

Section 9 ~ Electrical Systems - Chassis

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2005 Santiam

ELECTRICAL CHASSIS - INTRODUCTION

A majority of the lighting and appliances are designed to operate from 12 Volt DC (direct current) power. This is why batteries play such an important role in the function of the motorhome. There are exceptions with appliances such as the microwave or television; however, indirectly they still operate from 12 Volt DC power, as they can be operated from the inverter. The chassis functions (engine, transmission, dash air, etc.) are also 12 Volt DC.

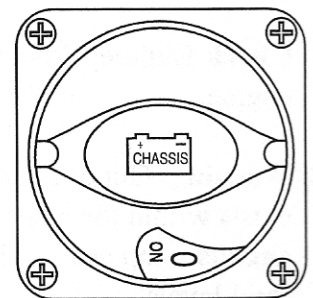
With the all technological advancements taking place in the past several years manufacturers have now incorporated electronics into these systems. It is important to keep the 12 Volt system(s) in good working order. These systems, with their incorporated electronics, are voltage sensitive. Some items can be damaged if the DC voltage is not maintained within the designed specifications.

There are two separate 12 Volt systems. One is the chassis system; the other is the house system. These two systems, for the most part, are separate from one another. The house system does not operate engine functions; as the engine system does not operate house functions. However, within the two systems there are some inner connections. For example: While the motorhome is driven the alternator on the engine will surface charge the house batteries. Each system will supply 12 Volt DC power to the 12 Volt distribution panels.

The two different systems, engine and house, have their own set(s) of batteries. The engine battery supplies 12 Volt DC power to the front distribution panel located in an outside compartment by the driver's side front wheel. This panel contains mostly engine system fuses and wiring such as headlights, taillight, dashboard functions, gauges, etc. The house battery(s) supplies 12 Volt DC power to the distribution panel located in the bedroom. This panel contains fuses for the house, interior lighting and appliances, such as the furnace and water heater.

BATTERY DISCONNECT - CHASSIS

The chassis battery disconnect is located in the curbside battery compartment. The battery disconnect for the chassis battery turns the DC power on or off to the front electrical bay. Chassis and engine functions are interrupted when the battery disconnect is turned off. Some electronic items require a constant power source for memory retention such as the dash and CB radios. Some electronic components of the engine and transmission require a constant power source. Turn the main battery disconnect switch off when the motorhome is going to be stored, or when performing electrical maintenance.



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NOTE: The solar panel (optional) will charge the batteries with the 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 storage bay between the frame rails.
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.

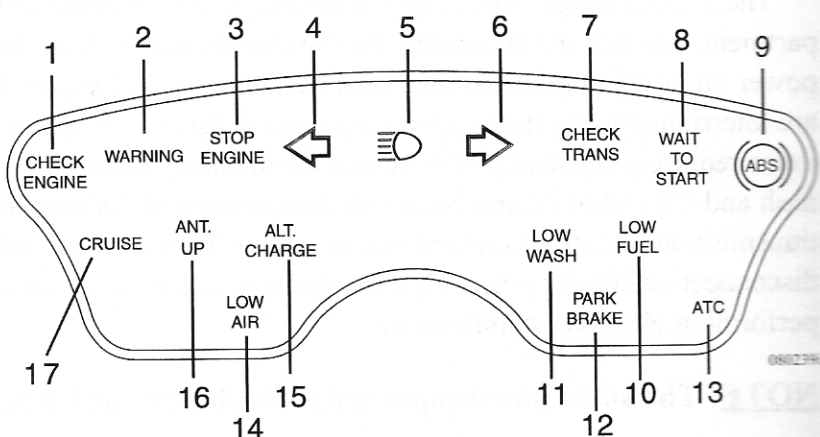
BATTERY - CHASSIS

The chassis battery operates only chassis and engine functions. The chassis battery is a crank type battery, producing the high amperage needed to start the engine. Engine starters initially require a large amount of current to crank an engine. Initial starter amperage draw exceeds 1200 amps. The type of application in which the engine battery is used differs from the house battery application. The engine battery state of charge remains consistent. Maintenance is still required with an engine battery. Regular electrolyte level checks and hydrometer readings should be performed. High electrolyte consumption, or inconsistent hydrometer cell readings, may indicate a charging system problem. Perform a charging system and current draw check if the battery is exhibiting abnormal hydrometer readings.

NOTE: Replacement batteries should have the same cold cranking amp (CCA) rating.

