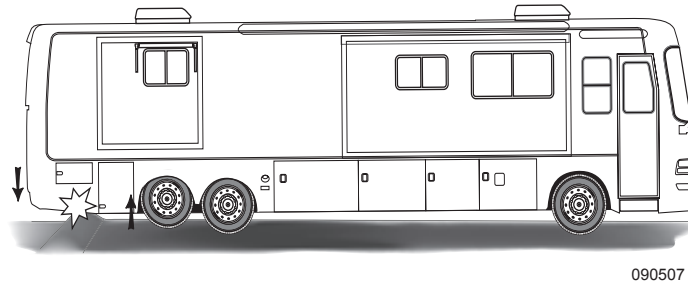
Keep the windshield clear of humidity in the form of water or ice. Start the motorhome and turn on the dash defrost and the overhead blowers to help remove moisture from inside the windshield. It may also be necessary to use a clean cloth to wipe away moisture. Keep windshield wipers in good working order at all times. **DO NOT** operate the motorhome if the windshield is not clear.

Check bridge weight limits before crossing to ensure they can support the weight of the motorhome. Signs should be posted at bridge entrances. Check the posted height of all overpasses or situations where overhead clearance is limited. Keep in mind that road surfaces may be repaved or packed with snow; therefore, the actual posted clearance height would not apply in such conditions.

### Driving Cautions:

- ◆ Do not get too close to the shoulder of the road. It may be too soft to support the weight of the motorhome.
- ◆ Maintain side spacing by centering the motorhome in the driving lane.
- ◆ Driving lanes in work zones can be uneven, congested and more narrow than usual.
- ◆ Watch for uneven ground surfaces and low road clearance.

- ◆ Avoid lifting the tag axle (42' only) on uneven surfaces. Chassis ground clearance is reduced.



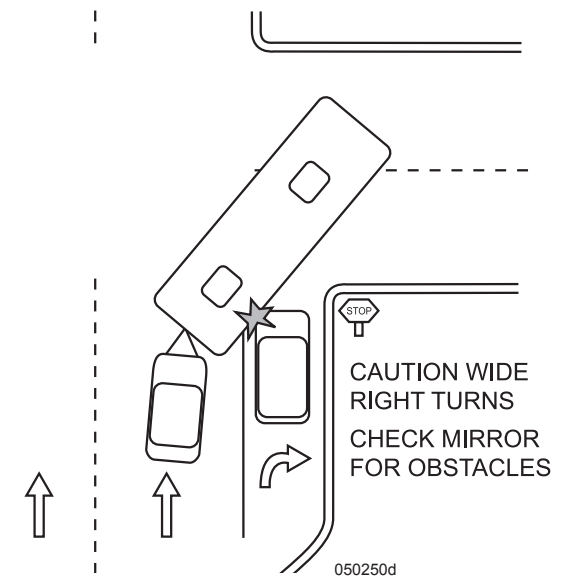
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- ◆ Be cautious of road debris that can damage the undercarriage of the motorhome or become lodged in the dual tires and cause damage to the tires, wheel rims or tow vehicle.
- ◆ Watch for low hanging branches on back roads and single divided roads. Tree branches and shrubbery can protrude into the roadway, especially during inclement weather when rain and snow can cause branches to hang lower than usual.
- ◆ Posted speed signs are usually passenger automobile rated. Be extra aware of driving conditions and use the appropriate speed for a motorhome, especially on corners and mountain roads.
- ◆ Downgrade speed should be at least 5 mph less than upgrade speed, or downgrade speed should be attainable within three seconds of a brake application.
- ◆ Use a four second rule when following other vehicles at speeds under 40 mph. Use a five second rule when following at speeds over 40 mph.

### Right Turns:

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

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



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**Left Turns:**

- ◆ **DO NOT** proceed with the turn until the driver's seat is aligned with the middle of the intersection. If two lanes are available, take the right hand lane. A vehicle or object located on the left-hand side is easier seen.

**Ascending a Grade:**

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

- ◆ **RPM** - Every engine has a range of RPM that produces power most efficiently.
- ◆ **Fuel/Air mixture** - At a given RPM, the engine, even with the help of a turbo-charger, can only introduce a given volume of air into the combustion chamber. This volume of air can efficiently combine with only so much fuel; so adding more fuel to the engine only wastes it.

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

**IMPORTANT SAFETY TIP:**

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

**Descending a Grade:**

Prepare to descend a grade at the crest of the hill. Observe signs indicating grade angle and duration. The sign may suggest maximum downhill speed according to Gross Combined Weight (the combined weight of the motorhome and a trailer/tow car). At the crest of the hill, manually shift the transmission into a lower gear. **DO NOT** allow the motorhome to gain momentum before slowing down.

The exhaust brake switch is located on the driver's console. Use the exhaust brake to help maintain a slow, safe downhill speed. When the brake switch is on, the brake will activate when the throttle is released.

With the exhaust brake applied, road speed may increase until the transmission automatically shifts to the next highest gear. Apply the brakes using moderately heavy pressure on the brake pedal to reduce speed. Manually downshift to maintain a safe, slow speed. **DO NOT** pump the brakes. This can result in a loss of air pressure. Avoid riding the brakes as this can cause the brakes to overheat. Either method can also result in loss of brake effectiveness or brake failure.

**Night Driving:**

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

**Extreme Heat/Hot Weather Conditions:**

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

**Winter and Cold Climate Conditions:**

- ◆ The motorhome should be prepared for cold weather use.
- ◆ Keep speeds slow and steady. Make moves gradually and increase visual distance for a gain in reaction time.
- ◆ If road or weather conditions are treacherous, find a safe stopping place and wait for conditions to improve.
- ◆ Avoid using an auxiliary braking device on wet or slippery surfaces, which can cause the drive wheels to skid.

- ◆ Wiper blades should be in good condition. Fill the washer reservoir with antifreeze formula window washer fluid.
- ◆ Remove any ice build-up from the entry step to avoid accidental slipping.

### Wet Conditions:

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

### Refueling:

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

### **WARNING:**

**Propane and gasoline are highly flammable and can ignite, resulting in explosion, fire or death. Ensure all flames are extinguished, all propane appliances are turned off and the primary propane valve is off prior to refueling.**

### Fuel Economy:

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

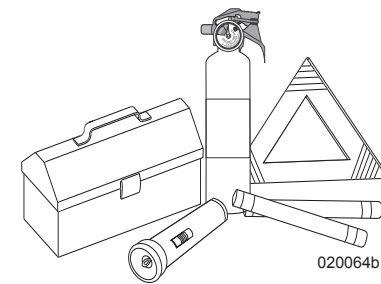
### Guidelines to Help Increase Fuel Efficiency:

- ◆ When starting out, apply throttle lightly and accelerate gradually. Avoid using excessive throttle and accelerating quickly.
- ◆ Check the tire pressure. A low tire is not only a safety hazard, but also increases rolling resistance and fuel consumption.
- ◆ Keep the engine at a low to mid operating range of 1100 to 1500 RPM, which requires less fuel than a higher RPM.
- ◆ Avoid using full throttle when ascending a long hill. This wastes fuel and increases engine operating temperature from incomplete combustion. Manually shift to a lower gear and use less throttle. Fuel will burn more efficiently.
- ◆ Avoid extended idling to warm-up the engine. Start the engine and wait for normal oil pressure to register. Engage the high idle feature until the engine coolant temperature gauge raises. The engine is now ready for travel. Whenever coolant temperature is below 160° F. (idling engine) incomplete combustion occurs, causing carbon build-up and raw fuel to wash lubricating oil from the cylinder walls and dilute the crankcase oil. Excessive idling (more than 10 or 15 minutes) can clog fuel injectors, damage the emission system, and eventually cause piston rings and valves to stick.

- ◆ Operate the transmission with the **MODE** function set to Economy whenever possible; this allows for earlier shifts and enhanced fuel economy.
- ◆ Follow the maintenance schedule for the engine.

## TRIP PREPARATION

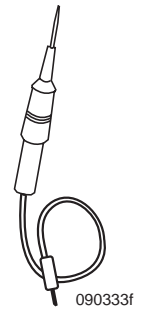
The following suggestions are general guidelines to follow when preparing for a trip:



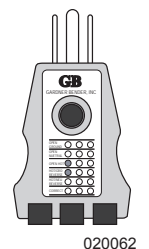
*Tool Box & Emergency Road Supplies*

### Items to Carry:

- ◆ An emergency road kit containing a flashlight, road flares, warning signs and a fire extinguisher.
- ◆ Local, State and National Maps, as well as a “Motor Carrier” road atlas (for refueling station and truck repair facility locations).
- ◆ Hand tools, a 12 Volt DC test light, a 120 Volt AC polarity tester, battery hydrometer, an assortment of blade fuses, mini fuses, and alternator belt.



*Test Light*



*120 Volt AC Polarity Tester*

- ◆ Potable and non-potable water hoses, a water pressure regulator and various termination connectors for sewage.

### Inspection:

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

### INFORMATION:

For chassis maintenance details refer to the chassis section.

### CAUTION:

Open the bay doors slowly after a trip as cargo may shift during travel.

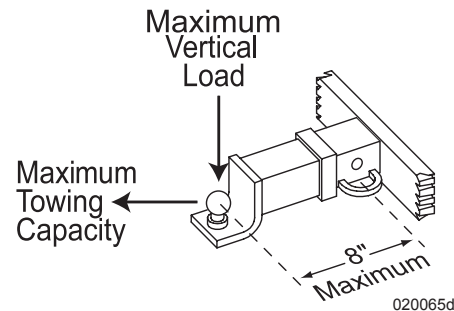
### WARNING:

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

### TIPS:

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


## HITCH



### Using the Rear Receiver

When using the rear hitch receiver, remember that the motorhome is intended for towing light loads and is primarily designed as a recreational vehicle. Safety and durability of the hitch receiver requires proper use. Avoid excessive towing loads or other misuse of the receiver. Towing will affect fuel economy.

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

 <b>MONACO</b> COACH CORPORATION	Do Not Cut, Weld or Modify	03213019
	Do Not Exceed Vehicle Ratings	
	Maximum Towing Capacity 10,000 Lbs. (4,536 Kg.)	
	Maximum Vertical Load 1,000 Lbs. (454 Kg.)	
Coburg, Oregon Springfield, Oregon Wakarusa, Indiana Elkhart, Indiana Nappanee, Indiana	Any Towed Vehicle or Trailer Over 1000 lbs (454 kg) Should Have Separate Functioning Brake System.	
	Refer To Owner's Manual For Additional Towing Guidelines	

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

### WARNING:

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

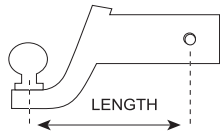
### WARNING:

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

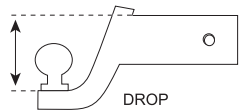


**Ball Mount:**

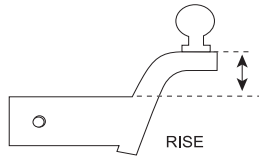
Ball mounts come in various configurations and weight limitations. Three things must be considered when selecting a ball mount: weight rating, pin to ball center length and rise/drop. The weight rating of the ball mount, tongue weight and tow weight must meet or exceed the total load weight. Pin to ball center should not exceed 8". Ball mounts of longer length will significantly reduce the weight rating of the hitch receiver. Observe weight reduction percentages that may be listed on ball mounts longer than 8". Selecting how much rise or drop a ball mount will need is relative to hitch receiver height and height of the towed load with respect to the type of towing equipment between the motorhome and towed load.



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



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



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

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**Weight Distributing Hitches:**

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

**Hitch Ball:**

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

**Safety Chains:**

Safety chains are required by law when towing any load. The chains and any fasteners used to attach the chains to the hitch receiver must be rated for the load being towed. Attach chains so they crisscross under the towing equipment. Allow just enough slack in the chains to make sharp corners. Too much slack will allow the chains to drag on the road surface. If the towed load should become uncoupled from the hitch ball, the towing equipment will be cradled

by the safety chains. If the towed load does uncouple, do not attempt to make a sudden stop and exacerbate the situation. Apply the brakes with gentle, steady pressure. Pull over to the side of road at a safe location.

**Tow Capacity and Class Ratings:**

Several components comprise a tow hitch system. The weight rating of individual components that are part of the towing system must be greater than the gross weight of the load being towed. To help define weight capacity of towing equipment, components are classified into weight groups. Maximum tow capacity is limited to the component with the lowest weight rating in the tow hitch system. Example: a ball mount may have a weight rating of 5,000 lbs. but the hitch ball is rated 3,500 lbs. Maximum tow capacity is reduced to 3,500 lbs. Many times a component will have a Class weight rating. These groups are shown in the class weight rating chart.

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

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

**WARNING:**

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

**Calculating Tow Capacity:**

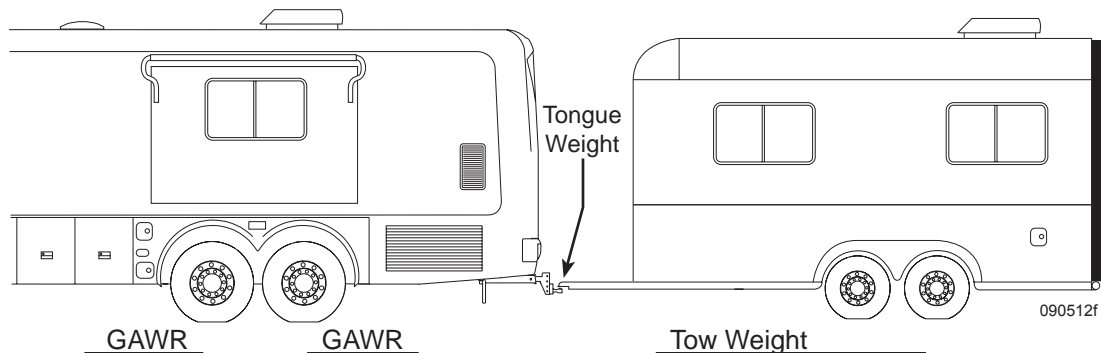
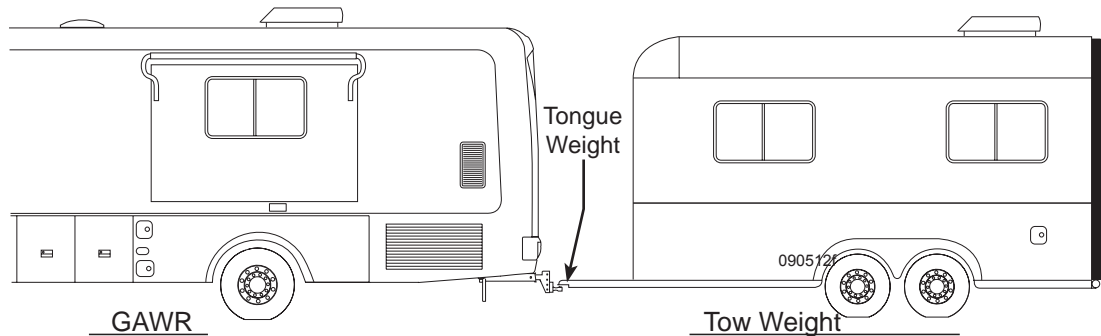
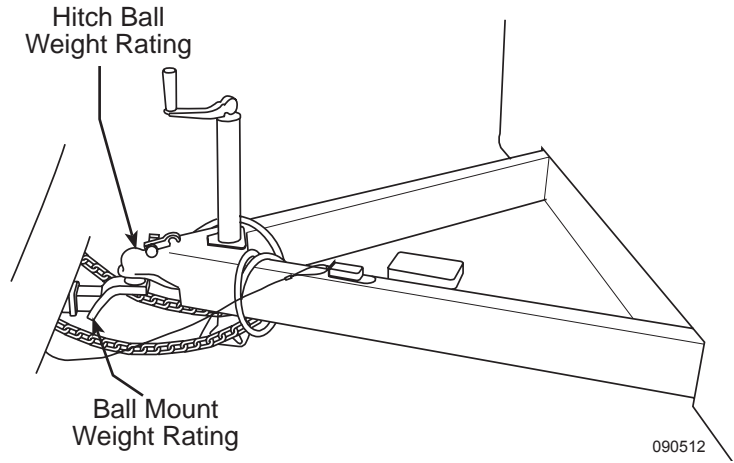
Several variables must be reviewed and calculated to properly determine towing capacity. Limiting factors include GCWR (Gross Combination Weight Rating), GAWR (Gross Axle Weight Rating), hitch receiver weight rating and the weight rating of each piece of towing equipment. One or some of these variables will limit tow capacity.

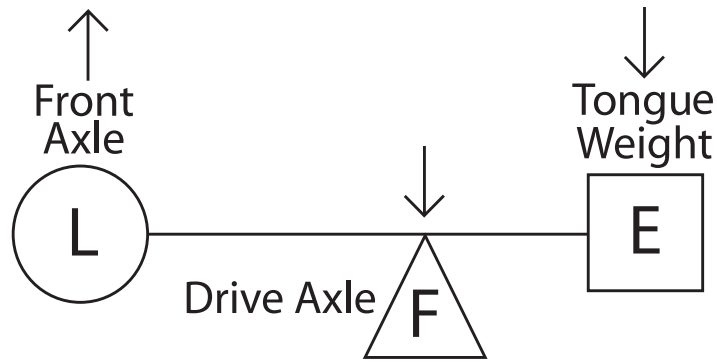
**Example:** The tow vehicle has a GCWR of 35,000 lbs. The tow vehicle in a fully loaded, ready for travel condition, weighs 29,500 lbs. The hitch receiver is rated at 700 lbs. tongue, 7000 lbs. tow. The load being towed weighs 4,200 lbs. with a tongue weight of 400 lbs. However, the hitch ball is rated at 3,500 lbs. In this case tow capacity is limited to 3,500 lbs. due to the rating of the hitch ball, even though the rest of the towing equipment, hitch receiver and vehicle GCWR are within specifications.

It is possible to be within the GCWR but exceed the GAWR. When tongue weight is applied, mechanical advantage increases with distance (lever) from the hitch ball to the drive or tag axle. The drive or tag axle now becomes a pivot point (fulcrum). As tongue weight increases (effort), weight on the drive or tag axle also increases (fulcrum) while weight on the front axle decreases (load).

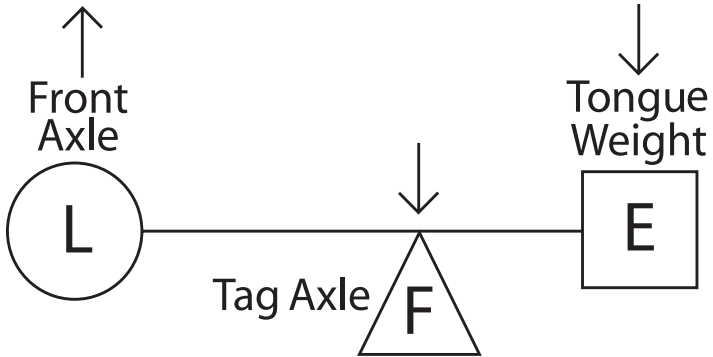
It may be necessary to weigh both the tow vehicle and towed load as an assembly to ensure the GAWR is not exceeded.

It is also possible to be within the rating of the hitch receiver and yet exceed the GCWR.





E= Effort    L= Load    F= Fulcrum



E= Effort    L= Load    F= Fulcrum

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Due to changes in weight, the motorhome must be weighed in a loaded, ready for travel condition that includes passengers, cargo and liquids. Subtract the weight of the motorhome in a loaded, ready to travel condition from the GCWR to determine tow capacity. Whether towing a vehicle or trailer, the load being towed must be weighed to ensure the towed weight, when added to the tow vehicle, will not exceed the GCWR and the weight ratings of each tow system component are equal to or greater than the load being towed.

**WARNING:**

The motorhome and towed load must be weighed after they are loaded for travel to determine if actual weights are within towing specification. Each component of the towing system must be rated equal to or greater than the load being towed. Do not exceed the Gross Combination Weight Rating.

**Taillight Configuration:**

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

Towing Weight Checklist				
<b>Towed Load</b>	(Tongue Weight) _____	(Overall) _____	Yes	No
<b>Towing Equipment</b>	(Ball Mount) _____	(Hitch Ball) _____	Yes	No
<b>Hitch Receiver</b>	(Tongue) _____	(Tow) _____	Yes	No
<b>GAWR</b>	(Rated) _____	(After Hitching) _____	Yes	No
<b>GCWR</b>	(Rated) _____	(After Hitching) _____	Yes	No

Insert Weight Ratings: Check Yes or No if within specifications.

### Tow Plug Connection:

The motorhome is pre-wired from the factory with an electrical connection (located on the hitch receiver) for towing. Convoluted tubing protects the tow harness wires. Current draw should not exceed 7.5 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 while the motorhome ignition is on.

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.

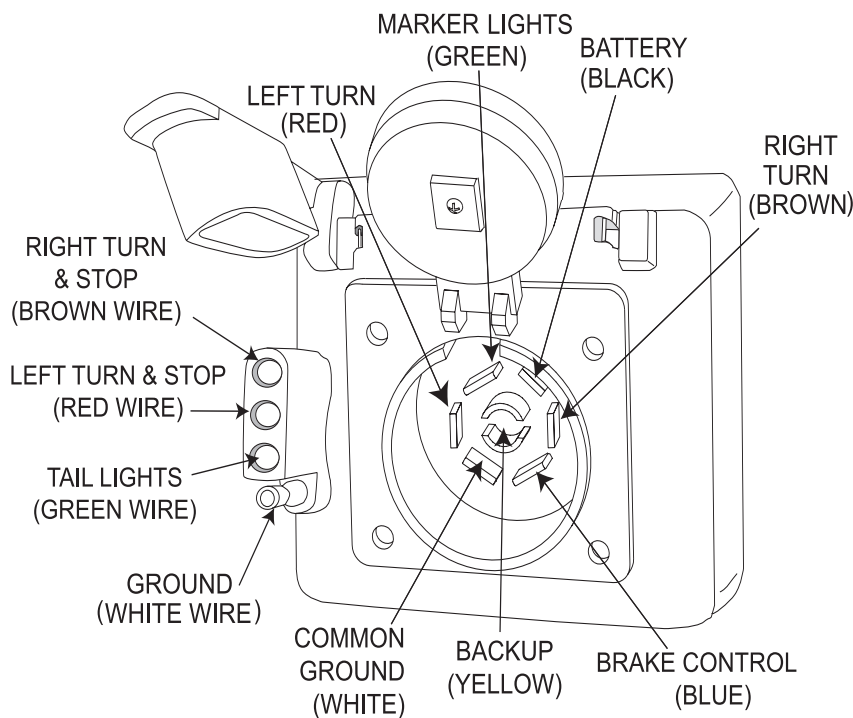
### To Tow Car or Trailer:

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

### REAR VIEW SYSTEM

The motorhome is equipped with a rear vision system. This system includes up to three cameras and a dash mounted monitor. The cameras are located at the rear and sides (optional) of the motorhome. The camera select button on the monitor is used to alternate camera views. The ignition must be in the ON or ACC position for monitor operation.

When the rear view system is on, the camera view will automatically change to the rear view when the transmission is placed in reverse. The camera view will also change to a side camera with turn signal activation. This system may be used while driving in forward, reverse or when parked.



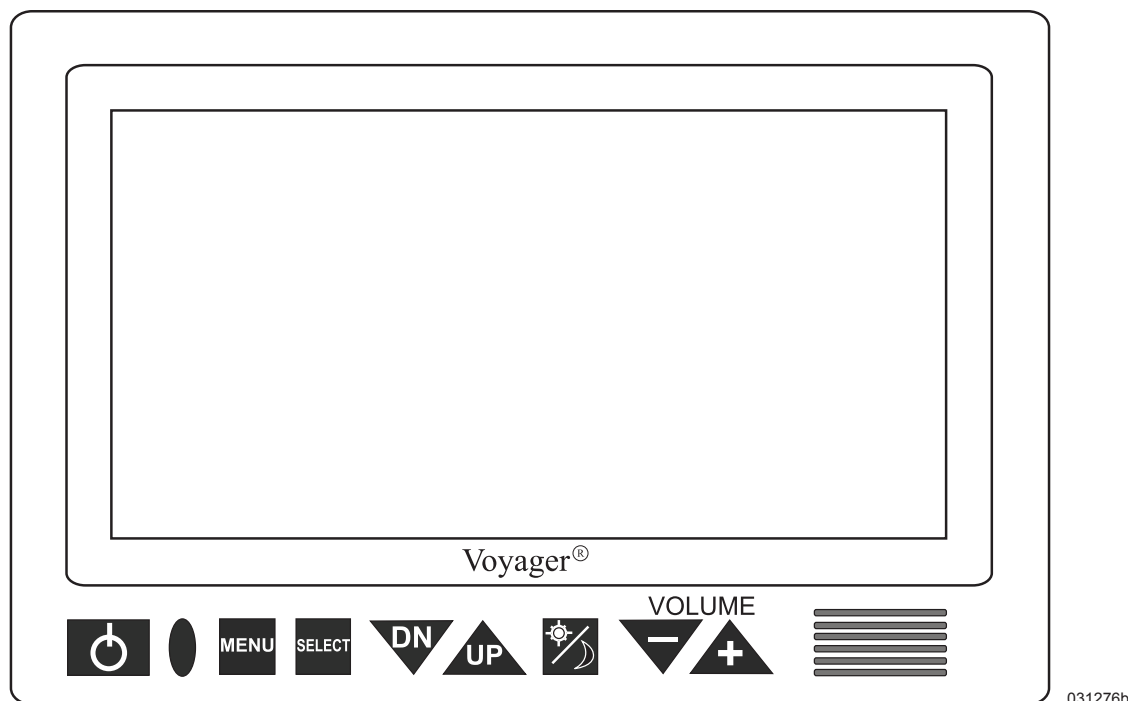
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### Monitor Controls

- ◆ **Power Button:** Press button to turn the unit on or off. Turn the unit on to allow continuous operation of the rear vision system when the ignition key is on.
- ◆ **Menu:** Press to enter or exit main menu mode. Functions that can be adjusted include brightness, contrast, color, tint, initial setup, auto-scan, split screen and distance markers.
- ◆ **Select:** Press button to sequence through input channels. The **Select** button is also used to select a highlighted function or option setting.
- ◆ **Up/Down:** Adjusts rear camera position upward and downward. In addition, while in the Menu mode, the **Up/Down** button navigates through the available menu options.
- ◆ **Day/Night:** Press button to change setting for daylight or nighttime driving conditions
- ◆ **Volume (+/-):** Adjusts volume. In addition, while in the Menu mode, the “-” and “+” button adjusts settings and navigates through the available menu options.

### **INFORMATION:**

**For more detailed instructions, consult the OEM manual or visit the manufacturer’s website at [www.asaelectronics.com](http://www.asaelectronics.com).**



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### To Display Camera Views:

- ◆ Place the ignition in the ACC, ON or START position.
- ◆ Turn on the monitor.
- ◆ Press the “Select” button on the monitor repeatedly to change camera views. The monitor will display each input channel separately and then will display a split-screen, tri-screen and quad-screen view.
- ◆ Leave the system powered on to enable automatic camera views.

### **NOTE:**

**The rear camera view will automatically display when the transmission is placed in reverse if the monitor is on.**

### **NOTE:**

**On motorhomes equipped with optional side cameras, the camera views will automatically change with turn signal activation.**

## BACKING UP A MOTORHOME

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

The backing process should begin while the motorhome is in forward motion. Maneuver the motorhome to align with the chosen site. Aligning the motorhome with the site after the backing process begins may require more than one attempt.

When the motorhome is properly aligned with the site, the parking area will be visible in both mirrors. Use road markings as reference points when possible.

When pull-through sites are not available, pick a solid, level site on the left side for a better field of vision using the roadside mirror. If the site is on the right, use the curbside mirror for backing up, but stay aware of blind spots. Get out and walk the area prior to backing in. Look for potential hazards or obstacles that may damage the motorhome. If the site is satisfactory, prepare to back in carefully. Have the co-pilot provide guidance using the five hand signals. Use of walkie-talkies will also aid in guidance.

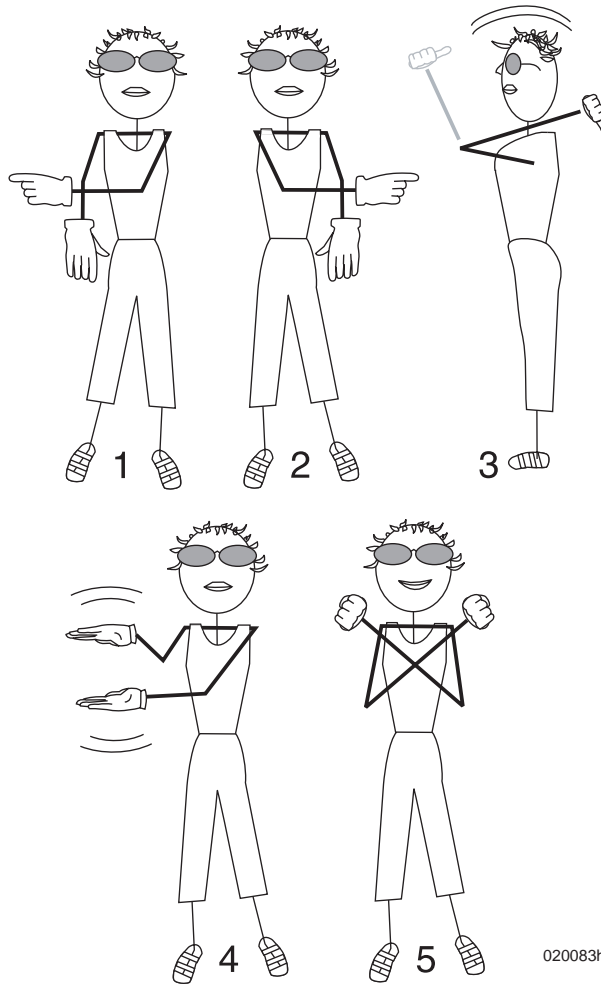
The co-pilot will perform just as important a job as the driver. When guiding the driver, the co-pilot should be located safely at the left rear corner of the motorhome, facing forward, while remaining visible in the roadside mirror at all times. The co-pilot should make a conscious effort to maintain sight of the driver through the roadside mirror as the motorhome maneuvers. If the driver loses sight of the co-pilot, stop the backing up process until the co-pilot returns to view. To avoid mishaps, the co-pilot should be focused only on what the driver is doing, with brief observation moments. If necessary, stop the backing up process to have co-pilot **inspect** other areas or angles of concern.

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

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

#### Five Directional Signals:

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



#### Backing Up Trailers:

Towed vehicles using a tow bar or tow dolly have more than one pivot point and are not suitable for backing. Attempting to back up the motorhome while connected to a tow bar or tow dolly can jack-knife the tow device causing the wheels of the towed vehicle to move in a forward “sideways” motion that will cause irreparable and expensive damage. If necessary, disconnect the tow vehicle to avoid a backing up situation.

Trailers have one pivot point and may be backed up. The same rules for backing a motorhome can be applied to backing a trailer. When preparing to back the trailer into a space, maneuver the motorhome sweeping wide. Turn back to the opposite direction to maneuver the trailer into the space. Keep the bottom of the steering wheel in the desired direction of travel for the trailer. **For example:** If the desired direction of the trailer is left, rotate the bottom of the steering wheel left.

If the trailer moves in an undesired direction, pull forward just far enough to align the trailer with the space. The co-pilot should stand safely at the left rear corner of the trailer within view of the driver in the roadside mirror, using the five hand signals for guidance.

#### **CAUTION:**

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

#### SET-UP PROCEDURES

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

### 1. Level the motorhome:

- ◆ Follow the procedures and guidelines for “*Leveling the Motorhome*” in Section 10. If the motorhome is equipped with hydraulic jacks, confirm that the parking surface will accommodate the weight placed on the jacks.

### 2. Hook up utilities and prepare appliances for use:

- ◆ Open the propane tank primary valve.
- ◆ Prepare the shore cord for connection. Uncoil and **inspect** the cord. Perform necessary cord maintenance. Install proper electrical adapters if anything other than 50 Amp service is provided. Operate electrical appliances in sequence when hooked to limited shore power service. Turn shore power circuit breaker **OFF** prior to plugging in the shore cord.
- ◆ If hooked to less than 50 Amp service, begin refrigerator operation on propane for the first 60 minutes. This allows time for the inverter to stabilize battery charging.

#### **CAUTION:**

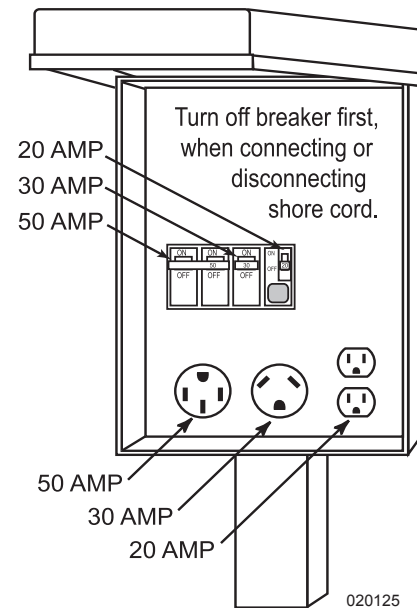
If shore power service is limited to 15 or 20 Amps, use of light duty extension cords and electrical adapters will create a voltage loss through the cord and at each electrical connection. Line voltage loss and the resistance at each electrical connection can be a hazardous combination. Damage to sensitive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

#### **CAUTION:**

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

#### **NOTE:**

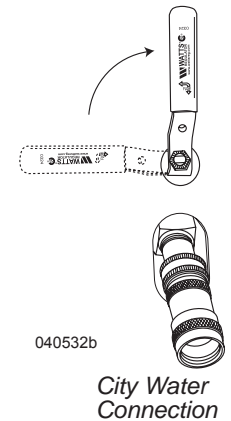
To avoid shore power overload when hooked to 30 Amp service, determine appliances current load prior to turning on appliances or using interior outlets.



Typical Power Pedestal

- ◆ If cable service is provided, hook-up a 75 Ohm RG59 or RG6 cable to the cable connection in the service center.

- ◆ A phone connection port is provided in the service center. Phone utility outlets are placed throughout the motorhome, including a phone line for Pay-Per-View movies and events.
- ◆ Attach a potable water hose to the city water connection in the service center.
- ◆ Hook-up the sewer hose. Sewer drain pipe diameters are generally either three or four inches. Proper sewer hose adapters will ensure against leaks or spillage. With the sewer hose properly connected open the grey water valve (small valve). The black water valve (large valve) remains closed until the tank is full or until time of departure.



### DRY CAMPING

Below are suggestions to follow when staying at a location that does not have electrical, water or sewage hook ups. Plan ahead and conserve resources.

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

**To conserve water and fuel:**

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

**To conserve battery power:**

- ◆ **DO NOT** allow batteries to fully discharge before operating the generator. If possible, run the generator twice a day (morning and afternoon) to charge the batteries.
- ◆ Turn **OFF** the inverter when not using it for 120 Volts AC.

- ◆ Turn **OFF** interior 12 Volt DC power whenever possible. Refrigerator, battery charging and inverter operation is not affected. Turn **OFF** small battery operated items i.e., porch, bay exterior step, generator and engine compartment lights, etc. Turn **OFF** the antenna boost when not watching TV. One light left on can quickly reduce battery reserves.

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

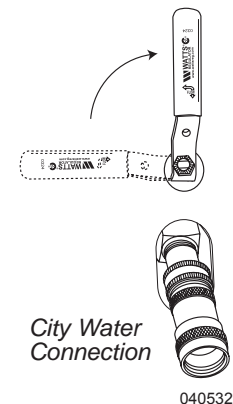
- ◆ Keep a working flashlight handy for night trips through the campsite and inside motorhome. When interior lighting is desired, use one light in a central location, such as the vanity. Unscrew all but one or two bulbs.
- ◆ Keep the solar panel (if equipped) clean for optimum performance.
- ◆ Turn on the water pump only when using water.
- ◆ If weather does not permit or an outdoor table is not available, eat at the dinette table by candlelight.
- ◆ Operate the generator when using microwave/convection oven.

**BREAKING CAMP**

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

**Outside Checklist:**

- ◆ Disconnect the cable TV and lower the TV antenna.
- ◆ Disconnect and stow the telephone line.
- ◆ Retract awnings and secure them for travel.
- ◆ Close the primary propane tank valve.
- ◆ Connect the sewer hose.
- ◆ Drain and flush holding tanks. Start by closing the grey water valve. Run enough cold water down sink and shower drains to fill the grey tank at least 50%. Use caution to avoid overfilling or flooding the grey tank. Connect a non-potable water hose to the “Waste Tank Flush” fitting in the lower left corner of the service center. Open the black tank drain valve and allow adequate time for black tank to drain. Close black tank valve and open grey water valve. Water from the grey tank will help to flush the drain hose. Once evacuated, close grey water valve. Disconnect the sewer hose and flush that hose with clean water from a non-potable hose. Store the hose. Replace the sewer cap.





- ◆ Fill fresh water tank, then disconnect fresh water hose from the source. Store hose with end cap in place. If applicable, remove the water pressure regulator that is protecting the potable hose from the city water faucet.
- ◆ Turn shore power breaker off and disconnect shore line. Wind up and store shore cord. Secure door.
- ◆ **Inspect** fluid level in oil bath hubs (if applicable) and check all tire pressures.
- ◆ Secure all compartment doors.
- ◆ **Inspect** tires and wheels.
- ◆ Check for fluid leaks under and around the motorhome.

#### Engine Checklist:

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

#### Interior Checklist:

- ◆ If applicable, retract leveling jacks and allow the air suspension to obtain proper ride height.
- ◆ Clear the slide room path and clean the floor. Move the driver seat forward. After confirming bay doors are closed, retract the slide room.

#### NOTE:

**Ignition must be OFF and the park brake set to extend/retract the slide-out room. The jacks must be retracted and the motorhome supported by the air suspension before extending/retracting the slide-out.**

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

#### Departure Checklist:

- ◆ Check items in storage bays to ensure shifting or damage of items will not occur.
- ◆ Look around, above and under the motorhome for obstructions. Check for debris stuck between the rear dual tires.
- ◆ Close and lock outside compartment doors.
- ◆ Check operation of all exterior lights, headlamp, taillamp, brake and clearance lights.
- ◆ Secure all awning travel locks.
- ◆ Ensure jack pad is clear of debris when retracting hydraulic jacks. Loose rocks, gravel and debris can be thrown from the jack pad and can possibly damage the tow car.

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

## EMERGENCY ROADSIDE PROCEDURES

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

Road flares or reflective warning signs should be displayed if the motorhome is on the side of the road for any length of time. Guidelines for placing warning triangles depend upon the road characteristics and visibility. **For example:** The standard placement is 10, 100 and 200 ft. from the rear of the motorhome when on a divided highway or one-way road. On a two-way road, with traffic traveling both directions, the same placement 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 ft. behind the motorhome in order to safely warn approaching traffic.

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

### In Case of Flat Tire



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

#### **WARNING:**

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

#### **WARNING:**

**If a flat tire cannot be repaired, the replacement tire must be of the same size, weight rating and load range as the original tire.**

### Dead Chassis Battery

A weak or discharged battery will not supply the amount of **CCA (Cold Cranking Amps)** necessary to initiate the required voltage to start the engine.

If the engine fails to crank, or cranks slowly due to a weak chassis battery, there are electrical back-up systems in place that may increase chassis battery voltage.

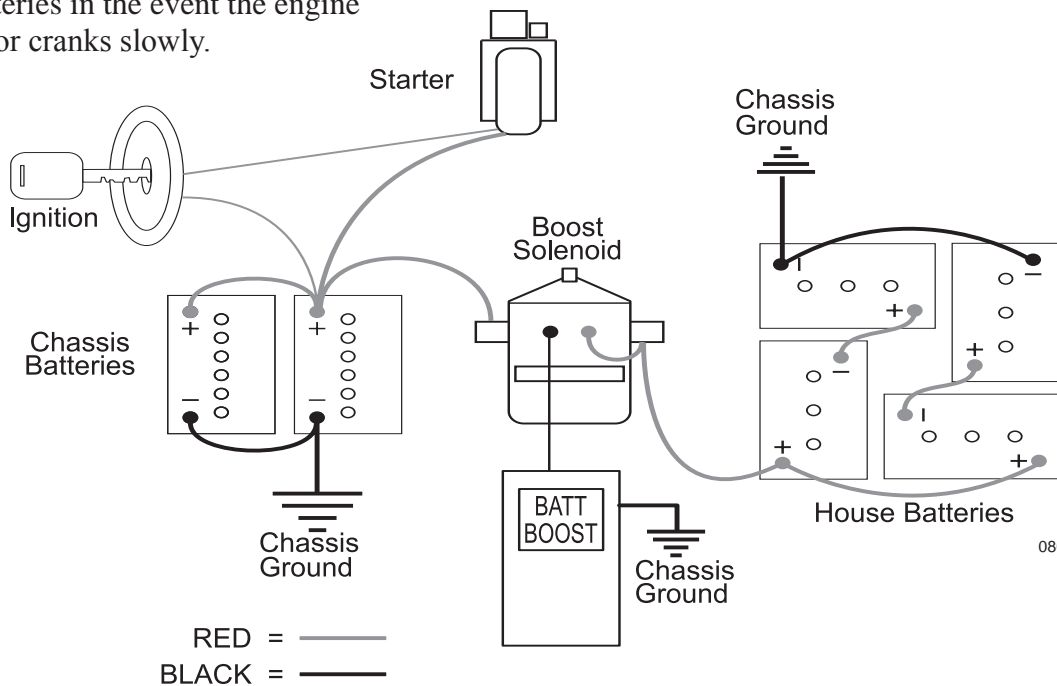
#### Battery Boost Switch:

The Battery Boost switch (located on the driver's console) engages a heavy-duty solenoid to electrically connect the house batteries to the chassis batteries in the event the engine will not crank or cranks slowly.

The solenoid is designed for short-term high current intermittent use. Engaging the boost solenoid for an extended period will damage the solenoid.

#### Jump Starting Using Battery Boost Switch:

- ◆ With the ignition key **OFF**, press and hold the Battery Boost switch for ten seconds. After ten seconds, continue to hold the switch down and turn on the ignition. If voltage is sufficient, try to start the engine.
- ◆ If the engine fails to crank or does not crank fast enough, discontinue the attempt. Continued attempts will only diminish any remaining surface charge in the chassis battery and end future alternative attempts.



080349

- ◆ Next, start the generator. This may require using the Battery Boost switch for the generator to start from the engine battery. Once the generator is operating, the electrical combination of the generator and the inverter will charge the batteries.
- ◆ Allow the generator to run approximately ½ hour before attempting to start the engine.
- ◆ After ½ hour of generator operation, leave the generator on and hold down the Battery Boost switch for one minute. Release the switch for one minute, then press the switch again for one minute. Alternate this cycle three to five times.
- ◆ Next, hold the switch down and turn the ignition ON. If voltage is sufficient with the Boost switch held down, try to start the engine.
- ◆ If the engine fails to crank, or fails to crank quickly, the chassis battery may be depleted and the motorhome will require jump-starting or an external charger hooked to the chassis battery.

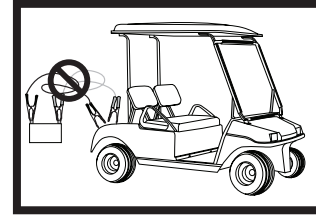
### Jump-Starting Using an External Source:

When using jumper cables to start the engine, the cables must connect in a parallel configuration. That is, positive (+) to positive and negative battery (-) to negative chassis (-). Always connect the positive (+) before connecting the negative (-). To prevent arcing when disconnecting the cables; disconnect the negative (-) before disconnecting the positive (+).

### CAUTION:

**DO NOT use the towed vehicle or other electrically incompatible sources for jump-starting.**

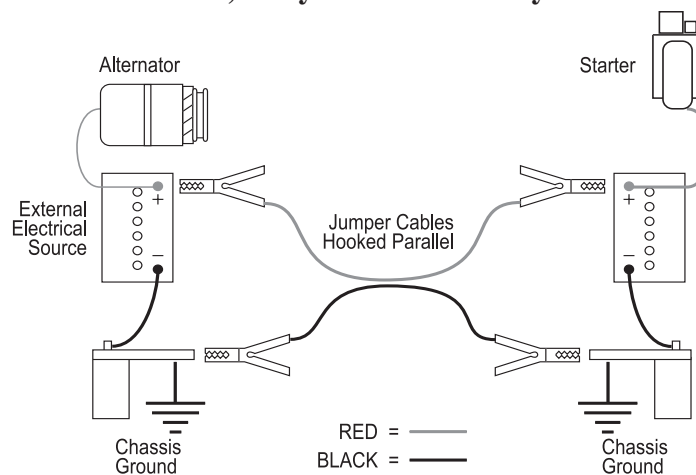
**The charging system of the towed vehicle does not supply the amperage necessary to jump-start the motorhome. Voltage sensitive equipment on the towed vehicle or motorhome can be damaged and render the towed vehicle disabled.**



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### WARNING:

**Always ventilate the battery compartment prior to any work or service to the batteries. Gas emitted by the batteries can explode when exposed to smoking material, flames, sparks or other sources of ignition, resulting in injury or vehicle damage. Batteries contain sulfuric acid that can burn skin, eyes and clothing. DO NOT connect the end of the second cable to the negative (-) terminal of the battery to be jumped. Connect only to the chassis, away from the battery.**



Typical jump-start connection.

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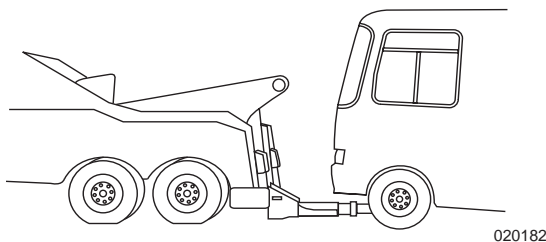
### CAUTION:

**A large amount of electrical current is required to jump-start an engine. The sizes of the battery, alternator and jumper cables supplying the “jump” are current limiting factors. Wait a sufficient amount of time for a surface charge to build before attempting to start the engine. Voltage fluctuations that occur during a jump-start procedure can damage sensitive electronic equipment and charging systems. If a jump-start is necessary, it is recommended to call Roadside Assistance. They will have the equipment necessary to jump-start the motorhome.**

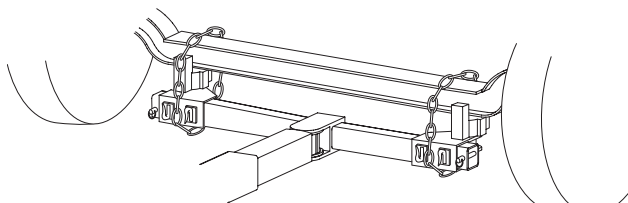
1. When using an external electrical source to connect to the chassis battery, turn the main battery disconnect switches OFF prior to hooking up the jumper cables.
2. Hook up the cables then wait several minutes to allow a surface charge to build in the chassis battery before attempting to start the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

## TOWING PROCEDURES

If calling a towing company for service, it is recommended to use a lowboy/landall type of trailer. If a tow truck is used it needs to have a support arm that goes under the motorhome and secures to the front axle. Inform the tow company of the axle weights and total weight of the motorhome.



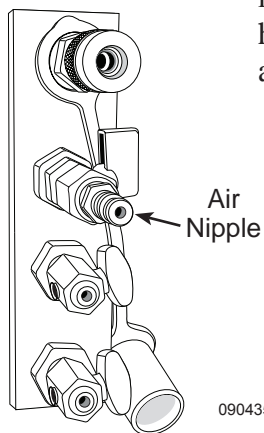
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Other important information is the length of the motorhome, number of passengers and milepost location. Two tow trucks may be necessary to tow the motorhome and a trailer or tow vehicle if it is not operational.

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.



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**Air Nipple:** Located roadside in generator compartment

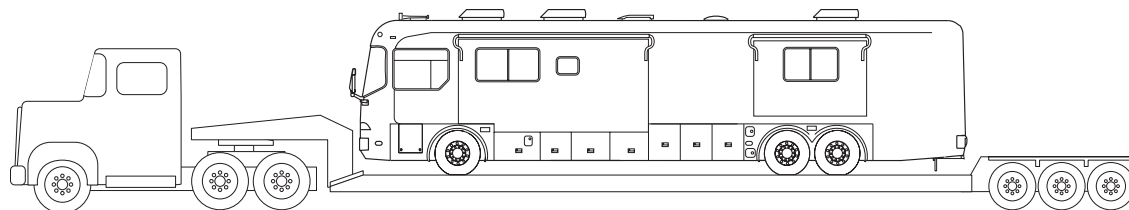
Generally, if the motorhome ever needs to be towed, use the following instructions:

- ◆ Secure any loose or protruding parts if the motorhome is damaged.
- ◆ **Inspect** 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 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 Air-Leveling System, the ignition **MUST** be left in the **ON** position. The **Travel** indicator lamp on the panel must be illuminated for the air suspension to 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.**



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### Disabling Parking Brake

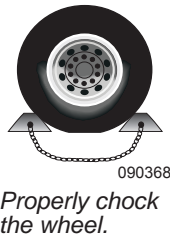
The park/emergency brakes apply to the drive axle only. The brakes can be manually released if the air system will not build sufficient air pressure to release them. This emergency procedure is to be used by trained technicians or towing personnel to move the motorhome to a safe location or repair facility.

**WARNING:**

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

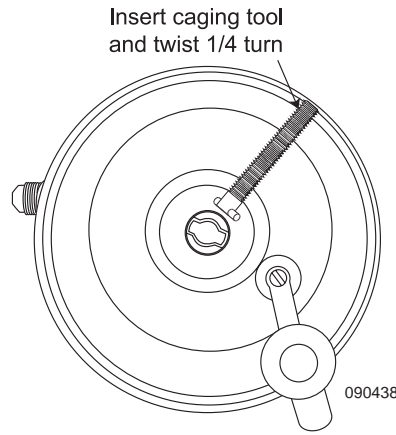
### Disabling Brakes:

- ◆ Place wheel chocks firmly against the wheel before performing this procedure.
- ◆ Remove the plug from the center of rear brake chamber on the drive axle.
- ◆ Remove the caging tool from its holder on the brake chamber and insert the tool into hole. Turn clockwise to engage.
- ◆ Screw the nut and washer onto the caging tool. Use a wrench to tighten the nut, compressing the internal spring to release the brake.
- ◆ Repeat procedure for the other side.

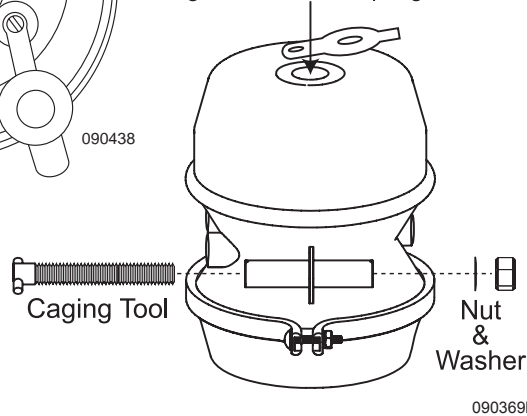


### Enabling Brakes:

- ◆ After towing, or when air pressure is again available, loosen the nut and remove the tool. Return the caging tool to its original location and replace the plug.
- ◆ Repeat for the other side.



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



**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.**

### TIRES

Maintaining proper tire inflation pressure is one of the most critical aspects of travel. Improper pressure will lead to abnormal wear and/or sudden tire failure.

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

### Tire Components:

**Tread:** Provides traction and cornering grip.

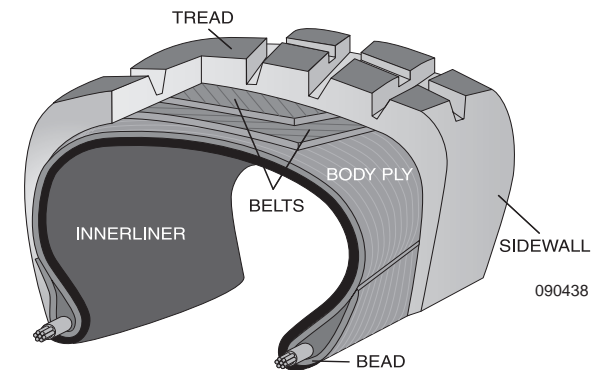
**Belts:** Stabilize and strengthen the tread.

**Sidewall:** Protects the side of the tire from road and curb damage.

**Body Ply:** Gives the tire strength and flexibility.

**Bead:** Assures an air-tight fit with the wheel.

**Inner Liner:** Keeps air inside the tire.



## Importance of Air Pressure

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

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

An over-inflated tire will reduce the tire 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 and can result in sudden tire failure. A damaged sidewall can burst upon inflation resulting in serious damage, injury or death. Aged tires are also susceptible to sidewall damage.**

## Tire Pressure Inflation Guideline

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

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

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

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

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

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

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

## Tire Charts

### **Understanding the Inflation Table:**

The tire size on the left margin of the table determines single inflation reading or dual inflation reading denoted with a D or S. Single is for the front axle and tag axle (if equipped). Dual is for the drive axle. On the following chart, find the corresponding psi at the top columns to see the corresponding maximum weight capacity for that psi.

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

### **NOTE:**

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

### **WARNING:**

**DO NOT exceed tire manufacturer's maximum speed rating.**

## Goodyear Tire Chart

Tire Size	Max Speed Rating (MPH)	Single (S) Dual (D)	INFLATION PRESSURE PSI												
			65	70	75	80	85	90	95	100	105	110	115	120	125
295/80R22.5	75	S D				5480	5750	6020	6285	6550	6810	7070	7320	7580	7830(H)
						4855	5100	5335	5570	5805	6035	6265	6490	6720	6940(H)

The motorhome manufacturer is not the author of this chart and makes no representation or warranty concerning the accuracy of the information disclosed by the chart. Monaco is not responsible for the accuracy of the information disclosed or for any errors within the Tire Inflation Chart. **WARNING: Do not exceed tire manufacturer's maximum speed rating.**

### Inspecting & Pressure

Weigh all tire positions separately and use the tire charts to determine correct tire inflation pressure. All pressures are rated at a cold psi. Cold psi is defined as early in the morning before the day's ambient temperature, heat of the sun or heat generated while driving have caused the tire pressure to temporarily increase. Check tire inflation pressure every morning before driving. Use a quality truck tire gauge with an angled head to ensure access to the dual wheel positions of the drive axle.

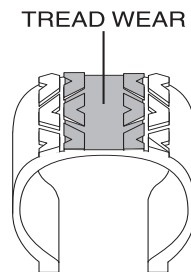
Ensure the valve cap is replaced on the stem after the inflation pressure is checked. Use valve stem caps with a positive seal to prevent air escaping from the valve stem. If extension hoses are on the valve stem, make sure they are good quality reinforced stainless steel braid. Attach hoses securely to the outer wheel. The valve stem cap guarantees the valve core will remain free of dirt and foreign material. Material lodged between the valve core and internal stem can cause slow leaks resulting in tire failure.

Optimum tire performance is achieved at proper inflation pressure for the load carried. **DO NOT** mix tires of different tread patterns, size or construction. The difference in traction could cause abnormal handling, rear end gear bind and mechanical damage to the drive train.

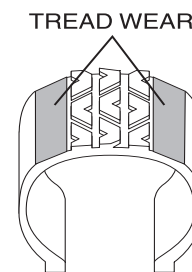
**CAUTION:**  
**Never let air out of a hot tire.**

#### Over-inflation can cause:

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



Over-inflation wears in center of tire.



Under-inflation wears on edges of tire.

#### Under-inflation can cause:

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

#### **WARNING:**

**A slow leak may go unnoticed on one of the dual tires. This can cause the good tire to fail by exceeding the load limit. Tires with damaged sidewalls can burst upon inflation. A flat or nearly flat tire can also generate enough heat from friction to ignite.**

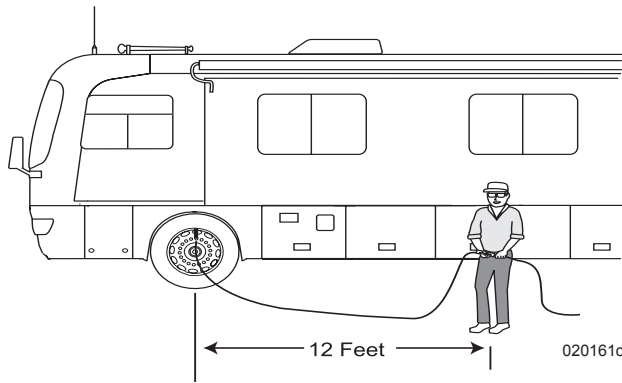
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**Unequal tire pressures on the same axle can cause:**

- ◆ Uneven braking
- ◆ Swerve upon acceleration
- ◆ Steering lead
- ◆ Torque steer
- ◆ Reduced handling quality

**WARNING:**

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



***Air Pressure Checklist***

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

**NOTE:**

**If the motorhome must be driven a distance to get air, check and record the tire pressure first and add the recorded calculation when reaching the pump. It is normal for tires to heat up and the air pressure to increase as driven. NEVER reduce air pressure when tires are hot.**

**NOTE:**

**Air pressure in a tire goes up (in warm weather) or down (in cold weather) one to two pounds for every 10° F. of temperature change.**

2. Remove cap from the valve on one tire.
3. Firmly press a tire gauge onto the valve and record reading.
4. Add air to achieve recommended air pressure.
5. If the tire is overfilled, release air by pushing on the metal stem in the center of the valve. Recheck the pressure with the tire gauge.
6. Replace the valve cap.
7. Repeat with each tire.
8. Visually inspect all the tires for nails or other objects that could be embedded or puncture the tire and cause an air leak.
9. Check the sidewalls for gouges, cuts, bulges or other irregularities.

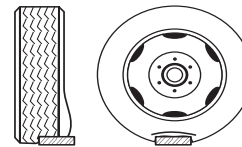
***Tire Support When Leveling***

Extreme caution must be taken to ensure the tires are fully supported when placing blocks under the tires. The load on the tire should be evenly distributed on the support block. In the case of dual tires, distribute the load evenly on blocks for both tires.

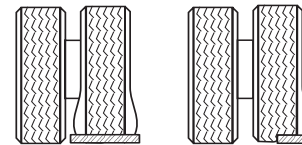
**Tire "Support" Methods**

**INCORRECT**

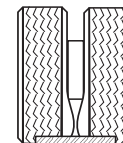
**Singles**  
Only a portion of the tire is supporting the full load.



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

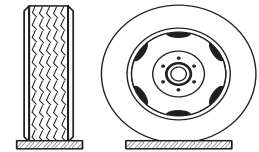


One tire or a portion of the two tires supporting the full load.

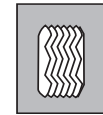


**CORRECT**

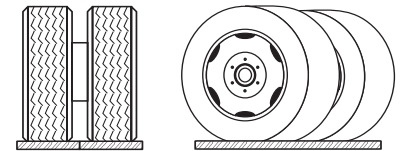
**Singles**



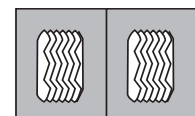
**Tire Footprints**



**Duals**



**Dual Tire Footprints**



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If not properly supported, the steel cables in the sidewall of the tires may be damaged and could lead to premature fatigue of the sidewall.

**CAUTION:**

**Supporting the tires prevents damage to the sidewall of the tires but does not prevent tire roll.**

### ***Tire Vibration***

Sudden tire failure is often preceded by tire vibration. Symptoms that can cause tire failure are a bulge in the sidewall or swelling in the tire carcass. Striking an object or large hole in the road surface can damage a tire. Inspect the tires periodically thereafter as rotational forces can continue to stress damaged areas and later manifest in tire failure. If an unusual vibration begins, or a bulge is noticed in the sidewall, have the tires evaluated by a qualified professional as soon as possible.

### ***Tire Rotation***

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

### ***Tire Replacement & Related Information***

As represented within the tire manufacturer's published tire data guide, the size and rated load carrying capacity of the original equipment tires on your motorhome meet or exceed the motorhome's maximum axle weight/load ratings.

Criteria used to determine when tire replacement is necessary are road hazard damage, wear, and age. Tire replacement based on wear is determined by either measuring the tire groove depth or a visual inspection of wear bars. Replace tires when the groove depth is 2/32" or less on rear tires and 4/32" or less on front tires. Wear bars are raised areas cast into the groove of the tire. Replace the tire when the wear bar in the groove is even (preferably before) with the road surface contact patch. A worn out tire cannot adequately channel water through the groove, which will result in hydroplaning.

The tire manufacturer determines tire replacement based on age. While ozone inhibitors in the rubber help extend the life expectancy of a tire, exposure to the elements slowly breaks down the rubber, which can then suddenly fail when put to use. Tires that are five to seven years old (depending upon environment) are considered age worn and need to be replaced for safety even though the tire may not outwardly show age weathering and still has considerable tread.

Replacement tires must be of the same manufacturer brand, model, size, and load range at each wheel position (matched set) and must have a load rated carrying capacity equal to or greater than the original equipment tires. Mixing tires of a different brand, model, size, load rating and load range can cause unusual handling and uneven braking due to different traction coefficient and could result in sudden tire failure or loss of control due to non-symmetrical handling.

**WARNING:**

**DO NOT mix tires of different sizes, load ranges or manufacturer brand types or models. Any and all replacement tires must have a rated load carrying capacity equal to or greater than the gross axle weight/load ratings as identified by the federal placard.**

**WARNING:**

**In many instances tire life is not determined by mileage or wear but by age. Tires are subject to weathering. Weathering cracks can appear in the sidewall and also run along the edge of the tire. Though the sidewall of the tire may look structurally sound, weathering can occur inside the groove of the tread. If any tire exhibits age weathering, replace all tires.**

**CAUTION:**

**Signs of irregular tread wear, exhibited by scalloping or unusually smooth areas on the tire surface, are cause for concern. Immediately have the tire manufacturer inspect the tires.**

## Storage of Tires - Long Term

A cool, dry garage with a sealed cement floor is the preferred method of storage. Tires stored outside may prematurely age.

### Prior to Storage:

- ◆ Thoroughly clean the tires.
- ◆ Unload the motorhome to reduce weight on the tires.
- ◆ Ensure the surface is reasonably level, firm, clean and has adequate drainage.
- ◆ Inflate the tires to the maximum inflation pressure as indicated on the Federal Identification Tag.

### During Storage:

- ◆ Cover the tires to block direct sunlight.
- ◆ Periodically check tires for proper pressure.
- ◆ Move the motorhome every three months to prevent cracking in bulge areas, as well as flat spotting from prolonged sidewall strain and tread deflection.

### Removal from Storage:

Before removing the motorhome from long-term storage, thoroughly **inspect** each tire tread area and air pressure. If tires have lost air during storage, inflate them to the correct pressure.

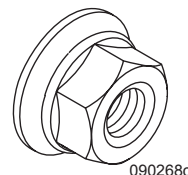
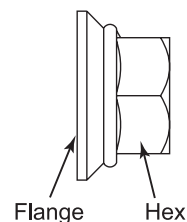
## WHEEL MOUNTING

### Hub Piloted Mounting:

- ◆ Flange nuts generate higher clamping force. Always use grade eight studs with hub mount wheels.
- ◆ Before installing the wheels, lubricate the hub pilot pads with a drop of oil to prevent galling. **DO NOT** lubricate any other wheel or hub surface.
- ◆ For a hub with intermittent pilot pads, position a pad at the twelve o'clock position to center the wheel and reduce runout.

### NOTE:

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



Flange Nut:  
Front & Side  
View.

### WARNING:

**DO NOT** use wheels or lug nuts different than the original equipment as this could damage the wheel or the mounting system. Damage to the wheel or mounting system could cause a wheel to come off while the motorhome is in motion.

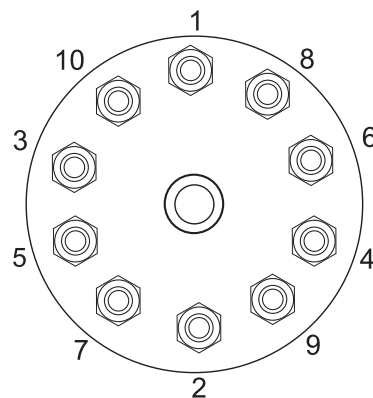
### Front Wheels:

Slide the front wheel over the studs. Use caution to avoid damaging stud threads. Snug the nuts in sequence. When all nuts have been seated, tighten the nuts to 500 ft. lbs. in sequence (as shown in illustration).

### Dual Rear Wheels:

Slide the inner dual wheel over the studs. Use caution to avoid damaging threads. Align the handholds for valve access and slide the outer dual wheel over the studs, again using caution to avoid damaging the stud threads. When all nuts are seated, tighten the nuts to 500 ft. lbs. in sequence (as in illustration).

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



Nut Tightening Sequence

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**Torque the Nuts Properly:**

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

**WEIGHING THE MOTORHOME**

Proper weight distribution, load management and operating within established limitations will aid in safe and enjoyable travel. The information in this section outlines guidelines and provides worksheets for weighing procedures.

Proper weight distribution and load management is an individual responsibility. In order to correctly manage load and weight distribution, more than one weight measurement will be required. Each wheel position must be weighed to accurately determine the weight placed on each wheel position for proper weight computations. The entire process of weight management begins with the **Gross Vehicle Weight Rating** as listed on the Federal Certification Label. **This weight cannot be exceeded.**

**CAUTION:**

**Most States limit the amount of weight carried by any single axle position. It is the responsibility of the operator to know the legal weight limit of the State in which they travel.**

***Weight Limits***

Numerous Federal, State and local governments mandate weight limits. Understanding the terminology and performing proper weighing procedure will help eliminate confusion. It is important to weigh the motorhome to calculate **Cargo Carrying Capacity (CCC)** and ensure no axle is overloaded.

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

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

**NOTE:**

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

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

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

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

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

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

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

### Weight Terms

#### Common Weight Terms and Abbreviations:

- ◆ **Gross Vehicle Weight Rating (GVWR):** Maximum permissible weight of this motorhome. **GVWR** is equal to or greater than the sum of **UVW** plus **CCC**.
- ◆ **Unloaded Vehicle Weight (UVW):** Weight of this motorhome as built at factory with full fuel, engine oil and coolants. **UVW** does not include cargo, fresh water, propane, occupants or dealer installed accessories.
- ◆ **Cargo Carrying Capacity (CCC):** Equal to **GVWR** minus each of the following: **UVW**, full fresh potable water weight (including water heater), full propane weight, and **SCWR**. Tongue weight of towed vehicle and dealer installed equipment will reduce **CCC**.

- ◆ **Gross Combination Weight Rating (GCWR):** The maximum allowable loaded weight of this motorhome and any towed trailer or towed vehicle.
- ◆ **Gross Axle Weight Rating (GAWR):** Load-carrying capacity specified by manufacturer of a single axle system, as measured at tire ground interfaces.
- ◆ **Sleeping Capacity Weight Rating (SCWR):** The manufacturer's designated number of sleeping positions multiplied by 154 lbs.

### Tire Pressure & Weighing

A motorhome may weigh slightly heavier on one side. Tire inflation pressure of the heavier side tires determine the inflation pressure for all tire(s) on that axle due to the weight transfer that occurs when cornering.

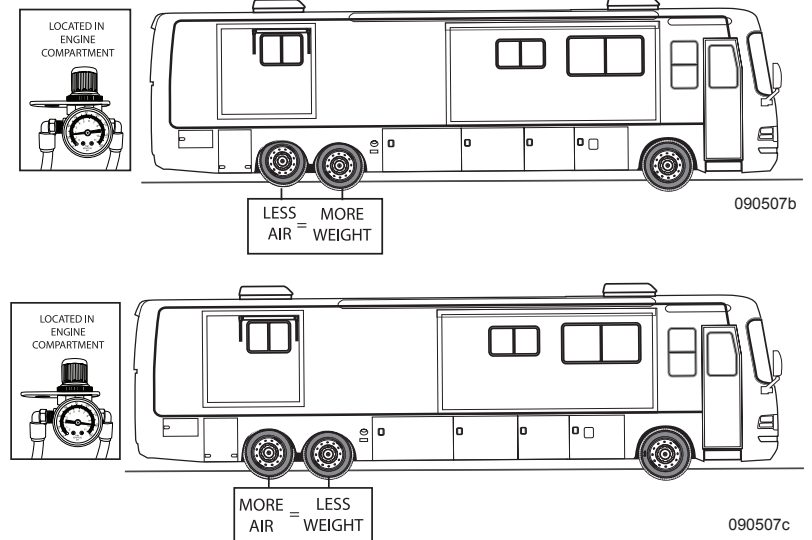
Improperly inflated tires or an incorrectly loaded suspension can result in poor fuel economy, poor handling and over-stressed chassis components. How the motorhome is loaded will influence tire inflation pressure and the load carried by each axle. This is why each wheel position must be weighed. Motorhome axle configuration and floor plan styles will require different weighing procedures.

#### NOTE:

**When weighing a motorhome, each tire on any axle must be inflated to the same pressure. The wheel position carrying the most weight determines the tire inflation pressure for each tire of that particular axle.**

### Tag Axle Regulator (42' Only)

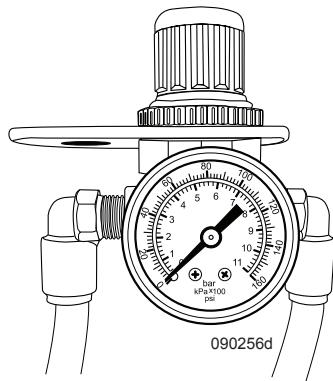
The motorhome tag axle is equipped with an air pressure regulator. The tag axle regulator requires adjustment for the tag axle to maintain proper weight distribution. The adjustable regulator and gauge are located in the engine compartment on the curbside. The regulator controls the amount of air pressure in the tag axle air bags. Increasing air pressure in the tag axle air bags will increase weight carried by the tag axle and decrease weight carried by the drive axle. Decreasing air pressure in the tag axle air bags will decrease weight carried by the tag axle and increase weight carried by the drive axle.



The regulator adjustment knob has a positive lock. Pull up on the knob to unlock; push down on the knob to lock. Turn the knob clockwise to increase air pressure; turn the knob counterclockwise to decrease air pressure. A stabilization procedure must be performed every time the regulator is adjusted to enable a constant air pressure setting.

### Tag Axle Adjustment (42' Only)

- ◆ Start the motorhome and allow the air system to reach a full charge, indicated by release of air from the air dryer.
- ◆ Pull the knob to unlock the regulator. Turn the knob clockwise to increase pressure and counterclockwise to decrease.
- ◆ Ensure the air system is still at full charge.
- ◆ To stabilize the new setting, raise the tag axle using the tag axle switch on the driver's console. Allow approximately 60 seconds for the system to discharge air from the tag axle air bags.
- ◆ Lower the tag axle. The regulator will hold the new air pressure setting.
- ◆ Push down on the regulator adjustment knob to lock the setting.

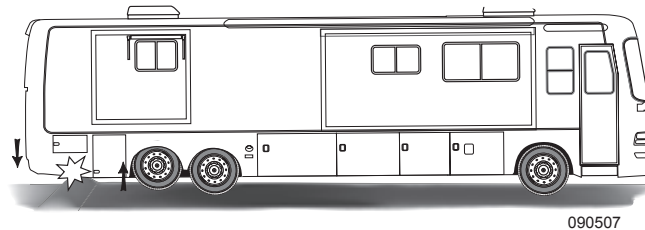


Located in engine compartment on curbside.

When increasing the air pressure setting, allow for an approximately 2 lbs. 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.

**CAUTION:**  
Ground clearance is reduced when the tag axle is raised.



### Scales

Certified public scales are located in moving and storage lots, farm supplies with grain elevators, gravel pits, recycling companies and large commercial truck stops. A public scale may be located by looking in the local telephone book yellow pages under Scales – Public or Weighers. A nominal fee may be charged, but this is money wisely spent.

Weight scale types and weighing methods determine the procedure used to calculate proper tire inflation pressure and axle loading. Several types of scales are in use today. A platform scale allows the entire motorhome to fit on the scale to read the **GVW** in one scale recording. A segmented platform scale is designed to weigh one axle at a time. A single axle scale weighs one axle at a time. Some scales read only one wheel position at a time due to physical size. Several scale readings may be required to determine the **GAW** or **GVW** total. Each wheel position requires weighing to accurately determine the correct tire inflation pressure.

**NOTE:**  
Independently weighing each wheel position is the most accurate method in determining proper tire pressure. Weighing the entire axle will not accurately determine actual weight carried by each wheel position. When weighing the drive axle dual position, divide total weight by two to determine the weight carried by each tire.

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

**Weight Label**

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

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

**GVWR** (Gross Vehicle Weight Rating) is the maximum permissible weight of this fully loaded motorhome .....            
LBS. KGS.

**UVW** (Unloaded Vehicle Weight) is the weight of this motorhome as manufactured at the factory with full fuel, engine oil and coolants.....          

**SCWR** (Sleeping Capacity Weight Rating) is the manufacturer's designated number of sleeping positions multiplied by 154 pounds (70 kilograms) .....          

**CCC** (Cargo Carrying Capacity) is the GVWR minus each of the following: UVW, full fresh (potable) water weight (including water heater), full propane weight and SCWR (\*1).....          

**GCWR** (Gross Combination Weight Rating) is the maximum allowable combined weight of this motorhome and the towable product. (\*1).....          

FACTORY INSTALLED OPTIONS are options installed at the factory but do not include dealer installed after market equipment...          

**CARGO CARRYING CAPACITY (CCC) COMPUTATION**

GVWR.....	_____	_____
minus UVW.....	_____	_____
minus fresh water (*2) weight of _____ gallons @ 8.3 lbs./gal .....	_____	_____
minus propane weight of _____ gallons @ 4.2 lbs./gal .....	_____	_____
minus SCWR of _____ persons @ 154 lbs./person.....	_____	_____
CCC for this motorhome (*3) .....	_____	_____

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

Factory installed options do not include dealer installed after market equipment.

**WARNING: DO NOT EXCEED THE GVWR, GCWR AND/OR GAWR AFTER LOADING YOUR MOTORHOME WITH WATER, FUEL, PASSENGERS AND CARGO. GAWR (Gross Axle Weight Rating) means the maximum permissible load weight a specific axle is designed to carry. See Federal Certification Label for disclosure of The GAWR for each axle.**

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

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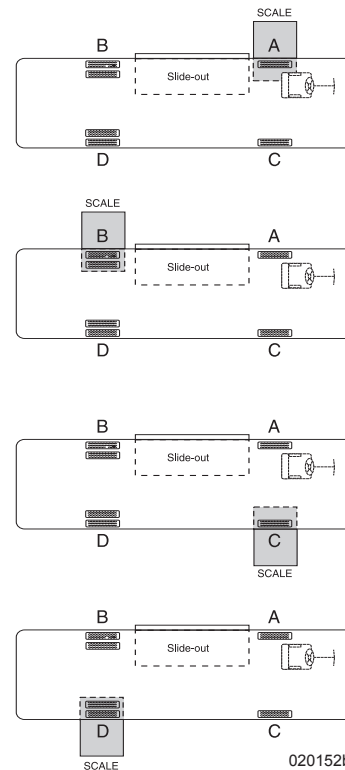
**Four Point Weighing (Non Tag Axle)**

**NOTE:**

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

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

1. Take the **FRONT** axle Gross Axle Weight Rating (**GAWR**) and divide it by two. Example: **FRONT** axle **GAWR** taken from the motorhome Vehicle Certification Label is 13,000 lbs. Divide the figure by 2, using chart , record 6,500 lbs. on line 1.
2. Weigh the driver side **FRONT** corner (Scale A) and record weight on chart scale A, line 2. Example: 5,000 lbs.
3. Weigh the passengers side **FRONT** corner (Scale C) and record weight on chart Scale C, line 2. Example: 4,000 lbs.
4. Add roadside and curbside from line 1, for Gross Axle Weight Rating (**GAWR**) and record on chart under Totals. Example: 13,000 lbs.



Four Point Weighing Example Chart

5. Add chart scale A and C, line 2 for actual Gross Axle Weight (GAW) and record on chart under Totals. Example: 9,000 lbs.
6. Actual Gross Axle Weight (GAW). Example: 9,000 lbs is not to exceed Gross Axle Weight Rating (GAWR). Example: 13,000 lbs.
  - ◆ Refer to the Tire Chart (Tire size 295/80R22.5). Use the highest actual weight, Scale A or C, line 2. Example 5000 lbs. Determine the proper tire pressure for each tire using the Load Inflation chart.
  - ◆ Repeat above procedures to determine REAR axle Scale B and D, tire pressures.

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

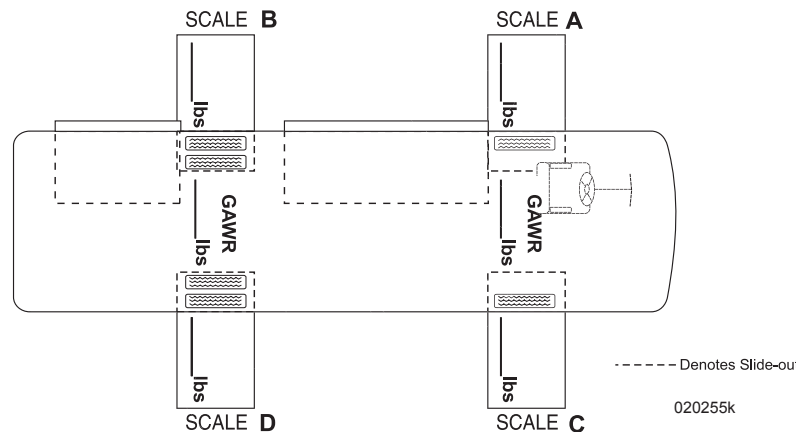
**CAUTION:**  
 If actual weight carried by any tire is below the tire chart weight specification minimum tire pressure, the minimum inflation pressure must be maintained. Tire pressure below the minimum inflation pressure can overheat and damage the tire casing leading to premature tire failure or blowout.

**Load and Inflation Tables:**

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

	ROADSIDE		CURBSIDE		TOTAL AXLE WEIGHT	GROSS AXLE WEIGHT RATING GAWR	GAWR Minus Total Axle Weight
FRONT AXLE	1. 6,500	+	6,500	=	13,000	13,000	4,000
	2.(A) 5000		(C) 4,000		9,000		
DRIVE AXLE	1. 10,000	+	10,000	=	20,000	+ 20,000	6,000
	2.(B) 7,100		(D) 6,900		+ 14,000		
	Total Axle Weight				= 23,000 UVW	= 33,000 GVWR	= 10,000 CCC

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



**Cargo Carrying Capacity:**

When weighing the motorhome it is important to understand that each motorhome, even of the same model year, floor plan and length will weigh different due to options and accessories.

The Gross Vehicle Weight Rating (GVWR), Gross Combination Weight Rating (GCWR) and/or Gross Axle Weight Rating (GAWR) must not be exceeded.

**GVWR** of the vehicle limits the weight of the entire load combination, regardless of the water, propane, passengers and cargo weight.

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

**GVWR 35,000 - UVW 20,000 = A 15,000**

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

Fresh water weight and propane weight can now be subtracted from the remaining total line A.

- ◆ Water weight is the number of gallons multiplied by 8.3.
- ◆ Propane weight is the number of gallons multiplied by 4.2.

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

A 30 gallon propane tank will have 24 gallons of propane due to the 80% valve. This would mean 24 gallons multiplied by 4.2, or 100.8 lbs.

**A 15,000 - 415 = B 14,585**  
**B 14,585 - 100.8 = C 14,484.2**

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

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

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

**C 14,484.2 - SCWR 716 = CCC 13,768.2**

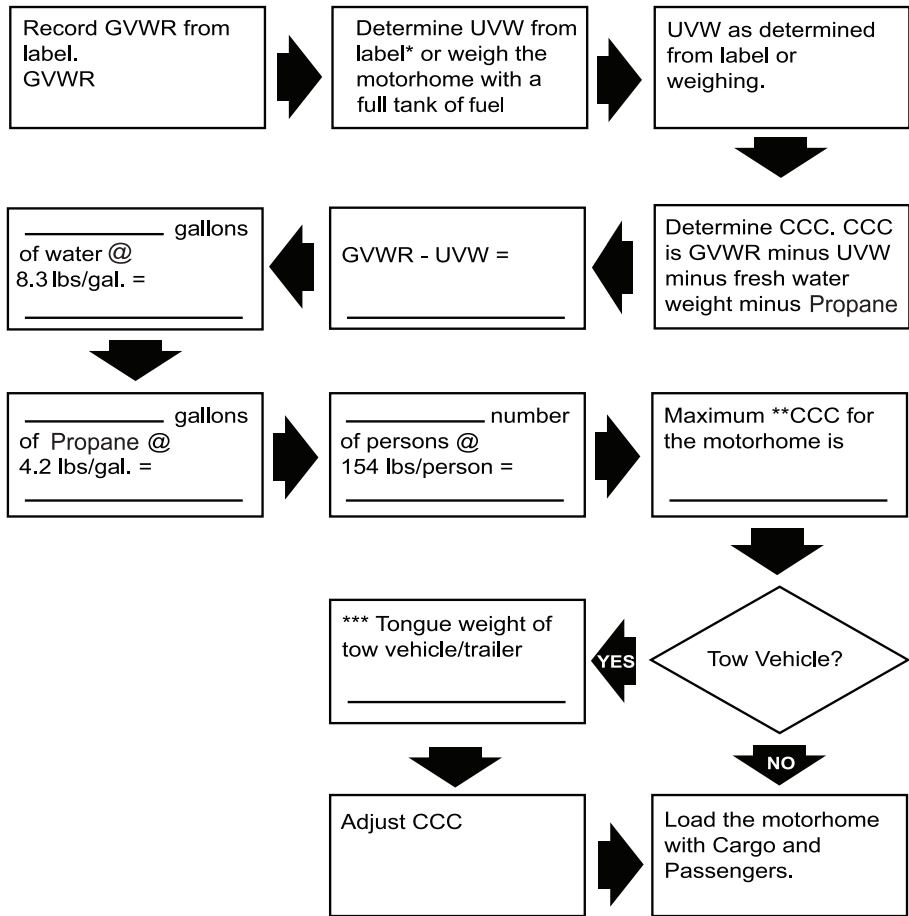
**Cargo Carrying Capacity (CCC)** is how much cargo the motorhome can carry. However, tongue weight of a towed vehicle will further reduce this amount.

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

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



### Cargo Carrying Capacity Flowchart



**Figure Cargo Carrying Capacity (CCC)**

- \* Actual UVW may vary based upon options ordered.
- \*\* Maximum CCC can be adjusted with amount of water, propane, number and weight.
- \*\*\* Actual CCC will vary with number and weight of passengers. Amount of water and propane and Tow Vehicle/Trailer Tongue weight.

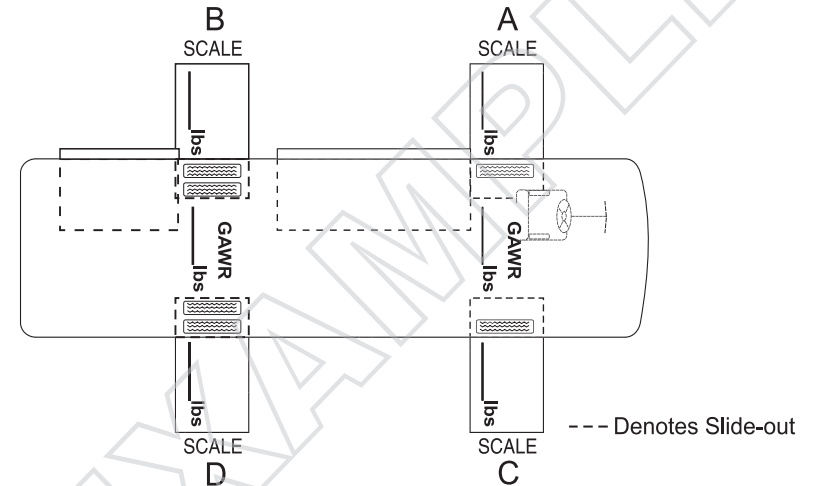
□ = Process  
 ◇ = Decision

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### Weight Example Worksheet

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

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



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

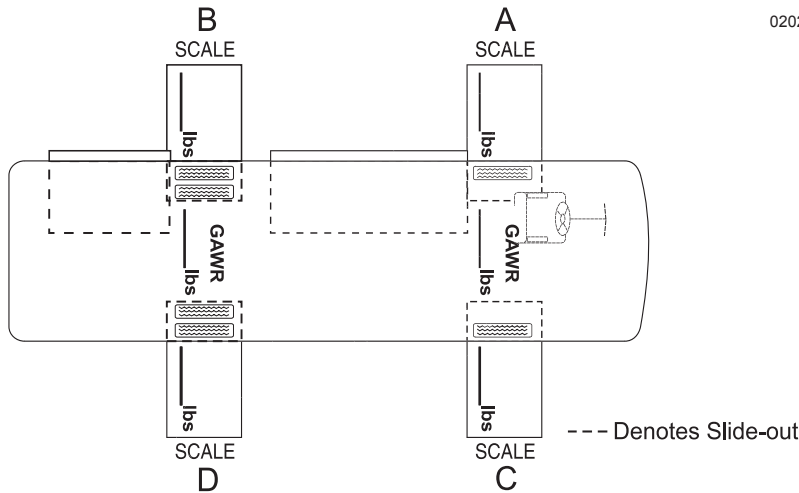
Maximum Cargo Carrying Capacity will change by varying any of the capacities. Tongue Weight of a towed vehicle will reduce the Cargo Carrying Capacity (CCC).

**Weight Record Sheet**

**ACTUAL WORKSHEET**

	ROADSIDE	CURBSIDE	TOTAL AXLE WEIGHT	GROSS AXLE WEIGHT RATING GAWR	GAWR Minus Total Axle Weight
FRONT AXLE	1.				
	2.(A)	(C)	=		
DRIVE AXLE	1.				
	2.(B)	(D)	+	+	
		Total Axle Weight	= UVW	= GVWR	= CCC

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



	FORMULA	UVW CAPACITY	CCC
FRESH WATER	Subtract Gallon @ 8.3 lbs/gal	X 8.3 =	-
WATER HEATER	Subtract Gallon @ 8.3 lbs/gal	X 8.3 =	-
PROPANE	Subtract Gallon @ 4.2 lbs/gal	X 4.2 =	-
SLEEP CAPACITY WEIGHT RATING	Subtract Persons @ 154 lbs/person	X 154 =	-
		Maximum Cargo Carrying Capacity CCC	

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

DATE: \_\_\_\_\_

PLACE: \_\_\_\_\_

FRONT: \_\_\_\_\_ + \_\_\_\_\_ = \_\_\_\_\_  
LEFT                      RIGHT                      TOTAL

REAR: \_\_\_\_\_ + \_\_\_\_\_ = \_\_\_\_\_  
LEFT                      RIGHT                      TOTAL

= \_\_\_\_\_  
 TOTAL GROSS VEHICLE WEIGHT

DATE: \_\_\_\_\_

PLACE: \_\_\_\_\_

FRONT: \_\_\_\_\_ + \_\_\_\_\_ = \_\_\_\_\_  
LEFT                      RIGHT                      TOTAL

REAR: \_\_\_\_\_ + \_\_\_\_\_ = \_\_\_\_\_  
LEFT                      RIGHT                      TOTAL

= \_\_\_\_\_  
 TOTAL GROSS VEHICLE WEIGHT

DATE: \_\_\_\_\_

PLACE: \_\_\_\_\_

FRONT: \_\_\_\_\_ + \_\_\_\_\_ = \_\_\_\_\_  
LEFT                      RIGHT                      TOTAL

REAR: \_\_\_\_\_ + \_\_\_\_\_ = \_\_\_\_\_  
LEFT                      RIGHT                      TOTAL

= \_\_\_\_\_  
 TOTAL GROSS VEHICLE WEIGHT

DATE: \_\_\_\_\_

PLACE: \_\_\_\_\_

FRONT: \_\_\_\_\_ + \_\_\_\_\_ = \_\_\_\_\_  
LEFT                      RIGHT                      TOTAL

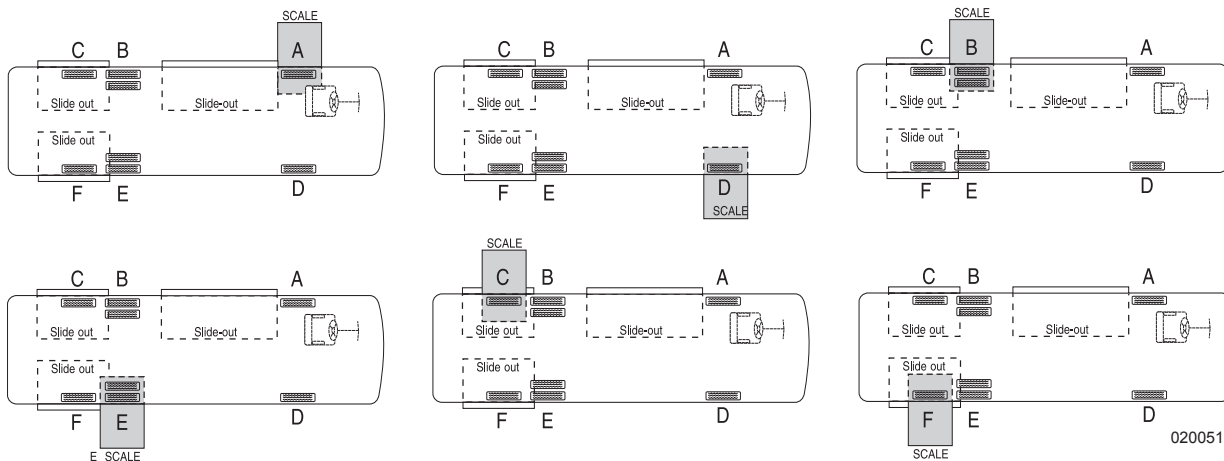
REAR: \_\_\_\_\_ + \_\_\_\_\_ = \_\_\_\_\_  
LEFT                      RIGHT                      TOTAL

= \_\_\_\_\_  
 TOTAL GROSS VEHICLE WEIGHT

## Six-Point Weighing (Tag Axle)

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

- ◆ Record the Front Axle **Gross Axle Weight Ratings (GAWR)** and divide it by two. **Example:** Front Axle **GAWR** as listed on the Vehicle Certification Label is 13,000 lbs. Using the chart, record 6,500 lbs. on Scale A and D, line 1.
- ◆ Weigh driver side steer axle (**Scale A**) and record weight on chart Scale A, line 2. **Example:** 5,000 lbs.
- ◆ Weigh passenger side steer axle (**Scale D**) and record weight on chart Scale D, line 2. **Example:** 4,000 lbs.
- ◆ Record the rear axle **Gross Axle Weight Ratings (GAWR)** and divide it by two. **Example:** Rear Axle **GAWR** as listed on the Vehicle Certification Label is 20,000 lbs. Using chart below, record 10,000 lbs. on Scale B and E, line 1.



- ◆ Weigh driver side drive axle (**Scale B**) and record weight on chart Scale B, line 2. **Example:** 7,100 lbs.
- ◆ Weigh passenger side drive axle (**Scale E**) and record weight on chart Scale E, line 2. **Example:** 6,900 lbs.
- ◆ Take the Tag Axle **Gross Axle Weight Rating (GAWR)** and divide it by two. **Example:** Tag axle **GAWR** taken from the Vehicle Certification Label is 10,000 lbs. Using the Six-Point Weighing Example Chart, record 5,000 lbs. on Scale C and F, line 1.
- ◆ Weigh driver side tag axle (**Scale C**) and record weight on chart Scale C, line 2. **Example:** 4,500 lbs.
- ◆ Weigh passenger side tag axle (Scale F) and record weight on chart Scale F, line 2. **Example:** 4,000 lbs.
- ◆ Add chart Scale C and F, lines 1, for the **Gross Axle Weight Rating (GAWR)** and record on chart under Totals.

- Example:** 10,000 lbs. Add chart Scale C and F, line 2 for actual Gross Axle Weight (**GAW**) and record on chart under Totals. **Example:** 8,500 lbs.
- ◆ Actual Gross Axle Weight (**GAW**). **Example:** 8,500 lbs., is not to exceed **Gross Axle Weight Rating (GAWR)**. **Example:** 10,000 lbs.
- ◆ If necessary, adjust tag axle regulator to compensate for payload carried by tag, drive and front axles.
- ◆ Perform regulator stabilization procedure.

**NOTE:**  
Adjustments made to the Tag Axle Regulator will require repeated weighing procedures.

- ◆ If necessary, adjust the payload so the GAWR is not exceeded. Total combined weights must not exceed the GVWR.
- ◆ Refer to the Tire Chart in this section (the example tire size is 295/80R22.5). Use the highest actual weight, Scale A or D, line 2. **Example:** 5,000 lbs.; Scale B or E, line 2. **Example:** 7,100 lbs.; Scale C or F, line 2. **Example:** 4,500 lbs. Determine the proper tire pressure for each axle. Front axle tire pressure is 115 psi, Rear axle tire pressure is 85 psi. Tag axle tires are 80 psi using the Load Inflation chart.

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

**CAUTION:**

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

**Cargo Carrying Capacity:**

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

**GVWR** limits the weight of the entire load combination, regardless of the water, propane, passengers and cargo weight.

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

**GVWR 35,000 - UVW 20,000 = A 15,000**

Next, begin to calculate the **Cargo Carrying Capacity (CCC)**. Fresh water weight and propane weight can now be subtracted from the remaining total line A.

- ◆ Water weight is the number of gallons multiplied by 8.3.
- ◆ Propane weight is the number of gallons multiplied by 4.2.

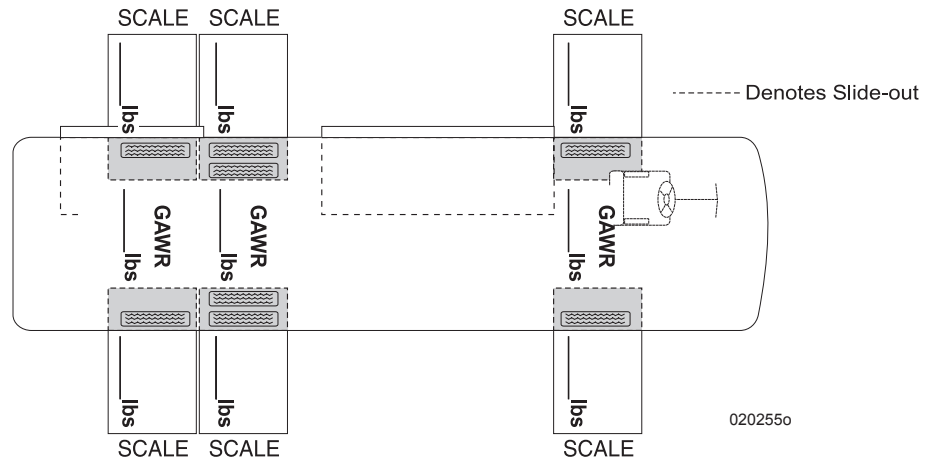
A 10-gallon water heater with a 40-gallon fresh tank totals 50 gallons times 8.3, or 415 pounds. A 30-gallon propane tank has 24 gallons of propane due to the 80% valve. This is 24 gallons multiplied by 4.2, or 100.8 lbs.

**A 15,000 - 415 = B 14,585**  
**B 14,585 - 100.8 = C 14,484.2**

	ROADSIDE		CURBSIDE		TOTAL AXLE WEIGHT	GROSS AXLE WEIGHT RATING GAWR	GAWR Minus Total Axle Weight
FRONT AXLE	1. 6,500	+	6,500	=	13,000	13,000	4,000
	2.(A) 5,000		(D) 4,000		9,000		
DRIVE AXLE	1. 10,000	+	10,000	=	20,000	+ 20,000	6,000
	2.(B) 7,100		(E) 6,900	+	14,000		
TAG AXLE	1. 5,000	+	5,000	=	10,000	+ 10,000	1,500
	2.(C) 4,500		(F) 4,000	+	8,500		
TAG AXLE REGULATOR	SETTING @ 24 psi		Total Axle Weight		= 31,500 UVW	= 43,000 GVWR	= 11,500 CCC

**NOTE:**

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



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

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

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

**C 14,484.2 - SCWR 716 = CCC 13,768.2**

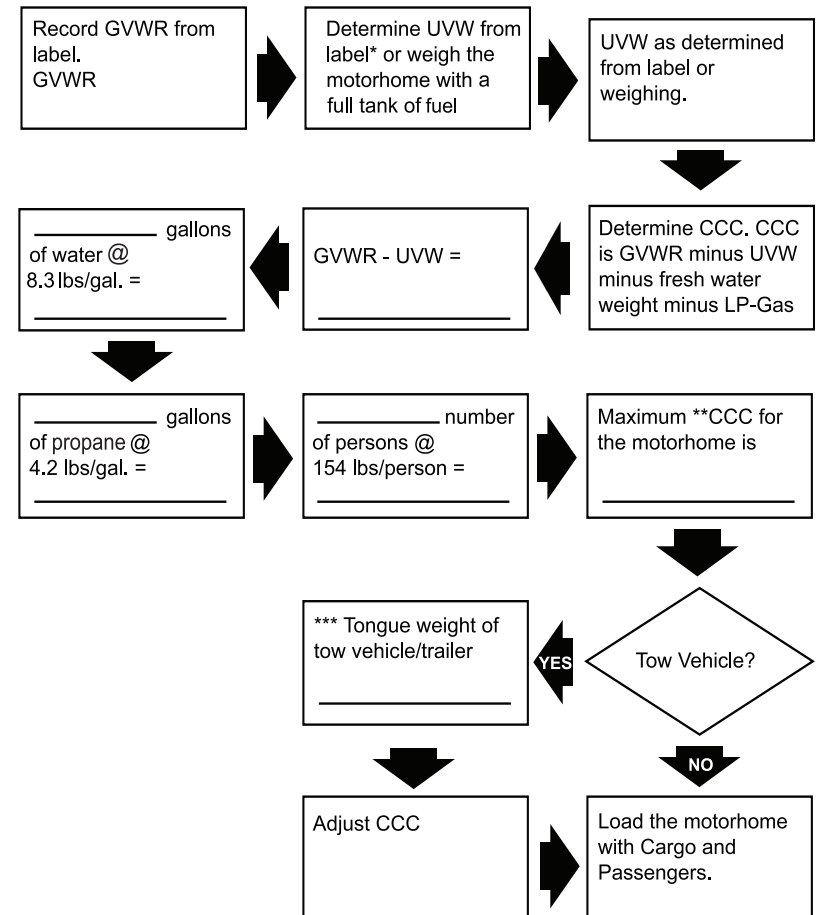
**Cargo Carrying Capacity (CCC)** is how much cargo the motorhome can carry. However, tongue weight of a towed vehicle will further reduce this amount.

Now the motorhome can be fully loaded and weighed to ensure **GVWR** is not exceeded. Once the motorhome is fully loaded it is ready to be weighed to obtain an accurate scale reading and determine the proper tire pressure.

All slide rooms must be in the retracted position when weighing the motorhome. The motorhome must remain as level as possible on the scale, even when an axle or side is not physically on the scale.

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

**Cargo Carrying Capacity Flowchart**



020254h

\* Actual UVW may vary based upon options ordered.

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

\*\*\* Actual CCC will vary with number and weight of passengers. Amount of water and propane and Tow Vehicle/Trailer Tongue weight.

□ = Process

◇ = Decision

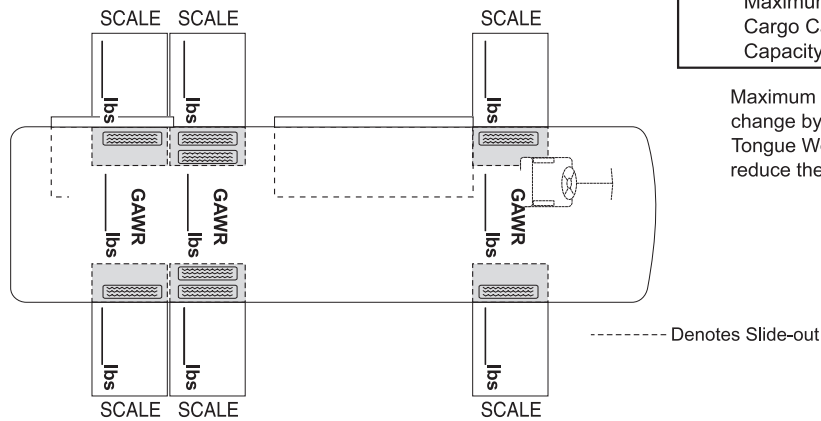
**Figure Cargo Carrying Capacity (CCC)**

**Weighing Procedure Worksheet**

	ROADSIDE		CURBSIDE		TOTAL AXLE WEIGHT	GROSS AXLE WEIGHT RATING GAWR	GAWR Minus Total Axle Weight		
FRONT AXLE	1.	+		=					
	2.(A)		(D)						
DRIVE AXLE	1.	+		=		+			
	2.(B)		(E)		+				
TAG AXLE	1.	+		=		+			
	2.(C)		(F)		+				
TAG AXLE REGULATOR	SETTING @ _____ psi		Total Axle Weight	=	UVW	=	GVWR	=	CCC

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

	FORMULA	UVW CAPACITY	CCC
FRESH WATER	Subtract Gallon @ 8.3 lbs/gal	X 8.3 =	-
WATER HEATER	Subtract Gallon @ 8.3 lbs/gal	X 8.3 =	-
PROPANE	Subtract Gallon @ 4.2 lbs/gal	X 4.2 =	-
SLEEP CARRYING WEIGHT RATING	Subtract Persons @ 154 lbs/person	X 154 =	-
		Maximum Cargo Carrying Capacity CCC	



020255CC

**Weight Record Sheet**

DATE: \_\_\_\_\_

PLACE: \_\_\_\_\_

FRONT: \_\_\_\_\_ + \_\_\_\_\_ = \_\_\_\_\_  
 LEFT RIGHT TOTAL

REAR: \_\_\_\_\_ + \_\_\_\_\_ = \_\_\_\_\_  
 LEFT RIGHT TOTAL

TAG: \_\_\_\_\_ + \_\_\_\_\_ = \_\_\_\_\_  
 LEFT RIGHT TOTAL

= \_\_\_\_\_  
 TOTAL GROSS VEHICLE WEIGHT

DATE: \_\_\_\_\_

PLACE: \_\_\_\_\_

FRONT: \_\_\_\_\_ + \_\_\_\_\_ = \_\_\_\_\_  
 LEFT RIGHT TOTAL

REAR: \_\_\_\_\_ + \_\_\_\_\_ = \_\_\_\_\_  
 LEFT RIGHT TOTAL

TAG: \_\_\_\_\_ + \_\_\_\_\_ = \_\_\_\_\_  
 LEFT RIGHT TOTAL

= \_\_\_\_\_  
 TOTAL GROSS VEHICLE WEIGHT

DATE: \_\_\_\_\_

PLACE: \_\_\_\_\_

FRONT: \_\_\_\_\_ + \_\_\_\_\_ = \_\_\_\_\_  
 LEFT RIGHT TOTAL

REAR: \_\_\_\_\_ + \_\_\_\_\_ = \_\_\_\_\_  
 LEFT RIGHT TOTAL

TAG: \_\_\_\_\_ + \_\_\_\_\_ = \_\_\_\_\_  
 LEFT RIGHT TOTAL

= \_\_\_\_\_  
 TOTAL GROSS VEHICLE WEIGHT

## SMOKE DETECTOR

Statistics show that most fire casualties are not caused by direct flame, but by less visible smoke (products of combustion). The smoke detector 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:**

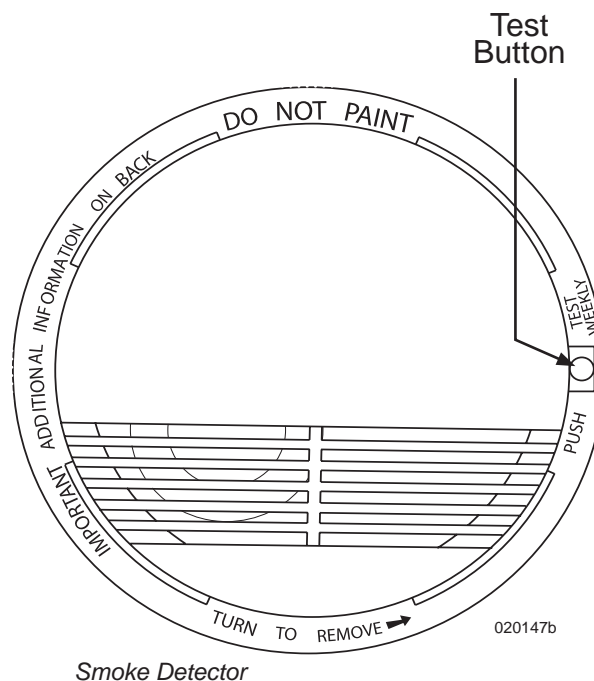
**There is no way to ensure against injury or loss of life in a fire; however, the smoke detector is intended to help reduce the risk of tragedy. Additional smoke detectors may help reduce the risk. Proper use and care of the smoke detector could save lives.**

### ***Operation***

When a 9 Volt DC battery is correctly connected, the LED will flash every minute and a loud alarm will sound when a product of combustion is sensed.

### **NOTE:**

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



### ***Testing***

Simply press the test button on the smoke alarm cover for approximately three seconds. The alarm will sound if all electronic circuitry, horn and battery are properly working. Test the smoke alarm at least once a week when the motorhome is in use, prior to each trip and when the motorhome has been removed from storage. The smoke alarm is designed to be loud. Test the alarm at arm's length to reduce exposure to hearing.

### **WARNING:**

**Test detector at least once a week, before each trip or when the motorhome has been removed from storage.**

### **CAUTION:**

**DO NOT use an open flame to test the smoke alarm as this may ignite the alarm or surrounding area and set fire to the motorhome.**

### ***Maintenance***

#### **Maintenance for Proper Operation:**

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

### ***Troubleshooting***

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

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

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

## CARBON MONOXIDE DETECTOR

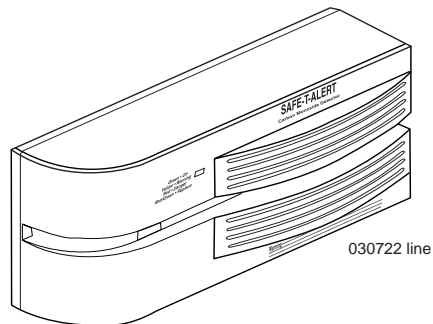
American National Standards Institute (ANSI) **119.2 - Fire & Life Safety 6.4.6 Carbon Monoxide Detectors** states “*CO detectors used must be listed as suitable for use in RV’s and installed in accordance within the terms of their listing. No specific mounting location is mandated for CO detectors; only that they be installed in accordance with their listing. The installation of the CO detector mounting bracket alone will be considered acceptable as long as the CO detector is provided.*”

*A CO detector is required to be installed in any RV that either contains an internal combustion engine or is designed to have one installed. This would include all motorized RV’s, regardless of whether the fuel source is gasoline, diesel, propane, or other alternate fuel. This would also include an RV equipped with a generator or designed to accommodate future installation of a generator (commonly called “generator prep” setups). This would not include RV’s equipped to store or transport internal combustion engine vehicles.*

*Also, all truck campers must have a CO detector installed, since an internal combustion engine is ultimately present once the truck camper is mounted on a pickup truck.”*

The motorhome is equipped with a Carbon Monoxide detector. Carbon Monoxide (CO) is a colorless, odorless and tasteless gas that binds with hemoglobin to reduce the body’s ability to absorb and carry oxygen to vital organs. Anyone exposed to CO gas can be at risk to CO poisoning. When removed from exposure, the symptoms dissipate as Carbon Monoxide is expelled through the lungs. Level of contamination in the body reduces at half-life increments at approximately four-hour intervals. Treatment with Oxygen will quicken recovery time.

In cases of mild exposure, the symptoms may include: a slight headache, nausea, vomiting and fatigue. Some consider this a “Flu-like Symptom.” Symptoms for medium exposure may include a severe throbbing headache, drowsiness, confusion and fast heart rate. Extreme exposure can result in unconsciousness, convulsions, cardio-respiratory failure and death. Young children and household pets may be the first affected. Other highly sensitive people include the elderly and those with lung or heart disease or anemia. 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.



The CO detector is designed to detect the toxic CO Gas resulting from incomplete combustion of any fuel. This can be gasoline, propane, natural gas, oil, charcoal or wood. Anything that burns fuel such as engines, generators, furnaces, gas stoves or water heaters, produce CO Gas. Consequently, it is uncommon for household smoke from cigarettes or normal cooking to cause the alarm to sound.

### **CAUTION:**

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

### **WARNING:**

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

The CO detector is powered from the house batteries. The main battery disconnect switch (located in the rear curbside bay) must be on for the CO detector to function. The interior battery cut-off switch will not affect the CO detector. Once the unit is powered, it will run through a brief warm-up and self-check prior to monitoring for CO gas.



## Operation

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

### Indicator Lights and Sound Patterns:

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

## 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.

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.

### Potential Sources of CO when operating the motorhome:

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

## Testing

### Test Procedures:

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

## Peak Level Memory:

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

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

### NOTE:

**Memory is erased when power is disconnected for 15 seconds.**

## Cleaning & Maintenance

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

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

### INSPECT:

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

## FIRE EXTINGUISHER

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

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

### Use the **PASS** word!

**P**ull the pin to unlock the extinguisher.

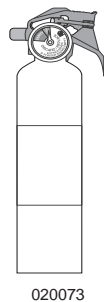
**A**im at the base (bottom) of the fire and stand 6 to 10 ft. away.

**S**queeze the lever to discharge the agent.

**S**weep the spray from left to right until totally extinguished.

### **WARNING:**

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



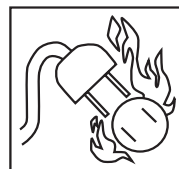
Three classes of fire can occur within a motorhome. A fire can fall into more than one class. For example, a fire that involves both burning paper and kitchen grease is a Class AB fire.

### Classes of Fire:

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

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

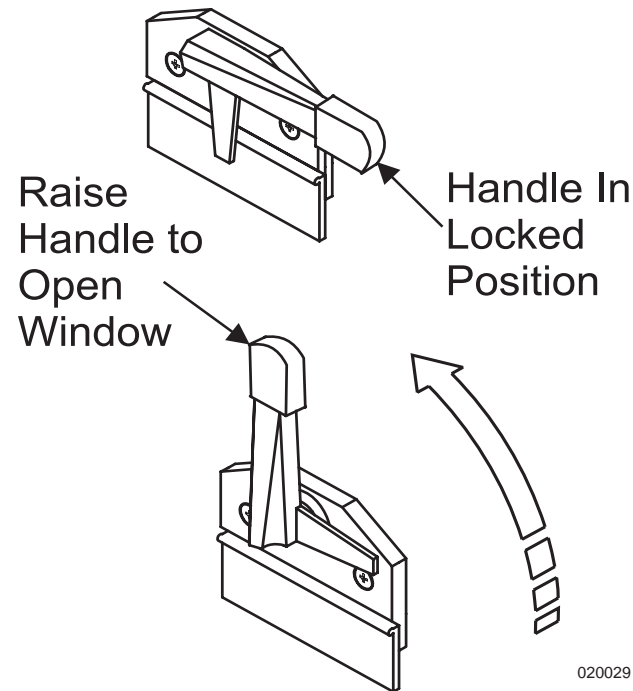
**C** - Fires that involve energized electrical wiring or equipment. If electricity to the equipment is turned off, a class C fire becomes one of the other two class fires.



## ESCAPE (EGRESS) WINDOW

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

Hinges along the outside window top identify the Egress window on the motorhome exterior. The glass slider in the Egress window operates the same as all other windows in the motorhome. Occasionally open and close the Egress window to prevent the rubber seal from sticking.



Egress Window Handle

# 09 Camelot

*Exterior & Interior Care – Section 3*

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## EXTERIOR CARE

### *Corrosion*

The most common cause of corrosion to the motorhome exterior is accumulation of road salt, grime and dirt. These elements, combined with moisture, may possibly cause early component failure. The undercarriage, around wheel openings and the radiator/charge air cooler package require periodic cleaning to prevent component failure caused from corrosive materials collected on roadways. If the motorhome is stored or driven near the ocean or in areas where road salts are used, wash it at least once a week, including the undercarriage. Otherwise, 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 undercarriage and inside wheel openings. However, these devices can cause damage. Avoid directly spraying the painted surface with a high-pressure washer of any type. Also avoid directly spraying electrical wiring, connectors or electro-mechanical components with high pressure.

#### **CAUTION:**

**It is up to the motorhome owner to properly wash and protect the motorhome and its components from corrosion. Sources of corrosion include road surfaces treated with de-icing agents and atmospheric conditions, such as those found in coastal regions.**

#### **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. The nozzle discharge pressure of these devices can exceed 1800 psi. Also avoid using high pressure/high temperature steam cleaners on the exterior paint surfaces. Remove all spattered washing debris from the exterior paint surfaces as soon as possible.**

### *Winter Drive Protection*

Various substances and chemicals are applied to roadways to reduce hazardous winter driving conditions. These substances can include rock salt, sand, gravel or chemical applications such as LMC (Liquid Magnesium Chloride).

Road salts are known for their corrosive properties to steel and other metals. Road salt can also damage other vehicle components and materials. Vehicles located in or traveling through areas where road salt is used are subject to rapid corrosion. LMC is a moisture activated chemical applied directly to the road surface for the purpose of lowering the freeze point of water. According to published information, LMC is a suitable replacement for road salt or sanding.

The drawback is that LMC is highly corrosive to all metals and plastics and can even destroy rebar embedded in concrete. After application, road traffic causes LMC to become airborne vapor traveling as much as 2000 ft. from the point of origin.

Vehicles located within that distance, even when stored outside, are exposed to the same corrosive affects as vehicles traveling over a road treated with LMC. LMC lowers the freeze point allowing moisture to further penetrate surfaces, and remains active down to 27% humidity. Foot traffic will also track road salt and LMC into living spaces.

While most sand, road salt and LMC accumulation can be washed away through use of a high-pressure washer, road salt and LMC is still bonded to all exposed surfaces including paint. Only chemical washing can neutralize road salts or LMC. However, chemical washing can only neutralize open surfaces. LMC and road salt remains trapped between mating surfaces and will corrode wiring as well.

Local or state governments determine what is applied during winter months and these substances can change by location. It is possible to encounter one or all of these substances while driving. Only regular weekly washing of the exterior and undercarriage can slow corrosion during the winter months. No single treatment can be used to eliminate and neutralize the affects of these corrosive substances.

Diligent washing and awareness of substances applied to the road surface will dictate if a neutralizing agent must be applied to help slow the process of corrosion to exterior surfaces, including the paint finish. Therefore, it is up to the motorhome owner to perform regular washing maintenance and neutralize any corrosive agent applied to the roadway by local or state governments.

## Washing

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

## Drying

Chamois cloths come in natural and synthetic materials. Either type is acceptable as long as the surface is clean. Soak the chamois in clean water and wring it dry. Remove the water from the surface, starting at the top and working towards the bottom, using a downward “S” pattern. Wring out the chamois as needed. Using a chamois cloth to remove the rinse water is not necessary, but the effort can be worthwhile.

## Waxing

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

### **NOTE:**

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

### **INFORMATION:**

**When selecting a product, follow the product manufacturer’s recommended application instructions.**

### **Types of Products:**

**Glazes** - Glazes are generally used to fill very fine scratches in the clear coat. They are applied either by hand or by using a polisher with a special pad. Glazes are temporary and will rinse out after a few washes and/or heavy rains.

**Waxes** - Waxes come in many types of chemical make-up. Most contain cleaning agents, lubricants and wax. Cleaning agents remove oxidation and leave a high gloss, and wax leaves a clear film that protects the finish. Full Molecular Jacket (FMJ) wax by Menzerna is applied at the factory.

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

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

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

Observe the test area from different angles to check for hazing or swirl marks. If an abnormal reaction to the finish occurs, discontinue product use and consult the product manufacturer. If the product is a paste, do not allow dried paste to be baked on by the sun. Remove paste shortly after drying. Clean, dry, 100% cotton cloths are best suited for the removal of dried paste. Turn the cloth often. Use a separate clean cloth to buff. The surface should feel slick when rubbing the cloth lightly over it. Avoid repeated wax applications which can cause wax to build up. Some very fine scratches or swirl marks may be removed by an application of a glaze. These types of glazes fill the scratches or swirl marks.

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

### **Paint Codes**

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

#### **To Obtain the Paint Code:**

1. Contact **National Parts** at **1-877-466-6226**.
2. Specify the year, model, serial number and exterior color scheme name (if known) to obtain the paint codes.

3. The formula can be mixed at a local BASF paint store.

#### **NOTE:**

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

### **Tire Care**

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.

### **Wheels - Polished Aluminum**

#### **Inside:**

If the tires are removed, **inspect** and clean the entire rim. Air used to fill the tire may contain moisture and can cause the areas of the wheel under the tire to severely corrode. Use a soft brush to remove foreign material from the tire side of the rim. Lubricate the rim and tire bead with a non-water-based lubricant before

mounting the tire and ensure the inside of tire is dry before installing.

#### **WARNING:**

**DO NOT use a flammable solution to coat the inside of the rim. This can lead to an explosion during tire inflation or in subsequent operation of the motorhome.**

#### **Outside:**

The wheels should be treated the same as the paint finish on the motorhome. Road soils, grime and brake dust trap moisture which can cause corrosion over a period of time.

1. Frequently clean using high-pressure water.
2. Wash with a 100% cotton cloth and a mild soap solution (dish soap or car wash soap is recommended).
3. Rinse all remaining soap residue with high-pressure water and wipe the surface dry using a 100% cotton cloth to avoid water spots.
4. A secondary hand washing may be required to remove some stubborn road films.
5. Carnauba wax can be applied to help protect the finish.

#### **NOTE:**

**Allow heated wheels that are extremely hot to cool before spraying with cold water.**

**CAUTION:**

**DO NOT** use the following items on aluminum wheels:

- ◆ Synthetic cleaning pads, wire or abrasive brushes, steel wool or scouring pads (these can mar or scratch the finish).
- ◆ Strong detergents, alkaline or acidic cleaners, acids or lye-based chemical products or solvents.

**CAUTION:**

Rinse aluminum wheels using high-pressure water to remove debris from the surface before washing. **DO NOT** scrub. Rubbing debris against the surface of the wheel can result in scratches. **DO NOT** allow soap solution to dry on the finish of the wheel as spotting will occur.

**Bright Metal**

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

**NOTE:**

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

**EXTERIOR MAINTENANCE**

The motorhome is exposed to extreme temperatures, humidity, ultraviolet rays, rain and other environmental conditions. While in operation the motorhome is subject to twisting and flexing caused by rough roads, potholes and winding mountain roads. Maintenance is necessary not only to keep the exterior looking nice, but also to keep it in proper working order.

**Fiberglass**

**Inspect** the fiberglass exterior. Periodic **inspection** may reveal that flexing of the fiberglass exterior has created imperfections in the surface commonly known as “spider” or “hairline” cracks. A crack that has opened up to reveal the cloth weave threatens the integrity of the fiberglass. If the exterior exhibits signs of damage, prevent moisture penetration, particularly in freezing climates. Cover the area using plastic sheeting and/or tape, and have the damaged fiberglass repaired as soon as possible.

**Roof Care & Seal Inspections**

Wherever there is something affixed to the motorhome, such as a vent attached to the roof, a seal is applied to prevent water intrusion. Each type of sealant has a specific use. While the belt line uses a silicone or urethane base sealant to prevent water intrusion, roof openings use an acrylic based sealant. Moisture intrusion can occur at any time for a number of reasons; therefore, regular sealant inspection and

maintenance will greatly reduce the likelihood of moisture intrusion and costly repairs.

The motorhome is sealed at the factory. However, extreme weather conditions can shorten the life of sealant and harsh road conditions can compromise sealant integrity. Maintaining sealant is part of regular motorhome maintenance. Inspect all joints, seams and openings at least once every six months.

While sealant integrity may appear fine, a small void under the right conditions can quickly cause major damage. Make a full interior inspection for signs of moisture intrusion every two weeks when the motorhome is in storage.

**CAUTION:**

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

**INSPECTING:**

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

**WARNING:**

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

**Sealant Replacement:**

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

**WARNING:**

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

**Sealant Types****Acryl-R®:**

**Product Manufacturer Schnee-Moorehead Part # 5509.** Used on all roof openings such as vents, skylights, roof-mounted antennas and ladder roof mounts. Sealant should be applied only where equipment bases meet the roof. Acryl-R is generally available in a caulking tube. Two colors are available - white and silver. Silver is used on items mounted on the forward painted area of the roof. White is used at all other points.

Remove old sealant that is not adhered. Sealant that is secured need not be removed. Dirty or damp surface areas will compromise sealant effectiveness. Thoroughly clean and dry the surface area before applying new sealant.

Lay masking tape around the area to be sealed to stop sealant from spreading beyond the desired area. Using a caulking gun, apply new sealant as needed. Work the caulking gun in a manner that will cause the sealant to fully adhere to the applied area. Allow adequate cure time. Roof air conditioners use a closed cell foam base gasket and do not require sealant. The roof air conditioners should be regularly inspected for tightness at the four mounting bolts, one located in each interior corner of the air conditioner roof opening. Torque specification is 40 to 50 in/lbs. The base gasket should be compressed to approximately a ½".

**Acrylic Sealants:****Product Manufacturer Geocel Part # 2300**

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

**Black Urethane:****Product Manufacturer Bostik Part # 1100**

Used for sealing windshields only. Black Urethane is available in a tube that applies similar to silicone. Clean up using solvents such as paint thinner. Gloves are required as this considered a hazardous material.

**Silicone:****Product Manufacturer Dow Corning Part # 733**

Product made in several colors. Primarily used on the sidewalls around windows, doors, handles, belt line molding, latches and bases of surface mounted items such as clearance lights. Old peeling sealant should be removed with nylon sticks or equivalent. Metal utensils can scratch the painted surface. Avoid lacquer thinners or ketone based solvents as these chemicals can damage painted surfaces. Confirm that surface is clean and dry before a new application. Cut the tube at an angle with the smallest usable opening. Avoid a heavy bead as a little goes a long way. Wear a disposable latex glove and use finger at a 45° angle on beaded surface to smooth out product. Keep rags or paper towels handy for clean up. Use care when applying silicone and plan ahead before applying. Look for obstacles that may impede application.

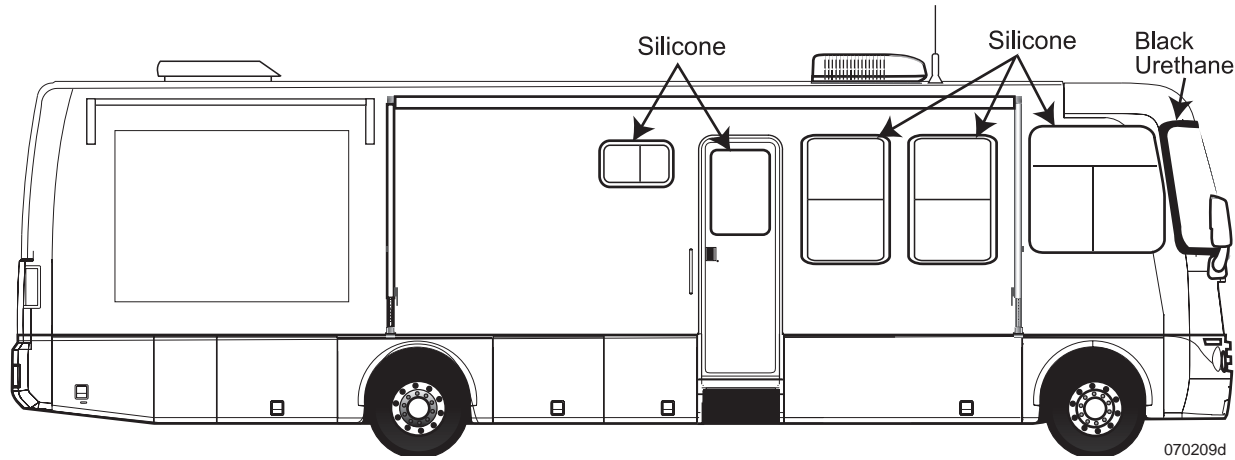
**Spray Foam:**

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



## INTERIOR CARE

### Cockpit



**Typical Side View:**  
Side window seals require silicone. Windshield requires Black Urethane.

The cockpit area dashboard is a molded-fiberglass, vinyl-wrapped pod. The instrument panel is comprised of various gauges and switches. Specific cleaning requirements are necessary for the dashboard and instrument panel. Clean the vinyl wrapped dash pod following the instructions under Vinyl Care in this section. In the event a blemish or small cut occurs in the vinyl, contact a professional upholstery repair service.

Clean the plastic or Plexiglas® instrument panels using a cloth dampened in a mild soap and water solution. Dry using a separate cotton cloth. Plastic polish products that will help to brighten the appearance of plastic or Plexiglas instrument panels are Novus Plastic Care®, a three-part system; Meguires® and Johnson Paste Wax®, which will require extensive buffing and rubbing.

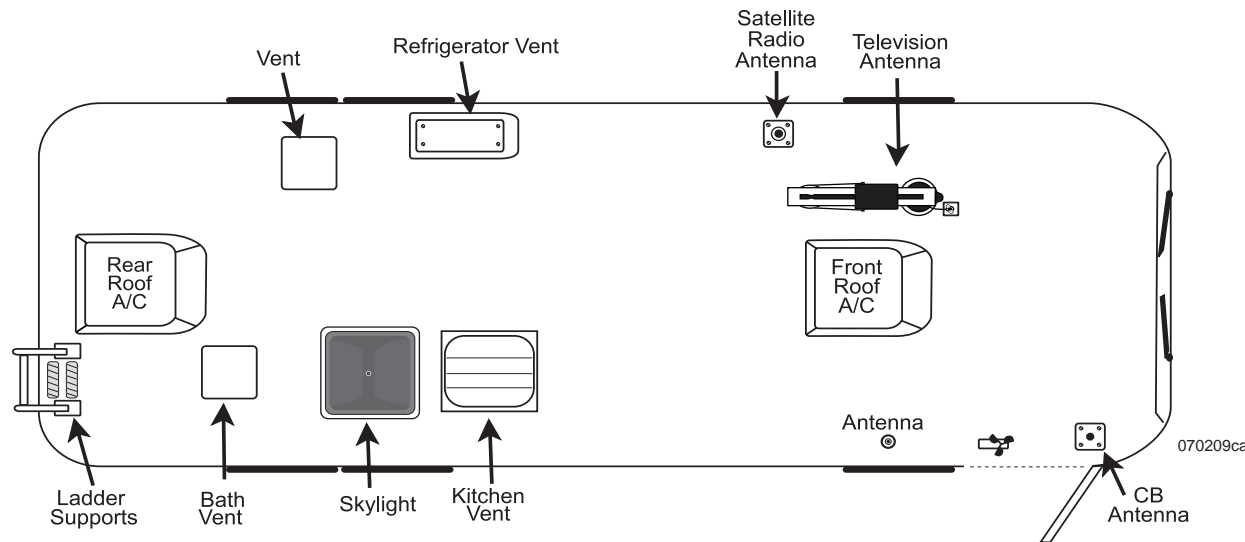
Glass lens gauges can be cleaned using glass cleaner. Spray cleaner on the cloth (not directly onto the lens) to prevent over-spray or runoff.

### **CAUTION:**

**DO NOT** allow glass cleaners to come in contact with plastic surfaces. Glass cleaning products can damage plastic by dulling the finish or causing it to become brittle.

### **TIP:**

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



**Typical Roof Layout:**  
Inspect each item for sealant integrity. Acryl-R is used as a roof sealant. Roof A/C's use a special foam gasket.

**FABRICS****General Care & Cleaning**

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

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

**Cleaning Upholstery Fabrics:**

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

**Vinyl**

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

**Normal Cleaning:**

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

Full strength rubbing alcohol or mineral spirits may be tried cautiously as a last resort on very stubborn stains if the above suggestions do not work. Indiscriminate use of any solvent, or solvent containing cleaner, can severely damage or discolor the vinyl. Stains may become permanent if they are not immediately removed.

**NOTE:**

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

**CAUTION:**

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

**Bird Excreta & Vomit Stains:**

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

**Urine Stains:**

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

**Surface Mildew:**

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

**Ballpoint Ink:**

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

**WARNING:**

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

**Oil-Base Paint:**

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

**CAUTION:**

**Lacquer solvent will cause immediate irreparable damage to the vinyl. DO NOT use wax on vinyl upholstery as it will cause premature embrittlement and cracking. Dilute chlorine bleach before using. Never use full strength bleach. Paint strippers will remove the print pattern and damage the vinyl if it comes in direct contact.**

**Latex Paint:**

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

**Tar or Asphalt:**

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

**Crayon, Mustard or Ketchup:**

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

**Chewing Gum:**

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

**Blood or Plant Residue:**

Rub out spots using a clean cloth soaked in cool water. For stubborn spots, use household ammonia and rinse repeatedly with a clean, wet cloth. **DO NOT** use hot water or soap suds as this will set the stain.

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

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

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

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

**TIP:**

**Vinyl requires periodic cleaning to maintain its appearance and to prevent the buildup of dirt and contaminants that may permanently stain or reduce the life of the vinyl if left untreated. Frequency of cleaning and procedures used depend upon the amount of use and the environmental conditions in which the vinyl is subjected. Tears or holes in the vinyl can be temporarily covered with clear tape to prevent further damage. Repairs should be made by a professional upholstery shop. Commercial repair products may contain lacquers and cause the vinyl to become brittle and more difficult to repair.**

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

The following steps are to be performed in sequence. Each subsequent step is to be used if the previous step was not successful. Clean area with warm water after each process.

**For General Cleaning:**

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

**For Oil-based Stains:**

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

**For Marker-type Stains:**

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

**WARNING:**

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

**CAUTION:**

**DO NOT use any abrasive cleaner with this material.**

**NOTE:**

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

## Ultra-Leather

### Care Instructions:

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

### Removing ballpoint pen stains:

Wipe the stain off with ethanol (ethyl alcohol). Follow all manufacturer safety instructions when using chemicals.

### If the stain remains, use the following procedure:

1. Dilute household bleach (sodium hypochloride) with an equal amount of water (1:1 ratio).
2. Apply bleach/water solution sparingly to a piece of tissue. Place the tissue on the stained surface and cover it with polyethylene film to prevent the solution from drying.

3. Periodically remove the tissue to check on the condition of the stain. When the stain is almost gone, remove the tissue completely. Do not leave on for more than one hour.
4. Rinse the stain with sufficient amount of clean water.

### **CAUTION:**

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

### Neutralize bleach by the following method:

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

### **CAUTION:**

**Ensure adequate ventilation when using chemical solutions for stain removal.**

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

### **NOTE:**

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

## Leather

### 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.**

## ***Fabric Cleaning Codes***

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

**“W”** - Clean 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. A professional furniture cleaning service is recommended for cleaning. 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 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. 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”** - A professional dry cleaner or furniture cleaning service is recommended for cleaning this fabric.

**“X”** - Vacuum only. A non-metallic brush may be used.

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

**“Wash Cycle”** - Use synthetic setting and high water level with mild agitation. A mild soap or detergent in water not to exceed 160° F. can be used. 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”** - Press as following if necessary:

- ◆ 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**

Pomegranate			
COLOR/PATTERN	APPLICATION	CONTENT	CODE
Pelli Penny F-0168122-01140017	Sofa	74.44% Rayon, 25.15% Polyester, .41% Nylon	S
Claus Autumn K41123RX	FSD	53% Acrylic, 34% Polyester, 13% Cotton	S
R-Elena Spice	LR/BR Valances, LR Pillows, Bedspread Accent, BR Shams	79% Rayon, 21% Polyester	S
R-Petra Spice	LR Pillows, BR Shams	73% Rayon, 27% Polyester	S
Bartow Caramel F-0165961-01140004	LR/BR Valances	100% Polyester	S
G3649 Japur color 9 Taffie	Bedspread, BR Pillows	100% Polyester	Dry Clean Only
Waterfall II color Rust	Headboard, BR Pillows, Ensemble Back	62% Rayon, 38% Polyester	S
Palomino vinyl	Dash	Vinyl	Vinyl
Buff vinyl	Dash Vinyl	Vinyl	Vinyl
UL Brisa Distressed Buckskin	Driv/Pass Chair, Euro Recliner	100% Polyurethane Blend w/ 100% Rayon Backing	Ultraleather
Tombstone #2823 Leather	Opt Sofa, J-Lounge, Ensemble	Leather	Leather
Fairview Café	Windshield Drapery	64% Cotton, 36% Polyester	Dry Clean Only
TB 1387B Eggnog	Windshield Closeoff Rope Tie Back	90% Rayon, 8% Cotton, 2% Polyester	S
FRL 03349-01-A Cinnamon	Decorative Fringe	50% Rayon, 43% Polyester, 7% Polypropylene	S
CD 03349-01-A Cinnamon	Decorative Cord	48% Polyester, 38% Rayon, 14% Polypropylene	S

Jamocha Cream III			
COLOR/PATTERN	APPLICATION	CONTENT	CODE
Ayres Walnut	Sofa	58% Rayon, 42% Polyester	S
Saki Driftwood	LR/BR Pillows, Headboard, LR/BR Valance, BR Shams	65% Rayon, 35% Polyester	S - Dry Clean Only
Alvarado Java	FSD, LR/BR Val, LR/BR Pillows, Bedspread Accent, Ensemble Back	46% Viscose Chenille, 44% Polyester, 10% Cotton	S
Gate Paradise Coffee	Bedspread	100% Polyester	S
Odyssey 0005 Jet	BR Shams	70% Polyester 30% Cotton	S
Palomino vinyl	Dash	Vinyl	Vinyl
Buff vinyl	Dash Vinyl	Vinyl	Vinyl
Ultraleather Brisa Distressed Buff	Driv/Pass Chair, Euro Recliner	100% Polyurethane Blend w/ 100% Rayon Backing	Ultraleather
Café Mocha CGT 8970 Leather	Opt Sofa, J-Lounge, Ensemble	Leather	Leather
Fairview Café	Windshield Drapery	64% Cotton, 36% Polyester	Dry Clean Only
TB 1387B Egnog	Windshield Closeoff Rope Tie Back	90% Rayon, 8% Cotton, 2% Polyester	S
FRL 03153-01-A Jamocha Cream	Decorative Fringe	57% Rayon, 32% Polyester, 11% Polypropylene	S
CD 03153-01-A Jamocha Cream	Decorative Cord	48% Acrylic 43% Polyester 9% Rayon	S

Sagebrush			
COLOR/PATTERN	APPLICATION	CONTENT	CODE
K-Omega Cocoa	Sofa, LR Pillows, Ensemble Back	73% rayon, 27% polyester	Dry Clean Only
R-Virgo Forest	FSD	70% rayon, 30% Polyester	S
Dalmata Sagebrush	LR Pillow, LR/BR Valance	46%Viscose Chenille, 37% Rayon, 17% Polyester	S
Luminous Strie Fog	Bedsread, BR Shams	100% Polyester	W
Brilliant Topaz F-0166238-01180005	Bedsread Accent, BR Pillow, BR Shams	34.75% Polyester, 33.21% Cotton, 32.04% Postindply	S
Drexel Teak	LR/BR Valance, BR Pillow	100% Polyester	S
Rio Bravo - Patina	Headboard	85% Polyester, 15% Cotton	W
Palomino vinyl	Dash	Vinyl	Vinyl
Buff vinyl	Dash vinyl	Vinyl	Vinyl
UL Brisa Distressed Buckskin	Driv/Pass Chair, Euro Recliner	100% Polyurethane Blend w/ 100% Rayon Backing	Ultraleather
Oceanside Driftwood Leather	Opt Sofa, J-Lounge, Ensemble	Leather	Leather
Fairfiew Café	Windshield Drapery	64% Cotton, 36% Polyester	Dry Clean Only
Eggnog	Windshield Closeoff Rope Tie Back	90% Rayon, 8% Cotton, 2% Polyester	S
FRL 04596-01-A Sagebrush	Decorative Fringe	36% Polyester 33% Rayon 31% Acrylic	S
CD 04596-01-A Sagebrush	Decorative Cord	36% Polyester 26% Rayon 36% Acrylic	S



Golden Twilight II			
COLOR/PATTERN	APPLICATION	CONTENT	CODE
Tres Chic Midnight	Sofa, LR/BR Valances, Headboard, Ensemble Back	44% Rayon, 32% Polyester, 24% Acrylic	S
Sabrina Onyx	LR/BR Valances, LR/BR Pillows	78% Polyester, 22% Viscose	S
Candice Olson, Pattern Jentry, Color Onyx	LR Pillow	53% Polyester, 47% Polyamide	S
Rubin Dijon	Bedsread, BR Shams	100% Silk	Dry Clean Only
Mandalay Black	Bedsread Accent	100% Polyester	S
Retreat Ebony	BR Pillow, BR Shams, FSD	100% Cotton	S
Palomino vinyl	Dash	Vinyl	Vinyl
Buff vinyl	Dash vinyl	Vinyl	Vinyl
Ultraleather Brisa Distressed Buckskin	Driv/Pass Chair, Euro Recliner	100% Polyurethane Blend w/ 100% Rayon Backing	Ultraleather
Café Sand MEA 8972 Leather	Opt Sofa, J-Lounge, Ensemble	Leather	Leather
Fairview Café	Windshield Drapery	64% Cotton, 36% Polyester	Dry Clean Only
TB-1387B Eggnog	Windshield Closeoff Rope Tie Back	90% Rayon, 8% Cotton, 2% Polyester	S
Victoria Midnight 1/2" cord	Decorative Cord	37% Polyester, 36% Rayon Chenille, 27% Olefin Filler	S/W
FRL 0226-12-A Black	Decorative Fringe 2" Loop	58% Polyester, 39% Polypropylene, 3% Acrylic	S

**FLOORS**  
*Carpet Cleaning*

**Spot Removal Procedures:**

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

**Cleaning Solutions:**

- A. Dry Cleaning Fluid:** A nonflammable spot removal liquid, available in grocery and hardware stores.
- B. Nail Polish Remover:** Any acetate, which often has a banana fragrance. **DO NOT** use if it contains acetone.
- C. Detergent Solution:** Mix two cups of cold water and 1/8 teaspoon mild liquid detergent (no lanolin, non-bleach).
- D. Warm Water:** Lukewarm tap water.
- E. Vinegar Solution:** One cup white vinegar to one cup water.
- F. Ammonia Solution:** One tablespoon household ammonia to one cup water.
- G. Stain Removal Kit:** Available from retail carpet stores or professional cleaners.
- H. Call Professional:** Additional suggestions, special cleaning chemicals or the ability to patch the area may be available.
- I. Permanent Change:** Due to the nature of the stain, there may be color loss. The carpet has been permanently dyed or the carpet yarns have been permanently damaged.

**NOTE:**

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

**Spot Removal Guide**

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

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

## Tile Floor

Tile floors vary in porosity and surface irregularities. Regular maintenance is important 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 or break. Avoid dropping heavy or sharp objects on the tile.**

### **Cleaning Tile:**

Use a damp sponge mop or a cloth to clean tile. If moderate staining occurs, cleaning with a window cleaner such as *Windex*® should do the job. A mild solution of hot water and all-purpose cleaner for tile floors, walls and countertops can also be used. Rinse well with clear water and 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.

### **NOTE:**

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

### **Grout:**

Grout used is a two part concrete mix and can 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.

### **Sealing the Tile:**

Grout sealers are available that protect the porous surfaces. If a sealer is used, follow the sealant manufacturer guideline for application. Never use sealers on unglazed tile. With the exception of terra-cotta, which may be oiled or waxed, tile does not need to be polished or buffed to maintain its finish.

Apply sealant to the tile floor and grout to prevent discoloring from soils and spills. Follow the sealant manufacturer's application instructions carefully.

### **CAUTION:**

**Product contains petroleum distillate. Open windows, vents and doors to provide adequate airflow during application.**

### **NOTE:**

**It is recommended to test a small amount of sealant on an inconspicuous area before applying to the entire floor. Avoid getting sealant onto surfaces other than the flooring.**

### **To Apply:**

1. Extend slide room(s) and clean floor. Allow floor and grout to thoroughly dry.
2. Working from rear towards doorway, apply sealant direct from container onto a cloth towel or broom handle applicator. Grout sealant applicators are available at large hardware stores.
3. Apply sealant per manufacturer instructions. **DO NOT** allow sealant to puddle in grout lines. Extra care should be used to make sure all grout has been sealed.
4. Refer to container for cure time.

### **NOTE:**

**If a spill occurs before sealant has cured, it may be necessary to clean and additionally treat area with sealant as needed.**

## SHOWER

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

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

## CEILING

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

### Hardwood, Vinyl and Decorated Paneling:

Certain cleaning agents will affect the surface on both printed and unprinted vinyl. Use only a mild, non-abrasive detergent and warm water with a soft cloth or sponge to clean. **DO NOT** use bleach, alcohol, oil-based spray cleaners or cleaning agents that contain solvents, citrus oil or harsh chemicals.

### Decorative Ceiling Mirror:

Household cleaners, ammoniated detergents or glass cleaners may be used on A-Look Decorative Metals. Use a glass cleaner applied to a soft cloth to clean.

### Suede Fabric:

Restore surfaces using a soft brush. Remove dust from the suede fabric using the soft brush attachment of a vacuum.

### Lumicor:

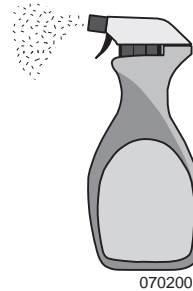
Clean using warm water, mild detergent, and a soft sponge, cloth or chamois.

## WALL COVERINGS

Immediately remove solvent based or pigmented substances from wall coverings. **DO NOT** use abrasive cleaners containing chlorine bleach or solvents.

*Fidelity* and *Jolie* brands are recommended. Always begin with a mild detergent or soap and warm water. To remove normal dirt, clean with a soft sponge. Rinse and wipe dry.

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



## Specific Stain Removal Procedures:

### Normal Dirt:

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

### Nail Polish, Shellac or Lacquer:

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

### Ink:

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

### Chewing Gum:

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

### Pencil:

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

### Blood, Feces or Urine:

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

## WOOD CARE

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

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

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

**NOTE:**

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

### Sanding and Sandpaper:

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

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

### Steel Wool:

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

### Nail Holes and Small Cracks:

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

**TIP:**

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

### Scratches and Nicks:

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

### Fixing scratches in stained woodwork:

Light scratches will often disappear when carefully rubbed with furniture polish or paste wax. When scratches appear lighter than the surrounding dark-stained woodwork, it usually means either that the scratch goes through the stain into the wood or that the varnish is flaking off. Deeper scratches can be hidden by carefully rubbing with a piece of oily nut meat such as Brazil nut, black walnut or pecan. Be careful to rub the nut meat directly into the scratch to avoid darkening of the surrounding wood. Color the scratch with brown coloring crayon or liquid shoe dye (especially good on walnut). Always test a procedure on an inconspicuous area on the wood to ensure no damages to the finish occurs.

**Staining the scratch with iodine:**

**Mahogany** - Use new iodine.

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

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

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

**Dents:**

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

**Restoring the clear finish:**

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

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

**CAUTION:**

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

**Re-staining the wood:**

If bare wood is visible at the bottom of the scratch, the wood will need to be re-stained. To remove damaged lacquer, lightly roughen a small area around the scratch with sandpaper, steel wool or synthetic steel wool. Find a stain that is a shade lighter than the wood finish. Stain the bare wood with a very small amount of stain on a rag, brush or cotton swab. If the color is too light, apply additional coats. Rub away excess stain with a dry rag. If the wood becomes too dark, use a rag moistened in mineral spirits to lighten the wood. Select a lighter color stain and continue.

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

**COUNTERTOPS**  
***Solid Surface*****Routine Care:**

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

**Cleaning the Countertops:**

- ◆ **Most dirt and stains:** Use soapy water or ammonia-based cleaner.
- ◆ **Water marks:** Wipe with damp cloth and towel dry.
- ◆ **Difficult stains:** Use Soft Scrub® and a gray Scotchbrite® pad.
- ◆ **Disinfecting:** Occasionally wipe surface with diluted household bleach (one part water and one part bleach).

**Cleaning the Solid Surfaces Sink:**

Occasionally clean by using Soft Scrub Liquid Cleanser® and a gray Scotchbrite® pad. Scrub the sink, rinse and towel dry.

**Removing Cuts and Scratches:**

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

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

**Preventing Heat Damage:**

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

**Other Important Tips:**

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

**NOTE:**

**DO NOT cut directly on the solid surface. Run cold water to dilute the excess heat when pouring boiling water into the Solid Surface sink.**

***Laminate***

Clean laminate countertops with a damp cloth or sponge. Use a spray cleaner to remove stubborn stains. Do not use harsh abrasives, scouring powders, peroxides or bleaches as these products may dull or damage the surface. Avoid contact with dyes, bleaches, and indelible inks on food packages. Do not use laminated countertops as a cutting board. Laminated countertops are resistant to minor heat; however, hot pans, irons, and lit cigarettes will damage the surface. Use hot pads under pans taken directly from the stovetop.

**STAINLESS STEEL SURFACES**

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

**General Cleaning:**

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

**For Heavy Soiling:**

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

**DO NOT USE:**

- ◆ Steel wool pads or abrasive cloths
- ◆ Abrasive powders or cleaners
- ◆ Citrus-based cleaners
- ◆ Acidic or vinegar based cleaners
- ◆ Ammonia
- ◆ Oven cleaners

**NOTE:**

**Citric acid permanently discolors stainless steel. Immediately remove the following items from stainless steel surfaces: mustard, tomato juice, marinara sauce and citrus-based sauces or products.**

**WINDOWS****Water Spots:**

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

***Condensation***

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

**Controlling Moisture Condensation:**

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

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

**WINDOW TREATMENTS****Mini Blinds****Dusting:**

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

**Vacuuming:**

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

**Compressed Air/Hair Dryer (non-heat setting):**

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

**Spot-Cleaning:**

Spot-clean shades and blinds using a soft cloth or a moistened sponge with lukewarm water. Add mild detergent, if needed. Blot gently to avoid creasing. In a dusty environment, the blinds may need to be cleaned regularly using a sponge or dampened soft cloth. Use warm (not hot) water and a mild detergent that does not contain abrasives.

Rinse the blinds using a clean cloth and water to prevent water spots. Place a towel directly under the blinds to absorb water that may drip.

**Ultrasonic cleaning:**

Professional ultrasonic cleaning may be preferred.

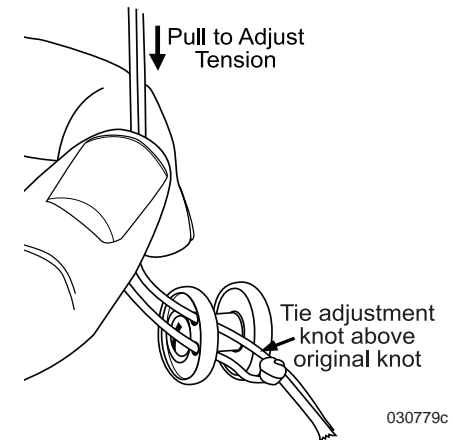
**Day/Night Shades**

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

**Tension Adjustment:**

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

- ◆ Pull the tied-off lines through the button to increase tension. Leave some slack so the shades are not too tight.
- ◆ Tie the lines off at the new position. Adjust each side equally.
- ◆ Operate the shades to ensure tension is set correctly and equally on both sides.
- ◆ Trim excess line from both sides if desired.



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**Dusting:**

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



**Cleaning:**

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

**NOTE:**

**DO NOT use colored liquid soap as a stain may appear when fabric dries.**

**MOLD & MILDEW****What is Mold?**

Mold is a type of fungus that occurs naturally in the environment and can leave a musty odor, discolor fabrics, stain surfaces and cause considerable damage to the motorhome.

**What Does Mold Need to Grow?**

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

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

**Consequences of Mold:**

All mold is not necessarily harmful, but certain strains of mold have been shown to cause, in susceptible persons, allergic reactions, including skin irritation, watery eyes, runny nose, coughing, sneezing, congestion, sore throat and headache. Individuals with suppressed immune systems may risk infections. Some experts contend that mold causes serious symptoms and disease which may even be life threatening. However, experts disagree about the level of mold exposure that may cause health problems, and about the exact nature and extent of the health problems that may be caused by mold. Moreover, the Center for Disease Control states that a casual link between the presence of toxic mold and serious health conditions has not been proven.

Standards or threshold limit values for concentration of mold or mold spores have not been set. Currently, there are no EPA regulations or standards for airborne mold contaminants. There is simply no practical way to eliminate all mold and mold spores in the indoor environment. For example, studies have shown that ozone cleaners are not effective at killing airborne mold or surface mold contamination.

**Controlling Mold Growth:**

The motorhome owner should eliminate mold growth in the motorhome. Take the following steps to eliminate mold growth in the motorhome:

1. Carefully examine items for signs of mold before loading them in the motorhome. Potted plants (roots and soil), furnishings, clothing and linens, as well as many other household items, may contain mold.
2. Regular vacuuming and cleaning will help reduce mold levels. Mild bleach solutions and most tile cleaners are effective in eliminating or preventing mold growth.
3. Indoor humidity can be reduced by 30 to 60% when venting clothes dryers to the outdoors. Ventilate the kitchen and bathroom by opening windows, using exhaust fans or a combination of both. Operating the air conditioning will remove excess moisture in the air, and help facilitate evaporation of water from wet surfaces.
4. Promptly clean up spills, condensation and other sources of moisture. Thoroughly dry any wet surfaces or material. **DO NOT** let water pool or stand in the motorhome. Promptly replace materials that cannot be thoroughly dried.
5. **Inspect** for leaks on a regular basis. Look for discolorations or wet spots. Repair leaks promptly. **Inspect** condensation pans (refrigerators and air conditioners) for mold growth. Take notice of musty odors and any visible signs of mold.

6. Should mold develop, thoroughly clean the affected area with a mild solution of bleach. First, test to see if the affected material or surface is color safe. If mold growth is severe, call on the services of a qualified professional cleaner.
7. If mold cannot be removed, throw the item away.

Whether or not a motorhome owner experiences mold growth depends largely on how the motorhome is managed and maintained. As a manufacturer, our responsibility is limited to things that we can control. As explained in the written warranty, we will repair or replace defects in the construction (defects defined as a failure to comply with reasonable standards of motorhome construction) for the Limited Warranty coverage period provided.

**THE MANUFACTURER WILL NOT BE RESPONSIBLE FOR DAMAGE CAUSED BY MOLD THAT MAY BE THE CONSEQUENCE OF OR ASSOCIATED WITH DEFECTS IN THE CONSTRUCTION.**

## PEST CONTROL

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

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

### Steps to help control pests:

- ◆ Reduce clutter inside the motorhome and storage bays. All storage items, particularly food (including pet food), should be kept in tightly sealed containers. Seal all cracks and holes, and ensure that window, door and vent screens are securely in place.
- ◆ Routinely clean the motorhome, including storage bays. Wipe down the water bay. Promptly remove all crumbs from areas where food is regularly prepared and eaten. Garbage should be placed in a sealed container and removed to an outside receptacle daily. Only put out pet food that will be immediately eaten.
- ◆ Keep foods such as flour, cereal, spaghetti and pet food in re-sealable containers with tight lids.
- ◆ Sweep and vacuum often (especially in eating areas) to help eliminate a food source for pests.
- ◆ Seal cracks, crevices, and gaps around doors and windows.

- ◆ Many pests need moisture to successfully live and reproduce. Limit their access to water or moisture sources by sealing any cracks and leaks in pipes and faucets. Reduce moisture in the motorhome by controlling condensation, immediately wiping up spills and promptly repairing leaks. Be extra alert around areas that attract rodents and insects, including the sewer hose, fresh water hose, bay doors and items that may be leaning against the outside of the motorhome, such as fishing poles and golf clubs.
- ◆ When the motorhome is stored outdoors, clear the surrounding area of all rodent friendly hiding places: shrubs, trees and clutter. Completely seal the underside of the motorhome. Wire mesh will work well to prevent points of entry, but beware of blocking necessary air vents. Prior to operating the motorhome after storage, remove all insect and animal nests that may have developed around vents, engine compartments, the exhaust pipe and in the wheel wells.

### Rodents:

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

**NOTE:**

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

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

**Insects:**

Eliminate insects when signs of infestation appear. If you are unable to identify the type of insect, purchase sticky traps from the hardware store and place the tape where the insects have been seen. Once a sample is caught, seek assistance in identifying the insect to determine what will be required to remove the infestation.

Regularly **inspect** the exterior of the motorhome for signs of a budding wasp nest, and promptly destroy small nests before they become too large.

Spiders can be in any structure. Immediately remove spider webs. Some types of spiders like to nest on top of the diesel tank and around the diesel hoses. Dispense of spiders using a vacuum. Use care to capture the spider and egg sacs. Throw the vacuum bag away in a sealed bag.

Fruit flies invade the motorhome by attaching to fresh fruits and vegetables. Determine what food items are generating the flies and discard that item in an outdoor trash receptacle. Fruit flies can be eliminated with a homemade trap. Pour a few ounces of vinegar into a cup and cover the cup with plastic wrap. Secure the wrap with tape or a rubber band and poke a ¼" hole in the plastic. Place the trap in the area where fruit flies are present.

Ants live in colonies. Only a fraction of the ant colony will leave to seek food. Spraying pesticides will only kill the ants that are away from the colony. The colony must be destroyed to eliminate all ants. Keep ants away from the sewer hose by spraying the hose ends with a soap and water solution.

Fleas can be removed by properly treating pets with a veterinarian approved treatment and by thoroughly cleaning the motorhome. Vacuum vinyl areas and tile floors to remove dust, flea larva and flea eggs. Follow by thoroughly washing those areas with soap and water. Carpets must be vacuumed and treated with a residual flea control product labeled safe for indoor carpet and furniture use. Perform the cleaning treatment daily for three days to ensure that all fleas have encountered the treatment.

Flying outdoor insects are attracted to bright light. Yellow porch light covers on the motorhome work to discourage insect invasion. During nighttime hours insects will be attracted to docking lights, or other bright exterior lighting.

If the presence of moths is detected inside of the motorhome, usually by holes appearing in material, clean the affected clothing and all other items stored in the same area. Follow

by completely cleaning the closet, dresser or storage area. If cracks are detected, seal the cracks and treat the area with a control product that is safe for indoor use. Follow product manufacturers safety warnings.

**Birds:**

Even birds can be considered pests, particularly when the motorhome is parked in the flight path of a flock. Bird droppings are hard to remove and will leave stains. Prevent permanent staining to the motorhome roof by regularly cleaning the surface to remove all bird droppings.

**Damage from Pests:**

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

**Best sources of information about common household pests:**

The Internet is a great place to find information about common pests. The National Pest Management Association website can be useful resource about common pests. Another good source for information are colleges and universities with entomology (study of insects) departments.

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

If a pest problem is suspected in the motorhome, consider professional pest control help.

**The following guidelines can be used for selecting a pest control service:**

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

## STORAGE

### *Short Term*

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

#### **Checklist - Short Term Storage:**

- ◆ Retract the slide rooms. **DO NOT** store the motorhome with slide rooms extended.
- ◆ Shut off all appliances.
- ◆ Close the primary propane valve.
- ◆ Remove all articles from refrigerator/freezer and clean thoroughly.
- ◆ Drain the refrigerator icemaker and icemaker tray. See manufacturers manual for more details.
- ◆ Drain holding tanks. Winterize the fresh water system using FDA approved RV antifreeze or evacuate the plumbing system with air pressure.
- ◆ Retract and secure all awnings.
- ◆ Turn **OFF** interior house power.
- ◆ Store batteries fully charged. Batteries stored in a discharged state will readily freeze.
- ◆ If possible, position the motorhome so the batteries are accessible for charging or changing without having to move the motorhome.
- ◆ If available, leave the motorhome hooked to shore power. Leave the main battery disconnect switches **ON**.
- ◆ If AC power is not available, turn the battery disconnect switches **OFF**.
- ◆ Careful placement of a small heat source in the interior will help control moisture. Desiccate filter systems will help remove interior moisture.
- ◆ If possible, store the motorhome inside a storage building.
- ◆ If stored outside, **inspect** all seams and seals twice a month for possible leakage.
- ◆ Store the motorhome with a full fuel tank to minimize moisture condensing at top of fuel tank.
- ◆ Close vents and windows to prevent wind driven rain entrance.
- ◆ Store tires at the maximum inflation pressure listed on the sidewall.
- ◆ Perform a full interior **inspection** for water leaks twice a month. Be sure to check behind all cabinet doors and drawers.

## Long Term

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

### **NOTE:**

**The natural process of condensation 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 AC power is not available in storage area:**

- ◆ Turn **OFF** all appliances.
- ◆ Close the primary propane valve.
- ◆ Turn **OFF** interior house power using the battery cut-off switch.
- ◆ If possible, situate the motorhome so the batteries remain accessible. This allows a battery to be charged or replaced without moving the motorhome.
- ◆ Charge the batteries to a full state of charge.
- ◆ Turn the main battery disconnect switches **OFF**.

- ◆ Use the monitor panel to make a quick reference check of the battery voltage while the motorhome is in storage. If the motorhome is stored outside, optional solar panels may offset the parasitic loads. Preventative measures should be used if the voltage readings are low. Removing the motorhome from storage or moving the motorhome in case of an emergency will be a much easier process if the batteries are properly maintained.

### **NOTE:**

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

### **If AC power is available:**

The main battery disconnect switches should remain **ON**. The inverter will charge both house and engine battery banks. A 30 Amp shore power service is 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 voltage sensitive electronic equipment may result!**

### **Surfaces to park/store the motorhome on:**

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

- ◆ Storage buildings with concrete floors, or heated storage facilities, greatly reduce the amount of moisture accumulation and protects the motorhome from moisture damage.

### **Outdoor Storage Area:**

- ◆ The interior should be heated to help prevent mold and mildew growth. Moisture removing desiccate filter systems are available from hardware and RV supply stores. Place the filter system inside the motorhome to reduce interior moisture, condensation or humidity.
- ◆ Proper winterization of the fresh water system will prevent potential damage in extreme cold.
- ◆ Ultraviolet radiation affects soft goods and rubber products such as privacy curtains, window shades and tires. These items should be protected. Store Day/Night Shades in the Up position.
- ◆ Cardboard templates can be made for the windows to protect the interior from exposure to direct sunlight.
- ◆ Tire covers are available to protect the sidewall of the tires from cracking. Make sure tires in storage contain the correct air pressure to prevent damaged caused by under-inflation.
- ◆ Regularly wash the exterior to help control moss accumulation. Waxing the motorhome twice a year will augment these substances.

**Inspect the motorhome:**

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

**Fuel:**

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

**Brakes:**

Brakes suffer from non-use during periods of storage. The bare metal machined surfaces of brake drums or rotors have only a light coating of dust from the brake lining friction material. The brake dust is the only thing protecting the bare metal surfaces from rusting. Only regular brake applications dry the moisture preventing rust on brake drum or rotor surfaces.

During periods of non-use, oxygen and moisture oxidize the machined surfaces. Only occasional use keeps these surfaces from oxidizing. Rusty brake drum or rotor surfaces permeate the brake lining upon the first few applications, reducing the friction action of the linings.

**Engine:**

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

**Electric Motors:**

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

**Winter Storage Checklist**

- ◆ **Plumbing Lines** - Drain and protect. (See *Winterizing - Section 6*)
- ◆ **Fresh Water Tank** - Drain.
- ◆ **Body** - Clean and wax. Oil locks and hinges. Seal roof and seams as needed.
- ◆ **Countertop and Cabinets** - Wash with mild soap and water.

- ◆ **Curtains** - Remove and clean according to care specifications.
- ◆ **Windows** - Cover windows by pulling blinds, closing shades or using a separate cover such as a sheet.
- ◆ **Holding Tank** - Drain and rinse. Close valves.

**NOTE:**

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

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

## Removal from Storage

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

- ◆ Thoroughly **inspect** the outside of motorhome. Look for animal nests in the wheel wells or in other out of the way places.
  - ◆ Remove all appliance flue vent covers, ceiling vent covers and air conditioning covers. 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 LLA cells with distilled water only. Charge as necessary. **Inspect** the cable ends and terminals. They should be secure and free of corrosion.
  - ◆ Check all the chassis fluid levels: engine oil, engine coolant, hydraulic fluid reservoir, transmission oil and rear axle oil.
  - ◆ Start the engine and allow it to reach operating temperature. Ensure engine instruments indicate proper readings.
  - ◆ While the engine is running, check the operation of headlights, taillights, turn signals, back-up lights, license plate light and emergency flasher. Operate the dash air conditioner. If the air conditioner does not work or the compressor makes unusual noises, have the system checked by a qualified air conditioner technician.
  - ◆ Shut the engine down. Adjust or add fluids as necessary. **Inspect** around the engine and under the motorhome for fluid leaks.
  - ◆ Drain, sanitize and flush the fresh water system as outlined in the *Water Systems-Section 6*. **Inspect** the sewer drain hose and connections for leaks. Replace if necessary.
  - ◆ Operate all faucets and fixtures in the fresh water system. Run a sufficient amount of fresh water through all the water lines and faucets to thoroughly purge any potable antifreeze from the fresh water system.
- NOTE:**  
**Discard at least the first two trays of ice from the icemaker to ensure the ice does not contain traces of antifreeze or other contaminants.**
- ◆ Open cabinet doors and drawers. **Inspect** for water leaks at joints or fittings. Repair as necessary.
  - ◆ Operate all 12 Volt DC lights and accessories. If something does not work there may be a bad 12 Volt DC circuit breaker or blown fuse.
  - ◆ Install new batteries in battery operated safety detectors or devices. Test the Carbon Monoxide, propane and smoke detectors for proper operation.
  - ◆ **Inspect** the 120 Volt AC electrical system which includes the power cord, inverter/converter, all outlets and exposed wiring.
- NOTE:**  
**Prepare the generator for operation following the instructions in the Generator OEM manual.**
- ◆ Start and run the generator.
  - ◆ Confirm that the batteries are being charged. Operate the 120 Volt AC appliances and air conditioners. If an electrical item or appliance is not properly functioning, contact the dealer or an authorized service center to have it evaluated.

- ◆ Have a qualified technician inspect the propane system and perform a gas leak test. The leak test should also include a propane regulator adjustment (if needed). The test can also verify if the regulator is faulty and should be replaced. Have the propane tank inspected.
- ◆ Operate each propane appliance. Observe all burner/pilot flames for proper color and size.
- ◆ Inspect and clean the interior.
- ◆ Check the sealant around all roof and body seams and windows. Reseal if necessary.
- ◆ Lubricate all the exterior locks, hinges and latches with a graphite lubricant.
- ◆ Check the windshield wiper blade condition. Check the wiper/washer operation.
- ◆ Wash and wax the exterior. Check the body for scratches or other damage; touch up or repair as necessary. Flush the underside thoroughly.
- ◆ Run through the operational checks for steering, brakes, engine and transmission. Operate the motorhome slowly during these checks to allow sufficient circulation of fluids and resetting of the components.
- ◆ If desired, have the dealer or repair center double-check preparation to make necessary adjustments and/or correct defects.



# 09 Camelot

Appliances — Section 4

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## APPLIANCES - INTRODUCTION

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

### **NOTE:**

Some appliance displays and appliance manuals may refer to LP-Gas as a fuel source; however, the actual fuel source used and required for these appliances is propane. The phrase “LP-Gas” is synonymous with not only propane, but butane and propane/butane mixtures. Since propane is the actual fuel required, the term “propane” will be used throughout this manual except for references to third party appliances (such as the refrigerator) that include the term “LP-Gas” on their displays or other literature.

### **INFORMATION:**

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

### **WARNING:**

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

### **WARNING:**

Carbon Monoxide gas may cause nausea, fainting or death. Operating a propane appliance with inadequate ventilation or partial blockage of the flue can result in Carbon Monoxide poisoning. **DO NOT** store flammable liquids such as lighter fluid, gasoline or propane in the outside refrigerator compartment.

### **NOTE:**

Features and options vary with floor plans.

## REFRIGERATOR

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

### **INFORMATION:**

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

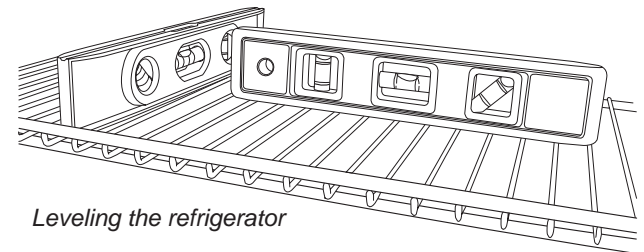
### **NOTE:**

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

## Operation Specifics

- ◆ The refrigerator operates from propane or 120 Volts AC electric.
- ◆ DC Voltage for control pad operation must be no higher than 15.4 Volts DC or lower than 10.5 Volts DC.
- ◆ AC voltage must be no higher than 132 Volts AC or lower than 108 Volts AC.

**Important:** Operate refrigerator only when level. Place a torpedo level on the bottom shelf of the refrigerator. The bubble should be at least halfway in the circle. Generally, this is within comfortable living conditions.



Leveling the refrigerator

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### **CAUTION:**

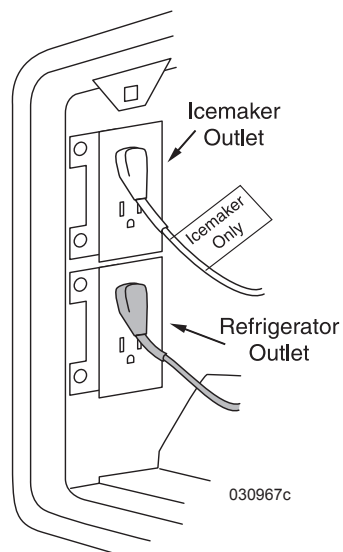
Operating the refrigerator off-level separates chemicals, causing them to crystallize and block the circulation action of the cooling unit. Damage is cumulative and irreversible.

### **WARNING:**

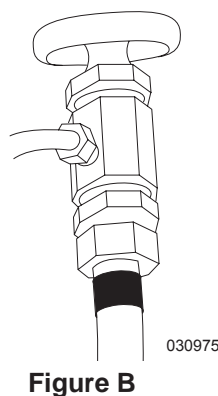
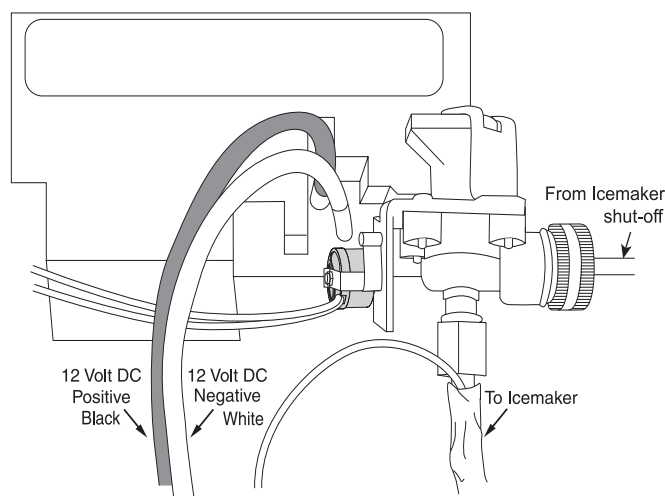
**DO NOT** use the refrigerator if an ammonia smell is present inside or outside of the refrigerator or a yellowish substance appears inside or at the outside access compartment. This can be an indication of a refrigerant leak. Contact an authorized repair facility.

**For the refrigerator to operate:**

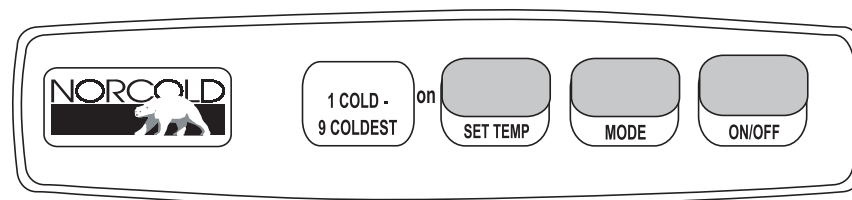
- ◆ House batteries must be charged.
- ◆ The primary propane valve must be on or an **AC** source must be available.
- ◆ **Figure A:** The refrigerator 120 Volt AC cord(s) must be plugged in (located outside behind refrigerator access door).

**Figure A**

- ◆ **Figure B:** The icemaker shutoff valve must be open if the refrigerator is equipped with an icemaker. The icemaker shutoff valve is located behind the exterior refrigerator access panel.
- ◆ **Figure C:** If controls do not light up, check the house batteries charge status or see if the 12 Volt DC wires are plugged into the refrigerator circuit board (located outside behind refrigerator access door).

**Figure B****Figure C****Control Panel**

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



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**Manual Mode:**

There are two manual modes:

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

**Automatic Mode (AU):**

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

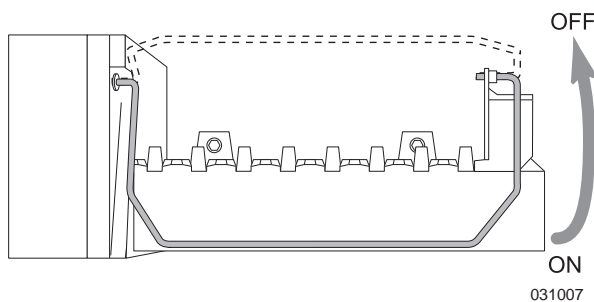
- ◆ Press the **MODE** button until **AU** displays.
- ◆ Press and hold the **SET TEMP** button until the desired temperature displays. Release button.
- ◆ In **AUTO** mode, **AU/AC** or **AU/LP** will alternate three times when a mode has changed.

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

## Icemaker

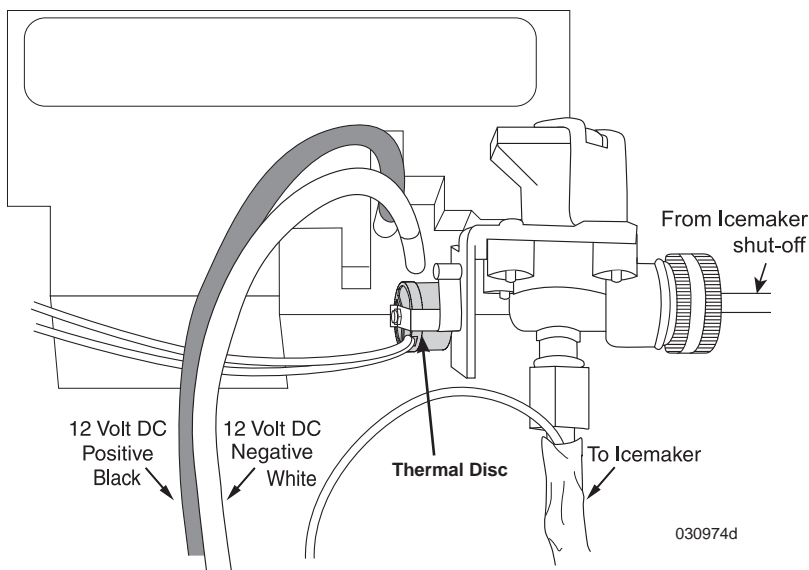
The icemaker requires 120 Volts AC to operate. Only after the freezer reaches freezing temperature will the icemaker function. City water or the water pump must be on and the valve for the water supply line to the icemaker must be on. The icemaker shutoff valve is located behind the exterior refrigerator access panel or under the galley counter.

- ◆ 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 as this can damage the icemaker assembly.**



### **Water Line Heater:**

A thermal disc supplies voltage to heater tape when ambient temperature is less than 38° F (+/- 4°) and shuts off at temperature greater than 48° F (+/- 5°). The water line heater is only for the line from the solenoid to the icemaker.

### **Refrigerator Alarm**

**The refrigerator audible alarm will sound for the following reasons:**

1. DC or AC voltage is higher or lower than allowed.
2. The refrigerator fails to light on propane or fails to light after a period of operation.

3. Refrigerator is set to **Auto**, 120 Volts AC is discontinued and propane fails to light. **NO AC** will display, followed by **NO FL**, and the alarm will sound. Consult the OEM manual.
4. Door is open longer than two minutes.
5. The circuit board detects a failure. The control panel will display a code.

### **NOTE:**

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

### **INFORMATION:**

**Refer to the OEM manual for the list of codes and their meanings.**

### **Cooling Unit Fans**

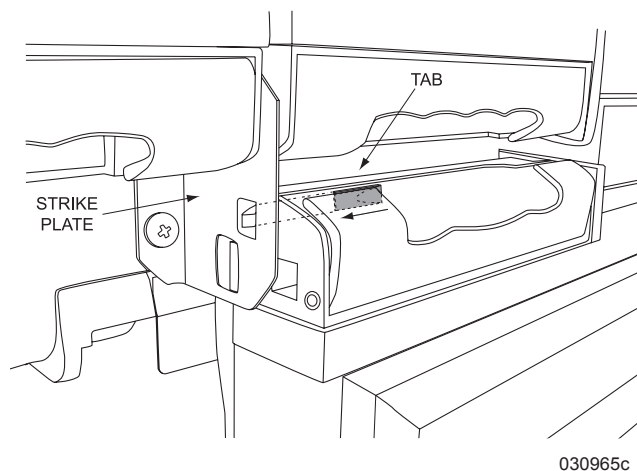
The cooling unit is equipped with a pair of cooling fans that pass air across the cooling unit. These fans start automatically and are audible when in operation.

### **Doors**

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

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

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



### Storage Procedures

#### Storage Feature:

- ◆ Turn the refrigerator **OFF** and remove all items. Leave the drip tray under the cooling fins.
- ◆ Shorten defrost time by using trays of warm water. **DO NOT** use a heating gun, hair dryer or sharp objects to remove frost as these can damage the interior or cooling unit.
- ◆ Wash the interior using mild spray cleaners or a solution of liquid dish detergent and warm water. **DO NOT** use scouring pads or abrasive cleaners that can damage the interior finish.

- ◆ Rinse with a solution of baking soda and water. Dry with a clean cloth.
- ◆ Lock the doors open.

#### **CAUTION:**

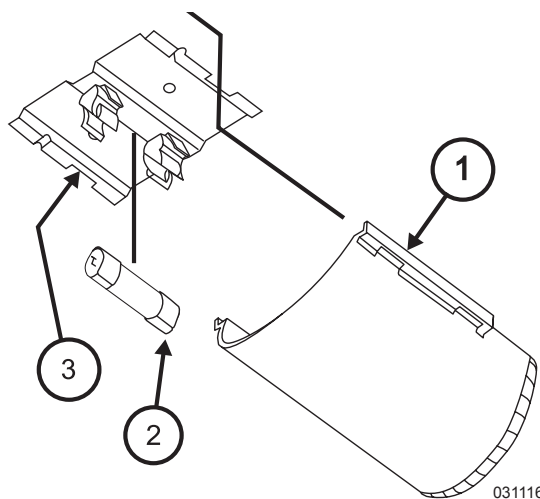
**When defrosting, do not use a hot air blower. Permanent damage could result to plastic parts. DO NOT use a knife, ice pick or any other sharp instrument to remove ice from the freezer as they can puncture the system.**

### Interior Light

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

#### Bulb Replacement:

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



## REFRIGERATOR (OPTIONAL)

### Control Panel

#### Control Panel Functions:

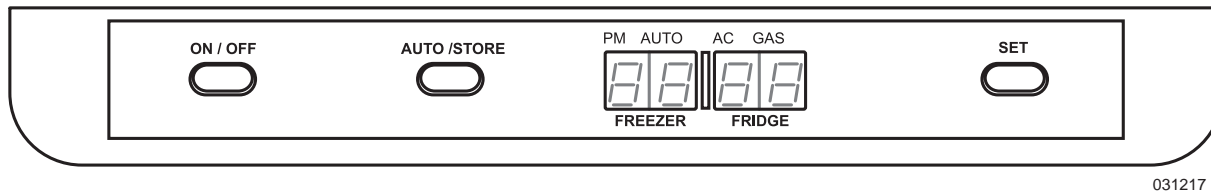
- ◆ **ON/OFF button** – Turns the refrigerator on or off.
- ◆ **AUTO/STORE button** – Selects energy mode between **AUTO AC**, **AUTO Gas**, or **GAS**. The **AUTO/STORE** button is also used to save settings.
- ◆ **LED display** – Displays temperature, different modes of operation and status messages.

#### Includes:

- Temperature in frozen food compartment
- Temperature in fresh food compartment
- **AUTO AC** mode
- **AUTO Gas** mode
- **GAS** mode
- Temperature setting
- Clock
- Status and error messages

- ◆ **SET button** – Adjusts temperature range and sets the clock.

## Operation



- ◆ Press the main power **ON/OFF** button. If the clock has to be set the LED display will show flashing horizontal bars "-- --".

### Setting the Clock:

1. Press the **SET** button until figures flash on the LED display.
2. Press the **SET** button to adjust time. PM is indicated by a dot under PM on the LED display.
3. Save settings by either pressing the **AUTO/STORE** button, or waiting five seconds (the settings will automatically save).

### Setting the Temperature:

1. Press the **SET** button to the desired temperature setting (1 to 5, with 5 the coldest).
2. Save settings by either pressing the **AUTO/STORE** button or waiting five seconds (the settings will automatically store).

### Selecting Mode of Operation:

The mode of operation ranges between **AUTO AC**, **AUTO Gas**, or **GAS**.

1. To select automatic operation press the **AUTO/STORE** button until **AUTO** is displayed. In this mode the system will automatically select the most suitable energy source that is available, either AC or propane operation.
2. To select propane operation only, press the **AUTO/STORE** button until a dot is indicated by **GAS**.

### NOTE:

**Current mode of operation and the energy source, AC or Gas, will be indicated by a dot on the LED display.**

### Automatic Defrost:

The refrigerator will automatically defrost the frozen and fresh food compartments every 24 hours.

### Manual Defrost:

The refrigerator may be defrosted manually. A defrost cycle usually takes about one hour, depending upon the amount of frost in the refrigerator.

1. Press the **ON/OFF** button to turn off the refrigerator.
2. Press and hold the **AUTO/STORE** button, then press the **ON/OFF** button. "dE Fr" will show in the LED display.

### Status Message:

At times the LED display may show either a status message or error message. Refer to the manufacturer's manual for the list of codes and their meanings.

### Cleaning:

Cleaning the refrigerator is usually done after a defrost cycle or before storage. Use a lukewarm, weak soda solution to clean the interior of the refrigerator. Use only warm water to clean the finned evaporator, ice trays and shelves.

### WARNING:

**Never use strong chemicals or abrasives to clean the refrigerator. Damage to the protective surfaces will occur.**

### NOTE:

**If the refrigerator will not be in operation for a period of weeks, it should be emptied, defrosted, cleaned and the doors left ajar. The ice trays should be dried and kept outside the refrigerator.**

**Tips:**

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

**NOTE:**

**If the ice maker is in operation while the motorhome is in motion, water may spill out of the ice tray. Raise the bail arm to the full UP/OFF position about 1 ½ hours before departing. This will allow water in the ice tray to freeze. DO NOT use the first one or two trays of ice if the refrigerator has been in storage. Ice cubes may have contaminants. DO NOT operate the icemaker without water pressure supplied to the refrigerator as this can damage the ice maker assembly.**

**Drip Tray Feature:**

The drip tray located beneath the dispenser catches small spills. The tray is removable and dishwasher safe.

**NOTE:**

**The drip tray is not a drain. DO NOT pour water into the drip tray.**

**Lock Out Feature:**

The ice dispensing system can be “locked out” to prevent unwanted use.

1. **To Lock Out** - Press lock button for three to five seconds until the red light comes on.
2. **To Unlock** - Press the lock button for three to five seconds until the red light goes out.

**Dispenser Light:**

The light illuminates the dispenser area and can be turned on and off by pressing the light button. The dispenser light will also turn on automatically when ice is dispensed.

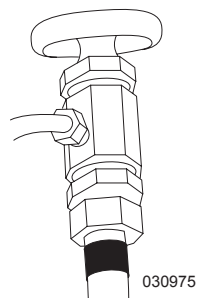
**INFORMATION:**

**For safety reasons, when opening the freezer door the ice dispensing and ice making system will automatically shut off. Closing the freezer door automatically resumes operation of ice dispensing and ice making operation.**

**Icemaker**

The icemaker works from 120 Volts AC only. The water valves supplying the refrigerator must be turned on, and the ice level bail arm must be in the down position.

The icemaker valve is located in the exterior refrigerator access compartment.

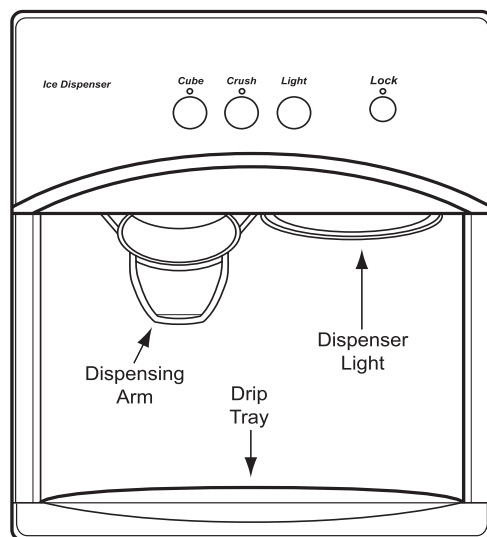


Water supply valve to icemaker.

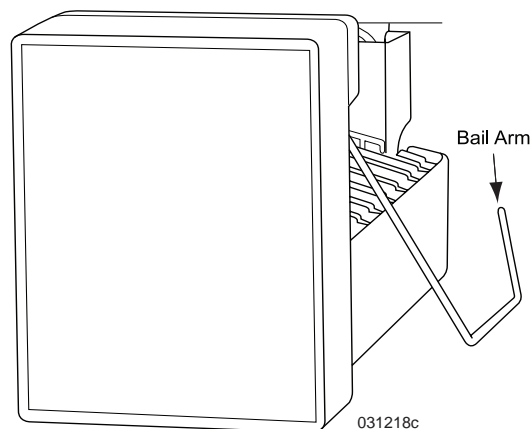
**Automatic Ice Dispenser**

**To Operate:**

1. Press the Cube or Crush button and place a glass against the dispensing arm.
2. To stop dispensing ice, pull the glass away from the dispensing arm.



Optional stainless steel models include a water dispenser.

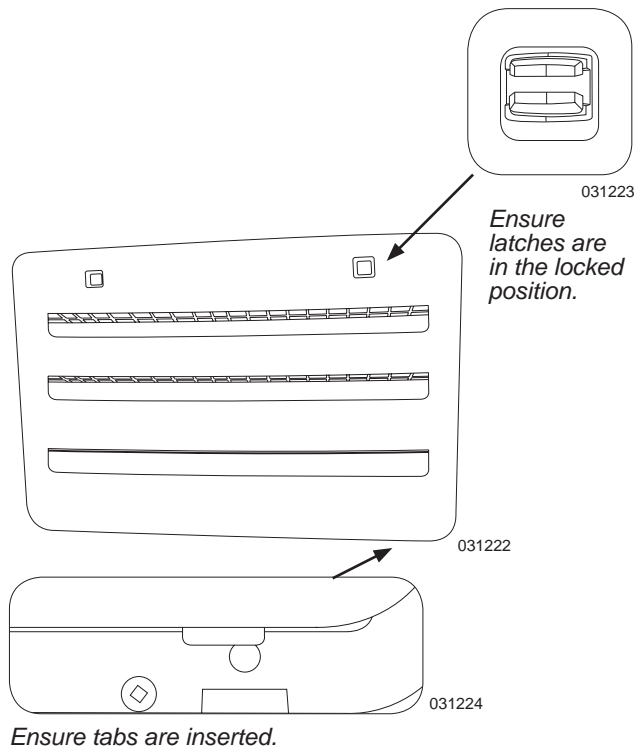


To make ice move the arm down until locked into place.

## REFRIGERATOR MAINTENANCE Service

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

Ensure the exterior refrigerator access panel is properly replaced after removal.



## Air in Propane Supply Lines

For safety reasons, the refrigerator will attempt to ignite on propane gas within a specified amount of time. When starting the refrigerator for the first time after storage, or after servicing the gas supply system, propane gas supply lines may contain air. Due to the air in the gas supply lines, the refrigerator may not ignite on propane gas within the specified amount of time. Follow the procedure on how to remove air from the propane supply lines.

### To remove air from propane supply lines:

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

## MICROWAVE/CONVECTION OVEN

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

### Operation Tips:

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



**Microwave/Convection Oven Facts:**

One of the most useful documents for the microwave/convection oven is the operations manual, located in the owner's information file box. Read it carefully and keep it for reference.

A properly functioning microwave/convection oven presents no hazard with ordinary use. Safety features should be kept in good condition. Never attempt to bypass safety interlocks or allow debris or residue to accumulate on the door or oven face. If the oven is damaged, discontinue use.

Oven adjustments or repairs should be made by qualified service personnel. Check the microwave/convection oven owner's manual for maintenance tips and other information. Remember to register the microwave/convection oven with the manufacturer.

**CAUTION:**

**The ventilation fan will not manually turn off if started automatically from a heated cooktop. The microwave AC Breaker must be cycled.**

**NOTE:**

**When dry camping, minimize using the inverter to operate the microwave/convection oven due to the high rate of battery consumption.**

**NOTE:**

**The microwave/convection oven is for food preparation only. DO NOT use the microwave/convection oven to dry clothes, newspapers, shoes or other items.**

**Setting the Clock****To Set the Clock:**

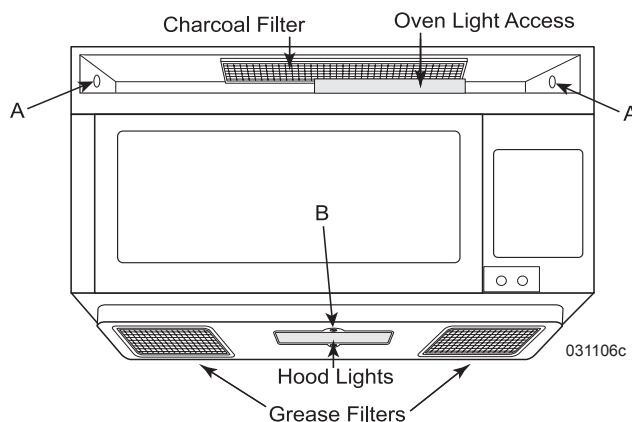
- ◆ Press the **STOP/CLEAR** button.
- ◆ Press the **CLOCK** button.
- ◆ Enter the time using the number buttons.
- ◆ Press the **CLOCK** button to start time.