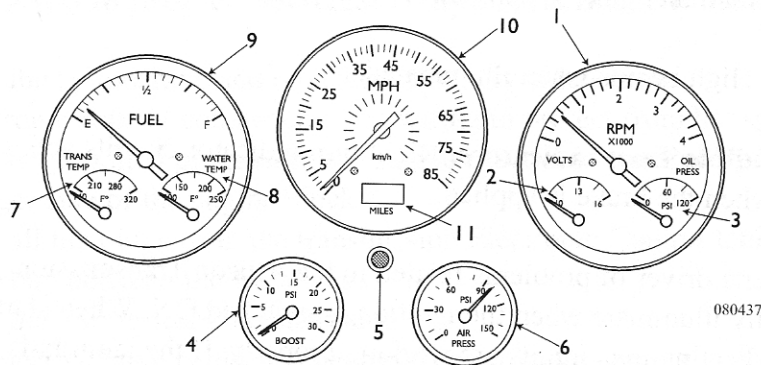
DASH - Indicator Lamps

1. **Check Engine:** Problem with the engine.
2. **Warning:** Out of range condition exists within the engine protection circuits. Stop coach, check all fluid levels.
3. **Stop Engine:** Alerts driver of severe out of range condition within the engine protection circuits. Pull over and stop as soon as possible. Shut-off engine to avoid engine damage.



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4. **Left Arrow - Audible Turn Indicators:** Left turn indicator circuits active. Audible indicator cancels when the brake is applied.
 5. **Headlight Beam:** High beams when illuminated.
 6. **Right Arrow - Audible Turn Indicators:** Right turn indicator circuits active. Audible indicator cancels when the brake is applied.
 7. **Check Trans:** Alerts driver of problems related to the Allison Transmission. The light should momentarily illuminate when the ignition is switched ON. When starting, the lamp will extinguish indicating the circuits are working properly. If the lamp fails to illuminate or remains on, the transmission needs to be checked immediately. Contact the nearest Allison dealer.
 8. **Wait to Start:** Monitors the air intake heater at engine start up.
 9. **ABS:** ABS possible fault in the ABS Brake system. Also indicates fault codes for service technicians.
 10. **Low Fuel:** Fuel level is becoming low.
 11. **Low Wash:** Windshield washer fluid is becoming low.
 12. **Park Brake:** Parking/emergency brake is applied.
 13. **ATC (Automatic Traction Control):** The ATC indicator light will illuminate steady when the ignition key is turned ON. The light remains illuminated until the first brake application. The indicator flashes slowly when the ATC switch is pressed. The indicator light will flash quickly when an ATC event occurs.
 14. **Low Air:** Air tank pressures are out of operating range. Check air pressure.
 15. **Alt Charge:** Failure within the alternator charging system.
 16. **Ant:** TV antenna is raised. Lower antenna before moving coach.
 17. **Cruise:** Indicates when cruise control is activated.

Gauges



1. Turbo Boost: Indicates boost pressure produced by engine turbocharger.

2. Trans Temp: Shows temperature of transmission fluid. Normal transmission operating temperature is 160 to 250° F. The maximum transmission to cooler oil temperature is 300° F. Do not let the transmission temperature exceed 275° F. If excessive temperature is indicated stop motorhome and shift to neutral. Accelerate engine to 1200 to 1500 RPM and allow temperature to return to normal.

3. Coolant Temp: Under average conditions the gauge reads between 180° F and 205° F. Monitor this gauge frequently when **CLIMBING HILLS, TOWING** or in **HIGH AMBIENT TEMPERATURES**. If the gauge shows that over-heating exists (the needle moving above the 212° F area) **IMMEDIATE ACTION** should be taken.

Overheating may be a Result of any of the Following Conditions:

- Low coolant level.
- Hydraulic fan motor failure.
- Mechanical failure of hoses or belts.
- Blocking of charge air cooler fins.
- Climbing a long hill on a hot day.
- Towing a heavy trailer.
- Idling for long periods of time.

4. Tachometer: Displays engine speed in revolutions per minute (RPM).

5. Oil Pressure: Indicates pressure of oil and not the amount of oil in system. Please refer to manufacturer's instructions for specific pressure recommendations.

6. Speedometer: Indicates the speed of the motorhome. The gauge indicates MPH and KPH.

7. Odometer/Trip Meter: This meter records mileage driven as well as keeps track of mileage on a trip. To operate trip meter push the round black button under the speedometer. This changes odometer mileage reading to the trip mileage reading. The black reset button sets the trip mileage back to zero when held for 2 to 3 seconds. Release the button and momentarily press the button again. This changes the trip mileage reading to the odometer mileage reading.

8. Mileage/Trip Reset Button: Operates the trip meter, changes the odometer mileage reading to the trip mileage reading. Press and hold to reset the trip meter.

9. Fuel: Fuel gauge will register approximate fuel level in the tank when ignition switch is in the run position.

NOTE: Fuel mileage varies with driving style and road conditions. Always average more than one tankful to obtain a more accurate figure. The diesel Generator uses fuel from main tank and will affect fuel mileage figures. Diesel Generators will not operate below 1/4 tank to ensure there is enough fuel to run main engine.