**NOTE:**

**The clock is a 12 hour clock only.**

**Care & Cleaning**

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

**Charcoal Filter:**

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

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

**Oven Light:**

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

**Hood Light:**

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

4. Close the cover and re-secure with screw.

**CAUTION:**

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

**Grease Filters:**

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

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

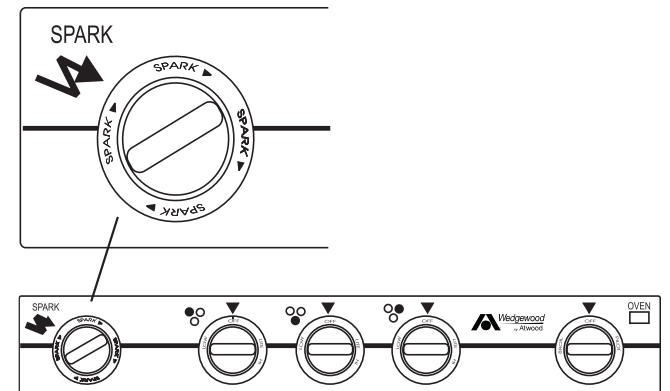
**Cleaning Tips for the Microwave:**

- ◆ Turn the oven **OFF** before cleaning.
- ◆ Cover food while cooking to keep food spattering to a minimum.

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

**COOKTOP**

The cooktop uses propane as a fuel source. The cooktop burners use a piezo type igniter. The cooktop should be used for cooking purposes only and not as a heating source. When the burner valve is opened, the fuel flows through the valve into the mixture tube. The fuel passes by a hole or venturi in the mixture tube, which draws air in with the fuel for a proper fuel/air ratio. The flame should have a blue appearance with a lighter blue defined flame at the burner head.



Rotate spark knob to light burner.

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## Operating the Cooktop

- ◆ The primary propane valve on the propane tank is open.
- ◆ Turn the appropriate burner knob counterclockwise to **LITE**. **DO NOT** attempt to light more than one burner at a time.
- ◆ Turn the **SPARK** knob located at the left hand side of the cooktop, clockwise one click. If the burner fails to light, continue turning the **SPARK** knob clockwise until the burner lights.
- ◆ Turn the burner knob clockwise to **OFF** to turn the burner off.

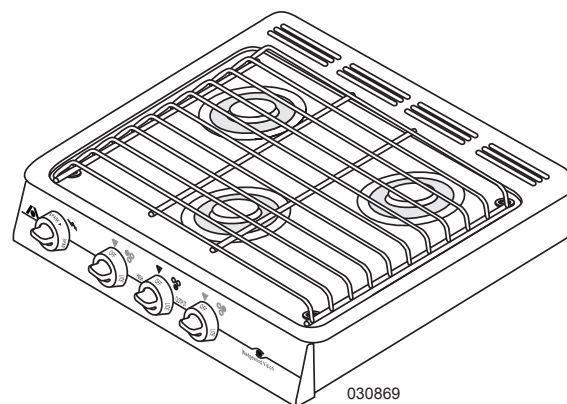
## Operation Tips

1. A yellow flame or yellow tips indicate a rich fuel mixture or incorrect fuel/air ratio. This results in lowered BTU output and can cause carbon build up to occur, thus leaving a black color or carbon on the bottom of a pot or pan.
2. Flame appearance may change and BTU output will lower when operating the cooktop at an altitude above 5,000 feet. Allow extra cooking time.
3. **DO NOT** allow the tips of the flame to extend beyond pan or pot edge. When this occurs heat is wasted and possibility of injury increases.
4. Remove cooktop cover to help keep the underside of the cooktop clean. Place strips of aluminum foil on the cooktop floor pan and under burners. **DO NOT** restrict airflow of mixture tubes.

## Burner Grate

### Removing the Burner Grate and Cooktop Cover for cleaning:

- ◆ Place a towel on the counter next to the cooktop.
- ◆ Remove the burner grate by lifting out of rubber inserts of cooktop cover and place on towel.



## Cleaning

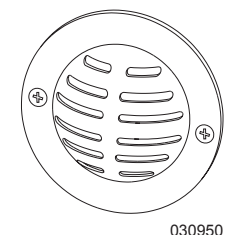
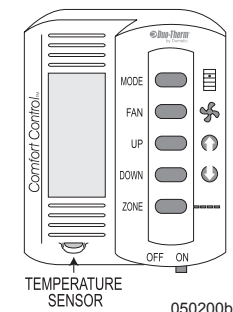
- ◆ Clean all surfaces as soon as possible after boil-overs or spills.
- ◆ Use warm, soapy water to clean the burner grates, painted surfaces, porcelain surfaces, stainless steel surfaces and plastic items on the range or cooktop. Grit or acid-type cleaners may ruin the surface.
- ◆ Use only non-abrasive plastic scrubbing pads.
- ◆ **DO NOT** allow foods containing acids (such as lemon or tomato juice, or vinegar) to remain on porcelain or painted surfaces. Acids may remove the glossy finish. Wipe up egg spills when cooktop is cool.

- ◆ Allow porcelain surfaces to cool before cleaning. Burns from the heated surface may occur or the cooktop porcelain can crack.

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

## WALL THERMOSTAT

The Comfort Control thermostat, located on the hallway monitor panel, operates the HVAC (Heating, Ventilation and Air Conditioning) functions throughout the motorhome. Remote temperature sensors are also located throughout the motorhome.



Remote Temperature Sensor

The motorhome is divided into operating zones. The selected zone number will blink at the bottom of the Comfort Control display.

Zone 1	Zone 2*	Zone 3
Front AC	Middle AC	Bedroom AC
Living Room Heat	Hallway Heat	Bedroom Heat

\*42' Models Only

**NOTE:**

**Zone 2 is only operational on 42' Models equipped with three roof air conditioners.**

The HVAC system provides five different functions: **Off, Fan, Cool, Heat Pump** and **Furnace** selected by pressing the **Mode** button.

The **Fan** function controls blower speed of the roof air conditioner. Two speeds are available: low and high. Selecting fan speed **Auto** adjusts the fan speed automatically based on temperature set point and actual temperature in a selected zone.

**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 CONDITIONING - ROOF

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

**NOTE:**

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

**NOTE:**

**The roof air conditioner will not operate in Heat Pump mode with ambient temperatures of 30° F. and below.**

#### Operations

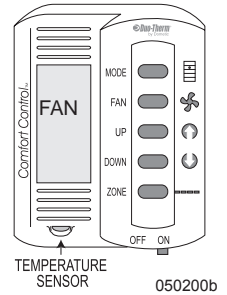
##### Roof air conditioner operation requirements:

- ◆ 120 Volts AC is supplied from either shore power or the generator.
- ◆ Interior house power is **ON** and the house batteries are charged.

##### Fan Operation:

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

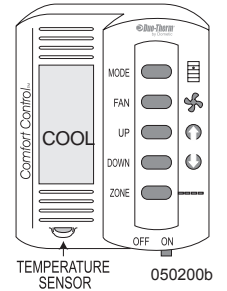
- ◆ Press the **MODE** button repeatedly until **Fan** is displayed.
- ◆ Press the **FAN** button to select the desired fan speed.



##### Air Conditioner

##### Operation:

- ◆ Press the **MODE** button repeatedly until **COOL** is displayed.
- ◆ Select desired zone.
- ◆ 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 to prevent accidental compressor operation against high pressure.**

##### Heat Pump Operation

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

**NOTE:**

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

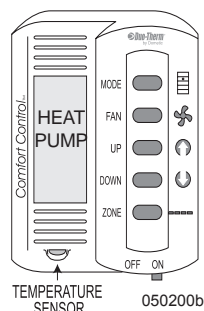
### Aux Heat Mode:

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

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

### Heat Pump Operation:

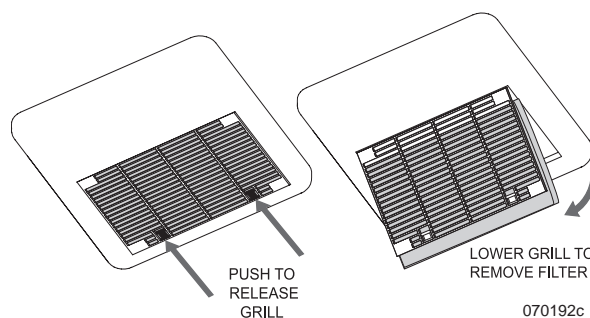
- ◆ Turn **ON** the interior house power.
- ◆ Slide the **ON/OFF** switch to the **ON** position.
- ◆ Press the **MODE** button repeatedly until **HEAT PUMP** is displayed.
- ◆ Set desired fan speed by pressing the **FAN** button.
- ◆ Press the **UP** or **DOWN** buttons to set desired heating temperature.



### Air Conditioner Maintenance

#### Return Air Filters:

Frequently clean the return air filters. The filters are located inside the motorhome behind the intake vent covers. Push on both tabs to access filters. **DO NOT** run the air conditioner without the return air filters in place. Dust and other particles will plug the evaporator core and substantially reduce the performance of the air conditioners.



#### **NOTE:**

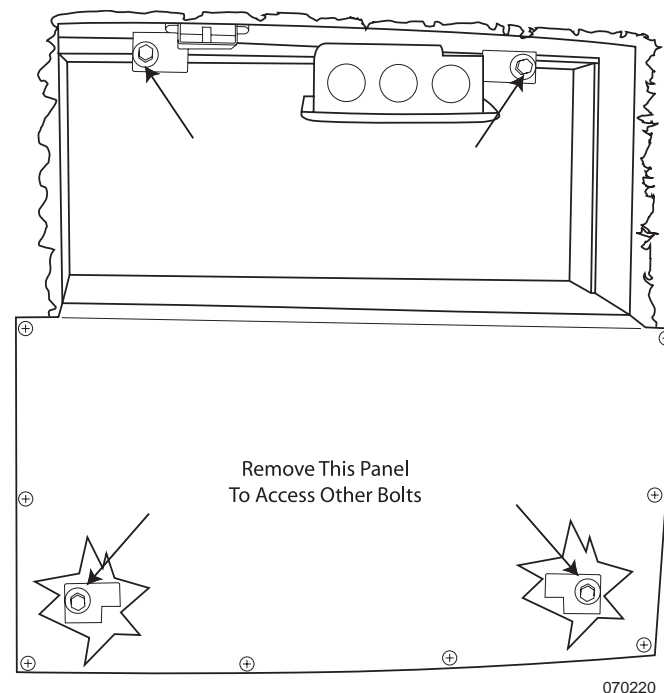
**Turn off optional ceiling fan and battery cut-off switch prior to accessing the return air filter in the bedroom.**

#### To Clean the Return Air Filters:

- ◆ Wash filters in warm soapy water. **DO NOT** use solvents.
- ◆ Rinse filters thoroughly with fresh water. Allow them to dry.
- ◆ Install filters and secure cover.

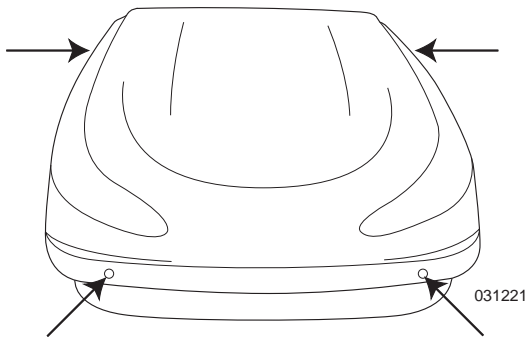
### Mounting Bolts:

Four AC mounting bolts must be re-torqued every six months. Two bolts are located directly behind the return air filter and two bolts are located behind a baffle. Torque the mounting bolts to approximately 40 to 50 in. lbs. The base gasket should be compressed to approximately 1/2".



**AC Cover Screws:**

Use a screwdriver to ensure the AC cover screws are tight whenever the roof is accessed.



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

**FURNACE**

The furnace and its related components are 12 Volt DC operated, using propane as the fuel source. Electronic circuitry (automatic ignition) is used to ignite the burner. The furnace uses outside air for the burner combustion and exhaust is expelled through the outside vent. Inside air is drawn into the furnace and blown across the internal heat exchanger. Heated air is then discharged through ducted hoses which may run throughout the motorhome.

**CAUTION:**

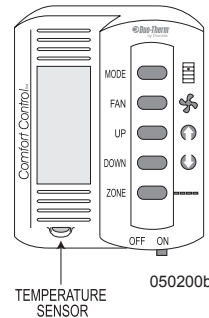
**DO NOT store any items/materials in furnace area. Restricted air flow may hamper furnace operation leading to failure and/or fire hazard.**

**WARNING:**

**IF YOU SMELL GAS** extinguish all open flames and turn off the primary propane valve. Liquid propane is a highly volatile, extremely dangerous gas. It can explode or ignite, which may result in property damage, injury or death. Propane is heavy and can build up on the floor or in corners. Open all windows and doors. **DO NOT** touch electrical switches. They may spark, which can ignite. Keep all open flames, spark producing devices and smoking material out of the area. Contact a qualified service center to have the problem correctly diagnosed and repaired before resuming operation.

**Operation**

- ◆ Open primary valve on the propane tank.
- ◆ House batteries are fully charged.
- ◆ Slide the **ON/OFF** switch (on wall thermostat) to the **ON** position.
- ◆ The motorhome is equipped with two furnaces. Select Zone 1 for living room or Zone 3 for bedroom/bathroom.
- ◆ Select the Furnace mode on the Comfort Control using the **MODE** button.
- ◆ Select the desired temperature using the **UP** and **DOWN** arrow buttons.

**NOTE:**

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

**Tips:**

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

**NOTE:**

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

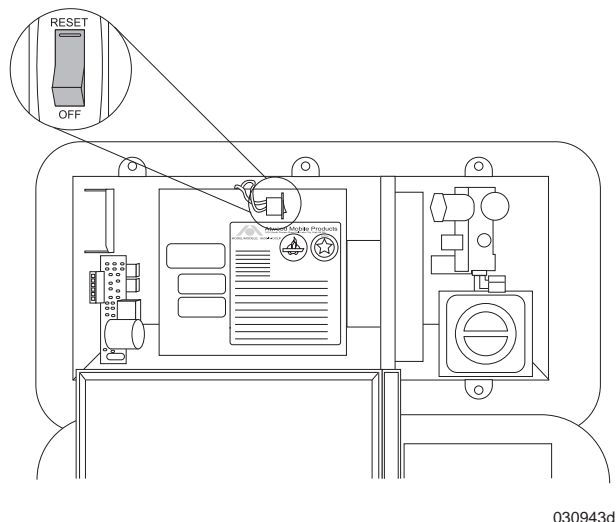
## Troubleshooting

If the furnace fails to light, make sure the propane primary supply valve is open. The furnace will not light if the blower motor is not spinning to its specified speed. This may be due to a low house battery charge condition. To charge the house batteries: hook-up to shore power, start the generator or start the main engine.

If the blower fails to operate after verifying the batteries are charged, use a flat-tip screwdriver to open the outside access door. Ensure the Reset switch is in the Reset position.

### **WARNING:**

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



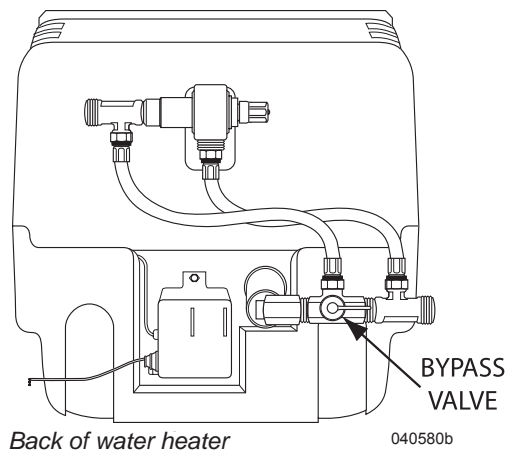
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## WATER HEATER

The water heater uses two different methods to heat water: 120 Volt AC (supplied either by shore power or the on board generator) or propane. The 120 Volt AC function is most energy efficient when operated from shore power. The burner for propane operation is controlled by an automatic ignition circuit board powered by 12 Volt DC. Separate thermostats control water temperature for 120 Volt AC and propane operation. Thermostat temperature is preset by the water heater manufacturer and not adjustable. For ease of winterization, the water heater is equipped with a tank drain plug and bypass valve.

### **NOTE:**

**Refer to the Water Heater OEM manual for detailed instructions.**



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

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

### **To Purge Air and Pressurize the System:**

- ◆ Turn the water heater bypass valve (located at the back of the water heater) to Normal Flow. If necessary install drain plug.
- ◆ Fill the fresh water tank or hook to city water.
- ◆ Turn on the water pump or city water.
- ◆ One at a time, open the hot and cold valves of all faucets until a steady stream of clear water flows with no bubbles or pockets of air.
- ◆ Inspect the water heater and water system for leaks after the water system is purged of air.

### **CAUTION:**

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

### **WARNING:**

**IF YOU SMELL GAS extinguish all open flame and turn off the primary propane valve. DO NOT touch any electrical switches. They may cause a spark that can ignite. Open all windows and doors. Evacuate the motorhome. Propane is a heavy gas and will lie on the floor and hide in corners. Liquid propane is highly volatile, explosive and extremely dangerous. Explosion, fire, property damage, injury or death can result. Contact a qualified service center to repair propane leaks before resuming operation.**

**Water Heater Operation:**

- ◆ Turn on interior house power.
- ◆ 120 Volt AC is supplied from shore power (preferred) or the generator.
- ◆ The house batteries are charged.
- ◆ Open the primary propane valve on the propane tank.

**NOTE:**

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

**Heating Water with 120 Volt AC:**

- ◆ Have either shore power (preferred) or the generator supplying AC voltage.
- ◆ Press the water heater switch.

**NOTE:**

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

**Heating Water with Propane:**

- ◆ Make sure the propane is turned on.
- ◆ Press the **LP-GAS** water heater switch. The indicator lamp will glow steady. A flashing lamp will indicate lockout. Press the switch twice to reset the ignition cycle.

**NOTE:**

**Propane and 120 Volt AC functions can be on at the same time. This will speed up the process of heating water for large volume use.**

**CAUTION:**

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

**NOTE:**

**Due to potential air in the propane lines, the water heater will attempt three ignition cycles. If the burner does not light after the third attempt, the propane function will lock-out. Reasons for lockout may be air in the gas system or burner tube obstructions caused by an insect or spider web.**

**High-Temperature Thermostat:**

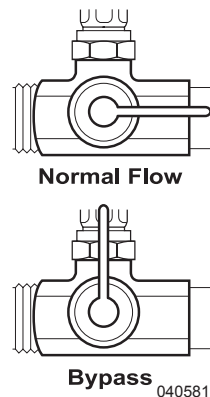
Separate thermostats are used for propane and AC electric. If a thermostat fails, a high-temperature safety limit switch will open.

**CAUTION:**

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

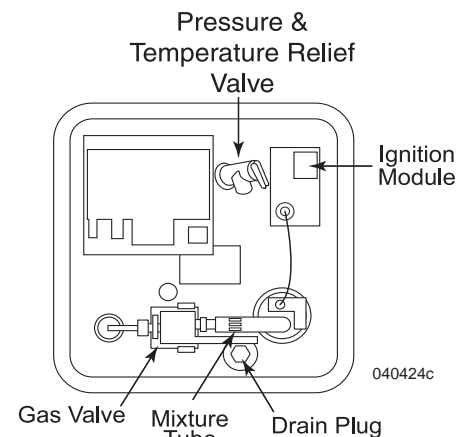
**Water Heater Bypass Valve:**

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



**Pressure & Temperature Relief Valve:**

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



**Re-establishing the Air Pocket:**

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

**CAUTION:**

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

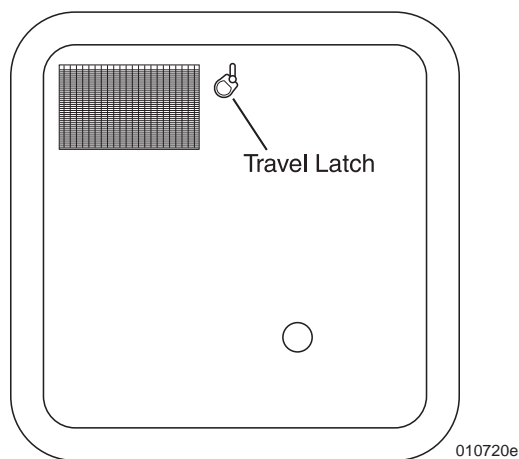


1. Turn Off the water heater.
2. Turn Off the incoming water supply.
3. Open the hot water faucet closest to the water heater.
4. Open the handle of the P & T valve.
5. Allow excess water to drain from the water heater through the P & T valve. When draining is complete, close the P & T valve by allowing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

### Burner Compartment:

Periodically inspect the burner compartment and door screen for foreign material that can prevent the flow of combustion and ventilating air.

**CAUTION:**  
**DO NOT block any opening.**



### Tips:

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

### Draining & Storage:

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

1. Turn off electrical power to the water heater.
2. Shut off the primary propane valve.
3. Open low point drains.
4. Open both Hot and Cold on all faucets.
5. Remove water heater drain plug.
6. Turn the bypass valve to the bypass position.

### NOTE:

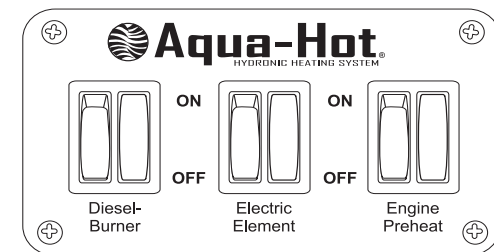
**Be sure to refill the water heater with water before resuming operation.**

### Troubleshooting:

- ◆ Check the burner tube for obstruction if the water heater fails to light. Insects may make nests in the burner tube. It is recommended to clean the burner tube with a brush, rather than compressed air. Compressed air may not fully remove the obstruction.
- ◆ If the indicator light on the switch does not light and the water heater does not light, ensure interior house power is on or check for a blown fuse in the house distribution panel.
- ◆ Check the two amp fuse located on the ignition module (access at exterior burner compartment).
- ◆ If the water heater fails to operate after checking the fuses, the high-temperature safety limit switch may be tripped. Have a qualified technician inspect the water heater.

### AQUA-HOT (OPTIONAL)

The Aqua-Hot appliance is a water heater and furnace in one. A 56,000 BTU diesel fired burner and a 1650 Watt AC element work to heat a 50/50 solution of Propylene Glycol antifreeze and water to approximately 200° F.



The heated antifreeze solution circulates through heat exchangers located within the motorhome to provide interior heat. Potable water is heated by the Aqua-Hot for domestic use. The Aqua-Hot can also preheat the engine, making it easier to start on cold mornings.

**NOTE:**

**The Aqua-Hot antifreeze is propylene glycol based boiler antifreeze. DO NOT mix antifreeze types.**

**NOTE:**

**The Aqua-Hot must be turned on before using any heat feature.**

**Diesel Burner:**

The Aqua-Hot will consume approximately ½ gallon of diesel fuel for each hour of continuous burner operation (about one or two gallons a day). The diesel burner is rated at 12 Volt DC/65 watts. Circulating pumps are rated at 12 Volt DC/12 Watts each. The Aqua-Hot has a fast recovery rate when operating on diesel. To heat with the diesel burner, turn the Diesel switch to the **ON** position. The switch will illuminate when the Aqua-Hot is **ON**. The burner will have to operate for 20 to 30 minutes before maximum heat is available for interior heating or hot water.

**WARNING:**

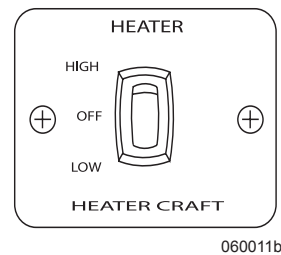
**DO NOT operate the diesel burner if the motorhome is located inside a building. Carbon Monoxide can accumulate and cause asphyxiation.**

**Electric Heat Element:**

The 1650 watt electric element works well when 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. Allow two to three hours for the Aqua-Hot to reach operating temperature when operating from the electric element.

**Bathroom Heat:**

The bathroom has a separate heater control switch located on the cabinet under the sink. If the Aqua-Hot is on, select fan speed to operate the bathroom heat exchanger.

**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 the holding tank bay is ¼ Amp.

**Engine Preheat:**

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

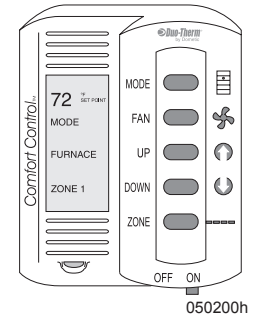
**To Use Engine Preheat:**

- ◆ Turn on the Diesel switch at the galley and allow the system to warm up.
- ◆ Turn on the Engine Preheat switch. The time required to preheat the engine varies with ambient temperature. Allow two or three hours of engine pre-heat time.

**Engine Heat Exchange System:**

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

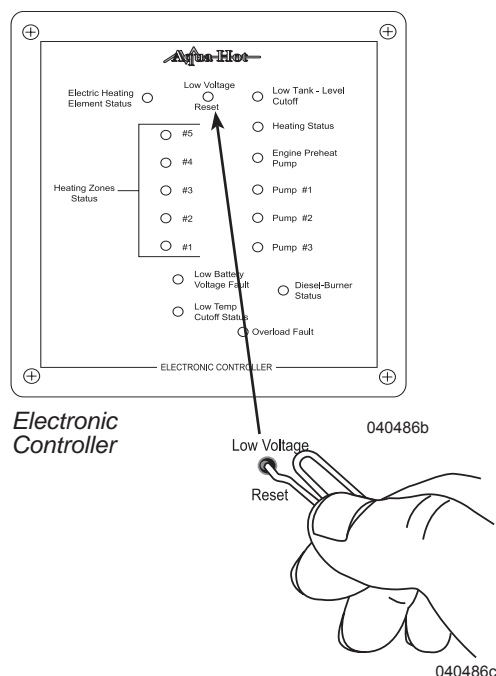
Use the Comfort Control to operate the heat exchangers.

**To Heat the Interior:**

- ◆ Turn **ON** the interior house power.
- ◆ Set the Comfort Control to Furnace.
- ◆ Select the desired Zone and Temperature.

**Troubleshooting**

An electronic display panel (Electronic Controller) is located next to the Aqua-Hot in the curbside bay. The display panel has LED fault indicators that are used for diagnostics. If a heating source is selected (diesel or electric) and the Aqua-Hot does not appear to be working, check to see if any LED fault indicators are lit on the electronic display panel. A fault lamp may be overlooked due to viewing angle.



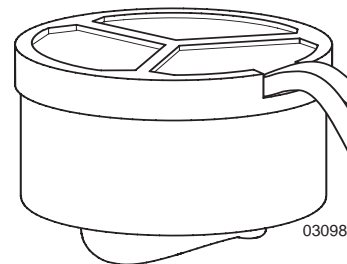
- ◆ **Low Tank Level Cutoff:** Heating function has shutdown due to low level of coolant in the Aqua-Hot. Check coolant level.
- ◆ **Electric Heating Element Status:** Green indicator means the Aqua-Hot is being heated by 120 Volts AC.
- ◆ **Low Voltage Reset:** The Low Battery Voltage Fault LED will illuminate. Reset the Controller by cycling the Diesel burner switch or inserting a paperclip into the hole. Press the reset button.
- ◆ **Heating Status:** The Aqua-Hot is being heated by Diesel or the 120 Volt AC electric element.

- ◆ **Heating Zones Status:** A thermostat is calling for heat in a zone. Normal LED is green. Red LED means a short has occurred in that zone.
- ◆ **Pump Status:** When a pump is operating, LED is green. A red LED indicates a short in the pump.
- ◆ **Low Battery Voltage Fault:** Red LED indicates that battery voltage is low. Hook to shore power or start the generator. The Aqua-Hot will not function until the Electronic Controller is reset by cycling the Diesel Burner switch off then back to on, or by inserting a paperclip or similar tool into the Low Voltage Reset hole. Press the Reset button.

### Bay Thermostat

During cold weather, a thermostat in the holding tank compartment will turn on the exchanger to heat the storage bay. The thermostat turns on at 45° F. +/- 10° F. Ensure the Aqua-Hot is **ON** to heat the bay.

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



Bay Thermostat

### Care & Maintenance

#### Antifreeze:

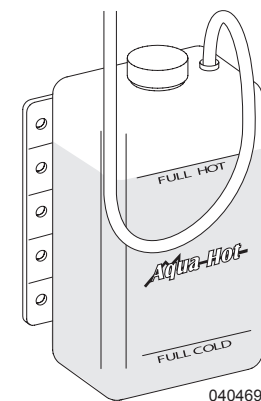
The antifreeze, a special boiler type propylene glycol base, has low silicate content with corrosion inhibitors and heat transfer compounds. This type of antifreeze provides freeze protection and excellent heat transfer for operating efficiency. The antifreeze is mixed to a 50/50 ratio with distilled water. **DO NOT** mix antifreeze types as this can cause scaling and possible component failure. The antifreeze can be purchased directly from *Aqua-Hot Heating Systems Inc.*

#### **CAUTION:**

Use only a non-toxic propylene glycol based antifreeze recommended for boiler applications. This antifreeze is affirmed GRAS (Generally Recognized as Safe by the EPA). Contact Aqua-Hot Heating Systems Inc. at 1-800-685-4298 to purchase the antifreeze.

#### Reservoir:

The coolant reservoir is located curbside in the Aqua-Hot bay. Check the reservoir coolant level monthly. Inspect the coolant level when the diesel burner has just shut off. The coolant level should be at the Full Hot level. Adding coolant to the reservoir when the Aqua-Hot is not at operating temperature may result in overflow when the Aqua-Hot attains normal operating temperature.



**Disinfecting:**

The tubing inside the Aqua-Hot is rated for fresh water and winterizing solutions. The potable water system will be periodically disinfected, which includes flushing the disinfecting solution through the Aqua-Hot. This will not affect the Aqua-Hot as long as the solution is thoroughly rinsed. However, failure to thoroughly rinse the Aqua-Hot with fresh water may result in damage to the Aqua-Hot.

**CAUTION:**

**If not properly and thoroughly rinsed, bleach or other concentrated chlorine bearing chemicals can cause failure to the tubing inside the Aqua-Hot domestic water loop.**

**Annual Tune Up:**

The Aqua-Hot tune up consists of fuel nozzle and fuel filter replacement and a thorough cleaning of the combustion chamber. A 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 noise indicates service or repair is required.

**CAUTION:**

**Disconnect all power supplies before cleaning or servicing.**

**Winterization:**

The Aqua-Hot can remain on during the winter months or it must be winterized with FDA approved RV antifreeze to prevent freeze damage. The RV antifreeze must be pumped through the Aqua-Hot until the solution appears at the hot water side of a faucet.

The on-board water pump can be used (see illustration), or a separate pump can be hooked to the city water fitting. Refer to the OEM owner's manual for complete winterizing instructions.

If the Aqua-Hot is not winterized, it must remain operational. If the system is operating from electric and there is a power outage, freeze damage may occur.

**CAUTION:**

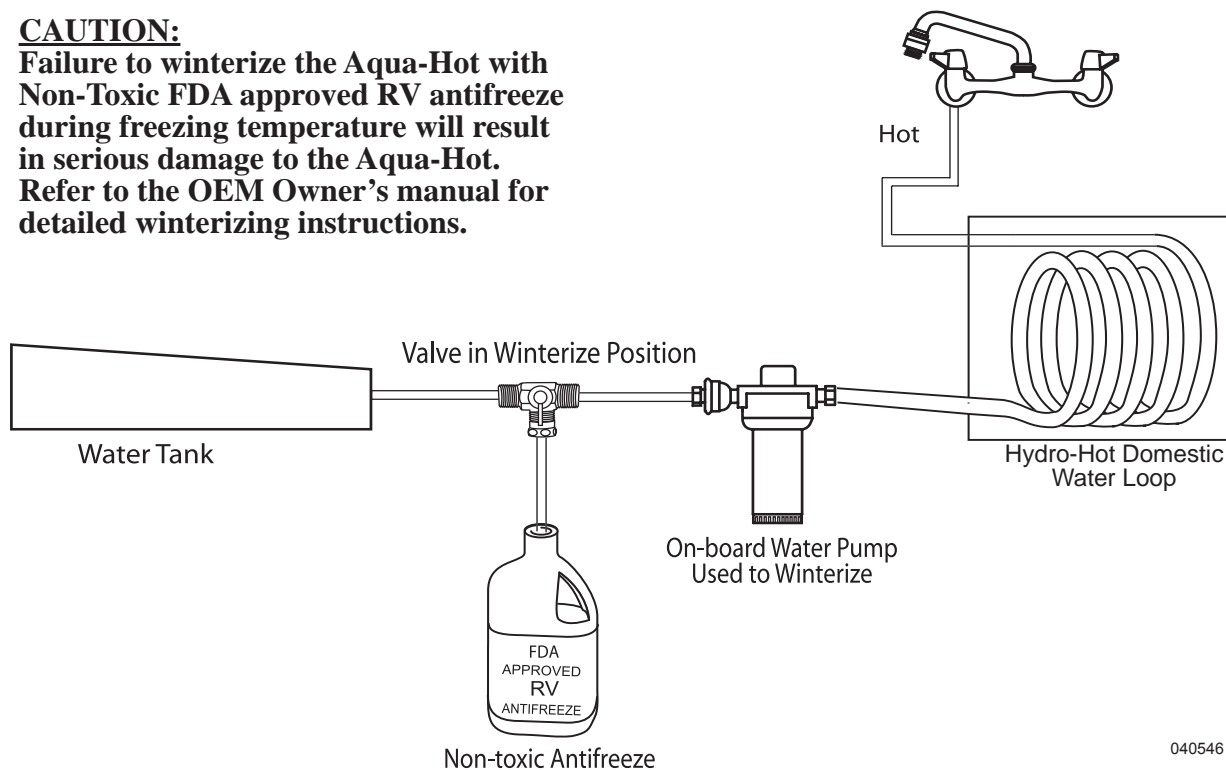
**Failure to winterize the Aqua-Hot with Non-Toxic FDA approved RV antifreeze during freezing temperature will result in serious damage to the Aqua-Hot. Refer to the OEM Owner's manual for detailed winterizing instructions.**

**CAUTION:**

**If the motorhome is hooked to shore power during the winter months and the Aqua-Hot is operating on the electric element, a temporary power outage can allow the Aqua-Hot to freeze resulting in damage.**

**WARNING:**

**DO NOT operate the diesel burner when the motorhome is located inside a building. Carbon Monoxide can accumulate which can be fatal.**



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## Fuel Filter

### Aqua-Hot Fuel Filter:

The filter is located on the curbside of motorhome behind the fuel access door.

### Filter Replacement:

Contamination levels in the fuel determine the frequency of element replacement. 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 filter when clogged (first indication of heat loss) or at the beginning of each heating season. Always carry an extra filter, as one tank of contaminated fuel can plug a fuel filter. Replacement filter must have a 10-micron rating.

**Garber Filter:** Model #R, 10 micron.

### To Replace the Filter:

- ◆ Ensure the Hydro Hot Diesel switch at the galley is turned **OFF**.
- ◆ Spin the filter counterclockwise and remove from head. Remove old O-ring gasket on threaded stud.
- ◆ Install new O-ring supplied with filter. Ensure the gasket is seated in the groove around the filter canister.
- ◆ Apply clean lubricating oil to the new filter gasket and washer.



- ◆ Spin filter onto head until filter makes contact then tighten  $\frac{3}{4}$  of a turn.
- ◆ Start Aqua-Hot and check fuel filter for leaks.

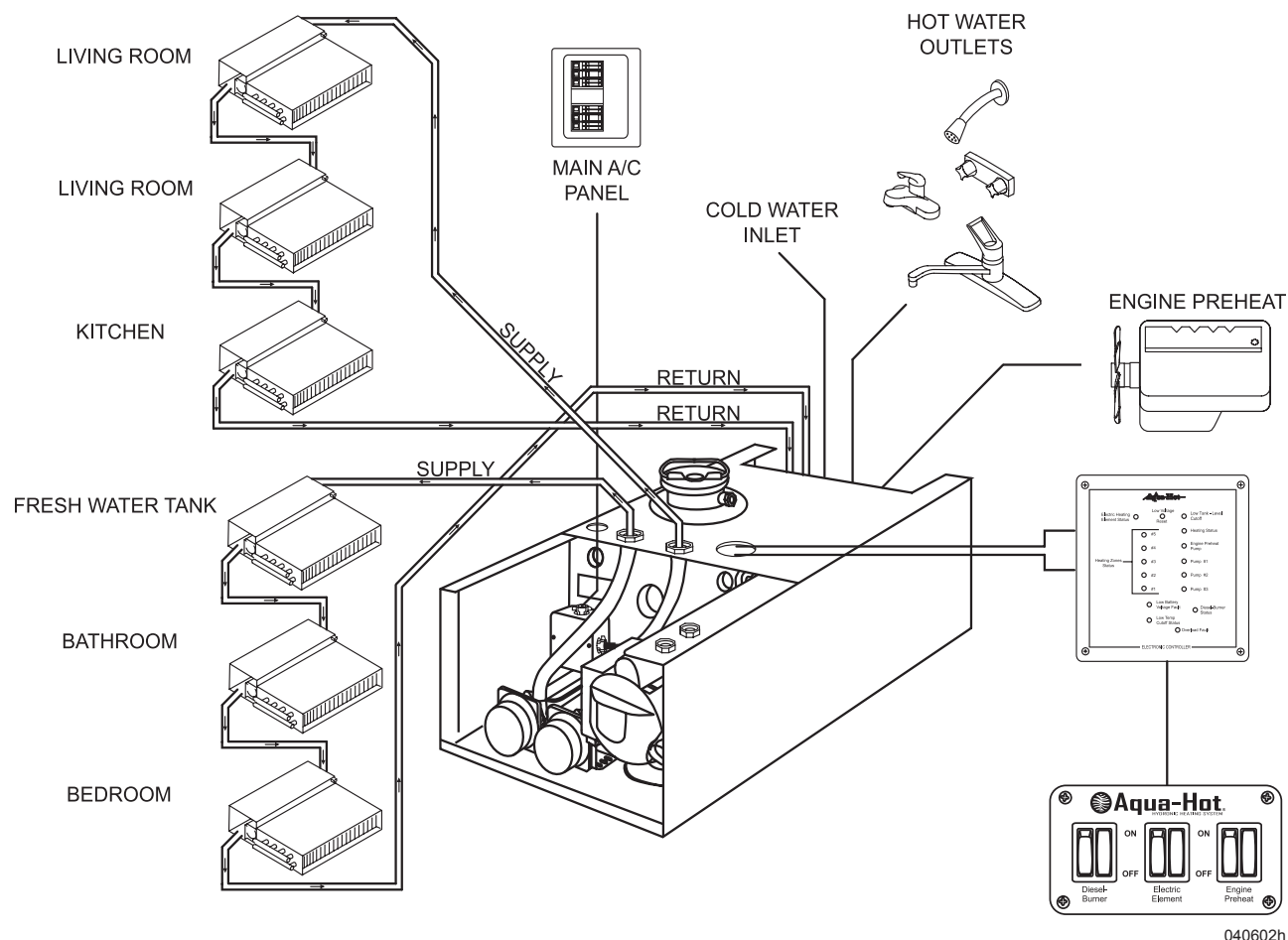
### NOTE:

**It may be necessary to cycle the diesel burner switch on and off a few times to thoroughly purge the fuel system of air.**

## Aqua-Hot Overview

### General Layout:

An understanding of the general layout of the Aqua-Hot system will help in operating and troubleshooting the system.



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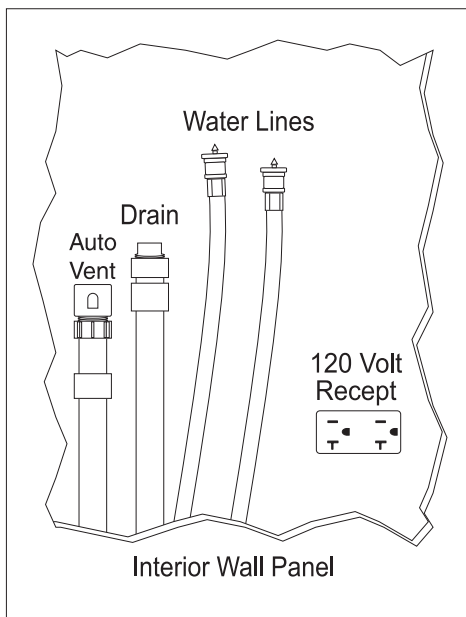
## WASHER-DRYER PREPARED

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

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

**NOTE:**

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



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

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

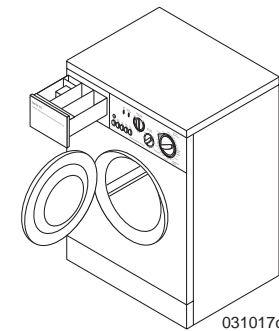
- ◆ **DO NOT** connect the clothes dryer exhaust duct to any other duct, vent or chimney.
- ◆ **DO NOT** terminate the exhaust duct beneath the motorhome.
- ◆ Use proper length fasteners when attaching exhaust vent to exterior sidewall. Stainless steel fasteners are best suited for this as they will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

**CAUTION:**

**It is highly recommended to hook the motorhome to shore services when using the washing machine due to limited fresh water supply and limited grey tank capacity. The washer may drain into the black tank on some floor plans.**

## WASHER-DRYER 1 (OPTIONAL)

The automatic washer-dryer is front loading with an extra large door opening for easier access. Several wash and dry programs are available along with variable water temperature settings.



- ◆ Washer-dryer operates on 120 Volt AC from shore power or generator.
- ◆ Washer-dryer uses approximately 12 to 20 gallons of water per wash cycle.

**INFORMATION:**

**Refer to the washer-dryer manufacturer’s manual in the owner’s information file for detailed operating instructions.**

**WARNING:**

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

**CAUTION:**

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

## Test Procedure

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

### NOTE:

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

### Test Procedure Requirements:

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

### To Conduct the Test Procedure:

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

10. The door will unlock in two minutes or less. The **Status** light flashes fast, then slow. The door should now open.
11. Push the **ON/OFF** button to **Out (Off)** position. The **Status** light should be off.

### WARNING:

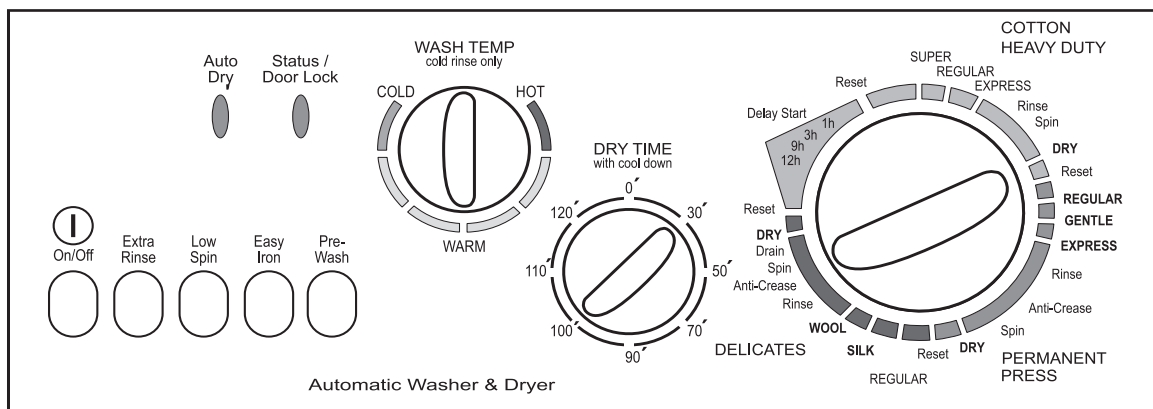
**DO NOT wash or dry articles that have previously been cleaned, washed, soaked or spotted with gasoline, dry cleaning solvents or other flammable or vaporous substances that could ignite or explode. DO NOT add gasoline, dry cleaning solvents or other flammable or explosive substances to the wash water.**

### CAUTION:

**DO NOT use heat to dry articles containing foam rubber or similar textured, rubber-like materials.**

### To begin a wash load:

- ◆ Sort and pre-treat clothes.
- ◆ Add the measured amount of detergent suggested by the package directions (maximum two tablespoons).
- ◆ Load wash tray with detergent.
- ◆ Load the laundry loosely into the washer. Close the washer door.
- ◆ Turn the Wash Temperature knob to the desired temperature setting.
- ◆ Choose the desired washing cycle option using the Selector knob.
- ◆ Turn the power **ON**.
- ◆ After cycle is complete, wait two minutes for the door lock to release before attempting to open the door.

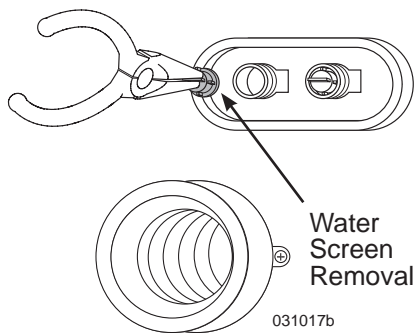


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## Washer-Dryer Maintenance

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

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



### **NOTE:**

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

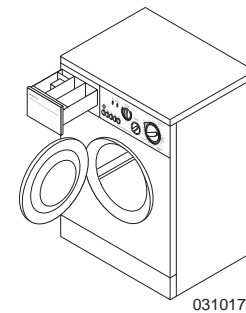
## Winterizing the Washer-Dryer

### Winterize Using Air Pressure:

1. Hook an airline (regulated to 45 psi or less) to the water inlet of the motorhome.
2. Rotate Selector knob to a wash position with the Wash Temp setting on Warm. Press the power button to On. Air pressure will clear the Hot and Cold water lines.
3. After water lines are clear, rotate Selector knob to Spin. Allow the pump to drain the drum.
4. Set Selector knob to Reset and Timer to zero. The door will unlock in two minutes or less. Open door and pour in ¼ gallon of RV antifreeze.

## WASHER-DRYER 2 (OPTIONAL)

The automatic washer-dryer is front loading with an extra large door opening for easier access. Several wash and dry programs are available along with variable water temperature settings.



- ◆ The washer-dryer operates on 120 Volt AC from shore power or generator.
- ◆ The washer-dryer uses approximately 7 to 18 gallons of water per wash cycle.

### **INFORMATION:**

**The washing machine can be set to a variety of wash cycles as well as optional functions. Refer to the OEM manual in the owner's information file for detailed operating instructions.**

### **WARNING:**

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

### **CAUTION:**

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



**Test Procedure:**

Before using the washer for the first time, after winter storage or a long period of non-use, conduct a test procedure to verify that all the hardware and electronic components are functioning.

**NOTE:**

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

**Test Procedure Requirements:**

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

**To Conduct the Test Procedure:**

1. Press the On/Off button to turn the washing machine on.
2. Place a tablespoon of laundry detergent into Bin 2.
3. Set the Selector knob to wash cycle 2. Set Wash Temp knob to Warm.
4. With Dry Time knob set to Off, press the Start button. Water should flow into washer and the drum should rotate.

The washing machine will run a complete wash cycle then the door will unlock. Push the On/Off button to turn the washing machine off.

**WARNING:**

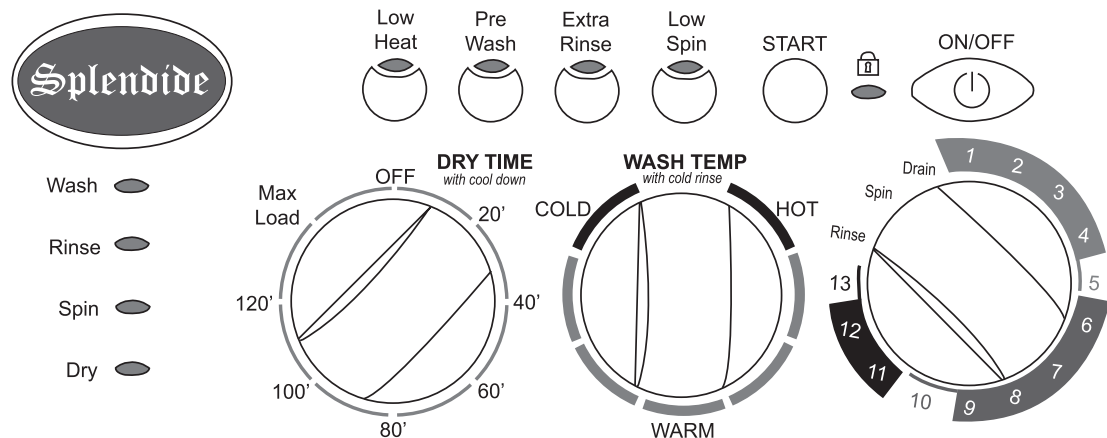
**DO NOT wash or dry articles that have previously been cleaned, washed, soaked or spotted with gasoline, dry cleaning solvents or other flammable or vaporous substances that could ignite or explode. DO NOT add gasoline, dry cleaning solvents or other flammable or explosive substances to the wash water.**

**CAUTION:**

**DO NOT use heat to dry articles containing foam rubber or similar textured, rubber-like materials.**

**To begin a wash load:**

- ◆ Sort and pre-treat clothes.
- ◆ Press the On/Off button to turn on the washing machine.
- ◆ Add the measured amount of detergent suggested by the package directions (maximum two tablespoons).
- ◆ Place detergent in Bin 2 (center bin).
- ◆ Load the laundry loosely into the washer. Close the washer door.
- ◆ Set the Wash Temp knob to the desired temperature.
- ◆ Choose the desired washing cycle using the Selector knob. Wash cycles 1-4 are cotton/heavy duty cycle. Wash cycles 6-9 are permanent press. Wash cycles 11-12 are gentle cycle.
- ◆ (Optional) If desired the washing machine can be set to initiate a drying cycle after the wash cycle has completed. Select the amount of drying time using the Dry Time knob
- ◆ Press the Start button.



Control Panel

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- ◆ The door lock indicator will illuminate indicating the door is locked and the wash cycle will start. The door can be unlocked within 5 minutes of starting a wash cycle or anytime during a drying cycle by pressing the On/Off button. After cycle is complete, wait for the door lock to release before attempting to open the door.

**NOTE:**

**Selector settings 5, 10 and 13 are dedicated drying cycles only. All other numbered cycles are washing cycles. Refer to OEM manual for wash cycle details.**

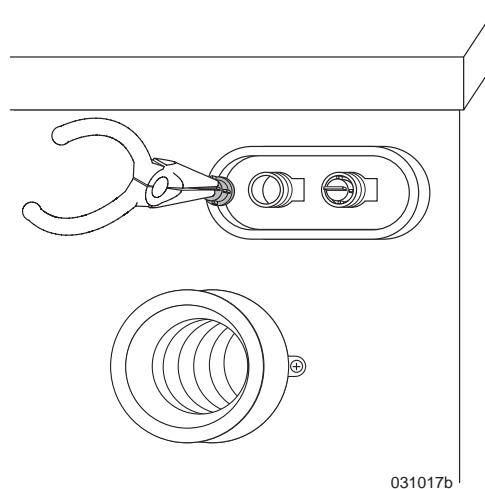
**Tips:**

- ◆ Press the On/Off button to unlock the door within 5 minutes of a wash cycle or anytime during a drying cycle. Ensure water level is below door opening.
- ◆ Use only liquid fabric softener. Do not use fabric softener sheets.
- ◆ Fill drum no more than  $\frac{3}{4}$  full to allow adequate space for tumble drying.
- ◆ To help prevent wrinkles, the washing machine will automatically stop at the end of the Gentle Wash cycle. Press Start to Rinse.
- ◆ Due to delicate fabrics, the wash to dry feature is not functional in wash cycles 11 and 12.
- ◆ High Efficiency laundry detergent can be used.
- ◆ Do not use abnormally large amounts of detergent. Excess suds can flow from detergent bins.

- ◆ Some optional features are not allowed in certain wash cycles. Refer to OEM chart for details.

**Washer-Dryer Maintenance**

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



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

**NOTE:**

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

**Winterize Using RV Antifreeze**

1. Ensure washing machine is off.
2. Open door and pour in 1 pint of RV Antifreeze.
3. Close door. Press the On/Off button to turn washing machine on.
4. Press Start button allowing washing machine to run 1-2 minutes.
5. Turn washing machine Off. Remove supply hoses and drain excess water.

## WASHER (OPTIONAL)

The Whirlpool stackable washer is a large capacity automatic washer.

- ◆ The washer operates on 120 Volts AC from shore power or generator power.
- ◆ The washer uses between 16 and 35 gallons of water per load, depending on cycles and water levels chosen, as well as the volume of laundry.

### **CAUTION:**

**DO NOT use the washer while traveling as damage will occur to the washer and motorhome.**

### **NOTE:**

**Monitor fresh water and grey water tank levels when not hooked to city water and/or sewer.**

### **INFORMATION:**

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

## Test Cycle

Run a test cycle before using the washer for the first time after a long period of non-use. The test cycle will confirm the unit is working correctly, remove RV antifreeze that may be present and verifies all hardware, plumbing and electronic components are functioning.

### **Test Cycle Requirements:**

- ◆ Wipe the exterior and interior of the unit with a damp cloth to remove accumulated dust.
- ◆ Make sure water lines are secure and all the necessary supply valves are open to supply water.
- ◆ Hook to city water or turn on the water pump (must have sufficient water in fresh tank).
- ◆ Hook to shore power, or turn on the generator.

### **Conducting a Test Cycle:**

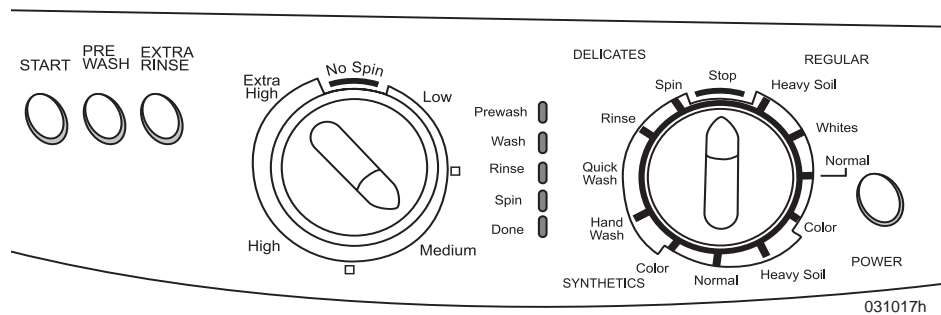
- ◆ Add ½ the laundry detergent for a normal load to the pull-out dispenser.
- ◆ Set the load selector Regular/Normal.
- ◆ Push the power button followed by the Start button.

## Operating Instructions

- ◆ Add sorted laundry loosely into the washer and close the door. Do not overload.
- ◆ Add detergent to the middle compartment of the pull-out dispenser.
- ◆ Choose the cycle that matches load requirements. Water temperature is automatically determined by load preset.
- ◆ Select the appropriate spin cycle setting.
- ◆ Push the Power button and then push the Start button.
- ◆ Indicator lights on the washer displays load status. The door lock will not deactivate until the Done light has been on for two minutes.
- ◆ To cancel the load at any time, turn the cycle knob to Stop. The door will remain locked for two minutes after selecting Stop.

### **WARNING:**

**DO NOT wash articles that have previously been cleaned, washed, soaked or spotted with gasoline, dry cleaning solvents or other flammable or vaporous substances that can ignite or explode. DO NOT add gasoline, dry cleaning solvents or other flammable or explosive substances to wash water.**



**CAUTION:**

**DO NOT** use heat to dry articles containing foam rubber or similar textured, rubber-like materials.

**NOTE:**

See the OEM manual for more specific instructions and recommendations.

**NOTE:**

Make sure there is room available in the grey tank when not hooked to sewer.

**To Clean the Lint Filter:**

- ◆ The lint filter is behind a small door located on the lower right front of the washer.
- ◆ Place a small container or towel underneath the filter door.
- ◆ Open the filter door.
- ◆ Rotate the filter ½ turn counterclockwise and pull out to remove.
- ◆ Clean the filter under running water with a soft brush until clean.
- ◆ Replace filter. Pull gently to confirm that it is properly installed.
- ◆ Close filter door.

**NOTE:**

Clean the lint filter at least once a month or more depending on use.

***Winterizing the Washer*****To Winterize the Washer:**

- ◆ Put one quart of FDA approved RV antifreeze in the washer drum.
- ◆ Run washer on a Spin cycle.
- ◆ Unplug washer or disconnect power.
- ◆ Shut off both water faucets.
- ◆ Disconnect water inlet hoses from faucets and drain.

**NOTE:**

When returning the unit to service, run it through a complete cycle with ¼ the normal amount of detergent to purge the antifreeze from system before using the washer for laundry (see “Conducting a Test Cycle”).

**DRYER (OPTIONAL)**

The Whirlpool® dryer is front loading and operates on 120 Volt AC from shore power or the generator.

**INFORMATION:**

Read the instructions in the dryer manufacturer’s manual located in the owner’s information file.

**CAUTION:**

Open a window or vent while operating dryer. Negative air pressure inside the motorhome can be dangerous while operating fuel burning appliances.

**CAUTION:**

**DO NOT** use the dryer while the motorhome is in motion as it can damage internal components of the dryer.

**NOTE:**

Wipe the dryer drum with a damp cloth to remove dust from storage and traveling before using the dryer.

***Dryer Operation***

Hook to shore power or start the generator to operate the dryer.

**WARNING:**

**DO NOT** dry articles that have previously been cleaned, washed, soaked or spotted with gasoline, dry cleaning solvents or other flammable or other vaporous substances that can ignite or explode.

**CAUTION:**

**DO NOT** use heat to dry articles containing foam rubber or similar textured, rubber-like materials. Clean the lint screen, (located inside the dryer) after each use. Keep the exhaust opening and adjacent areas free from accumulation of lint, dust and dirt.

**To Operate the Dryer:**

1. Load laundry loosely into dryer and close the door. Allow space for the clothes to tumble freely.
2. Turn the cycle control knob to the recommended cycle for the type of load being dried.
3. Push the START button.
4. Open the door, or turn the Cycle Control Knob to OFF to stop the dryer.

**CAUTION:**

**DO NOT** run dryer with lint screen loose, damaged, blocked or missing. Doing so can cause overheating and damage both the dryer and fabrics.

**WARNING:**

**Never use flammable cleaners to clean the any part of the dryer. Failure to comply with this warning could result in fire, explosion, injury, and/or death.**

**Maintenance**

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

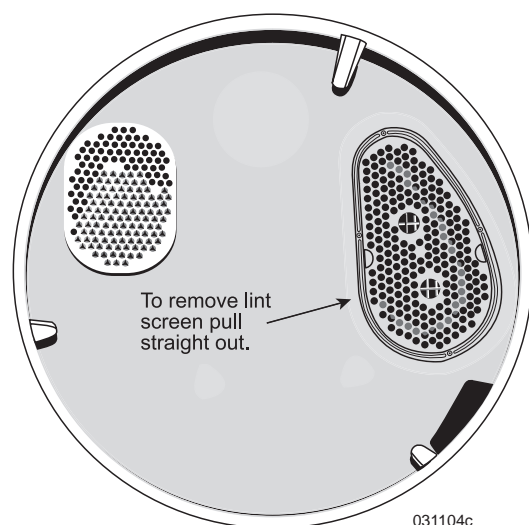
**Changing the Bag:**

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

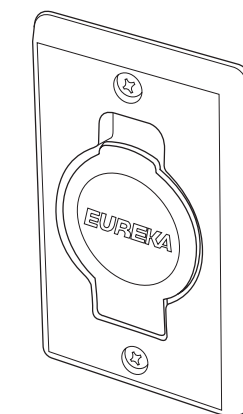
1. Unplug the power unit from grounded outlet.
2. Rotate the bag cover counterclockwise and remove cover.
3. With a finger on each side of the inlet, slide the bag off the inlet tube.

**Dryer Maintenance****Clean the lint screen after each load:**

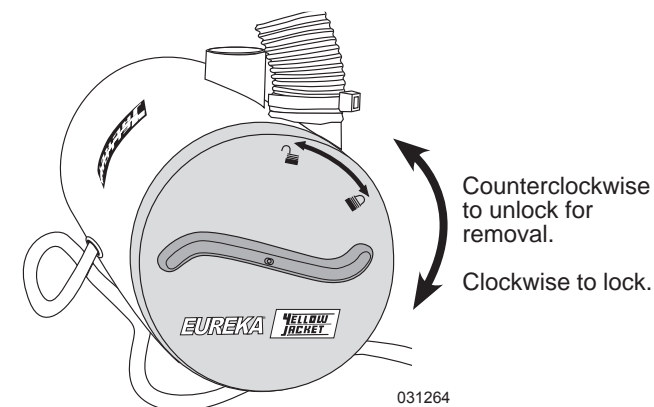
- ◆ Open the door and pull the lint screen straight out.
- ◆ Squeeze body of lint screen slightly while pulling off cover.
- ◆ Roll lint off screen. **DO NOT** rinse or wash screen to remove lint.
- ◆ Replace cover on lint screen body. Push the lint screen firmly back into place and close the door.

**CENTRAL VACUUM (OPTIONAL)****Operation**

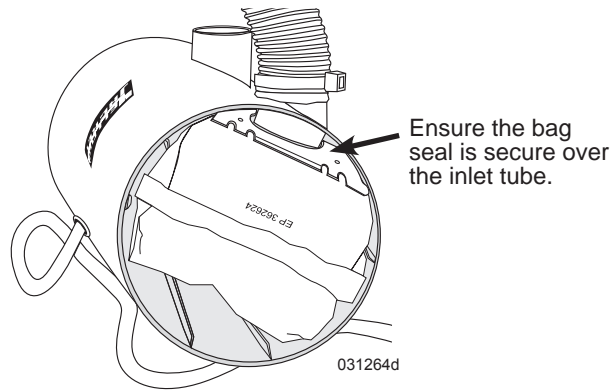
- ◆ Start generator or plug into shore power.
- ◆ Lift lid on wall receptacle to start vacuum. Insert the hose in the receptacle and release lid.
- ◆ Connect desired attachment on hose and start vacuuming.

**NOTE:**

**Consult OEM manual for detailed operation and maintenance.**



4. Pull the center cardboard tab to automatically seal the bag and prevent dust from leaking out.
5. Remove the bag from the vacuum and discard. **DO NOT** reuse.
6. Check motor filter in back of canister.
7. Unfold the new bag and insert into the vacuum so the center cardboard seal tab is toward bag cover. The top arrow should point to the bag cover.
8. With a finger on each of the cardboard tabs, slide the bag on the inlet tube.
9. Line up the mark on the bag cover with the unlock symbol and rotate clockwise to lock symbol.



5. Reinstall dry motor filter before use, making sure filter is tucked under retaining tabs.
6. Reinstall bag as previously instructed.

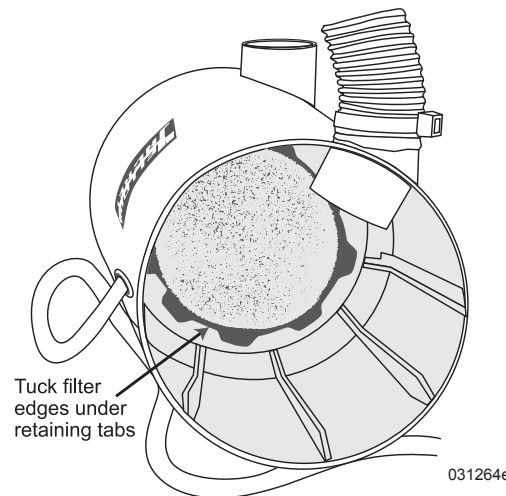
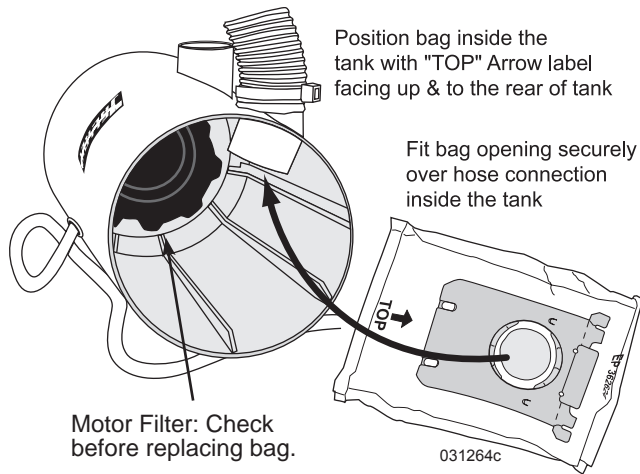
**WARNING:**

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

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

**Replacing & Cleaning the Motor Filter:**

1. Inspect during each bag change. The filter should be cleaned every fifth bag replacement or when excessively dry.
2. Remove dust bag as previously instructed.
3. Locate the motor filter in the back of the vacuum and lift out.
4. Clean by rinsing under warm water and let air dry if heavily soiled. If the filter is torn or obstructed it must be replaced.



# 09 Camelot

Equipment – Section 5

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## EQUIPMENT - INTRODUCTION

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

### **INFORMATION:**

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

## ENTRY STEP *Operation*

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



*Located on the base of passenger console*

### **NOTE:**

**When dry camping and the switch is illuminated, all step circuits are active and drawing current from the chassis battery.**

### **Operating the Entry Step:**

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

### **CAUTION:**

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

### **CAUTION:**

**Ensure the exterior step is fully extended before exiting or entering the motorhome.**

### **If the step fails to operate:**

- ◆ Verify that the step switch is ON.
- ◆ 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.
- ◆ Check entry step fuses in front electrical bay.

### **WARNING:**

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

### **CAUTION:**

**If the Step Out warning indicator lamp illuminates while the motorhome is in motion, the entry step is either partially or fully extended. Repair the step as soon as possible to avoid serious damage to the entry step or motorhome.**

## **Stepwell**

The interior stepwell features a cover and step lighting.

### **Cover:**

An electrically operated stepwell cover will extend and retract using the switch on the dash console.

### **To operate the Stepwell Cover:**

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



**CAUTION:**

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



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Located on  
passenger  
console

**Assist (Grab) Handle**

The assist handle is made of clear acrylic. Though normally UV resistant, the assist handle can be weakened or damaged by using improper cleaning agents which cause small stress fractures that can eventually lead to failure of the assist handle. Approved cleaning solutions are mild soap and water solution only. Cleaning agents containing alcohol, such as commonly found in window cleaners, or cleaning agents containing petroleum distillates will damage the assist handle. **DO NOT** use waxes or plastic and upholstery conditioners as these substances can also cause damage.

**ENTRY DOOR**

The door uses two separate locks for safety and security: the door handle and a dead bolt. The door handle incorporates a primary and secondary latching system used to ensure secure and safe latching. Adjustments can be made to help maintain entry door performance.

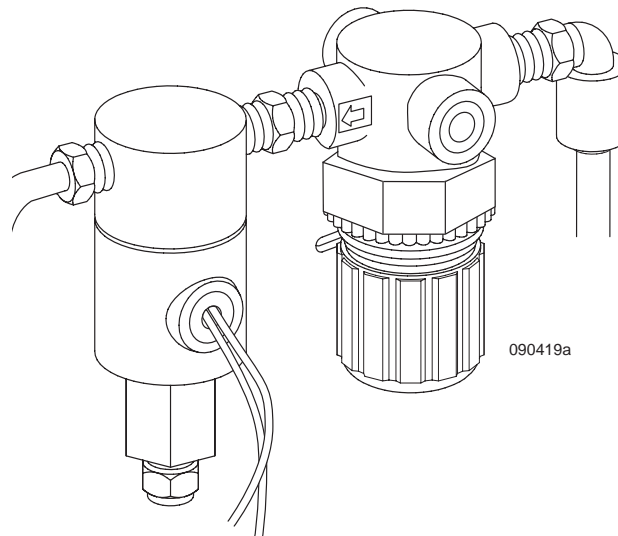
**Air Seal**

The entry door is equipped with a one-piece air seal to reduce wind and road noise.

- ◆ The seal automatically inflates when the engine is running and the transmission is placed in Drive.
- ◆ The entry door seal will inflate to approximately 3 to 4 psi.
- ◆ The pressure regulator control valve is located curbside in the generator compartment.
- ◆ The entry door seal will deflate when the transmission is placed in neutral.

**CAUTION:**

**If the pressure regulator should require adjustment, do not exceed 5 psi. Damage to the seal will occur.**



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Door Seal Regulator: Located curbside in the generator compartment.

**Latch Adjustments****Adjusting the Entry Door Latch:**

- ◆ Determine which bolt needs adjustment.
- ◆ Observe the latch and strike bolt alignment while slowly closing the entry door. **DO NOT** attempt to latch if 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 further movement of the door.
- ◆ The handle should operate with little effort to open the entry door. Excess amounts of pressure indicate the bolts are set too far back.
- ◆ Use wrench to 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 function.
- ◆ Apply silicone weekly to the entry door rubber gaskets to prevent squeaking while the motorhome is traveling. Use a one inch sponge paint brush sprayed with silicone for easy application.

**CAUTION:**

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

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

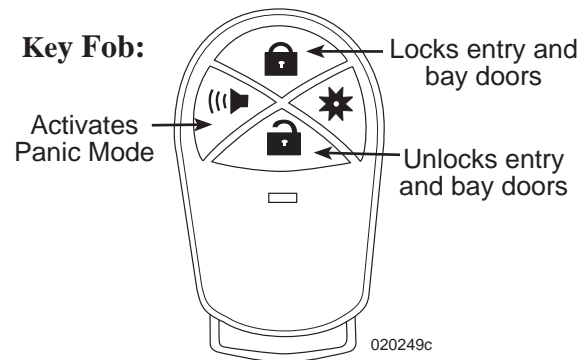
- ◆ The screen slider is Lexan® and can be bowed for removal and replacement.
- ◆ Replace with new Lexan and reverse the procedure.

**Adjusting the Screen Door:**

- ◆ Loosen the chrome bolts on the hinge side of the screen door: Two on each of the three hinges (six hinges total).
- ◆ Slots in the steel hinge allow for in and out movement.
- ◆ Adjust the screen door to fit. The hinge should fit tightly to the trim of the door when the screen door is latched and the door is open.

**Removing the Screen:**

- ◆ The top half of the screen door is removable to allow clear viewing through the entry door glass while traveling.
- ◆ Rotate the clips to remove the top half of the screen door. Store for travel.

**KEYLESS ENTRY  
Operation**

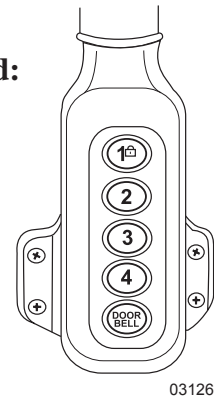
Keyless Entry Key Fob

**NOTE:**

Key fob operation distance is approximately within 50 ft. of the motorhome. If the door locking mechanism is not audible, marker lights will flash when the doors are unlocked or locked.

**Locking Doors with Keypad:**

Regardless of system configuration, lock all doors by pressing and holding down the lock button (1) until there is a beep and the doors lock. An access code is not needed to lock the doors.

**Unlocking Doors with Keypad and other Secure Operations:**

After access codes have been assigned, secure operations can be accomplished by enabling the keypad. The keypad is enabled by entering a valid five digit access code.

Entering the correct access code alone will not initiate a secure operation. If the lock/unlock (1) button is not pressed within five seconds after the access code was entered, then the keypad reverts back to a disabled state. If an unassigned button or no button is pressed while the system is enabled, the keypad reverts back to a disabled state.

**NOTE:**

Use of entry door deadbolt along with door lock will reduce unauthorized entrance into motorhome.

**Factory Access and Authority  
Default Codes:****NOTE:**

Consult OEM manual for Access and Authority codes.

**WARNING:**

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

Up to four different access codes can be assigned at one time. As additional access codes are defined, pre-existing access codes are over-written. For example, if a new access code is assigned for access #3, the previous access #3 code is no longer valid.

**INFORMATION:**

Consult the OEM manual for further information. Contact Monaco Technical Support at 1-877-466-6226 for the master reset code.

**NOTE:**

During any service work, it is recommended all key fobs be left with the motorhome for thorough testing procedures.

## SLIDE-OUT OPERATION

Safety features are applied to slide room operation to prevent mechanical damage or physical harm. Slide room(s) will not operate until all safety requirements are met.

### Safety Requirements:

- ◆ Ignition must be **OFF** when extending slide rooms.
- ◆ Park brake must be applied.

### **CAUTION:**

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

### **CAUTION:**

Extensive damage could occur to the slide-out room and awning when extending the slide-out room in snow, sleet, ice or freezing rain conditions. If the slide-out room is extended in such conditions, clear the awning and ensure free movement prior to operating the slide-out room.

### **CAUTION:**

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

### Guidelines to ensure long life of slide system:

- ◆ **Inspect** roof of the slide for debris such as pine needles, dirt, leaves, sticks, etc. Debris left on the top may cause damage to the seals during retraction. If debris is present, wash with soap and water, then rinse.
- ◆ When the room is out, **inspect** the wipe seal for dirt or other foreign material and for tears.
- ◆ If the slide room leaks, fully retract the room. If necessary, seal exterior opening with duct tape until repairs to the motorhome can be completed.

### **CAUTION:**

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

### **NOTE:**

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

### **NOTE:**

**Dirt and grit trapped under the slide room could result in damage to the floor. If the motorhome has a ceramic tile floor, ensure the floor is clean before retracting the slide room. Trapped dirt or grit under the slide room can scratch the floor surface. Never move the motorhome with the slide room extended.**

### *Extending & Retracting Slide Rooms*

### **CAUTION:**

**The motorhome must be supported by the air suspension (air bags) whether extending or retracting the slide room. Do not operate the slide out room with the air suspension (air bags) deflated or when supported by hydraulic jacks. Damage to the slide out room, mechanism or seals can occur.**

### **To Extend or Retract Slide Rooms:**

- ◆ Confirm the house batteries are fully charged.
- ◆ Turn on interior house power.
- ◆ Ensure the cab seats are in the forward position. Clean the floor of dirt or grit that could result in damage during operation.
- ◆ Open a window or vent to equalize pressure during slide operation.
- ◆ Confirm there is enough clearance inside/outside the motorhome for the room to extend/retract.
- ◆ Retract hydraulic jacks.
- ◆ Turn off the engine. Ensure park brake is applied prior to extending the slide room.
- ◆ Ensure all people, pets and objects are clear of the slide room path.
- ◆ The switch for the slide rooms are located on the hallway monitor panel. Press and hold the slide room switch to the desired (**IN** or **OUT**) position.
- ◆ Release the switch to stop room movement. The drive motor will not automatically stop; the switch must be released. A change in motor sound indicates full extension/retraction.

**CAUTION:**

Continuous operation of the slide room can drain the batteries and damage the motor by overheating.

**WARNING:**

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

**Manual Override**

A safety feature may be engaged to prevent operation if the slide room does not operate.

**If the slide room does not operate:**

- ◆ Ensure ignition key is **OFF** when extending room.
- ◆ Ensure park brake is applied.

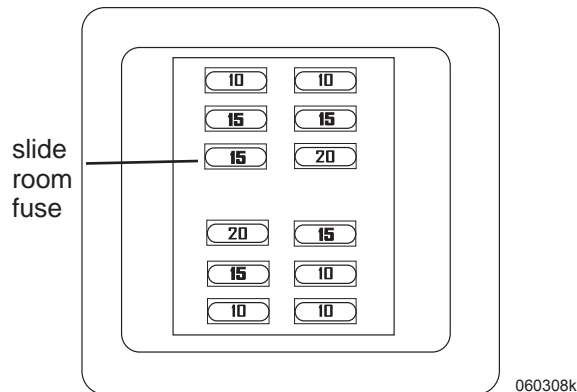
**CAUTION:**

Turn off the main house and chassis battery disconnect switches prior to working on any of the slide room systems.

**If the slide room does not operate after checking the safety requirements:**

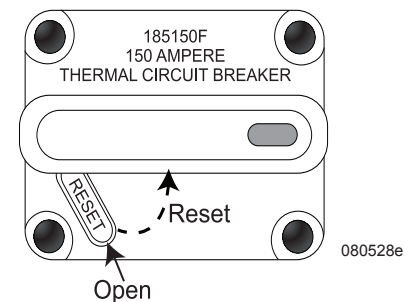
- ◆ Ensure the house batteries are fully charged and interior house power is on.
- ◆ Ensure all electrical connections at the interior switch are good.

- ◆ Check the fuse in position 3 of the 12 Volt DC distribution panel (located either in the bathroom or the cabinet above the dining room television).

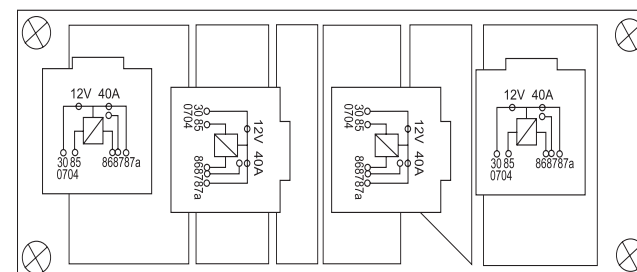


12 Volt DC Distribution Panel: Located in the bathroom or in a cabinet above the dining room TV.

- ◆ Check the fuse at position VCM-8, F17 in the front electrical bay.
- ◆ For the main and galley slides, check the hydraulic fluid level in the reservoir located in the generator compartment. Maintain fluid within ½" from top of reservoir when slide-outs are retracted. If necessary, add ATF fluid (Dexron III).
- ◆ For the living room and galley slides, check the 150 Amp circuit breaker located in the front roadside electrical bay. Check the electrical connections at the control valve manifold of the hydraulic motor located in the generator compartment.



150 Amp Breaker: Located in front roadside electrical bay



Relays: Located under cabinet in rear passenger side of motorhome

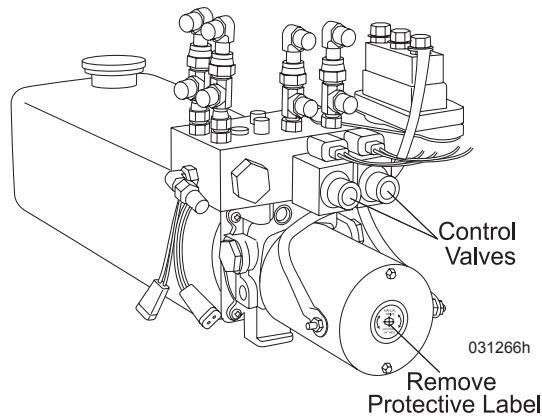
- ◆ For the bedroom slides, check the four relays located underneath the cabinet in the rear passenger side corner of the motorhome.
- ◆ It may be necessary to contact a repair facility to have the problem diagnosed and repaired.

**Manual Override – Hydraulic:**

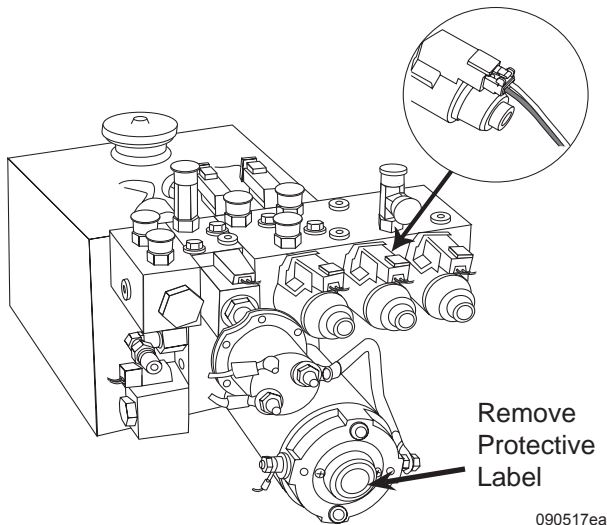
The hydraulic slide motor operates the galley and living room slides. The hydraulic slide motor is located curbside in the generator compartment. A control valve is located on the pump for each slide room the pump operates.

**NOTE:**

On models equipped with hydraulic leveling, the hydraulic pump operates two slide rooms and the hydraulic leveling system. If the correct slide room is not retracting, the wrong control valve may have been selected. Return the control valve to the out position and try another valve.



Hydraulic Slide Motor: Models with Air Leveling



Hydraulic Slide Motor: Models with Hydraulic Leveling

- ◆ Insert an Allen wrench into one of the control valves and turn clockwise. Leave the other control valves in the normal position.
- ◆ Remove the protective label from the pump.
- ◆ Attach a standard 1/4" hex bit into a cordless drill, screwdriver or socket wrench.
- ◆ Insert the 1/4" hex bit into the coupler found under the protective label.
- ◆ Turn counterclockwise to retract slide room.
- ◆ Return the control valve to the normal position, and repeat process on the other control valve to retract the other slide room.
- ◆ Take the motorhome to an authorized repair center.

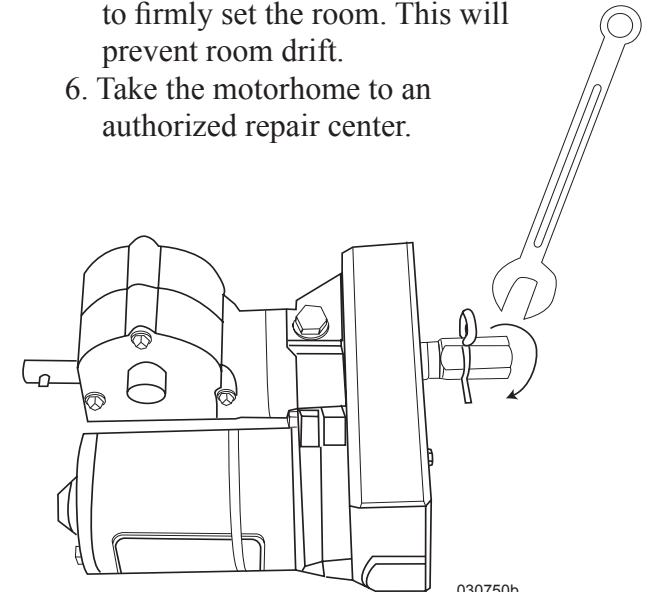
**Bed Slide (Electric Gear Drive):**

1. The bedroom slide-out motor is located under the bed. Lift the bed and remove the access panel.
2. Turn off the house and chassis battery disconnect switches (located in rear curbside bay).
3. Remove 12 Volt DC from the motor by disconnecting the plug from the slide-out motor to the power supply.
4. Use a 5/8" wrench to turn driveshaft and retract room (see illustration).

**CAUTION:**

Do not continue to turn the motor after the room is fully extended or retracted. Damage to the slide mechanism can occur.

5. Once the slide room has manually retracted, apply pressure to the wrench to firmly set the room. This will prevent room drift.
6. Take the motorhome to an authorized repair center.



Bedroom Slide Motor

**Wardrobe Slide (Electric Cable Drive):**

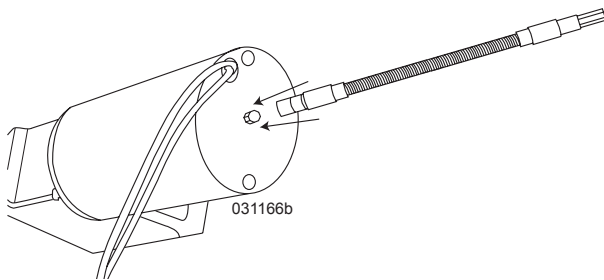
1. Turn off both the battery and house disconnect switches (located in rear curbside bay).
2. Locate the slide room motor near the ceiling of the slide-out. Remove the fascia, valance or both. The fascia and valance may be attached by Velcro® or screws.
3. Disconnect the slide room motor electrical plug. Locate by following the wires that run from the motor to the plug. This removes 12 Volt DC power from the slide-out motor.

4. Attach the flexible shaft to the ¼" fitting on the end of the slide-out motor.
5. Attach a ¼" socket and ratchet or drill to the other end of the flexible shaft.
6. Turn in proper direction to move the room. Reverse direction if cables tighten and the motor is difficult to turn.

**CAUTION:**

**Over-torquing can result in severe damage.**

7. Take the motorhome to an authorized repair center.



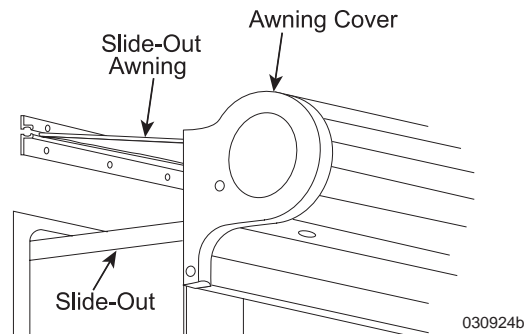
Wardrobe Motor

## AWNINGS

### Slide-Out Cover

The slide-out cover automatically reacts to slide-out direction. A fixed edge of the slide-out cover is installed into an awning rail, mounted just above the slide-out. A spring-loaded roller with special brackets mounts to the slide-out. In a hard rain the cover helps prevent water from penetrating the seal of the slide-out. The slide-out cover will automatically reach full extension when the slide-out room is fully extended.

The slide-out cover automatically rolls up into the travel position when the slide-out room is completely retracted.

**NOTE:**

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

**CAUTION:**

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

**CAUTION:**

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

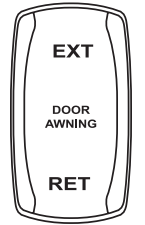
**CAUTION:**

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

## Entry Door Awning

**To Operate the Awning:**

- ◆ Ensure interior house power is on.
- ◆ Verify the extend/retract path of the awning and related hardware is clear and unobstructed.
- ◆ Turn the ignition key off. Press and hold the door awning switch to extend/retract.
- ◆ Release the switch to the neutral position when fully extended or retracted.



060313f

**CAUTION:**

**DO NOT activate the awning switches during travel; the awning can extend while the engine is running. Take precautions to ensure the awning switches located at the base of the passenger console are not activated during travel or at other unwanted times.**

**NOTE:**

**It is not required to have the awning at full extension. The awning may be stopped at any point of extension or retraction by releasing the momentary switch.**

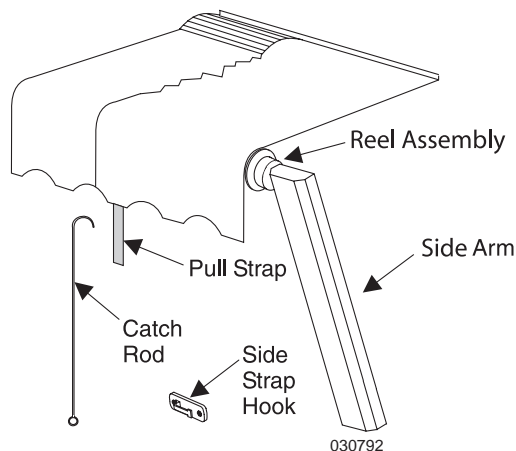
## Window Awning

**To Extend the Window Awning:**

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

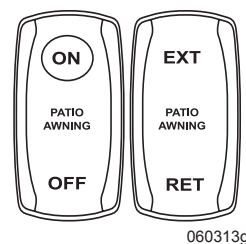
### To Retract the Window Awning:

- ◆ Hook catch rod on pull strap, remove pull strap from side strap hook and slowly allow awning to retract.
- ◆ Remove catch rod from pull strap and store.



### To Operate Awning:

- ◆ The interior awning power switch (mode switch) must be on in order for the interior and exterior awning switches to operate.
- ◆ Push and hold the retract/extend switch to extend the awning. Release the switch at any time for partial extension.
- ◆ Push and hold the switch to retract awning.

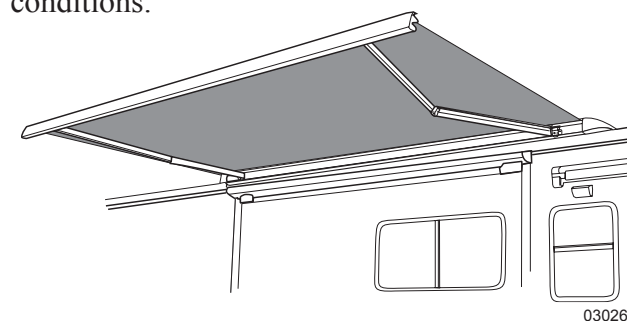


### CAUTION:

**DO NOT activate the awning switches during travel; the awning can extend while the engine is running. Take precautions to ensure the awning switches located at the base of the passenger console are not activated during travel or at other unwanted times.**

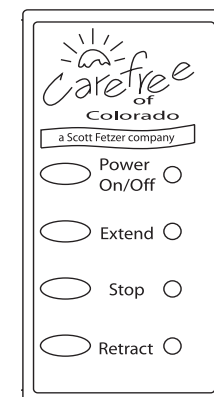
### Patio Awning (Optional)

The Apex patio awning is a roof-mounted box awning that requires 120 Volts AC to operate. The Apex awning includes an adjustable Auto-Retract feature that (when activated) will automatically retract the awning in windy conditions.



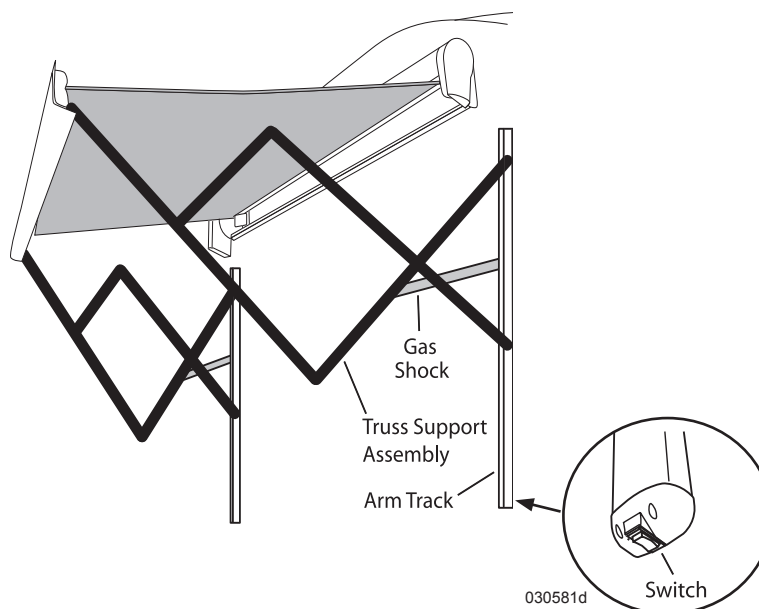
### To Operate Awning:

- ◆ Connect to shore power, start the generator or turn on the inverter.
- ◆ Ensure there is sufficient clearance before extending the awning.
- ◆ Press the “Power On/Off” button on the awning control.
- ◆ Press and release the “Extend” or “Retract” button. The awning will completely extend or retract.
- ◆ Press and release the “Stop” button to stop extension or retraction at any time.
- ◆ Turn awning power off when not in use.



### Patio Awning

The Eclipse awning operates on 12 Volts DC. The awning requires 10' of lateral side clearance. The awning is equipped with an automatic retract feature. If the awning senses movement that exceeds factory presets for more than two seconds, it will automatically retract. If there is sudden and swift movement, the awning will automatically retract without delay.



**NOTE:**

When any button is activated, the LED illuminates and stays on until another function is performed.

**NOTE:**

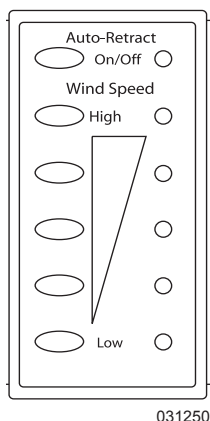
A remote control is included with the Apex awning system. Extend the antenna on the remote and follow the previous operating instructions.



Awning Remote 031262b

**Auto-Retract System:**

The Auto-Retract system detects awning motion caused by windy conditions. The system can be set at five levels of wind sensitivity. The system operates by monitoring the motion of the awning's front edge. When awning motion exceeds a preset sensitivity level for more than two seconds, the awning will automatically retract.



031250

**To Operate the Auto-Retract System:**

- ◆ Press the “Power On/Off” button on the awning control.
- ◆ Press the “Auto-Retract On/Off” on the Auto-Retract control.
- ◆ Set the sensitivity to the desired level.

**NOTE:**

The Awning Power button must be on and AC power must be available for Auto-Retract to operate.

**NOTE:**

If the Auto-Retract LEDs flash, this indicates that the motion sensor has been disengaged or otherwise disabled. Contact a Carefree service center for service.

**Awning Care & Cleaning**

On a monthly basis, loosen hardened dirt and remove dust from the awning with a dry, medium bristle brush. Thoroughly rinse both the top and bottom with a garden hose.

A high-quality acrylic fabric cleaner may be used to help maintain appearance. Carefully follow the instructions on cleaning products. Metal surfaces should be cleaned with soapy water and thoroughly rinsed. Allow the awning to thoroughly air dry while extended. Awning maintenance products can be found at RV supply stores.

**Acrylic Awnings:**

Wash both sides of the awning with a mild soap (i.e., dish soap) and lukewarm water. **DO NOT** use detergents. If necessary, reapply the solution to keep fabric saturated. Rinse the awning thoroughly. Repeat, if necessary, until most of the stains disappear. Contact *Carefree of Colorado* for removal of stubborn stains.

**Leaks:**

It is normal for slight leakage to occur through the fabric where water is allowed to accumulate. If water drips through the needle holes in the

stitching use a commercial seam sealer that is available in canvas and trailer supply stores. Paraffin wax may also be applied to the top of the seams. As the awning “weathers” these holes will normally seal themselves.

Soap or chemical residue can “wet” the fabric so that it appears unable to repel water. Rinse the fabric thoroughly and test to see if it is water repellent after it dries. If leakage continues after washing and thoroughly rinsing, please contact *Carefree of Colorado*.

**Storm Precautions**

The warranty does not cover damage caused by acts of nature; therefore, steps should be taken to prevent damage from occurring due to wind, rain or storms. Retract the awning in inclement weather or when leaving the motorhome unattended. If the awning must be retracted while the fabric is wet, extended it as soon as possible to allow it to completely dry.

**NOTE:**

**Water weighs 8.33 pounds per gallon. The awning was not designed to withstand the 500 to 700 pounds of water that could accumulate on the canvas.**

**FANS  
Exhaust Fan**

The exhaust fan power switches are located on a multiplex switch panel in whichever room the fan is located. The fans operate using 12 Volt DC from the house batteries.