10. Voltmeter: This gauge shows the charge condition in the chassis battery. The normal voltage with the ignition switch ON and the engine OFF varies between 12.0 and 13.0 Volts. With the engine operating without a heavy load the battery charging voltage is about 14.0 Volts. Battery readings of less than 10.5, or more than 15.0 Volts, usually indicates a battery or electrical system problem.

11. Air Pressure Gauge: This gauge indicates air system pressures. The normal air system operating pressures are 105 to 120 psi. These air pressures are preset at the factory. If a problem occurs with air system not maintaining normal operating pressure it is an indication of a malfunction in the air system. Use caution and stop the motorhome in a safe area. Contact your dealer immediately.

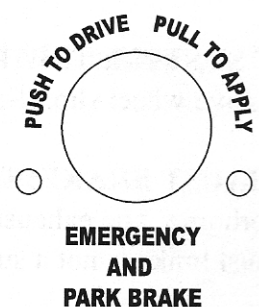
NOTE: It is not safe to drive the motorhome with low air pressure. Damagé can occur to the suspension and drive line. The operation of the air brake system is also affected.

NOTE: Layouts may vary with different models and options.

Parking Brake

The parking brake system is activated when the push-pull control knob (located on the driver's left console panel) is pulled. When the knob is pushed, the brake is released. Prior to driving, allow time for the air compressor to build up sufficient air to shut off the air warning lamp.

WARNING: If the air tank is not dumped, there is the possibility of an accidental release of the parking brake. Traveling with small children and/or pets may require a small block to be fabricated to prevent accidental release. The block should be placed under the knob and rested on the dash panel. A wooden clothes pin clasped at the base of the shaft will work. Wooden clothes pin is not shipped with unit.



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Switches

Two types of switches are used. One is lighted; the other is non-lighted. Each switch has the function it controls printed on the switch. Press the top of the switch to start the function and press the bottom to stop the function. Following is a list of switches used and their functions.

PEDAL IN/OUT: Use the Pedal In/Out switch to adjust the brake and throttle pedal to be either closer or farther away. The switch moves the pedals inward or outward about three inches. If it is necessary to move the pedals inward, push the same switch in the opposite direction. When the pedal comes to the end of the traveling distance there will be a different sound in the noise of the motor. Stop by releasing the switch. Do not continue moving the pedals. Damage to the motor and or fuse may result if operation of the switch continues after reaching the fullest extend or retract position.

BATT BOOST: In the event the motorhome chassis battery has been drained and cannot start the engine, this switch momentarily "jumps" the domestic battery to the motorhome chassis battery to assist in starting the engine.

AUG LIGHTS: Turns fog lights ON and OFF for better visibility. The fog lights will operate with the Low Beam of the headlights.

SIDE DOCKING LIGHTS: Operates the side docking lights to increase visibility when parking.

FANS ON/OFF (Not on all units): Operates driverside windshield fan.

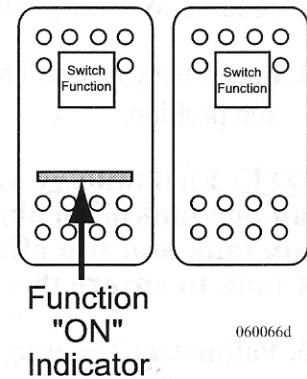
FANS ON/OFF (Not on all units): Operates passenger side fan.

ATC SYSTEM: The ATC system improves traction on slippery or unstable surfaces by preventing excessive wheel slip. (See SECTION 10 for detailed information.)

EXHAUST BRAKE: The exhaust brake is an auxiliary braking device for slowing down the motorhome. The exhaust brake is an effective device for speed control in town and on local routes. The exhaust brake is not a substitute for service brakes. Do not neglect service brake maintenance.

ENG DIAG: Checks engine functions.

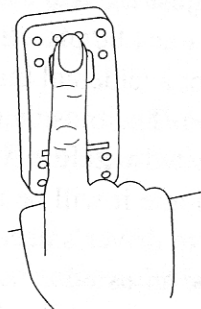
GEN START: The generator automatically initiates a preheat cycle when the switch is pressed to START. The preheat cycle is indicated by the light on the switch flashing rapidly. Depending on ambient temperature the preheat cycle may last up to 15 seconds.



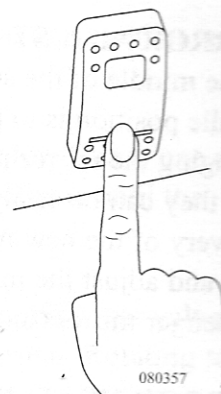
To Start the Generator: Press and hold the switch to START. The light will flash rapidly indicating the preheat cycle. At the end of the preheat cycle the engine will crank and start. Release the switch after the generator has started and is operating smoothly.