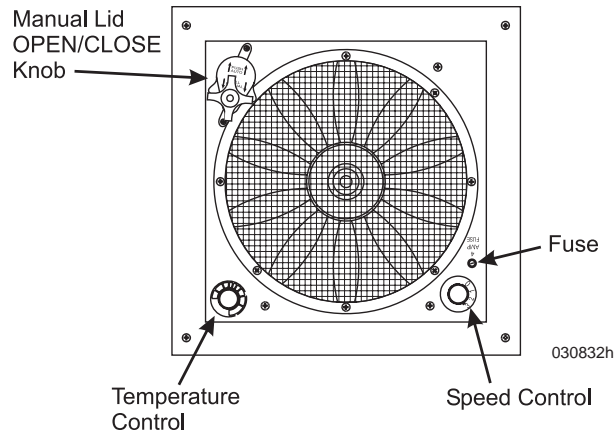
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The vent fan has three speeds and a built-in thermostat. The blue zone on the thermostat is cool; the red zone indicates heat. The fan starts automatically after the lid opens approximately two inches during normal operation.

### Automatic Operation:

Leave the fan in **AUTO** position for normal operation. Turn the multiplex power switch on; the lid will open and the fan will start. The fan will not operate with the fan speed switch in the **0** position. Turn the multiplex power switch off to lower vent lid and stop fan.



### Manual Operation:

To adjust vent lid to different opening positions, pull down on the manual lid knob. Turn the knob counterclockwise to lower the lid. Return fan to **AUTO** position by pushing in on the knob.

### NOTE:

To override any fan setting, pull the vent cover knob out to the manual position and close vent. The fan blade will stop spinning when the vent cover is closed.

### CAUTION:

It is recommended to travel with the vents closed. High winds and vibration can damage the dome.

### Tips for Fan Operation:

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

### NOTE:

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

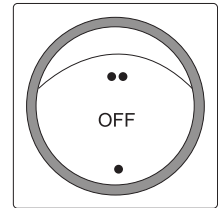
### Bedroom Ceiling Fan (Optional)

A bi-directional, 12 Volt DC powered ceiling fan is located in the bedroom. Fan operation is controlled by a switch located next to the bed.

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

### CAUTION:

Fan blades are not enclosed. Use caution not to enter into fan path when on. Serious injury can occur.



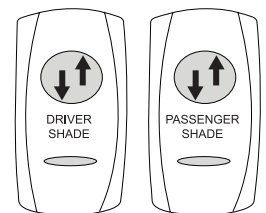
Bedroom Ceiling Fan Switch.

### POWER SUNVISOR

The windshield visors are 12 Volt DC operating from the house batteries. One visor assembly is used for the driver and another for the passenger.

### To Operate the Visors:

- ◆ Use the **Battery Cut-off** switch to turn **ON** the interior house power.
- ◆ Push the switch down to lower the desired Sunvisor.
- ◆ Push the switch up to raise the Sunvisor.



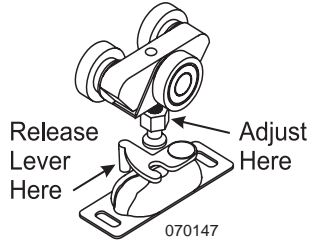
### NOTE:

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

## DOOR - SLIDING

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

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



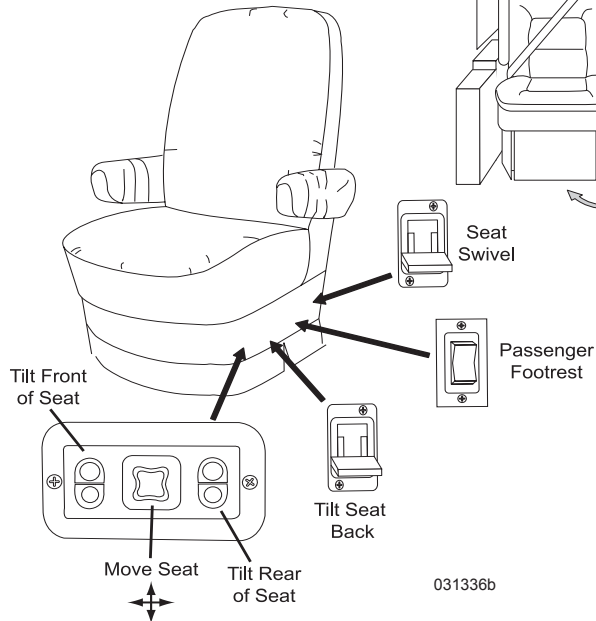
### LUBE:

**Lube the pocket door rollers with a small drop of oil once a year to help increase the life of the rollers and improve the sliding of the door.**

## SEAT CONTROLS

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

**NOTE:**  
The seats operate from 12 Volt DC house power.



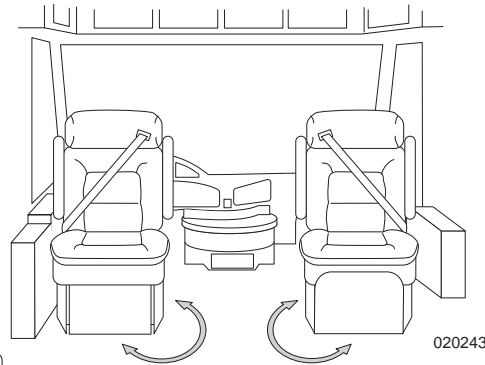
## Swivel Seats

### Swivel Seat Operation:

- ◆ To swivel, lift up the lever located on the side control panel.
- ◆ The passenger seat swivels all the way around when the slide-out is extended.
- ◆ When rotating the driver seat, put the steering wheel in the upright position.
- ◆ Move the seat forward, then pull the swivel lever up and rotate to the desired position.

### WARNING:

**Seats must be locked in the forward facing position while the motorhome is in transit.**



### NOTE:

**After either seat is rotated 180°, it must be rotated back in the opposite direction. The 12 Volt DC wiring in the seat may disconnect if rotated 360°.**

## SOFA BED CONVERSION

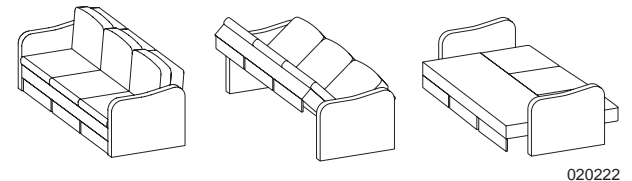
The sofa will convert easily into a bed. The sofa comes equipped with safety belts to use during travel.

### Sleeper to Sofa:

- ◆ Lift up the seat base and pull up the backrest until they are in a “V” position.
- ◆ Push down on seat base.

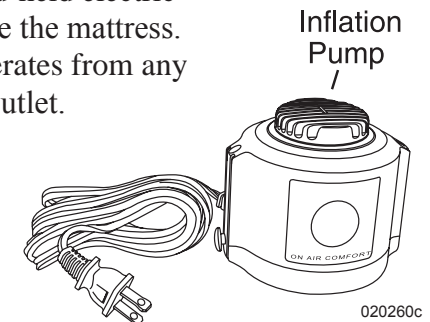
### Sofa to Sleeper:

- ◆ Lift up from the center of sofa, just below the seat cushions, to form a “V” shape with the seat base and back rest.
- ◆ Push down on seat base, then pull out until the seat base and backrest are flat.
- ◆ Fold seat belts out of the way.



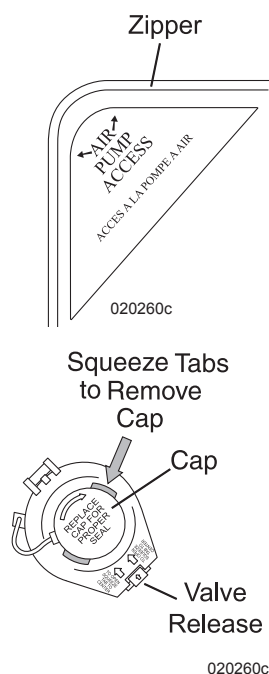
### Air Mattress (Optional)

Use the hand-held electric pump to inflate the mattress. The pump operates from any 120 Volt AC outlet.



**To Inflate the Mattress:**

- ◆ Remove and store seat cushions.
- ◆ Open the convertible sofa and fully extend the mattress (may be necessary to extend slide-room).
- ◆ Unzip the corner of the mattress labeled “Air Pump Access” to access the pump valve.
- ◆ Push down on the valve to ensure it is locked in place.
- ◆ Open the cap on the valve.
- ◆ Plug the pump motor into a wall outlet. Hook to shore power, start the generator or turn on the inverter.
- ◆ To turn on the pump, place it on the valve and turn the pump ¼ turn. The pump will lock in place.
- ◆ Inflate the mattress to desired firmness.
- ◆ Remove the pump, replace the valve cap and zip up the mattress cover.

**To Deflate the Mattress:**

- ◆ Remove bedding items.
- ◆ Unzip the corner of the mattress where the air valve is located.
- ◆ Lift the valve release.
- ◆ Once deflated, close the valve release, zip up the mattress cover and close the convertible sofa.

**AIR MATTRESS BED (OPTIONAL)**

The air mattress includes two separate air chambers to allow different firmness settings. Each side is equipped with a remote control. The air pump located under the bed is powered by 120 Volt AC.

**Operation:**

- ◆ Hook to shore power, start the generator or turn on the inverter.
- ◆ Press the up or down arrow on the remote to adjust the firmness setting. Firmness is represented on a scale of 5 (softest) to 100 (firmest) and is adjustable in increments of 5.

**Troubleshooting:**

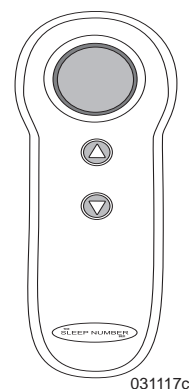
- ◆ Ensure the pump power cord is plugged in at the pump and at the 120 Volt outlet under the bed.

**CAUTION:**

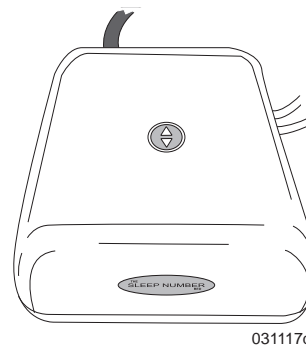
Set bed to a maximum of 20 before traveling in higher elevations.

**CAUTION:**

To prevent damage to the remotes, place remotes in wall-mounted holders before extending or retracting the slide-out. Broken or damaged remotes are not warrantable.



Air Mattress Remote



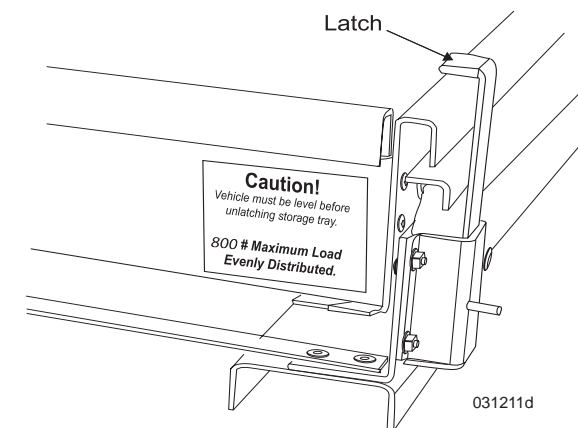
Air Mattress Pump

**NOTE:**

See the manufacturer’s website at [www.selectcomfort.com](http://www.selectcomfort.com), for more information.

**STORAGE SLIDE (OPTIONAL)**

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



- ◆ The motorhome must be level before opening the storage slide.
- ◆ Push down on yellow lever to release slide. Be ready to control slide after releasing.

**CAUTION:**

Confirm maximum load rating noted on the storage slide.

**WARNING:**

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

## LADDER - REAR

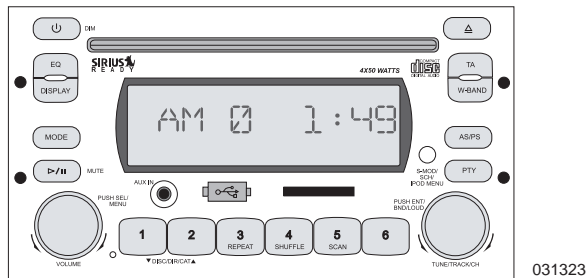
The rear ladder allows access to the roof. Care should be used when climbing the ladder. Access to the roof should be limited to cleaning and sealing purposes only. Stow the lower portion of the ladder in the cargo bay during travel.

### **NOTE:**

**Maximum weight capacity for the ladder is 300 lbs.**

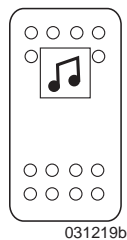
## RADIO - DASH

The dash radio is Sirius ready and includes an AM/FM tuner, CD/DVD player, Weather Band and auxiliary inputs. The stereo switch in the bedroom turns rear speakers on and off.



### **Operation:**

- ◆ Turn ON the battery cut-off switch located at the entry door.
- ◆ Turn ON the radio.
- ◆ Insert CD, select AM/FM by pressing the lower right knob or select Weather Band by pressing the W-Band button on the right.



Rear  
Speaker  
Switch

### **Clock Adjust:**

- ◆ Press and hold the Display (DISP) button until clock starts flashing.
- ◆ Use the tuning knob to adjust time. Turn clockwise to adjust minutes and counterclockwise to adjust hours. Cycle through hour 12 to change between AM and PM (indicated on screen).
- ◆ Press the Display (DISP) button to set.

### **Auxiliary Inputs**

There are three auxiliary inputs on the front of the dash stereo. When an auxiliary device is attached the radio will automatically switch modes to playback from that input. Press the Mode button to change modes at anytime.

### **Stereo Jack:**

Connect a cable with a 1/8" stereo plug (male) on both ends from an auxiliary device (such as an MP3 player headphone jack or a laptop computer speaker/headphone output) to this input for audio reproduction through the dash stereo. Set the auxiliary device to a mid-range volume level and adjust volume at the dash stereo for best results. Source information will not display on the radio screen (such as song title, artist, etc.).

### **USB Connection:**

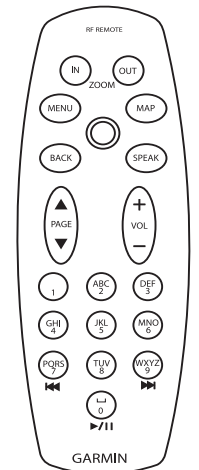
Use this input to connect a portable USB drive. This input can also be used to connect MP3 players, although not all MP3 players are compatible (use the stereo jack input if not compatible). The radio will automatically switch modes to play back from this input when a USB device is connected. Depending on the source material, the radio may display track title and file type information.

### **SD Card Slot:**

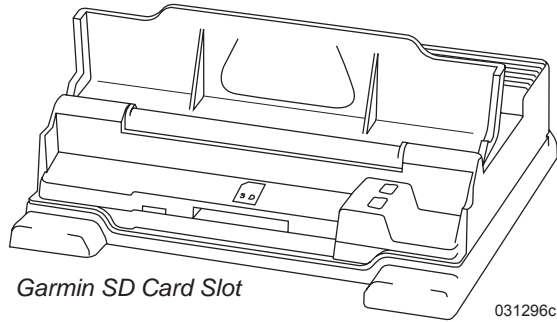
Insert a Secure Digital (SD) flash memory card here to playback music files. The radio will automatically switch modes to play back from this input when a SD card is inserted. Depending on the source material, the radio may display track title and file type information.

## NAVIGATION SYSTEM (OPTIONAL)

The navigation system displays through the rear vision monitor. The Garmin GVN 52 provides detailed street maps, points of interest such as restaurants, hotels, and gas stations; a trip computer and turn-by-turn directions with voice guidance. The unit is preloaded with street mapping for all of North America which is displayed through the back-up monitor. Map perspectives include 3-D, top-down, track-up, or north-up view. The unit is operated by a remote control.



An SD card slot is available for loading custom points of interest, additional maps and software updates.



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

**INFORMATION:**  
Complete operating instructions and information are found in the Garmin OEM manual.

**SYSTEM MONITOR PANEL**

The System Monitor Panel is a central location for many of the switches and monitors used to operate the motorhome. This unit is generally located in the hallway.

- 1. **Comfort Control:** Thermostat controls for roof AC, furnace and fan.
- 2. **Inverter Remote:** Turns the inverter on or off and monitors battery charging status. See Section 8 for more information.

3. **Energy Management System:** Helps prevent overloading limited shore power supply by shedding electrical loads. See Section 8 for more information.

4. **System Heat:** Activates basement heater and fresh water tank heat pad.

5. **Generator:** Starts and stops the generator.

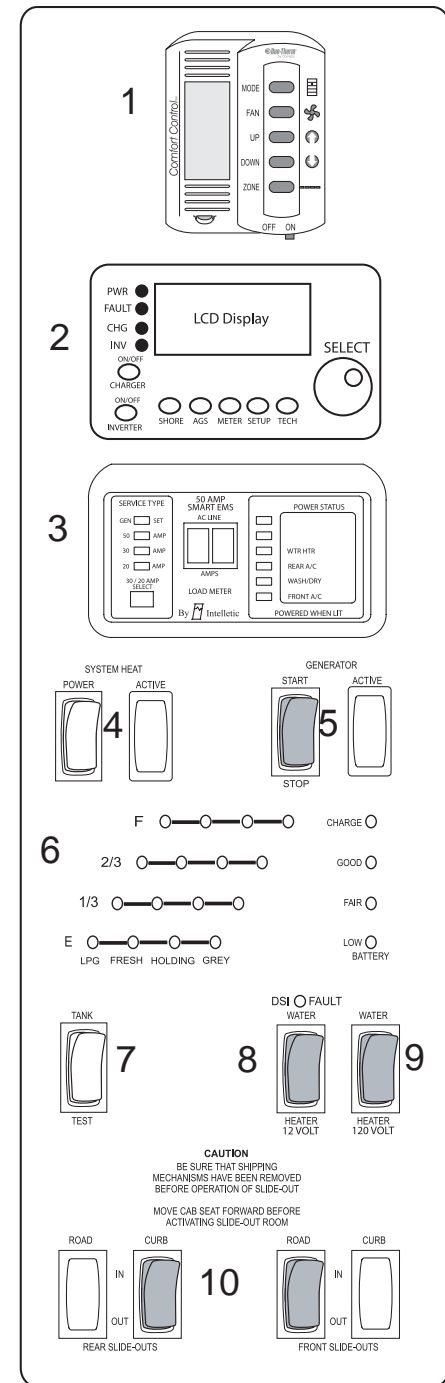
6. **Tank/House Battery Monitor:** Displays the status of the holding tanks, fresh tank, propane tank and house batteries.

7. **Tank Test Switch:** Spring loaded switch used to display tank and house battery status on the monitor panel.

8. **Water Heater Propane Switch:** Applies 12 Volt DC power to ignite and operate the water heater with propane. If the water heater fails to ignite, the DSI FAULT lamp will illuminate.

9. **Water Heater Electric Switch:** Operates water heater from 120 Volt AC power.

10. **Slide-out Room Controls:** Extends and retracts the slide rooms.



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## TV & ENTERTAINMENT COMPONENTS

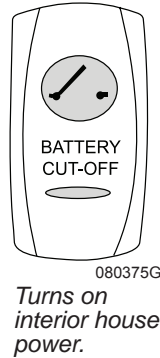
The following paragraphs discuss the operations and various components that make up the entertainment center.

### **INFORMATION:**

It is recommended to become familiar with individual components. Refer to the respective manual for detailed instructions on operating individual components.

### **NOTE:**

All components of the entertainment system require 120 Volts AC to operate. Hook to shore power, start the generator or turn on the inverter. Turn on the interior house power using the battery cut-off switch.

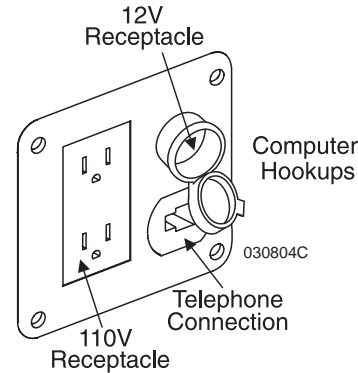


### **Television (Front) Lockout Feature**

The ignition switch controls the outlet for the front TV, allowing the front TV to be operated only when the ignition is off. Viewing time of the front TV from the inverter depends on state of charge of the house batteries and any additional 12 Volt DC lighting being used.

### **Connections - Cable TV, Computer & Phone**

The motorhome is equipped with cable TV and phone hook-ups located in the water service bay. For convenience, the auxiliary outlet is located at the cockpit.



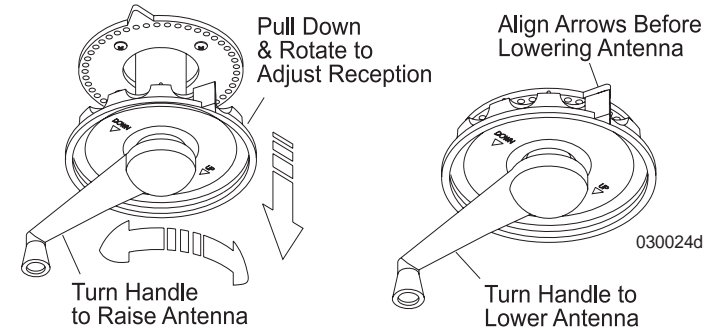
### **TV Antenna**

#### **To Raise the Antenna:**

- ◆ Rotate the crank handle clockwise to raise the antenna (approximately 14½ turns).
- ◆ Pull down on the outside directional wheel and rotate the antenna until the best picture is obtained. The directional wheel is spring loaded.

#### **To Lower the Antenna:**

- ◆ Pull down on the directional wheel and align arrows together.
- ◆ Rotate the crank handle counterclockwise to lower the antenna fully into the cradle. Make an outside visual inspection to ensure the antenna is properly stowed.



### **CAUTION:**

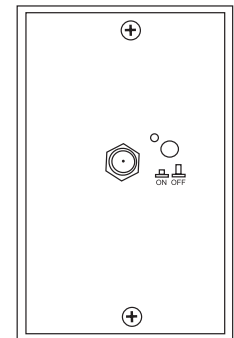
**DO NOT** move motorhome with antenna in the raised or partially raised position and risk damage by tree limbs or wires. Worm gear damage or breakage may result.

### **WARNING:**

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

### **Antenna Select**

The antenna select switch (located in the cockpit overhead cabinet) will select between the roof antenna or shore cable.



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**To Watch TV Using Roof Antenna:**

With the button in the **ON** position, the input to the TV is set to roof antenna and the LED will illuminate.

**To Watch TV Using Shore Cable:**

With the button in the **OFF** position, the input to the TV will be set to shore cable and the LED will be off.

**Television/Entertainment System - Front**

The front television entertainment system consists of a TV and DVD Home Theater System.

**To Operate Any Component:**

- ◆ Hook to shore power, start the generator or turn on the inverter.
- ◆ Use the battery cut-off switch to turn on interior house power.
- ◆ Ignition key must be in the OFF position.

**NOTE:**

**It is necessary to read the individual component owner's manuals to fully understand the entertainment system components.**

**To Watch TV from Antenna/Shore Cable:**

- ◆ Press the Power button on the TV. Press the Input button on the TV until the TV tuner displays.
- ◆ Select either Roof Antenna (On) or Shore Cable (Off) on the Selector switch in the curbside overhead cabinet.
- ◆ Select the desired channel and adjust volume on the TV.
- ◆ If home theater sound is desired, turn on the Home Theater System. Press the Source button on the DVD player until AUX 1 displays. Turn the television volume down for best results.

**To Watch a DVD:**

- ◆ Insert a DVD into the Home Theater System.
- ◆ Turn on the TV. Press the Input button (on TV) until the DVD menu displays.
- ◆ Adjust the volume on the home theater system or TV.

**To Play a Music CD:**

- ◆ Press the desired Disc Open/Close button (numbered 1-5 for each slot of the 5 disc changer) on the Home Theater System. Place a CD on the tray, label side up. Press the Open/Close button. Press Play if necessary.

**Television – Bedroom****To Operate All Components:**

- ◆ Hook to shore power, start the generator or turn on the inverter.
- ◆ Use the battery cut-off switch to activate the interior 12 Volt DC power.

**NOTE:**

**Reading individual component owner's manuals is strongly recommended.**

**To Watch TV from Antenna/Shore Cable:**

- ◆ Turn on the TV. Press the input button until a channel number displays in the upper right corner.
- ◆ Select either Roof Antenna (**On**) or Shore Cable (**Off**) on the Selector switch in the front overhead cabinet.
- ◆ Select channel.

**To Watch a DVD (Optional DVD Player):**

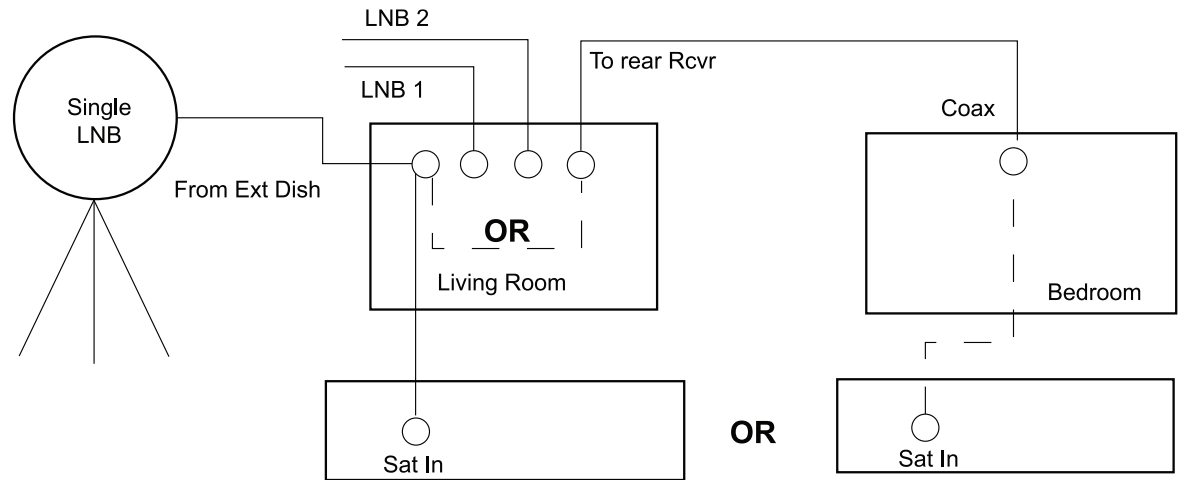
- ◆ Turn on the DVD player. Press the **Open/Close** button and insert DVD.
- ◆ Turn on the TV. Press the Input button until DVD menu displays.
- ◆ Adjust sound to desired level.

## SATELLITE PREP

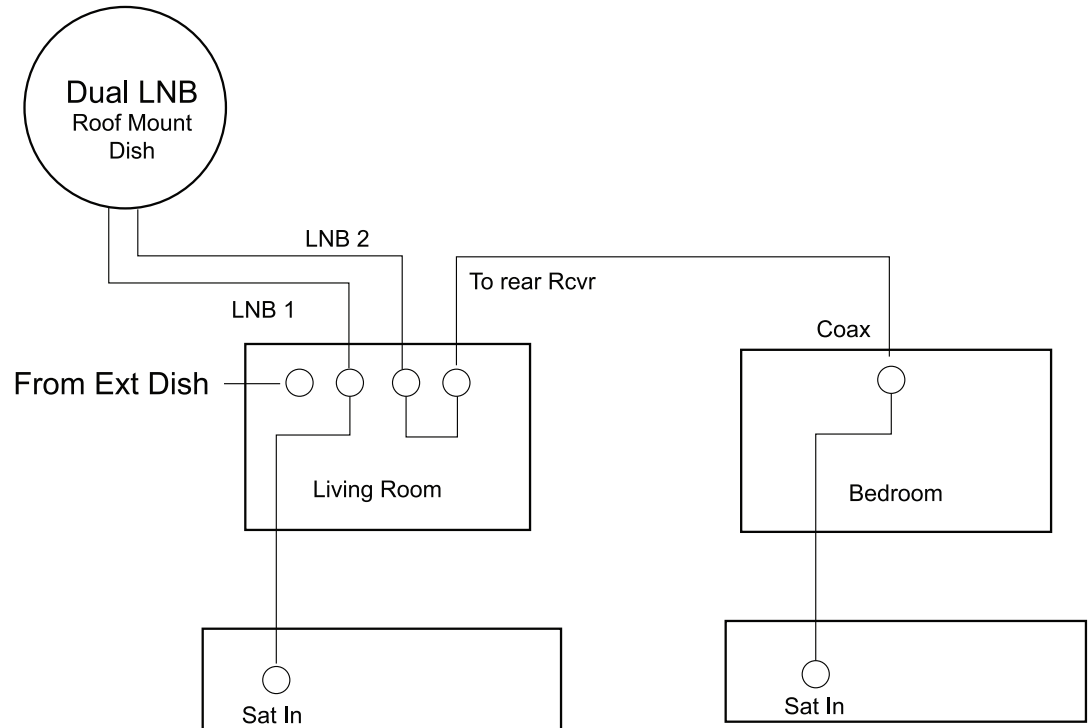
The motorhome is pre-wired to accept a roof-mounted or portable satellite dish system. Coaxial and audio/video connections to install a satellite receiver(s) are located in the front overhead cabinet next to the television and in the cabinet below the bedroom television. A phone cable is provided for pay-per-view programming. The “Sat” coax connection located in the water service bay allows connection of a stand-alone dish.

### **NOTE:**

**There are a number of ways satellite reception can be obtained dependant upon: types of satellite dishes, equipment hardware, standard definition, high-definition and DVR receivers, satellite subscription providers etc. Due to available possibilities, only the most probable receiver installation instructions are provided. Additional hardware and cabling can be required when installing satellite equipment.**



A single receiver can be mounted in the living room or the bedroom (not both) when using a stand alone satellite dish.



Receivers in living room and bedroom using dual LNB roof mount dish.



## Connecting - Portable Dish System

This type of dish and supplied cabling is for a standard definition receiver to be located either in the living room or bedroom, not both.

### Front TV:

- ◆ Run a coaxial cable from the external satellite dish to the coaxial connection labeled “Sat” in the water service bay.
- ◆ Run a coaxial cable from the “From Ext Dish” connection on the satellite prep plate located in the front overhead cabinet to the satellite receiver.
- ◆ Connect the satellite receiver to the front TV using the video and audio jacks on the satellite prep plate.

### **NOTE:**

**A portable dish system is not designed for use with a DVR receiver.**

### Bedroom TV:

The connection marked Coax comes from the “To Rear Rcvr” connection on the front satellite prep plate.

- ◆ Run a short coaxial cable between the connection “From Ext Dish” to the connection marked To Rear Rcvr.
- ◆ Run a coaxial cable from the Coax connection on the bedroom satellite prep plate to the back of the satellite receiver.
- ◆ Connect the satellite receiver to the bedroom TV via the video and audio jacks on the satellite prep plate.

## Connecting - Roof-mounted System

### Front TV:

- ◆ Connect a coaxial cable from the “Roof LNB #2” on the satellite prep plate to the satellite receiver.
- ◆ Connect the satellite receiver to the front TV using the video and audio jacks on the satellite prep plate.

### With a DVR Receiver:

- ◆ Connect coaxial cables from the “Roof LNB #1” and “Roof LNB #2” to a DVR receiver.
- ◆ Connect the receiver to the front TV via the video and audio jacks on the satellite prep plate.

### Bedroom TV:

The following instructions are for installing a second receiver at the rear TV with a standard receiver (not DVR) in the front. Due to system configuration, additional hardware and wiring will be required when using a DVR receiver in the front and installing a second receiver in the rear.

- ◆ Connect a coaxial cable from the “Roof LNB #1” to the front satellite receiver.
- ◆ Run a short coaxial cable between connections Roof LNB #2 and “To Rear Rcvr”.
- ◆ Run a coaxial cable from the Coax connection on the bedroom satellite prep plate to the satellite receiver.
- ◆ Connect the satellite receiver to the bedroom TV using the video and audio jacks on the satellite prep plate.

## SATELLITE (OPTIONAL)

The KVH R5 system includes an antenna and a power switch panel with diagnostic port. The KVH system powers the antenna and sends the information to the receiver (not included), which decodes the satellite signal from the antenna and sends it to the television.

### **NOTE:**

**For specific instructions, satellite coverage areas and providers see the OEM manual.**

### **NOTE:**

**Satellite receiver not included with satellite option. Additional cabling required for high definition.**

### **NOTE:**

**Satellite service requires subscription activation and additional hardware. Contact your service provider to activate the account.**

### **NOTE:**

**Inclement weather conditions may adversely affect the satellite signal acquisition. Degraded audio and video signals through the receiver will result.**

### **Maintenance:**

- ◆ Periodically clean the antenna dome with water and mild soap if necessary. Do not spray the dome or the roof with high pressure water.
- ◆ For assistance in operation or for technical support call:

**KVH Technical Support  
1-401-847-3327**

### Winegard (Optional)

The Winegard Trav'ler stationary satellite system includes a roof-mounted antenna and interface box. The interface box is used to raise and stow the antenna. Satellite receiver not included. The Winegard system is compatible with virtually any DirecTV receiver, including HD and DVR receivers. Before ordering service from a satellite provider, ensure that the service provider's receiver is compatible with the Winegard system. Consult the receiver manual or [www.winegard.com](http://www.winegard.com) for receiver compatibility.

**NOTE:**

**The satellite system does not include a satellite receiver.**

**NOTE:**

**Satellite service requires subscription activation. Contact your service provider to activate the account.**

**NOTE:**

**For specific satellite coverage areas and providers see the OEM manual.**

**Operation:**

- ◆ Press and hold the Power button for two seconds or until the interface box screen displays "Power On." The system is on and the satellite antenna will raise.
- ◆ Press and release the Power button to stow the satellite antenna. The interface box will not turn off until the satellite antenna is successfully stowed.

**NOTE:**

**Operation procedures will vary depending on the satellite service provider and receivers added to the Winegard system. See the satellite service provider owner's manuals for operating instructions.**

**NOTE:**

**Inclement weather conditions may adversely affect the satellite signal acquisition. Degraded audio and video signals through the receiver will result.**

### EXTERIOR ENTERTAINMENT CENTER (OPTIONAL)

The exterior entertainment system includes a LCD television, AM/FM radio, CD/DVD player and two speakers.

**To Operate Any Component:**

All the entertainment components require 120 Volt AC from shore power, the generator, or the inverter. Ensure the interior battery cut-off switch is on and the house batteries are charged.

**NOTE:**

**For detailed information on features and operating procedures refer to the OEM manual.**

**To Watch a DVD:**

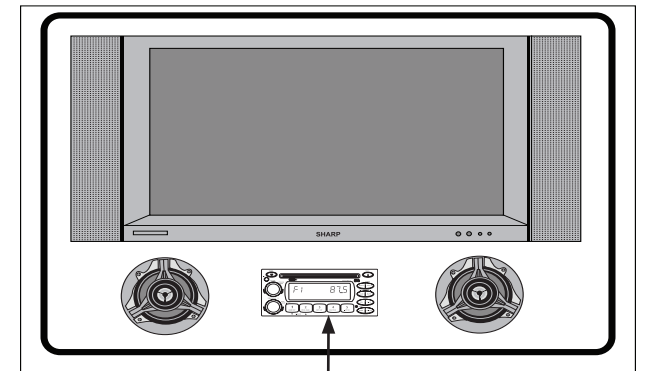
- ◆ Turn on TV. Press Input button until **Input 2** is displayed on the input menu in the upper right hand corner.
- ◆ Turn on exterior DVD player.
- ◆ Insert DVD. Press Play (Mute button) if necessary.
- ◆ Adjust volume at exterior DVD player.

**Radio Operation:**

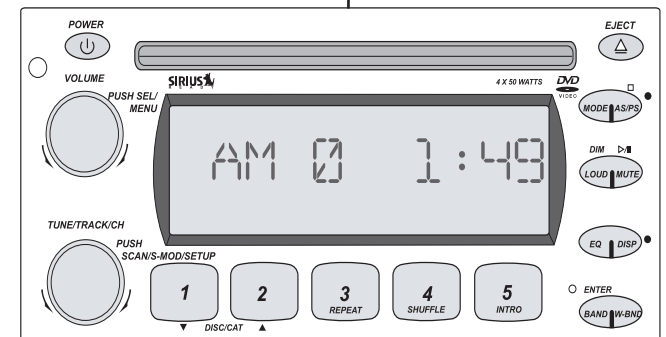
- ◆ Turn radio ON.
- ◆ Select AM/FM or Weatherband.
- ◆ Select station.
- ◆ Set volume to desired level.

**CD Player Operation:**

- ◆ Turn CD player ON.
- ◆ Insert CD. CD will load and play automatically.
- ◆ Adjust volume.



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# 09 Camelot

Water Systems – Section 6

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## WATER SYSTEMS - INTRODUCTION

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

Newcomers to a self-contained motorhome soon discover water does not last long unless consumption is drastically reduced. For example: less water can be used for showering if the shower is turned off while soaping down and then turned back on to rinse. There is plenty of water to meet personal needs once habits are adjusted.

The plumbing system is fully self contained (FSC); the entire fresh water system and waste water system can be operated independently of shore services. The plumbing system includes holding tanks for fresh (potable) water, grey (sinks and shower) water and black (toilet) water. An onboard water pump will supply all faucets and toilets with water from the fresh tank. A monitor panel located in the hallway displays holding tank levels.

If shore services are available, city water is used to pressurize the water system so the onboard water pump can be left off. The grey and black holding tanks share a termination outlet. A sewer hose attaches between the termination outlet and shore sewer connection.

Leave the black tank drain valve closed to prevent solids from clogging the hose. Leave the drain valve to the grey tank open. Drain and flush the grey and black tanks prior to departure.

### Fresh Water System:

The fresh water system consists of the fresh water tank, water pump, water filter and a water hose for potable water use only. The onboard water pump uses water from the fresh water tank when a faucet is opened or a toilet is flushed. Use water sparingly when not hooked to shore service.

Proper care of the hose is necessary. After each use, drain the water hose and attach the plug to keep out insects and debris.

### Waste Water System:

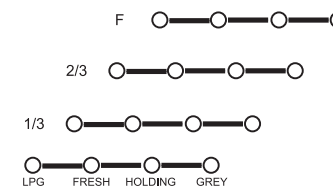
The sinks, shower and washing machine (optional) drain into the waste water (grey water) holding tank. The sewage holding tank (black water) is dedicated for the toilets. Normally these tanks are proportionate in size to the fresh water tank. If a camping trip is started with a full fresh water tank, the waste holding tanks will be full or nearly full when all the water is used from the fresh water tank.

Prior to using the toilet, add several gallons of water to the black tank to help prevent accumulation of solids. Holding tank odor control chemicals are available.

## WATER TANKS Measurements

The motorhome is equipped with tank monitors located on the hallway monitor panel and in the water service bay. Hold down the “Test” switch to view tank levels. Levels are displayed on a LED scale with a corresponding scale reading.

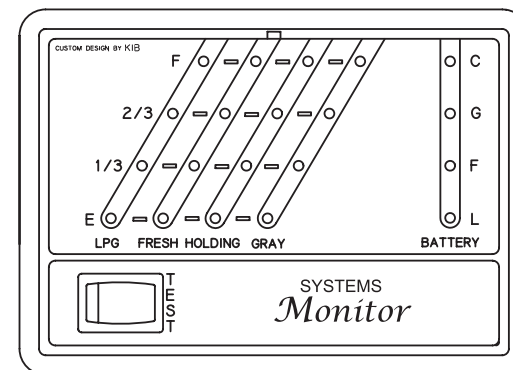
- ◆ **Green** lamps indicate good or normal ranges.
- ◆ **Yellow** lamps indicate fair ranges.
- ◆ **Amber** lamps indicate partial ranges.
- ◆ **Red** lamps indicate full or empty ranges.



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Hallway Monitor



Water Service Center Monitor

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## WATER- POTABLE

The motorhome is equipped with a fresh water holding tank and an on-demand water pump. The water pump pressurizes the fresh water system to supply faucets and toilets with water. When city water is available, city water will pressurize the fresh water system and the water pump can be turned off. A water pressure regulator must be installed to safely limit water pressure within the fresh water system to no more than 45 psi.

### Three methods for supplying fresh water to the motorhome:

- ◆ A potable hose connects the city water/fresh tank fill connection located in the service center to the water source.
- ◆ Potable water hose connects to water source.
- ◆ Water can also be added to the fresh water tank via the gravity fill located in the water service center.

### **WARNING:**

**Water is electrically conductive. DO NOT use any electrically powered item or electrical outlet that may be exposed to a water source. Such use can result in a serious shock, causing injury or death.**

### **CAUTION:**

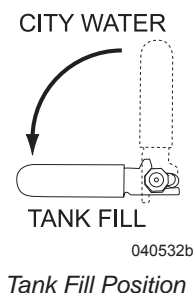
**Some water sources develop high water pressure, particularly in mountainous regions. High water pressure is anything over 55 psi (pounds per square inch). Excessive water pressure may cause leaks in water lines, damage the water heater and cause the potable water hose to swell and burst. Attach a pressure regulator to the city water faucet to regulate the pressure to the potable water hose and the motorhome.**

### **CAUTION:**

**When connecting the motorhome to fresh water be sure to use a hose manufactured and labeled for potable water to ensure water purity.**

### **Fresh Tank Fill**

- ◆ Attach a water pressure regulator to the city water supply to limit water pressure to 45 psi.
- ◆ Connect a potable water hose from a city water source to the “City Water” connection in the water service bay. For motorhomes with the optional hose reel, pull the hose to extend and connect to a city water source.
- ◆ Turn the “Tank Fill” lever to the tank fill position to fill the fresh water tank.
- ◆ The water pump should be off.
- ◆ Turn on the city water supply.
- ◆ Monitor the tank filling process at all times at the service bay monitor.
- ◆ Water will flow from an overflow pipe when the tank is full.
- ◆ Shut the water supply off as quickly as possible when the fresh tank is full.

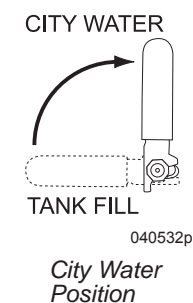
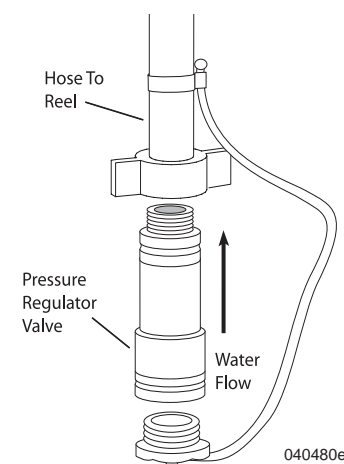


### **CAUTION:**

**DO NOT leave the hose unattended when filling the fresh water tank. Turn water off immediately when water flows from the overflow discharge.**

### **City Water Hook-up**

- ◆ Attach a water pressure regulator to the city water supply to limit water pressure to 45 psi.
- ◆ Connect the potable water hose to the “City Water” connection. For motorhomes with the optional hose reel, pull the hose to extend and connect to a city water source.
- ◆ Ensure the “Tank Fill” lever is in the city water position.
- ◆ Turn on the city water supply.
- ◆ The water pump can be either off or on. It will not affect the water pump to leave it ON.



### **CAUTION:**

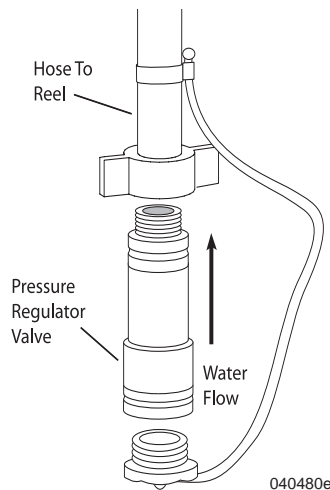
**Some outside water sources develop high water pressure, particularly in mountainous regions. High water pressure is anything over 55 psi (pounds per square inch). Excess pressure on a hot day can cause the water hose to swell and burst. An additional pressure regulator can be connected to the city water faucet to regulate the pressure to the potable water hose.**

### Hose Reel (Optional)

The potable water hose reel is located behind the water service center. The hose extends through an opening in the service center panel. The hose reel includes a 12 Volt DC motor for retraction.

#### To Retract the Hose Reel:

- ◆ Turn off the city water source and water pump.
- ◆ Disconnect the water hose from the faucet.
- ◆ Press and hold the Hose Reel switch (located in the service bay).
- ◆ Guide the hose into the service center panel opening.
- ◆ Install plug in hose end.



#### Maintenance:

- ◆ Prevent kinks while using the hose.
- ◆ Fully extend the hose. Straighten and clean the hose before retracting.

### Gravity Fill

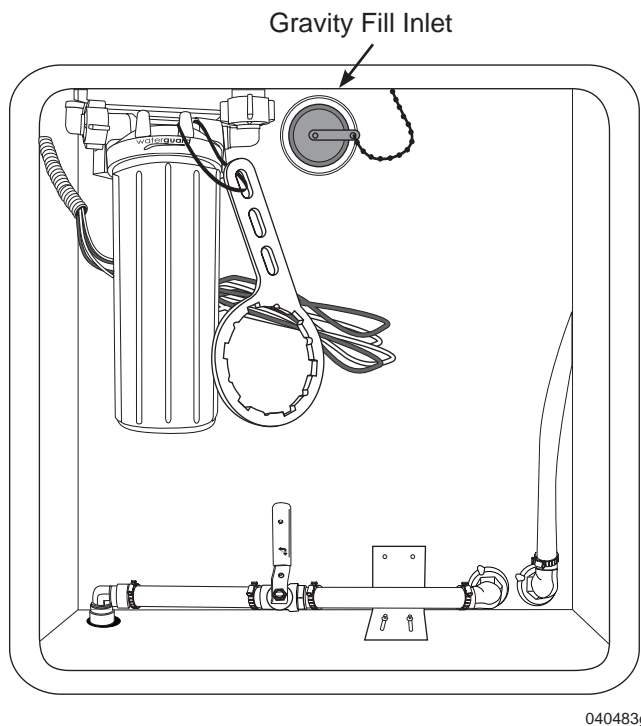
The gravity fill inlet is located on the fresh water tank, which is in the roadside bay next to the fuel tank. The gravity fill inlet can be used for adding fresh water or disinfectant solutions to the fresh water system.

Use only potable water sources, solutions and delivery systems when using the gravity fill inlet.

#### Filling the Tank:

1. Remove fill cap. Keep the cap and inlet clean.
2. Insert potable water hose or funnel into inlet.
3. Fill tank until water overflows from inlet.

**NOTE:**  
Do not leave the tank unattended while filling.



### WATER PUMP

The water pump pressurizes the fresh water system when not connected to city water. The water pump is self-priming, operating on demand as water is used. The water pump is located behind the water service panel. Access the water pump by removing an access panel in the pass-through storage bay next to the water service center.

#### WARNING:

Before leaving the motorhome for extended periods of time (i.e. overnight or longer) be sure that the city water supply and water pump have been turned off. Damage from neglect will be the responsibility of the owner, not the manufacturer.

The water pump can be operated from the following locations:

- ◆ Bathroom/Vanity
- ◆ Galley
- ◆ Water Service Bay
- ◆ Hallway Monitor

#### To turn the water pump ON or OFF:

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

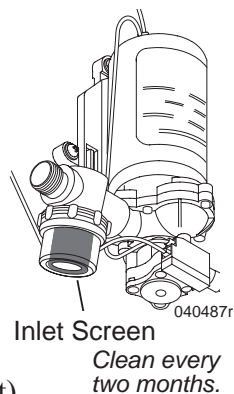


#### CAUTION:

DO NOT continue water pump operation if the fresh water holding tank is empty. Damage to the water pump or electrical supply system will result.

**To operate the water pump:**

- ◆ 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 will not prime or sputters (No discharge/motor runs):**

- ◆ Is the pump inlet screen 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 a faulty plumbing connection (vacuum leak)?
- ◆ Check for proper voltage with the pump operating.
- ◆ Check the pump housing for cracks or loose drive assembly screws.

**Water pump will not shut-off or continues to run when the faucet is closed:**

- ◆ Check to see if the fresh water/tank fill valve is fully seated into position.
- ◆ Check the output (pressure) side plumbing for leaks and inspect for a leaky toilet or valves.
- ◆ Look for a loose drive assembly or pump head screws.

**Water pump is noisy or rough in operation:**

- ◆ Check for plumbing that may have vibrated loose.
- ◆ Does the mounting surface multiply noise (flexible)?
- ◆ Check for mounting feet that are loose or compressed too tight.
- ◆ Look for loose pump head to motor screws.

**Water pump is rapid cycling:**

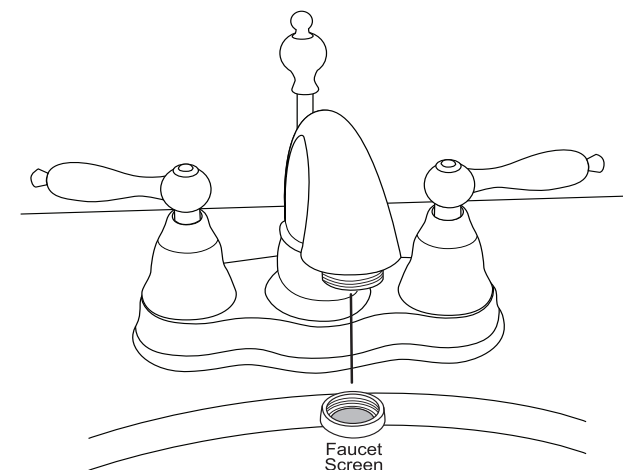
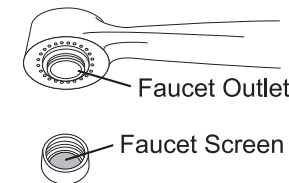
- ◆ Look for restrictive water flow in the faucets or shower heads.

**FAUCETS**

The kitchen faucet head has a flexible hose allowing the faucet head to be removed from the base. O-rings seal the faucet head to the base preventing water from dripping into the cabinet. Push the button to select either stream or spray.

**To clean faucet screens:**

- ◆ Unscrew kitchen - screen retainer from faucet head.
- ◆ Lavatory/vanity - remove threaded collar from faucet outlet.
- ◆ Clean screen using a small, soft brush, and a de-liming solution if necessary.
- ◆ Install screen and check water flow.

**Water Pump Troubleshooting**

Vibration induced by road conditions can cause the plumbing or pump hardware to loosen. Check the water pump system for components that are loose. Many symptoms can be resolved by tightening the hardware. Check the following items:

**Water pump will not start or blows fuse:**

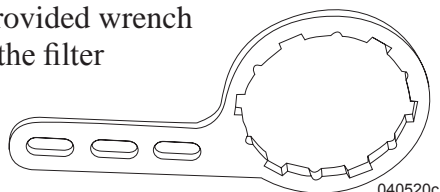
- ◆ Check electrical connections at the pump and ground connection.
- ◆ Check the water pump fuse on multiplex module typically located in the bathroom.
- ◆ Is voltage present at the pressure switch on the pump? If voltage is present, the pressure switch may be faulty. As a test, temporarily bypass the pressure switch.
- ◆ Are batteries fully charged and battery cut-off switch on?
- ◆ Check for an open or grounded circuit at the motor.
- ◆ Check for a seized or locked diaphragm assembly (water frozen).

## WATER FILTER

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

### Filter Replacement:

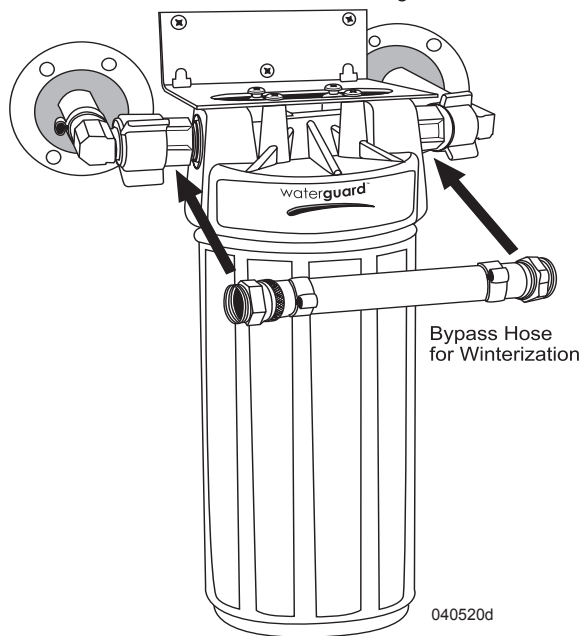
- ◆ Turn off the water supply (turn off water pump or disconnect from shore services).
- ◆ Open the kitchen faucet to relieve water pressure.
- ◆ Use the provided wrench to loosen the filter housing.



Filter Wrench

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Filter Connected - Normal Usage



Bypass Hose for Winterization

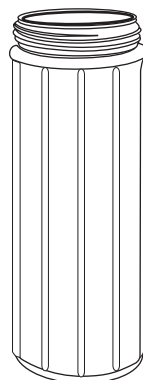
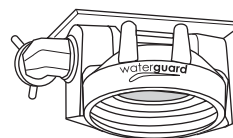
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- ◆ Finish unscrewing the filter housing by hand.
- ◆ Examine the o-ring located at the top of the filter housing. Replace this O-ring every third filter change to ensure proper sealing.
- ◆ Replace the old filter element with a new one.
- ◆ Thread the filter housing back onto the filter mount and hand tighten.
- ◆ Reconnect water supply and run water for 20 minutes to flush the system.

**NOTE:**  
**Contact Shurflo at 1-800-3218 or [www.shurflo.com](http://www.shurflo.com) for replacement filters and o-rings.**

### Winterization:

- ◆ Remove filter bowl and element from housing.
- ◆ Remove housing by disconnecting water lines on both ends and remove screws retaining housing to the bracket.
- ◆ Install a diverter hose in place of housing or replace housing o-ring and reinstall.
- ◆ Winterize the motorhome as outlined in Section 6 of this manual.



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## WATER SYSTEMS Troubleshooting

Water system problems are generally caused by 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. Close drain valves. If the pump continues to run, take the motorhome to an authorized dealer for service.

### Disinfecting Fresh Water

Disinfecting the water system with household bleach protects against bacteriological or viral contamination from common water sources. Read the following instructions completely before attempting to disinfect the fresh water system.

#### When to disinfect the fresh water system:

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

#### To Disinfect the Water System:

1. Remove water filter element and re-install the filter housing.
2. Drain the fresh water tank. Close drain when empty.



3. Prepare a disinfecting solution using one of the following methods:
  - ◆ Combine one gallon of water and ¼ cup of household bleach. Use 1 gallon of this solution for every 15 gallons of tank capacity.
  - ◆ Multiply tank capacity (in gallons) by 0.13. The result is the amount (in ounces) of household bleach to pour into fresh water tank. These methods will yield a 50 PPM (parts per million) disinfecting solution in the water system that will act as a quick-kill dosage for harmful bacteria, viruses and slime-forming organisms. Concentrations higher than 50 PPM may damage the water lines and/or tanks.
4. Pour the solution into the gravity fill opening.
5. Top off tank with fresh water.
6. Turn on the water pump in the motorhome.
7. Open each faucet and run water until you smell a distinct bleach odor.
8. Turn off all faucets and allow the system to stand for four hours.
9. Drain the fresh water tank of the mixed solution.
10. Fill the water tank with fresh water. Thoroughly flush hot and cold lines with fresh water. Repeat this process until the chlorine bleach smell is no longer detected in the water.
11. Install new water filter.

**INFORMATION:**

**Household bleach is 5.25% Sodium Hypochlorite. Higher concentrations increase PPM Ratio.**

**WASTE WATER SYSTEMS*****Proper Waste Disposal***

Dumping raw sewage from toilet holding tanks, except at authorized dumping stations, is universally prohibited. Most National, State and private parks have either a central dump facility or campsite hook-up for sewage.

Many modern rest areas along the interstate now have dump stations available. Woodall's Campground Directory, Trailer Life's RV Campgrounds and Services Directory, Rand McNally's Campground and Trailer Park Guide, Good Sam Park Director (Good Sam Club) and other similar publications list dumping stations. Some major oil companies offer dump facilities at selected stations also.

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

- ◆ **DO NOT** use strong or full strength detergents to deodorize and disinfect. Use odor control chemicals made especially for holding tanks.
- ◆ Automotive antifreeze, ammonia, alcohol or acetone in holding tanks will dissolve plastic.
- ◆ **DO NOT** put large table scraps in the tanks. They could be stuck in or damage the valve seals.

- ◆ Facial tissue is thicker, softer and stronger than a rapidly dissolving tissue. White toilet paper dissolves faster than colored. To test tissue dissolvability, immerse one tissue square into a jar of water. Shake the jar five times to determine if the tissue disintegrates into pieces or remains in one piece. **DO NOT** use tissue that remains in one piece. Paper designed specifically for holding tanks is available at most RV supply stores.

**NOTE:**

**Never dispose of sanitary supplies or other non-dissolving items into the system. Facial tissue, wet strength tissue, paper towels or an excessive amount of toilet tissue can create clogging in the holding tank system.**

**CAUTION:**

**DO NOT use any products that contain petroleum distillate or ammonia in place of RV odor controlling chemicals. Petroleum distillate or ammonia will damage the ABS plastic piping and seals.**

***What to Put in Holding Tanks*****Grey Water Tank:**

The grey water waste tank stores the sink, shower and clothes washer drain water. A reduced mixture of chemicals should help to control odor in the grey tank.

Ensure there is enough liquid in the holding tanks prior to dumping the waste holding tanks to provide sufficient flushing action through the valve, drain pipe and drain hose. Empty the waste holding tanks weekly to prevent stagnation and overfilling.

### **Black Water Tank:**

Before initially operating the toilet, treat the sewage holding tank with a pre-charge of several gallons of water and an odor-control chemical (available at most RV supply stores). First, add approximately three gallons of water to the holding tank. Next, mix the chemicals, in accordance with the manufacturer instructions, with approximately one gallon of water.

Pour mixture through toilet to the holding tank. Be careful not to spill the chemical on hands, clothing, toilet bowl or carpet. Hot weather conditions may require adjusting the amount of chemical used to control odor. Repeat the chemical pre-charge to the holding tank each time the tank is cycled.

### **WARNING:**

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

## **Waste Drain & Sewage Tanks**

The waste drain system provides adequate and safe storage and/or discharge of waste materials. The drain system uses ABS plastic piping and fittings connected to sinks, shower, toilet and holding tanks draining to an outside termination. The motorhome should be reasonably level for optimum operation of the waste systems. The wastewater holding system consists of a grey water tank that stores the sink, shower and laundry washer drain water, and a black holding tank that stores waste from the toilet.

Drain valves and a tank flush system dispose of 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 hallway monitor to observe tank levels. When ready to drain the tanks, drain the sewage tank first. Next, flush the black tank with the flush system. Close black tank valve after flushing tank. Drain the grey water tank. Using this sequence helps to flush solids from the sewer hose. It is recommended that both holding tanks are less than half full when traveling.

### **Waste Drain System**

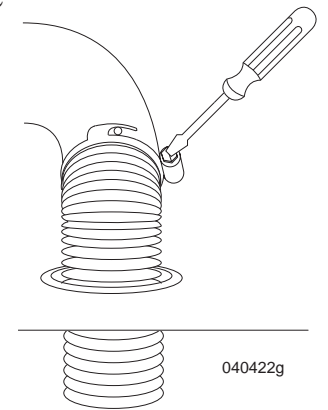
The waste drain system includes waste valves and a flexible sewer hose. When it is time to dump either the grey or black holding tanks, connect the flexible sewer hose to the termination outlet at the service center. Place the other end of the hose in the appropriate waste dump site, and open the desired tank valve.

A flexible, 3" sewer hose connects the termination drain and the shore facility. Sewer hoses usually come in 10 or 20' lengths. The sewer hose is stored in a tube accessed through a door on the roadside next to the service bay. The shore fitting for the sewer hose may be a 3" or 4", male or female threaded pipe; or a 4" pipe with no threads, covered by a metal plate. Different styles of adapters are available to fit most configurations. Hose ladders may also be purchased to support the hose.

It is important that the hose remains secure.

Always tighten clamps and restraining devices before use. Lay the hose in line between the termination outlet and the shore fitting.

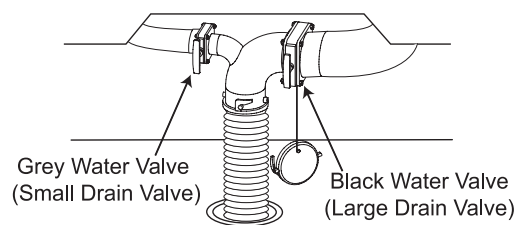
Restrain the hose to prevent movement during use. Wear protective and/or disposable gloves when handling the sewer hose.



*Tighten clamps before use.*

### **To Attach the Hose:**

- ◆ Remove sewer hose from carrier.
- ◆ Unscrew the access deck plate and feed the drain hose through the opening.
- ◆ Remove termination cap. Align coupler tangs with termination tabs. Twist coupler clockwise 90° to lock the coupler to the termination outlet.
- ◆ Attach the other end of the hose to the drain service. Restrain hose to prevent movement during use.
- ◆ Open the grey water valve.



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

**LUBE:**

**Lubricate the O-ring on the sewer hose adapter periodically with silicone spray.**

**NOTE:**

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

**NOTE:**

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

***Tank Flush***

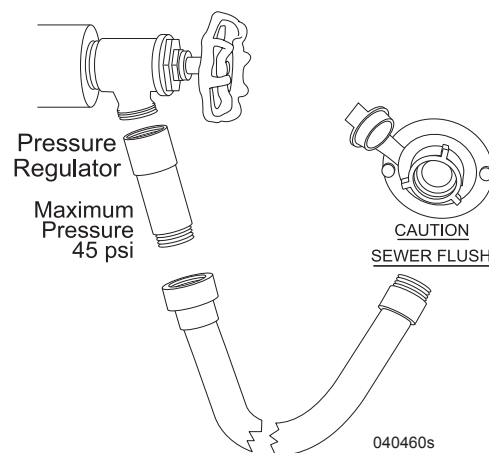
The motorhome comes equipped with a power flush nozzle, located in the black tank to help reduce solid build-up. Flush the tank each drain cycle. Failure to thoroughly rinse the black tank each drain cycle may result in accumulated solids and a clogged spray nozzle.

**NOTE:**

**The spray nozzle is a maintenance item, and as such is not a warrantable item. Keeping the spray nozzle clean and functioning is the sole responsibility of the owner.**

**Dumping the Tanks:**

1. 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 tank monitor in the service bay to observe tank levels. Stop filling the tank when the grey tank is half full.
4. Open the black water valve and allow the black tank to drain.
5. Connect a non-potable water hose with pressure regulator to the flush system fitting located in the service center.
6. Turn on the faucet and allow water to rinse the black tank for at least three minutes. Never operate the system unattended. Ensure water flows freely through the drain hose.
7. Turn off the faucet and close the black water valve when completed.



8. Open the grey water valve. Water in the grey tank will flush remaining solids from the hose. The grey valve remains open until the next drain cycle or time of departure.

**WARNING:**

**DO NOT 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.**

9. Close both valves when preparing for travel. Undo restraining devices from the hose. Disconnect the hose from the termination outlet by rotating the fitting counterclockwise 90°.
10. Install sewer hose in carrier and lock door.
11. If desired, add chemicals to the tanks to control odor. Follow directions given by the manufacturer of the chemical.

**NOTE:**

**Dump the black tank before traveling.**

**WASTE PUMP (OPTIONAL)**

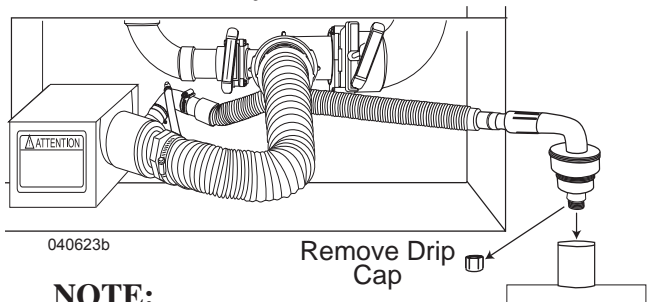
The waste pump is a self-priming impeller pump designed to minimize clogging when draining the tanks.

**To Empty the Black Tank:**

- ◆ Wear disposable gloves, safety glasses and protective clothing as necessary.
- ◆ Remove the drip cap at the 1½" hose end (see illustration).

**WARNING:**

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



**NOTE:**

If the pump is activated while the drip cap is on the hose end, switch the pump off and wait at least 30 seconds to allow pressure to dissipate before removing the drip cap.

- ◆ Insert hose end into sewer connection.
- ◆ Periodically tighten all hose clamps.
- ◆ The waste pump hose end can be connected to a 3" or 4" threaded or non-threaded sewer connection. Ensure the hose end is installed correctly prior to operation (see illustration).
- ◆ Open the solid waste drain valve at the plumbing service center by pulling outward.
- ◆ Turn on the pump using the Sani-Con power switch located in the service center.

- ◆ When the black tank is empty, turn off the pump and leave the black tank valve open.

**WARNING:**

Never leave the pump unattended while in use. DO NOT allow the pump to run dry for any period of time. Damage to the pump impeller will result.

**To Flush the Black Tank:**

- ◆ Insert the sewer pipe adapter in the facility sewer connection.
- ◆ Open the solid waste drain valve. Close the liquid waste drain valve. Fill the grey tank at least 50% full.
- ◆ Connect a non-potable water hose with pressure regulator to the flush system fitting in the plumbing service center. Turn on the water supply and waste pump. Allow the water to rinse the black tank for at least three minutes.
- ◆ Never operate the system unattended. The water must flow freely through the waste pump outlet hose.
- ◆ When completed turn off the faucet.
- ◆ Close the solid waste drain valve and open the liquid waste drain valve. Turn on the waste pump. The water in the grey tank will flush the remaining solids from the sewer hose. The liquid waste drain valve remains open until the next drain cycle or time of departure.

**WARNING:**

Operating the flush system unattended can risk flooding. Use the tank flush system each time the holding tanks are cycled. Failure to routinely use the flush system will result in a clogged spray nozzle. Turn off the water supply when finished flushing the tank.

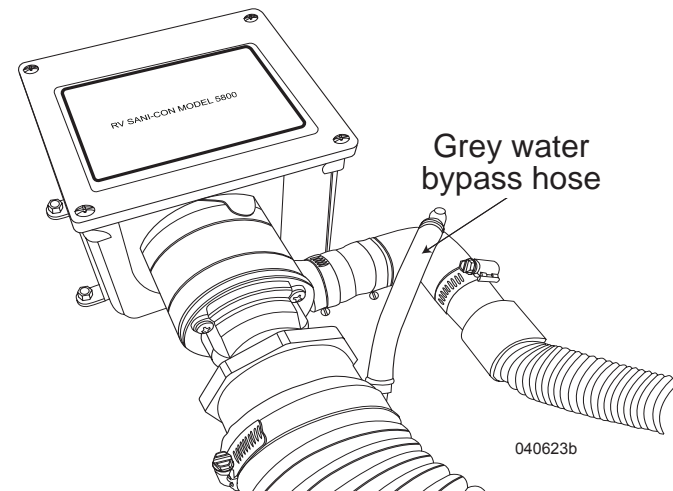
**Grey Water Bypass:**

The grey water bypass system allows continuous grey water flow. The liquid (grey) waste uses gravity to drain from the tank and bypasses the pump by going through the bypass hose into the sewage service.

The bypass hose is the small hose connected at the termination point of the dump valves and “T-s” into the small flexible hose on the outlet side of the macerator pump.

**Troubleshooting:**

The house battery disconnect switch in the battery compartment must be on for the macerator pump to run.



## TOILET

### Operating Instructions

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

#### **NOTE:**

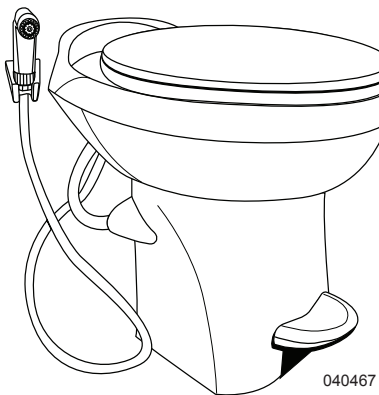
Add several gallons of water to the holding tank before use to prevent accumulation of solids.

#### **CAUTION:**

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

#### **Toilet Operation:**

- ◆ Push the flush pedal down halfway to add water to the bowl. Generally, more water is required when flushing solids.
- ◆ Push the pedal all the way down to open the flush ball.



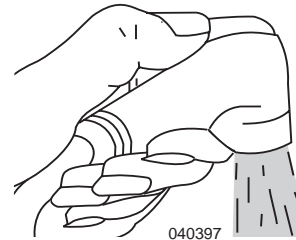
Water flow pressures vary at different locations; therefore, holding the flush pedal down for several seconds may be required. Release the flush pedal by allowing it to snap back, which permits positive sealing around the flush ball. A small amount of water should remain in the bowl.

#### **NOTE:**

Holding the flush pedal down longer than necessary will result in excessive water usage.

#### **Spray Nozzle:**

- ◆ Depress the thumb lever and step on the flush pedal.



### Cleaning & Maintenance

#### **Cleaning the Toilet:**

The toilet should be cleaned regularly for maximum sanitation and operational efficiency. Clean the toilet bowl with a mild bathroom cleaner. Do not use chlorine or caustic chemicals, such as drain opening types, as they will damage the seals. Clean out the system by flushing with several gallons of fresh water mixed with one cup of dry laundry detergent. Add odor control deodorant, in the amount specified for the holding tank capacity, after cleaning and every few days during use.

#### **NOTE:**

If the motorhome is in storage, spray silicone on the toilet bowl valve and work it back and forth. Perform this maintenance monthly (silicone will evaporate in about 30 days).

#### **Maintenance - Checking for leaks:**

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

#### **Troubleshooting:**

##### **Poor flush:**

- ◆ A good flush should be obtained within two to three seconds. If the problem persists, remove the water supply line and check the flow rate. The flow rate should be at least ten quarts (9.5 liters) per minute.

##### **Leaks:**

- ◆ Check water supply line connection at back of toilet.
- ◆ Check the screws for tightness between closet flange and toilet. If the leak continues, remove the toilet and check flange height. Adjust the height, if necessary, to 7/16" above floor. Replace the flange seal if it is damaged.

##### **Bowl will not hold water:**

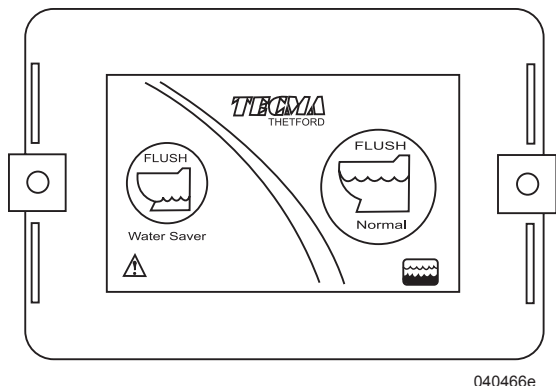
- ◆ Check for foreign material in the valve blade groove in the flush drain.

#### **NOTE:**

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

## TOILET - ELECTRIC

The Tecma is an electric macerating toilet. Only flush organic material and toilet paper to avoid damage. Ensure the house batteries are charged and interior house power is on.



### Water Saver Flush:

◆ **Press and release left button.**

Recommended for flushing liquids and small amounts of toilet paper only.

### Normal Flush:

◆ **Press and release right button.**

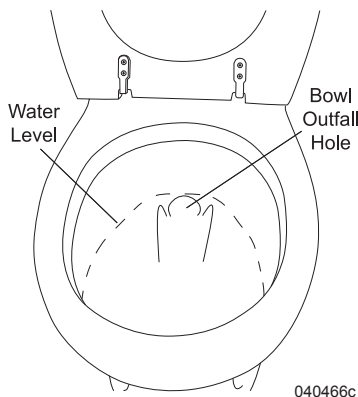
Recommended for flushing solids and toilet paper.

### Empty Bowl:

- ◆ Press both buttons simultaneously and release. This empties the bowl and leaves it dry for travel.
- ◆ Press either button once to add water and return to normal use.

## Programming Water Level

The water level in the bowl can be programmed. The minimum recommended refill level is ½" above the bowl outfall hole (see illustration). It may be necessary to reset the water level after switching water sources (from city to fresh tank or vice versa).



### Setting the water level:

- ◆ Press both buttons and hold.
- ◆ The LED's will flash, indicating the toilet is in program mode.
- ◆ As water enters the bowl, release buttons to set the level of standing water in the bowl. The level will remain constant after each flush until a water source of different pressure is used.

## Tank Level Sensors

The Tecma toilet system includes a black tank level sensor. The water icon located in the bottom right corner of the control panel denotes tank level and system status.

Icon Status	Meaning
Off	System is off, in sleep mode or not receiving power.
Green	System is on and black tank is half full or less.
Yellow	System is on the black tank is at least half full.
Red	System is on and holding tank is full.

### Full Tank Lockout:

The toilet will not flush when the system senses a full tank. This will prevent system backup and occurs when the Water Icon is red.

### LED Sleep Mode:

An automatic sleep mode will save power consumption when the system is not in use for eight hours. The keypad's LED lights will go out. Press any button to flush and reactivate backlighting.

## DRAIN TRAPS & AUTO VENTS

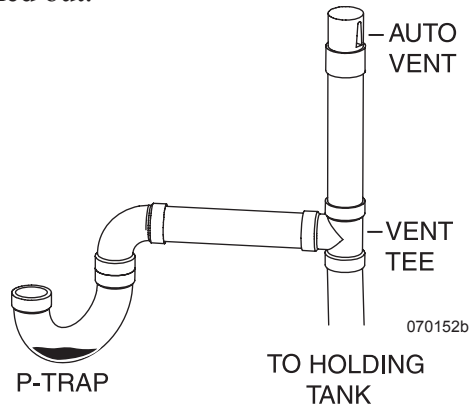
Sinks, shower and clothes washer drains incorporate a water trap (P-Trap) and auto vents to prevent waste water holding tank odor from entering the motorhome.

### Drain Traps:

P-Traps are usually within 54" of a vent tee and must contain water to block odors. During storage water can evaporate and allow odor into the motorhome. If odor is detected, run water into sinks, shower and clothes washer to fill P-Traps.

**Auto Vents:**

The auto vent is designed to assist in the smooth flow of water in the drain without creating a vacuum. If stuck in the open position, the auto vent can allow grey odors to enter the motorhome. Some auto vents can double as “clean outs” in the event the line needs to be snaked out.



**COLD WEATHER CONDITIONS**

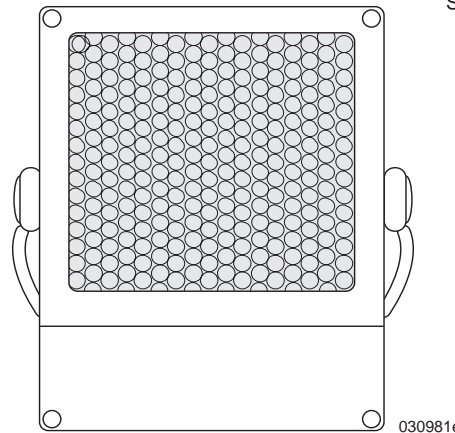
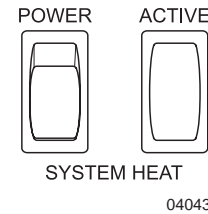
The motorhome is not designed for extended use in below freezing (32° F./0° C.) weather. There are precautionary measures that can be taken during extended cold weather use.

Interior water lines, fixtures, and drains above the floor are normally protected from moderate freezing temperatures as long as the furnace is operating. Cold temperatures can adversely affect water systems below the floor level because the propane furnace does not provide heat to these components. A supplemental 12 Volt DC bay heater is located in the water service bay.

**System Heat**

A 12 Volt DC bay heater is located behind the water service bay. The bay heater will help prevent waterlines from freezing and should be turned on when ambient temperature approaches 44° F. (+/- 6° F.) and freezing temperatures may occur.

The System Heat switch on the hallway monitor panel operates the bay heater.



**Bay Heater:** Located in the Water Service Bay.

**System Heat Operation:**

1. Turn the Systems Heat switch on.
2. The bay heater will activate when the bay temperature reaches 40° F. (+/- 6° F.). The bay heater and the systems heat active light will turn on. The heater will continue to operate until bay temperature reaches 55° F. (+/- 6° F.). The bay heater and active indicator light will then turn off.

**NOTE:**

The bay heater consumes about 20 Amps when operating. House battery power can be quickly consumed. It is recommended to connect to shore power when using the bay heater.

**Aqua-Hot Bay Heater (Optional):**

The Aqua-Hot includes a heat exchanger in the basement that operates when the Aqua-Hot is on and temperatures drop below 45° F.

**Cold Weather Storage**

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

**NOTE:**

Icemakers, water filters, water heater and optional Aqua-Hot all use domestic water. They should be drained and stored in accordance with the manufacturer’s recommendation for winterization.

**WINTERIZATION**

Water, plumbing and sewer systems require winterization when the motorhome is placed in storage. The recommended method of winterizing the motorhome is using air pressure to remove liquids that may freeze and cause damage to the various systems and appliances. The lines can then be left empty or filled with an FDA approved RV antifreeze.

When plumbing lines are drained, antifreeze is not necessary and the decision to use antifreeze is left to the motorhome operator.

**CAUTION:**

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

**WARNING:**

**Turn off the water heater or the Aqua-Hot (optional) and allow it to cool before beginning the winterization procedure. Hot water can result in burn injuries.**

**NOTE:**

**Some items (optional and otherwise) such as the Aqua-Hot, icemaker and washer-dryer may require special instructions. Check all OEM manuals for instructions and recommendations.**

**NOTE:**

**Use ONLY FDA approved RV antifreeze to winterize the water systems in the motorhome.**

### *Using Air Pressure*

Access to an air compressor and an adapter to connect the air pressure regulator to the water system is necessary. Air adapters used for winterizing are available at RV supply locations. Air pressure should not exceed 40 PSI. Higher pressure can damage the lines.

1. Empty and flush the holding tanks.
2. Drain the fresh water tank by opening the drain valve located in the front roadside bay with the fresh water tank.
3. Open all low-point drain valves. Let all the water drain. If equipped with a propane water heater, position the winterize valve to by-pass. Remove drain plug to drain tank.

**WARNING:**

**Ensure the water is not hot when opening the low-point drain lines. Hot water from the lines can cause burn injuries.**

4. Remove water filter housing and install a diverter hose.
5. Connect an air hose with pressure regulator to the City Water connection. Turn the tank fill lever to the “City Water” position. Set regulator for 40 psi and turn on air. (Air adapters for winterizing are available at RV supply locations.)
6. When water stops flowing from the drain valves, open and close the faucets one at a time, hot and cold, until only air comes out. Do not forget the toilet and any outside faucets.
7. Hold the toilet flush mechanism open until the water has stopped running.
8. Disconnect the air hose with adapter and turn the tank fill lever to the “Tank Fill” position.
9. Close all valves and faucets.
10. If applicable winterize the washer-dryer (see “Winterize the washer-dryer”).

11. Use one (1) gallon of FDA approved RV antifreeze to protect various water drain lines in the motorhome. Pour one pint into both the kitchen and bath shower drains. Pour two pints into the bath sink drain. This will protect the P-Traps, with some of the antifreeze going into grey tank to protect the drain valve. Open the valve on the toilet. Pour another three pints into the toilet, letting the antifreeze run into the black tank to protect the drain valve. Use a soft cloth to wipe out the sinks, shower and toilet (after the antifreeze is poured in) to protect the surfaces from stains. Pour the last pint into the washer-dryer drain.

### *Using Nontoxic Antifreeze*

Approximately eight gallons of FDA approved RV antifreeze is required to winterize the motorhome.

**WARNING:**

**Use only specifically designed, non-toxic, FDA approved RV antifreeze for potable water systems. Never use automobile engine antifreeze. Automobile antifreeze can cause serious injury or death if ingested. Always keep antifreeze away from pets.**

**CAUTION:**

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



1. Empty and flush the holding tanks. It is not necessary to blow out the lines with air.
2. Drain the fresh water tank (valve located on fresh water tank in roadside bay).

**CAUTION:**

**Ensure the fresh water tank is completely drained as antifreeze will not enter the fresh water tank.**

3. Remove water filter housing and install a diverter hose.
4. Open all low point drains and allow to drain.
5. Close all faucets, drain valves and low point drains.
6. If equipped with a water heater, remove drain plug and allow to drain. Replace plug and place the bypass valve (located on interior side of water heater) to the bypass position.

**CAUTION:**

**Ensure water is cool before draining the water heater.**

7. Access the winterization valves behind the service center from the access panel located in the pass-through storage bay next to the service center. Turn the winterization valves to the winterize position (see illustration). The winterization hose is the clear hose clipped into place on the left side of the service center. Set the end of the hose into a container of non-toxic, FDA approved RV antifreeze.

**NOTE:**

**Using the gravity fill to winterize is not advised. A few gallons of antifreeze will remain in the fresh water tank and require extra flushing to remove residual antifreeze.**

8. Turn on the water pump.
9. Turn on all the faucets, one at a time, hot and cold, starting with the faucet farthest from the pump. When antifreeze is present, let one cup flow into the drain to fill traps and turn the faucet off. Do not forget the toilet and all outside faucets.
10. Use a soft cloth to wipe out the sinks and shower to protect surfaces from antifreeze stains.
11. Disconnect the power supply line for the water pump.

**NOTE:**

**Some items (optional and otherwise) such as the Aqua-Hot, icemaker and washer-dryer may require special instructions. Check all OEM manuals for instructions and recommendations.**

**NOTE:**

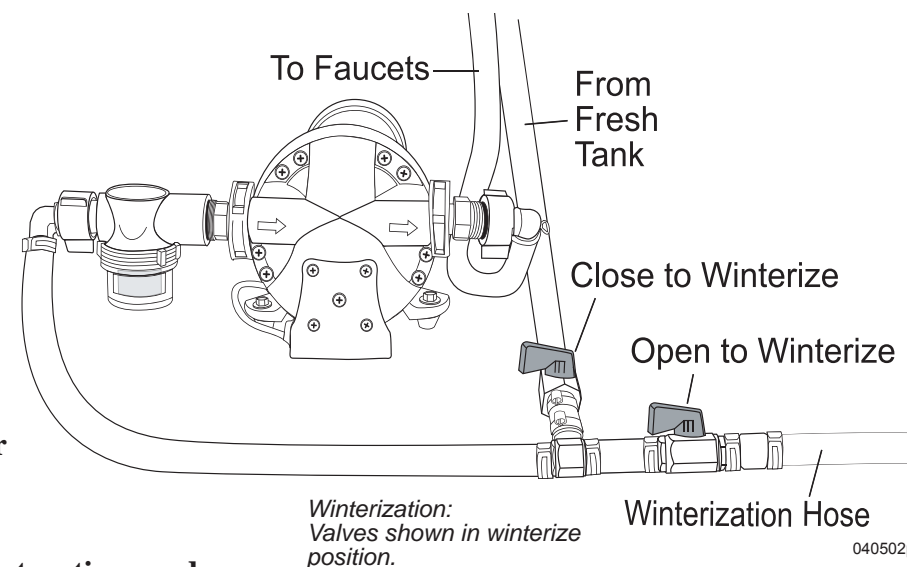
**Clean up spilled antifreeze immediately to prevent permanent staining.**

**De-Winterization**

To de-winterize: drain and fill the fresh tank with water. Connect the power supply line for the water pump. Switch the winterizing valves back to normal flow position. Operate all faucets, one at a time, until clear water is present. Add water to water heater. Install new water filters if so equipped.

**NOTE:**

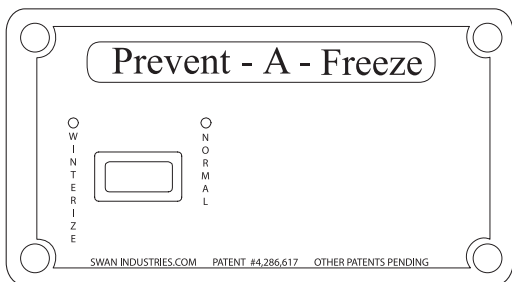
**The first two trays of ice from the icemaker may contain contaminants. Discard and replenish ice as necessary.**



### Prevent-A-Freeze System (Optional)

Depending on the size of the motorhome, as many as eight gallons of FDA approved, potable RV antifreeze will be added to the storage tank. The storage tank is located behind the water service center. Remove the panel in the pass-through storage bay next to the service center to access. The Prevent-A-Freeze winterization switch is located on the service center.

1. Turn the water pump off.
2. Fill the storage tank (located behind service center) with FDA approved, potable RV antifreeze. Ensure the valve in the line between the storage tank and Prevent-A-Freeze valve is open. It may be necessary to continually refill the storage tank as antifreeze is pumped through the system.



3. Open all low point drains and drain valves to drain the fresh water tank and fresh water lines. The fresh water tank drain is located in a front roadside bay and low point drains are located in the water service bay.

4. Remove water filter housing and replace with a diverter hose. The water filter is located in the roadside bay with the fresh water tank.
5. Drain and flush the holding tanks. Close valves when tanks have drained.
6. Close all faucets, drain valves and low point drains.
7. Set the Prevent-A-Freeze switch to "Winterize."
8. Turn the water pump on and operate each faucet individually until a small amount of antifreeze is present. It may be necessary to refill the storage tank. Allow about a cup to run into all drains to fill traps.
9. Close all faucets.
10. Open the shower faucets and toilet valves to allow a small amount of antifreeze to run into the holding tanks.
11. Use a soft cloth to wipe out the sinks and shower to protect surfaces from antifreeze stains.
12. Exterior faucet or shower head should be opened and closed using the same procedures as the interior faucets.
13. If applicable, winterize the washer-dryer (see "**Winterizing the Washer-Dryer**" in Section 4).
14. If the motorhome is equipped with an icemaker, see the refrigerator manual for winterization procedure.
15. Turn water pump off.
16. Open a hot and cold faucet to relieve line pressure. Close the faucets.
17. Leave Prevent-A-Freeze switch in "Winterize" position until de-winterization.

### **WARNING:**

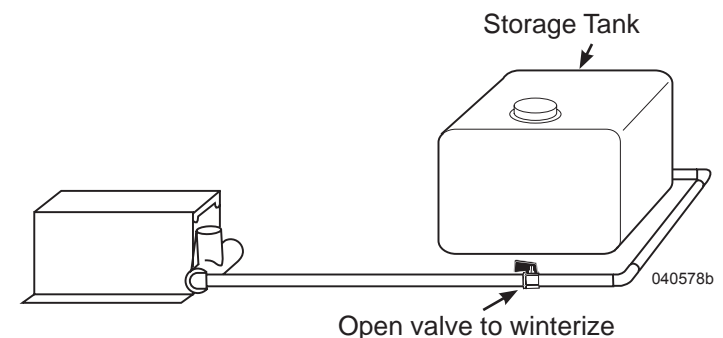
**Use only non-toxic RV antifreeze for potable water systems. Automotive antifreeze, if ingested, can cause blindness, deafness or death. Always keep antifreeze away from pets.**

### **De-winterization:**

1. Fill the fresh tank with water.
2. Turn Prevent-A-Freeze switch to Normal position.
3. Turn water pump on and operate all faucets one at a time until water is clear.
4. Open the shower faucets and toilet valves until clear water is present.
5. Install a new water filter.
6. If applicable, cycle icemaker several times until fresh water is present.
7. If applicable, operate washer-dryer to purge antifreeze from washer.

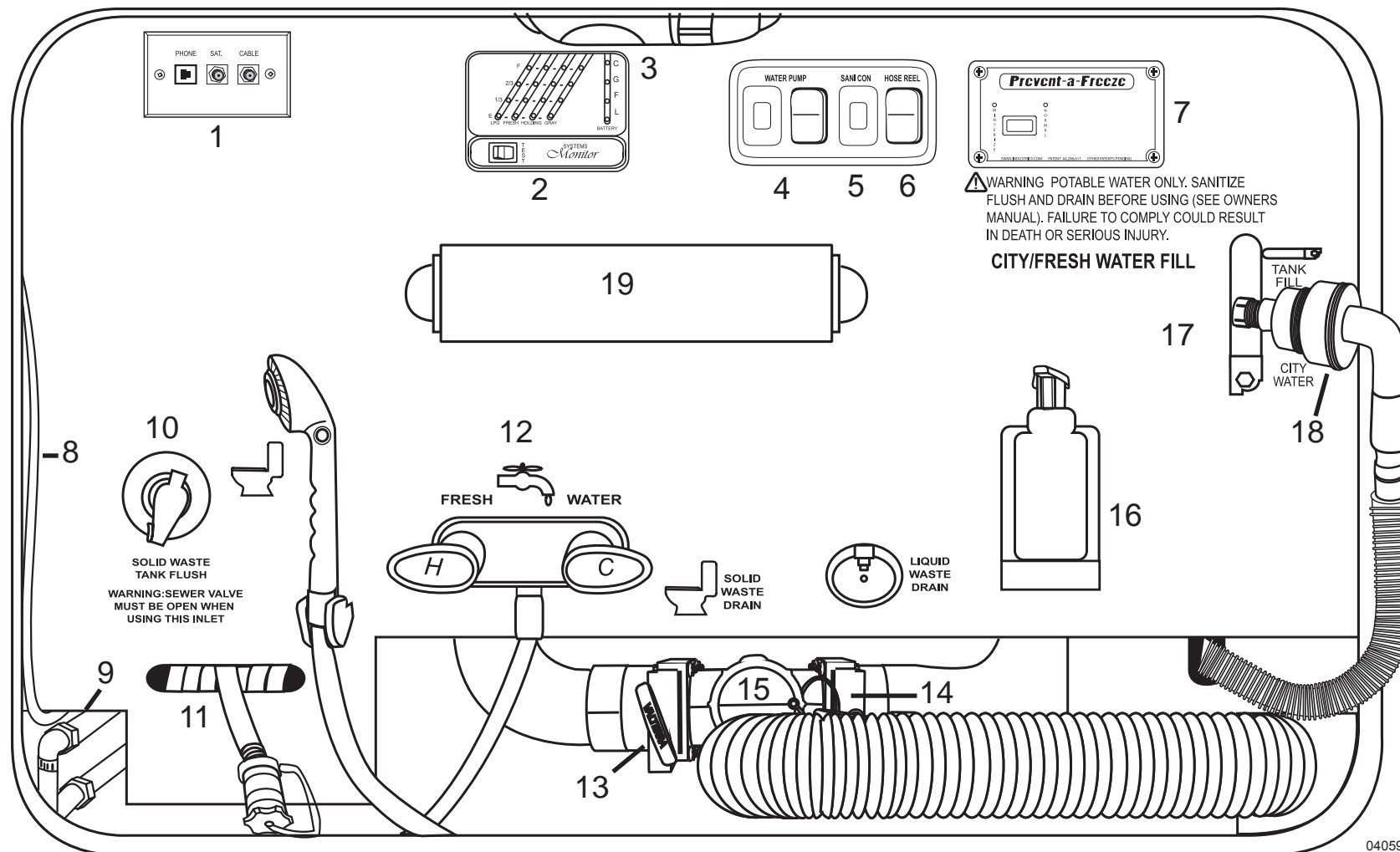
### **CAUTION:**

**The first two trays of ice from the icemaker may contain contaminants. Discard and replenish ice as necessary.**



*Located behind the service center*

SERVICE CENTER



040596p

- |                                       |  |  |
|---------------------------------------|--|--|
| 1. TV and Phone Hookups               | 9. Low Point Drains                    | 17. City/Fresh Water Fill Valve            |
| 2. Monitor Panel                      | 10. Black Tank Flush Connection        | 18. Waste Pump (Optional) Sewer Connection |
| 3. Storage Light                      | 11. Potable Water Hose Reel (Optional) | 19. Paper Towel Dispenser                  |
| 4. Water Pump Switch                  | 12. Exterior Shower                    |  |
| 5. Waste Pump (Optional) Switch       | 13. Black Tank Drain                   |  |
| 6. Power Hose Reel (Optional) Switch  | 14. Grey Tank Drain                    |  |
| 7. Prevent-A-Freeze (Optional) Switch | 15. Termination Drain                  |  |
| 8. Winterization Hose                 | 16. Soap Dispenser                     |  |

**NOTE:**  
**Layout of Service Center and location of components may vary with floor plans.**



# 09 Camelot

*Propane Systems – Section 7*

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## PROPANE SYSTEMS

This section contains safety information and operating instructions for the propane system and related equipment in the motorhome. Some items discussed may not be applicable to all motorhomes. More detailed information with **CAUTION** or **WARNING** instructions for various equipment, other than items within this section, can be found in the equipment manufacturer's manual in the owner's information box.

**NOTE:**

**Some appliance displays and appliance manuals may refer to LP-Gas as a fuel source; however, the actual fuel source used and required for these appliances is propane. The phrase "LP-Gas" is synonymous with not only propane, but butane and propane/butane mixtures. Since propane is the actual fuel required, the term "propane" will be used throughout this manual except for references to third party appliances (such as the refrigerator) that include the term "LP-Gas" on their displays or other literature.**

The propane tank mounted in the curbside bay is under high pressure. As fuel is used, the liquid vaporizes and passes through the primary tank valve to a regulator that reduces pressure. Low-pressure gas is then distributed to components through a pipe manifold system.