To Stop the Generator: Momentarily press the switch to STOP. It is not necessary to hold the switch until the generator has stopped.

Press Top to
START



Press Bottom to
STOP



STEP COVER (FRONT DOOR MODELS ONLY): Extends and retracts the step cover.

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

DRV SHADE: Operates the power sun visor located on driver's side.

PASS SHADE: Operates the power sun visor located on passenger side.

MAP LIGHT: Turns ON and OFF map light

ENTRY STEP: Provides power to operate the Entry Step through magnetic switches.

CEILING LIGHT: Illuminates the front ceiling light from the Entry Area.

PORCH LIGHT: Turns ON and OFF the outside Porch Light.

RADIO: Applies power to dash radio, allowing the radio to be turned ON and OFF, independent of the main radio switch.

BATTERY CUTOFF: Controls the 12 Volt DC power to the domestic fuse panel.

STEPWELL LIGHT: Turns step well lights ON and OFF.

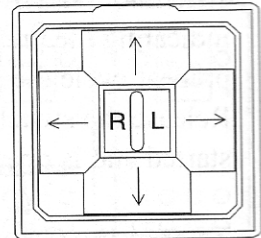
STOR LIGHTS: Turns bay lights ON and OFF.

AIR DUMP: Manually dumps air from air bags. May aid in leveling the motorhome. Releasing the air from air bags will give the leveler more range of travel. Ignition must be in accessory or run position.

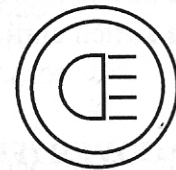
NOTE: Never drive the motorhome with the air bags deflated as it may damage the motorhome.

Controls

MIRROR ADJUST: To adjust the rear view mirror the small selector in the middle of the switch must be placed in the desired side. The middle position is to prevent accidental bumping of the switch and changing the mirror position. The outside mirrors have been placed so that they can be easily adjusted with the Allen wrench. After taking delivery of the new motorhome it will be necessary to sit in the driver's seat and adjust the mirrors to driver's needs. Both the driver and the passenger mirrors should be adjusted.



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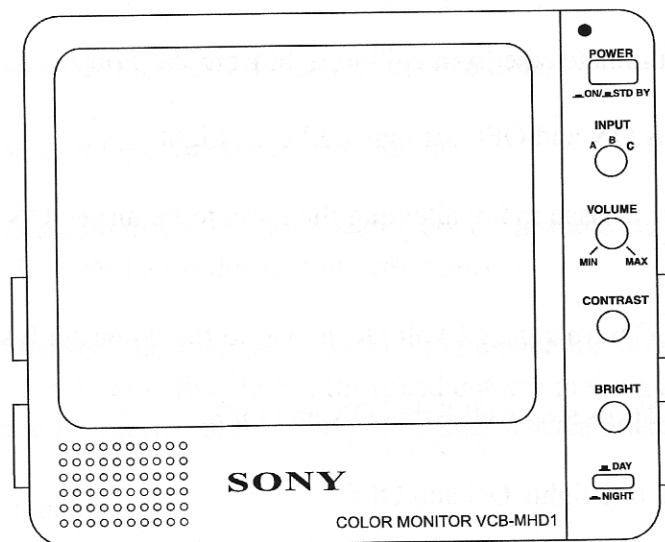
Headlight Control

MIRROR HEATER: This switch turns on the heaters in outside rear view mirrors. The mirror heaters should be used when defogging or deicing is needed. To use the mirror heat, press the switch to the ON position.

NOTE: Mirror heat should not be left on unless continuous fogging conditions occur.

HEADLIGHT: Pull one click to operate the parking lights. Pull two clicks to operate the headlights. Rotating the headlight switch clockwise will dim the dash lights. Counterclockwise rotation will illuminate the map light in the overhead compartment.

BACK UP MONITOR: Used with the back up camera and will display the rear view of the motorhome.



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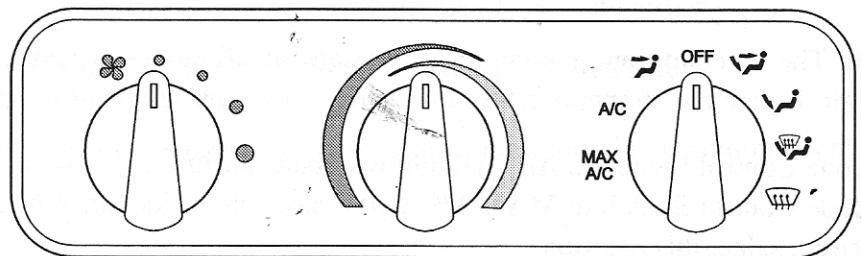
AIR CONDITIONER & HEATER CONTROLS

The system is designed to only provide heating, cooling and defrost for the pilot and co-pilot area. The system is not capable of heating or cooling the entire motorhome.

Blower Control Switch: This switch controls the four speeds of the blower motor. This is one of the best and most effective ways of controlling temperature. The blower will not activate until the Mode Control Switch is set to any position other than Off.

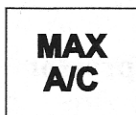
Temperature Control Switch: Setting the switch to the Red zone controls an electric water valve regulating the amount of engine coolant passing through the heating coils in the system. Rotating to the blue zone sets the cut-in/cut-out temperature of the air conditioning compressor on the engine.

Mode Control Switch: This switch directs air flow by opening or closing damper doors. Use the Mode Control Switch to direct airflow where it is needed to maximize comfort in the cockpit area.

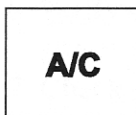


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Blower Speed Control Temperature Control Mode Control Switch



MAX A/C - Recirculated air is drawn from the passenger area and discharged through the dash louvers.



A/C - Fresh Air is drawn from outside into the system and discharged through the dash louvers.



VENT - Fresh air is drawn in and discharged throughout the dash louvers.



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 louvers.

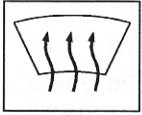
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FLOOR - Fresh air is drawn in and discharged through the floor louvers. A small amount of air discharges through the defrost vents.



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 compressor operates to dehumidify the discharged air.

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Heat and Defrost Operation: The air conditioning compressor operates in all modes except **VENT**, **FLOOR** and **OFF** to dehumidify the air. Rotate the temperature control switch to set discharge air temperature.

- Set the Mode Control Switch to the desired position.
- Set the Temperature Control Switch to the red zone.

A/C Operation: The air conditioning compressor operates in all modes, except vent, floor and off, to dehumidify the air. Rotate the temperature control switch to set discharge air temperature.

- Setting the Mode Control Switch to **A/C** will allow outside air into the system.
- Setting the Mode Control Switch to **MAX A/C** will recirculate inside air. When maximum cold air is desired, select this position.
- Set the Temperature Control Switch to the blue zone.

NOTE: The temperature control switch must be set to the blue zone for cool air.

NOTE: Activate the A/C system monthly to keep internal components of the compressor lubricated.

Winter Use:

- De-ice the windshield using the DEFROST mode.
- The system will heat up faster with a slower blower speed until normal engine operating temperature is obtained.

Summer Use:

- Close all windows and vents preventing hot and humid outside air from entering the motorhome.
- MAX A/C and HI blower will provide quick cool down.
- Using a lower blower speed will produce cooler air.

Operating Tips and Hints:

- Air intake and discharge temperatures are greatly effected by ambient temperature and relative humidity.
- A large amount of cooling capacity is used to dehumidify air as well as cool it. After three to five minutes of A/C compressor operation, the discharged air temperature should be about 30° F cooler than the fresh or recirculated air entering the A/C system.
- The air system on the motorhome must have adequate pressure to operate the vacuum generator or damper doors will not function.
- At the beginning of the day, activate the compressor with the engine at idle. This will avoid sudden high speed activation resulting in damage from lack of internal compressor lubrication.
- The dash A/C and heater system should be used monthly to keep the compressor lubricated.

Trouble Shooting: The dash A/C/Heat system uses a combination of compressed air (developed by the chassis system), vacuum air (developed by the vacuum generator) and electric relays and vacuum switches. Therefore, any repair can be classified in one of five categories:

- **Electrical** • **Vacuum** • **Air Conditioner** • **Heater** • **Defroster**

The following information is provided to assist in troubleshooting common operational problems which may occur.

No Heating:

1. A/C switch is turned off.
2. Blower switch is turned off.
3. Verify the proper engine coolant level.
4. Verify that the engine is reaching operating temperature.
5. Verify engine coolant is reaching water valve attached to unit.
6. Verify operation of water valve to permit engine coolant to pass through valve to heater core.
7. Check unit fuses.
8. Check power supply to water valve and grounding.
9. Check wiring.
10. Engine thermostat faulty.

No Cooling:

1. Check blower is operating, A/C switch is in A/C or Max position, temperature control is turned to Max cooling (blue area).
2. System fuses are not blown.
3. Condenser fan is operating.
4. Check power supply to unit and grounding of system.
5. Check wiring.
6. Coolant valve is leaking.
7. Drive belt is loose or broken.
8. Compressor Clutch is inoperative, will not engage.
9. Expansion Valve is faulty or frozen.
10. Thermostat control is faulty.
11. Mode control switch is faulty.
12. Compressor is faulty.
13. Loss of refrigerant.

Reduced Cooling:

1. Coolant valve not operating correctly.
2. Air passages are obstructed.
3. Loose or worn drive belt.
4. Check blower and select switch.
5. Thermostat control valve is faulty.
6. Expansion valve is faulty.
7. Compressor is faulty.
8. Low refrigerant charge.