Component ignition problems are commonly caused by air in the manifold system or incorrect gas pressure. **DO NOT** attempt to adjust the regulator. Adjustments must be made by a dealer or an authorized service personnel with the proper equipment. In higher elevations or extreme cold weather (10° F./-12° C. or lower) a shortage of propane may be experienced. If propane is going to be used in higher elevations or cold climates for a long period of time, have authorized service personnel adjust the propane regulator for these conditions.

Have the propane system tested by an authorized dealer or service center at least once a year and before every extended trip. The test will include having the system checked for leaks and the regulator pressure checked and tested for functionality. Although the manufacturer and dealer test the system carefully for leakage, travel vibrations can loosen fittings.

**WARNING:**

**When storing portable propane tanks that are not connected to a propane system, install an approved plug in the tank outlet hole to prevent leaks. DO NOT store or transport empty propane tanks, portable tanks, gasoline or other flammable liquids in the interior area of the motorhome. Keep open flame and spark producing materials away from the propane area. Shut off all appliances and the primary propane tank valve when the motorhome is in storage. If this warning is ignored, a fire or explosion could result.**

Leaks (identified by the odor of rotten eggs or sulfur) can be found by applying a leak detector solution on all connections. Never light a match, use an open flame or use any spark producing equipment or appliance to test for leaks. Leaks can usually be repaired by tightening the fittings. If not, shut off the primary gas valve at the tank. Hand-tighten the primary valve only. **DO NOT** use a wrench or pliers as over-tightening may damage valve seats and cause leaks. If a leak is suspected, immediately see an authorized dealer or service center for repairs.

**WARNING:**

**Propane is highly volatile and extremely explosive. DO NOT use matches or a flame to test for leaks. Only approved propane leak testing solution for leak detection should be used. Unapproved solutions can damage copper tubing and brass fittings. A liquid dish soap solution of 10 parts water may be used. Shake the solution until bubbles form and then apply the mixed solution to fittings and accessory control valves. All fittings tested should be thoroughly rinsed and dried after testing. Never attempt to adjust propane regulators. Only qualified service personnel should perform maintenance or repairs to the propane system.**

**NOTE:**

**It may be illegal to travel in some states and Canadian provinces with the primary propane valve open. Failure to comply with these State and Canadian province requirements may result in fines and/or pose a safety hazard.**

## PROPANE DETECTOR

The propane detector is required safety equipment in RVs. American National Standards Institute (ANSI) **1192 - Fire & Life Safety, 6.4.8, Propane Detectors** states:

*“All recreational vehicles equipped with a propane appliance and electrical system shall be equipped with a propane detector listed as suitable for use in recreational vehicles under the requirements of UL 1484 and installed according to the terms of its listing.”*



Propane is heavier than air and will settle to the lowest point in the motorhome. The propane detector is also sensitive to other fumes, such as hair spray, which may contain butane as the propellant. Butane, like propane, is heavier than air and will settle to the floor level. Sulfated batteries (rotten egg odor) will also sound the alarm. When this occurs, reset the detector to stop the alert sound.

### About the Propane Detector:

Be aware of the difference between a leak versus propane escaping from an unlit, open burner. Pure propane vapors from a leaking pipe or fitting are heavier than air and will build up heaviest concentration at the leak and float down to mix with air. If a burner is left on, the area around the burner, range and adjoining counter space is

combustible and can cause injury and damage when ignited. This condition will exist for an extended time. Eventually, propane will reach the detector's location and cause the alarm to sound.

### NOTE:

**The propane detector indicates the presence of propane only at its sensor. Combustible levels of propane may be present in other areas. The detector is intended for detection of propane only.**

The propane detector is not designed to detect other types of gas. However, some products may cause the detector to alarm, such as alcohol, liquor, methane, kerosene, gasoline, deodorants, colognes, propellant used in spray cans and cleaning solvents. In some cases, vapors from glue and adhesive used in the manufacturing of the motorhome may also cause the detector to alarm for several months after the date of manufacture. If it is determined that the detector has false alarmed because of the above mentioned nuisance gases, reset the detector and ventilate the motorhome with fresh outside air. Take precautions to ensure one of these cases has not masked an actual propane alarm condition.

The propane detector draws less current than one instrument panel lamp and will detect gas until the battery is drained down to 7.0 Volts. A voltage higher than 7.0 Volts is needed for the detector to operate properly. If the power source is disconnected, or if the power is otherwise interrupted, the detector will not operate.

The propane detector has a self-check circuit running at all times while the detector is powered. In the event that the circuitry fails, a failure alarm will sound and the operating indicator will cease to light.

### Propane Detector Operation:

Upon first application of power the LED will flash yellow for three minutes as 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 propane it will immediately sound an alarm. The propane detector draws power from the chassis batteries at a rate of less than 1/10th of one amp.

### CAUTION:

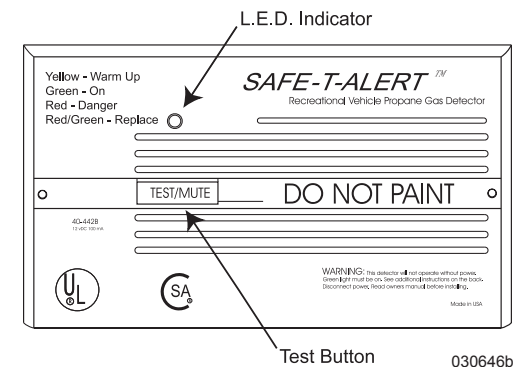
**The detector will not alarm during the three minute warm up cycle.**

### Testing

Press the TEST switch any time during the warm up cycle or while in normal operation. The LED will turn red and an alarm will sound. Release the switch. This is the only way to test full operation of the detector.

### WARNING:

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



**Alarm**

The red LED will flash and the alarm will sound whenever dangerous levels of propane or natural gas are detected. The detector will continue to alarm until the gas clears or the **Test/Mute switch** is pressed.

**Alarm Procedures:**

1. Turn off all propane appliances (stove, water heater, furnace, refrigerator), extinguish all flames and smoking material. Evacuate immediately. Leave doors and windows open.
2. Turn off primary valve on propane tank.
3. Determine and repair the source of the leak. If necessary, contact a qualified professional for service.

**WARNING:**

**DO NOT** operate any electric switch. This can produce a spark and ignite the gas.

**CAUTION:**

**DO NOT** re-enter until the problem is corrected.

**Alarm Mute:**

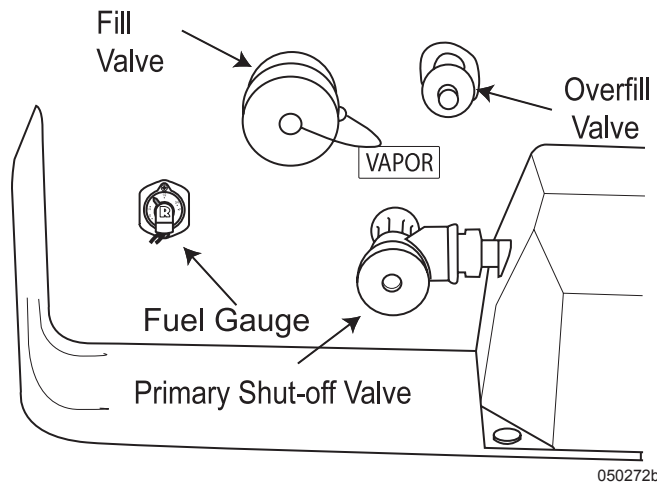
Press the **Test/Mute switch** when the detector is in alarm.

1. The red LED will continue to flash and the alarm will beep every 30 seconds until the gas level has dropped to a safe level.

2. The LED will flash green until the end of the Mute cycle.
3. If dangerous gas levels return before the end of the Mute cycle, the alarm will beep four times and return to phase 1.
4. After two minutes the detector will return to normal operation (solid green) or resound the alarm if dangerous levels of gas remain in the area.

**Fault Alarm:**

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



**Maintenance**

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

**PROPANE EMERGENCY PROCEDURES CHECKLIST**

If you smell gas (a rotten egg or sulfur smell) at any time, perform the following steps immediately:

**WARNING:**

**A fire or explosion from ignited gas or fumes can cause serious injury or death.**

**Emergency Procedures:**

- ◆ Shut off propane appliances.
- ◆ Manually turn off the primary shut-off valve at the propane tank.
- ◆ **DO NOT** operate any electric switch. This can produce a spark and ignite the gas.
- ◆ Open windows and doors.
- ◆ Evacuate the motorhome. Stay clear of the surrounding area.
- ◆ Keep all ignition sources out of the area.
- ◆ Contact a qualified service technician to find the source and repair the gas leak.

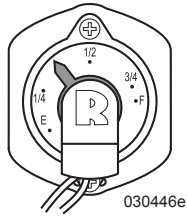
**POTENTIAL SOURCES OF PROPANE LEAKS WHEN OPERATING THE MOTORHOME**

- |                   |   |
|-------------------|---|
| ◆ Cooktop Burners | ◆ Defective Propane Connection                    |
| ◆ Oven            | ◆ Defective Regulator                             |
| ◆ Refrigerator    | ◆ Portable Propane Powered Appliances/Accessories |



## PROPANE TANK Measurement

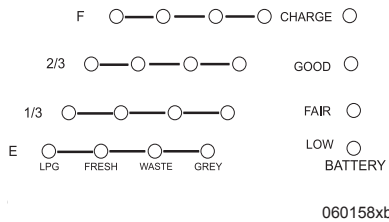
The propane tank level can be monitored from the hallway monitor panel, the propane tank gauge and a monitor panel in the water service bay.



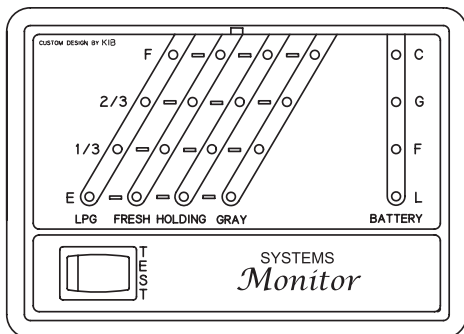
Propane Tank Gauge: Located on the propane tank.

### To display tank level on monitors:

Press the Tank Test switch located on the hallway monitor panel or the monitor panel in the water service bay. Observe the indicator lamps corresponding to the propane tank.



Hallway Monitor



Water Service Center Monitor

030446e

## Tank Capacity

Propane Tank Capacity
*31 Gallons
<i>*Actual filled propane capacity is 80% of listing due to safety shut-off required on tank.</i>

**NOTE:**  
This chart reflects product specifications available at the time of printing.

**NOTE:**  
Propane tank capacity is estimated based on calculations provided by the tank manufacturer and represents approximate capacity. The actual “usable capacity” may be greater or less than the estimated capacity. Actual full liquid capacity is 80% of full tank capacity.

## Tank Filling

Woodall’s Campground and Trailer Guide, and other similar publications, list refueling stations. Many travel parks sell propane. Before filling the propane tank, shut off pilot lights, appliances and igniters to prevent a fire or explosion. Have a trained service person fill the propane tank.

**WARNING:**  
Turn off all pilot lights and propane operated appliances before entering a refueling station. Most propane appliances used in motorhomes are vented to the outside. Fuel vapors can enter those vents when a motorhome is parked close to a gasoline pump, resulting in an explosion or fire.

**WARNING:**  
Extinguish all sources of heat, sparks, flames and smoking materials within a 50' radius during the fueling process.

The propane tank fill is located in a curbside compartment. The tank must be filled to the proper level to allow for expansion. An overfilled tank may cause the safety valve to release pressure emitting a strong rotten egg odor near the tank and/or a hissing noise may be detected.

**WARNING:**  
Small amounts of propane can escape and evaporate during the fueling process. Protect bare skin. Instant freezing will occur if exposed to liquid propane.

Propane exists in both liquid and vapor form within the tank. A full tank is approximately 80% liquid. The pressure inside the tank varies with the temperature of the liquid. All tanks are required to have a safety pressure relief device to release excess pressure. When the tank is full, the gauge on the tank will only read 3/4. The monitor panels are adjusted to indicate Full at this point.

**NOTE:**  
If the tank is new and being filled for the first time, inform the service technician to purge any air from the tank prior to filling.

### Tank Operation

- ◆ Manually open the primary shut-off valve located on the propane tank.
- ◆ Turn off the primary valve on the propane tank when the tank is being filled, when driving, in between trips and when in storage.
- ◆ Hand-tighten the primary valve only. **DO NOT** use a wrench or pliers. This will over-tighten the valve. The primary valve is designed to be closed by hand. Over-tightening may permanently damage the valve seat.

**NOTE:**

In some States and Canadian provinces, it may be illegal to drive the motorhome while primary valve on the propane tank is open.

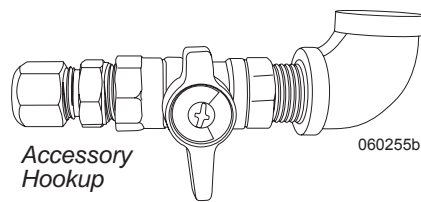
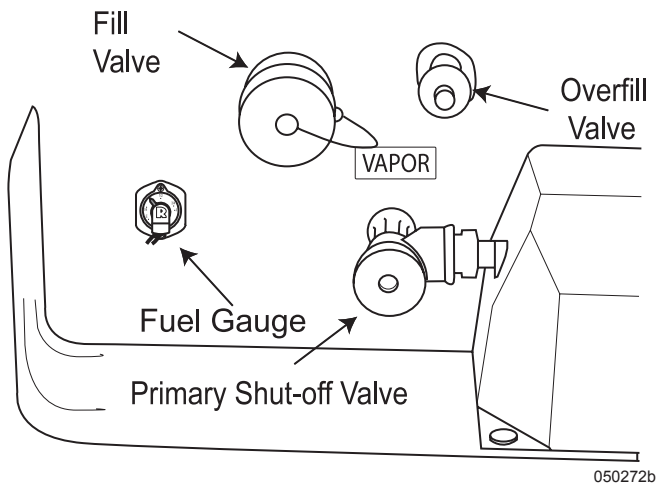
### Accessory Hookup

**Exterior Propane Line Hookup Prep:**

An auxiliary remote propane hookup is located in the curbside propane tank. The auxiliary hookup is for external propane accessories and is for use with external components only. For safety, only approved propane quick disconnect fittings and flexible hose should be used to connect external accessories to the remote hookup. A propane Quick Disconnect fitting should be installed by a qualified agency as defined in the **National Fire Protection Association NFPA (Fire) 54-02 code.**

**NOTE:**

Check for leaks on all connections each time the remote hook-up is used. If a leak is detected, turn off the primary valve at the main propane tank. Contact a qualified service center for the necessary repairs.



**WARNING**

**Hazardous vapors, explosive and flammable gas can cause suffocation, severe injury or death.**

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### PROPANE FUNDAMENTALS

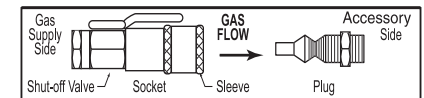
#Capacity	Gallon Capacity	BTU Capacity
5	1.18	107,909
10	2.36	215,807
11	2.59	237,387
20	4.72	431,613
30	7.08	647,420
40	9.43	863,226

The above capacities allow for 20% vapor space on each cylinder. Data taken from the National Fire Prevention Association (NFPA). Pamphlet #58-1998.

**CONVERSIONS**

Gallons to Liters (1 Gallon = 3.785 Liters)  
 Fahrenheit to Celsius (F° - 32 ÷ 1.8 = C°)  
 11 in. Water Column = 6 1/4 ozs. per sq. in. pressure.  
 27.7 in. Water Column = 1 lb. per sq. in. pressure.

**QUICK DISCONNECT FITTING**



**NOTE:**  
**COUPLING TO BE INSTALLED BY A QUALIFIED AGENCY AS DEFINED IN THE NATIONAL FUEL GAS CODE (NFPA 54)**

**INSTALLATION INSTRUCTIONS**

- 1) INSTALL SOCKET WITH SHUT-OFF VALVE ON THE GAS SUPPLY SIDE
- 2) INSTALL PLUG ON THE ACCESSORY SIDE
- 3) LEAK TEST USING SOAPY WATER SOLUTION

**OPERATING INSTRUCTIONS**

**TO CONNECT:**

- 1) CLOSE SHUT-OFF VALVE
- 2) PULL SOCKET SLEEVE BACK
- 3) INSERT PLUG; RELEASE SLEEVE
- 4) PUSH PLUG INTO SOCKET UNTIL SLEEVE SNAPS FORWARD
- 5) OPEN SHUT-OFF
- 6) LEAK TEST USING SOAPY WATER SOLUTION

**TO DISCONNECT:**

- 1) CLOSE SHUT-OFF VALVE
- 2) TO RELEASE PLUG, PULL SLEEVE BACK AWAY FROM PLUG; PULL OUT PLUG
- 3) INSERT PLUG; RELEASE SLEEVE
- 4) LEAK TEST USING SOAPY WATER SOLUTION

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## PROPANE STATISTICS

Pounds Per Gallon	4.24
Specific Gravity of Gas	1.50
Specific Gravity of Liquid	.504
Cubic Feet Gas Per Gallon of Liquid	36.38
Cubic Feet Gas Per Pound	8.66
BTUs Per Gallon	91,502
BTUs Per Pound	21,548
Dew Point in Degrees Fahrenheit	-44° F
Vapor Pressure at 0° F	31
Vapor Pressure at 70° F	127
Vapor Pressure at 100° F	196
Vapor Pressure at 110° F	230
Flash Point	842° F

## BASIC FACTS ABOUT PROPANE

- ◆ Propane detectors are a federal requirement on all propane equipped recreation vehicles.
- ◆ Propane is a by-product produced by refining oil.
- ◆ Odor is added to propane after the refining process for the purpose of detection.
- ◆ Each liquid gallon of propane produces 91,502 BTUs (British Thermal Units).
- ◆ Temperature affects pressure of propane. Internal tank pressure can exceed 200 psi.
- ◆ Tanks or valves contain pressure relief valves. The relief valve opens at 125% above tank rating.
- ◆ Propane stops vaporizing at -44° F.
- ◆ Standard propane operating pressure is 11" of Water Column or approximately 6 ¼ ounces per square inch.
- ◆ An inch of Water Column is a measurement of applied pressure to one side of a U-Tube ½ filled with water at sea level. The amount of pressure required to raise the water level 11", represents 11" of Water Column.

**NOTE:**

Propane fundamental information is not a complete guide for the use of propane tanks or appliances. In cold climates keep propane level above 50% to keep vaporization of propane at the highest level.

## PROPANE REGULATOR

Propane is compressed into liquid form in the tank. Only the vapor is used during combustion by an appliance. As vapor is removed from the tank, the remaining liquid will vaporize to maintain pressure that is removed during consumption. This process will continue until there is no liquid remaining in the tank.

Temperature affects the vaporizing action of the liquid. If temperature of the liquid is - 44° F, the liquid remains stable with tank pressure, about 0 psi. If liquid temperature is 100° F, the liquid quickly vaporizes with tank pressure, about 200 psi. Vapor pressure must remain relatively consistent, regardless of temperature, for the appliance heat output to remain stable. Vapor pressure regulation is performed by the regulator.

The two-stage regulator reduces vapor pressure so that it is safe for use. The first stage of the regulator reduces tank pressure to a range of 10 to 13 psig (pounds per square inch gauge). The second stage further reduces pressure to a working pressure of 0.4 psig (11 Inches of Water Column or about 6¼ ounces psi.). A vent is installed to allow the internal diaphragm to move with atmospheric pressure change. It is important to keep the vent clean and clear of obstruction or corrosion. If the vent becomes clogged, pressure from the propane tank may cause erratic pressure regulation. If there is any corrosion, contact a qualified propane service technician. The regulator is mounted so that the vent faces downward. If the vent becomes clogged, clean it with a toothbrush.

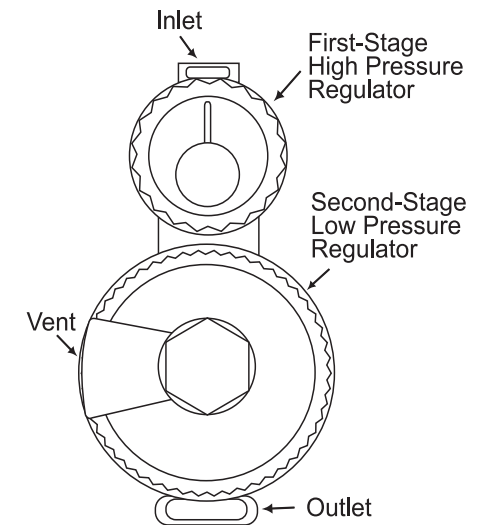
Under normal atmospheric conditions a propane regulator will not freeze, nor will propane. Vapor passing through the regulator will expand and cool, condensing moisture in the gas. The moisture will freeze, build up and block the vent. The possibility of freeze up is greatly reduced with the two-stage regulator.

**To Prevent Freeze Up:**

- ◆ Ensure the propane tank is totally free of moisture prior to filling.
- ◆ Ensure the tank is not overfilled.
- ◆ Keep the valve closed when the tank is empty.

**If A Freeze Up Occurs:**

- ◆ Have a propane distributor purge the tank.
- ◆ Have the propane distributor inject methyl alcohol in the tank.



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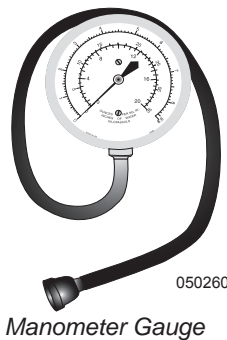
Damage to the regulator can occur when the tank is overfilled. The regulator is designed to work with vapor only. This is why the tank is filled to only 80% of its liquid capacity. The other 20% allows for vaporization of the liquid. The primary vapor valve is located in the vapor section of the tank. In an overfilled tank, liquefied petroleum can fill the regulator. Vaporizing liquid can freeze the diaphragm. High tank pressure on a frozen diaphragm can cause a rupture and result in erratic pressure regulation. This is why it is important to have the propane pressure checked for proper pressure and accurate regulation during appliance operation. Erratic pressure regulation dramatically affects refrigerator operation on propane.

**WARNING:**

**DO NOT attempt to adjust the regulator. Adjustments require special equipment. Failure to follow these instructions may result in a fire or explosion, and can cause severe personal injury or death. DO NOT operate propane appliances until the propane pressure is checked and a leak down test is performed.**

**Manometers:**

The manometer is the best way to accurately determine propane pressure. Two different styles of manometers are gauge and U-Tube.

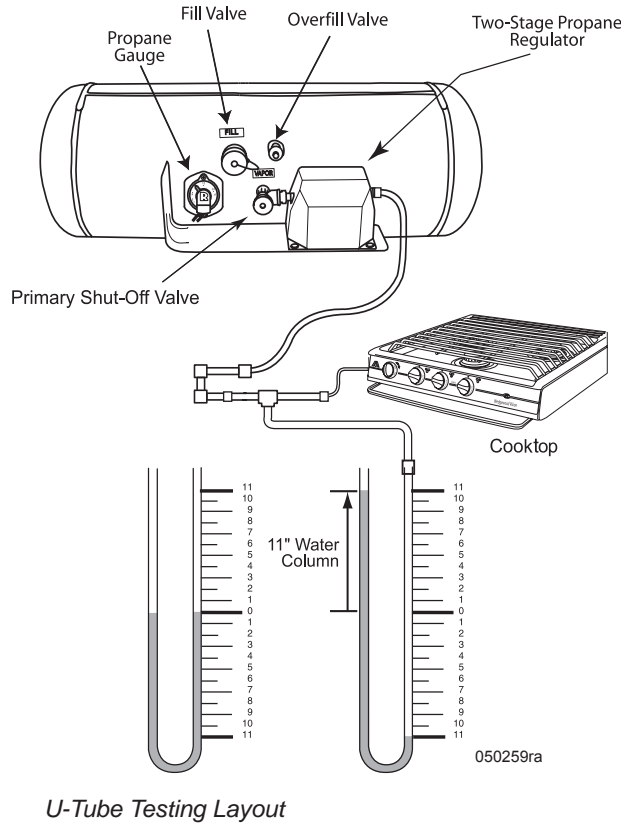


Manometer Gauge

**TIP:**

**Attach the manometer gauge to the accessory hookup line to avoid loosening any interior propane line connections.**

Gas pressure is measured in Inches of Water Column. This is the amount of pressure applied to one side of a U-shaped tube half filled with water. The amount of pressure needed to raise the column of water 11" represents 11 Inches of Water Column.



U-Tube Testing Layout

**PROPANE HOSE INSPECTION**

The hose manufacturer suggests that a flexible propane supply hose undergo regular inspection. As a guideline, we suggest that all flexible propane lines connecting the slide-out, appliances and tanks be inspected in the spring and fall of each year by a qualified RV technician.

**Inspection tips:**

Hose strength is controlled by the plies of reinforcement. Damage in this area cannot be tolerated. It is important that if a damaged propane hose is found, the source of the damage be determined and corrected prior to the replacement. Small cuts, nicks, or gouges that do not go completely through the cover are not cause for replacement of the hose. Inspection should be performed when the hose is not under pressure.

**NOTE:**

**Pricking of the cover in the manufacture of this type of hose is common and necessary for satisfactory hose performance. Consequently, the uniformly pricked cover should not be viewed with alarm.**

**Cause for hose replacement:**

- ◆ Damage to the textile reinforcement or wire braid
- ◆ Wire braid reinforced hose that has kinked or been flattened so as to permanently deform the wire braid in the unpressurized state.
- ◆ Blistering or loose outer cover.
- ◆ Slippage evident by the misalignment of the hose and coupling and/or the scored or exposed area where slippage has occurred.

**NOTE:**

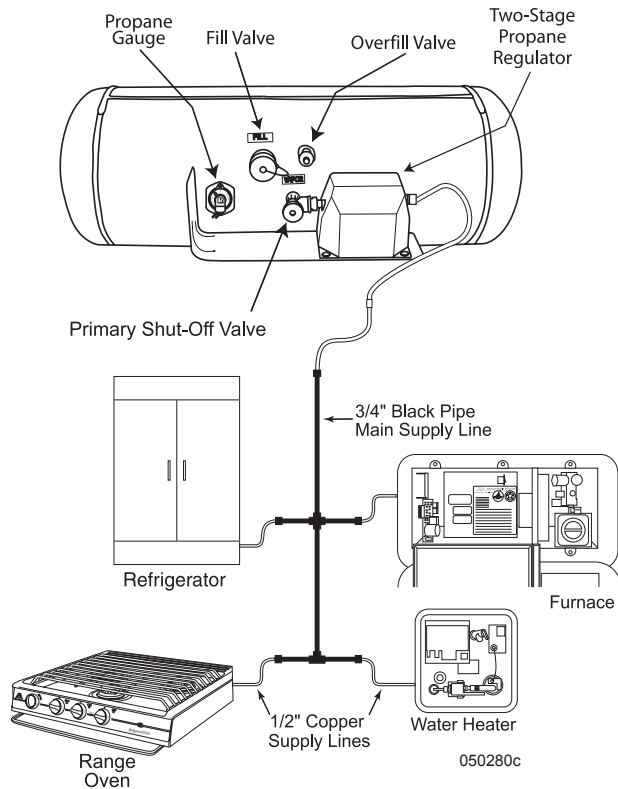
**Only a qualified RV service technician should replace propane components.**

**Additional suggested maintenance:**

After performing extensive testing the manufacturer of the flexible propane supply hoses has determined that the hoses be replaced every ten (10) years as the failure rate may increase after this period of time. The motorhome manufacturer recommends following this guideline to assure continued safety and dependable use.

**PROPANE DISTRIBUTION LINES**

A primary manifold black steel pipe running throughout the motorhome distributes propane to secondary lines.



All secondary lines leading to gas appliances are usually copper tubing with flared fittings. It is recommended that gas distribution work be performed by an authorized dealer or an authorized service technician.

**INSPECTION:**  
**Inspect the rubber flexible lines twice a year for abrasions, tears, kinks or other signs of damage.**

If a gas leak is suspected, have the system inspected and repaired by a qualified service technician as soon as possible.

**PROPANE CONSUMPTION**

Each gallon of propane produces 91,502 BTUs of heat. One 27 gallon tank produces two million BTUs. Total consumption depends on the rate of usage by each appliance and the operating time. The stove typically uses the most propane.

**Determine Fuel Consumption:**

To determine approximately how many hours a propane appliance will operate on one gallon of propane, use the following formula:

- ◆ Propane appliances are rated in Input BTU (British Thermal Units). The rating is usually stamped or printed on a tag affixed to the appliance. For example: the Input rating of the appliance is 10,000 BTUs.

- ◆ One gallon of propane produces 91,502 BTUs.
- ◆ Divide the amount of BTUs of one gallon of propane (91,502) by the rating on the appliance in this example 10,000. Net continuous operation time for one gallon of propane 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 propane will last. Generally, propane appliances do not continuously operate. An example would be the typical cycling of the refrigerator.

**Typical Appliance BTU Ratings**

**Cooktop**

- Large Burner - 9,000 BTU
- Small Burner - 6,500 BTU

**Refrigerator (Norcold)**

- 4-door - 2,200 BTU

**Water Heater**

- 10 gal - 10,000 BTU

**Furnace**

- 1 - 31,000 BTU
- 1 - 20,000 BTU

### Determining how long a tank of propane 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 propane tank by 91,502.
- ◆ Divide the total of BTUs of the propane tank by the total number of BTUs the appliances consume. This equals the approximate number of operation hours of before refueling.

## PROPANE SAFETY TIPS

Propane is one of the safest and most reliable fuels available on the market when handled properly. Propane, 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 propane appliances. Use of propane requires the responsibility of enforcing extra safety measures.

The motorhome is equipped with many propane operated appliances because it is a convenient and efficient source of fuel. Propane 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 called GAS<sup>®</sup> (Gas Appliance System) Check. The GAS<sup>®</sup> Check program is aimed at educating users about the convenience of propane with safety and peace of mind. For information on the **NPGA Gas<sup>®</sup> Check program**, call (202) 466-7200 or visit [www.npga.org](http://www.npga.org).

### Maintenance and Safety Tips for the Propane Refrigerator and Furnace:

- ◆ Have the refrigerator and furnace systems inspected annually by an authorized service center.
- ◆ Have the venting system checked for blockage before using the refrigerator or furnace for the first time each season. 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. Improper combustion can cause Carbon Monoxide buildup, which is potentially fatal.

### Maintenance and Safety Tips for the Propane Cooktop:

- ◆ Burner flame should be a blue color, which indicates complete combustion. If not, have the unit serviced by a qualified technician.
- ◆ **DO NOT** cover the oven bottom with foil. Air circulation will be restricted.

- ◆ Never use the propane cooktop or ovens for heating purposes.
- ◆ Ensure children understand never to turn or play with the knobs on the front of the propane cooktop.

### Maintenance and Safety Tips for the Propane Water Heater:

- ◆ Have the water heater venting system inspected annually or before first use of the season.
- ◆ Keep flammable substances away from the water heater. **DO NOT** store items close to it as this may block airflow that the water heater needs to operate efficiently.
- ◆ At the first indication of incomplete combustion (yellow flame instead of a blue flame or soot is present) call a service technician immediately. Improper combustion can cause Carbon Monoxide buildup, which is potentially fatal.

# 09 Camelot

## Electrical Systems - House – Section 8

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## HOUSE ELECTRICAL - INTRODUCTION

This section contains guidelines, procedures and information that will assist in understanding the domestic electrical system and the operation of various components. Refer to the OEM manuals included in the Owner's Information File box for their respective, in-depth component operating instructions.

### General Overview:

The motorhome can utilize various sources of electrical power: shore power connection, generator, inverter, solar panels, chassis batteries and house batteries. All of these electrical power sources, while independent of each other, can be combined in a variety of ways to provide a highly efficient electrical operating system. Two types of electrical systems are used: 120/240 Volt AC and 12 Volt DC.

The motorhome 120/240 Volt AC system can be operated from three different power sources: shore power, the on-board generator or the inverter/charger. Shore power is the most efficient and should be used whenever possible. The generator can be used when shore power is unavailable. The inverter/charger supplies silent AC power using the house batteries of the motorhome. However, the inverter/charger AC power output is limited and should be used sparingly to conserve house battery power.

Two different sources supply the AC circuit breaker panel with power: the 50 Amp shore power cord or the on-board generator. The power source used is automatically selected by a switching device known as a transfer switch.

### **WARNING:**

**The electrical system is engineered and tested for complete safety. Circuit breakers and fuses protect the electrical circuits from overloading. When planning modifications or additions to the electrical system, we strongly recommend consulting a dealer for assistance to ensure continued integrity and safety of the electrical system. Please note that any modifications may void the warranty.**

### **WARNING:**

**Water is electrically conductive. DO NOT use any electrically powered item or electrical outlet that may be exposed to a water source. Such use can result in a serious shock causing injury or death.**

The motorhome has two 12 Volt DC systems: chassis and house. These two systems, for the most part, are separate from one another. The house system does not operate engine functions; the engine system does not operate house functions. However, within the two systems there are some inner connections. **For example:** While the motorhome is driven the alternator on the engine will charge the house batteries. Likewise, while the motorhome is plugged into shore power or the generator is running, the engine batteries are charged. Each system will supply 12 Volt DC power to the 12 Volt DC distribution panels.

The chassis and house systems have their own sets of batteries. The chassis batteries supply 12 Volt DC power to the front distribution panel located outside in the front roadside bay. This panel contains mostly engine system circuits and wiring such as headlights, taillights, dashboard

functions, gauges, etc. The house batteries supply 12 Volt DC power to the distribution panel located in the bedroom. This panel contains fuses for the house, interior lighting and appliances. Become familiar with these panels and the items they operate.

With all the technological advancements taking place in the past several years manufacturers have now incorporated electronics into these systems. It is important to keep the 12 Volt DC systems in good working order. These systems, with their incorporated electronics, are voltage sensitive. Some items can be damaged if the DC voltage is not maintained within the designed specifications.

A majority of the lighting and appliances are designed to operate from 12 Volt DC (direct current) power. This is why the batteries play such an important role in the function of the motorhome. There are exceptions with appliances such as the microwave or television; however, indirectly they still operate from 12 Volt DC power as they can be operated from the inverter. The chassis functions (engine, transmission, dash air, etc.) are also 12 Volt DC.

### **Shore Power:**

The motorhome is equipped with a shore power cord to connect the motorhome to outside electrical services. Shore power service is the most efficient source of electrical power. The plug end of the shore power cord is 50 Amp, 240 Volt AC. When this type of power service is not available, electrical adapters are required to allow a proper and safe connection to the electrical service supply.



**NOTE:**

When 50 Amp shore service is not available, take care when operating the appliances and using the outlets to avoid overloading the shore power service.

**Generator:**

The generator can be selected for use when shore power is unavailable. The maximum amount of generator output power, measured in watts, is calculated at an elevation of 500 ft. above sea level. This figure will decrease slightly at higher altitude. Ambient temperature also affects total maximum output. The amount of AC electrical load applied to the generator determines fuel consumption.

**Inverter/Charger:**

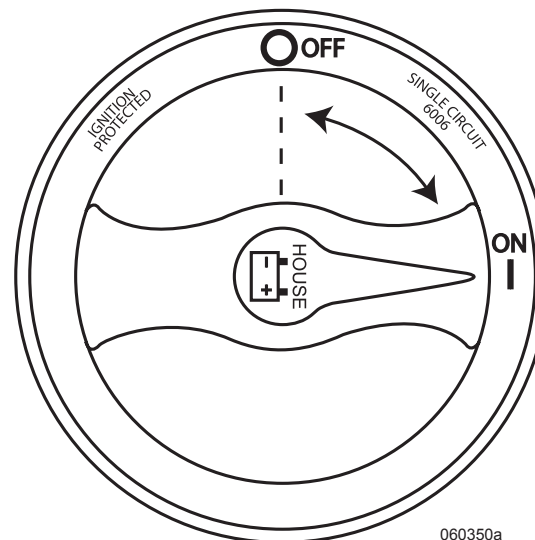
The Inverter/Charger is an auxiliary 120 Volt AC power source that inverts 12 Volt DC house battery power to 120 Volts AC. This device has limited AC power output, measured in watts, and operates only selected appliances and outlets. The Inverter/Charger also converts 120 Volts AC power, supplied from either shore power or the generator, to 12 Volts DC power to recharge the batteries. When dry camping, the Inverter/Charger may be used to supply power to selected outlets.

**BATTERY DISCONNECT - HOUSE**

The main house battery disconnect switch turns the house battery power supply on or off by disconnecting 12 Volt DC power to the following items: inverter, domestic fuse panel in the bathroom (with AC breakers), and the fuse panel in the front electrical bay. The switch is located in the rear curbside bay. Turn the house battery disconnect switch off when the motorhome is going to be stored for more than 48 hours or before performing electrical maintenance. If possible, leave the motorhome plugged into outside electrical service with the battery disconnect switch on to help prevent the possibility of dead batteries. This switch does not turn off all DC electrical items or other parasitic loads present on the house battery.

**NOTE:**

The optional solar panel will charge the house batteries with the disconnect switch off.



Located in the rear curbside compartment.

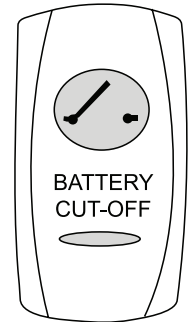
**BATTERY CUT-OFF**

The battery cut-off switch is located inside the motorhome next to the entry door. This switch controls the 12 Volt DC power to the domestic fuse panel. Power is supplied to all interior DC lighting and DC operated appliances when the switch is activated. Some appliances will require both DC and AC power to operate, such as the roof air conditioner. This switch is helpful when dry camping to conserve house battery power.

Refrigerator and inverter operation are unaffected by the use of this switch. When the interior house power is off there are still parasitic loads on the house batteries; therefore, it is not a substitute for the main battery disconnect switch.

**CAUTION:**

Avoid flash damage to electrical contacts. Turn off the interior lighting before operating the battery cut-off switch.



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## SHORE POWER HOOK-UP

The power requirement for the motorhome is 50 Amp 240 Volt AC single phase. The motorhome can operate from 30 Amp 120 Volt AC with limited capacity. If 50 Amp shore power service is available, connect the supplied shore power cord. If less than 50 Amp service is available, electrical adapters will be required and power consumption must be reduced to avoid tripping the shore power breaker.

### **CAUTION:**

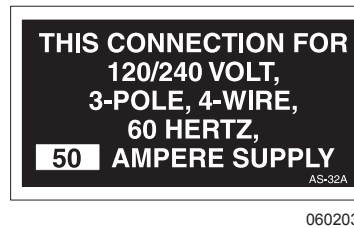
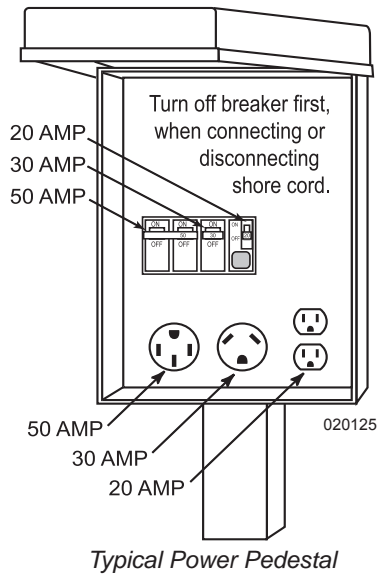
**Avoid flash damage to the electrical system contacts. Before plugging the motorhome into shore power, starting the generator or using the inverter, turn all the appliances off.**

### **WARNING:**

**Keep fingers away from metal contacts of the shore plug end. DO NOT stand in water when making electrical connections. Serious electrical shock and personal injury can occur. To avoid the risk of electrical shock, turn the circuit breaker off at the power supply outlet before making the shore power connection.**

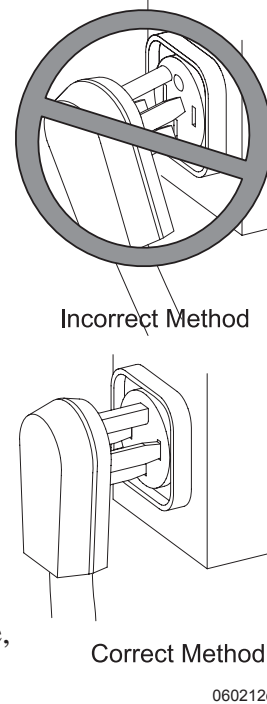
### **CAUTION:**

**DO NOT remove cover from shore power supply to troubleshoot electricity to the motorhome. Serious personal injury or death may occur. If there is no power to the motorhome inform the park manager. It is the park manager's responsibility to fix problems with the shore power pedestal.**



### **Plugging in Shore Cord:**

- ◆ The shore power cord is located in the rear roadside bay.
- ◆ Extend a sufficient amount of cord to reach the power supply. If 50 Amp service is not available, install the proper electrical adapter(s) to the cord.
- ◆ Always turn **OFF** the shore power breaker at the power supply before connecting or disconnecting the shore cord to avoid an accidental shock or flashing of electrical contacts.
- ◆ Plug shore cord straight into the receptacle (see illustration).
- ◆ After the connection is made, turn the shore power breaker on.



### **When Hooked to 50 Amps:**

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

### **When Hooked to 30 Amps:**

If 50 Amp service is not available, wait approximately one hour before operating electric appliances. Use caution when operating appliances to avoid overloading the supplied shore service breaker. Operate appliances and outlets in sequence rather than all at the same time.

### **CAUTION:**

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

### **Disconnecting Shore Cord:**

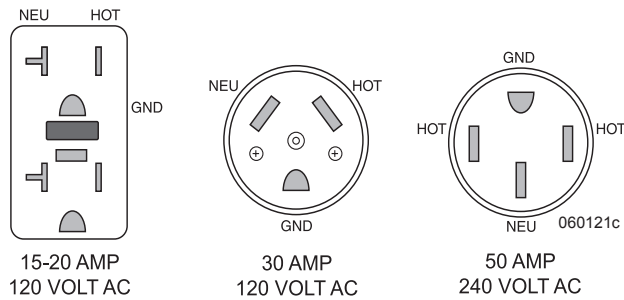
- ◆ Turn off all AC appliances.
- ◆ Turn off the shore power breaker to prevent accidental shock and flashing of electrical contacts when disconnecting.
- ◆ Grasp housing of electrical plug. Without touching electrical contacts, work plug out and away from socket.
- ◆ Straighten and clean the cord.
- ◆ Press the power cord switch to retract the cord or stow the cord in storage bay.

**WARNING:**

Avoid the risk of electrical shock or component damage by disconnecting from shore power during electrical storm activity. Use the Inverter/Charger or start the generator if AC power is needed.

**NOTE:**

Three types of shore power outlets most commonly used are shown in the illustration.

**Power Supply:**

Amperage supplies vary greatly depending on the amount of available current.

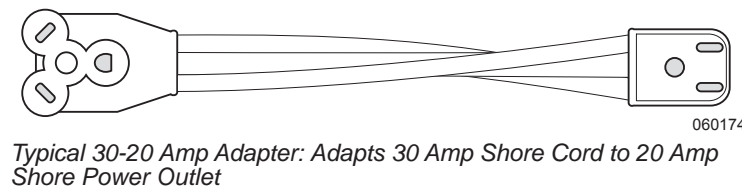
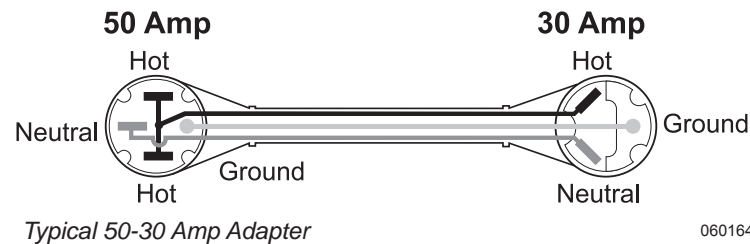
- ◆ Continuous amount of current through a breaker or fuse is only 80% of its rated capacity.
- ◆ 50 Amp 240 Volt AC shore power service consists of two power supply conductors, a neutral and a safety ground. The 50 Amp breaker simultaneously limits each power supply conductor to no more than a short-term maximum of 50 Amps for each conductor. The 50 Amp 240 Volt AC 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:**

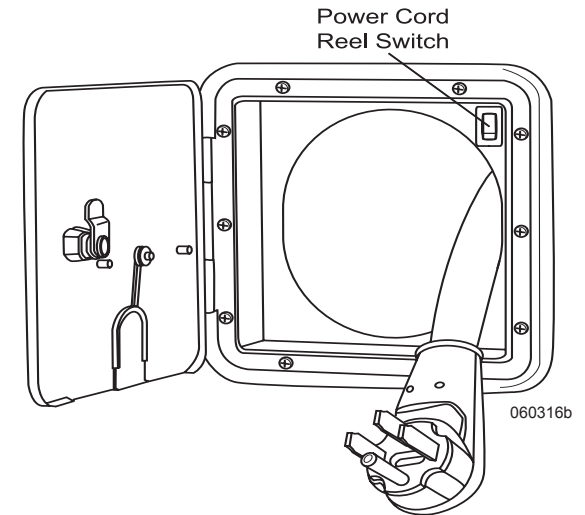
There are different electrical adapters to suit a variety of needs. Only UL approved adapters should be used. The most common adapter is a 50-30 Amp adapter. This type of connector adapts the 50 Amp shore cord to a 30 Amp power outlet.

Another common adapter is the 30-20 Amp adapter. Always install the adapter to the cord prior to making the connection to the outlet.

**Power Cord Reel**

The Power Cord reel is a 12 Volt DC powered assembly that mechanically coils and stows the shore cord. The power cord reel is located in a rear roadside hatch. The power cord switch operates a 12 Volt DC motor that retracts the cable.

Assist the cord when retracting. Stop retracting the cord when it is 6" from the opening. Retracting the cord too far will make it difficult to retrieve the cord. When connected to shore power, the cord should be slightly slack.

**Maintenance:**

Kinks may form in the shore power cable when only a short section is frequently used. Routinely extend the cable full distance and straighten the power cable on the ground to relieve kinking.

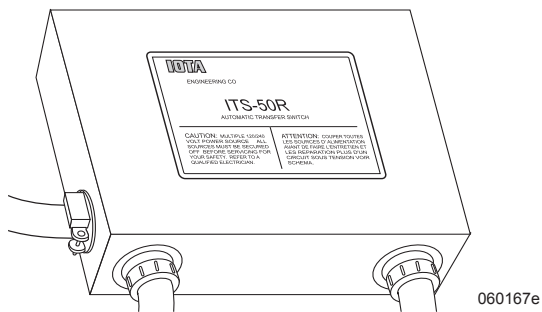
It is important the cable remains clean. Accumulated dust and dirt on the cable may cause difficulty in retracting the cord. Clean and straighten the cord before retracting.

**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 batteries. Remove rings, metal watchbands and other metal jewelry before working around batteries and connectors. Use caution when working with metal tools. If the tool contacts a battery terminal or metal connected to it, a short circuit could occur causing personal injury, explosion or fire.**

**TRANSFER SWITCH**

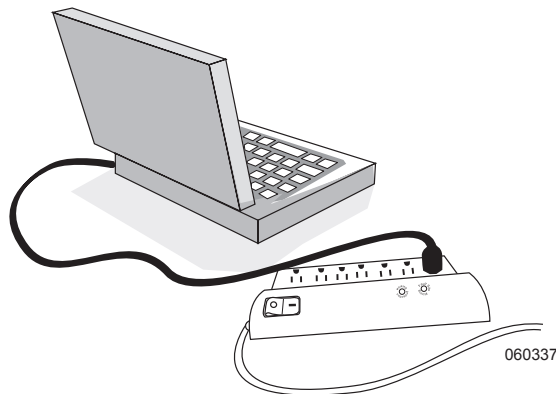
The transfer switch automatically transfers AC power from the shore power cord or generator through the transfer switch to the 120/240 Volt AC breaker panel. When using the generator as a power source, the transfer switch engages a time delay before transferring power to the AC breaker panel.



Transfer Switch: Located in pass-through storage bay.

This allows the generator time to stabilize output voltage before applying an AC load. When operating the generator while hooked to shore power, the transfer switch automatically selects generator power as priority over shore power.

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



Use of a dedicated surge protector is recommended.

**CAUTION:**

**The transfer switch does not have surge protection or high/low voltage cutout.**

**WARNING:**

**DO NOT have appliances on or AC loads plugged into outlets when hooking to shore power or starting the generator. Damage to the transfer switch contacts may result. Low voltage operation 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.**

**NOTE:**

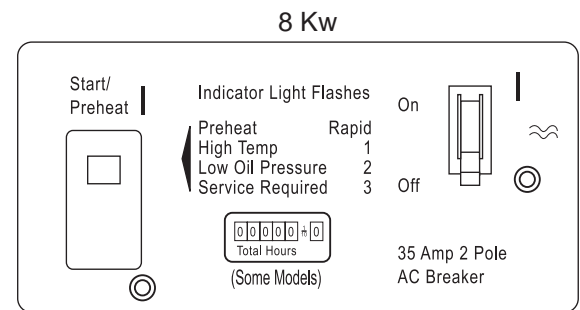
**The shore cord is NOT electrically connected to the generator. When the generator is operating, the electrical contacts of the unplugged shore cord are not electrically energized.**

**GENERATOR - 120/240 VOLT AC**

The generator is located in the front compartment of the motorhome.

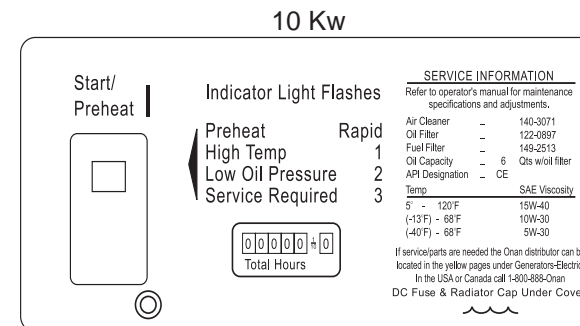
**The generator can be started from the following locations:**

- ◆ Generator remote switch on the dash
- ◆ Generator control panel located on the generator
- ◆ Hallway monitor panel



120 Volt AC. 38' & 40' models.

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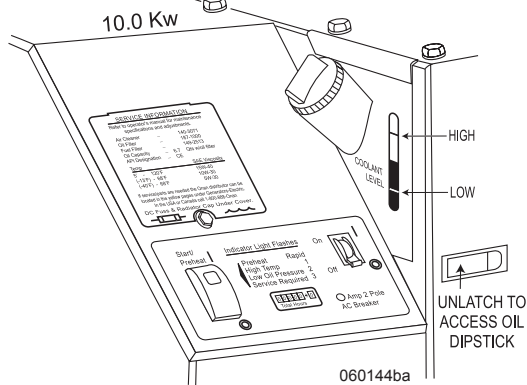
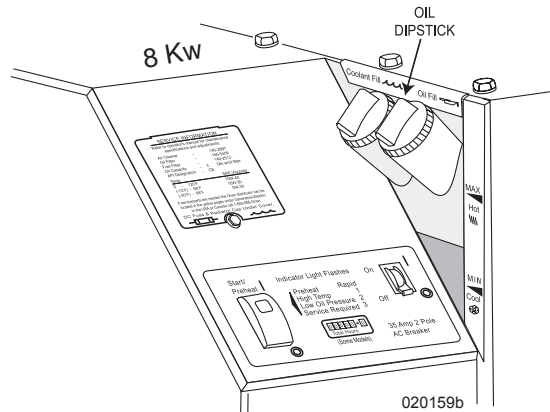


240 Volt AC. 42' models.

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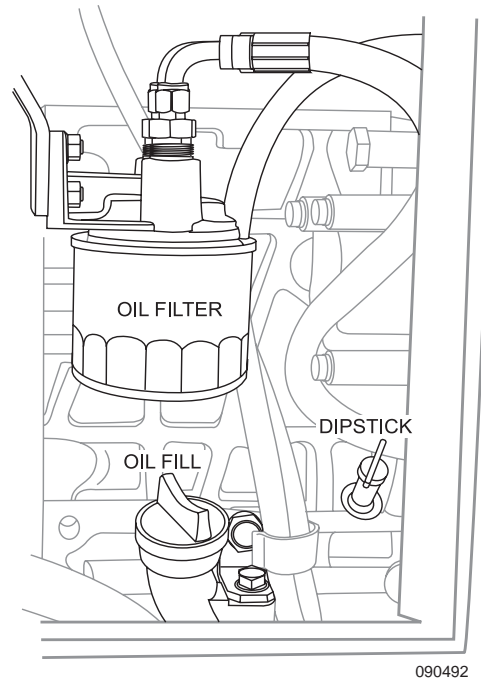
## Pre-Start Checks

Prior to the first start of the day perform a general inspection including oil and coolant levels. Keep a maintenance log on number of hours in operation since the last service. Perform any service or maintenance that may be due.



### Before Starting the Generator:

- ◆ Clear people and animals from hazards of electrical shock and moving parts.
- ◆ All appliances and other large AC electrical loads must be off.



Located behind the access door on the 10Kw generator.

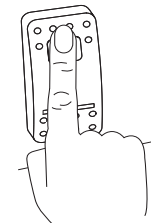
### NOTE:

The generator may require priming. To prime hold control switch in the OFF position. Repeat if necessary. The diesel generator fuel pick-up tube is cut to approximately  $\frac{1}{4}$  tank so as not to run the main engine out of fuel.

### Starting the Generator

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

Press Top to  
START



### 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 2 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:

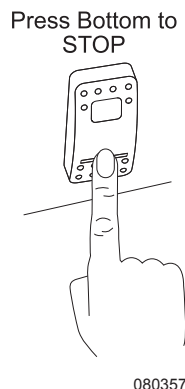
When parking near high grass, hot exhaust pipe or hot exhaust gases can ignite the grass.

### CAUTION:

An exhaust extension adds weight and stresses the generator exhaust system. Damage to the exhaust piping or exhaust manifold can result allowing Carbon Monoxide gases to accumulate under or leak into the motorhome.

## Stopping the Generator

Turn off the appliances and disconnect other AC loads being used. Allow the generator to run unloaded for at least one minute before shutdown to allow the engine to cool. Momentarily push the control switch to the **STOP** position. Release the switch.



### **NOTE:**

**The generator requires only a momentary stop signal.**

## Powering the Equipment

The AC output of the generator powers the motorhome air conditioners, the AC Inverter/Charger and all appliances and items plugged into the electrical outlets of the motorhome. The number of electrical appliances operated at any given time depends upon how much power is available from the generator.

If the generator is overloaded or a short circuit causes over-current, either the generator will shut down or the circuit breaker will trip. If power consumption, in total, exceeds the generator power output, compensation for temperature and elevation may be necessary. Operate appliances in sequence, rather than all at the same time.

### **NOTE:**

**The generator may shut down when loaded nearly to full power and an air conditioner (or other large motor load) cycles on. For a brief moment during start up an electric motor can draw up to three times the rated power. For this reason it may be necessary to operate some appliances in sequence when air conditioners or other large motor loads are on.**

Compensation for temperature and elevation may also be necessary. Maximum output for the generator is rated at 500 ft. above sea level. Beyond that elevation, the generator will lose approximately 3.5% of its rated power for every 1000 ft. gained in elevation. High temperatures can also affect generator output. Power decreases 1% for every 10° F above 85° F. Counteract these effects by operating appliances in sequence rather than at the same time.

### **INFORMATION:**

**The generator may shut down for reasons other than an overload. If a blink code appears on the control switch, refer to the manufacturer's manual to obtain an explanation for the code.**

## Generator Fuel

Fuel can become contaminated. Diesel fuel may contain water or a microbe growth (black slime). Any contamination of fuel will greatly reduce the total output of the generator and may cause erratic AC output.

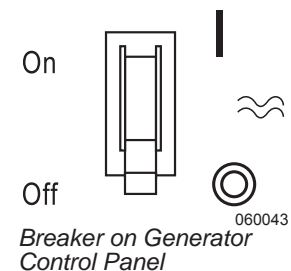
### **NOTE:**

**The motorhome manufacturer does not cover damage to the generator caused by fuel contamination, or to appliances due to erratic AC voltage.**

Average Fuel Consumption	Diesel 8,000 Watts (gal./hrs.)	Diesel 10,000 Watts (gal./hrs.)
No Load	.13	.1
Half Load	.49	.6
Full Load	1.02	1.1

## 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 will help promote better starting, more reliable operation and longer engine life. This procedure drives off moisture, lubricates the internal engine parts, replaces the old stale fuel with a fresh supply, and also promotes removing oxides from the electrical switches and contacts.

**NOTE:**

**Avoid short run periods of the generator. Run the generator set under a load for a minimum of one-half hour.**

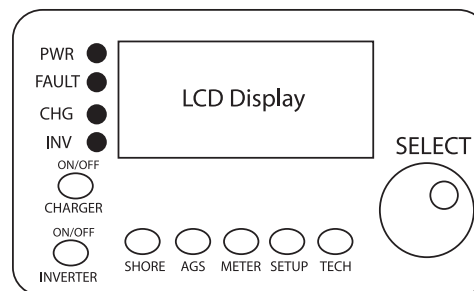
## INVERTER

The inverter changes DC battery power to AC electrical power, and it also charges the batteries when hooked to shore power or operating from the generator. Use the inverter to supply AC power when shore power is not available and the generator is not used as a secondary AC power source. The inverter supplies AC power to most outlets and appliances. Remember that using the inverter quickly consumes house battery power. Turn off the inverter when not in use to conserve house battery power. The remote panel is used to change the variable settings.

### Providing AC Power with Inverter

**To turn the inverter on:**

Press the **INVERTER ON/OFF** switch at the remote panel. If the inverter does not sense AC power from the generator or shore power, it will provide AC power from the motorhome batteries to most outlets and appliances. If the generator is started or the motorhome is connected to shore power, the inverter will automatically begin charging.



060254  
Remote Panel: Located on hallway monitor.

### Battery Charging with Inverter

The inverter will automatically charge when AC power is supplied from shore service or the generator. The inverter uses a three-stage charge cycle to charge the batteries. The charger may be turned off if desired.

**To turn the charger on and off:**

- ◆ Press the switch marked **CHARGER ON/OFF** on the remote panel.

**Shore Setting:**

The Shore setting in the remote panel adjusts the amount of AC current the battery charger can use. If hooked to less than 50 Amp service, select the proper Shore setting to help prevent combined AC loads such as the roof air conditioner and the charger from overloading limited shore power service.

**To Adjust Shore Power Setting:**

- ◆ Press the Shore button on the inverter remote.
- ◆ Turn the knob on the inverter remote left or right to scroll through shore setting options.
- ◆ Press the knob to select. An arrow will appear next to the selected setting.

**NOTE:**

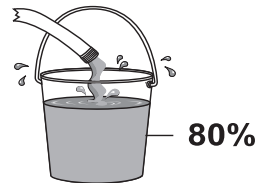
**Settings 20 Amp and below will limit battery charge capacity and may hamper ability to efficiently operate DC electrical loads. Remember to reset to higher amperage when available.**

## Set To:

Shore Setting	AC Power
50 Amp	When hooked to 50 Amp Shore Service.
30 Amp	When hooked to 30 Amp shore service.
20 Amp	When hooked to 20 Amp shore service.
10 Amp	Used when shore service is severely limited or experiencing shore power overload.
5 Amp	Minimum charge capacity setting. Used when shore service is severely limited or experiencing shore power overload.

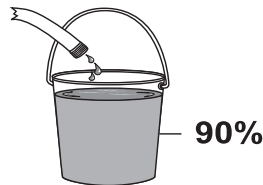
**Inverter three-stage charging cycle:**

◆ **Bulk Charge Cycle:** Brings the DC voltage up high, initially between 14.2 - 14.6 Volts DC. The length of time the inverter is in Bulk Charge depends on the state of charge of the batteries.



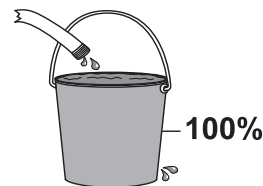
80%

◆ **Absorb Cycle:** Absorb Cycle battery voltage is the same as the Bulk Charge Cycle, between 14.2 - 14.6 Volts DC. Length of the Absorb Cycle is a timed event determined by the inverter.



90%

◆ **Float Charge Cycle:** Charge voltage is generally around 13.3 - 13.7 Volts DC. Approximately 80% of the charging cycle has been completed by this time.



100%

060236c

*Hose = Inverter in Charge Mode  
Bucket = Battery*

**Bulk Charge**

Water (charger) on full until bucket (battery) is 80% full.

**Absorb Charge**

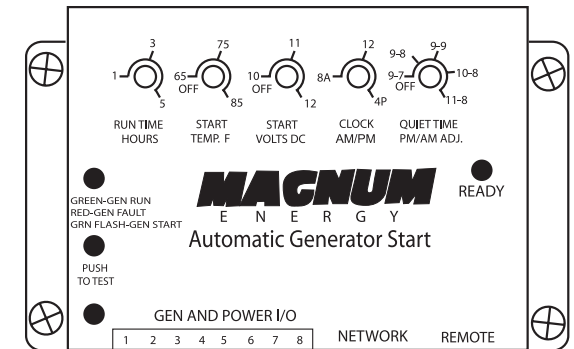
Water (charger) slows until bucket (battery) is 90% full.

**Float Charge**

Water (charger) slowly trickles into bucket (battery) until 100% full. Water (charger) will adjust flow to maintain level.

**Auto Generator Start Menu (Optional)**

The **Auto Gen Start (AGS)** feature allows the user to program the inverter remote control to start the generator when battery voltage or interior motorhome temperature reaches a preset point. The AGS parameters are set at the inverter remote control (located in the front passenger overhead cabinet). The AGS controller, located in the front electrical bay, executes the AGS functions.



060299

AGS Controller

**NOTE:**

The setting knobs on the AGS controller (located in the front electrical bay) are not functional. AGS settings must be set at the inverter remote located in the front electrical bay.

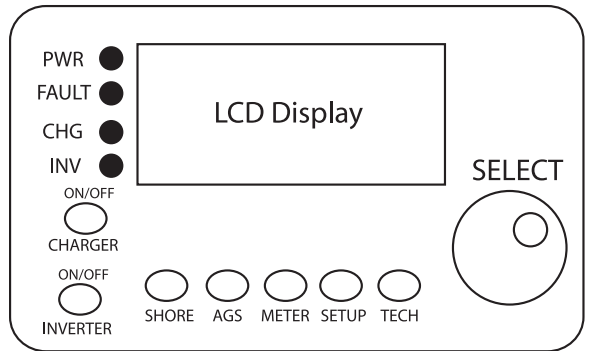
**NOTE:**

Refer to the OEM manual located in the Owner's Information File Box for detailed instructions.



**Operation:**

Press the AGS button on the remote to access the AGS menu. Rotate the knob to scroll through menu options; press the knob to make selections. Press the AGS button at any time to return to the main AGS menu. Menu options are labeled 1 through 8.



Inverter Remote

060254

1. **AGS Control:** Rotate the knob to scroll through Off, Enable, Test, or Enable w/Quiet Time.
2. **AGS Status:** View current AGS status.
3. **Run Time Hours:** Choose run time duration after the AGS system starts the generator (from .5 to 6 hours).
4. **Start Temp F:** Select the interior coach temperature set point for AGS. Be sure to set the Comfort Control Thermostat at the same temperature.
5. **Start Volts:** Select the battery voltage set point for AGS.
6. **Set Time:** Set the 24 hour clock on the remote. Time will have to be set if power to the remote is lost.

7. **Quiet Time:** Choose from a preset list of quiet time hours during which the AGS will not start the generator. This function is only active when the AGS Control (menu option 1) is set to Enable w/Quiet Time.
8. **AGS Tech:** Used by service personnel for troubleshooting.

**Factory Default Settings**

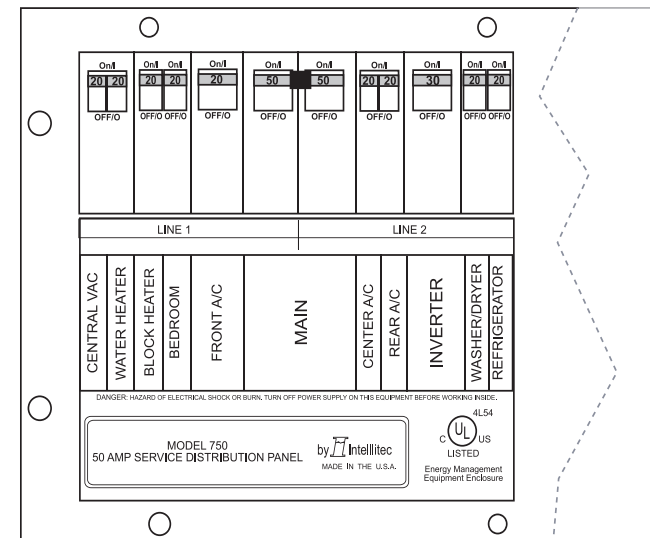
Function	Default
Search	5 Watts
Low Battery Cut-off	11 Volts DC
Battery Bank	400 AH
Battery Type	Liquid Lead Acid
Charge Rate	80 %
Contrast	75 %

**Battery Temperature Sensor**

A Battery Temperature Sensor (**BTS**) is affixed to one of the house battery terminals to measure battery temperature and send that information to the inverter. When battery temperature rises, the inverter will decrease charge voltage to prevent boiling the batteries. When battery temperature cools, the inverter will raise charge voltage. Voltage compensation with temperature variation is necessary to keep charge voltage at optimum values. If the BTS cord is unplugged from the inverter, the inverter will use a temperature default setting of 77° F./25° C. as a reference point.

**DISTRIBUTION PANEL - HOUSE 120/240 VOLT AC**

The AC distribution panel is located in the bathroom or the cabinet above the dining room TV. The main 120/240 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.



060101J

The panel label describes the breaker layout and the item, outlet or appliance to which they pertain.

**WARNING**

**The 120/240 Volt AC panel contains high voltage which can cause serious injury or death. Before beginning any work or testing procedures involving the distribution 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.**

***Circuit Breaker***

The internal configuration of the circuit breaker is designed to trip when excess current causes the breaker to heat up. The trip action of the circuit breaker can occur within milliseconds. 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:**

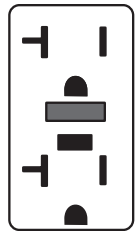
**To calculate watts to amps divide the watt figure by the voltage of which the item operates from. For example: The electrical item is rated at 1370 watts. Divide that by the operating voltage of 115 Volts AC which equals 11.913 Amps. Use this formula to calculate the amount of load and compare to the available power supply.**

***GFCI Breakers & Outlets***

A **Ground Fault Circuit Interrupter (GFCI)** can be found in two different types of applications. One type is incorporated in a breaker used in 120 Volt AC breaker panels; the other is incorporated in an outlet.

The GFCI, whether it is a breaker or an outlet, offers two types of protection. One type of protection is from over-current or shorts to guard against hazardous ground fault currents that can result in injury or death. Ground fault currents are currents that flow from the "hot" or power terminal through a person to the ground. *For example:* touching a faulty appliance while making contact with an electrical ground such as a water fixture or the earth.

The GFCI offers 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 (black) wire through the load (eg. a light bulb or appliance) and coming back on the neutral (white) wire. If a small amount of current comes back on the safety ground wire, the electronics will trip the breaker or outlet, stopping the flow of electricity.



060072



RM03A0003

**GFCI Breaker**

The amount of current it takes to trip the device from a ground fault varies slightly from the different outlet or breaker manufacturers (approximately 4 to 6 milliamps or less).

Electrical shocks resulting from ground faults can be felt, but such a shock is considerably less than one without ground fault protection. People with medical conditions that make them susceptible to shock, can still be seriously injured. A GFCI outlet or breaker will not protect against shock from a normal current flow. **For example:** a shock from touching both metal prongs of an electrical cord or appliance while plugging it in.

**WARNING:**

**If a breaker or outlet continually trips, DO NOT continue to reset breaker or outlet until the problem is identified and corrected.**

**NOTE:**

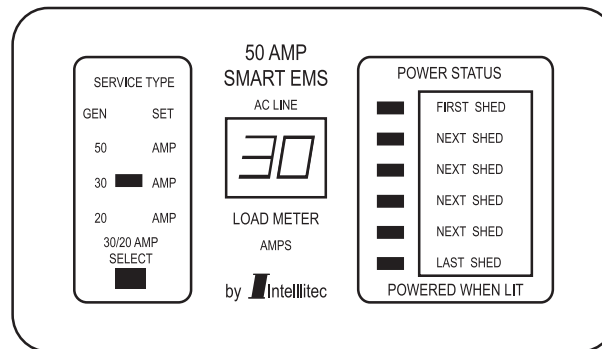
**The ground fault outlet or breaker should be tested once a month to ensure it is operating. Use the TEST button on the outlet or breaker. It should trip with an audible “click.” The breaker or outlet will not trip if AC power is not present at the device. If power is present and the device will not trip, replace it before using that circuit.**

**NOTE:**

**One milliamp is 1/1000 of one Amp.**

### Energy Management System

The Energy Management System remote display panel is located on the hallway monitor panel. The 50 Amp Smart EMS consists of two elements: the display panel and the bedroom distribution panel. The distribution panel is a self-contained 120/240 Volt AC power distribution and energy management system intended to be used in recreational vehicles. Housed in a sheet metal enclosure with removable front panel, the EMS provides circuit protection for all the 120 Volt AC loads in the motorhome and a system of energy management to minimize the over-loading and tripping of circuit breakers.



Display shown when connected to 30 Amp shore power.

### Circuit Breakers:

The distribution panel offers slots for eight single or dual, standard 120 Volt circuit breakers. Two of these breakers, located in the two center positions, are 50 Amp and act as input protection for each of the lines supplying the remainder of the branch breakers.

### Energy Management:

The 50 Amp Smart EMS automatically senses the available power to the motorhome, determining whether it is connected to 30 Amp 120 Volt AC shore power source, 50 Amp 240 Volt AC shore power or the generator. Depending upon available power, the EMS controls operation of six possible loads as indicated on the display panel. These are typically heavier loads that can be postponed until enough current is available. If the available power source is 30 Amp 120 Volt AC shore power, the EMS attempts to keep the total 120 Volt current draw to less than 30 Amps.

### Operation:

If 120 Volt AC is not available at the distribution panel, L1 or L2 outputs, the system shuts itself off. This feature is intended to prevent the system from drawing current from the 12 Volt DC battery supply when not in operation.

When 120 Volt AC power is applied, the system automatically powers up and determines the nature of the power source. On 50 Amp shore power, the load meter will not indicate Amp load.

If the generator is running, 120 Volt AC will be present at the distribution panel L1 (Line 1) and L2 (Line 2) inputs. In this mode the energy management feature is disabled and all control relay contacts are closed, energizing all of the controlled loads. The control module sends a signal to the display panel causing the load meter to display actual load current, the **GEN SET** service indicator to light and all power status indicators to light.

If 120 Volt AC is present at the distribution panel L1 and L2 inputs, the system will assume that 120 Volt AC, 30 Amp shore power is available and the energy management feature will enable. The load meter will indicate the total load in Amps in real time. If only 20 Amp service is available the user must select the 20 AMP service mode by momentarily pressing the 20/30 Amp select switch on the Control Panel.

Initially, all relay contacts are closed and the total current is monitored. If the total current should exceed the service limit, the system will turn off the first load in the shedding table and calculate the amount of current that was removed. This value is placed in memory. If the current remains above the service limit, the system will turn off the next load in the shedding table, again calculating the amount of current removed and placing this value in memory. The system continues to turn off loads until the total current falls below shore power amperage or all of the six controlled loads are shed. Through this process the system has “learned” the amount of current that each particular load draws. This feature compensates for the differences in current draw over a range of line voltage and ambient temperature, by re-learning the load each time it is turned off or “shed.”

The 50 Amp Smart EMS now waits until the total current is lower than the service limit and enough current is available (as compared with the amount in memory for the last load shed) before turning that load back on. This assures a sufficient current is available to operate the load.

**NOTE:**

**There is a two minute minimum delay period after a load is shed before the load will be turned on.**

**Three Hour Averaging:**

The RVIA (Recreational Vehicle Industry Association) in conjunction with the NEC (National Electrical Council) have established rules regarding the rating of electrical systems and the use of energy management systems. One of these rules requires that, if any energy management system is used, the average total load current for the system over a three hour period be limited to 80% of the service rating. For that reason the 50 Amp EMS calculates the average running current for the system and, if it exceeds 80% of the service rating, the EMS sheds loads to reduce the average current below that limit.

For example, if average current demand over a three hour period exceeds 24 Amps when hooked to a 30 Amp service, the system will automatically shed a load in order to keep average current demand below 80% (24 Amps) of the 30 Amp shore service to avoid the possibility of overloading the shore power breaker.

If the user selects the 20 Amp service mode this limit will translate to 16 Amps. Because the EMS calculates a running three hour average, if the average load current drops below the limit, the system will restore power to loads based on their impact on the limit. If the system is in Averaging Mode, a decimal point will illuminate at the lower right corner of the load meter.

**Display Panel:**

The display panel connects to the distribution panel located in the bedroom. Six power status LEDs indicate power is applied to those loads. These LEDs are on when the power is applied. The load meter has a two digit display to indicate the amount of current actually being drawn by all the appliances in the motorhome.

Four service type LEDs indicate the source for 120/240 Volt AC power. Three of these sources are automatically detected and indicated by the EMS, namely: Gen Set Service, 50 Amp Service and 30 Amp Service.

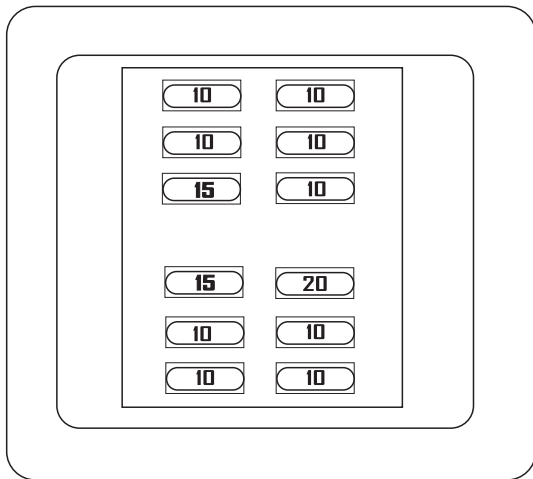
**NOTE:**

**The 20 Amp service mode is not automatically detected and the operator must manually select the 20 Amp mode when 20 Amp service is available.**

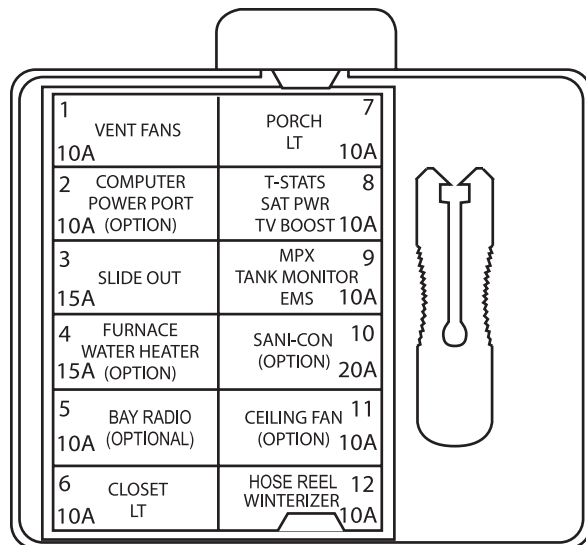
The 20/30 Amp select button sets amperage to 30 Amps or 20 Amps to match shore power amperage.

## DISTRIBUTION PANEL - HOUSE 12 VOLT DC

The 12 Volt DC house distribution panel (located with the AC circuit breaker panel) contains fuses that protect the electrical circuits. These fuses are a standard automotive type.



Distribution Panel: Located in the bathroom with AC breaker panel. 060308p



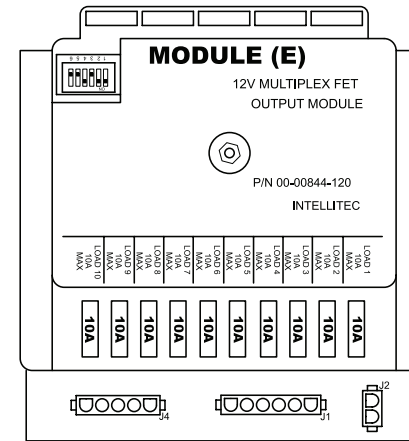
Distribution Fuse Label 060308m

## Multiplex

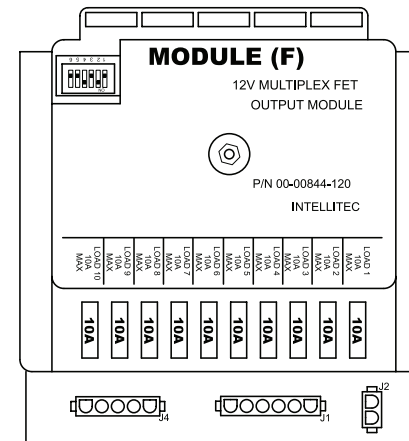
The Multiplex system consists of fuse modules and switches located throughout the motorhome. The fuse modules are located with the AC Breaker Panel, which is typically located in the bathroom. The Energy Management System (EMS) acts as the Central Processing Unit (CPU) for the Multiplex system. When a switch is pressed, the EMS processes the command and then activates or deactivates the corresponding circuit on a fuse module.

### Troubleshooting:

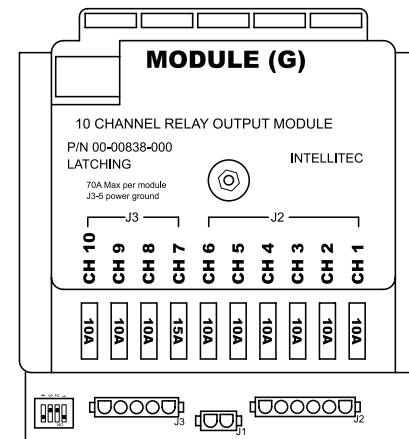
- ◆ The Battery Cut-off switch must be on.
- ◆ If a switch is pressed and the backlighting does not turn on, check the 10 Amp fuse in position 9 on the 12 Volt DC distribution panel (located in the same cabinet as the multiplex modules).
- ◆ If the backlighting turns on and the yellow communication LED illuminates but the item does not turn on, check the fuse for that circuit.



1. 14 YEL - T-RM VANITY LT
2. 14 YEL - BATH VANITY LTS
3. 14 YEL - T-RM CAB LT
4. 14 YEL - BATH CAB LT
5. 14 YEL - PS SLIDE CAB LTS
6. 14 YEL - PS READING LTS
7. 14 YEL - DS READING LTS
8. N/C
9. N/C
10. 14 YEL - EDGE CEILING LTS



1. 14 YEL - GALLEY CAB LTS
2. 14 YEL - PS SOFA CAB LTS
3. 14 YEL - DS SOFA CAB LTS
4. 14 YEL - DINETTE LT
5. 14 YEL - SCONCE LT
6. 14 YEL - GALLEY CEILING LTS
7. 14 YEL - DINETTE CEIL LTS
8. 14 YEL - HUTCH LTS
9. N/C
10. N/C



1. 14 YEL - T-RM CEILING LTS
2. 14 YEL - BATH CEIL LTS
3. 14 YEL - BDRM CEIL LTS
4. 14 YEL - LVRM CEILING LTS
5. N/C
6. N/C
7. 12 RED - WATER PUMP
8. 14 YEL - GALLEY FAN
9. 14 YEL - BATH FAN
10. 14 YEL - TOILET FAN

## FUSES & CIRCUIT BREAKERS – 12 VOLT DC

Circuit protection devices are installed to protect circuit wiring in case an over-current condition occurs. An over-current condition usually falls into one of two categories, a short circuit or overload. A short circuit is when a break or fault in the circuit allows electricity to flow directly to ground. Circuit overload is when circuit amperage or the electrical load exceeds designed operating parameters.

Several factors are considered when designing a circuit to operate an electrical load. The amperage required to operate the electrical load will determine wire size and wire insulation type. The application of the electrical load can be a factor whether a fuse or circuit breaker is selected.

Circuit protection devices come in a variety of shapes and ratings. Most common are the blade style plug in fuse and auto reset circuit breakers. These types of circuit protection devices are readily available from auto supply stores. Circuit protection devices in a 12 Volt DC system are actually rated at 32 Volts DC due to voltage variances in a 12 Volt DC system. Replacement devices must use the same amperage rating and be of the same type as the original for proper circuit protection and electrical safety.

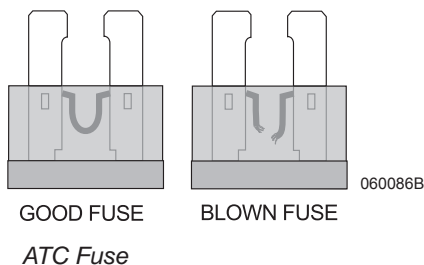
Generally a fault exists in the circuit when an over-current condition has caused a fuse to blow or circuit breaker to trip. Until the condition that caused the fault is corrected replacing the fuse may be a temporary fix. Continually replacing the fuse or circumventing the protection device can jeopardize safety and circuit integrity.

### **WARNING:**

**Replacement fuses or circuit breakers must be of the same type and rating as the original equipment. Installing protection devices other than the original type and rating creates a safety hazard potentially resulting in circuit and/or component damage and fire.**

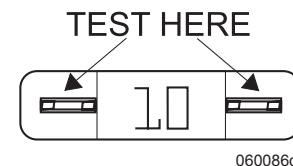
### **Fuses:**

The blade fuse comes in three sizes: Mini, Standard and Maxi. Fuse color determines amperage ratings. A blown fuse indicates an over-current condition has occurred.



Typically the conductor strip in the center of the fuse is broken, but not always, and is best verified by use of a 12 Volt DC test light.

Located atop the blade style fuse housing are two exposed terminals. The fuse is good if the test light illuminates at both terminals. This may require the circuit be activated for power to be present at the fuse. The fuse is bad if the test light illuminates at only one terminal.

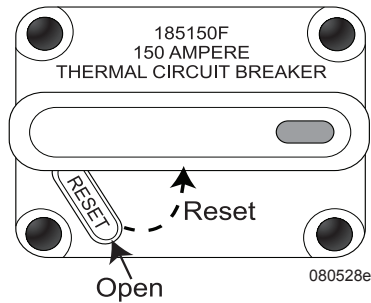


BLADE FUSE GUIDE			
	Mini	Standard	Maxi
Black	1		
Gray	2	2	25
Violet	3	3	
Pink	4	4	
Tan	5	5	70
Brown	7 1/4	7 1/4	35
Red	10	10	50
Blue	15	15	60
Yellow	20	20	20
Clear	25	25	80
Green	30	30	30
Blue-Green	35		
Orange	40		40

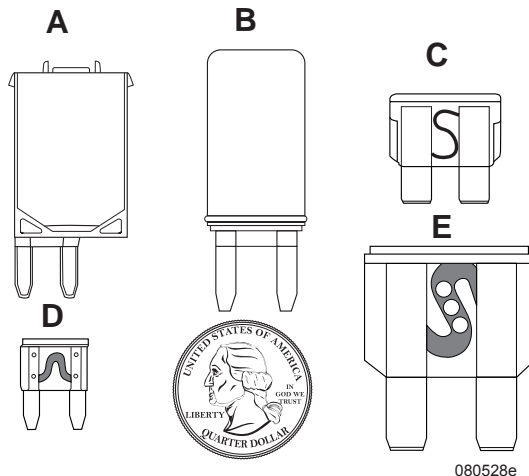
*Mini, Standard and Maxi fuse colors and amperage ratings*

### The three types of Circuit Breakers:

**Type 1** is an automatic reset type circuit breaker. Under a short circuit condition this type of breaker may cause component damage, but no damage to the circuit, installation or present a safety risk



Large Amperage Circuit Breaker



Quarter is used for size comparison of fuses. Not to actual scale.

- A. Manual Reset Circuit Breaker
- B. Auto Reset Circuit Breaker
- C. Standard Fuse
- D. Mini Fuse
- E. Maxi Fuse

**Type 2** is an automatic reset type circuit breaker. Under a short circuit condition this type of breaker will not cause component damage or damage to the circuit, installation or present a safety risk.

**Type 3** is a manual reset circuit breaker. This type of breaker will open under a short circuit condition and requires manual reset.

### BATTERIES - HOUSE

House batteries are designed for use with 12 Volt DC operated lights, appliances and inverter.

#### **NOTE:**

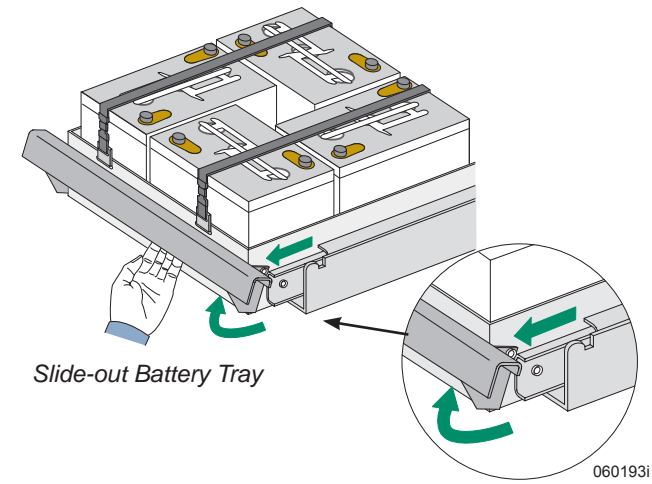
Tap water contains minerals which can alter battery chemistry and ruin the battery. Use only distilled water when refilling the LLA battery.

#### **Slide Tray Operation:**

The slide-out battery tray is secured in place by a locking mechanism at the front of the tray. To slide the tray out, lift up on the handle and pull until the tray stops. To secure the battery tray, push back in until the tray latches.

#### **Slide Tray Maintenance:**

The battery tray slide will occasionally require lubrication. When performing maintenance to the batteries, remove old lubricant and dirt from the battery tray slide with solvent, brake cleaner or equivalent. **DO NOT** allow any cleaning solution or battery acid by-products to splatter onto and damage the painted surfaces. Lubricate all moving parts of the battery tray slide with white lithium grease or Kwikie brand spray lubricant.



Slide-out Battery Tray

#### **NOTE:**

Driving without the tray secured can result in damage.

#### **CAUTION:**

Many types of petroleum based products or battery by-products can damage the paint finish. **DO NOT** allow these types of chemicals to get on the paint finish. If the chemicals splatter onto the painted surfaces, immediately rinse the surface using plenty of water and a mild automotive detergent.

### Battery Maintenance

**Check Liquid Lead Acid (LLA)** battery cells at least once a month. The level should be above the top of the plates, but not overfull. The electrolyte level should be approximately 3/8" below the well to allow room for expansion while the battery is being charged. Over-filling the battery will allow the electrolyte solution to boil or gas out of the battery cap.

Remember to use only distilled water to refill the battery. A battery with a low electrolyte level will rapidly boil out the water once the plates have been exposed to air.



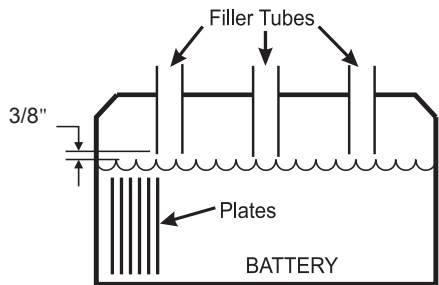
## IMPORTANT!

**IMPORTANT!**  
This motorhome is equipped with Non-sealed Liquid Lead Acid (LLA) house batteries which require regular maintenance. Lack of maintenance will result in a shortened battery life.

**NOTE:**  
Read your owners manual for storage, dry camping and battery maintenance.

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060331



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

NOTE: The distilled water level in battery should be 3/8" below the filler tube. 020034c

Periodically check the batteries for corrosion and cracks. Replace vent plugs that are cracked or missing. Keep the top of the batteries clean. The accumulation of electrolyte and dirt may permit small amounts of current to flow between the terminals, which can drain the battery.

Check the battery connections for tightness and corrosion. If corrosion is found, disconnect the cables (mark cable locations) and carefully clean them with a mild solution of baking soda and water, or an aerosol product specifically designed for battery maintenance. **DO NOT** allow cleaning solution to seep into the battery and damage the electrolyte balance. Use water to rinse the top of the battery and surrounding area when done. Carefully hook the cables back to the battery. The battery cable to battery terminal connections should be metal to metal. Coat the terminals with petroleum jelly or an anti-corrosion grease.

**WARNING:**

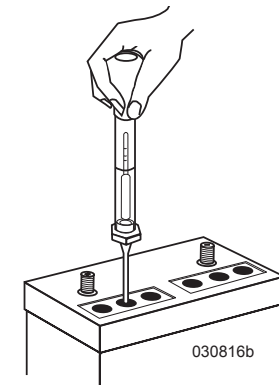
**Liquid lead acid batteries produce hydrogen gas while being charged. This is highly explosive. DO NOT smoke around batteries and keep all sources of ignition or flames away from batteries. The hydrogen gas may explode resulting in fire, personal injury, property damage or death.**

***Testing the Battery***

A battery can be tested and/or monitored several ways. The inverter remote will show house battery voltage.

**Checking the Electrolyte Solution (LLA Only)**

The most efficient way of testing the batteries is to check the electrolyte solution. The only way to test electrolyte solution is with a hydrometer. Many styles are available, from types with cylinder graduation (shown here) to types with floating balls.

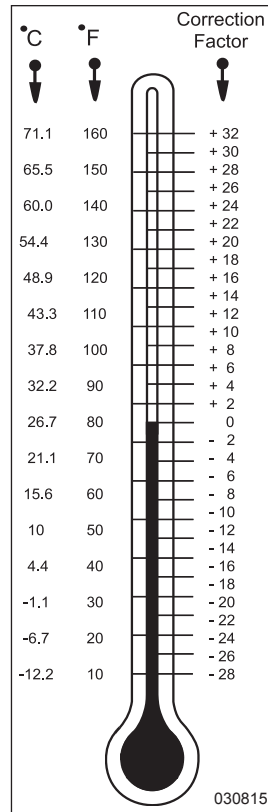


*Hydrometer (cylinder type) shown testing LLA type battery.*

Hydrometers can be purchased from most auto parts stores. The hydrometer tests the battery 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.



Temperature Correction Chart

If one cell in a particular battery bank being tested is at a 50% state of charge while the others are indicating a full charge, charge only that battery to see if the low cell will come up. At the same time, do not overcharge the healthy cells. If the low cell does not come up after charging, this battery is damaged, will damage the rest of the battery bank and needs to be replaced. An accurate digital Volt meter  $\pm .5\%$  will also give an indicator of the battery's state of charge.

#### Placing a load on the Battery:

Another test that can be performed is to place a specific load on the battery for a predetermined length of time equal to that particular battery's rating. This machine is usually an adjustable carbon pile that can vary the load being applied to the batteries while monitoring voltage to see if they will perform to specific rated capacities.

#### NOTE:

**See the chart for temperature compensation. Liquid levels should be even between the cells of the battery being tested as it will affect the accuracy of the test.**

#### WARNING:

**Sulfuric acid in the batteries can cause severe injury or death. Sulfuric acid can cause permanent damage to eyes, burn skin and eat holes in clothing. Always wear splash-proof safety goggles when working around the battery. If the battery electrolyte is splashed in the eyes, or on skin, immediately flush the affected area for 15 minutes with large quantities of clean water. In case of eye contact, seek immediate medical aid. Never add acid to a battery once the battery has been placed in service. Doing so may result in hazardous splattering of electrolyte.**

#### Battery Charge Time & Consumption Rate

##### Calculating Run Times:

Calculating run time figures when operating 120 Volt AC electrical items with an inverter can be exponential due to battery characteristics. Flow characteristics of electrons vary with different battery types and chemical compositions. Deep cycle batteries are generally designed to slowly release a majority of their charge capacity. Deep cycle batteries are rated in Amp hours (Ahrs) with the discharge occurring over an extended period of time before the battery is charged. Engine starting batteries are designed to quickly release large amounts of current for short durations, without depleting battery reserves. Commercial type batteries bridge the gap of deep cycle and engine batteries. Commercial batteries release medium amounts of current over a longer period of time but they are not designed to cycle their charge capacity.

The working range of a deep cycle battery is between 50 and 100% state of charge (SOC). Deep cycle batteries should not be cycled below 50% state of charge. Discharging a deep cycle battery below 50% state of charge shortens the life of the battery. Deep cycle batteries use an amp hour rating which is usually calculated over a 20 hour discharge interval. **For example:** A deep cycle battery with a rated capacity of 100 Ahrs. is designed to release current at the rate of 5 Amps per hour. Multiply a 5 Amp load over a 20 hour discharge period equals the rated 100 Ahr. capacity.

These discharge figures are calculated with the battery starting at 100% state of charge with the battery at 80° F. when the discharge cycle begins. However, increasing the discharge load applied to the battery from 5 Amps to 10 Amps on a 100 Ahr battery does not yield ten hours of discharge time. This is due to the internal reactions which occur when a battery is discharging. Actual discharge time for a 10 Amp load may be closer to eight hours of discharge time. Increasing the load applied to the battery to 20 Amps will not yield five hours discharge time but may be less than three hours. It might be understood as a point of diminishing return.

Calculating applied loads to an inverter to approximate run time from the battery amp hours available is not an equal trade up when voltage is inverted and amperage is calculated. When the inverter is used to operate an AC load it uses approximately ten times the DC current needed from the battery when inverting 12 Volts DC to operate the 120 Volt AC item. There is also a small efficiency loss of about 10% when inverting. **For example:** When using the inverter to operate an AC electrical item, which has a current draw rating of 2 Amps, the inverter will use over 20 Amps DC power from the batteries.