Blower Does Not Operate or Runs Slow:

1. Check fuses.
2. Check for loose or corroded connection.
3. Check wiring.
4. Check to ensure ignition switch is "ON."
5. Check blower and select switch.
6. Motor shaft has seized.
7. Blower wheel is out of alignment.

Damper Doors Do Not Operate:

1. Does the motorhome air tank have pressure?
2. Is the vacuum generator being powered and producing a vacuum?
3. Check the vacuum line entering the unit for vacuum.
4. Check that the vacuum solenoid mounted on unit is receiving power from the mode switch. If operating properly, the vacuum solenoid will feel hot if current is engaging the solenoid.
5. Check the mode switch.
6. Check wiring.
7. Check for a pinch in the vacuum line leading to the vacuum motor that operates the damper door in question.

Air Conditioner Refrigeration Components:

Compressor - The compressor is belt driven from the engine through the compressor and electronic clutch pulley. The compressor will pump freon from a low pressure gas into a high pressure, high temperature gas. This is the start of the refrigeration process.

Condenser - The condenser in front of the radiator is made of coils and fins which provide rapid transfer of heat from the refrigerant as external air passes over the coils. The high pressure gas is changed to a high pressure liquid.

Condenser Fan - A steady flow of cooling air is maintained across the condenser during system operations. The fan is part of the hydraulic system.

Receiver-Drier - Freon leaves the condenser, enters the dehydrator and is stored until needed. The drier filters out moisture in the system. It only takes one drop of moisture to cause a malfunction in the cooling unit.

Expansion Valve - The expansion valve suppresses the refrigerant into the evaporator according to the cooling requirements. The pressure is reduced in the restrictive effort of the expansion valve. A part of the valve is the capillary tube assembly. The capillary tube is the sensing bulb at the outlet of the evaporator.

Evaporator - A tube core and fins are used in the evaporator similar to the condenser. Air is blown through the fins to allow the evaporator to cool and reduce the pressure.

Blower and Motor - Just as the condenser has a fan, the evaporator has a fan called the blower. The blower will draw air from the cab area and force the air over the evaporator coils and fins. This forced air will ensure continuous vaporizing of the R134a.

Relays and Switches - Both electronic and vacuum switches are used in the control and operations of the system.

About Refrigerants

Chemical Stability: The air conditioning system life and efficient operations depends upon the chemical stability of the refrigeration system. The refrigeration system is made of Refrigerant-R134a and Polyakylene Glycol (PAG) synthetic lubricant. It is very important that all materials contained within the refrigerant system be chemically compatible.

The only suitable compound for use with R134a is PAG. The total amount of PAG within the refrigerant system is about 18% of the total refrigerant in the system.

How much refrigerant is in the system? How much should be used when charging? Use 1 oz. of PAG for each 7 feet of hose after the first 15 ft. of hose. Roughly, a 40 ft. motorhome will use 92 ft. of refrigerant hose. Take 15 ft. off the measurement and the result is 77 ft.. This 77 ft. is then divided by 7 for total of 11. This represents the number of ounces of PAG oil needed for the A/C system (11 oz.).

Carrying the formula one step further, the 11 oz. equal about 18% of the entire system. The total will equate to about 61 oz. or 3.8 lbs. of R134a.

High pressure readings are another way to determine the amount of charge. The ambient temperature reading is measured one inch away from the condenser. The ambient temperature reading, plus 40° F, will equate to a value from the pressure table.

EXAMPLE:

90° F. 1 inch from condenser + 40° F = 130° F ----- 198.90 PSIG -

On fully charged system the expected pressure that should be seen on the HIGH-SIDE gauge will be around 200 PSIG.

NOTE: All systems are charged at the factory with 4.0 lbs of R134A.

TEMPERATURE	PSI GAUGE	TEMPERATURE	PSI GAUGE	TEMPERATURE	PSI GAUGE
16° F	15.69	60° F	57.47	112° F	151.30
18° F	17.04	65° F	64.10	114° F	156.10
20° F	18.43	70° F	71.19	116° F	161.10
22° F	19.73	75° F	78.75	118° F	166.10
24° F	21.35	80° F	86.80	120° F	171.30
26° F	22.88	85° F	95.40	122° F	176.60
28° F	24.47	90° F	104.40	124° F	182.00
30° F	26.10	91° F	106.30	126° F	187.50
32° F	27.79	92° F	108.20	128° F	193.10
34° F	29.52	93° F	110.20	130° F	198.90
36° F	31.32	94° F	112.10	135° F	213.70
38° F	33.17	95° F	114.10	140° F	229.40
40° F	35.07	100° F	124.30	145° F	245.80
42° F	37.03	102° F	128.50	150° F	263.00
44° F	39.05	104° F	132.90	155° F	281.00
45° F	40.09	106° F	137.30	160° F	300.10
50° F	45.48	108° F	141.90	165° F	320.00
55° F	51.27	110° F	146.50	170° F	340.80

psi gauge_temp

R-134a Refrigerant:

R-134a is classified non-explosive, non-flammable and non-corrosive.

There is hardly any odor and it is much heavier than air. R134a is ozone friendly; however, it is not technician friendly. Proper care in handling and adequate ventilation must be observed. Under normal atmospheric pressures and temperatures R134a will evaporate so quickly it will freeze anything it comes in contact with. The open container boiling point for R134a is minus 21.7° F. This low boiling point makes for an ideal refrigerant. The tremendous amount of heat transfer which occurs when a liquid boils, or vapors condense, forms the basic principles of all A/C systems. The amount of heat required to raise or lower the temperature of one pound of water by 1° F equals one British Thermal Unit (BTU). The BTU is the standard measurement of an air conditioner system.

Safety and Handling of 134A and Pag Oil:

- When working with any refrigerant system wear eye protection and hand protection.
- Pag Oil irritates the skin. Flush with water immediately if in contact with any body part.
- Ensure any service work performed on the A/C system is in a well ventilated work area.
- Keep open flame away from service area. The discharge of a refrigerant gas near an open flame can produce a very poisonous gas.

NOTE: O-rings used in a 134A system are Hydrogenated Nitrile Butadiene Rubber (HNBR). These are green in color and required for the 134A system.

A/C Heater: The A/C system will also produce heat to warm the air in the dash area. Much like the refrigeration side of the system, a liquid will be used in the process. This liquid is the engine coolant. The coolant is passed from the radiator to an electronic water valve. The water valve, when open, will allow the coolant to flow through the heater core. The heater core is tubing and fins. Air is drawn into the system by a blower motor through the outside recirculation door opening. Air is blown through the A/C evaporator core and then through the heater core. When the temperature control is in the **WARM** position coolant flows through the heater core. When the temperature is in the **COOL** position coolant flow bypasses the heater core. In either position the air flow is felt at the discharge vents.

Diagnosis of Electric Water Valve: Theory of Operation: The thermostat is a potentiometer. The water valve, which controls the water flow to the heater core, is opened and closed by a stepper motor mounted on the water valve. A control module compares the output voltage from the potentiometer to the feedback for the stepper motor of the water valve. The control module then drives the motor to within one-half volt of the control potentiometer voltage.

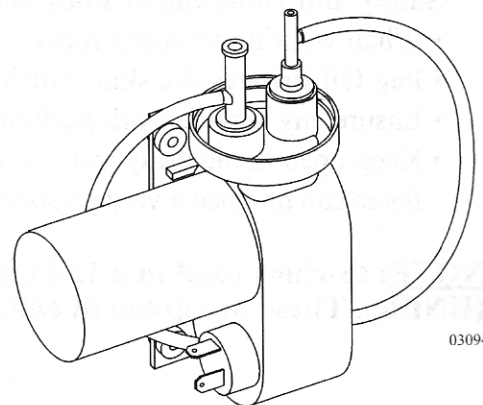
Functional Test:

- Start and operate the engine until the water reaches normal operating temperature.
- Set the HVAC temperature control to the full hot position.
- The discharge air outlets should have hot air.
- Rotate the temperature control to full cold position.
- Allow 10 minutes for the temperature to stabilize.
- The discharge air outlets should have cold air.

No Heat:

- Check the blower and air mode operations. Repair prior to proceeding.
- Verify the engine is reaching normal operating temperature. (Check with engine manufacturer for proper procedure.)
- Check the inlet hose at the water valve. The hose has hot water at the valve inlet. The inlet water temperature should be the same as the engine water temp.
- With the temp control on full hot position, check the outlet hose of the water valve. The hose should be at engine water temperature.

Vacuum Generator: The vacuum generator is important to the operation of the dash heating and A/C systems. This provides the vacuum to open and close the vacuum switches. When the vacuum generator is operating it creates 15" of vacuum and 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. The vacuum generator uses the air from the front air storage tank through a 1/4" red air line. Whenever the ignition is ON, and the A/C is operating, the vacuum generator will operate.

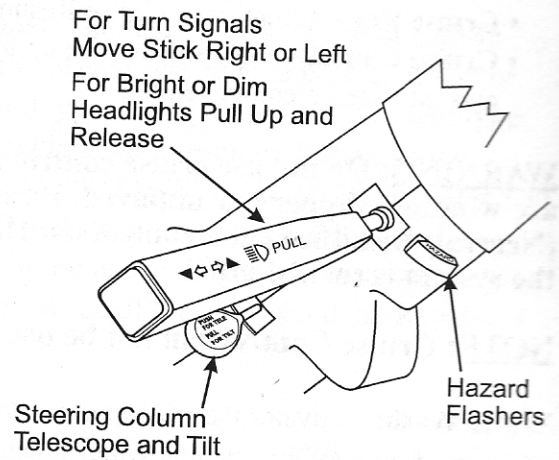


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STEERING COLUMN - *Tilt & Telescope*

Tilt and Telescope Steering Wheel Control Lever: Located on the Steering Column.