#### **Determining Current Consumption:**

First determine the amount of current used by an AC item. **For example:** The television is rated at 200 watts at 120 Volts AC. Calculate watts to amps. Divide 200 watts by the operating voltage of 120, this equals 1.6 Amps. Multiply 1.6 Amps AC current by a factor of ten the inverter will use, this equals 16 Amps DC battery current. Add the revised 10% efficiency loss figure, this calculates to a total of 17.6 Amps DC. If the battery bank capacity is rated at 500 Ahrs., actual elapsed time to the suggested 50% state of charge would net viewing time for the television at approximately 13 hours in ideal conditions.

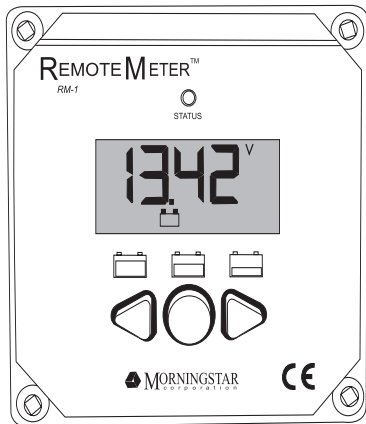
The run time figure will vary greatly with the actual state of charge of the battery bank when the discharge process begins. Ambient temperature combined with other working loads, such as lights and parasitic loads applied to batteries, affect run times. Calculating the exact run time is not precise due to all the variables and equations involved; however, an approximate time figure can be obtained. Proper battery maintenance and charge cycles affect battery performance. Observe the battery condition with hydrometer and voltage readings. Use only distilled water when filling batteries. To achieve the highest quality of battery performance and longevity maintain the batteries in their proper operating range.

#### **SOLAR PANEL (OPTIONAL)**

The solar power system consists of a solar panel, charge controller and a remote monitor panel located in the hallway. This system can deliver enough power to offset the normal day-to-day drain on house batteries caused by various parasitic electrical loads, such as radio memories, alarm systems and natural self-discharge of batteries.

## Monitor

The remote monitor is located in the hallway. The monitor features a display screen, three operation buttons and three battery state of charge LED's for a quick reference of battery charging levels. Press the center button to scroll through four main screens, and use the left or right arrow buttons to scroll through sub-screens.



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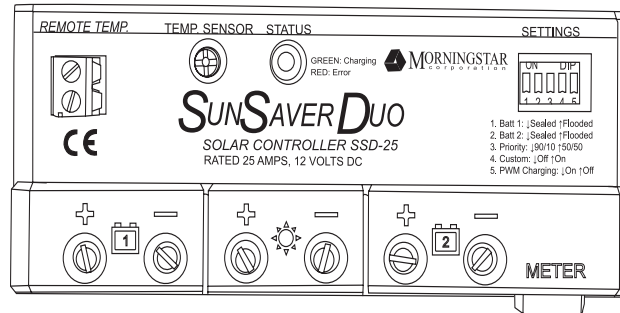
Located in the hallway

### Main Screens:

- ◆ **Solar Charge Current:** Press the left and right arrows to view solar amp hours and maximum charge current.
- ◆ **Battery 1 Voltage:** This is house battery voltage. Press the left or right arrows to view battery amp hours and minimum and maximum battery voltage.
- ◆ **Battery 2 Voltage:** This is chassis battery voltage. Press the left or right arrows to view battery amp hours and minimum and maximum battery voltage.
- ◆ **Temperature Screen:** This displays the ambient temperature at the remote monitor.

## Charge Controller

The charge controller automatically charges the house and chassis batteries whenever sunlight is available. Features include Pulse Width Modulation (PWM) charging. This means the controller delivers full charging amperage (Bulk Charge) when batteries are low. As battery voltage rises, charge amperage lowers (Absorption Charge) until the batteries reach their set voltage point. The charger then delivers low amperage (Float Charge) to maintain the batteries.



060361b

Located behind the service center

The charge controller is located on the ceiling of the bay behind the service center. The green Charging LED (see illustration) illuminates when sunlight is reaching the solar panel. Solid green indicates bulk charging; flashing green indicates absorption or float charging. The LED will glow red if errors occur. A red LED means that the system is not charging. An error code will also display on the remote monitor. See the OEM manual for troubleshooting.

It is normal for the controller to become warm to the touch, especially when processing higher amperage.

### NOTE:

**The charge controller is limited to 425 watts maximum input.**

### NOTE:

**This system will charge only lead-acid batteries.**

### CAUTION:

**The charge controller may be warm to the touch. This is a normal function of the charge controller.**

### Maintenance:

Perform the following maintenance tasks twice a year for best performance.

- ◆ Tighten all terminals. Inspect for loose, broken or corroded connections.
- ◆ Ensure all wire clamps and tie-downs are secure.
- ◆ Verify LED indication matches system conditions.

### Fuse Location:

There are two fuses for the solar charging system in positions F6 and F7 on the circuit board located in the curbside rear electrical bay.

## Solar Panel Care

Keep the solar panel clean. The amount of power that a panel produces is directly related to the intensity of sunlight. A single layer of dust, road grime or other debris can greatly reduce power. Regular inspections and regular cleaning will assure maximum charging power. Use a non-abrasive cleaner and paper towels to clean the panel. The surrounding environment and the amount of road dust encountered will determine how frequently the panel should be cleaned.

- ◆ Solar panels should be cleaned monthly or more frequently depending upon weather conditions.
- ◆ The panel should be cleaned if a film or a layer of dust is on the windshield.
- ◆ High winds can blow dust and debris around causing dirt build up. Frequently inspect the panel and clean as necessary.

### **CAUTION:**

**To avoid arcing at the battery connections when replacing batteries or performing battery cable maintenance, be sure to remove the fuses for the solar panel charge controller, or cover the solar panel to stop the production of electricity.**

### **NOTE:**

**See OEM manuals for more information.**

## MAP LIGHTS

### **Operation:**

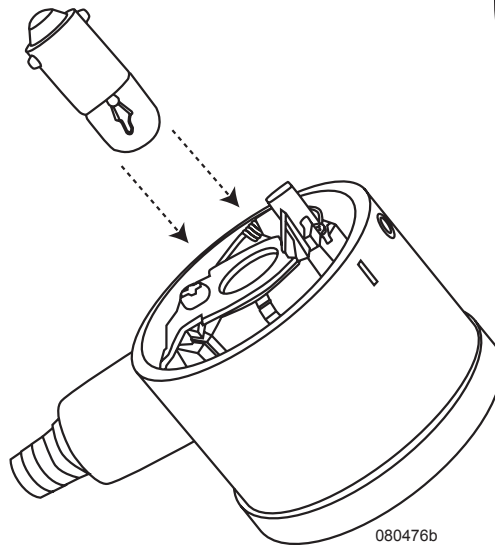
Turn the light on and off by aligning the pointer on the back of the light with the **ON** and **OFF** indicator on the front portion of the light.

### **To Replace a Bulb:**

1. Align the pointer on the back of the light to the position to remove the cover.
2. Remove cover and lift bulb from holder.
3. Replace with a 12 Volt DC 4 Watt type 1816 bulb and install cover by realigning the pointer to the same location. Turn cover to **OFF** or **ON** position.

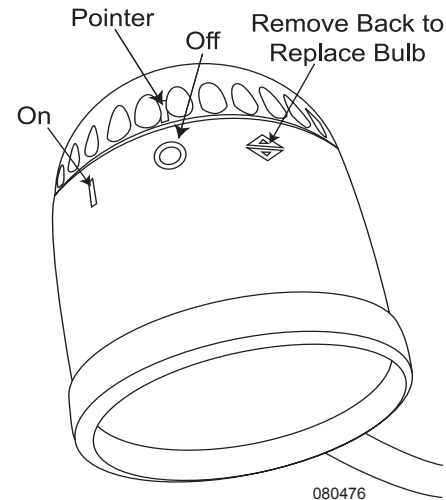
### **If the map lights fail to operate:**

- ◆ Ensure interior house power is turned **ON**.
- ◆ Check fuses in front electrical bay on the roadside.



## BULB USAGE – INTERIOR

INTERIOR BULB CHART	
LOCATION	BULB NUMBER
FLUORESCENT CEILING LIGHTS	F15T8 - CW
DINETTE	12V DC C912 or 921
MAP LIGHT	1816 12V DC 4W
STEPWELL LIGHTS	90416
CLOSET LAMP	12V DC 10W Type T-3
OVERHEAD CEILING LIGHTS	1383



# 09 Camelot

## *Electrical Systems - Chassis — Section 9*

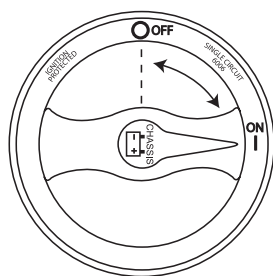
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## CHASSIS ELECTRICAL - INTRODUCTION

This section contains guidelines, procedures and information that will assist in understanding the chassis electrical system and the operation of various components. Refer to the OEM manuals included in the Owner's Information File box for their respective, in-depth, individual component operating instructions.

## BATTERY DISCONNECT - CHASSIS

The main battery disconnect switch located in the rear curbside bay controls the DC power to the front electrical bay. Most chassis and engine functions are interrupted when the battery disconnect is turned off.



060350ba  
Located in the rear curbside compartment.

Some electronic components of the engine and transmission require constant power and will continue to draw power when the disconnect is off.

Turn the main battery disconnect switch off when the motorhome is stored or when performing electrical maintenance. If possible, leave the motorhome plugged into an AC source with the battery disconnect switch on to help prevent the possibility of dead batteries.

If an AC source is not available and the motorhome is stored more than 48 hours, it is recommended to turn the battery disconnect switch off.

### **WARNING:**

When welding is involved for motorhome repair or modification, only qualified, experienced technicians should weld on the chassis. Improper welding procedures and materials may weaken the assembly or result in damage that is not obvious and may not cause an immediate problem or failure. Unauthorized modifications or repairs to the chassis could result in a forfeiture of warranty coverage.

### **DANGER:**

Due to the sensitive nature of the electronics on the chassis, the following precautions are required to protect electrical components in the motorhome chassis:

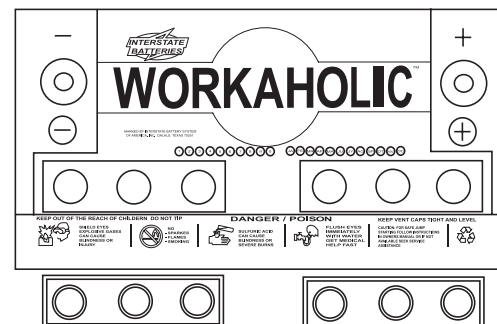
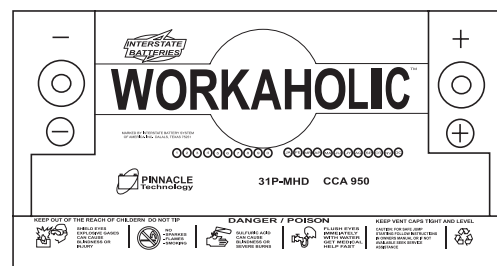
1. Disconnect the (+) positive and (-) negative battery connection.
2. Cover electronic control components and wiring to protect from hot sparks.
3. Disconnect the terminal plugs from the engine Electronic Control Unit, located on the passenger side of the engine block.
4. Disconnect all the plugs from the transmission Electronic Control Unit, located in the front electrical bay.
5. Disconnect the wiring from the alternator.
6. DO NOT connect welding cables to electronic control components.
7. Attach the welding ground cable no more than two feet from the part to be welded.

## BATTERY - CHASSIS

The chassis battery is designed to produce high amperage necessary to start the engine. Maintain the chassis battery through regular electrolyte level inspections and hydrometer readings. High electrolyte consumption or inconsistent hydrometer cell readings may indicate a charging system problem. Perform a charging system and current draw check if the battery is exhibiting abnormal hydrometer readings.

### **NOTE:**

Replacement batteries should have the same cold cranking amp (CCA) rating.



Battery with cover removed. Cut plastic to remove cover.

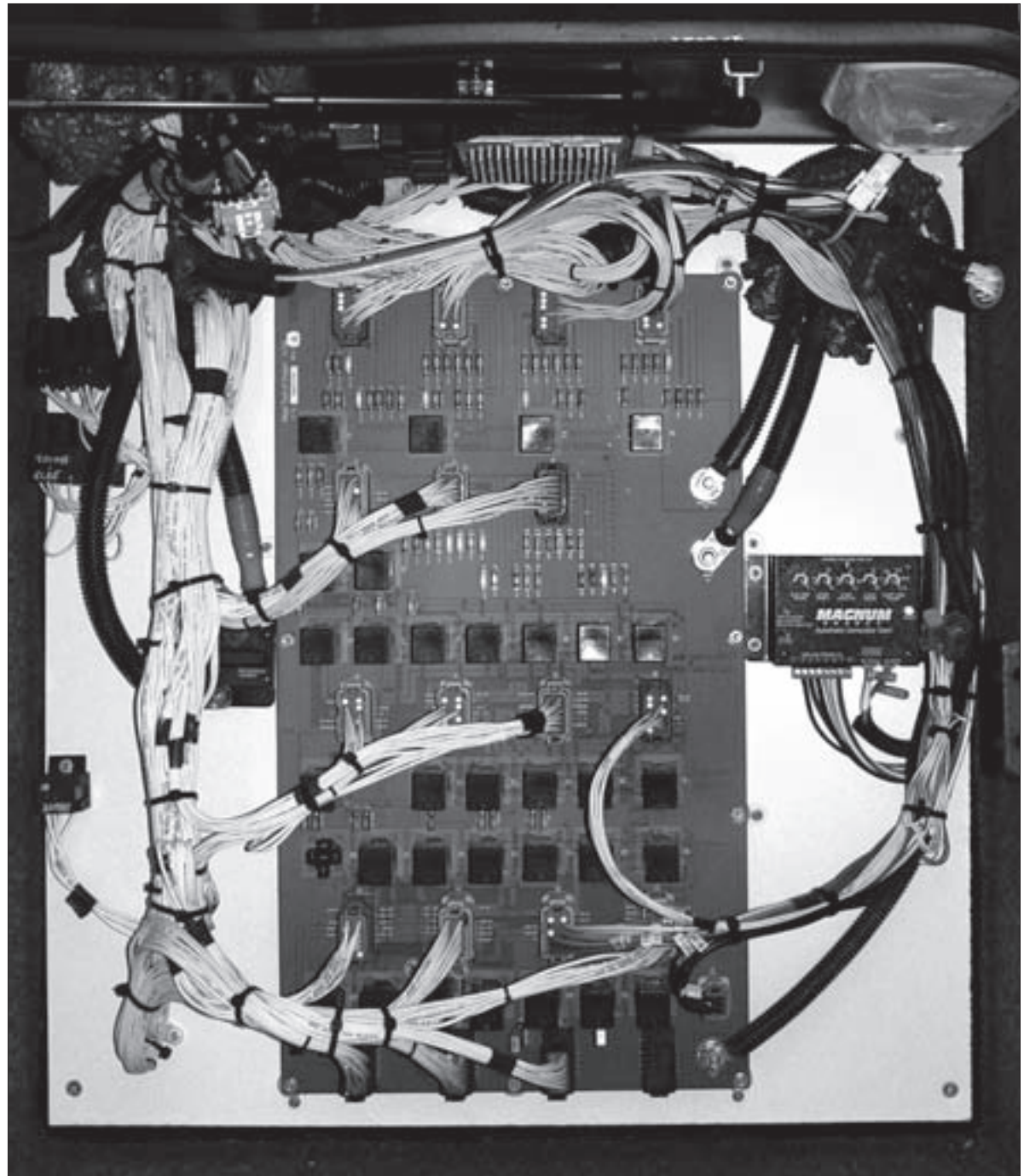
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## FUSES & CIRCUITS

The front electrical panel located roadside ahead of the front wheel contains relays and mini-fuses. Specific assignments are noted on a label on the inside of the bay door.

The wire in the middle of the plastic case will break when a fuse blows. A bad or blown fuse must be replaced with a fuse of the same rating and type. Using a fuse of a different type or rating will defeat the circuit protection provided by the fuse and may result in damage to the motorhome electrical system.

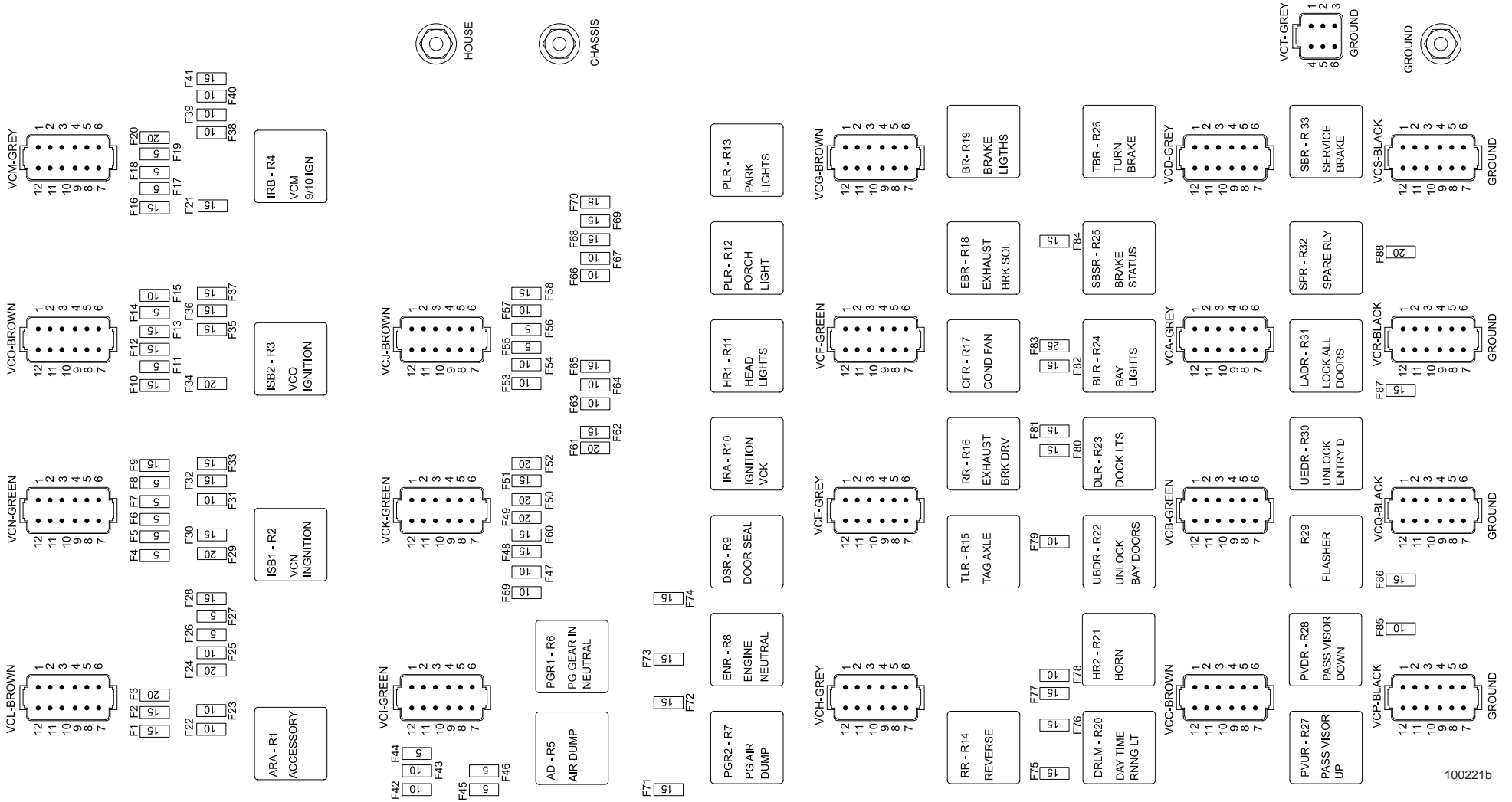
A fuse that continues to blow may indicate that a fault exists or an electronic component has failed. It is recommended that the motorhome be taken to a qualified RV technician before any future use to diagnose and repair the potential problem.



*Front Electrical Panel*

Fuse Labels

Vehicle Cabin - PCB Connectors





VCL - BROWN (FIREWALL HARNESS)

LOC No	FUNCTION	FROM
1	VCL1 BATT+ BRAKE SW	F28
2	VCL2 BATT+ SEC SYSTEM	F26
3	VCL3 BATT+ INSTRUMENTS	F27
4	VCL4 BATT+	F24
5	VCL56 BATT+ HEADLIGHTS	F25
6	VCL56 BATT+ HEADLIGHTS	F24
7	VCL28 BATT+ STEP COVER	F23
8	VCL28 BATT+ STEP COVER	F2
9	VCL10 ACC+	F2
10	VCL10 ACC+	F1
11	VCL10 ACC+	F23
12	VCL12 ACC+	F22

VCN - GREEN (FIREWALL HARNESS)

LOC No	FUNCTION	FROM
1	VCN1 IGN+ DRIVING LIGHTS	F33
2	VCN2 IGN+ OVERHEAD FAN	F32
3	VCN3 IGN+ INSTRUMENTS, FUEL SNOR	F31
4	VCN4 IGN+ DIAGNOSTICS PLUG ALARM	F18
5	VCN5 IGN+ MIRROR HEAT *	F9
6	VCN6 IGN+ PREHEAT *	F7
7	VCN8 IGN+ WIP CONTROLLER *	F6
8	VCN8 IGN+ WIP CONTROLLER *	F4
9	VCN9 IGN+ SHFT CONSOLE	F5
10	VCN10 IGN+ DASH SPARE	F30
11	VCN11 IGN+ CAB AC	F29
12	VCN12 IGN+ CAB AC	F29

VCO - BROWN (FIREWALL HARNESS)

LOC No	FUNCTION	FROM
1	VCO1 IGN+ ENGINE ECM	F37
2	VCO2 IGN+ TRANSMISSION TCM	F36
3	VCO3 IGN+ ABS ECU	F35
4	VCO4 IGN+ ENGINE SUBS SYSTEMS	F14
5	VCO5 IGN+ HEAD DC BOX	F15
6	VCO6 IGN+ WINDSHIELD WIPER	F13
7	VCO7 IGN+ VGT WALT	F12
8	VCO8 IGN+ TRAILER CHARGE	F11
9	VCO9 IGN+ AUX BRAKE CONTRLR *	F10
10	VCO11-12 IGN+	F34
11	VCO11-12 IGN+	F34
12	VCO11-12 IGN+	F34

VCM - GRAY (FIREWALL HARNESS)

LOC No	FUNCTION	FROM
1	VCM1 HSE BATT+ DSH RADIO, BOOST	F41
2	VCM2 HSE BATT+ NAV SYS, DIP *	F40
3	VCM3 HSE BATT+ TANK HEATERS *	F39
4	VCM4 HSE BATT+ CB RADIO *	F28
5	VCM5 CHAS BATT+ CB RADIO *	F19
6	VCM6 CHAS BATT+ CB RADIO *	F18
7	VCM7 CHAS BATT+	F17
8	VCM8 RELAY R4 NC OUTPUT +12	F16
9	VCM9 IGN+	F17
10	VCM10 IGN+	F21
11	GROUND	GROUND
12	GROUND	GROUND

Vehicle Cabin - PCB Layout

VCI - GREEN (LEVELER HARNESS)

LOC No	FUNCTION	TO/FROM
1	GND FRONT REAR AIR *	GROUND
2	GND CONT JACKS DOWN *	GROUND
3	AD96 JACKS DOWN *	TO RL5-86
4	PGR37 GEAR IN NEUTRAL	FROM RL6-37/F73
5	SWPB5 PARK BRAKE	FROM VCH-10
6	TCM25 SPEEDOMETER *	FROM VCH-9
7	VCI48 BATT+ CONTROLLER *	F46
8	VCI48 BATT+ FRONT AIR *	F45
9	VCI49 BATT+ FRONT HYD *	F42
10	VCI10 BATT+ REAR AIR *	F43
11	VCI11 IGN+	F44
12	GND LEVELER SPEEDO COM *	GROUND

VCK - GREEN (FRONT CAP HARNESS)

LOC No	FUNCTION	FROM
1	VCK1 BATT+ PSNGR PNL	F62
2	VCK2-3 BATT+ STEP	F61
3	VCK4 BATT+ DT, RUIN, LT MOD	F52
4	VCK5 BATT+ MIRROR, RING LT	F51
5	VCK6 BATT+ AIR COMP *	F50
6	VCK7-8 IGN+ SPARE	F49
7	VCK9 IGN+ SPARE	F48
8	VCK10 IGN+ VACUUM PUMP	F49
9	VCK11 IGN+ WIPER	F47
10	VCK12 IGN+ DRUM, STEP OUT WARN	F59

VCL - BROWN (FIREWALL HARNESS)

LOC No	FUNCTION	FROM
1	VCL1 BATT+ AUX BRAKE CONTRLR *	F68
2	VCL2 BATT+ DSH POWER PORTS	F67
3	VCL3 BATT+ PARKING LTS	F66
4	VCL4 BATT+ WIP CONTROLLER *	F58
5	VCL5 BATT+ SHIFTER CONSOLE	F57
6	VCL6 BATT+ DASH SPARE	F56
7	VCL7 BATT+	F55
8	VCL8 BATT+ DASH SW GRP #1 *	F54
9	VCL9 BATT+ ABS	F53
10	VCL10 BATT+	F65
11	VCL11 BATT+ ABS	F64
12	VCL12 BATT+ ABS	F63

VCG - BROWN (AUX CHASSIS HARN)

LOC No	FUNCTION	TO/FROM
1	RL12-30 PORCH LIGHT	FROM RL12-30
2	SW33 GND AC TRN SW	TO RL12-87A
3	FC37 SWRN SW CLUTCH OUT	TO RL17-86
4	FC37 SWRN SW CLUTCH OUT	FROM RL12-37/F70
5	FC38 FOG LIGHTS	FROM RL12-37/F83
6	FC38 FOG LIGHTS	FROM RL17-30/F83
7	FC38 COND PAN *	FROM RL17-30/F83
8	SW15 LEFT TURN	FROM VCE-5
9	SW15 RIGHT TURN	FROM VCE-5
10	DSR87 DOOR SEAL	FROM RL87A/F74
11	655 PORCH LIGHT POWER	TO RL12-98-87
12		

VCG - BROWN (AUX CHASSIS HARN)

LOC No	FUNCTION	TO/FROM
1	SW18 BRAKES SW OUT	TO RL25-86
2	TCM63 SERVICE BRAKE STATUS	FROM RL25-30
3	TCM5 SIGNAL RETURN	TO RL25-87
4	SWC31 CANCEL CRUISE COM *	TO RL33-36
5	ECM COMMON	FROM RL33-30
6	ECM SERVICE BRAKE	FROM RL33-87A
7	SWC38 CRUISE ON *	TO RL32-86
8	ECM COMMON *	TO RL32-30
9	ECM COMMON OFF *	FROM RL32-87
10	RL687 EXH BRAKE SOL *	TO RL686 RL688
11	ECM ENGINE BRAKE ACTIVE	FROM RL687
12	RLT87 BRAKE/TURN OUT	FROM RL25-87/F81

VCH - GRAY (FIREWALL HARNESS)

LOC No	FUNCTION	TO/FROM
1	DO NOT USE	FROM RL14-30/F69
2	BRAKE LIGHTS *	FROM RL15 RL16/F81
3	AM5 PARKING LIGHT FLASH *	TO RL13-86
4	PARK LIGHTS OUT *	FROM RL13-87/F70
5	SW15A LEFT TURN	TO VCF-30/VCF-9
6	SW15B RIGHT TURN	TO VCF-30/VCF-10
7	DO NOT USE	TO RL15-86
8	DO NOT USE	TO RL15-86
9	PARKING LIGHT DISCRETE	TO RL13-86
10	AM6 PORCH LIGHT	TO RL23-85
11	AM6 PORCH LIGHT	TO RL11-86
12	DO NOT USE	TO RL11-86

VCG - GREEN (FRONT CAP HARNESS)

LOC No	FUNCTION	TO/FROM
1	RL12-30 PORCH LIGHT	FROM RL12-30
2	SW33 GND AC TRN SW	TO RL12-87A
3	FC37 SWRN SW CLUTCH OUT	TO RL17-86
4	FC37 SWRN SW CLUTCH OUT	FROM RL12-37/F70
5	FC38 FOG LIGHTS	FROM RL12-37/F83
6	FC38 FOG LIGHTS	FROM RL17-30/F83
7	FC38 COND PAN *	FROM RL17-30/F83
8	SW15 LEFT TURN	FROM VCE-5
9	SW15 RIGHT TURN	FROM VCE-5
10	DSR87 DOOR SEAL	FROM RL87A/F74
11	655 PORCH LIGHT POWER	TO RL12-98-87
12		

VCA - GRAY (SUB FLOOR CHAS HARN)

LOC No	FUNCTION	TO/FROM
1	BLR87 YELLOW BAY LIGHTS	FROM RL24-87/F82
2	DLR87 YELLOW DOCKING LTS *	FROM RL24-87/F80
3	UDR93 (GRN) DOOR UNLOCK	FROM RL12-30/F87
4	UDR93 (BLU) DOOR LOCK	FROM RL12-30/F87
5	VCAF2 (RED) CHAS BATT SEAT	F88
6	VCAF2 (RED) CHAS BATT SEAT	F88
7	UDR93 (BLU) DOOR LOCK	FROM RL12-30/F87
8	UDR93 (GRN) DOOR UNLOCK	FROM RL22-30/F87
9	SWED (GRN) DOOR SW	TO VCF-2
10		
11		
12		

VCA - GRAY (SUB FLOOR CHAS HARN)

LOC No	FUNCTION	TO/FROM
1	SW18 BRAKES SW OUT	TO RL25-86
2	TCM63 SERVICE BRAKE STATUS	FROM RL25-30
3	TCM5 SIGNAL RETURN	TO RL25-87
4	SWC31 CANCEL CRUISE COM *	TO RL33-36
5	ECM COMMON	FROM RL33-30
6	ECM SERVICE BRAKE	FROM RL33-87A
7	SWC38 CRUISE ON *	TO RL32-86
8	ECM COMMON *	TO RL32-30
9	ECM COMMON OFF *	FROM RL32-87
10	RL687 EXH BRAKE SOL *	TO RL686 RL688
11	ECM ENGINE BRAKE ACTIVE	FROM RL687
12	RLT87 BRAKE/TURN OUT	FROM RL25-87/F81

VCC - BROWN (FRONT CAP HARNESS)

LOC No	FUNCTION	TO/FROM
1	SWHLH HIGH BEAM	FROM VCB-12
2	SWHLO LOW BEAM	FROM VCB-11
3	LDR90 LOCK ENTRY DOOR	FROM RL31-30/F87
4	RLV086 PASS VISOR DOWN	TO RL26-86, VCB-9
5	RLV086 PASS VISOR UP	TO RL27-86, VCB-8
6	UNUSED	TO VCB-7
7	UDR93 UNLOCK ENTRY DOOR	FROM RL30-30/F87
8	RLV086 PASS VISOR UP	FROM RL27-30/F86
9	RLV086 PASS VISOR DOWN	FROM RL28-30/F86
10	RLH87 HORN RELAY OUT	FROM RL21-87/F78
11	RLH87 HORN RELAY OUT	TO RL24-85
12	RLBL86 BAY LIGHT SW IN	TO RL24-85

VCC - GREEN (FIREWALL HARNESS)

LOC No	FUNCTION	TO/FROM
1	SWDL DOCKING LTS *	TO RL23-85
2	SWD DOOR SW	FROM VCA-11
3	AM5 UNLOCK BAY DOORS *	TO RL22-86
4	AM7 LOCK ALL DOORS	TO RL31-86
5	AM6 UNLOCK ENTRY DOOR	TO RL30-86
6	VCB86 FLASHER OUTPUT	FROM RL29/F86
7	RLV086 PASS VISOR UP	TO RL27-86
8	RLV086 PASS VISOR DO	TO RL28-86
9	HR85 HORN RELAY	TO VCC-2
10	SWHLO LOW BEAM	TO VCC-2
11	SWHLH HIGH BEAM	TO VCC-1
12		

VCB - GREEN (FIREWALL HARNESS)

LOC No	FUNCTION	TO/FROM
1	SWDL DOCKING LTS *	TO RL23-85
2	SWD DOOR SW	FROM VCA-11
3	AM5 UNLOCK BAY DOORS *	TO RL22-86
4	AM7 LOCK ALL DOORS	TO RL31-86
5	AM6 UNLOCK ENTRY DOOR	TO RL30-86
6	VCB86 FLASHER OUTPUT	FROM RL29/F86
7	RLV086 PASS VISOR UP	TO RL27-86
8	RLV086 PASS VISOR DO	TO RL28-86
9	HR85 HORN RELAY	TO VCC-2
10	SWHLO LOW BEAM	TO VCC-2
11	SWHLH HIGH BEAM	TO VCC-1
12		

VCD - GRAY (SUB FLOOR CHAS HARN)

LOC No	FUNCTION	TO/FROM
1	SW18 BRAKES SW OUT	TO RL25-86
2	TCM63 SERVICE BRAKE STATUS	FROM RL25-30
3	TCM5 SIGNAL RETURN	TO RL25-87
4	SWC31 CANCEL CRUISE COM *	TO RL33-36
5	ECM COMMON	FROM RL33-30
6	ECM SERVICE BRAKE	FROM RL33-87A
7	SWC38 CRUISE ON *	TO RL32-86
8	ECM COMMON *	TO RL32-30
9	ECM COMMON OFF *	FROM RL32-87
10	RL687 EXH BRAKE SOL *	TO RL686 RL688
11	ECM ENGINE BRAKE ACTIVE	FROM RL687
12	RLT87 BRAKE/TURN OUT	FROM RL25-87/F81

\* INDICATES EQUIPMENT OPTIONS USED ON SOME VEHICLES.

VCP - BLACK (SPARE)

LOC No	FUNCTION	FROM
1	GROUND	GROUND BUS
2	GROUND	GROUND BUS
3	GROUND	GROUND BUS
4	GROUND	GROUND BUS
5	GROUND	GROUND BUS
6	GROUND	GROUND BUS
7	GROUND	GROUND BUS
8	GROUND	GROUND BUS
9	GROUND	GROUND BUS
10	GROUND	GROUND BUS
11	GROUND	GROUND BUS
12	GROUND	GROUND BUS

VCS - BLACK (FIREWALL HARNESS)

LOC No	FUNCTION	FROM
1	GROUND	GROUND BUS
2	GROUND	GROUND BUS
3	GROUND	GROUND BUS
4	GROUND	GROUND BUS
5	GROUND	GROUND BUS
6	GROUND	GROUND BUS
7	GROUND	GROUND BUS
8	GROUND	GROUND BUS
9	GROUND	GROUND BUS
10	GROUND	GROUND BUS
11	GROUND	GROUND BUS
12	GROUND	GROUND BUS

VCS - BLACK (FRONT CAP HARNESS)

LOC No	FUNCTION	FROM
1	GROUND	GROUND BUS
2	GROUND	GROUND BUS
3	GROUND	GROUND BUS
4	GROUND	GROUND BUS
5	GROUND	GROUND BUS
6	GROUND	GROUND BUS
7	GROUND	GROUND BUS
8	GROUND	GROUND BUS
9	GROUND	GROUND BUS
10	GROUND	GROUND BUS
11	GROUND	GROUND BUS
12	GROUND	GROUND BUS

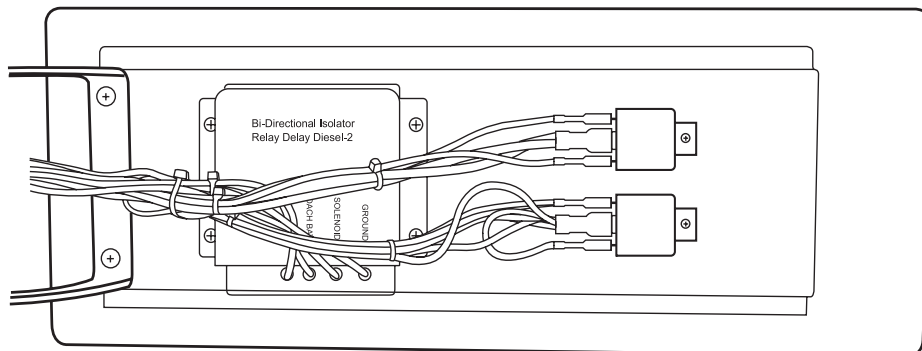
VCT - GRAY (SUB FLOOR CHAS HARN)

LOC No	FUNCTION	FROM
1	GROUND	GROUND BUS
2	GROUND	GROUND BUS
3	GROUND	GROUND BUS
4	GROUND	GROUND BUS
5	GROUND	GROUND BUS
6	GROUND	GROUND BUS
7	GROUND	GROUND BUS
8	GROUND	GROUND BUS
9	GROUND	GROUND BUS
10	GROUND	GROUND BUS
11	GROUND	GROUND BUS
12	GROUND	GROUND BUS

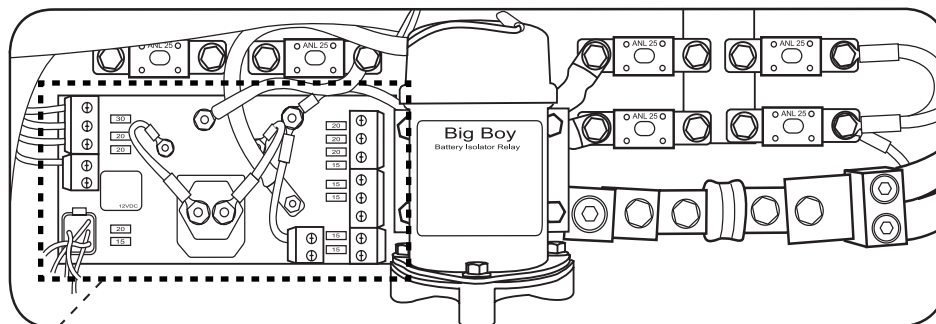
## Distribution Box - Main

The main distribution box includes the battery isolator (Big Boy), the Bi-Directional Isolator Relay Delay (BIRD), the battery disconnect relay and various mini-breakers.

The Battery Isolator is installed between the chassis and house systems to connect them for charging. The Battery Disconnect Relay provides a quick and easy means of disconnecting the battery prior to storing or performing electrical maintenance.

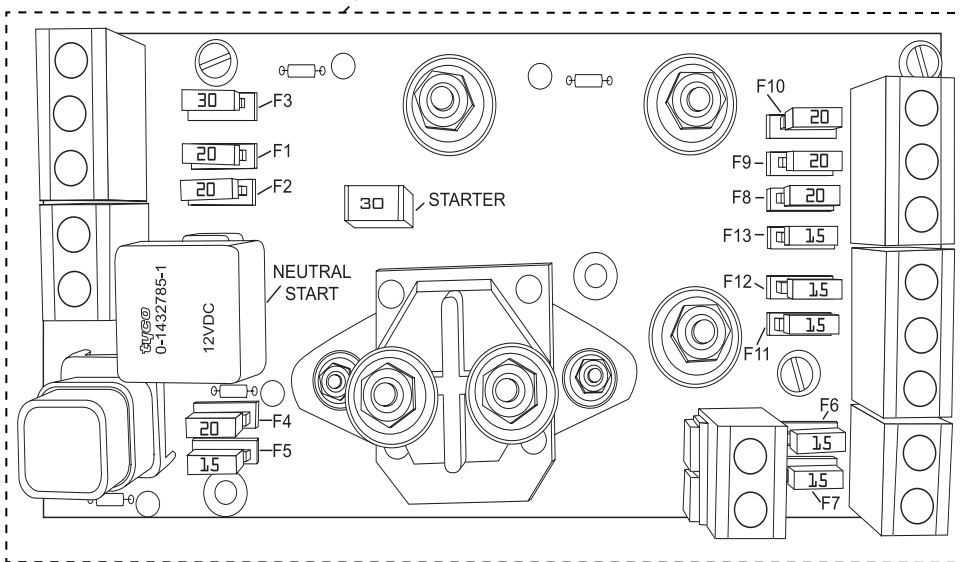


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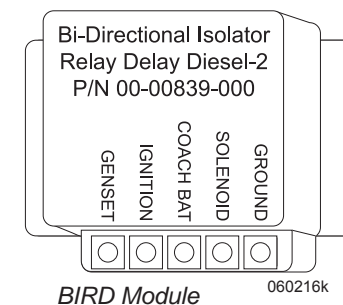
Distribution Box: Located in rear curbside bay.



- F1 - OPEN
- F2 - OPEN
- F3 - ECM BATT
- F4 - IGN SW POWER
- F5 - BATT TRANSMISSION
- F6 - SOLAR PANEL
- F7 - SOLAR PANEL
- F8 - TANK HEAT/FAN
- F9 - CORD REEL
- F10 - HYDRONIC HEAT (opt)
- F11 - BOOST/BIRD
- F12 - LP/CO DETECTOR
- F13 - REFER

## Bi-Directional Isolator Relay Delay

The Bi-Directional Isolator Relay Delay (BIRD) performs two important functions: Charging the motorhome house batteries from the engine alternator and charging the chassis batteries from the inverter/converter when the motorhome is plugged into shore power or operating from the generator. When neither battery bank is being charged they are isolated from each other to prevent the loads of one battery bank from inadvertently discharging the other.



BIRD Module

060216k

The BIRD measures both house and chassis battery voltage. If voltage of either battery bank is above 13.3 Volts DC (indicating the battery is being charged), BIRD will close the isolator relay, thus paralleling the batteries and charging both.

### NOTE:

The BIRD controls the Isolator Relay (Big Boy) that is connected directly to the chassis and house batteries. Power from both battery banks is fed into the module. The full power of batteries may be available at this module. Inadvertent shorts at this box could result in damage and/or injury. Only a qualified Service Technician should service this module.

**Engine Alternator Charging the Batteries:**

When the engine is running, the system senses the level of voltage on the chassis 12 Volt DC system. When this voltage goes above 13.3 Volts DC for approximately 12 seconds, as happens when the engine is running normally (normal alternator output voltage of a cold engine is approximately 14.4 Volts DC), the isolator relay will close and charging current will go to the house batteries. This delay allows the opportunity for chassis voltage to stabilize before a heavy load, such as discharged house batteries, are placed on it. If chassis battery voltage should fall below 12.6 Volts DC for more than four seconds, the relay will drop out so full alternator output to the chassis battery is available as needed to keep the engine running. This even may happen when the alternator is unable to supply sufficient current to all of the loads and charge the house batteries at the same time. When the chassis voltage again reaches above 13.3 Volts DC, the relay will close in four seconds and send charge to the house batteries. A resultant flickering of lights may signify alternator overload.

**Inverter Charging the Batteries:**

The inverter charges the house batteries when connected to shore power or when the generator is running. When house battery voltage rises above 13.3 Volts DC for approximately 12 seconds, the BIRD module will close the isolator relay, connecting the house and chassis battery banks. This provides charging current to the chassis batteries. If house battery voltage should fall below 12.8 Volts DC for more than four seconds, the BIRD module will open the relay to prevent the house loads from

discharging the chassis batteries. This might happen when a heavy demand is placed on the inverter. If house battery voltage again rises about 13.3 Volts DC for 12 seconds, the relay will close to also charge the chassis batteries.

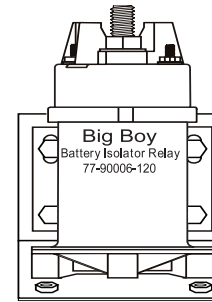
**Isolator Relay**

The Isolator Relay provides a simple means of isolating the two battery systems, house and chassis, and connecting the batteries together when the engine is running.

A momentary dash-mounted switch is added to provide a boost for the engine batteries from the domestic batteries.

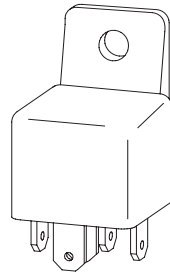
When using the battery boost switch, the relay may have to deliver the full starting current to the engine batteries. The relay contacts must close and provide low resistance without the harmful effects of arcing.

To be sure relays can perform under harsh conditions, the contacts are protected with a unique antioxidant coating. The relay is of heavy construction and can easily deliver the needed current. In a battery charging situation, both batteries will charge at equal voltage.



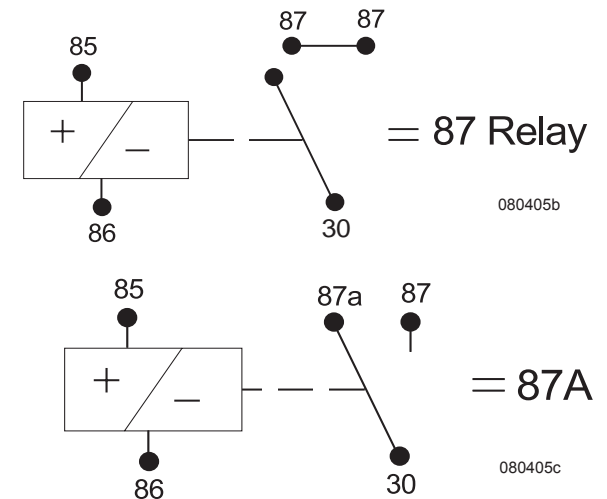
060216b  
*Isolator Relay: Located in Rear Curbside Bay*

Relays of this style can look the same in appearance, but differ in function. Note that on the side of the relay is a schematic identifying the relay as an 87 or 87a relay. The operating characteristics differ, and if mixed, will create problems. Ensure the replacement relay is of the same type and current rating to assure proper operation.



080406

Another indicator to the type of relay is the post or legs. Turn the relay over and look at the posts.



**Note differences between numbered posts:**

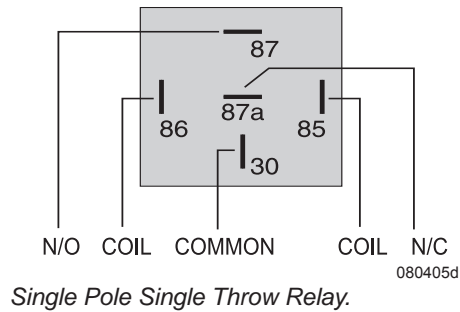
1. The 30 post is the incoming fuse and/or breaker power. Some relay applications supply power to the 30 post. Some use it for ground. The 30 post can be used many different ways.
2. The 85 post is one side of the coil, tripped different ways.

**Relays**

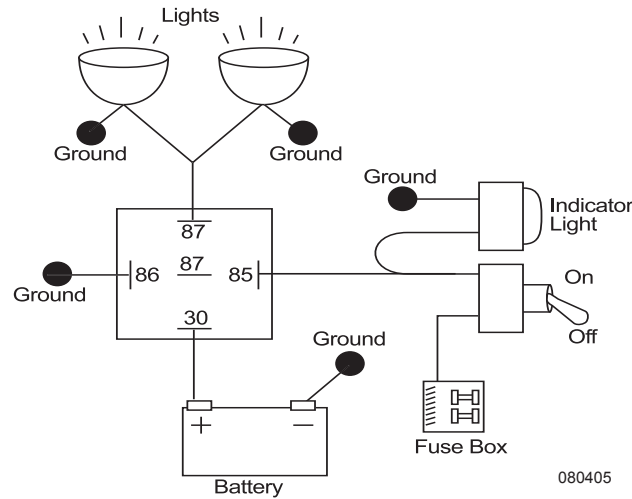
The motorhome uses various relays to operate electrical equipment such as lights and motors. If a relay needs to be replaced, carefully record the location of each wire and all markings or labels.

3. The 86 post is the opposite side of the coil, tripped different ways.
4. The 87 posts are not common to the 30 post until the relay is tripped. When the relay trips, both 87 posts are common to the 30 post.
5. Using an 87a relay, the 30 post and the 87a post are common. When the coil is tripped, the 87a post becomes inactive and the 30 post becomes common to the 87 post located on the outside of the relay.

A Single Pole Single Throw relay (SPST) is an electro-magnetic switch consisting of a coil (terminals 85 & 86), one common terminal (30), one normally closed terminal (87a), and one normally open terminal (87).



When the coil of the relay is at rest (not energized) the common terminal (30) and the normally closed terminal (87a) have continuity. When the coil is energized, the common terminal (30) and the normally open terminal (87) have continuity.



#### NOTE:

**When there is power applied to the coil, the coil sets up a magnetic field in the windings. When the power is removed, the field collapses. A momentary high voltage discharge will occur. This is how an ignition coil works.**

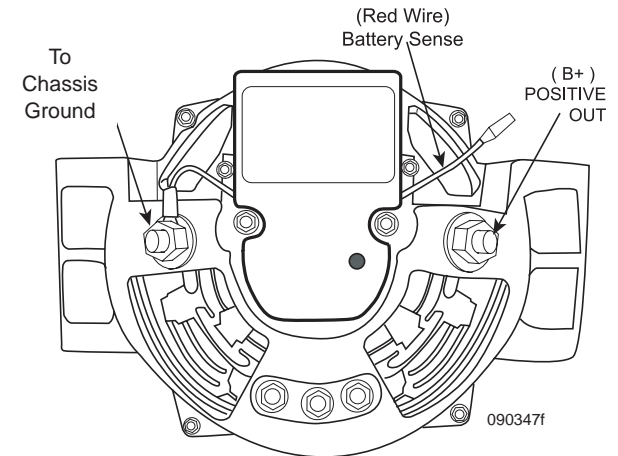
## ALTERNATOR

The alternator is designed for consistent output through the engine operating range. When traveling, keep an eye on the voltmeter in the dash area. Normal readings should be between 13 to 14.5 Volts DC. Voltage indications higher or lower indicate a potential problem with the charging system. If the alternator output drops below an acceptable level, a low battery warning will display on the dash LCD.

The alternator replaces amp hours the chassis battery used to start the engine. The amount of charge the alternator sends to the chassis battery is dependent on the amount of time the engine is operated. Repeatedly starting the engine for short periods may not be enough operating time to adequately replace the amp hours the chassis battery uses to start the engine.

The function of the alternator is an electrical system voltage maintainer, not a battery charger. When the engine is operating, the alternator maintains electrical system voltage relative to a load, such as headlights and windshield wipers. When a heavy load is placed on the alternator, such as trying to charge dead house batteries, the operating temperature of the alternator will increase.

Excess operating temperature of the alternator for extended periods of operation can lead to premature failure of the alternator.



160 Amp Alternator

**NOTE:**

The alternator is not designed to charge the house batteries from a complete discharge to a full state of charge. The alternator will maintain the battery charge during travel, supplying the DC current necessary to operate running lights or other DC loads.

If the house batteries are in a low state of charge, it is recommended to charge the house batteries with the inverter or an auxiliary battery charger before driving the motorhome.

**CAUTION:**

Long-term use of the inverter to operate the microwave while in transit will damage the alternator. Use the generator to operate the microwave while in transit.

**Alternator Testing Procedure****Alternator Testing:**

- ◆ Check all wiring for burnt or loose electrical connections. Repair as needed.
- ◆ Check all grounds and electrical connections to confirm they are clean and tight.
  - Alternator ground to chassis frame.
  - Motor block ground to chassis frame.
  - Chassis battery ground to chassis frame.
  - Alternator positive output to isolator relay terminal.
- ◆ **Inspect** the alternator for damage.
- ◆ Check belt pulley for wear. Replace as needed.

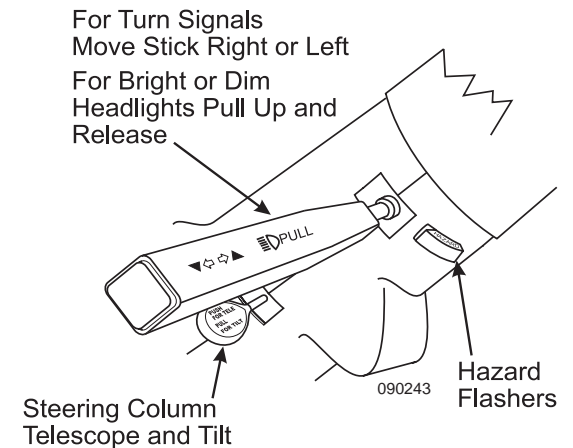
- ◆ **DO NOT** disconnect the battery or battery wire from the alternator with the engine running. This can damage the alternator or regulator and voltage sensitive drive train electronics.
- ◆ The pulley for the alternator should be torqued to 80 ft. lbs.
- ◆ Chassis battery voltage with the engine **OFF** should range from 12.2 to 12.7 Volt DC.
- ◆ Chassis battery voltage with the engine at idle should range 13.5 to 14.2 Volts DC.
- ◆ The output of the alternator range is 13.6 to 15.4 Volts DC. Connect a volt meter to the (B+) terminal of the alternator and chassis ground. Idle the engine up to 1200 RPM.
- ◆ Connect a clamp-on amp-meter, if available, to the positive battery cable to verify the battery state/rate of charge.

**CAUTION:**

The alternator is not a battery charger. The alternator is designed to maintain proper electrical system voltage. A battery with a low state of charge, or a dead battery, may overheat and damage the alternator.

**STEERING COLUMN  
Tilt & Telescope**

Tilt and telescope steering wheel control lever is located on the steering column.



- ◆ **To Tilt the Steering Wheel:** Pull the lever up and tilt the steering wheel to the desired level. Release the lever to lock the steering wheel in the new position.
- ◆ **To Telescope the Steering Wheel:** Push and hold the lever down. Move the steering wheel to the desired location. Release the lever to lock the steering wheel in the new position.

Turn indicator and headlight high/low dimmer control is located on the steering column.

- ◆ Push the lever forward to activate right turn indicator circuits when the ignition is on.
- ◆ Pull the lever back to activate left turn indicator circuits when the ignition is on.
- ◆ Pull the lever up to select high/low beam circuits when the headlights are on.

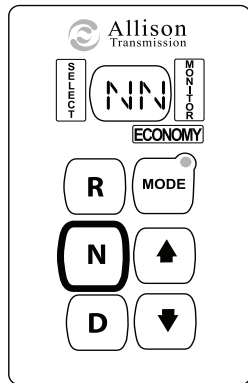
**Hazard Flashers:**

- ◆ The flasher button is located on the steering column.
- ◆ To turn on the four-way flashers, pull **out** on the flasher button. The turn signal alarm will sound.
- ◆ To turn off the flashers, push the button **in**.

## CONSOLE

### Transmission Shift Selector

**NOTE:**  
Switch and component placement on panels may vary.



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The keypads on the shift control are **R** (Reverse), **N** (Neutral), **D** (Drive), Arrow up, Arrow down, Mode button. A digital display window shows gear selection, various transmission modes, oil level and transmission fault codes. Two number sets display while in Drive. The left number displays the highest forward range available. The right number is the range that the transmission is currently in. **NN** (Neutral) will appear in the display window when the ignition is turned On.

This indicates the transmission is in neutral and it is safe to start. If **NN** does not display when the ignition is turned on, there is no power to the shift selector and the transmission will not allow the engine to start. No display is an indicator of electrical problems with the engine batteries, transmission ECU or the shift selector.

**Keypad Functions:**

- ◆ Select Reverse gear by pressing **R**. **RR** will display.
- ◆ Select Neutral by pressing **N**. The area around the **N** button has a raised ridge so the driver can orient his hand to the push buttons by touch without looking at the display. **NN** will display.
- ◆ Select Drive range by pressing **D**. The highest forward gear (6th gear) appears in the display and the transmission will shift to first gear indicated as 6 1.
- ◆ **Up** and **Down** arrow buttons are used to select a higher (if not in “6”) or lower (if not in “1”) forward range. These buttons are not functional in Neutral or Reverse. When in Drive, one press changes the gear range selected by one. If the button is held continuously, the selected range will continue to change up or down until the button is released or until the highest/lowest possible range of gears is selected.
- ◆ The Mode button enables a secondary shift point to be selected. This is commonly referred to as Economy mode. Economy mode affects the upshift schedule 3-4, 4-5, 5-6 and downshift schedule 6-5, 5-4, 4-3. During highway driving, with the cruise control set between 55 and 65 m.p.h., setting the transmission to economy mode will eliminate about 99% of transmission downshifts from sixth to fifth when incurring a slight incline or overpass.

**DO NOT** use economy mode while traveling in mountain terrain. The lower RPM shift schedule will reduce the flow of antifreeze, lubricating oil and air flow through the radiator, resulting in increased transmission and engine temperature.

**CAUTION:**

**DO NOT use the economy mode in heavy stop and go traffic or mountainous terrain. Frequent shifting will occur and increase transmission fluid temperature. Exit economy mode until road conditions improve.**

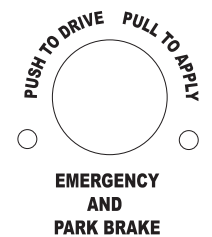
**NOTE:**

**When the Auxiliary Braking device is used, the display will change to a default reading of 6-2. The transmission is not actually in second gear. This is only a reference point indicating the transmission will automatically downshift to second gear when auxiliary braking device is engaged.**

**Parking Brake**

The parking brake system is activated by pulling the push-pull control knob located on the driver’s console. When the knob is pushed, the brake is released.

The air system must be fully charged and the motorhome at ride height prior to driving. Start the engine and allow the air system to fully pressurize (approximately 135 psi). The air dryer will audibly purge air when the air governor attains cutout pressure.



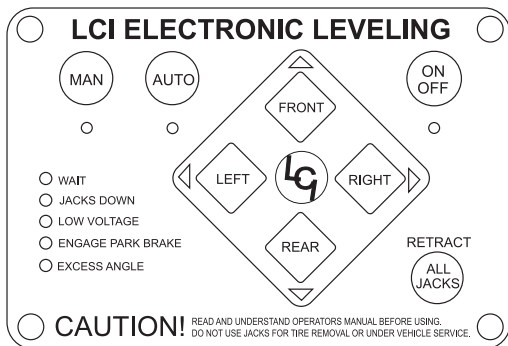
080313

If the air system is not depleted when parked, it is possible to accidentally release the parking brake. Traveling with small children and/or pets may require fabrication of a small block to be placed under the park brake knob. A wooden clothes pin, clasped at the base of the shaft, will also work (block or clothes pin not included). Do not forget to remove before travel.

### Leveling Controls

#### Lippert - Hydraulic System:

The three-point hydraulic leveling system is operated from the control module to manually or automatically level the motorhome. The control features a multiple warning system with flashing lights and an alarm to alert of a jack down.



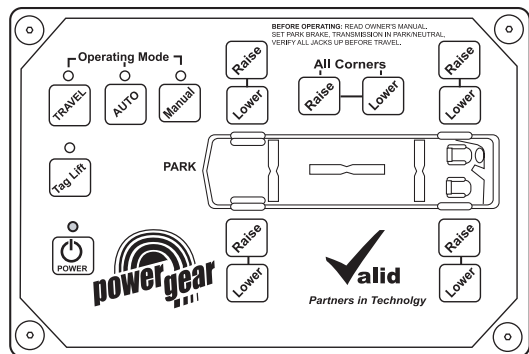
Lippert Hydraulic Level Control

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#### Power Gear/Valid - Air Leveling (Optional):

The touch panel controls air-leveling operations. The ignition must be ON in order for the leveling system to function.

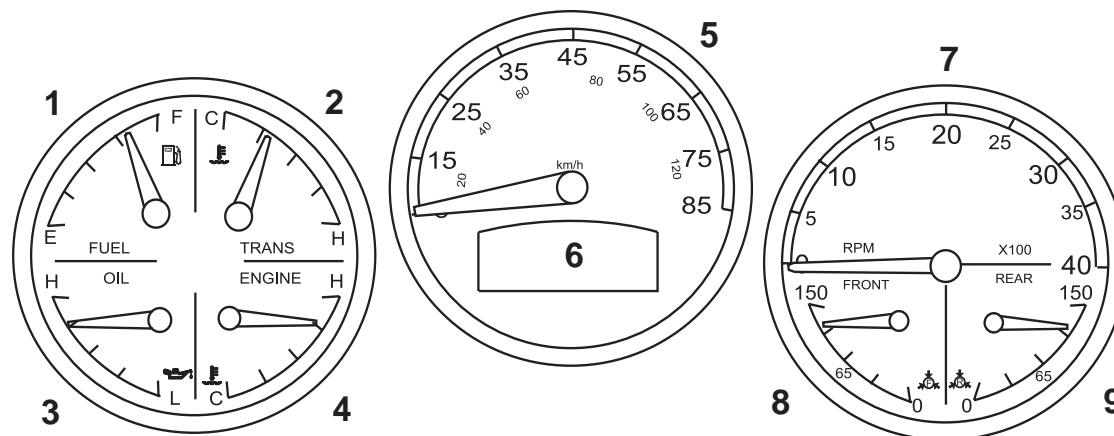
**NOTE:**  
Air leveling will NOT operate unless ignition is ON.



Power Gear Air Leveling Control

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### DASH Gauges



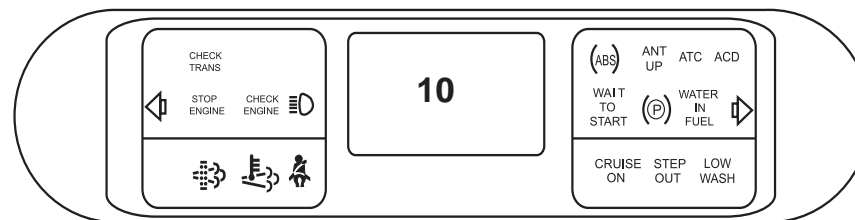
**NOTE:**  
Some of the items depicted in the dash drawing are not used depending on floor plans and equipment options.

#### 1. FUEL:

The fuel gauge will register approximate fuel tank level when the ignition switch is in the run position.

#### NOTE:

Fuel mileage varies with driving style and road conditions. Always average more than one tank of fuel to obtain a more accurate figure. The diesel generator uses fuel from the main tank and will affect fuel mileage figures. The diesel generator will not operate below 1/4 tank to ensure there is enough fuel to run the engine.



ULTRA LOW SULFUR DIESEL FUEL ONLY

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**2. TRANS TEMP:**

Shows approximate temperature of the transmission fluid. DO NOT let the transmission oil temperature exceed OEM specifications. Stop the motorhome and shift into neutral if excess temperature is indicated. Raise engine speed between 1200 to 1500 rpm to help transmission fluid temperature to return to normal.

**3. OIL PRESSURE:**

Indicates oil pressure (not the amount of oil in the engine). Please refer to manufacturer's instructions for specific pressure recommendations.

**4. COOLANT TEMPERATURE:**

Indicates an approximate normal operating range. Monitor this gauge frequently in all conditions, especially when climbing hills, towing and/or traveling in high ambient temperatures. If the needle indicates an out of range condition, take immediate action to avoid engine damage. Refer to the OEM manual for specific temperature recommendations.

**5. SPEEDOMETER:**

Indicates the speed of the motorhome. The gauge indicates MPH and KPH.

**6. ODOMETER:**

Displays total mileage.

**7. TACHOMETER:**

Displays engine speed in revolutions per minute (RPM).

**8 & 9. AIR PRESSURE GAUGES:**

One gauge is for the front air tank, and the other is for the rear air tank. Normal air system operating pressure cycles between approximately 115 to 135 psi. This range is preset at the factory. If a problem occurs with either air system not maintaining normal operating pressure, it is indication of a malfunction in the air system. Use caution and stop the motorhome in a safe area. Contact an authorized service technician immediately.

**NOTE:**

**DO NOT drive the motorhome with low air pressure. It is not safe. Damage can occur to the suspension and driveline and the air brake system will not properly function.**

**10. LCD DISPLAY:**

The LCD displays chassis data and fault codes.

**Warnings:**

LCD also displays following warnings:

- ABS Warning
- Check Transmission
- Bay Door Open (including engine door)
- Low Oil Pressure
- High Transmission Temp
- Generator Door Open
- High/Low Coolant Temp
- Low/High Battery

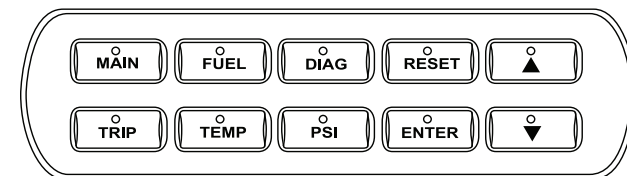
- Low Air Pressure – Front
- Low Fuel Level
- Low Air Pressure – Rear
- Water in Fuel
- Engine Not Running
- Turn Signal
- Headlight On
- Low Coolant

**NOTE:**

**The “Bay Door Open” warning includes all bay doors and the engine door.**

**LCD Controller:**

A ten button controller is located on the dash. Press the up and down arrows to scroll through menus, and press the enter button to select items.



080515f

**Main** – Press at any time to return to the main screen. The main screen displays outside temperature, chassis battery voltage and odometer.

**Trip** – Press to view Trip menu. Use the up or down arrow to highlight a trip, and press the Enter button to view trip information. Trip information includes average speed, distance traveled, trip time and fuel used.



**Fuel** – Press to display average miles per gallon, instantaneous miles per gallon, and fuel used. Hold the reset button for five seconds to clear.

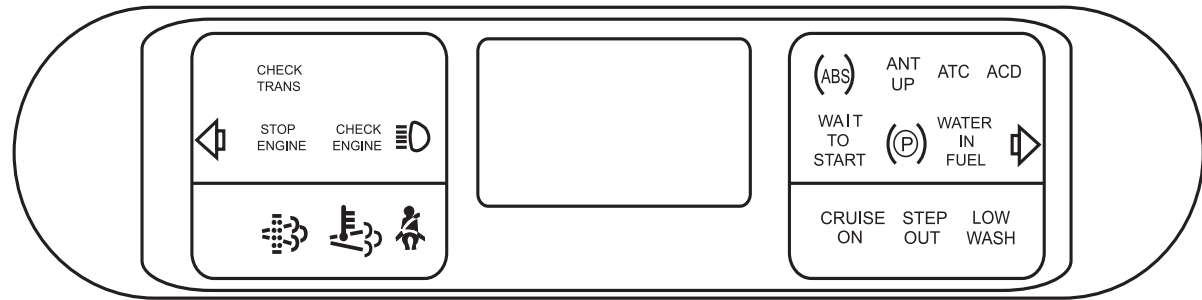
**Temp** – Press to view outside, basement, transmission and engine coolant temperature.

**Diag** – Press to view engine, transmission, ABS, and LCD diagnostic menu. Use the up and down arrow to highlight an option from the menu. Press the Enter button to view diagnostic information and options.

**PSI** – Press to view oil pressure, turbo boost pressure and front and rear air tank PSI.

**Reset** – Press and hold for five seconds to clear selected trip information (trips 1 through 4 can be individually selected for reset).

**Enter** – Press to select menu options.



ULTRA LOW SULFUR DIESEL FUEL ONLY

080515e

#### **LEFT ARROW - Audible Turn Indicators:**

Left turn indicator circuits active. Alarm cancels when service brake is applied.

#### **STOP ENGINE:**

A severe out of range condition exists within the engine protection circuits. Pull over and stop as soon as possible. Shut-off the engine to avoid damage to the engine or related systems. Check gauges. Inspect engine fluid levels. Refer to OEM engine manual.

#### **CHECK ENGINE:**

An out of range condition exists within the engine protection circuits. Have the engine serviced as soon as possible.

#### **HIGH BEAM:**

Turns on when high beams are active.

#### **DPF:**

The DPF (Diesel Particulate Filter) light signals an active regeneration cycle is necessary, but unable to initiate. See Section 10 for more information.



080515b

#### **HEST:**

The HEST (High Exhaust System Temperature) light illuminates when an active regeneration cycle is underway, which results in elevated exhaust temperatures. No fault exists as long as there are no other active warning lights. See Section 10 for more information.



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#### **SEATBELT LIGHT:**

Stays lit for eight seconds after the key is turned on.

#### **ABS:**

Indicates possible fault in the ABS Brake system.

#### **ANTENNA UP:**

Illuminates when the TV antenna is raised. Lower the antenna before moving the motorhome.

### **Indicator Lights**

#### **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 properly working. If the lamp fails to illuminate or remains on, immediately have the transmission checked by the nearest Allison dealer.

**ATC:**

The ATC (Automatic Traction Control) light is continuously lit when ignition is first turned on and stays lit until the brakes are used for the first time and then turns off. The ATC light continuously flash when the ATC switch (located on the driver console) is on. See Section 10 for more information.

**ACD:** N/A

**WAIT TO START:**

Monitors the manifold preheat. Wait for the lamp to cycle off before cranking the engine.

**PARK BRAKE:**

Parking/emergency brake is applied.

**WATER IN FUEL:**

Water has been detected in the primary fuel filter. Purge water from filter at engine compartment.

**RIGHT ARROW - Audible Turn Indicators:**

Right turn indicator circuit is active. Alarm cancels when service brake is applied.

**CRUISE ON:**

Cruise control is activated.

**STEP OUT:**

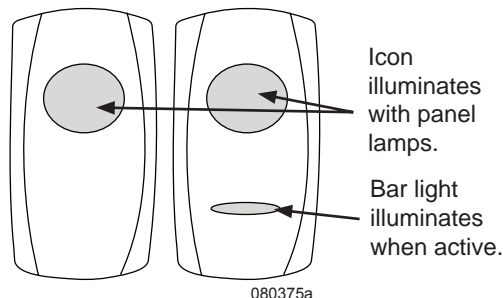
Exterior entry step is extended.

**LOW WASH:**

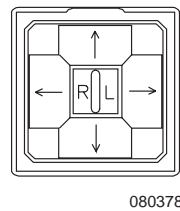
Indicates low windshield washer fluid.

**Switches**

Dash switches come either with or without a Bar Light. The Bar Light indicates the item/function is active. Icon lighting for both switch types illuminate with panel lamps.

**Driver's Console:****MIRROR ADJUST:**

To adjust the outside mirrors, place the small selector in the middle of the switch to the desired side. The middle position is to prevent accidental bumping of the switch and changing the mirror position. The outside mirrors are easily adjusted with the Allen wrench. After taking delivery of the new motorhome it will be necessary to sit in the driver's seat and adjust both the driver and the passenger mirrors.

**TAG AXLE (42' Models Only):**

**Hydraulic Leveling** - Switch on driver's console raises and lowers the tag axle. The bar light on the switch is illuminated when the tag axle is raised.

**Air Leveling (Optional)** - The tag axle switch is incorporated into the air leveling control panel. Pushing the "Tag Lift" button will raise or lower the tag axle. The engine must be running with level control in Travel Mode for two minutes before it is possible to raise the tag axle. This allows extra time to pressurize the air system.

**NOTE:**

**Raise the tag axle when making sharp turns under 5 mph.**

**NOTE:**

**DO NOT drive the motorhome over 5 MPH with the tag axle raised. The manufacturer will not be held responsible for any damage that occurs from driving with the tag axle raised.**

**AIR DUMP (Hydraulic Leveling Only):**

Dumps air from the air bags which may aid in leveling the motorhome. Releasing the air from air bags will lower the suspension, giving the jack more range of travel. Ignition must be in accessory or ON position.

**CAUTION:**

**DO NOT drive the motorhome with the air bags deflated. This will damage the motorhome.**

**PEDAL IN/OUT:**

This switch moves both the brake and throttle pedals closer or farther away from the driver.

**PASSENGER SHADE:**

Operates the passenger shade.

**DRIVER SHADE:**

Operates the driver shade.

**STEP COVER:**

Extends and retracts the step cover.

**FOG LIGHT:**

Turns on fog lights.

**MIRROR HEAT:**

The switch turns on the heaters in outside rearview mirrors. Mirror heaters should only be used when defogging or de-icing is needed.

**BATTERY BOOST:**

A switch that connects the house batteries to the chassis batteries to assist in starting the engine in the event that the motorhome chassis battery has been drained and cannot start the engine.

**EXH BRAKE:**

This is an auxiliary braking device. On flat, dry road conditions apply the exhaust brake until speed is reduced. The exhaust brake is very effective for speed control in town and on local routes. Use the exhaust brake to slow down when preparing to exit onto an off-ramp, when approaching traffic lights or when approaching slowed or stopped traffic. The exhaust brake is not a substitute for the service brakes. **DO NOT** neglect service brake maintenance.

**ATC:**

Activating the ATC switch allows greater torque during an ATC event.

**AUX BLOWER (Optional):**

Operates a two-speed overhead fan for air circulation in the windshield area.

**NOTE:**

**Extreme weather conditions combined with elevated interior humidity levels may require additional manual assistance to clear the windshield for safety. It is not safe to drive with obscured vision due to moisture or snow accumulating on the windshield.**

**Dash:****HEADLIGHT:**

Pull out one stop to operate the parking lights. Pull out two stops to operate the headlights.

**DIMMER/RHEOSTAT:**

Controls dash switch backlighting when headlight switch is on.



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**GEN START:**

The generator automatically initiates a preheat cycle when the switch is pressed to START. The preheat cycle is indicated by the light on the switch rapidly flashing. Depending on ambient temperature the preheat cycle may last up to 10 seconds. For detailed operating instructions, *see Section Eight of this manual.*

**SIDE DOCK:**

Operates the side docking lights.

**Passenger Console:****STEP COVER:**

Extends and retracts the step cover.

**MAP LIGHT:**

Turns map lights on and off.

**P/S SHADE:**

Operates the passenger side power sun visor.

**STEP LIGHT:**

Turns step well lights on and off.

**Passenger Console Base:****BATTERY CUT-OFF:**

Turns power **ON** and **OFF** to interior 12 Volt DC fuse panel.

**ENTRY STEP:**

Provides power to the entry step.

**PORCH LIGHT:**

Turns the outside porch light on and off.

**CEILING LIGHT:**

Turns the front overhead lights on and off.

**BAY LIGHTS:**

Turns storage lights on and off.

**DOOR AWNING:**

Extends and retracts the entry door awning.

**PATIO AWNING ON/OFF:**

Provides power to the patio awning. Turn on for interior and exterior awning switches to operate.

**PATIO AWNING EXTEND/RETRACT:**

Extends and retracts the patio awning.

**NOTE:**

See Section 5 for more information.

**DASH AIR CONDITIONER & HEATER CONTROLS****Dash AC and Heater Control:**

Designed to provide heating, cooling and defrost capabilities for the pilot/co-pilot area. The system is not designed to heat or cool the entire motorhome.

**Blower Control Switch:**

Controls the four speeds of the blower motor. This is one of the most effective ways of controlling temperature. The Mode Control Switch must not be in the OFF position in order for the blower to activate.

**Temperature Control Switch:**

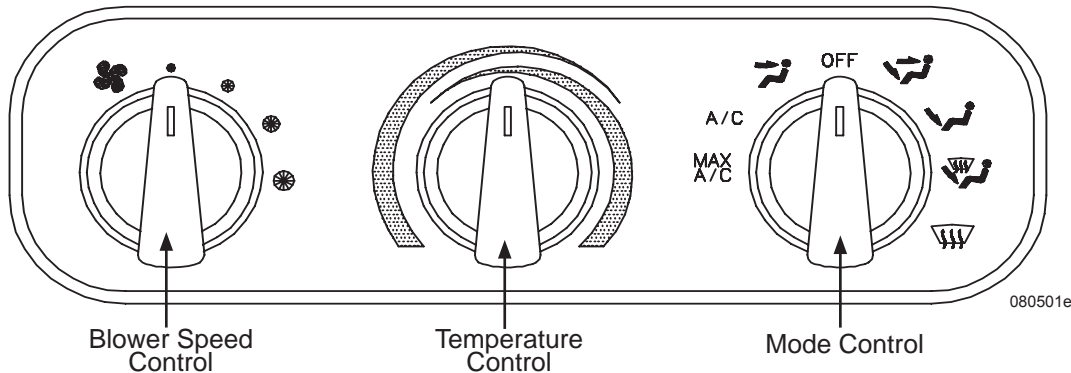
Setting the switch to the **red** zone controls an electric water valve regulating the amount of engine coolant passing through the heating coils in the system. Rotating to the **blue** zone sets the cut-in/cut-out temperature of the air conditioning compressor on the engine.

**Mode Control Switch:**

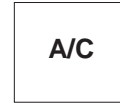
Directs air flow by opening or closing damper doors. Use the Mode Control Switch to direct airflow where it is needed to maximize comfort in the cockpit area.

**NOTE:**

The air conditioning compressor is activated when using MAX A/C, A/C, MIX and DEFROST.



**MAX A/C** - Recirculated air is drawn from the passenger area and discharged through the dash louvers.



**A/C** - Fresh air is drawn from outside into the system and discharged through the dash louvers.



**VENT** - Fresh air is drawn in and discharged throughout the dash.



**OFF** - The blower motor does not operate. The fresh air inlet door will close, minimizing outside air infiltration into the motorhome.



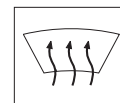
**BI-LEVEL** - Fresh air is drawn in and discharged through the dash and the floor.



**FLOOR** - Fresh air is drawn in and discharged through the floor louvers.



**MIX** - Fresh air is drawn in and discharged through the floor and defrost louvers. The A/C system operates to dehumidify the discharged air.



**DEFROST** - Fresh air is drawn in and discharged through the defrost louvers. The A/C system operates to dehumidify the discharged air.

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**A/C Operation:**

The A/C dash system will operate in all modes except **BI LEVEL**, **FLOOR** and **OFF**. When the Mode Control Knob is positioned in the A/C mode, fresh air is drawn through the front air intake of the unit through the A/C coil. The Mode Control Knob in the **MAX A/C** position closes off a damper door to outside interior air.

Select this position when maximum cold air is desired or to keep outside air from entering the motorhome.

**Heat and Defrost Operation:**

- ◆ Set the Mode Control Switch to the desired position.
- ◆ Set the Temperature Control Switch to the red zone.

**Operating Tips & Hints**

Air intake and discharge temperatures are greatly affected by ambient temperature and relative humidity. A large amount of cooling capacity is used to dehumidify as well as cool air.

**Winter Use:**

- ◆ De-ice the windshield using the **DEFROST** mode.
- ◆ Discharged air temperature increases with a slower blower speed until normal engine operating temperature ranges are reached.

**Summer Use:**

- ◆ Close all windows and vents to hot, humid outside air.
- ◆ The recirculation blower provides quick cool down.
- ◆ Use a lower blower speed to produce cooler air.

**Heater:**

The heater warms the air in the dash area. Much like the refrigeration side of the system, a liquid will be used in the process. This liquid is the engine coolant. The coolant is passed from the radiator to an electronic water valve. The water valve, when open, will allow the coolant to flow through the heater core. The heater core is much like a miniature radiator. Air is drawn into the system by a blower motor through the outside recirculation door opening.

Air is blown through the A/C evaporator core and then through the heater core. When the temperature control is in the **WARM** position coolant flows through the heater core. When the temperature is in the **COOL** position coolant flow bypasses the heater core. In either position, the airflow is felt at the discharge vents.

**Electric Water Valve:**

The water valve controls the water flow to the heater core. A control module compares the output voltage from the thermostat to the feedback for the stepper motor of the water valve. The control module then drives the motor to within one-half volt of the control thermostat voltage.

**Functional Test:**

- ◆ Start and operate the engine until the water reaches normal operating temperature.
- ◆ Set the HVAC temperature control to the full hot position.
- ◆ Discharge air outlets should have hot air.
- ◆ Rotate the temperature control to full cold position.
- ◆ Allow 10 minutes for the temperature to stabilize.
- ◆ The discharge air outlets should have cold air.

**System Components**

**Compressor** - The compressor is belt driven from the engine through the compressor and electronic clutch pulley. The compressor will pump freon from a low-pressure gas into a high-pressure, high-temperature gas. This is the start of the refrigeration process.

**Condenser** - The condenser is made of coils and fins which provide rapid transfer of heat from the refrigerant as external air passes over the coils. The high-pressure gas is changed to a high-pressure liquid.

**Condenser Fan** - A steady flow of cooling air is maintained across the condenser during system operations.

**Expansion Valve** - The expansion valve suppresses the refrigerant into the evaporator according to the cooling requirements. The pressure is reduced in the restrictive effort of the expansion valve. A part of the valve is the capillary tube assembly. The capillary tube is the sensing bulb at the outlet of the evaporator.

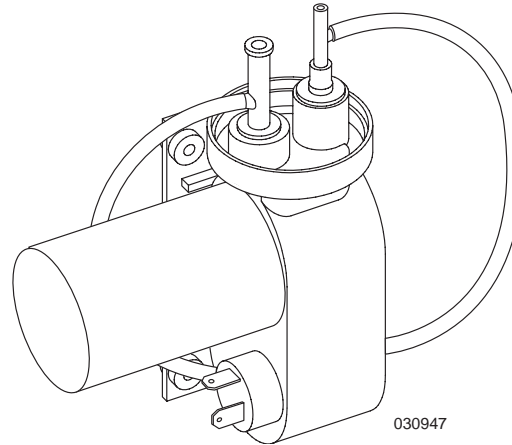
**Evaporator** - A tube core and fins are used in the evaporator similar to the condenser. Air is blown through the fins to allow the evaporator to cool and reduce pressure.

**Receiver-Drier** - Freon leaves the condenser, enters the receiver-drier and is stored until needed. The drier filters out moisture in the system. It only takes one drop of moisture to cause a malfunction in the cooling unit.

**Blower and Motor** - The evaporator has a fan called the blower. The blower will draw air from the cab area and force the air over the evaporator coils and fins. This forced air will ensure continuous vaporizing of the R134a.

**Relays and Switches** - Both electronic and vacuum switches are used in the control and operations of the system.

**Vacuum Generator** - The vacuum generator is important to the operation of the dash heating and A/C systems. This provides the vacuum to open and close the vacuum switches.



**Vacuum Generator:** Located at front firewall.

The vacuum generator creates 15" of vacuum that is passed to a reservoir ball. Most dash heater and A/C systems will only require 10" of vacuum to operate the switches. The output from the reservoir is sent to the vent control knob. The control knob will then direct the vacuum operation to the appropriate vacuum switch to open or close vents and switches. When the ignition is on and the A/C is operating, the vacuum generator will operate.

## Troubleshooting

The dash A/C and heat system uses a combination of compressed air (developed by the chassis system), vacuum air (developed by the vacuum generator) and electric relays and vacuum switches. Therefore, any repair can be classified in one of five categories:

- ◆ Electrical
- ◆ Air Conditioner
- ◆ Defroster
- ◆ Vacuum
- ◆ Heater

### No Cooling:

1. Check that the blower is operating, A/C switch is in **A/C** or **MAX A/C** position, temperature control is turned to **MAX** cooling (blue area).
2. Verify system fuses are not blown.
3. Verify condenser fan is operating.
4. Check power supply to unit and grounding of system.
5. Check wiring.
6. Coolant valve is leaking.
7. Drive belt is loose or broken.
8. Compressor clutch is inoperative, will not engage.
9. Expansion valve is faulty or frozen.
10. Thermostat control is faulty.
11. Mode control switch is faulty.
12. Compressor is faulty.
13. Loss of refrigerant.

### NOTE:

**An Ultraviolet or UV blue light is used for leak detection when dye is introduced to the A/C System.**

**Reduced Cooling:**

1. Coolant valve not operating correctly.
2. Air passages are obstructed.
3. Loose or worn drive belt.
4. Check blower and select switch.
5. Thermostat control valve is faulty.
6. Expansion valve is faulty.
7. Compressor is faulty.
8. Low refrigerant charge.

**No Heating:**

1. Verify A/C switch is turned off.
2. Verify blower switch is turned on.
3. Verify the proper engine coolant level.
4. Verify that the engine is reaching operating temperature.
5. Verify engine coolant is reaching water valve attached to unit.
6. Verify operation of water valve to permit engine coolant to pass through valve to heater core.
7. Check unit fuses.
8. Check power supply to water valve and grounding.
9. Check wiring.
10. Engine thermostat faulty.

**Blower Does Not Operate or Runs Slow:**

1. Check fuses.
2. Check for loose or corroded connection.
3. Check wiring.
4. Check to ensure ignition switch is on.
5. Check blower and select switch.
6. Motor shaft has seized.
7. Blower wheel is out of alignment.

**Damper Doors DO NOT Operate:**

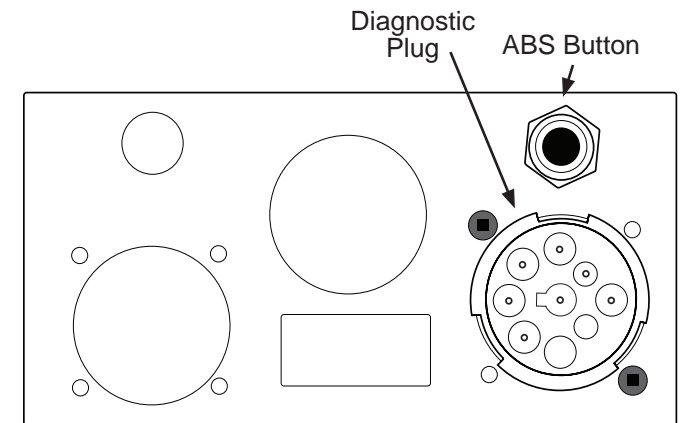
1. Is the vacuum generator being powered and producing a vacuum?
2. Check the vacuum line entering the unit for vacuum.
3. Check that the vacuum solenoid mounted on unit is receiving power from the mode switch. If operating properly, the vacuum solenoid will feel hot if current is engaging the solenoid.
4. Check the mode switch.
5. Check wiring.
6. Check for a pinch in the vacuum line leading to the vacuum motor that operates the damper door in question.

**DIAGNOSTIC PLUG LOCATION**

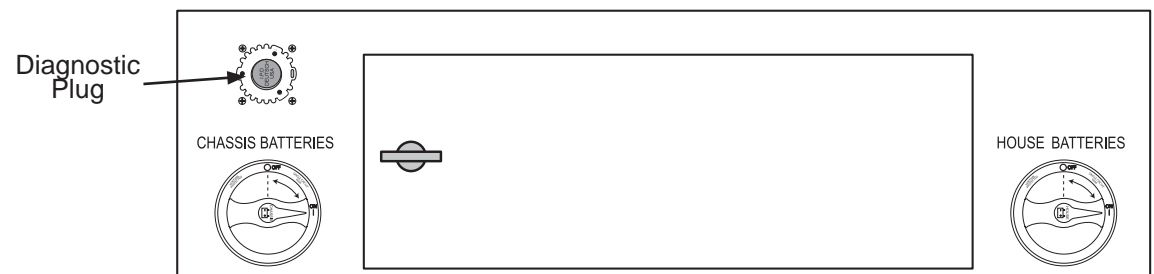
The ABS/ATC, engine and transmission systems communicate electronically over SAE J1939. J1587 is used to retrieve diagnostic codes from a particular system. A diagnostic plug is located to the left of the steering wheel under the dash, and another is located in the curbside rear bay. Both diagnostic plugs have J1939, J1587, power and ground.

**Engine Diagnostics:**

The engine diagnostics will notify the operator of deviations from the programmed limits of the engine through the “Check Engine” lamp in the dashboard. Should a system component with the engine develop a deviation, the “Check Engine” lamp will illuminate and a diagnostic code will be logged and stored in the system memory. These codes are accessed by a service technician using special equipment.

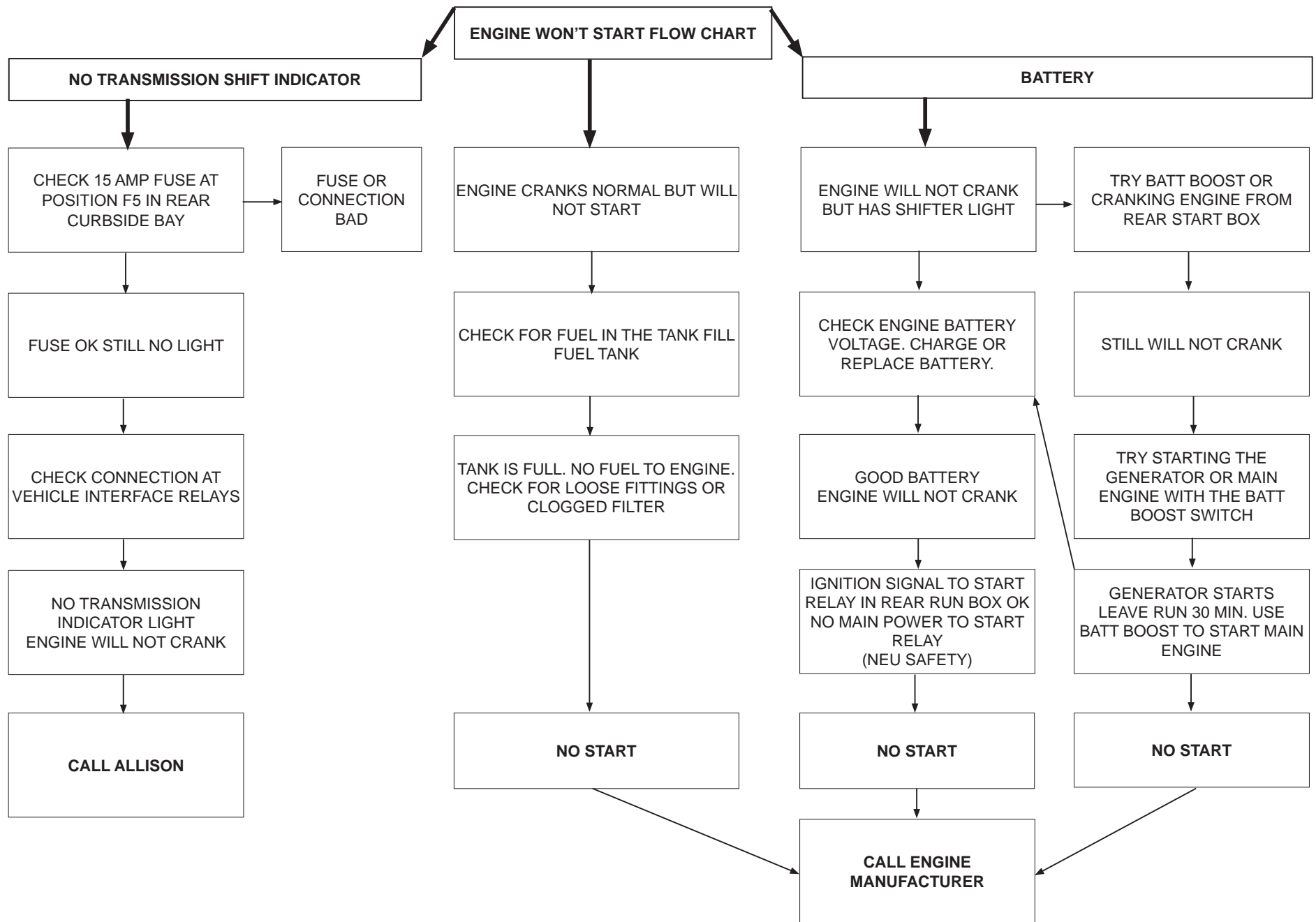


Located left of steering column.



Diagnostic Plug: Located in rear curbside bay

**ENGINE “NO START” - FLOW CHART**





# 09 Camelot

Chassis Information — Section 10

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## CHASSIS - INTRODUCTION

This section contains information and instructions regarding various components of the motorhome chassis. Follow the guidelines and procedures to help understand and operate the motorhome. Complete instructions for the engine and transmission are located in their respective operator's manual included in the Owner's Information File Box.

### **WARNING:**

**When welding is involved for motorhome repair or modification, only qualified, experienced technicians should weld on the chassis. Improper welding procedures and materials may weaken the assembly or result in damage that is not obvious and may not cause an immediate problem or failure. Unauthorized modifications or repairs to the chassis could result in a forfeiture of warranty coverage.**

### **DANGER:**

**Due to the sensitive nature of the electronics on the chassis, the following precautions are required to protect electrical components in the motorhome chassis:**

- 1. Disconnect the (+) positive and (-) negative battery connection.**
- 2. Cover electronic control components and wiring to protect from hot sparks.**
- 3. Disconnect the terminal plugs from the engine Electronic Control Unit, located on the curbside side of the engine block.**

- 4. Disconnect all the plugs from the transmission Electronic Control Unit, located in the front electrical bay.**
- 5. Disconnect the wiring from the alternator.**
- 6. DO NOT connect welding cables to electronic control components.**
- 7. Attach the welding ground cable no more than two feet from the part to be welded.**

The Roadmaster chassis design provides exceptional balance, handling and braking characteristics. The Roadmaster chassis is an engine and frame unit featuring an all steel frame design, providing structural integrity and uniform stress distribution. The air suspension system incorporated in the Roadmaster chassis uses eight air bags and shock absorbers. The tag axle (42' models only) uses two in-board mounted air bags. This design provides the smoothest ride, best handling and trouble free service while delivering excellent drivability. The Roadmaster chassis design offers unsurpassed ease of maintenance and service. The chassis also has a three-point hydraulic leveling system.

The Roadmaster's raised-rail chassis with air suspension consists of front and drive axles with trailing links. The tag axle (42' models only) uses leading arms. A panhard bar on each axle controls side motion. The axles mount to the trailing links that are connected to the chassis. The suspension control arms attach to the frame through bushings, which require no lubrication. Unlike suspension that uses springs, the air suspension system automatically maintains the same attitude and ride height throughout the entire load range. The raised rail design of the main chassis offers increased bay storage space.

The towing receiver is rated at 10,000 lbs. towing weight and 1,000 lbs. tongue weight.

### **NOTE:**

**Only 42' models are equipped with a tag axle.**



*Tag located on curbside frame behind curbside front wheel and in generator compartment.*

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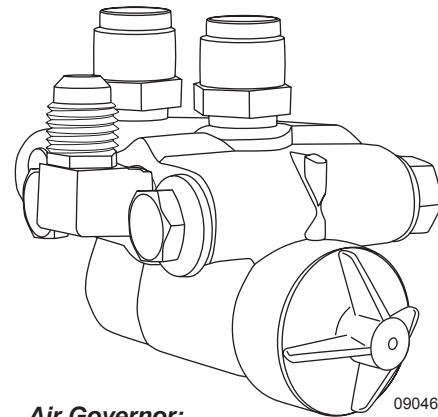
## AIR SUPPLY SYSTEM

The air compressing system on the motorhome includes a compressor, governor, dryer, front tank and rear tank. The compressed air system operates several items, including brakes, suspension, air horns, air gauge and the 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 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 and enters the air dryer to be filtered. The filtered air charges the front air tank, which is divided into a wet and dry side. The compressed air enters the wet side before entering the dry side. A discharge line from the dry side of the front air tank charges the rear air tank. Discharge lines use in-line check valves to prevent a 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 the air horns or stepwell cover, receive air through **pressure protection valves (PPV)**. The PPV will not allow compressed air flow until the system reaches approximately 60 psi. In the event of an air system problem, the pressure protection valve will leave a reserve air charge for braking. The pressure protection valve is installed for safety.

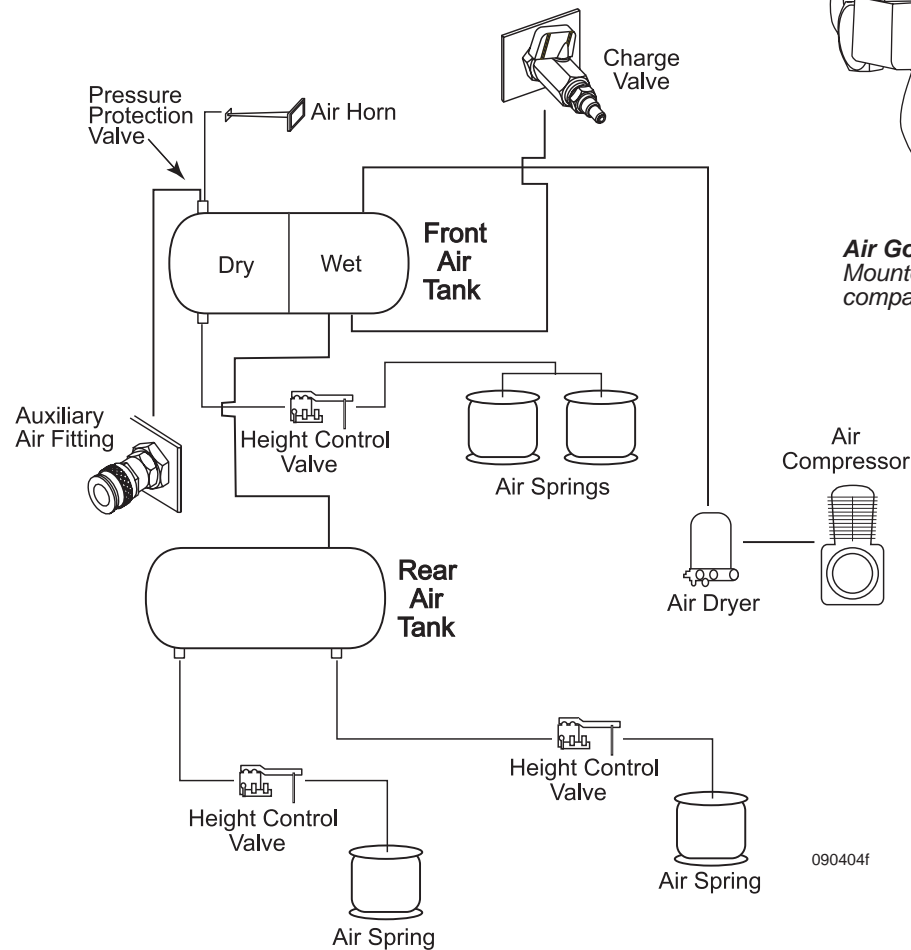
### Air Governor

The air governor, located in the engine compartment, regulates the air compressor to cut-in and cut-out, keeping the air system in the specified operating range of 115 to 135 psi and sending an air “purge” signal to the air dryer.



**Air Governor:**  
Mounted on curbside of engine compartment

The air governor will send an air purge signal to the air dryer when cut-out pressure is reached. 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 Storage Tanks

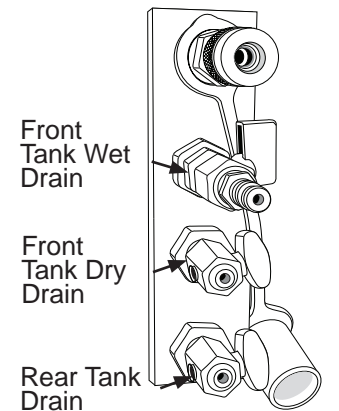
Drain the front and rear air tanks once a month or more depending on operating conditions and humidity levels. The front air tank has a drain valve for both the wet and dry side. The rear air tank only has one drain valve. The drain valves are located in the generator compartment. Both air tanks have a pressure relief valve set to release at approximately 150 psi.

**WARNING:**

**Wear safety glasses to prevent eye injury from expelled moisture. Open drain valves slowly as moisture will be expelled under high-pressure.**

**To Drain the Tanks:**

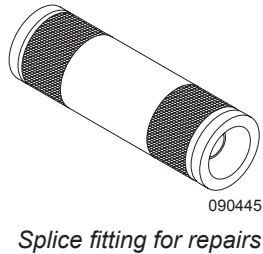
- ◆ Slowly open the drain valves. Air and moisture are expelled under pressure. Leave the valves open an additional five minutes after all air is expelled to allow any remaining moisture to drain.
- ◆ Close valves and start engine. Check valves for leaks.



Located roadside in the generator compartment

### Air Fittings

Push-in fittings are used to connect air hoses between pneumatically operated items. Fittings, sizes and types vary for different applications. Threaded fittings adapt the push-in fittings to connect pneumatically operated items. Parts include the release ring, locking ring, solid brass body and special rubber compound O-ring. Damaged hoses can be repaired by splicing.

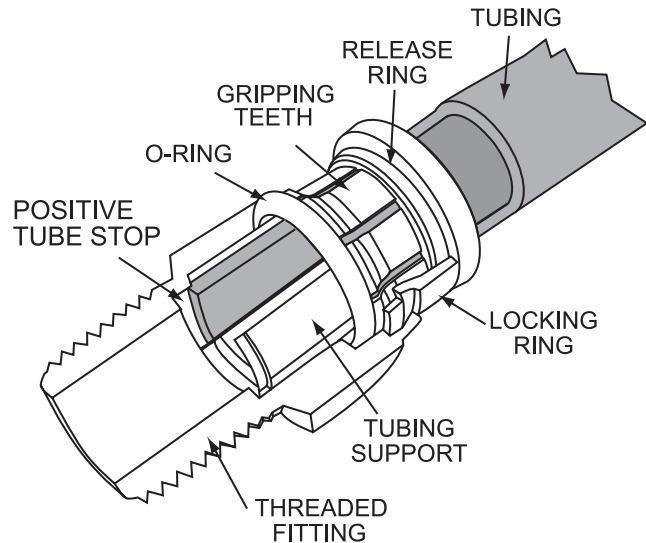


Splice fitting for repairs

090445

#### To Disconnect Hose:

- ◆ Push hose into fitting.
- ◆ Push release ring down against locking ring portion of the fitting body.
- ◆ While holding the release ring down, pull hose away from fitting.

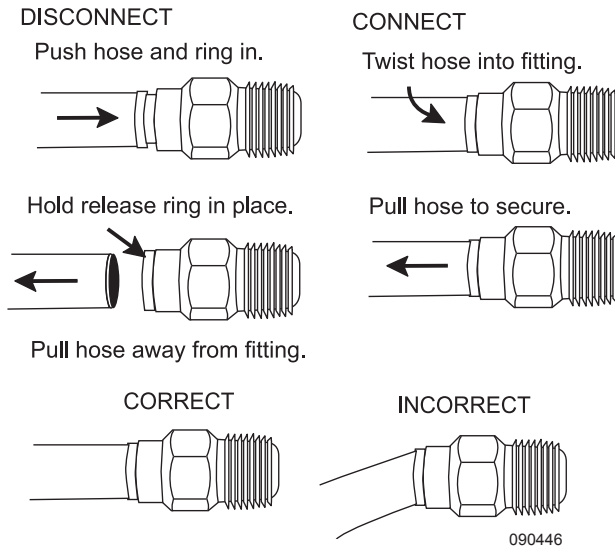


Cut-away of push-in fitting.

090466

#### To Connect Hose:

- ◆ Push hose into fitting through the release ring and the O-ring. Use a slight twisting motion to seat firmly against the internal tube stop.
- ◆ Pull hose away from fitting to expand and set inner seal. Ensure hose is properly retained in fitting.



#### NOTE:

When putting air hose back into fitting, be sure that hose is cut as squarely as possible to evenly seal in the fitting. The cavity of the positive tubing stop provides support to prevent leakage.

#### WARNING:

DO NOT remove air hoses from fittings while system is pressurized. Serious injury may occur.

#### WARNING:

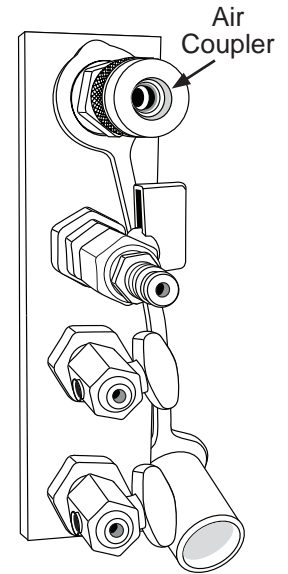
Never place yourself under motorhome without first properly blocking frame (jackstands) from coming down in case of rapid deflation of air system.

### Air Coupler - Universal

A remote air supply coupler is located in the generator compartment. The universal female fitting will accept several types of 1/4" ID male air fittings, including type C automotive. The auxiliary air fitting may be used to inflate tires, air mattresses or other pneumatic items. This fitting is not designed to charge the air system on the motorhome. The air supply for the auxiliary air fitting is charged from the front air tank through a pressure protection valve.

#### To Use the Universal Air Coupler:

- ◆ Remove the plastic protective dust cap.
- ◆ Using a firm grip, insert the air fitting into auxiliary air supply. The locking collar is spring loaded and will automatically lock when the fitting is properly inserted.



090435f

**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:**

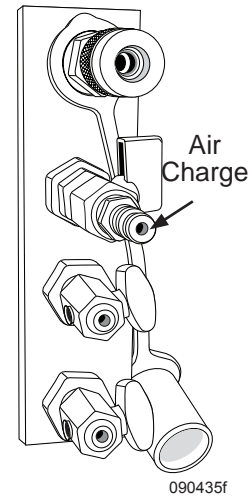
Due to air pressure restrictions in the pressure protection valve and tire stem valve, the maximum amount of tire pressure achieved when the system is used to fill a tire is approximately 115 psi with the air system on the motorhome charged to 130 psi. Maximum outlet air pressure is achieved when the 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. A type C automotive male fitting (also used as the front tank wet side drain) is located in the generator compartment. Use caution when charging the air system from this fitting. 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 140 psi. Damage to the air system or pneumatically operated items may occur.

***Air System Test***

Air system integrity is tested at the factory. The air system is equipped with several safety features. Periodically test these safety features for function as well as checking the air system for possible leaks.

**NOTE:**

These tests can also be found in the Department of Motor Vehicle (DMV) air brake certification requirement. Some tests will require precautions for safety purposes.

**Inflation Rate Test:**

This will test how long it takes the air system to achieve a specific pressure in a timed event when starting at a lower pressure. This test will verify the minimum acceptable volume of compressed air created by the air system.

1. Start engine. Increase engine speed to 1000 rpm.

2. Beginning time for the test will commence when air system pressure obtains 85 psi.
3. End time when system pressure obtains 100 psi.

Elapsed time must not exceed 45 seconds.

**Air Governor Cutout Test:**

The air governor controls action of the air system pump. This will test the air governor cutout pressure setting, which indicates system pressure has achieved maximum set psi.

1. Start engine.
2. Run engine until a chuff (air release) is heard from the air dryer.

Maximum cutout pressure must not exceed 155 psi. Air system pressure will stabilize between 125 to 135 psi.

**Unapplied Pressure Loss Test:**

This test will verify maximum acceptable air system pressure loss rate without use of any pneumatically operated devices. This test requires a flat, level surface as the park brake will be released with the engine off. Chock wheels to prevent vehicle movement.

1. Start engine.
2. Run engine until a chuff (air release) is heard from the air dryer.
3. Shut engine off.
4. Release the park brake.

Note system pressure after air system stabilizes from release of park brake. Air system pressure must not lose more than 2 psi per minute.

**Applied Pressure Loss Test:**

This test will verify the rate of maximum acceptable air system pressure loss with only the service brakes applied. Do not use other pneumatically operated devices during this test. This test requires a flat, level surface as the park brake will be released with the engine off. Chock wheels to prevent vehicle movement.

1. Start engine.
2. Run engine until a chuff (air release) is heard from the air dryer.
3. Shut engine off.
4. Release the park brake.
5. Apply and hold service brake pedal.

Note system pressure after air system pressure stabilizes. Air system pressure must not lose more than 3 psi per minute.

**Low Air Warning Test:**

This test will verify low air warning buzzer/lamp activation. A Low Air warning buzzer or lamp will sound/illuminate should air system pressure fall to 60 or 65 psi.

1. Start engine.
2. Run engine until low air warning indicators are inactive.
3. Shut engine off then turn key to ignition on.
4. Fan (apply/release in quick succession) service brake pedal.

Low air warning indicator will sound no lower than 60 psi.

**Park Brake Apply Test:**

The park brake will automatically apply if low air warning indicator(s) are ignored and system pressure falls well below safe operating levels. A flat, level surface is required as the park brake will be released with the engine off. Chock wheels to prevent vehicle movement.

1. Start engine.
2. Run engine until low air warning indicators are inactive.
3. Shut engine off.
4. Release park brake.
5. Fan (apply/release in quick succession) service brake pedal.

The park brake will automatically apply between 20 to 40 psi.

**Park Brake Hold Test:**

This test will verify engagement of the park brake. A flat, level surface is required. While the test is performed with the park brake applied, use precaution in case of vehicle movement. This test only verifies the park brake is engaged. It is not intended to verify the maximum amount of braking force created by the park brake.

1. Start engine.
2. Place transmission into gear. Do not release park brake.
3. Apply light throttle, not to exceed 1,000 RPM.

Test confirms that the park brake is engaged and holding.

**Air Governor Cut-in Test:**

The air governor controls action of the air system pump. This will confirm the air governor cut-in pressure setting.

1. Start engine.
2. Run engine until a chuff (air release) is heard from the air dryer.
3. Fan (apply/release in quick succession) service brake pedal until system pressure is between 110 and 115 psi.

Air governor cut-in pressure is approximately 115 psi.

**Brake Grab Test:**

A brake grab test will verify brake friction torque between the front wheels. The test requires a rapid and full pressure application of service brake pedal. Use proper precaution to prevent movement of cargo or other unsecured items. This is a single vehicle test. Select the most deserted, level road surface as possible (i.e. a large, empty parking lot). Road crown may affect test results, depending on severity of crown.

1. Start engine.
2. Run engine until a chuff (air release) is heard from the air dryer.
3. Release park brake.
4. Accelerate to approximately 5 mph.
5. Rapidly and firmly apply service brake pedal to bring vehicle to an abrupt stop.

The steering wheel will not pull to the left or right if front wheel braking torque is symmetrical.

## AIR DRYER

The air dryer, located curbside in the engine compartment, removes moisture from the compressed air system to prevent freezing of brakes or other pneumatically operated items. The three functions of the air dryer are cooling, filtering and drying the system air. This prevents valve and seal damage or wash away of lubricants as well as freeze damage to the system components.

### Air Dryer Cycle:

The governor turns the compressor on when the supply tank pressure drops below cut-in pressure. Compressed air then passes into the air dryer at the inlet port. Moisture-laden air and contaminants pass through the desiccant. Moisture is retained by the desiccant and collects in the base of the dryer. When the compressor reaches cut-out pressure (approximately 135 psi) the purge valve opens and the dryer purges and expels water collected in the dryer base. The regeneration valve opens sending a small charge of dry system air from the front air tank back through the dryer. The backflow dries the desiccant, preparing it for the next cycle.

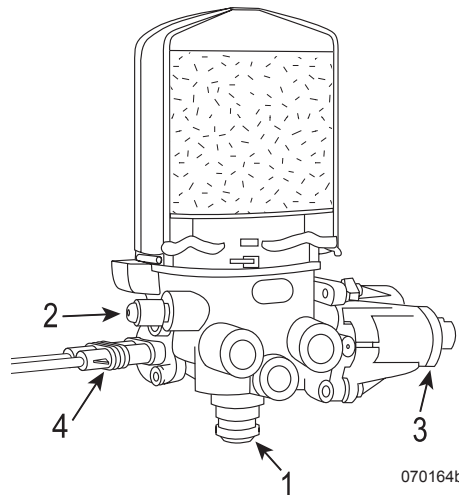
### Air Dryer Components:

**1. Purge Valve:** A valve located on the bottom of the air dryer base that remains open during a compressor unload cycle to allow collected moisture, condensation and contamination to expel from the air dryer during the purge cycle.

**2. Pressure Relief Valve:** Protects the air dryer from over-pressurization.

**3. Regeneration Valve:** Controls regeneration of the desiccant by allowing air from the supply and secondary tanks to bypass the outlet check valve.

**4. Heater Power Connection:** Provides 12 Volt DC power to the heating element.



In extreme cold, verify that the air dryer heater is in good working order. The 100-watt heater in the air dryer is controlled by ignition power. The heater turns on below 45° F. and off when the air dryer temperature is above 86° F.

### **WARNING:**

**Remove all pressure from the air system before disconnecting any component, including the desiccant cartridge. Pressurized air can cause serious personal injury.**

## Desiccant Cartridge

Warm, humid air from the compressor condenses into either water or water vapor. A desiccant-type air dryer protects the air brake system by drying moisture-laden air before it passes through the air reservoirs and into the brake system. The replacement kit contains one cartridge and one O-ring.



### To Replace the Cartridge:

1. Loosen and remove the old cartridge. Use a strap wrench, if necessary.
2. Remove and discard the O-ring from the dryer base.
3. **Inspect** and clean the seal seat. Repair any minor damage.

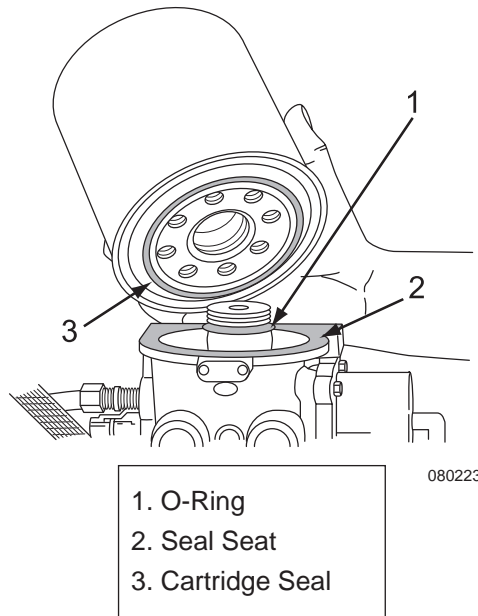
### **NOTE:**

**If the seats are damaged so badly that a tight seal cannot be maintained, replace the air dryer.**

4. Install a new O-ring.
5. Lubricate the O-Ring on the stem with a thin layer of grease.
6. Lubricate the cartridge seal with a thin layer of grease.
7. Thread the replacement cartridge onto the base until the seal touches the base. Tighten the cartridge **ONE** additional turn. **DO NOT OVERTIGHTEN.**

## REPLACEMENT REQUIREMENTS

Components	When to replace?	Why?
Desiccant Cartridge	<ul style="list-style-type: none"> <li>• Every two to three years.</li> <li>• When compressor is replaced</li> <li>• Water in supply tank</li> </ul>	<ul style="list-style-type: none"> <li>• Preventive maintenance</li> <li>• Contaminated cartridge</li> <li>• Saturated or contaminated cartridge, high duty cycle (wrong application of air dryer)</li> </ul>

**NOTE:**

If an excessive amount of water is present when performing the monthly air tank drain service, the filter for the air dryer may need to be changed.

**Desiccant-Type Air Dryer**

1. Warm, humid air from the compressor condenses into either water or water vapor before entering the air dryer.
2. A desiccant-type air dryer protects the motorhome air brake system by drying moisture-laden air before it passes through the air reservoirs and into the brake system.
3. Water collects in the base of the dryer when warm air condenses the water before it enters the dryer, or inside of the dryer before the water reaches the desiccant.
4. The desiccant material then removes additional water vapor, further drying the air.
5. During regeneration phase, the regeneration valve and pressure-controlled check valve remove water from the desiccant bed with a backflow of dried, expanded system air.

**Air Dryer Cycle**

The governor turns the compressor on when the supply tank pressure drops below cut-in pressure. Compressed air passes into the air dryer at the inlet port:

1. Moisture-laden air and contaminants pass through the desiccant.
2. Moisture is retained by the desiccant. Moisture also collects in the base of the dryer.
3. The governor turns the compressor off when the system reaches cutout pressure (approximately 135 psi).
4. The dryer purges and expels water collected in the dryer base.
5. When the regeneration valve opens, the dry system air flows back through the dryer. A small charge of air from the front air tank backflows through the filter. The backflow dries the desiccant, preparing it for the next cycle.

**AIR SPRING INSPECTIONS**

Items listed below should be checked when the motorhome is in for periodic maintenance.

**NOTE:**

Never attempt to service the air suspension on a motorhome with the air spring inflated.



- ◆ **Inspect** the **Outside Diameter (OD)** of the air springs. Check for irregular wear, heat cracking or chaffing.
- ◆ **Inspect** air lines to ensure contact does not exist between air line and OD of the air springs. Air lines can rub a hole in an air spring very quickly.
- ◆ Ensure there is sufficient clearance around the complete circumference of the air spring while at maximum diameter.
- ◆ **Inspect** the OD of piston for buildup of foreign materials. On a reversible sleeve style air spring, the piston is the bottom component of the air spring.
- ◆ The correct ride height should be maintained. All motorhomes with air springs have a specified ride height established by the manufacturer. This height should be maintained within ¼". This dimension can be checked with the motorhome loaded or empty.
- ◆ The leveling valves (or height control valves) assist in ensuring the total air spring system works as required. Clean, **inspect** and replace if necessary.
- ◆ Make sure to check shock absorbers for leaking hydraulic oil and worn or broken end connectors. If a broken shock is found, replace it immediately. The shock absorber will normally limit the rebound of an air spring and keep it from over extending.
- ◆ Check the tightness of all mounting hardware (nuts and bolts). If loose, tighten. **DO NOT** over-tighten.

### Cleaning:

The approved cleaning method is to use soap and water, methyl alcohol, ethyl alcohol or isopropyl alcohol. Unapproved cleaning methods include all organic solvents, open flames, abrasive and direct pressurized steam cleaning.

## HEIGHT CONTROL VALVES

**Height Control Valves (HCV)** inflate or deflate air springs to maintain proper suspension height throughout the load range. Two Height Control Valves are installed at the rear drive axle to control rear suspension height and left or right tilt of the motorhome. A separate HCV is installed to control front suspension height. The three HCVs mount to the main frame of the motorhome, above the axles, with a linkage rod connecting the valve to the axle.

Actuating components inside of the valves are oil dampened to reduce valve reaction to momentary suspension bounce and rebound. When a constant suspension change occurs, such as a load change or weight transfer through a sustained corner, the valve reacts by adding or purging air from the air springs as needed.

The air springs mount between the axle H-frame assembly and the two main frame rails. Air spring support plates mount to the main frame and the H-frame. There is a specified distance the air spring must maintain between the mounting plates. Other than specified distance between the plates will compromise ride quality and handling, and affect shock absorber travel, drive shaft angle, as well as various other running gear components.

## BRAKE SYSTEMS

### *Air Brakes*

The air brake system on the motorhome differs from a conventional automotive hydraulic braking system and should be treated differently. Proper maintenance and lubrication are the keys to keeping the air brake system in proper working order.

The air system supplies air to the foot brake or treadle valve. Pushing down on the treadle valve supplies an air charge signal to a sealed brake chamber, consisting of a spring and air bladder. The air charge signal pushes on the bladder and extends a threaded rod connected to the automatic slack adjuster, which rotates the S-cam and expands the shoes against the drum. Air disc brakes follow much the same principle, with the exception of the threaded rod directly activating calipers.

Consideration needs to be given to stopping distances and air system pressures. The motorhome requires longer stopping distances. Each brake application uses air from the air system, and engine speed is directly proportional to how fast that air system is replenished. Prepare for downhill grades. It may be necessary to select a lower gear and/or use the engine brake. Use individual, short brake applications down long hills rather than riding the brakes. This will extend the life of the brake lining. Avoid overheating the brakes. Hot brakes have less stopping power. When maneuvering the motorhome around small areas, or backing into spaces, several individual brake applications might be made. Watch the air gauge. When preparing to back into a space, swing the motorhome so it is aligned with the parking slot before backing up.

The air braking system on the motorhome is equipped with a low air pressure warning safety feature. Should a low air condition occur while the vehicle is in operation, a warning buzzer will sound and a dash warning light will illuminate at approximately 60 to 65 psi (pounds per square inch) to alert the operator.

### ***Park & Emergency Brake System***

The Park and Emergency Brake System (Spring Brakes) applies to the rear drive axle only. When the park brake is applied, air is released from the drive axle brake chambers, allowing the large spring in each rear brake chamber to push the brake pads against the rotor. The air system must be charged above 35 psi to allow the park brake to release. Pushing down on the park brake handle charges the rear brake chambers with air pressure, overriding the emergency brake springs and releasing the brakes. In the event of air loss while the vehicle is under operation, the park brake will automatically apply (this occurs at approximately 30 psi), acting as an automatic emergency brake system.

When preparing to depart, allow the air system to achieve full air pressure as indicated by the air gauge needles. Listen for the air dryer to purge, indicating that the air dryer is functioning. Look and listen for abnormalities. Abnormal air pressure readings by either needle of the air gauge alerts the operator to have the air system checked to avoid an untimely failure.

Should a failure occur in the air system, preventing the air pressure from building, it may become necessary to “cage” the spring brakes (**Section 2 Towing Procedures - Disabling Parking Brake**). This is an emergency procedure only. Caging the rear air brake chambers manually overrides the spring brakes and allows the vehicle to move. This procedure does not affect normal service braking.

#### **NOTE:**

**When the park brake is released, the Park illumination lamp will remain lit until air system pressure is above 65 psi.**

If the air system is not depleted when parked, it is possible to accidentally release the parking brake. Traveling with small children and/or pets may require fabrication of a small block to be placed under the park brake knob. A wooden clothes pin, clasped at the base of the shaft, will also work (block or clothes pin not included). Do not forget to remove before travel.

### ***Automatic Slack Adjuster***

The braking system is equipped with automatic slack adjusters. As brake lining wears, the slack adjusters will automatically ratchet on the return stroke as needed. This ratchet action will keep the brake lining at proper adjustment. Automatic slack adjusters and the connecting S-cam shaft require periodic lubrication and inspection.

#### **WARNING:**

**DO NOT manually adjust the slack adjusters. If any loss of braking effectiveness or abnormal braking indications are noticed, the brakes and slack adjusters should be inspected by a qualified brake technician.**

#### **NOTE:**

**Replacement parts should be of the same original equipment size and type. Mixing brake components may result in unequal braking action. Brake maintenance is not covered by the manufacturer.**

#### **WARNING:**

**Brake lining may contain asbestos material and should only be serviced by qualified service technicians who are trained in the appropriate precautionary procedures.**

### ***Brake Systems - Backup***

The motorhome air braking system is equipped with backup safety systems and warning alarms in the event of air system failure. For example: should the air compressor fail to charge the air system and low air gauge readings go undetected, a low air pressure warning buzzer will sound and a low air pressure dash warning indicator light will flash. These warning indicators occur at approximately 65 psi. This will alert the operator of an impending situation.

If the motorhome is allowed continued operation, the pneumatic emergency spring brake relay valve, installed in the air system, senses the low air pressure condition and will release the air charge from the spring brake air chambers on the rear drive axle. In this case, the park brake will automatically apply at approximately 30 psi. This safety backup system acts as an automatic emergency brake system.

Another backup safety is the air system separation of the front and rear brakes, implemented by using two air tanks. 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. This tank division gives reassurance in case one tank experiences the failure of an accessory air item that allows the compressed air to escape.

Accessory air items are other pneumatically operated items such as the air horn, vacuum generator, etc. The accessory air items operate only when air tank pressures exceed 65 psi. This is done with pressure protection valves. Should an accessory air item fail, the pressure protection valve (PPV) reserves the remaining air pressure of 65 psi for braking. This will leave the motorhome with one air tank fully charged for safety backup.

The rear air tank also has a safety backup - the safety inversion valve. The inversion valve senses the absence of rear air tank pressure. In this case the inversion valve will allow the operator to make a modulated spring brake application, which is 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 is made. This backup system implements use of all the brakes, allowing the operator to bring the motorhome a safe stop. In case of all compressed air charge escaping from the front air tank, the operator will still have full use of the rear brakes.

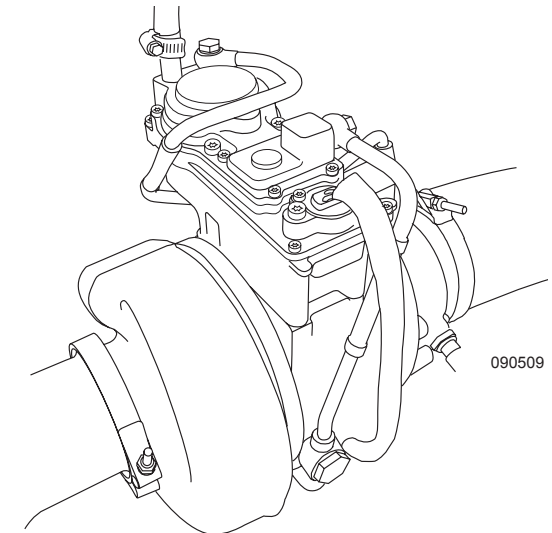
## BRAKE - AUXILIARY

Auxiliary braking systems are designed to supplement the standard wheel braking system. The auxiliary brake is not designed to bring the motorhome to a complete stop; however, it can assist in controlling the speed of the motorhome. Use of the auxiliary braking can extend service life of brake linings.

### *Exhaust Brake*

The exhaust brake switch (located on the driver's console) activates the auxiliary brake integrated in the variable geometry turbocharger. The auxiliary brake will operate when the dash switch is ON and throttle is released.

When the auxiliary brake is activated, backpressure in the engine will cause the motorhome to slow down. The amount of engine braking power developed is related to engine speed (RPM). As engine speed reduces, the transmission will automatically down shift to the next lower gear to maintain effectiveness of the auxiliary brake.



*Variable Geometry  
Turbo Charger*

### **NOTE:**

**The brake lights will illuminate while the Exhaust Brake is applied.**

## ABS/ATC SYSTEM

The motorhome is equipped with an Anti-lock Braking System (ABS) and Automatic Traction Control system (ATC). The ABS system monitors wheel rotation speeds by using a 100 tooth magnetic tone ring mounted to the hub. Revolving with the wheel, the magnetic tone ring is polarized, giving positive and negative pulsations. A stationary sensor is mounted adjacent to the tone ring to monitor magnetic pulses. The pulses are monitored by the ABS electronic control unit (ECU).

The ECU monitors all wheel sensors at the rate of 100 times per second. The ECU controls Pressure Modulator Valves. Pressure Modulator Valves have two electric-over-air solenoids – a hold solenoid and a release solenoid. The modulator valves are open under normal braking, allowing a straight through air signal from the treadle valve to the brake chamber. Should a wheel lose traction under a braking application, the ECU will energize the hold solenoid of the Pressure Modulator Valve to interrupt the air signal from the treadle valve to the brake chamber. The release solenoid vents the existing air signal, at the brake chamber to the atmosphere, allowing the skidding tire to regain traction. Skidding tires have less tractive efficiency. It is possible under certain conditions to have the wheel(s) skid with a normally functioning ABS system.

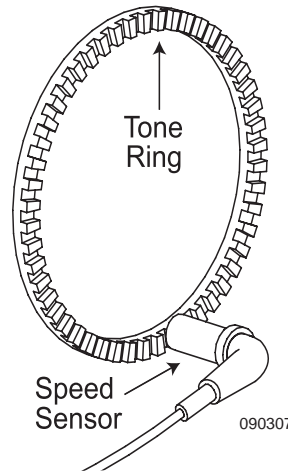
The ABS itself does not apply additional braking power. The purpose of the ABS is to limit wheel lock and decrease stopping distance. Cautious driving practices and maintaining a safe distance when following vehicles is the key to safe vehicle operation.

### **WARNING:**

**The ABS/ATC system is designed to increase tire to road surface traction but cannot overcome naturally occurring laws of physics. The ABS/ATC system combined with safe driving practices will reduce the possibility of wheel skid and loss of lateral stability.**

### **ABS Component Function:**

- ◆ Speed sensors and tone rings on each wheel monitor wheel rotation.
- ◆ Each speed sensor communicates wheel rotation pulses to the Electronic Control Unit.
- ◆ The ECU receives the speed sensor signal pulses to calculate speed and acceleration rates of each wheel.
- ◆ Based on the speed sensor input, the ECU detects impending wheel lock and operates the ABS Modulator Valves required for proper control. The Modulator Valves are operated in the Air, Release or Hold modes to regulate air pressure to the brake chambers.
- ◆ Braking force is applied at a level that minimizes stopping distance while maintaining as much lateral stability as possible.



### **ABS Warning Light:**

The ABS will perform a dash indicator lamp check and self-diagnostic test each time the ignition is switched to the ON position.

- ◆ When the ignition is turned on, the ABS indicator illuminates momentarily (five seconds) verifying the self-diagnostic test. If the ABS indicator light remains on, or illuminates while the motorhome is being operated, this indicates a fault in the anti-lock brake system. This fault will not affect normal service braking. Take the motorhome to a service center for repairs.

### **INFORMATION:**

**If a fault code occurs, call a Bendix service locator at 1-800-247-2725 and take the motorhome to the nearest repair facility.**

### **ABS Diagnostic Button:**

By properly actuating the ABS diagnostic button (located under the dash to the left of the steering wheel), system configuration codes and fault codes can be retrieved as blinked sequences on the ABS warning light. System configuration codes are sequences of six blinked digits while fault codes are sequences of two blinked digits. Refer to an authorized Bendix service center for a list of blink code sequences. If the Diagnostic button is not pressed correctly for a specific readout, stop and start over at the beginning of the procedure.

### **NOTE:**

**All blink codes are displayed by the ABS warning light only.**

The blink code switch is capable of performing several diagnostic mode functions. At Ignition On, a two second delay must be observed prior to pressing the diagnostic button. For functions requiring multiple presses, the delay between presses cannot be longer than two seconds.

- ◆ Press once for Active Code retrieval.
- ◆ Press twice for Inactive Code retrieval.
- ◆ Press three times to clear Active codes.
- ◆ Press four times for System Configuration check.
- ◆ Press five times for Dynamometer Test Mode.
- ◆ Press seven times to Reconfigure ECU.

**NOTE:**

**Reconfigure Mode is entered by holding the switch in prior to “ignition on.” Once ignition is on, release the switch and press seven times.**

**ATC System:**

The ATC system improves traction on slippery or unstable road surfaces by limiting excessive drive wheel slip. This is accomplished in two ways – limiting engine torque to the drive wheel or engaging a brake to the spinning drive wheel.

Engine torque is unaffected during normal operation. The ATC system works in conjunction with the ABS Electronic Control Unit. The ECU monitors tone ring speed of the drive wheel in relation to the other wheels. If a speed differential occurs in the drive wheel, the ECU enters Automatic Traction Control mode.

During an ATC event, the ECU will automatically react to optimize traction and safety if the motorhome encounters a slippery road surface. Engine torque is normally reduced to limit drive wheel slip.

**NOTE:**

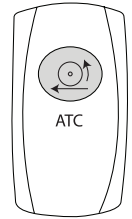
**The ATC system is always active.**

**ATC reacts to drive wheel slip by:**

- ◆ Reducing engine torque to the drive wheel if road speed is above 25 mph.
- ◆ Reducing engine torque and activating drive axle brake controls if road speed is below 25 mph. If the brake control activates, it remains active regardless of road speed.

**ATC Switch:**

Activating the ATC switch reduces ECU control over engine torque. Momentarily pressing the ATC switch allows the ECU to increase the amount of engine torque applied to the drive wheel in an ATC event. The amount of engine torque applied to the drive wheel will vary with the amount of drive wheel slip versus road speed. In an ATC event, the ECU remains active regardless of road speed or switch position.



080375o

Located on Driver Console

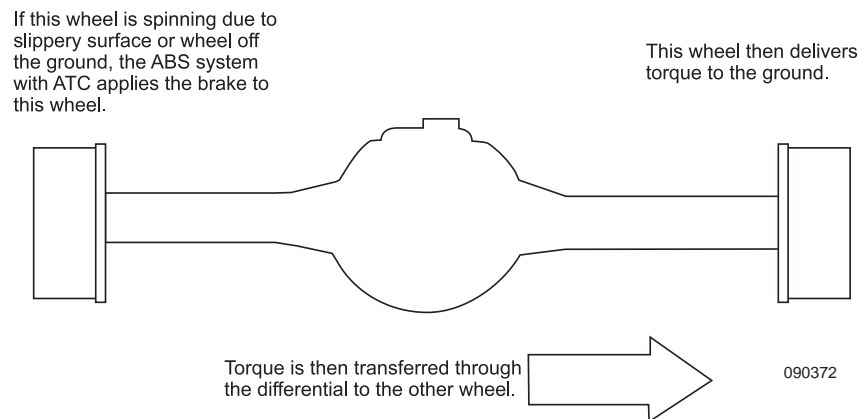
**ATC Indicator Light:**

During normal operation, the ATC indicator light on the dash will illuminate when the ignition key is turned ON until the first brake application. If an ATC event occurs, the indicator light will flash quickly. The indicator light will flash slowly if the ATC switch is activated.

**CAUTION:**

**Normally the switch should remain inactive. During an ATC event (drive wheel slip) the ECU will automatically optimize drive wheel traction in most situations. Activating the switch during periods of wheel slip can increase torque to the spinning drive wheel. Drive train damage can occur if the spinning drive wheel should suddenly regain traction. If the motorhome is stuck it is advised to call a professional towing company to limit the possibility of body and drive train damage.**

**How Automatic Traction Control (ATC) Works**



## FRONT AXLE

While driving the motorhome, be aware of any changes in the feel of steering and have the system checked when noting apparent differences. It is normal to hear some hydraulic noise from the steering, especially when the steering is at maximum, or while turning the wheel when the motorhome is stationary. Investigate any unusual or loud noises that occur. Begin by checking the level of the hydraulic fluid. Traveling at slow speeds over rough surfaces may cause a “clunking” noise to emanate from the steering column, but if noise is heard on smooth surfaces while sharply turning back and forth, the noise should be inspected and repaired as necessary.

Shimmy and looseness should be checked and corrected as soon as possible. If looseness is felt in the steering, the steering linkages can be observed while someone turns the steering wheel left and right. Watch the linkages for evident play or uneven interaction between components to help pinpoint a problem. Wheel bearings should be cleaned and repacked with high temperature disc brake grease every 30,000 miles. Have the steering system and tires checked for damage after a severe impact, such as striking large potholes or curbs, and front-end collisions. Observe the alignment of the steering wheel; a change in the alignment may indicate damage to the steering components or suspension.

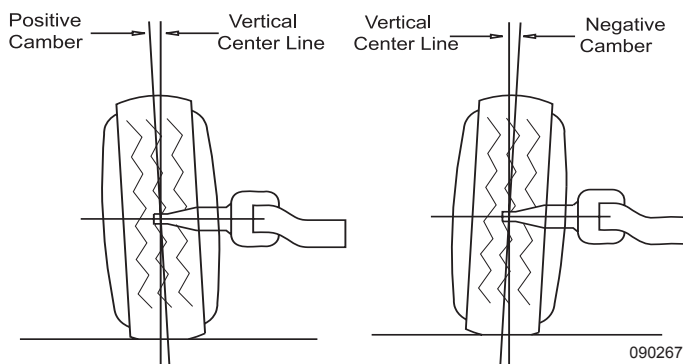
Maintenance for the system entails adequate lubrication. Use only a hand operated grease gun on the fittings. Grease fittings for the steering system are found on the both ends of the drag link (the bar connecting the steering gear to the axle), and on the intermediate steering shaft located between the steering wheel and steering gear. Proper front end alignment promotes longer tire wear and ease of handling while minimizing the strain on the steering system and the axle components. Use NLGI #2 Lithium soap base lubricant for all steering linkage and brake components.

### Alignment

#### Camber:

Camber, as shown, is vertical tilt of wheel as viewed from the front of the motorhome. This is machined into the axle when manufactured and is not adjustable.

- ◆ **“Positive”** camber is an outward tilt of the wheel at the top.
- ◆ **“Negative”** camber is an inward tilt of the wheel at the top.

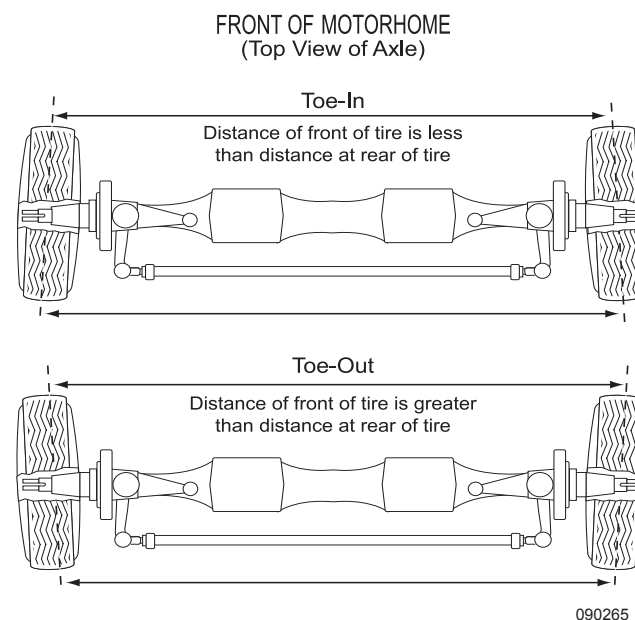


#### Toe Setting:

The toe setting represents different distances between the front and rear of the tires (measured at the vertical center line of the tires).

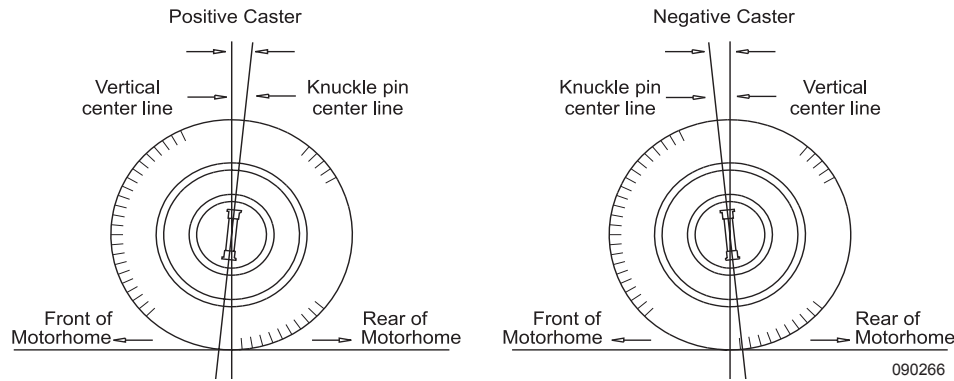
**Toe-in:** Occurs when the tire front distance is less than the tire rear distance.

**Toe-out:** Occurs when the tire front distance is greater than the tire rear distance.



Wheels are generally set with initial toe-in. As the motorhome operates tires tend toward a toe-out condition. By starting with an initial toe-in setting, a desirable “near zero toe-in” can be achieved when the motorhome is in motion.

Incorrect toe settings, whether toed-in or toed-out, can have a significant affect on tire wear. The toe setting is adjusted by lengthening or shortening the cross tube.



**Caster Adjustments:**

Caster is the fore and aft tilt (toward the front or rear of the motorhome) of the steering kingpin as viewed from the side of the motorhome.

“Positive” caster is the tilt of the top end of the kingpin toward the rear of the motorhome.

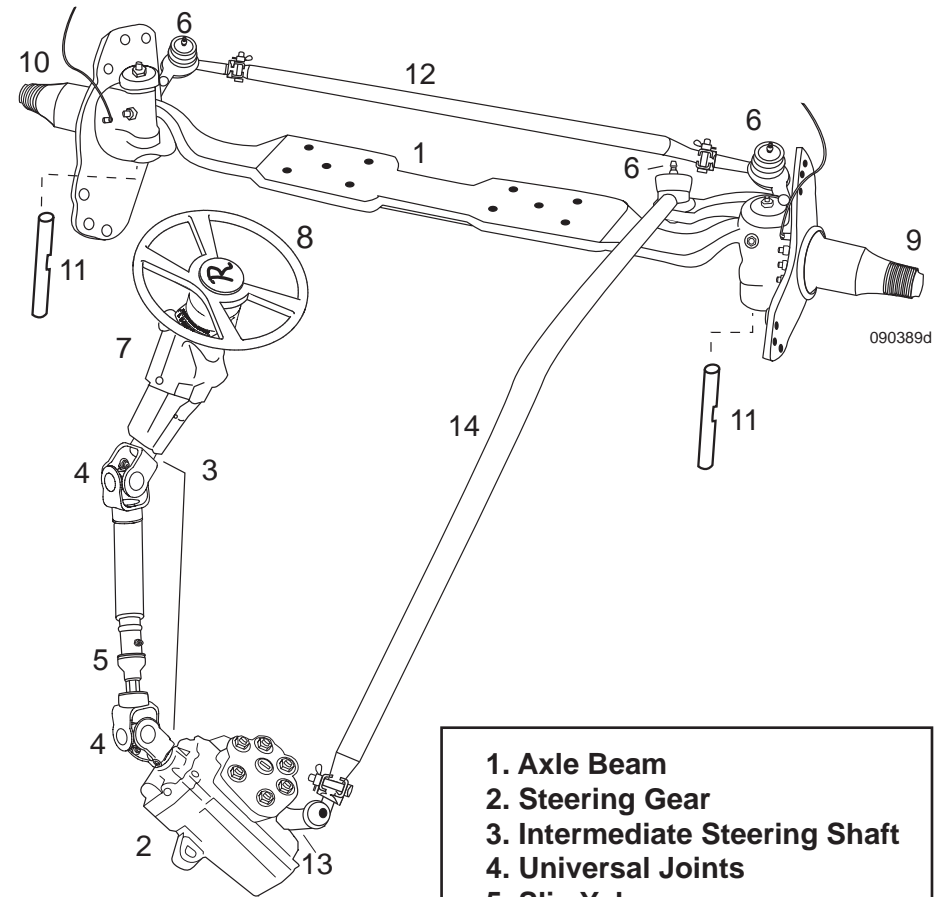
“Negative” caster is the tilt of the top end of the kingpin toward the front of the motorhome.

Setting the caster angle more positive than specified may result in excess steering effort and/or shimmy. Decreasing the angle may result in the motorhome wandering or poor steering return to center. The caster angle is determined by the installed position of the steer axle.

**WARNING:**  
DO NOT place yourself under the motorhome without first properly blocking frame (jackstands) from coming down in case of rapid deflation of air system.

**NOTE:**  
Suspension and steering components are lubricated at the factory using Texaco Starplex NLGI 2 Lithium Soap based grease.

**Steering Components**

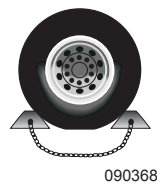


Typical Steering Components

- 1. Axle Beam
- 2. Steering Gear
- 3. Intermediate Steering Shaft
- 4. Universal Joints
- 5. Slip Yoke
- 6. Tie Rod End
- 7. Steering Column
- 8. Steering Wheel
- 9. Left Knuckle Assembly
- 10. Spindle
- 11. Kingpin
- 12. Centerlink
- 13. Pitman Arm
- 14. Drag Link

**Lubrication Maintenance Safety**

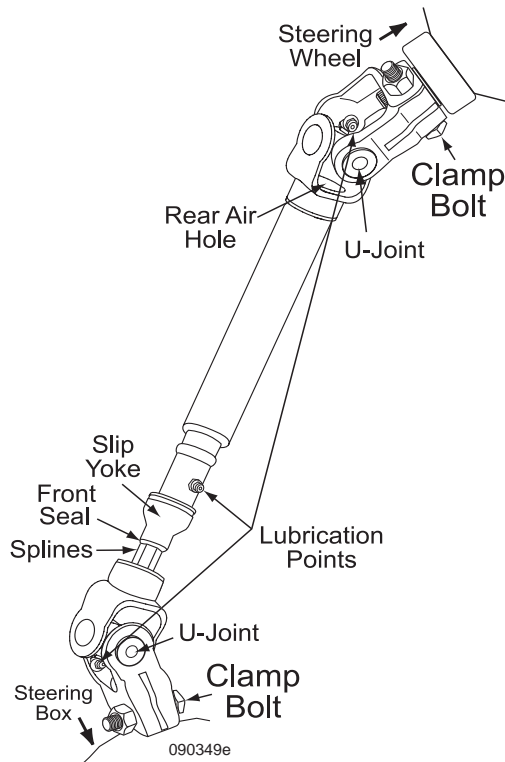
The front axle components require periodic lubrication maintenance. Chock wheels for safety prior to accessing components underneath the motorhome.



## Steering Column

The intermediate steering shaft connects the steering wheel to the steering box. Service the intermediate steering shaft universal joints and slip yoke every 30,000 miles or annually. Check the torque on the clamp bolt (48 ft. lbs. for 3/8" and 75 ft. lbs. for 7/16") at least every five years or 50,000 miles.

Remove the steering column cover to access the upper universal joint and slip yoke lubrication points. The lower universal joint is accessed from underneath in the generator compartment behind the front electrical box.



Intermediate Steering Shaft: Torque clamp bolt to 48 ft. lbs. for 3/8" and 75 ft. lbs. for 7/16".

### **WARNING:**

**DO NOT** place yourself under the motorhome without first properly blocking frame (jackstands) from coming down in case of rapid deflation of air system.

### Greasing the Intermediate Steering Shaft Universal Joints:

1. Check the shaft for looseness. Repair if loose or worn.
2. Apply the specified grease at the grease fitting on the universal joint. Apply until the new grease purges from all the seals.
3. If the new grease does not purge from the seals, disassemble and clean the joint or replace the universal joint. **DO NOT** lose the needle bearings.

### Greasing the Intermediate Steering Shaft Slip Yoke and Splines:

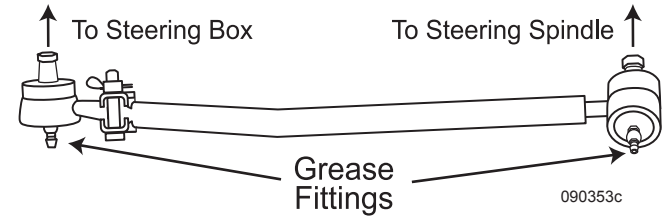
1. Check the shaft for looseness. Repair if loose or worn.
2. With finger, cover the rear air hole so grease flows to the front seal. Apply the specified grease at the grease fitting on the slip yoke. Apply until new grease purges and forces finger away from the air hole in the end of the slip yoke. Greasing interval is yearly or every 30,000 miles.

## Drag Link

The drag link connects the steering gear pitman arm to the steer axle. The movable joint uses sealed boots to prevent water intrusion. **DO NOT** rupture the boot when applying grease. Grease interval is six months or every 5,000 miles.

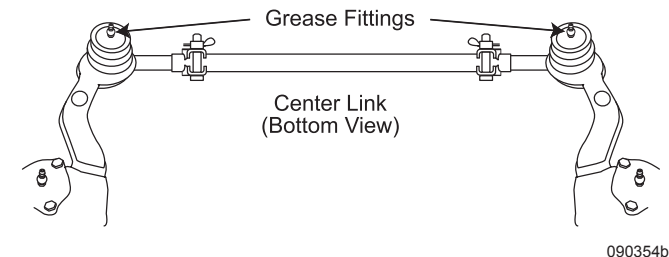
### **NOTE:**

**It will be necessary to start the motorhome and turn the steering wheel to access fitting(s).**



## Center Link

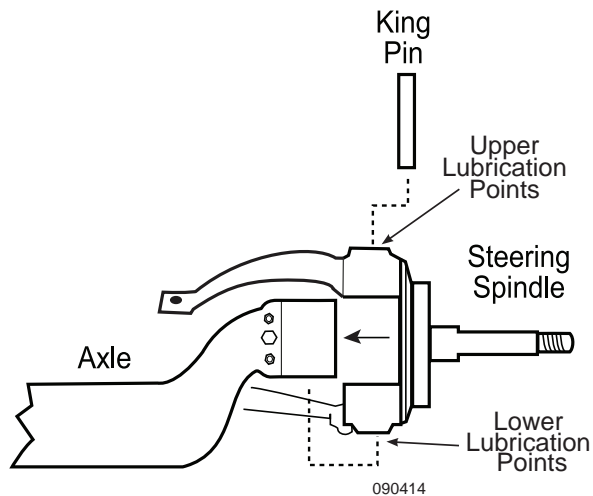
The center link is located on the backside of the steer axle. The center link attaches the two wheels together causing the right front to track with the left front. Greasing interval is every six months or 5,000 miles.





## Steering Spindles

The steering spindles attach to the front axle and pivot on the kingpin. The wheel end assembly and brake system attach to the spindle. There are upper and lower lubrication points for the kingpin. The drag link attaches to the roadside spindle. After initially lubricating the roadside and curbside kingpins, rotate the steering assembly lock to lock (full left to right) then move assembly back to center. This purges any remaining air pockets. Continue lubricating the kingpins until new grease purges with no air pockets. Greasing interval is every six months or 5,000 miles.



## Control Arm Bushings

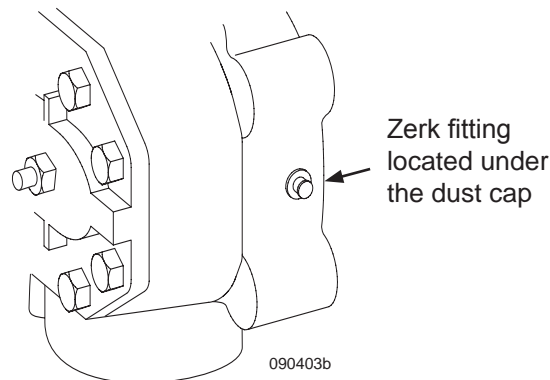
Control arms align the axles perpendicular with the frame. The panhard bar controls side to side motion of the axles in the frame. Control arm bushings and panhard bar bushings do not require lubrication.

## Steering Gear

Lubricate the steering gear at least twice a year. The grease fitting is located on the housing trunnion. Use NLGI grade 2 multipurpose chassis lube and use only a hand operated grease gun. Add grease until it begins to extrude past the sector shaft seal.

Power steering is provided by using hydraulic pressure to assist in rotating the output shaft of the steering gear. A poppet valve and worm drive are located at the end of the steering gear input shaft. The poppet valve directs the hydraulic fluid pressure to a type of spool; the worm drive threads in the center of the spool. When in the center position, pressurized hydraulic fluid bypasses the spool. When a turn is made, the poppet valve shifts to one direction or the other, directing the hydraulic pressure to one side of the spool depending on turning direction. The hydraulic fluid is then cooled before returning to the reservoir.

**NOTE:**  
Inspect for signs of leakage when performing fluid level checks.



Steering Gear - Rear View

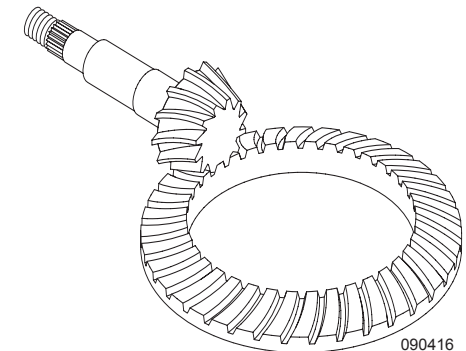
Change the hydraulic filters in the engine compartment at regular intervals to help ensure trouble-free operation.

## DRIVE AXLE & DRIVE SHAFT

### Drive Axle:

The chassis drive axle is a single reduction axle. The differential gears consist of a hypoid pinion and ring gear set and beveled differential gears. The differential carrier can be removed from the axle housing as a unit in order to perform repairs.

All power from the engine to the rear tires is transferred through the rear axle. For this reason, it is important that maintenance be performed on the axle as required to avoid premature wear of the gears and bearings in the axle.



Ring and Pinion Gears

### Drive Axle Lubricant:

The rear axle is filled with 80w-90 gear oil meeting SAE J 2360 specifications. Change interval is every 250,000 miles or 36 months, whichever occurs first.

During a lubricant change, fine metal particles may be observed clinging to the magnetic fill and drain plugs of the axle. These particles are normal wear particles from the axle components, but will cause faster than normal wear of the axle components if allowed to circulate through the lubricant. It is recommended that the magnetic plugs be tested, and if necessary, replaced at each lubricant change. These plugs should have sufficient magnetic strength to pick up 1.5 lbs. of low carbon steel. Never replace a magnetic plug with a non-magnetic “pipe plug” as they will not keep the lubricant clear of metal particles or properly seal.

The level of lubricant in the rear axle should be checked every 30,000 miles or annually, whichever occurs first. This will ensure adequate lubricant in the axle for proper operation. Regular inspection of the drive axle lube levels is an essential maintenance procedure.

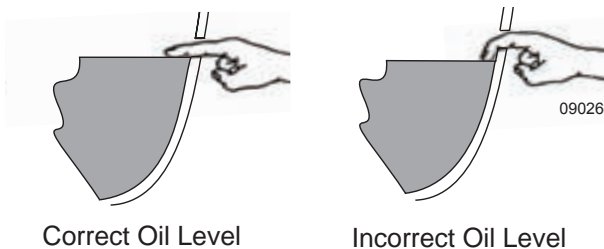
**WARNING:**

**Never place yourself under the motorhome without first properly blocking frame (jackstands) from coming down in case of rapid deflation of air system.**

**Proper Drive Axle Lubricant Level:**

- ◆ With the motorhome parked on a level surface and rear axle warm, place a large container under axle.
- ◆ Clean the area around the fill plug, which is located approximately halfway up the axle housing bowl.
- ◆ Remove the fill plug and observe the lubricant level.

- ◆ The lubricant should be level with bottom of the hole.
- ◆ Important: The lube level close enough to the hole to be seen or touched is not sufficient. The lube must be level with the hole.
- ◆ Correct the level as necessary.
- ◆ Re-install the fill plug and tighten to 35 to 50 ft. lbs.



**To Drain and Replace Lubricant:**

1. Place a large container under the axle.
2. Remove drain plug and allow axle to completely drain.
3. Properly dispose of oil.
4. Clean the drain plug and test (replace the drain plug if needed).
5. Install and tighten drain plug to 35 to 50 ft. lbs.
6. Clean the area around the fill plug from the axle-housing bowl.
7. Fill the axle with approved lubricant until the level is even with the bottom of the fill plug hole.



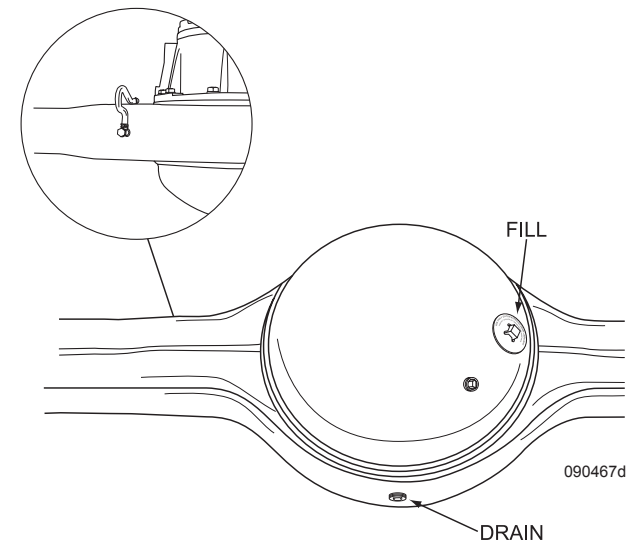
Fill Plug

**WARNING:**

**When checking or changing the lubricant, always ensure that the axle is not hot. Oil temperature 90° F. or hotter can easily cause severe burns.**

**NOTE:**

**When checking the lube level also check the housing breathers on top of axle housing. Clean the breathers if dirty or replace them if damaged.**



**Drive Shaft:**

The drive shaft transfers the power produced by the engine to the drive axle. A worn or out of balance drive shaft causes chassis vibration that generally increases in intensity with road speed.

**Lubrication Maintenance:**

The drive shaft requires periodic lubrication maintenance. Lubricate the slip joint and universal joints every 5,000 miles or six months, whichever occurs first. Use NLGI #2 chassis lubricant.

**NOTE:**

**It will be necessary to move the motorhome forward or backward to access all fittings on the drive shaft.**

**Greasing the Drive Shaft Universal Joints:**

1. Check the drive shaft for looseness. Repair if loose or worn.
2. Apply specified grease at grease fitting on the universal joint. Apply until new grease purges from all the seals.
3. If new grease does not purge at the seals, loosen bearing cap bolts and re-grease until all four caps purge. If new grease still does not purge, disassemble and clean or replace the universal joint.

**NOTE:**  
Depending upon application universal joints may have two grease fittings each. It is necessary to apply grease to each fitting to properly lube the universal joint.

**Greasing the Drive Shaft Slip Yoke and Splines:**

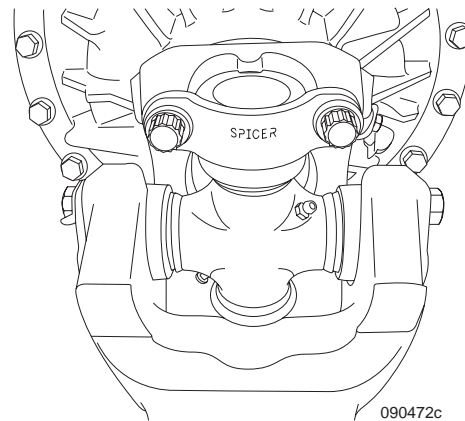
1. Check the drive shaft for looseness. Repair if loose or worn.

2. With finger, cover the rear air hole so grease flows to the front seal. Apply the specified grease at the grease fitting on the slip yoke. Apply until new grease purges and forces finger away from the air hole in the end of the slip yoke.



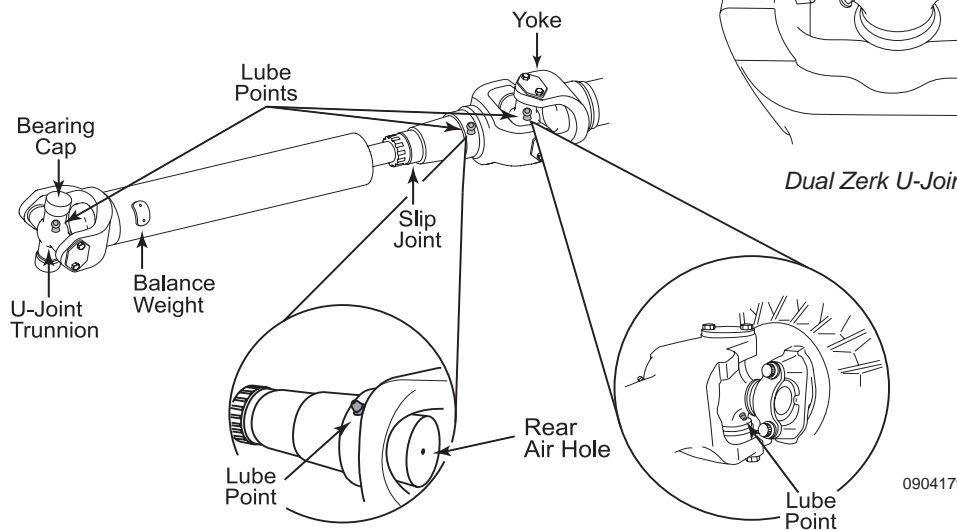
090341

**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.



090472c

Dual Zerk U-Joint



090417f

**TAG AXLE (42' Only)  
Tag Axle Switch**

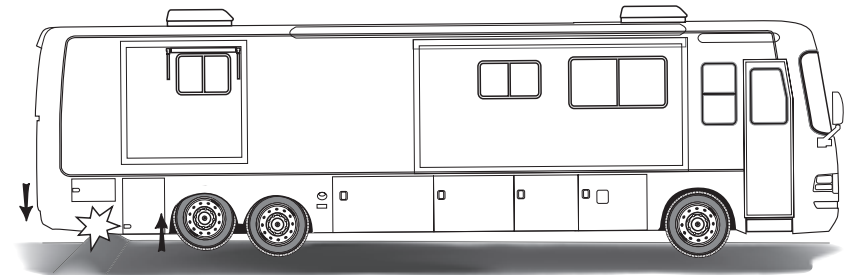


080504j

**Hydraulic Leveling Only:**

A stand alone switch is used to raise or lower the tag axle. The tag axle switch is located on the driver's console. Two lights are located on the switch: the tag axle icon will illuminate with the park lights and the lower bar light will illuminate when the tag axle switch is on and the transmission is in neutral, reverse or first gear. When the transmission is in second through sixth gear, the tag axle is automatically lowered and the light is off. A beeping alarm sounds when the switch is on. Raise the tag axle when performing tight maneuvers at less than 5 mph to reduce turn radius and prevent the tag axle tires from scuffing.

**NOTE:**  
A specific height is not required with the tag axle in the up position; however, the tire should be off the ground.

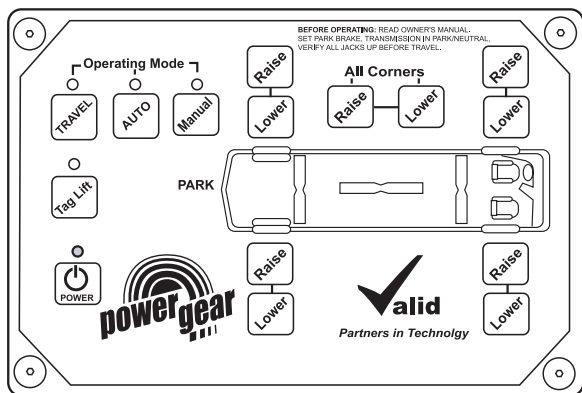


090507

Raising the tag axle reduces road clearance.

### Air Leveling (Optional):

The tag axle switch is integrated into the air leveling pad located on the driver's console. Pushing the "Tag Lift" button will illuminate the corresponding LED and raise the tag axle. The tag lift feature uses a two minute delay at each ignition cycle to ensure enough air pressure is available to raise or lower the tag axle. After starting the engine, press the Travel button to begin the time delay. After approximately two minutes the tag axle LED will stop flashing, indicating the time delay is over and the tag axle can be raised. The tag axle will automatically lower when speed approaches 10 mph.



Tag Axle Switch

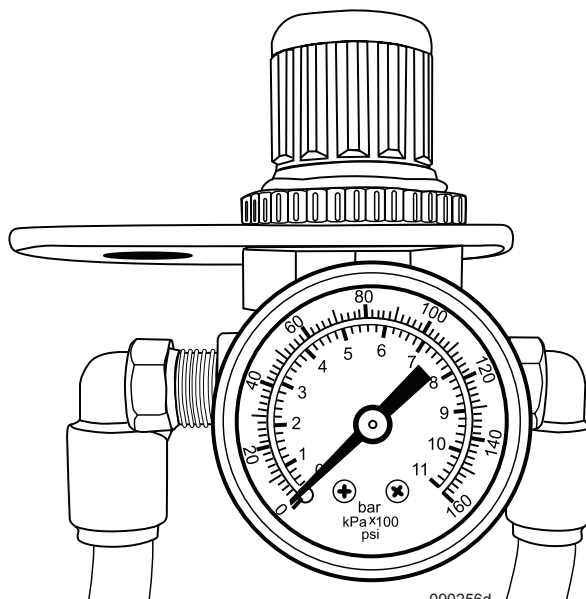
020307c

### Adjusting Tag Axle Load

An adjustable pressure regulator located in the engine compartment sets the amount of air pressure in the tag axle air bags. The amount of down force applied to the tag axle is controlled by the amount of air pressure in the tag axle air bags. Changing the amount of weight carried by the tag axle affects weight distribution between the tag, drive and steering axles. 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, weigh the motorhome after it has been loaded for travel. See Section 2, "Weighing the Motorhome" for adjustment instructions.

#### NOTE:

The tag axle pressure regulator valve is located in the engine compartment on the curbside.



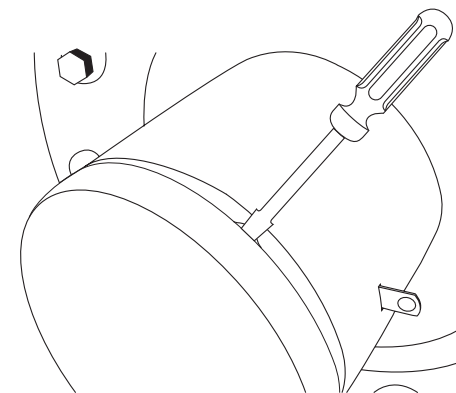
090256d

### Tag Axle Lubrication

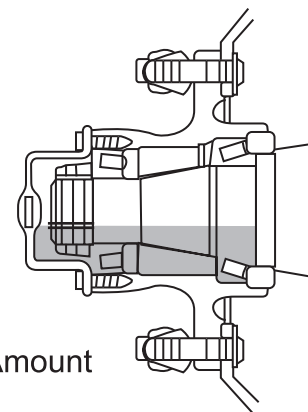
All tag axles use oil to lubricate the wheel bearings. The oil is drained and refilled without removing the wheel end assembly. Remove the hubcap to access the bearing cover and drain plug.

#### INSPECTION:

Inspect the oil level before every trip and every 5,000 miles. The motorhome should remain motionless for at least 30 minutes in order to stabilize oil level before inspecting.



090312c

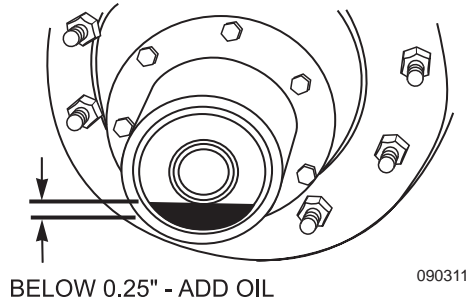


Shading Indicates Correct Amount of Oil

090312b

**To inspect the oil level:**

- ◆ The motorhome must remain stationary for 30 minutes.
- ◆ Remove the chrome hubcap.
- ◆ Locate the full and add mark on the outside of the clear plastic cover.
- ◆ If the lubricant is low, add recommended fluid to proper level.

**Oil Change Intervals**

The recommended oil change interval is based on operating conditions, speeds and loads. Limited service applications may allow the recommended interval to increase. Severe applications may require the recommended interval to reduce. For more information, contact a Dana/Eaton service representative.

**Recommended Interval Change:**

- ◆ Change the fluid whenever the seals are replaced, the brakes are relined or at 30,000 miles (48,000 km). 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 the fluid twice a year (spring and fall).

**Lubricant Type:**

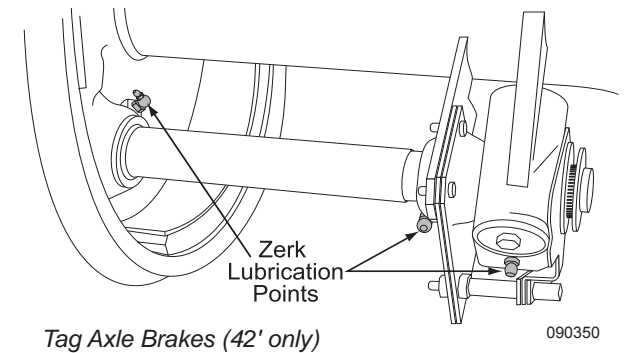
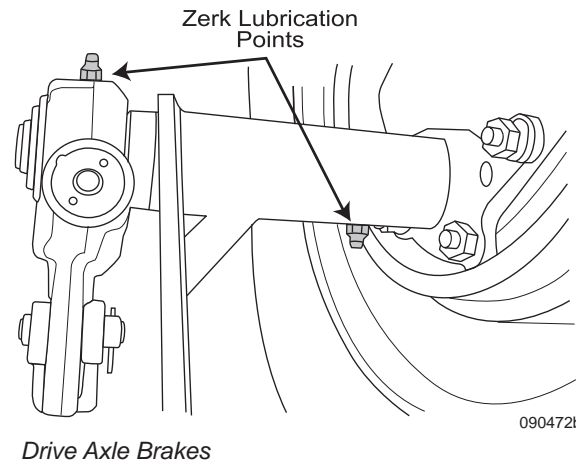
- ◆ Texaco Star Gear Lubricant SAE 80w/90. Specifications state a minimum ambient temperature of  $-15^{\circ}\text{F}$  ( $-26.1^{\circ}\text{C}$ ). There is no maximum ambient temperature. Lubricant temperature must never exceed  $250^{\circ}\text{F}$  ( $+121^{\circ}\text{C}$ ).

**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.

**DRUM BRAKE MAINTENANCE**

The drive and tag axle (42' only) slack adjusters and "S" cam shafts require periodic lubrication to ensure proper brake operation. Lubricate every 10,000 miles or three months.



Tag Axle Brakes (42' only)

090350

**SHOCK ABSORBER**

The shock absorber is a hydraulic device used to dampen suspension/body movement. Road surface irregularities are compensated for by the shock absorber.

The Roadmaster chassis incorporates the shock in the design of the exclusive air glide suspension system. This shock absorber is a telescopic, mono tube unit filled with nitrogen gas and hydraulic oil. The result of the mixture is uninterrupted damping for the smallest of wheel deflection.

By design, a self-lubricating seal is used to allow approximately 10% of the total oil capacity to pass onto the piston rod. The gradual process of oil loss does not affect performance of the shock absorber during service life. This process will be evident after a long period of service by an oil film on the body of the shock absorber. Coating or film on the body or rod is indication the shock is functioning normally.



090315

Road holding, handling, balance and braking characteristics all can be contributed to the shock absorber. The operating conditions for which the shock absorber must endure will determine the life span. However, since the only moving part is the piston rod, there are no springs, hinges or pins to wear out, get weak or deteriorate.

## LEVELING - HYDRAULIC

The leveling system is designed to reduce sight selection problems and stabilize the motorhome when parked. The leveling system features a remote control panel on the driver's console. The multiple warning system consists of a Jacks Down LED and warning alarm if a jack is down and the park brake is released. The leveling system can be operated in manual or automatic modes.

### Safety Features:

The leveling system has safety features to prevent a jack from extending during travel. The control panel will not activate until the following safety features are in place.

- ◆ Transmission is in Neutral.
- ◆ Parking brake is applied.
- ◆ Ignition switch is ON and the engine is running.

### Control Panel:

The control panel includes four jack extend switches, an Auto switch, a **MAN** (manual) switch, a retract All Jacks switch and a power **ON/OFF** switch. A LED next to a directional button indicates that position is low.

### Indicator Lamps:

- ◆ **MAN** – Indicates system is in manual level mode.
- ◆ **AUTO** – Initiates Automatic level mode.
- ◆ **ON/OFF** – Turns the leveling system on or off.
- ◆ **JACKS DOWN** – Indicates one or more jack is extended.
- ◆ **LOW VOLTAGE** – Indicates chassis voltage is low.
- ◆ **ENGAGE PARK BRAKE** – Indicates the Park Brake is disengaged.
- ◆ **EXCESS SLOPE** - Site is not level enough for system to compensate. Move to a more level site.

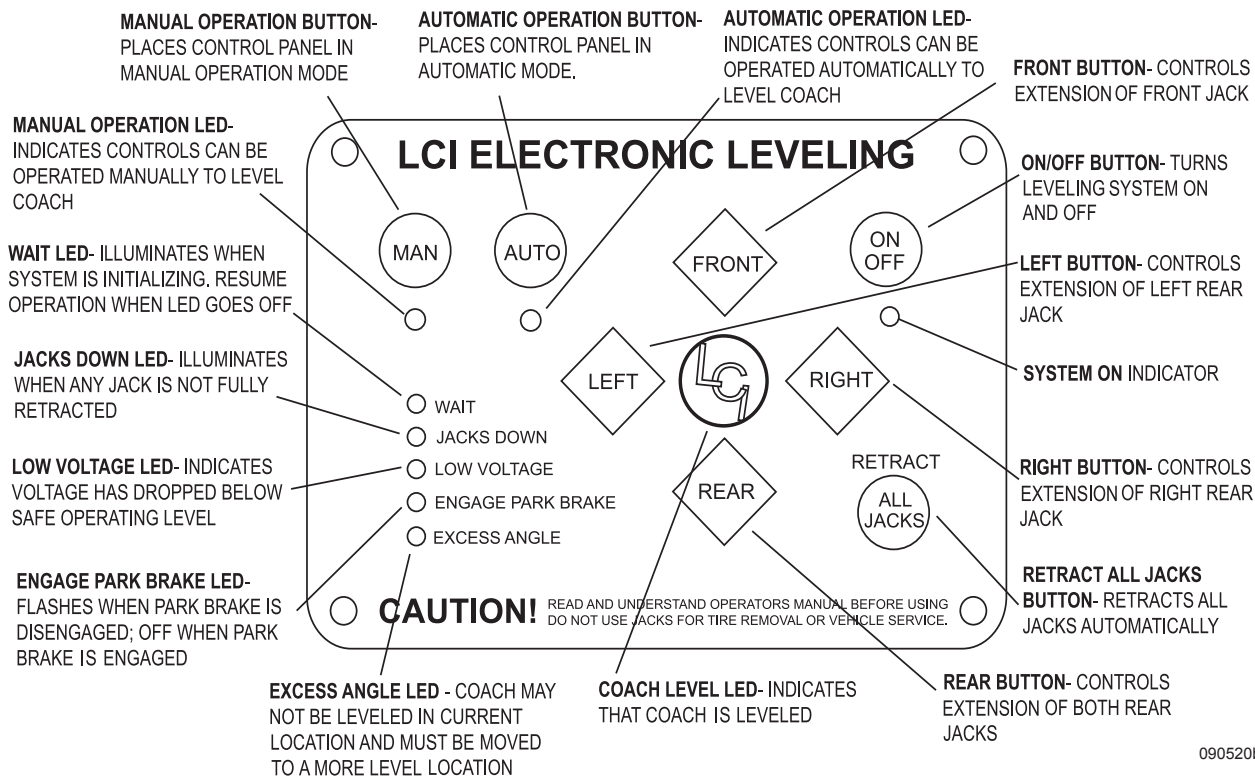
- ◆ The LED adjacent to any extend switch indicates that position is low.

### CAUTION:

**The leveling jacks are not designed for changing tires. Using the jacks to elevate any wheel position off the ground will cause problems with the suspension system, frame alignment and damage to the windshield.**

### CAUTION:

**DO NOT move the motorhome while the jacks are still in contact with the ground or extended. Damage to the jacks can occur.**



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### Prior to Leveling

- ◆ Chassis battery voltage must be at least 12 Volts DC.
- ◆ Select as level a site as possible. When the coach is parked on an excessive slope the leveling requirements may exceed the jack lift stroke capability. If the motorhome is parked on an excessive slope, the motorhome should be moved to a more level surface before the leveling system is deployed.
- ◆ Apply the parking brake. Place the transmission in Neutral.
- ◆ With the ignition on, push and hold the Air Dump switch to lower the suspension. This reduces the amount of jack extension required to make contact with the surface.

#### **CAUTION:**

Survey the area around and under the motorhome for obstruction that can damage the motorhome or undercarriage components before lowering the air suspension. Damage to the mud flap may occur if it is located over a raised area.

#### **CAUTION:**

Ensure potential jack contact points are clear of obstruction or depression before operation. Keep all people clear of the motorhome during the leveling system operation. Never expose hands or other parts of the body near hydraulic leaks. Hydraulic lines are under high pressure. Oil leaks may cut and penetrate the skin causing serious injury.

#### **CAUTION:**

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



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Properly chock the wheels to prevent the motorhome from rolling.

### Operation

#### **Automatic Leveling:**

- ◆ Follow the instructions in *Prior to Leveling*.
- ◆ Start the engine. The engine must be running for the leveling system to operate.
- ◆ Press the ON/OFF button to turn the system on.
- ◆ Press the Auto switch. The pump motor activates and the appropriate jacks automatically extend and level the motorhome. After starting the automatic leveling cycle, do not move around in the motorhome until the unit is level and the green LCI logo illuminates in the center of the touch pad. Failure to remain still during the leveling cycle could affect the performance of the leveling system.

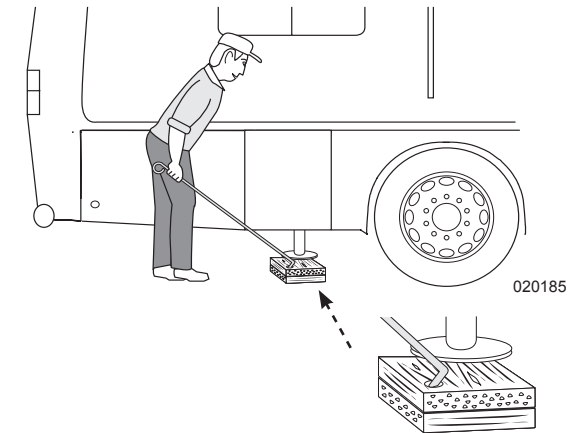
#### **NOTE:**

A “Jacks Down” warning light will turn on when the jacks are extended. The alarm will sound and all lights on the controller will flash if the jacks are down and the park brake is released.

- ◆ If further adjustments are necessary, press and hold the **MAN** (manual) button for five seconds. Once the indicator lamp below the MAN button illuminates, the system is set to manual level mode.
- ◆ Push the appropriate jack button to make adjustments.
- ◆ Turn off the remote panel.
- ◆ Turn off the ignition switch.

#### **NOTE:**

If additional height or surface support is needed, construct a 1' x 1' wooden block made from two pieces of ¾" plywood for a total thickness of 1½". Drill a hole in one corner and use the awning wand to slide the wooden block under the jack pad.



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Wood Support Block

**Manual Leveling:**

- ◆ Follow instructions in *Prior to Leveling*.
- ◆ Start the engine. The engine must be running for the leveling system to operate.
- ◆ Press the ON/OFF button to turn system on.
- ◆ Press and hold the MAN (manual) button for five seconds. Once the indicator lamp below the MAN button illuminates, the system is set to manual level mode.

**CAUTION:**

**Prior to leveling the motorhome it is important that all jacks be in contact with the ground to stabilize and support the frame. No single jack should be used to level the motorhome. Applying an improper leveling process can cause excess torsion stress and/or twisting of the chassis, frame and body, resulting in damage to the windshield or an entry door malfunction.**

- ◆ Push the **FRONT** button until the front jack makes contact with the ground.
- ◆ Push the **REAR** button until the rear jacks make contact with the ground.
- ◆ Extend the respective jack position according to the indicator lamps. Example: If the indicator lamp above the FRONT button is on, the front of the motorhome is low. Press and hold the FRONT button. The LCI Level light will illuminate when the motorhome is level. Release the switch.
- ◆ Turn off the remote panel.
- ◆ Turn off the ignition switch.

**WARNING:**

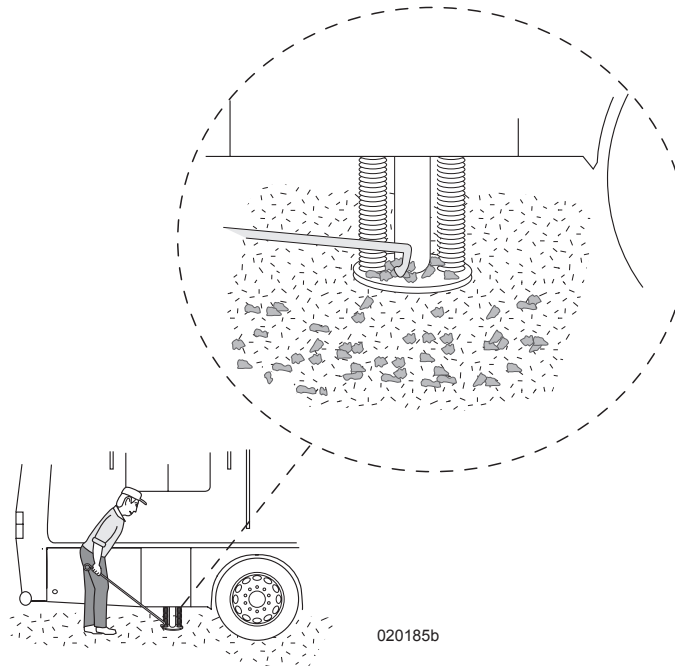
**DO NOT lift tires off the ground to level the motorhome. Lifting tires off the ground may result in serious damage to the motorhome and/or personal injury or death.**

**Retracting Leveling Jacks**

- ◆ Turn the ignition on.
- ◆ Apply the parking brake.
- ◆ Turn On the remote panel.
- ◆ Momentarily press the All Jacks Retract button. If retracting in manual mode, the All Jacks button must be held until the Jacks Down light goes out.
- ◆ Once the Jacks Down light goes out, the jacks should be fully retracted. Visually inspect to ensure that all jacks have fully retracted before moving the motorhome.

**INSPECTION:**

**Before moving the motorhome always perform a visual inspection to ensure all jacks have fully retracted. Remove any debris that may be on the jack pad.**



Remove any debris before travel.

**Drive-Away Protection:**

With the jacks extended and the park brake released, a warning alarm will sound and all LEDs will flash. The jacks will automatically retract. A full visual inspection is required to confirm full retraction of jacks before moving motorhome.

**If the jacks fail to extend or retract:**

- ◆ Apply the park brake, start the engine and place the transmission in Park.
- ◆ If the leveling panel does not light up check the following fuses located in the front electrical panel: VEC-1 20 Amp, F54 10 Amp, F73 15 Amp, F72 15 Amp, F71 15 Amp and F44 5 Amp.
- ◆ Check the 150 Amp breaker located in the front electrical bay.
- ◆ Turn off the main chassis and house battery disconnect switches, and check the electrical connection at each control valve on the hydraulic pump manifold.

**NOTE:**

**The hydraulic pump is equipped with an internal thermal breaker for protection against overheating. If the pump is repeatedly used in a short period of time the breaker will trip and automatically resets in five to thirty minutes.**



**Manual Retract:**

The hydraulic pump is located curbside in the generator compartment. This hydraulic pump also operates the main and galley slide rooms. To manually operate the pump and retract the leveling legs, an isolator valve must be closed to separate the slide room and leveling functions. There is a control valve on the pump manifold for each leveling leg.

**WARNING:**

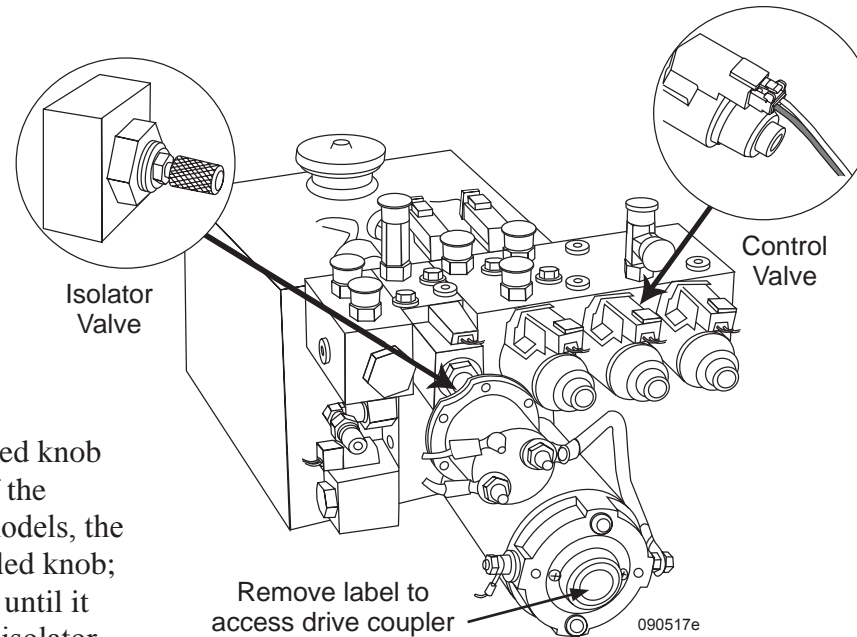
**The hydraulic motor can be extremely hot. Use extreme safety when accessing and working on the motor. Hot metal can result in serious burn injuries.**

- ◆ Turn off the house and chassis main battery disconnect switches.
- ◆ The isolator valve is a knurled knob located on the motor side of the pump manifold. On some models, the isolator valve is a blue knurled knob; push in and turn all the way until it stops. On some models, the isolator valve has a black plastic cap; remove the cap and turn the knob until it stops.
- ◆ Insert an Allen wrench into a leveling control valve and turn clockwise.
- ◆ Remove the protective label from the pump.
- ◆ Attach a standard 1/4" hex bit into a cordless drill, screwdriver or socket wrench.
- ◆ Insert the 1/4" hex bit into the coupler found under the protective label.

- ◆ Run drill counterclockwise to retract.

**NOTE:**

**The hydraulic pump operates two slide rooms and the hydraulic leveling system. If the correct leveling jack is not retracting, the wrong control valve may have been selected. Turn that control valve counterclockwise and try another valve.**



- ◆ Once the jacks are retracted, return the isolator valve (knurled knob) to the normal position.
- ◆ Use an Allen wrench turn control valve(s) counterclockwise.
- ◆ Turn on both the house and chassis disconnect switches.
- ◆ Take the motorhome to an authorized repair center.

**Maintenance****Jack Rod Maintenance:**

- ◆ If jacks are down for long periods, spray exposed leveling jack rods with a silicone lubricant every seven days for protection.
- ◆ If the motorhome is located in a salty environment, spray the rods every two to three days.
- ◆ Remove dirt and road debris from the jacks as needed.
- ◆ Operate the leveling system once or twice a week to keep seals and internal moving parts lubricated.
- ◆ Check for any visible fluid leakage before and after movement of the system.
- ◆ If squeaks emanate from the jacks during operation, apply a coat of silicone lubricant spray to the jack rod. Do not use grease on the jack rod.

**Checking/Adding Hydraulic Fluid:**

The hydraulic leveling pump is located curbside in the generator compartment. Check the fluid level once a month, and change fluid in reservoir every 36 months.

- ◆ Chock a wheel fore and aft for safety.
- ◆ Ensure that jacks and slide rooms are completely retracted. Filling the reservoir when jacks or slide rooms are extended will cause the reservoir to overflow during retraction.
- ◆ Unscrew the fill cap.

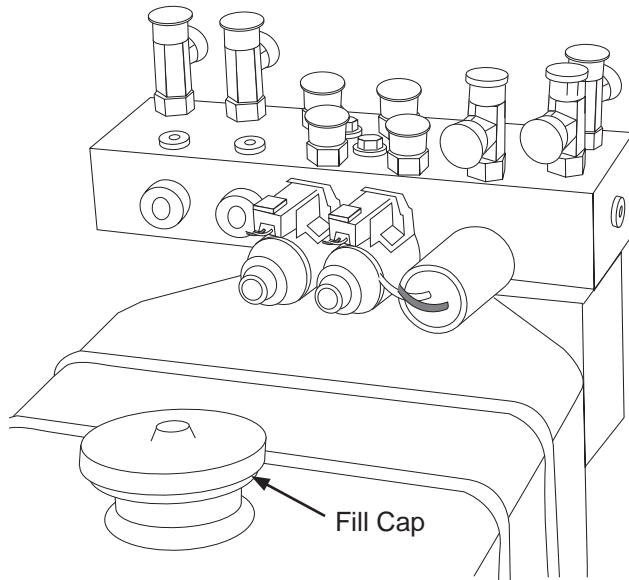
- ◆ The fluid level should be within ½" of spout lip. Slowly add ATF fluid if necessary. DO NOT allow any contamination into the reservoir during fill process.
- ◆ Replace the fill cap. Make sure the cap is free of contamination before removing and installing.

**WARNING:**

The hydraulic motor can be extremely hot. Use extreme safety when accessing and working on the motor. Hot metal can result in serious burn injuries.

**NOTE:**

In colder temperatures (less than 10° F.) the jacks may extend and retract slowly due to fluid's viscosity. For cold weather operation, fluid specially formulated for low temperatures may be desirable.



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**Electrical Connections:**

Inspect and clean all hydraulic pump electrical connections every 12 months. If corrosion is evident, spray with WD-40 or equivalent.

**WARNING:**

DO NOT work on the hydraulic pump unless the both the house and chassis battery disconnect switches are OFF.

**AIR LEVELING**

The air leveling control touchpad is located on the driver's console. The computer controlled system can operate automatically or manually to adjust the air springs when leveling the motorhome.

**NOTE:**

The motorhome engine must be ON for the air suspension to operate.

**NOTE:**

The automatic leveling system will perform best if there is no movement in the motorhome while the system is attempting to level.

**CAUTION:**

Several inches of unobstructed downward travel is required when using the leveling system. Look underneath the motorhome for any obstacles that could damage the undercarriage components before using the leveling system.

**WARNING:**

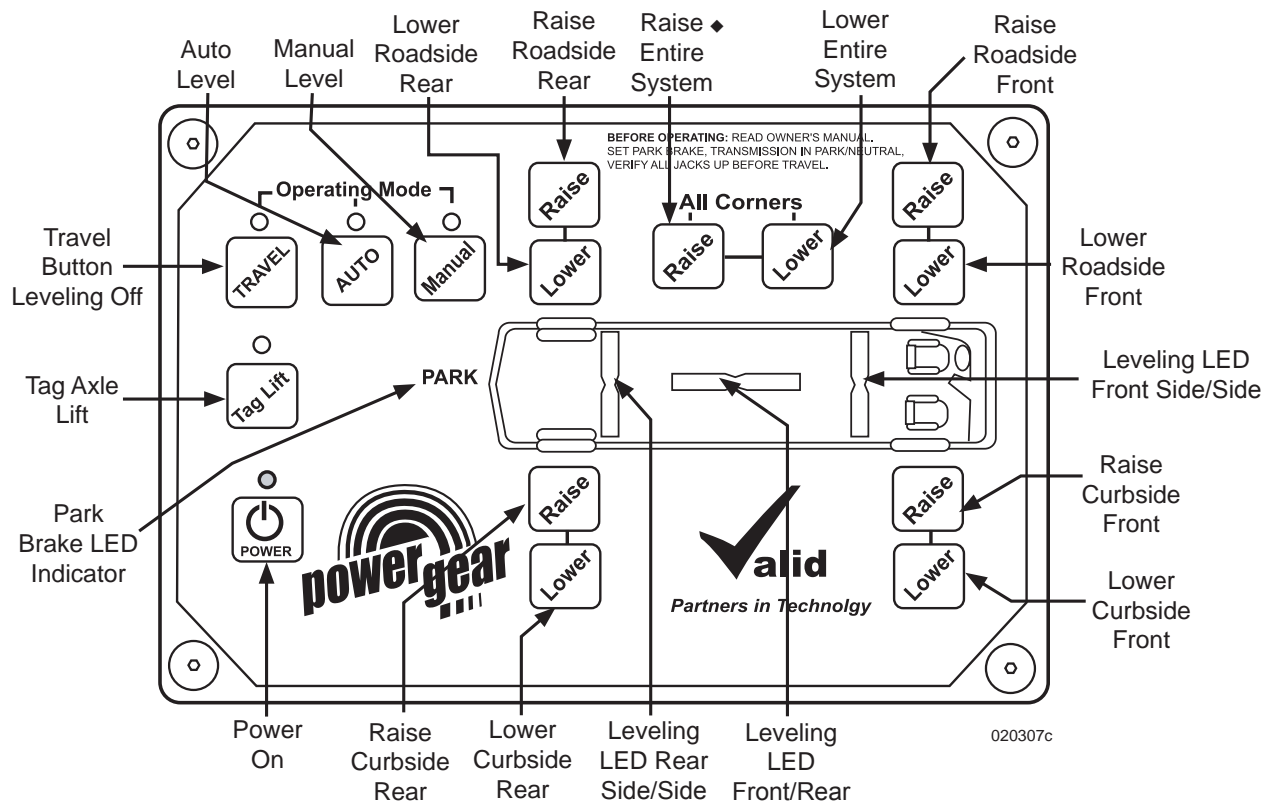
DO NOT engage the leveling system when anybody is near or underneath the motorhome. Serious injury or death can occur.

***Automatic Air Leveling*****Prior to leveling:**

- ◆ Set the park brake.
- ◆ Place the transmission in neutral.
- ◆ Front wheels must point straight ahead.
- ◆ The motorhome must be at ride height with air tanks full.
- ◆ Turn off ignition and extend slide-outs.

**Leveling Procedure:**

- ◆ Start engine.
- ◆ Press the **POWER** button on the leveling control panel to turn the system **ON**. The Power indicator light will glow solid green.
- ◆ Press the **AUTO** button to initiate the leveling process. The indicator light above Auto will blink and the motorhome will automatically level itself. Red lights in the motorhome icon indicate the motorhome is leveling. The system measures rear axle, front axle and longitudinal axis of the chassis to check for both level and flex in the motorhome.
- ◆ When all lights in the motorhome icon turn solid green, the motorhome is level.
- ◆ When leveling is achieved, leave the control panel on and turn ignition switch off.



## Manual Air Leveling

The Manual Leveling Mode gives the operator control over the leveling process.

### Prior to leveling:

- ◆ Set park brake.
- ◆ Place transmission in neutral.
- ◆ Ensure front wheels are pointing straight ahead.
- ◆ Have motorhome at ride height with air tanks full.
- ◆ Turn off ignition and extend slide-outs.

### Leveling Procedure:

- ◆ Start the engine.
- ◆ Press the **POWER** button on the leveling control panel to turn the system on. The Power indicator light will glow solid green.
- ◆ Press the **MANUAL** Mode button. The indicator light above Manual will blink.
- ◆ Press **RAISE** or **LOWER** for each corner to manually adjust. During the leveling process a red light will blink on the motorhome icon. Once that corner is level the light will turn solid green. Proceed to the next corner until the motorhome is level.
- ◆ To control all four corners simultaneously, use the **ALL CORNERS RAISE** and **ALL CORNERS LOWER** buttons.
- ◆ Turn ignition switch off when leveling is achieved.

### After leveling:

- ◆ The leveling system goes into “Sleep” mode after 15 seconds to minimize parasitic current draw on the chassis batteries.
- ◆ The system goes into “Low Power” mode after 20 seconds indicated by the occasional flashing of the Auto and Power indicator lights.
- ◆ After a period of time in “Low Power” mode the system automatically “wakes” and checks to see if re-leveling is required.

- ◆ If leveling is required the system will automatically level the motorhome.

### NOTE:

**Turning off the control panel after leveling will disable the system and not allow automatic re-leveling if necessary.**

### System Air Compressor:

Should air pressure in the leveling system need adjustment while parked in Automatic Leveling mode, a small air compressor provides the leveling system with air pressure. This compressor requires no maintenance.

## Travel Mode

Travel Mode exits Leveling Mode and allows the height control valves to set proper suspension height for travel. Initiate Travel Mode prior to moving the motorhome. It may take several seconds for the motorhome to achieve full ride height once in Travel Mode.

### **WARNING:**

**The time required to achieve ride height varies. Make sure that the motorhome is at ride height before driving. If the motorhome is too low, severe damage can result.**

### **To Use Travel Mode:**

- ◆ Start engine and press the **TRAVEL** button.
- ◆ If the Air Leveling System is turned off, or in any other mode other than Travel, the system automatically switches to Travel Mode when the parking brake is released.
- ◆ Enter Travel Mode before moving the motorhome.

### **NOTE:**

**The tag axle will not raise until Travel Mode is selected, initiating a two minute time delay. This allows extra time for the air system to pressurize before selecting Tag Lift.**

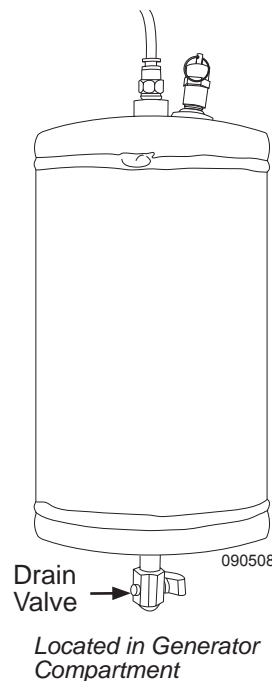
### **INFORMATION:**

**For detailed information and operating instructions on the Air Leveling System, refer to the OEM manual.**

## Service

The air leveling system includes a compressor and air tank located curbside in the generator compartment. Drain the air tank once a month or more depending on operating conditions and humidity levels.

The air tank drain is located at the bottom of the air tank. Open the drain valve until all air is released from the tank. Wait five minutes before closing the drain valve to ensure that all moisture has been expelled.



## ENGINE - GENERAL INFORMATION

The diesel engine operates differently from the conventional gasoline engine. Gasoline engines control engine speed using a butterfly throttle plate to control 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, slows engine speed and increases 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 the amount of intake manifold pressure (boost) measured in lbs./in<sup>2</sup>. Therefore, no intake manifold vacuum exists.

Diesel engine RPM (revolutions per minute) is generally much lower than that of the gasoline engine. Peak torque and horsepower output values occur at much lower engine speeds. Idle speeds between the two engine types are similar, however, maximum engine speeds are quite different. The gasoline engine generally is not regulated to a maximum engine speed. The maximum engine speed on a diesel engine is controlled by an engine speed governor set by the engine manufacturer.

### **WARNING:**

**DO NOT operate a diesel engine where there are or can be combustible vapors. Vapors can be drawn through the air intake system and cause engine acceleration and over-speeding, resulting in fire, explosion and extensive property damage. Numerous safety devices are available, such as air intake shutoff devices, to minimize risk of an engine over-speeding where an engine (due to its application) might operate in a combustible environment, such as fuel spills or gas leaks.**

**INFORMATION:**

The equipment owner and operator is responsible for safe operation of engine. Consult your engine manufacturers owners manual or authorized repair location for more information.

**STARTING PROCEDURE*****Normal Starting***

The engine is equipped with an intake manifold grid heater. The grid heater helps engine starting in cold weather. Intake manifold air temperature is monitored by the Electronic Control Module on the engine. The manifold grid heater will activate if intake manifold temperature is below approximately 40° F. Grid heater activation is indicated by the **WAIT TO START** indicator lamp.

**WARNING:**

**Use of ether starting fluids may cause an explosion upon grid heater activation.**

**To Start the Engine:**

With the throttle in idle position, turn ignition to ON. Allow the WAIT TO START lamp to extinguish. Turn key to the start position. When the engine starts the grid heater will again energize for a time period determined by the Electronic Control Module. Allow the engine to idle with no load for three to five minutes. The engine coolant temperature should be up to normal operating range (140° F./60 ° C to 212° F./100° C) before operating the engine under full throttle.

**CAUTION:**

**DO NOT idle the engine for long periods of time. Consistent periods of long idle wastes fuel and may cause engine damage.**

***Cold Weather***

In extreme cold temperatures, engine oil becomes thick and battery output is reduced. Thick oil, combined with less amperage available from the battery, increases difficulty in starting the engine.

Depending on ambient temperature it may be necessary to pre-heat the engine. Located in the coolant passage in the engine is a heating unit (block heater) that operates from 120 Volt AC. If it is necessary to pre-heat the engine due to ambient temperature, activate the block heater the night before, allowing several hours for the block heater to warm the engine.

Another method to preheat the engine is to use the optional Aqua-Hot. The Aqua-Hot engine pre-heat function will heat engine coolant and the interior.

It is possible to operate diesel engines in extremely cold environments when the engine is properly equipped with the correct lubricants, fuels and coolant. Cold weather operation can be defined in two categories: Winter and Arctic.

**WINTER (32° to -25° F.) (0° to -32° C.):** Use a 50% antifreeze to 50% water coolant mixture, use multi-viscosity oil meeting manufacturer specification 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 manufacturer specification and fuel to have maximum cloud pour points 10° F. (6° C.) lower than the ambient temperature in which the motorhome operates.

**NOTE:**

**The engine is filled with *Texaco Ursa Premium TDX EC SAE 15-40w* (with API CJ-4 rating) multi-viscosity oil from the factory. Generally this will start the engine in temperature down to 15° F. If the engine has normalized to a temperature below 15° F. it will be necessary to pre-heat the engine before starting.**

**CAUTION:**

**Upon cranking an engine in cold temperature, the starter may rapidly engage and disengage. If this occurs STOP attempting to crank the engine to prevent starter damage. Pre-heat the engine before making further attempts to start.**

**INFORMATION:**

**Refer to the engine manufacturers Owner's Manual for more detailed information.**

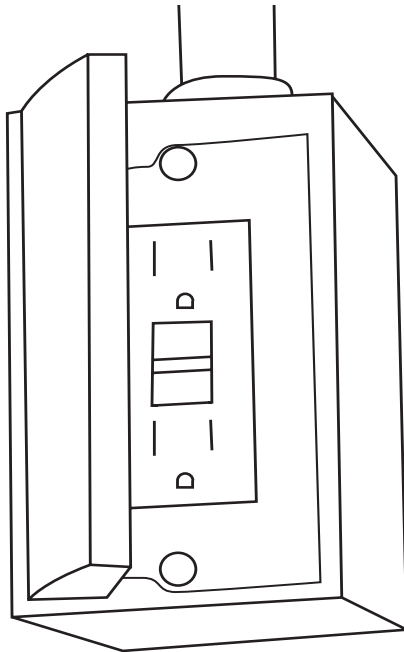
**Block Heat:**

A 120 Volt AC outlet and the block heater power cord are located in the exterior engine compartment.

The block heater is rated between 850 and 1500 watts, depending on engine size. For efficiency, hook to shore power or plug the block heater cord into a separate power cord rated for 15 Amps and a GFCI protected outlet rated at 20 Amps. The engine may require several hours of preheating before starting. It is recommended to start preheating the engine the night before departure.

**To Use the Block Heater:**

- ◆ Hook to shore power and plug the block heater cord into the block heater receptacle (both are located in the engine compartment).



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**Aqua-Hot (Optional) Engine Preheat:**

The diesel burner inside the optional Aqua-Hot heats an internal engine coolant loop. When the Aqua-Hot Engine Preheat switch is turned on, an engine coolant pump inside the Aqua-Hot circulates heated coolant through the engine. The time it takes for the Aqua-Hot to preheat the engine depends on ambient temperature. Allow at least three hours of preheating before attempting to start the engine.

**To Use the Engine Preheat System:**

- ◆ Press the Aqua-Hot switch at the kitchen to turn the system on.
- ◆ Turn the Aqua-Hot Engine Preheat switch at the dash to the **ON** position. This activates the engine pump inside the Aqua-Hot.

**Tips:**

1. When operating below 32° F., the Aqua-Hot and/or block heater preheat can enhance engine starting by easing cranking and helping to prevent engine misfire and white smoke during starting.
2. Always follow the recommended oil, fuel, and coolant specifications as outlined in the OEM Engine Manual. Proper oil viscosity and coolant concentration eases engine starting and helps to avoid engine damage.

3. Allow the engine to idle until it sufficiently warms for operation. Utilize the fast idle feature to quicken the process. Wait to operate the motorhome for at least three minutes or until the coolant temperature begins to rise.
4. Check the air inlet and filter daily, or as necessary, when driving in snow conditions.
5. The demand on batteries increase during winter; check and service the batteries frequently to help ensure trouble-free starts.
6. Start out slowly with the motorhome to allow the transmission and axle lubricants time to circulate and warm before putting them under full load.

**WARNING:**

**Use of ether starting fluids may cause an explosion upon grid heater activation.**

**ENGINE OIL****Cummins Engine Requirements:**

Maintenance guidelines and requirements are located in the Cummins Operation & Maintenance Manual. These recommendations for the engine will extend engine life and improve performance, resulting in cost efficient operations. A good maintenance schedule begins with a daily awareness of the engine and its various systems.

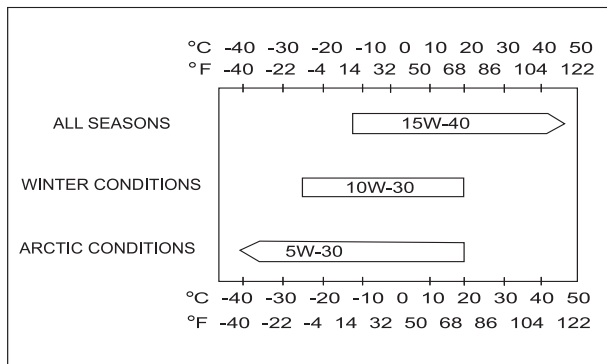
A high grade 15W-40 multi-viscosity heavy duty lubricating oil meeting American Petroleum Institute (API) specification **CJ-4** is recommended. A critical factor in maintaining engine performance and durability is the use of high grade, multigrade lubricating oil and strict adherence to the maintenance service intervals.

A straight weight or monograde lubricating oil is not recommended. Shortened drain intervals may be required as determined by a close monitoring of the lubricating oil condition by means of an oil sampling program. The use of oil analysis to extend drain interval is not recommended. There are numerous variables which is the basis of the recommendation.

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 is filled with ***Texaco Ursa Premium TDX EC SAE 15-40w (with API CJ-4 rating)*** multi-viscosity oil from the factory.



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Lubricating oil recommendations and specifications.

**NOTE:**

The engine does not require a “break-in” procedure.

**INFORMATION:**

Refer to the Engine Manufacturers Owners Manual for details on the oil maintenance schedule.

## ENGINE SHUTDOWN

Allow the engine to idle three to five minutes after a full load operation. This allows adequate cool down of pistons, cylinders, bearings and turbocharger components. Under normal driving conditions, exiting the highway is generally lighter engine operation and the need for the three to five minutes is not necessary.

### *Extended Engine Shutdown*

Verify all fluid levels are correct when the motorhome has been sitting for 30 days or more prior to starting, then follow the normal starting procedures. If oil pressure does not register within 15 seconds, immediately shut off the engine to avoid damage. Consult the engine manufacturer’s owner’s manual for guidelines on troubleshooting low oil pressure, or contact a qualified service technician. Otherwise, allow the engine to idle for five minutes before operating under a load.

## COOLANT SYSTEM

A fully formulated coolant is recommended to simplify cooling system maintenance. Coolant that is fully formulated contains balanced amounts of antifreeze, Supplemental Coolant Additive (SCA), buffering compounds and clean, quality water.

Antifreeze that is not fully formulated must be mixed with clean, quality water (distilled water preferred) in a 50/50 ratio (40 to 60% working range).

This ratio will provide protection from -34° F. to 228° F. Antifreeze must be of low silicate content as defined by ASTM D-4985. The 50/50 ratio of antifreeze and clean quality water plus SCA must be premixed prior to being put in the cooling system. Placing antifreeze and then water in the cooling system is not recommended. Refer to the OEM engine manual for more information.

**CAUTION:**

An over-concentration of antifreeze will reduce freeze protection. Use of high silicate antifreeze can damage the cooling system. SCA is required in the cooling system to inhibit cylinder liner pitting as a result of cavitation erosion.

**WARNING:**

DO NOT continue engine operation if engine temperature rises above 220° F. At approximately 225° F., the Check Engine light on the dash will illuminate and the engine protection software will begin to decrease fuel (derate) to the engine regardless of throttle position. Continued operation will result in severe engine damage.

Check the coolant level before each trip and when checking the oil level. Coolant freeze point is checked at every oil change interval or as specified by the engine manufacturer. Coolant drain and flush intervals are specified by the engine manufacturer. Refer to the OEM engine manual for more information on service maintenance intervals.

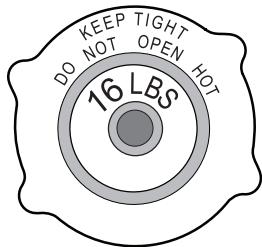
**INFORMATION:**

**Refer to the engine OEM manual for details on engine coolant maintenance.**

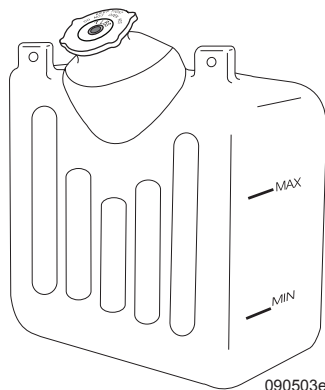
**Engine Coolant Reservoir:**

The engine coolant reservoir is connected to the radiator by a hose. Coolant heats and expands as the motorhome is driven. Coolant displaced by expansion overflows from the radiator into the reservoir tank. Coolant contracts as it cools and is drawn back into the radiator by vacuum. Thus, the radiator is filled to capacity with coolant at all times resulting in increased cooling system efficiency.

The reservoir fluid level is marked MIN (cold check)/MAX (hot check). Maintain coolant between the appropriate reservoir indicators.



Coolant Reservoir Cap rated at 16 lbs.



Coolant Reservoir Tank

**CAUTION:**

**DO NOT remove the reservoir cap while the engine is running or if the engine is hot. Cap removal can result in severe burns and damage to the engine cooling system.**

**CAUTION:**

**Be sure to replace the cap after adding fluid.**

**Coolant Checks:**

- ◆ Check coolant level daily or when refueling.
- ◆ A low coolant alarm will sound and a low coolant indication will appear on the instrument panel if coolant level drops below acceptable levels in the reservoir.
- ◆ Coolant level should remain between the MIN and MAX indicators on the reservoir when the cooling system is properly filled.

**Supplemental Coolant Additive (SCA):**

SCA is required to protect the cylinder liner/sleeve from cavitation erosion. Cavitation erosion is caused by minute air pockets that collect on the cylinder liner. The air pockets will pop (implode) during engine operation. Over time this can erode a hole through the cylinder liner. Supplemental coolant additives inhibit formation of the air pockets. The SCA content of the coolant is checked with Litmus paper. Test kits are available from the engine manufacturer as well as aftermarket. Litmus paper is time and light sensitive. Check the SCA content at each oil change following the directions in the test kit.

**NOTE:**

**Refer to the engine OEM manual for further information.**

**NOTE:**

**SCA test kits are time and light sensitive. Store test kit in a dry and dark location. Discard if out of date. Pink colored antifreeze may not be compatible with certain test kits.**

**Cooling System Maintenance:**

Refer to the engine OEM manual for detailed information regarding cooling system service and maintenance intervals. Services include draining and replacing the coolant, flushing the cooling system, inspecting the water pump and standpipe and replacing the thermostat, gasket or seal.

**Coolant Overheated:**

The engine can overheat for a number of reasons. Before engine temperature reaches a critical point it is preceded by illumination of dash indicator lamps as well as above normal temperature gauge readings. It is best to adhere to these indicators and take corrective action before the engine is subjected to extreme heat and potential engine damage.

If the engine should begin to severely overheat, engine protection software will decrease fuel regardless of throttle position (derate) to reduce heat created by combustion. Damage to the engine will occur if engine operation continues and cause of the overheat condition is not immediately corrected. At this point it is best to shut off the engine as soon as possible to avoid further engine damage.



**WARNING:**

It is advised to shut off the engine should the engine overheat. It may take several hours before engine temperature has lowered to a safe operating range. Do not remove the coolant reservoir cap as severe burns may result. Never add cold water to an overheated engine as this will cause uneven rapid cooling and possibly result in further engine damage.

**Coolant System - Thawing:**

If the coolant system becomes frozen, the motorhome must be towed. Place the motorhome in a warm area until completely thawed. If the engine is operated when the cooling system is frozen, the engine may overheat due to insufficient coolant circulation. Once thawed, check the engine, radiator and related components for damage caused by expansion of frozen coolant.

**Coolant Hoses:**

Inspect coolant hoses and connections when checking engine or transmission fluids. Look for any signs of chaffing at hose restraints or sharp edges. Indications that hoses have reached the end of service life include cracking or swelling around clamps and connections. Oil leaks can also deteriorate hoses.

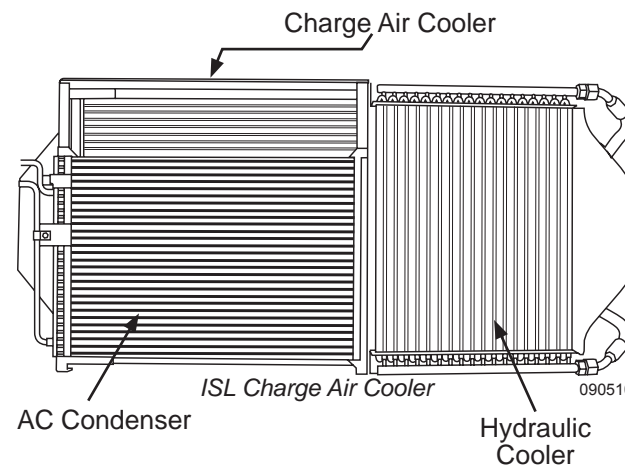
Overheating can be caused by a collapsed hose. Old hoses can also deteriorate on the inside causing partial clogs reducing cooling efficiency. Replace any hose found to be cracked, swollen or damaged. Periodically check hose clamp torque.

**INSPECT:**

Every 12 months, inspect all hoses, clamps, and fittings for leaks due to cracking, softness and loose clamps/fittings. Look for signs of fluid leaks, damaged end fittings or ballooning; chafed, kinked, or crushed hoses; and loose clamps and fittings. Correct any deficiencies found.

**Radiator/Charge Air Cooler**

The diesel engine uses compression to ignite the fuel/air charge. To increase compression inside the combustion chamber (resulting in increased power output) a turbocharger is added to the engine. The turbocharger is a paired housing assembly with impellers inside each housing connected by a common shaft. One impeller is propelled by the engine exhaust, which drives the other impeller. The function of the other impeller is to increase compression inside the combustion chamber by forcing air into the intake manifold.



This process works well, however, the intake air to the engine is heated two different ways: through convection by the exhaust gases driving the turbocharger and when air is compressed. This negative effect inside the combustion chamber results in lost power potential. Therefore, a Charge Air Cooler (CAC) is installed to cool the intake air before it enters the engine. The CAC performs the same function as a radiator, cooling air instead of liquid. Ambient air passing through the CAC will cool the engine intake air charge.

After leaving the turbocharger, intake air is compressed and heated to approximately 300° to 375° F., depending on the engine load and throttle position. Before air enters the intake manifold, the CAC cools the intake air temperature to the engine manufacturer specifications. Lowered intake air temperatures reduce exhaust emissions, improve fuel economy and increase horsepower. The CAC will continually expand and contract up to ¼" as throttle increases and decreases.

**Cleaning and Maintenance:**

- ◆ **Inspect** the charge air cooler every week and remove dirt and debris that may block the fins. If the motorhome develops an oil leak, there is a possibility that the oil will coat the fins of the CAC. Dust will adhere to the oil film, clog the fins and reduce cooling efficiency. When the oil leak is repaired, the CAC must be thoroughly cleaned.
- ◆ During each oil change **inspect** the engine side of the radiator/CAC assembly for foreign objects that may cause restriction.

- ◆ Spraying degreaser on the charge air cooler, as well as using a steam cleaner, will not damage the CAC. **However, pressure washer and steam cleaner nozzles placed too close to the CAC can bend the fins.** The recommended cleaning procedure for the CAC and the radiator is to use a bucket of mild soap and water. Carefully wash with a bristle brush then rinse using a garden hose with minimum water pressure, standing back a distance to avoid bending the fins.
- ◆ **Inspect** other components of the cooling system when performing maintenance. The charge air cooler and radiator also requires an **inspection** for cracks, broken welds, secure mounting, and general cleanliness.

#### Every 12 months:

**Inspect** all hoses, clamps, and fittings for leaks due to cracking, softness, and loose clamps/fittings. Look for signs of fluid leaks, damaged end fittings, ballooning, chafed, kinked, or crushed hoses, and loose clamps and fittings. Correct any deficiencies found.

## TRANSMISSION

The Allison World transmission incorporates the World Transmission Electronic Control (WTEC) system. The system is comprised of five major components connected by a wiring harness: the Electronic Control Unit (ECU), engine throttle position sensor, three speed sensors, remote shift selector (keypad) and the control module. The ECU processes information received from the engine, throttle position

sensor, speed sensor, pressure switch and shift selector to provide optimum shift quality. This is accomplished by matching transmission and engine RPM during a shift to establish a desired shift profile within the ECU. Another feature of the transmission is the ability to “learn” or “adapt.” The electronic control system optimizes shift quality by using “Adaptive Shifting.” A wide variety of varied shift conditions is required before optimizing shift quality. Generally, five typical shifts of a consistent shift type are needed to optimize shift quality.

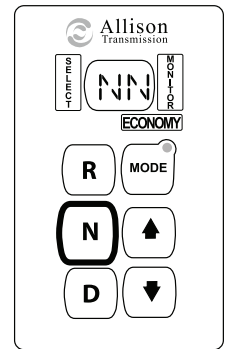
### Shift Selector

The keypads on the shift selector are **R** (Reverse), **N** (Neutral), **D** (Drive), Up and Down arrow, and Mode button. A digital display window shows gear selection, various transmission modes, oil level and transmission fault codes. Generation 4 keypads have a split screen displaying two number sets while in drive.

The left number displays the highest forward range available. The right number is the range that the transmission is currently in. **NN** (Neutral) will appear in the display window when the ignition is turned On. This indicates the transmission is in neutral. If **NN** does not display when the ignition is turned on, there is no power to the shift selector and the transmission will not allow the engine to start. No display is an indicator of electrical problems with the engine batteries, ECU or the shift selector.

### Keypad Functions:

- ◆ Select the Reverse gear by pressing **R**. RR will display.
- ◆ Select Neutral by pressing **N**. NN will display. The area around the **N** button has a raised ridge so the driver can orient his hand to the push buttons by touch without looking at the display.
- ◆ Select Drive range by pressing **D**. The highest forward gear (6th gear) appears in the display and the transmission will shift to first gear indicated as 6 1.
- ◆ The Up and Down arrow buttons are used to select a higher (if not in “6”) or lower (if not in “1”) forward range. These buttons are not functional in Neutral or Reverse.
- ◆ When in Drive, one press changes the gear range selected by one. If the button is continuously held, 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 schedule to be selected. This is commonly referred to as Economy mode. Economy mode affects the upshift schedule 3-4, 4-5, 5-6 and downshift schedule 6-5, 5-4, 4-3. During highway driving, with the cruise control set between 55 and 65 m.p.h., placing the transmission in economy mode will eliminate about 99% of transmission downshifts from sixth to fifth when incurring a slight incline or overpass.



080355g

**CAUTION:**

**DO NOT use Economy Mode in heavy stop and go traffic or mountainous terrains. Frequent shifting while using heavy throttle occurs in Economy Mode and increases transmission fluid temperature. Exit Economy Mode until road conditions improve.**

**NOTE:**

**The transmission shift schedule is adjusted to reduce frequent downshifts when Cruise power is enabled. Turn the Cruise power off when in mountainous terrain or heavy traffic.**

**NOTE:**

**The Mode button is used by the service technician to access diagnostic codes when troubleshooting. The diagnostic circuitry must be enabled to display.**

**CAUTION:**

**Engine temperature may rise when ascending long grades using full throttle. Towing a load will increase the demand on the engine. If this occurs, manually shift the transmission to the next lower gear and use less throttle. The engine will use less fuel and RPM should increase.**

**NOTE:**

**The transmission will not accept a manually selected gear change to occur if the selected gear is out of the specified operating range.**

**NOTE:**

**The transmission will not shift into gear from Neutral if the engine RPM is at or above 900. The display will flash “66” indicating the engine RPM is excessive. Select “N” and lower engine RPM.**

***Check Trans Indicator***

The electronic control system of the transmission is programmed to alert operator of a problem with the transmission system, and reacts automatically to protect the motorhome and transmission from damage. Normally, the Check Trans indicator will display when there is an error condition. The indicator will go out after the engine has started.

The transmission system should be checked immediately if the Check Trans indicator displays. The Check Trans warning indicates the ECU has detected a fault and recorded a diagnostic code. The Check Trans warning is accompanied by a flashing display from the shift selector.

The shift selector display shows the actual range attained and the transmission does not respond to shift selector requests when the ECU detects a Do Not Shift (DNS) condition. Indications from the shift selector inform the operator that the transmission is operating at reduced capabilities.

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) are not allowed. This allows time to find a safe place to park the motorhome to prevent transmission damage. If the engine is shut off and then started after a Check Trans indication, the transmission remains in Neutral until the fault is corrected. Service should be performed immediately in order to minimize potential damage to the transmission.

**NOTE:**

**Contact an authorized Allison Transmission service center whenever a transmission related concern arises. For some problems, fault codes may be registered without the ECU activating the Check Trans indicator. An authorized Allison Transmission Service center will have the equipment to check diagnostic codes and correct problems that may arise.**

**Diagnostic Codes:**

The shift selector can be used to display transmission malfunctions as numerical codes. Each code is a two-digit main code and a two-digit sub code. These codes will fall in two classes: active and inactive. Active codes are codes currently affecting the ECU process and transmission operation. Inactive codes are retained in memory but may not affect the ECU process or transmission operation. A service technician will activate Diagnostic mode or hook an electronic display (Pro-Link) to the data plug to retrieve diagnostic codes. 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. Allison 4th Generation controls list each code consisting of five characters. The first being a letter followed by a four digit number string. The most severe or recent code is listed in the ECU memory first with a maximum of five codes being d1 to d5 possibly listed at the same time. When new codes are added, the oldest inactive codes are dropped.

**To Display Diagnostic Codes:**

- ◆ Stop the motorhome at a safe location.
- ◆ Apply the parking brake.
- ◆ Simultaneously press the up and down arrows once to enter oil level display mode. Then press the up and down arrows again to enter diagnostic mode.
- ◆ The codes will display one digit at a time or two characters at a time on 4th Generation controls.
- ◆ Press the mode button to scroll through the codes.
- ◆ Record all diagnostic codes displayed. The codes are used by an Allison Service Center for evaluation and repair.
- ◆ Inactive codes can be cleared by holding the Mode button for approximately three seconds. Fourth Generation controls require holding the Mode button for ten seconds to clear both inactive and active codes.

Some codes are self-clearing while others will require service or ignition on/off cycles to clear.

**Periodic Inspections**

The Allison MH Series requires very little maintenance. Careful attention to the fluid level, electrical connections and hydraulic hoses is very important.

The transmission should be kept clean for easy inspection. Make periodic checks for loose bolts and leaking fluid. Regularly check the condition of the electrical harnesses. Check the engine cooling system for evidence of transmission fluid that would indicate a faulty oil cooler. Report any abnormal condition to an Allison Service Center.

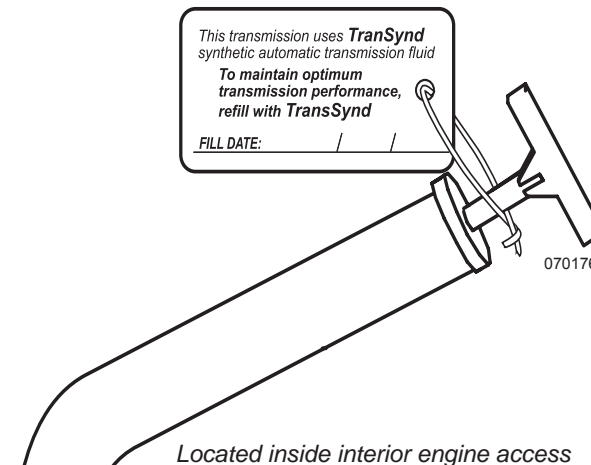
**Prevent Major Problems:**

Help the control system oversee operation of the transmission. Minor problems can be kept from becoming major problems if an Allison Transmission Service center is notified when one of these conditions occur:

1. Shifting feels odd.
2. Transmission leaks fluid.
3. Unusual transmission-related sounds (sound made by normal engine thermostatic fan cycling when climbing a long grade with a heavy load are often mistaken for transmission-related sounds).
4. The Check Trans indicator frequently comes on.

**TRANSMISSION FLUID & FILTERS**

The transmission is filled with TranSynd™ synthetic transmission fluid at the factory. TranSynd synthetic transmission fluid extends service intervals. A small tag is attached to the dipstick identifying that the transmission is filled with TranSynd synthetic transmission fluid.

**Fluid and Filter Change Interval:**

The transmission has two filters: a Main filter and a Lube filter. Follow the service intervals listed in the transmission OEM (Original Equipment Manufacturers) manual. Fluid and filters may require changing earlier than recommended in the transmission OEM manual depending on the severity of operating conditions. Fluid must also be changed whenever there is evidence of dirt or high temperature operation as indicated by discoloration, strong odor or fluid analysis. Local conditions, severity of operation or duty cycle will dictate more or less frequent service intervals.

**CAUTION:**

**DO NOT mix Dexron III® transmission fluid with TranSynd™ Synthetic transmission fluid.**

**NOTE:**

**Refer to the Allison transmission owner's manual or contact an authorized Allison service center for fluid and both filters service intervals.**

**Proper Fluid Levels:**

Transmission fluid cools, lubricates and transmits hydraulic power. Proper fluid levels must be maintained at all times. If fluid level is too low, the converter and clutches do not receive an adequate supply of fluid. If the level is too high, fluid can aerate. Aerated fluid can cause the transmission to shift erratically or overheat.

An **Oil Level Sensor (OLS)** is built into the transmission. The fluid level can be checked easily and cleanly using the shift selector. Check the transmission fluid level before each trip and after removing the motorhome from storage.

**Fluid Level Check from the Shift Selector:  
To Enter Oil Level Sense Mode:**

- ◆ Park the motorhome on a level surface. Place the transmission in “N” and set parking brake.
- ◆ The transmission must be at operating temperature or an error code will appear.
- ◆ The motorhome must be stationary and in Neutral for approximately two minutes to allow the fluid to settle in the sump.
- ◆ The engine must be idling lower than 800 RPM.
- ◆ Simultaneously press the Up and Down buttons once.

The transmission is now in Oil Level Sense mode. The display will indicate one character at a time. An “o” followed by “L” represents oil level check mode.

**One of the following will be indicated:**

- ◆ “o K” represents the level is okay.
- ◆ “Lo” represents a low fluid level followed by a numeric indication of the number of quarts needed fill the sump.
- ◆ “HI” represents an overfull condition followed by a numeric indication of the number of quarts the sump is overfull.
- ◆ A countdown of flashing numbers indicates the fluid is still settling. When the fluid has stabilized in the sump, the true level is indicated.
- ◆ If an “o” “L” “-” followed by a number displays, the oil level sensor could not read the level due to one of conditions listed in the “Common Oil Level Fault Codes” chart.
- ◆ Exit by pressing “N.”

Common Oil Level Fault Codes

Display	Cause of Code
o,L - O,X	Setting time too short
o,L - 5,0	Engine speed (RPM) too low
o,L - 5,9	Engine speed (RPM) too high
o,L - 6,5	Neutral must be selected
o,L - 7,0	Sump fluid temperature too low
o,L - 7,9	Sump fluid temperature too high
o,L - 8,9	Output shaft rotation
o,L - 9,5	Sensor failure

**Cold Check - Manual Check Procedures:**

The concept of a cold check is to determine adequate fluid level for safe operating, such as after a fluid and filter change.

A cold check should be performed after transmission maintenance or service until a hot fluid level check or fluid level check from the shift selector can be performed.

**To Check the Fluid When Cold:**

- ◆ Park the motorhome on a level surface. Set the parking brake.
- ◆ Chock the wheels to prevent the motorhome from moving.
- ◆ Start the engine.
- ◆ Allow the engine to run at idle (500 to 800 RPM) for one minute.
- ◆ Apply the service brakes and shift to **D (Drive)**, then to **N (Neutral)** and next to **R (Reverse)** to fill the system. Shift the transmission to **N (Neutral)** and release the service brakes. Allow the engine to idle at 500 to 800 RPM.
- ◆ Remove the dipstick and wipe clean. Reinsert the dipstick fully into the tube, then remove to check fluid level. Repeat to verify reading, if needed.
- ◆ Safe operating level is anywhere within the Cold Check band on the dipstick. This allows safe operation of the transmission until a Hot Check or fluid level check from the shift selector can be performed.
- ◆ If the level is not within this band, add or drain the fluid as necessary to put the level to the middle of the Cold Check band.
- ◆ Perform a fluid level check from the shift selector or a Hot Check at the first opportunity when normal operating temperatures are reached.

**CAUTION:**

**Low or high fluid level can cause overheating and irregular shift patterns. These conditions can damage the transmission if not corrected.**

### Fluid Levels - Hot Check

Fluid level rises as temperature increases. Fluid must be hot to ensure an accurate check. Be sure fluid has reached normal operating temperature. If a transmission temperature gauge is not present, check the fluid level when the engine coolant temperature gauge is stabilized and the motorhome has been driven for at least one hour.

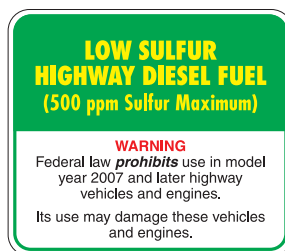
- ◆ Park the motorhome on a level surface and shift to **N (Neutral)**. Apply the parking brake and allow the engine to idle (500 to 800 RPM).
- ◆ After wiping the dipstick clean, check the fluid level. Safe operating level is anywhere within the Hot Run band on the dipstick.
- ◆ The width of the Hot Run band is approximately one quart of fluid at normal temperature range.
- ◆ If the level is not within this band, add or drain the fluid as necessary to put the level within the Hot Run band.
- ◆ Ensure that fluid level checks are consistent. Check the level more than once. If readings are not consistent, ensure the transmission breather is clean and not clogged. If readings are still not consistent, contact the nearest Allison Service Center.

### FUEL SYSTEM Fuel Requirements

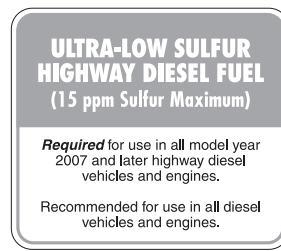
Diesel Fuel in the United States is categorized by sulfur content. There are two categories: Low Sulfur Diesel (LSD) and Ultra Low Sulfur Diesel (ULSD). LSD fuel contains a maximum sulfur content of 500 parts per million (ppm); ULSD fuel contains a maximum sulfur content of 15 ppm.

**CAUTION:**  
Cummins ISL engines require Ultra Low Sulfur Diesel.

**Do not use Low Sulfur Diesel.** Diesel fuel dispensing pumps are labeled to indicate either ULSD or LSD. Use of Low Sulfur Diesel in engines that require Ultra Low Sulfur Diesel will damage emission control systems and is subject to fine.



100217



100217b

**WARNING:**  
Use of LSD fuel in ULSD engines will damage emission control systems and is subject to fine.

### CAUTION:

Engines designed for ULSD fuel require specially formulated motor oil classified by the API (American Petroleum Institute) as category CJ-4.

### NOTE:

Some states (including California) have prohibited the sale of Low Sulfur Diesel.

### Seasonal Requirements:

Diesel fuel classified as # 2 is used in moderate and temperate climates. A winter blend of #1 and #2 diesel fuels is available during the winter months in cooler climates (or possibly year-round in extremely cold or arctic areas). The dispensing pump may not indicate winter blend.

### Biodiesel:

Biodiesel is a synthetic fuel made from plant oil or recycled cooking oil. Biodiesel is often sold as a biodiesel/petrodiesel blend with an alphanumeric designation that indicates biodiesel content. For example: B5 is 5% biodiesel and 95% petrodiesel while B100 is 100% biodiesel. Due to variances in biodiesel, its use is restricted by the engine manufacturer. Refer to the OEM engine manual for acceptable biodiesel tolerances.

### Tips:

Try to obtain fuel from sources that are serviced often, such as large truck service facilities. The fuel supply is fresh and the possibility of introducing contaminants or water into the fuel system is reduced. If the engine runs out of fuel, the fuel system will need to be thoroughly primed before the engine will start and run properly.

**WARNING:**

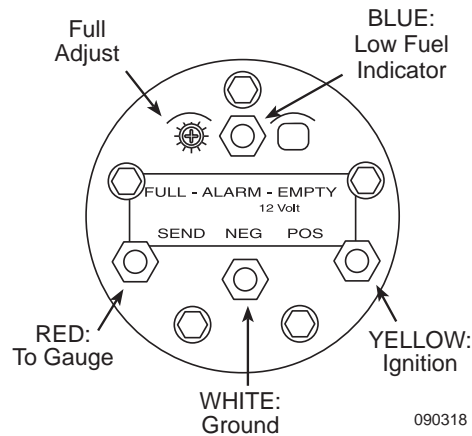
**DO NOT mix gasoline, alcohol or gasohol with diesel fuel. This mixture can cause an explosion.**

**NOTE:**

**Due to the precise tolerances of diesel injection systems, it is extremely important that fuel be kept clean and free of dirt or water. Dirt or water in the system can cause severe damage to both the fuel pump and the fuel injectors. Fuel additives for lubricity are not recommended. There are numerous diesel fuel additives to help remove moisture from fuel, prevent microbe growth and to prevent gelling during cold weather. Before adding any type of fuel additive or extender, consult the Manufacturer's Owner's Manual.**

**Fuel Sender**

The Centroid fuel sender has no moving parts and works by measuring between inner and outer tubes in the tank. Electronics in the head of the sender convert the capacitance to current to drive the fuel gauge.



Centroid Fuel Sender

**Connections:**

- ◆ Positive (POS) and Negative (NEG) - Battery voltage to run the electronics in the sender head.
- ◆ Send - Connects to the fuel gauge on the dash.

**Adjustments:**

- ◆ Empty - Adjusts for length of sender. It is calibrated by the sender manufacturer and covered with a sealant. It should not be changed.
- ◆ Full - Used to correct for slight differences between fuel meters. This is factory calibrated and does not need adjustment.

The correct adjustment technique, with a full tank of fuel, is to start with the full adjustment screw turned completely clockwise. This should cause the reading to be above full within 30 seconds of ignition on, rotate counterclockwise slowly until the full mark on the gauge is reached. The intent is to always adjust downscale rather than upscale.

**NOTE:**

**The adjustment must be made within 30 seconds of turning the ignition on. If the adjustment is not finished in time, turn the ignition off and back on to reset the timed cycle. The sender responds too slowly after 30 seconds (damped output) to allow adjustment.**

**Troubleshooting:**

- ◆ Electronic Output: The sender has a transistorized output to prevent an ohmmeter from getting a correct reading of output resistance.
- ◆ Fuel Only: The sender will not work correctly in conducting fluids such as water (it will read empty all the time in water). If there is a constant empty reading, there may be water in the bottom of the fuel tank.
- ◆ Contact Centroid: Many of the returned Centroid units function properly on the bench. If there are incorrect readings, contact Centroid (telephone: 800-423-3574, or preferably, fax: 386-423-3709) with the symptoms. A short, "fill in the blanks" troubleshooting test is provided to test the sender. It is easier to find the problem that way than after the sender has been removed from the system, if the problem is not necessarily with the sender.

**Fuel Tank**

Pick-up and return lines are placed at opposite ends of the tank to inhibit fuel aeration. The engine pickup tube is cut at a 45° angle to allow optimum flow to the engine. The generator intake tube is set to approximately ¼ of a tank. This will prevent depleting the fuel supply while dry camping.

**NOTE:**

**Fill the fuel tank prior to storage to reduce the amount of potential condensation. After storage, check the fuel tank vent tube for blockage. It is not uncommon for insects to plug the vent tube. If pressure or vacuum exists when the fuel cap is removed, the vent tube may be blocked. The end of the vent tube is located on the curbside of the fuel tank, near the bottom.**

## Fuel Lines & Hoses

Make a visual check for fuel leaks at all engine-mounted fuel lines, connections and at the fuel tank pick-up and return lines. Leaks in this area may best be detected by checking for accumulation of fuel under the tank. Engine performance and auxiliary equipment is dependent upon the ability of flexible hoses to transfer lubricating oil, air, coolant and fuel. Maintenance of hoses is an important step in ensuring efficient, economical and safe operation of the engine and related equipment.

### **INSPECTION:**

**Check hoses for leaks each day as part of the pre-start inspection. Check all fittings, clamps and ties. Ensure the hoses are not touching shafts, couplings or heated surfaces, including exhaust manifolds, sharp edges or other obvious hazardous areas. Vibration from the engine and road can move or fatigue clamps and ties. To ensure continued proper support, inspect fasteners frequently and tighten or replace them as necessary.**

## Fuel Filters

Two filters are used for the engine: a primary and secondary filter. Both filters are located in the engine compartment.

### **NOTE:**

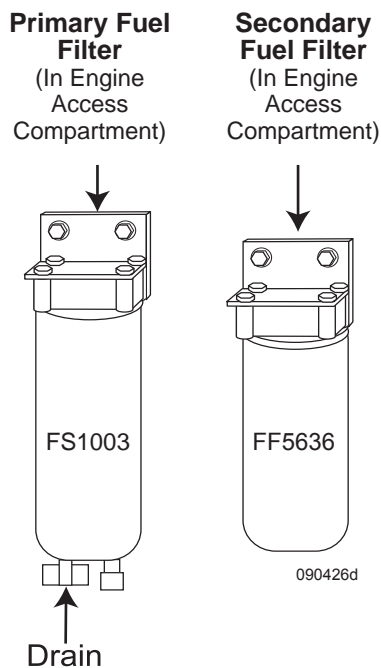
**It is recommended to wear gloves and old clothing when working with diesel fuel. Avoid getting fuel in the interior of the motorhome.**

### **Filter Maintenance Intervals:**

- ◆ Drain the primary fuel filter daily before travel.
- ◆ Change the primary fuel filter every six months or every 15,000 miles or at the first indication of power loss.
- ◆ Refer to the engine OEM manual for service intervals of the secondary fuel filter.

### **Water in Fuel Light:**

If the **WATER IN FUEL** light illuminates on the dash, the primary filter has detected water in the fuel. **DO NOT** continue engine operation. Fuel contaminated with water can damage fuel injectors. Water is heavier than fuel and will collect in the primary filter. Drain the primary filter by opening the valve on the bottom of the filter bowl.



### **To Drain the Filter:**

- ◆ Shut off the engine.
- ◆ Open the drain valve, by hand, counterclockwise approximately 1½ to 2 turns until draining occurs. Drain water/fuel into a container and dispose of in accordance with local environmental regulations.
- ◆ Close the drain valve by turning clockwise when clear fuel is visible.

### **NOTE:**

**Water and sediment from the filter can contain petroleum products. Consult the local environmental agency for recommended disposal guidelines.**

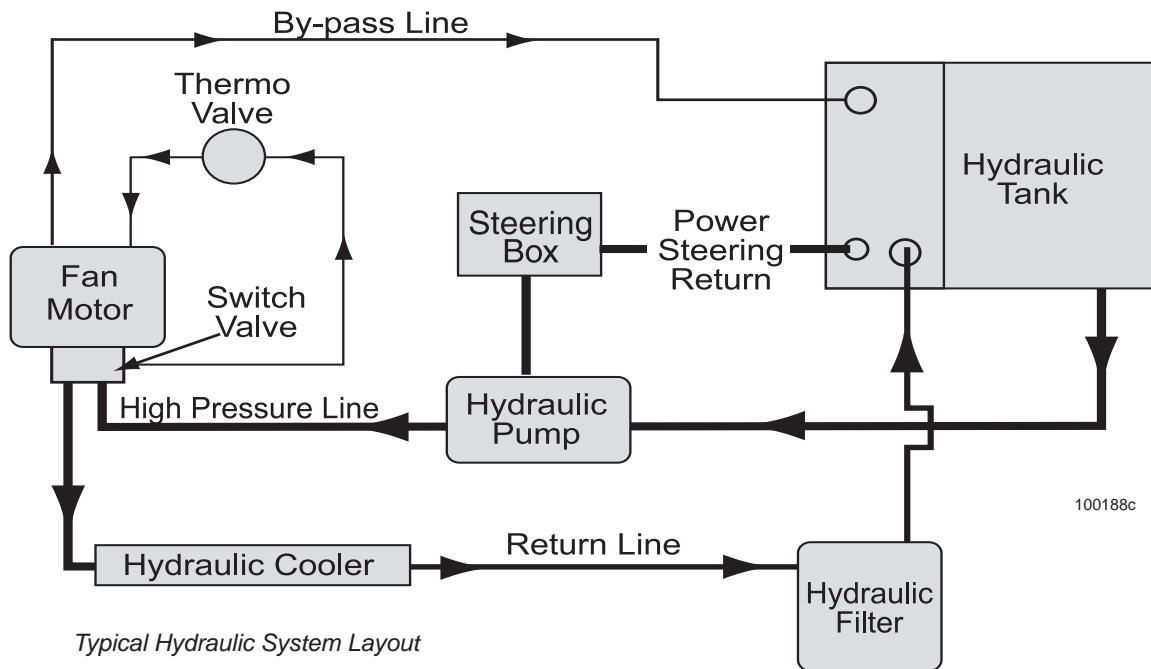
## HYDRAULIC SYSTEM

The motorhome uses an engine driven hydraulic pump to operate the power steering and radiator fan cooling systems. Both systems share a common reservoir, which is located in the engine compartment. The hydraulic fluid is Texaco Rando HD46 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 temperatures will raise the hydraulic system operating pressure and may damage the hydraulic cooler.**





Typical Hydraulic System Layout

### Hydraulic Pump

The hydraulic pump creates pressure by meshing sets of gears together inside 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 bars. 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.

### Hydraulic Cooler

The hydraulic cooler prevents hydraulic fluid from overheating. When a load is placed on the hydraulic system, heat is created in the fluid. Heat must be dissipated to prevent 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 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.

### Hydraulic Fan System

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 include a hydraulic reservoir, filter, pump, hydraulic fan motor, hydraulic switching valve and thermostatic valve. Cooling fan speed is proportional to engine speed and coolant temperature.

When coolant temperature rises above 185° F., the thermostatic valve slowly closes off the bypassing hydraulic fluid from the switching valve. As coolant temperature rises, a spool valve begins to move in the switching valve. The spool valve directs the pressurized hydraulic fluid to the fan motor. The higher the coolant temperature, the further the spool valve is moved in the switching valve, providing a higher volume of pressurized hydraulic fluid to the fan motor. Fan motor speed is increased to meet the demand for cooling. The action of the thermostatic valve is designed to move the spool in the switching valve to ramp up fan motor speed. This design saves horsepower and increases fuel mileage by precise control of hydraulic fan motor speed. The fan motor will increase in speed when the motorhome is ascending long hills or operating in high ambient temperatures. It is normal for the fan to “roar” when it is operating. Fan motor speed and engine RPM are approximately the same with the switching valve in the full open position.

### **Thermostatic Valve**

The wax filled thermostatic valve, mounted at the top of the radiator, controls the action of the switching valve. When the radiator is cool, hydraulic fluid is allowed to flow through the inlet and outlet ports of the thermostatic valve and return to the hydraulic reservoir. As coolant temperature inside the radiator rises to approximately 185° F, wax inside the thermostatic valve begins to melt and expand, which restricts hydraulic fluid flow through the thermostatic valve. The restricted hydraulic fluid pressure then begins to move the internal spool valve of the switching valve.

This process will continue until coolant temperature inside the radiator reaches approximately 199° F. At this temperature, hydraulic fluid flow through the thermostatic valve is stopped, moving the spool valve to the full open position.

### **Switching Valve**

The switching valve is mounted to the fan motor and controls direction of high pressure hydraulic fluid flow. High pressure hydraulic fluid comes from the hydraulic pump to the switching valve before returning to the reservoir. Either the thermostatic valve or the electric override valve (ISM Only) directs the fluid to the spool in the switching valve. When the radiator is cool, pressurized hydraulic fluid will bypass the fan motor and return to the fluid reservoir. As radiator temperature rises, the thermostatic signal is slowed or stopped to the switching valve. High pressure fluid is then directed to the fan motor, cooling the radiator.

### **Fan Motor**

The fan motor is driven by hydraulic fluid pressure from the switching valve. The fan motor works on the same mechanical principle as a hydraulic pump, only in reverse. Instead of creating hydraulic pressure by meshing gears together in close-tolerance housing, the fan motor receives hydraulic pressure. The hydraulic fluid drives the fan motor’s internal gear assembly, spinning the fan motor and attached fan blades.

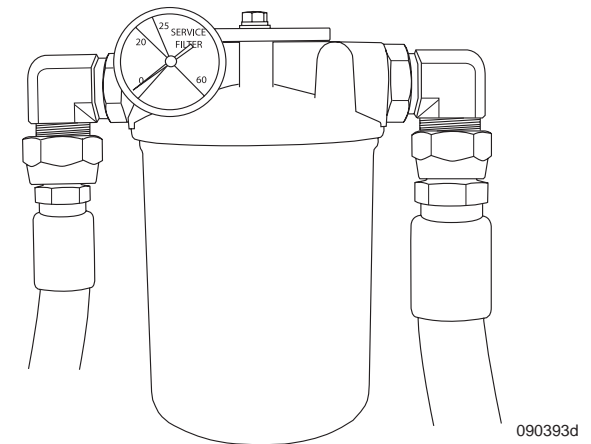
The switching valve is mounted to the fan motor. The hydraulic fluid is then cooled and filtered before returning to the reservoir.

### **Hydraulic Filter**

The remote-mounted hydraulic system filter is located in the engine compartment. A specially designed media filter absorbs harmful contaminants, such as moisture and dirt. The filter element is rated at 10 micron. Replace the filter whenever the needle leaves the green range and enters the yellow range with the engine running.

### **Filter Part Number: Zinga ZSE 10**

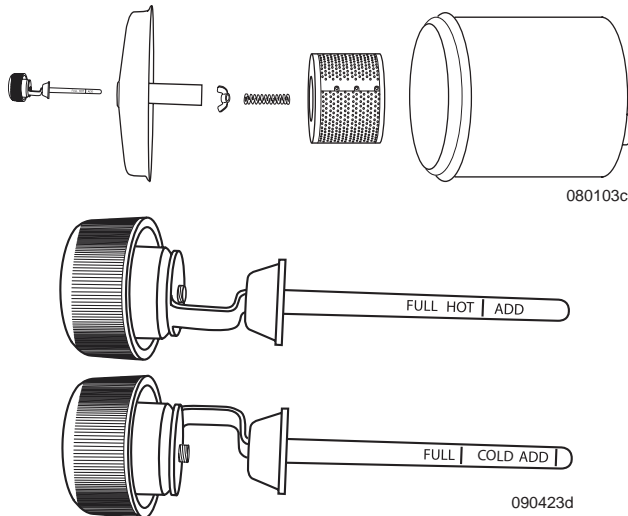
**CAUTION:**  
Hydraulic fluid is not being filtered when the filter gauge needle enters the red zone.



## Hydraulic Reservoir/Filter

The hydraulic reservoir with internal filter, located in the engine compartment, is the reservoir for the hydraulic fan drive and power steering systems. Check the oil level in the reservoir when the oil is at operating temperature before each trip, every 6,000 miles or three months.

The dipstick/oil fill is located on top of the reservoir. When performing fluid level checks, inspect fittings and hoses for signs of leakage. Avoid untimely and costly failures by having leaks repaired. The oil level should be kept between the full and add marks on the dipstick.



Replace the internal filters every 15,000 miles or once a year. Loosen the band clamp at the top of the reservoir and remove the lid. Place a 5-gallon drain bucket under the reservoir. Loosen one of the bottom fittings to drain the reservoir. Drain only enough fluid from the reservoir to expose filter and tighten fitting.

Remove the wing nut, filter spring and filter washer. Remove and replace the filter. Install the filter washer and filter spring. Tighten the wing nut until wing nut reaches end of threaded rod. It is recommended to install new hydraulic fluid. Old fluid may contaminate the hydraulic system. Fill the reservoir to the full mark and install top and band clamp. Run engine to purge trapped air. Check fluid level after fifteen minutes of operation to confirm proper level.

**Nelson Filter Part Number: 83804**

### **NOTE:**

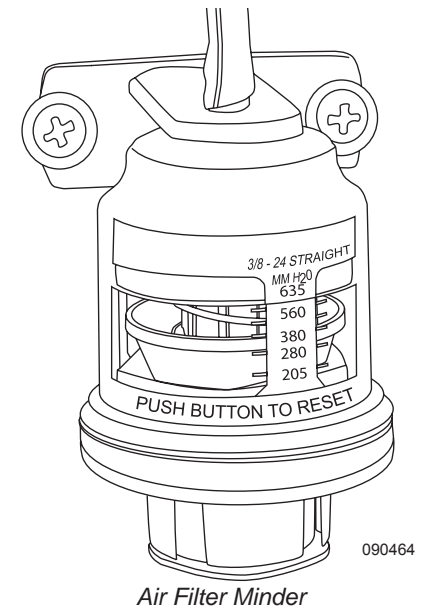
**Confirm filter element part number stamped on the outside of the reservoir.**

## AIR FILTER *Air Filter Minder*

The air filter minder, located in the roadside engine compartment, is a precision overflow restriction gauge designed to take the guesswork out of air cleaner replacement.

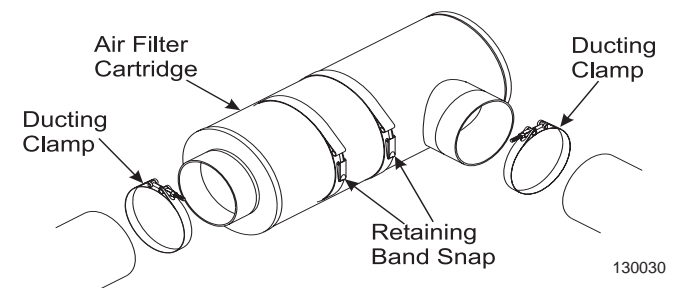
As dirt captured by the filter cartridge slowly builds up, vacuum between the filter and charge air cooler increases. The indicator locks at the point of maximum restriction so readings can be taken with or without the engine running.

When the desired change-out point is reached, the air filter should be replaced and the service indicator reset by pushing the **Reset** button on the bottom of the minder.



## Changing the Filter

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 engine compartment. The Air Filter Minder will indicate when the filter will need to be changed.



## LUBRICATION MAINTENANCE

Performing regular scheduled maintenance ensures reliable operation and optimum service life of the various chassis components. Completed maintenance brings peace of mind knowing the various components have received proper service. Failure to follow maintenance guidelines, or perform scheduled maintenance, results in inefficient operation, premature component wear or component failure resulting in breakdown.

Maintenance schedules are usually performed at certain mile or time intervals. When performing high level procedures, lower level service should also be performed.

### **NOTE:**

**Maintenance schedules are based on normal operating conditions and use. Operating under unusual or adverse condition shortens service intervals.**

### **NOTE:**

**Engine and transmission service intervals are listed in their respective manuals.**

### **Proper Lubricant Waste Disposal:**

When performing service maintenance on the engine, transmission or rear axle, waste fluids and filters should be properly disposed of or recycled. Package used oils, antifreeze and other fluids in sealed containers. In many cases used oil is accepted free of charge at county disposal sites. Waste fluids are toxic to pets and other animals. Waste fluids should not be left in open containers. The sweet odor of antifreeze is attractive to pets, but highly toxic.

### **CAUTION:**

**Properly dispose of used antifreeze and waste oil. Animals like the sweet odor of antifreeze and may ingest it if left in open containers. Wipe up any fluid spills. Pets may lie in puddles of fluid, many of which are irritants and can cause severe chemical burns if not properly washed.**

### **Lubricant Classification:**

Lubricants are manufactured in many forms for a variety of applications. There are many different oil and grease consistencies each with a designed application. To properly select a particular type of lubricant for a specific application, the component must be evaluated. Component stress loads, ambient temperature, working temperature and environmental exposure are just a few of the variables to consider. Select the proper lubricant for its intended application. As an example: selecting high viscosity grease to lubricate a lock cylinder results in sluggish lock cylinder operation especially in a cool environment.

Conversely, using graphite to lubricate a component that is under extreme temperature and load will result in component failure.

Grease ratings and their base compounds are especially important when selecting a lubricant type for an intended application. Some grease compounds are manufactured for multi-use application. These are acceptable if the grease rating is in accordance with the manufacturer's recommended lubricant type and rating.

### **Lubricants:**

Many chassis components require lubrication. The types of lubricants used will vary with the application of the component. A component may fail prematurely due to lack of lubrication or from using an incorrect lubricant type. The component manufacturer usually recommends a particular type of lubricant with a minimum approval rating. Most lubricants are tested under strict guidelines set by the **ASTM (American Society for Testing and Materials)**.

The **NLGI (National Lubricating Grease Institute)** helps disperse information to the grease production industry. Grease containers usually have an approval rating by the **SAE (Society of Automotive Engineers)**, **Mil Spec (Military Specification)**, **API (American Petroleum Institute)** or by other recognized and accepted organizations. The correct lubricant type with an approved specific rating must be used whenever applying, changing or adding any lubricant. When purchasing lubricants for a specific application be sure the label affirms the type of lubricant required with the tested rating by the term "meets or exceeds" in accordance with the manufacturer specifications.

Lubricating greases are made from different base compounds giving the grease different lubricating consistencies, properties and maximum operating temperatures. Most containers list the base compound and maximum operating temperature usually listed as melting point or drip point. Lubricating components, such as brake component for example, require a high-temperature special base compound grease. Lubricating this type of component with other than specified grease type will result in inadequate lubricating qualities resulting in component malfunction or failure.

**INSPECTION:**

**When performing any scheduled maintenance, inspect the area around where you are working. For example, changing the oil, look at the rear differential. Inspect for visual signs of fluid leaks.**

Most fluids and lubricants have a distinct odor, which can be used to detect early signs of trouble. Generally, odors are most detectable soon after parking. Unusual sounds are another method of detecting a problem early. There are many types of sounds that are normal, such as the cyclic purging of the air dryer. Become familiar with the different sounds. If something sounds odd, smells peculiar or looks unusual, investigate the situation.

**Greasing:**

Thoroughly clean all Zerk grease fittings before applying new lubricant. Keep paper towels or disposable rags handy when greasing.

When lubricating items such as drive shafts and steer axle components, continued grease application is generally required until new grease appears at exit points.

Some items use sealed boots around the component to prevent moisture intrusion. When greasing these types of components, care must be given to prevent excess lubricant pressure from rupturing the seal.

**WARNING:**

**Always chock wheels before going underneath the motorhome.**

**WARNING:**

**Never place yourself under motorhome without first properly blocking frame (jackstands) from coming down in case of rapid deflation of air system.**

Brake actuating components require lubrication to keep the actuating components freely operating. Avoid contaminating brake linings with lubricant. Particular care and attention to details should be taken when lubricating brake actuating components. Wheel removal may be necessary to gain access the grease fittings.

**NOTE:**

**Suspension, steering, brake and drivetrain components are lubricated at the factory using Texaco Starplex NLGI 2 Lithium Soap based grease.**

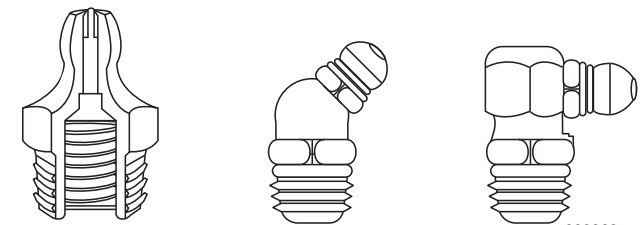
**To apply grease:**

- ◆ Clean the grease fitting. Initially operate grease gun until new lubricant discharges from nozzle, then wipe nozzle clean to avoid introducing contaminants into the component.
- ◆ Snap nozzle onto grease fitting. Nozzle must remain in line with the grease fitting during the application process. If the nozzle is not in line, lubricant will collect around nozzle and grease fitting, failing to lubricate the component.
- ◆ Wrap the nozzle with a paper towel or rag to prevent contamination and accidental soiling of other areas.

If the component does not accept grease the Zerk fitting may be plugged or damaged. Zerk fittings are replaceable and generally available at most auto supply stores. Zerk fittings come in a variety of angles depending on the application. Every effort should be made to lubricate the component, as neglect will only result in premature component failure.

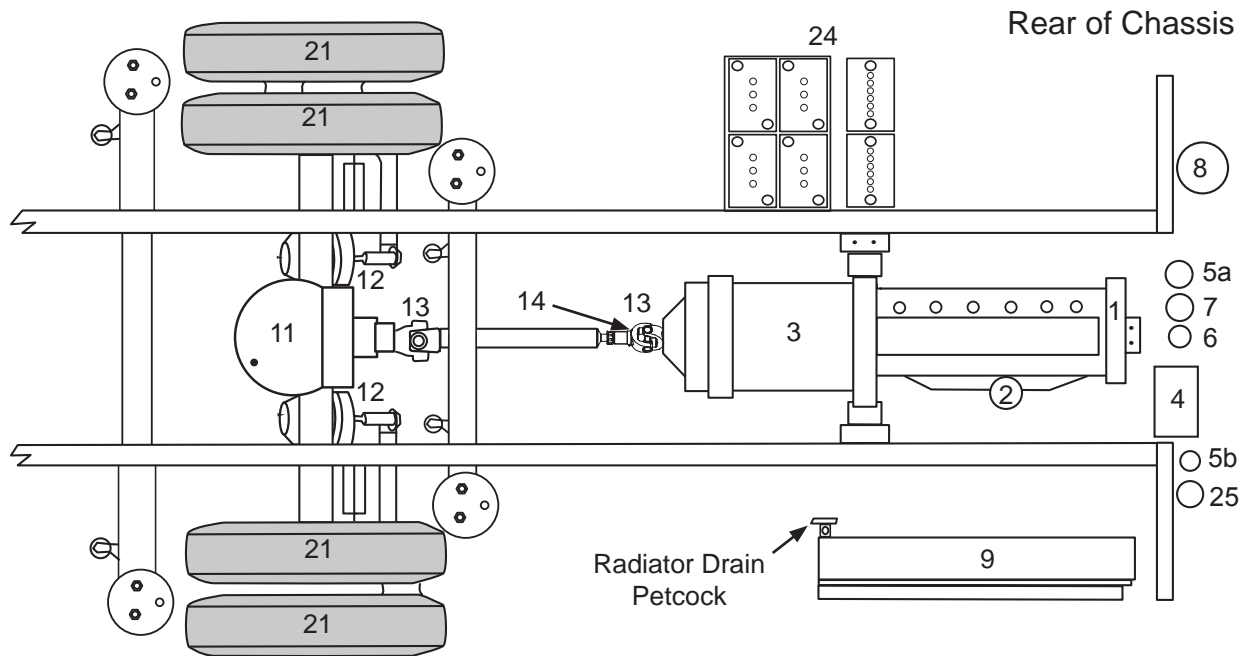
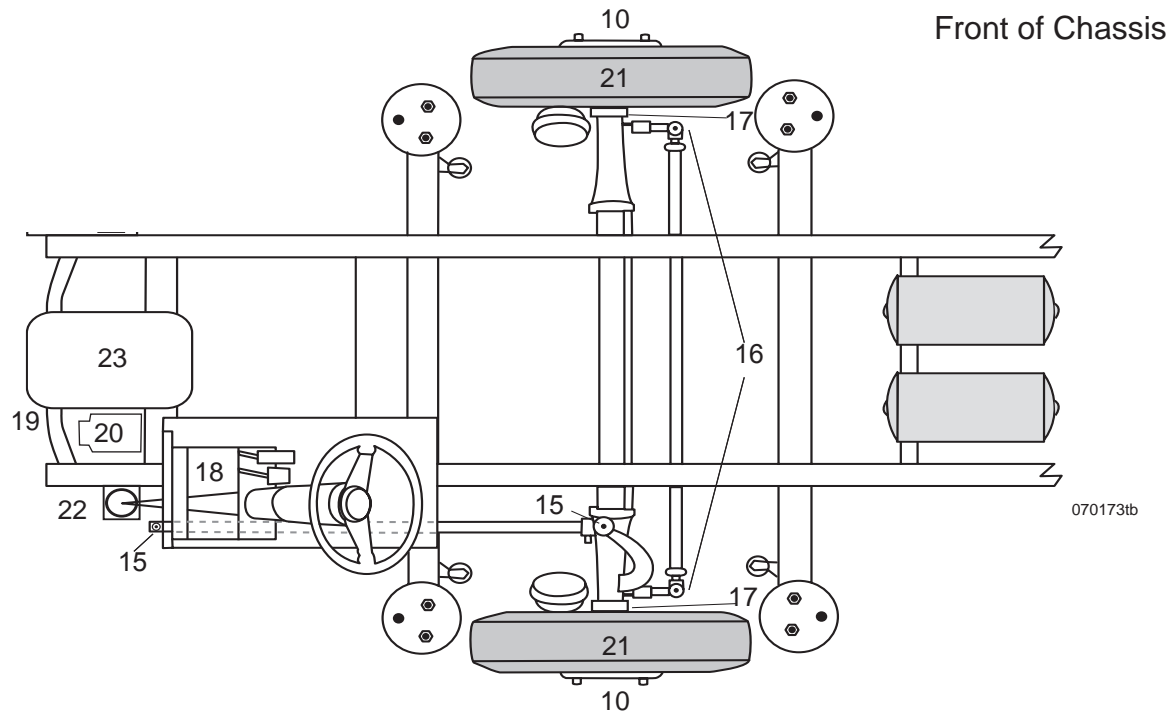
**NOTE:**

**Some grease fittings may not be accessible until the steering wheel is turned or the motorhome is moved slightly.**



Typical Zerk Fitting (Not actual size).

**LUBRICATION CHARTS**  
*38' to 40' Models*



070173tb

- 5a
- 7
- 6
- 5b
- 25

Radiator Drain  
 Petcock

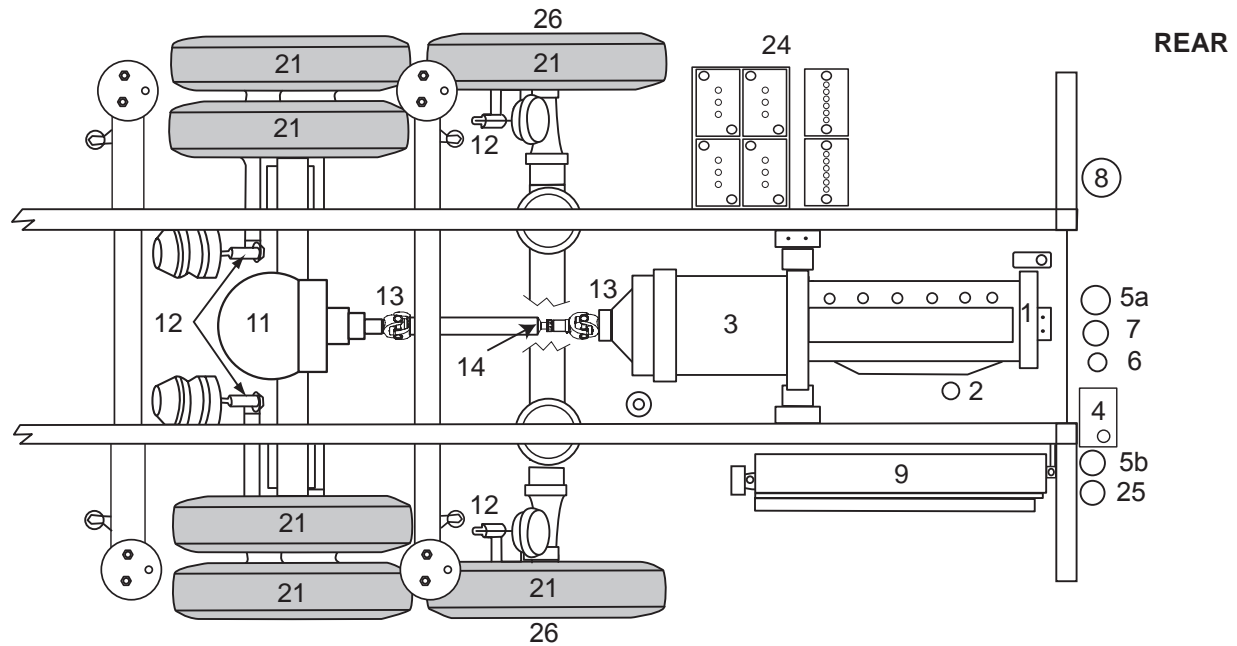
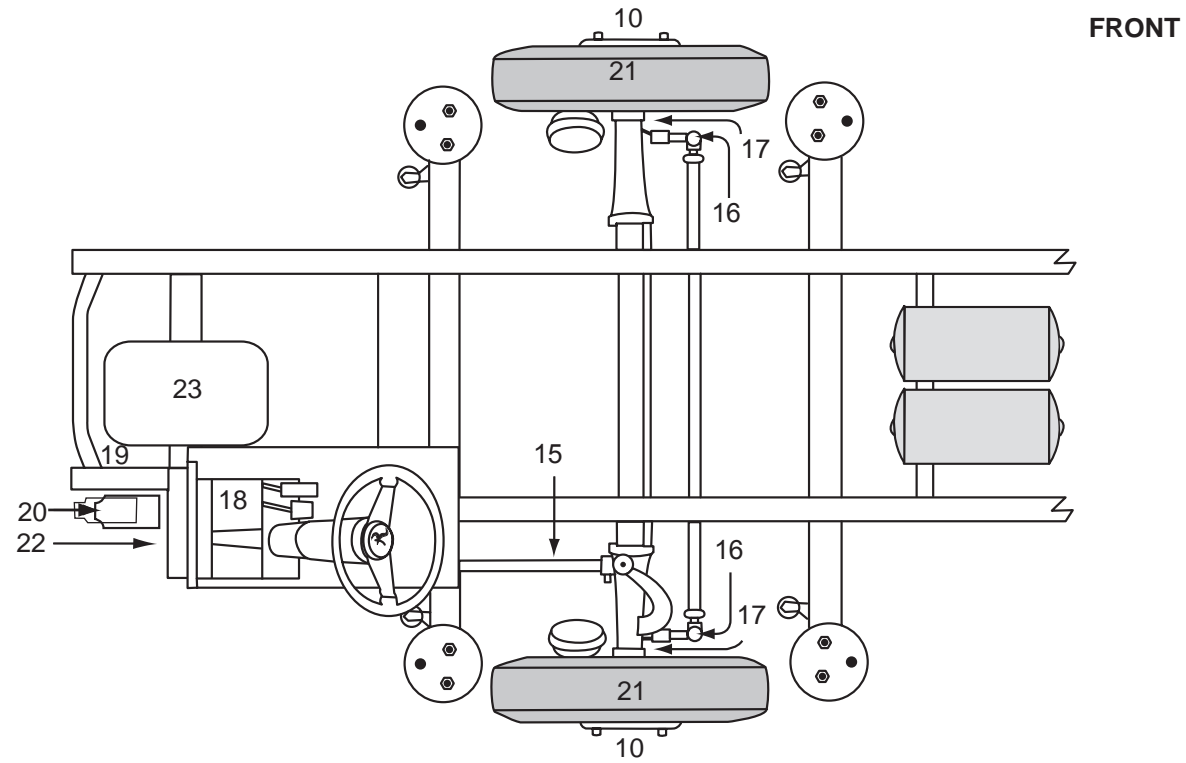
COMPONENT:		ACTION:	WHEN:	CODE:
1	Engine Oil Fill	Keep to full mark	Before each trip/daily en route	EO
2	Engine Oil Filter	Replace	At Oil Change	OEM
3	Transmission	Keep to full mark	Refer to OEM Manual	TS
4	Engine Coolant Reservoir	Maintain level	Before each trip	OEM
5a	Hydraulic Reservoir/Filter	Maintain level	Before each trip/ 15,000 miles or 6 months	HF
5b	Hydraulic Filter	Replace	Monitor Gauge	-
6	Primary Fuel Filter	Replace	15,000 miles or 6 months	FF
7	Secondary Fuel Filter - Cummins	Replace	Refer to OEM manual	OEM
8	Air Dryer Filter	Replace	2-3 Years	-
9	Radiator/Charge Air Cooler	Inspect	Weekly	-
10	Wheel Bearings	Re-pack	30,000 miles or annually	HT
11	Rear Differential	Replace Fluid	250,000 miles or 3 years	MP
12	Slack Adjuster/S-cams	Grease 3 fittings each	10,000 or 3 months	CL
13	Drive Shaft Universal Joints	Grease 2 fittings	5,000 or 6 months	CL
14	Drive Shaft Slip Yoke	Grease 1 fitting	5,000 or 6 months	CL
15	Drag Link	Grease 2 fittings	5,000 or 6 months	CL
16	Center Link	Grease 2 fittings	5,000 or 6 months	CL
17	Spindles/Kingpins	Grease 2 fittings	5,000 or 6 months	CL
18	Intermediate Steering Shaft	Grease 3 fittings	30,000 or annually	CL
19	Air Tank Drains	Drain	Monthly	-
20	Slide-room/Hydraulic Leveling Reservoir	Keep to full mark	3 months	ATF
21	Tire Pressure	Check	Before each trip	-
22	Steering Box	Grease 1 fitting	Every 6 months	CL
23	Generator	Refer to OEM Manual	Refer to OEM Manual	OEM
24	Batteries	Inspect Apply Coating	Every Two Weeks 10,000 miles or quarterly	DW P
25	Air Filter Minder	Inspect	--	-

LUBRICATION CODE CHART:	
EO	Engine oil as recommended by engine manufacturer.
OEM	Refer to the Original Equipment Manufacturer's manual.
GO	Texaco Star Gear Lubricant SAE 80w-90
CL	Chassis lubricant should be a high quality non corrosive multi-purpose lithium soap base lubricant that is water resistant and designed to withstand extremely high operating temperatures.
TF	Transmission fluid. Use Dexron III® transmission fluid only.
AF	Antifreeze as recommended by engine manufacturer.
BF	Dot-3 Brake Fluid
FF	Fuel Filter
HT	High Temperature Bearing Grease
TS	TranSynd™
DW	Distilled Water
P	Petroleum Jelly
HF	Texaco Rando HD 46
ATF	Dexron III/Mercon

**NOTE:**

Service must be performed every twelve (12) months, regardless of actual mileage, to protect seals, bearings and gaskets from drying out and failing. The motorhome must be started and driven for at least 20 miles every two weeks. It is important to remember the generator maintenance interval is based on hours of usage. Consult the OEM Owner's Manual for the generator service interval.

42' Models





COMPONENT:	ACTION:	WHEN:	CODE:
1 Engine Oil Fill	Keep to full mark	Before each trip/daily en route	EO
2 Engine Oil Filter	Replace	At Oil Change	OEM
3 Transmission	Keep to full mark	Refer to OEM Manual	TS
4 Engine Coolant Reservoir	Maintain level	Before each trip	OEM
5a Hydraulic Reservoir/Filter	Maintain level/Replace	Before each trip/ 15,000 miles or 6 months	HF
5b Hydraulic Filter	Replace	Monitor Gauge	-
6 Primary Fuel Filter	Replace	15,000 miles or 6 months	FF
7 Secondary Fuel Filter - Cummins	Replace	Refer to OEM manual	OEM
8 Air Dryer Filter	Replace	2-3 Years	-
9 Radiator/Charge Air Cooler	Inspect	Weekly	-
10 Wheel Bearings	Re-pack	30,000 miles or annually	HT
11 Rear Differential	Replace Fluid	250,000 miles or 3 years	MP
12 Slack Adjuster/S-cams	Grease 3 fittings each	10,000 or 3 months	CL
13 Drive Shaft Universal Joints	Grease 2 fittings	5,000 or 6 months	CL
14 Drive Shaft Slip Yoke	Grease 1 fitting	5,000 or 6 months	CL
15 Drag Link	Grease 2 fittings	5,000 or 6 months	CL
16 Center Link	Grease 2 fittings	5,000 or 6 months	CL
17 Spindles/Kingpins	Grease 2 fittings	5,000 or 6 months	CL
18 Intermediate Steering Shaft	Grease 3 fittings	30,000 or annually	CL
19 Air Tank Drains	Drain	Monthly	-
20 Slide-room/Hydraulic Leveling Reservoir	Keep to full mark	3 months	ATF
21 Tire Pressure	Check	Before each trip	-
22 Steering Box	Grease 1 fitting	Every 6 months	CL
23 Generator	Refer to OEM Manual	Refer to OEM Manual	OEM
24 Batteries	Inspect Apply Coating	Every Two Weeks 10,000 miles or quarterly	DW P
25 Air Filter Minder	Inspect	--	-
26 Tag Axle - Oil Bath Hubs	Keep to full mark Change	Before each trip/daily en route Annually	MP

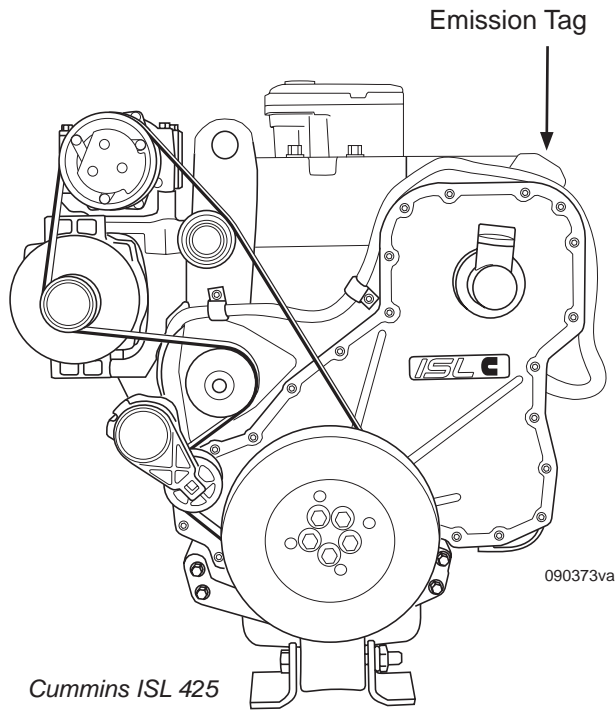
LUBRICATION CODE CHART:	
*EO	Engine oil as recommended by engine manufacturer. Texaco URSA Super Plus SAE 15W-40.
*OEM	Refer to the Original Equipment Manufacturer's manual.
*MP	API GL-5 or MT-1 type gear lubricant - Texaco Star Gear SAE 80W-90 Non-Synthetic.
*CL	Chassis lubricant should be a high quality non corrosive multi-purpose lithium soap base lubricant that is water resistant and designed to withstand extremely high operating temperatures. Texaco Starplex NLGI 2.
*AF	Antifreeze as recommended by engine manufacturer. Texaco 50/50 with bitterant and SCA.
*BF	Dot-3 Brake Fluid
FF	Fuel Filter
HT	High Temperature Bearing Grease
*TS	TranSynd™
DW	Distilled Water
P	Petroleum Jelly
HF	Texaco Rando HD 46
ATF	Dexron III/Mercon

\* Fluids initially filled at factory

#### **NOTE:**

Service must be performed every twelve (12) months, regardless of actual mileage, to protect seals, bearings and gaskets from drying out and failing. The motorhome must be started and driven for at least 20 miles every two weeks. It is important to remember the generator maintenance interval is based on hours of usage. Consult the OEM Owner's Manual for the generator service interval.

## ENGINE DRIVE BELT DIAGRAM



## SPECIFICATION CHARTS

### Tank Capacities

Tank Capacities (Approx. Gallons) All Models	
Water Heater	10 gallons
Grey Water	78 gallons
Black Water	44 gallons
Fresh Water	100 gallons
Fuel Tank	130 gallons
Propane*	31 gallons

\*Actual filled propane tank capacity is 80% of listing due to safety shutoff required on tank.

#### NOTE:

All tank capacities are estimated based upon calculations provided by the tank manufacturers and represent approximate capacities. The actual “usable capacity” may be greater or less than the estimated capacities based upon fabrication and installation of the tanks.

#### NOTE:

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

## Engine Specifications

ENGINE SPECIFICATIONS	ISL
Cubic Inch Displacement	8.9 L/538 CI
Engine HP	425 HP @ 2100 RPM
Engine Torque	1200 lbs./ft. @ 1300 RPM
Governed Speed	2200 RPM
Firing Order	153624
Rear Axle Ratio	4:30:1
Alternator Amp Size	200 Amp

## Chassis Fluid Capacities

CHASSIS LIQUID CAPACITIES	
Engine Oil	26 Qts.*
Transmission Oil (initial fill)	26 Qts.*
Transmission Oil (with service)	19 Qts. w/filter
Radiator Coolant (initial fill)	50-55 Qts.*
A/C Refrigerant (initial fill)	4 lbs. 134 A*
Hydraulic Oil	35 Qts.*
Rear End	15 Qts. Approx.*

\*On Initial Fill. Service quantity may vary.

## Generator Specifications

### 8.0 Kw

#### SERVICE INFORMATION

Refer to operator's manual for maintenance specifications and adjustments.

Air Cleaner	-	140-2897
Oil Filter	-	185-5409
Fuel Filter	-	149-2513
Oil Capacity	- 3	Qts w/oil filter
API Designation	- CE	
Temp		SAE Viscosity
5° - 120°F		15W-40
(-13°F) - 68°F		10W-30
(-40°F) - 68°F		5W-30

If service/parts are needed the Onan distributor can be located in the yellow pages under Generators-Electric. In the USA or Canada call 1-800-888-Onan  
DC Fuss & Radiator Cap Under Cover.



38' to 40' Models

020159c

### 10 Kw

#### SERVICE INFORMATION

Refer to operator's manual for maintenance specifications and adjustments.

Air Cleaner	-	140-3071
Oil Filter	-	122-0897
Fuel Filter	-	149-2513
Oil Capacity	- 6	Qts w/oil filter
API Designation	- CE	
Temp		SAE Viscosity
5° - 120°F		15W-40
(-13°F) - 68°F		10W-30
(-40°F) - 68°F		5W-30

If service/parts are needed the Onan distributor can be located in the yellow pages under Generators-Electric. In the USA or Canada call 1-800-888-Onan  
DC Fuse & Radiator Cap Under Cover.



42' Models

060144p

## Belts & Filters

### CUMMINS ENGINE

Oil Filter	Fleetguard	LF 9009
Fuel Filter (Primary)	Fleetguard	FS 1003
Fuel Filter (Secondary)	Fleetguard	FF 5636
Aqua-Hot Fuel Filter	Garber	Model # R
Hydraulic Filter	Zinga	ZSE 10
Drive Belt	Cummins	4942431
Air Filter	Donaldson	P53744802 (*MP 2329)
Air Dryer Filter	Meritor Wabco	R950011
Transmission Filter	Allison	2952688
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.**

## BATTERY SPECIFICATION CHARTS

Application	AH (20 HR)	CCA†	RC (25A @ 80° F) Minutes
12 Volt Chassis* Group 31p - MHD (2 each)		950	195
6 Volt Domestic** U2200 (4 each)	450		75 Amp @ 80° F = 230 Min.

\*Batteries connected in parallel. \*\*Four batteries connected in a Series/Parallel configuration. †CCA Ratings are 0° F. These are the minimum requirements.

Approximate Hours of Ampere Load					
U2200*	5 AMPS	10 AMPS	15 AMPS	20 AMPS	25 AMPS
	110	44	25	18	14

\*Four batteries connected in a Series/Parallel configuration.

Battery State of Charge vs Voltage/Specific Gravity			
Voltage	Specific Gravity	State of Charge	Depth of Charge
12.65	1.265	100%	0%
12.45	1.225	75%	25%
12.25	1.190	60%	50%
12.05	1.145	25%	75%
11.90	1.100	0%	100%

Voltage Reading: Battery fully charged at rest for one hour.

Engine Cold Cranking Amp Requirements			
ISL	1500	CCA	12 VOLTS

CCA Ratings are at 0° F. These are the minimum requirements.

**MAINTENANCE RECORDS**

After scheduled services are performed, record the date, odometer reading and who performed the service in the boxes provided after the maintenance interval. Any additional information from “Owner Checks and Services” or “Periodic Maintenance” can be added on the following record pages. **In addition, retain all maintenance receipts.** The owner information portfolio is a convenient place to store them.

**LUBRICATION SERVICE RECORD**

**KEY TO SERVICES**

- A – Lubrication & Inspection
- A1 – Motor Oil & Filter Change
- A2 – Transmission Oil Change

- A3 – Drive Axle Oil Change
- A4 – Wheel Bearing Service
- B – Prescribed Service

- C – Prescribed Service
- D – Prescribed Service
- E – Prescribed Service

MILEAGE	SERVICES										JOB PERFORMED	
	A	A1	A2	A3	A4	B	C	D	E	DATE	BY	
1												
2												
3												
4												
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8												
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# WEIGHT RECORD SHEETS

Without Tag Axle

DATE: \_\_\_\_\_

PLACE: \_\_\_\_\_

FRONT:        +        =         
LEFT            RIGHT            TOTAL

REAR:        +        =         
LEFT            RIGHT            TOTAL

=             
TOTAL GROSS  
VEHICLE WEIGHT

DATE: \_\_\_\_\_

PLACE: \_\_\_\_\_

FRONT:        +        =         
LEFT            RIGHT            TOTAL

REAR:        +        =         
LEFT            RIGHT            TOTAL

=             
TOTAL GROSS  
VEHICLE WEIGHT

DATE: \_\_\_\_\_

PLACE: \_\_\_\_\_

FRONT:        +        =         
LEFT            RIGHT            TOTAL

REAR:        +        =         
LEFT            RIGHT            TOTAL

=             
TOTAL GROSS  
VEHICLE WEIGHT

DATE: \_\_\_\_\_

PLACE: \_\_\_\_\_

FRONT:        +        =         
LEFT            RIGHT            TOTAL

REAR:        +        =         
LEFT            RIGHT            TOTAL

=             
TOTAL GROSS  
VEHICLE WEIGHT

DATE: \_\_\_\_\_

PLACE: \_\_\_\_\_

FRONT:        +        =         
LEFT            RIGHT            TOTAL

REAR:        +        =         
LEFT            RIGHT            TOTAL

=             
TOTAL GROSS  
VEHICLE WEIGHT

DATE: \_\_\_\_\_

PLACE: \_\_\_\_\_

FRONT:        +        =         
LEFT            RIGHT            TOTAL

REAR:        +        =         
LEFT            RIGHT            TOTAL

=             
TOTAL GROSS  
VEHICLE WEIGHT

DATE: \_\_\_\_\_

PLACE: \_\_\_\_\_

FRONT:        +        =         
LEFT            RIGHT            TOTAL

REAR:        +        =         
LEFT            RIGHT            TOTAL

=             
TOTAL GROSS  
VEHICLE WEIGHT

DATE: \_\_\_\_\_

PLACE: \_\_\_\_\_

FRONT:        +        =         
LEFT            RIGHT            TOTAL

REAR:        +        =         
LEFT            RIGHT            TOTAL

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TOTAL GROSS  
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## TECHNICAL PUBLICATIONS

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### 2009 CAMELOT

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#### Printing

Holiday Graphics - IN

### CORPORATE SITE

[www.monaco-online.com](http://www.monaco-online.com)

#### Online Tours

[www.monaco-online.com/tours](http://www.monaco-online.com/tours)

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