- To tilt the steering wheel pull the lever up. Tilt the steering wheel where desired. Releasing the lever will lock the steering wheel in the new position.
- To telescope the steering wheel push and hold the lever down. Push down or pull up on the steering wheel until the wheel is in place. Release the lever and the steering wheel will lock in the new position.



Turn Indicator and Headlight High/Low Dimmer Control Lever: Located on the Steering Column.

- Pushing the lever forward will activate the right turn indicator circuits when the ignition is on.
- Pulling the lever down will activate the left turn indicator circuits when the ignition is on.
- Pulling the lever up will select high/low beam circuits when the headlights are ON.

Hazard Flasher Button: Located on the Steering Column.

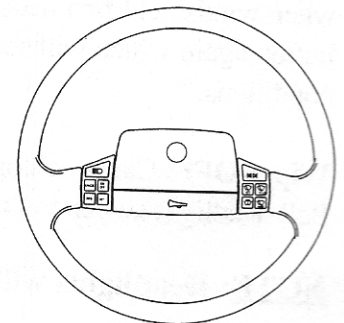
- Pull out on flasher button to turn four way flasher on.
- Push button inward to shut off flasher.

Smart Wheel Operation

City Horn: Horn bar on the steering wheel sends the appropriate signal to cause the electric horn output to activate when the switch is pressed. It is recommended for city driving.

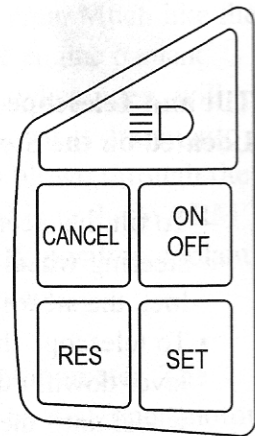
Headlamp Flash: If the headlamps are on, pressing the switch will cause them to go off while the switch is pressed. In a like manner, if the headlamps are off, pressing the switch will cause them to go on while the switch is pressed.

Marker Lamp Flash: If the marker lamps are turned on, pressing the switch will cause them to go off while the switch is pressed. If marker lamps are off, pressing this switch will cause them to temporarily illuminate.



Cruise Functions:

- **Cruise ON/OFF** - Cycles the Cruise system ON and OFF.
- **Cruise Set** - Actuates the Cruise Set function of the engine controller.
- **Cruise Res** - Actuates the Cruise Resume function of the engine controller.
- **Cruise Cancel** - Signals the cruise system to disengage without losing the current speed memory setting.

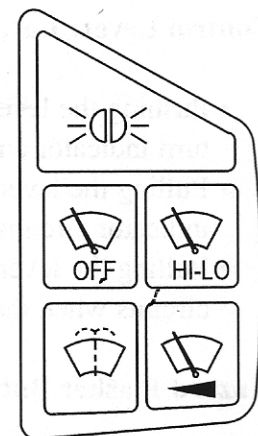


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WARNING: Do not use cruise control in heavy traffic or on roads that are winding, slippery or unpaved. Do not shift the transmission into "N" (Neutral) with the cruise control on. High engine RPM will occur until the system is turned off.

NOTE: Cruise Control can not be used if exhaust brake switch is in the ON position.

Wiper Wash: Activates the wash pump relay when the switch is pressed. In addition, if none of the latching wiper functions (Wiper Lo/Hi or Variable) had been previously selected, the Low-Speed Wiper will be activated for a period of about three wiper cycles after the switch is released. If any of the latching wiper functions (Wiper Lo/Hi or Variable) had been previously selected, the wipers will continue to run in the selected mode after the wash switch is released. Washer reservoir is located in the front generator compartment.



090270

Wiper LO/HI: Causes the Low-Speed Wiper functions to activate. If the switch is pressed again the High-Speed Wiper will be activated. Subsequent presses of this switch will cause alternate operation of the wipers in the low or high-speed mode.

Wiper Variable: The operation of this switch initially causes the Low-Speed Wiper function to activate for one wipe. If the switch is pressed again within about 30 seconds, the Low-Speed Wiper function will be activated again and will repeat at an interval determined by the time between the last two operations of the switch. Additional switch operations will shorten the cycle. Activation of any wiper mode cancels the variable mode. For example: In light rain or mist conditions the driver presses the switch once when windshield first needs clearing. When the windshield again requires clearing, the driver presses button again which will set the time period between subsequent wipes to that required by the current conditions.

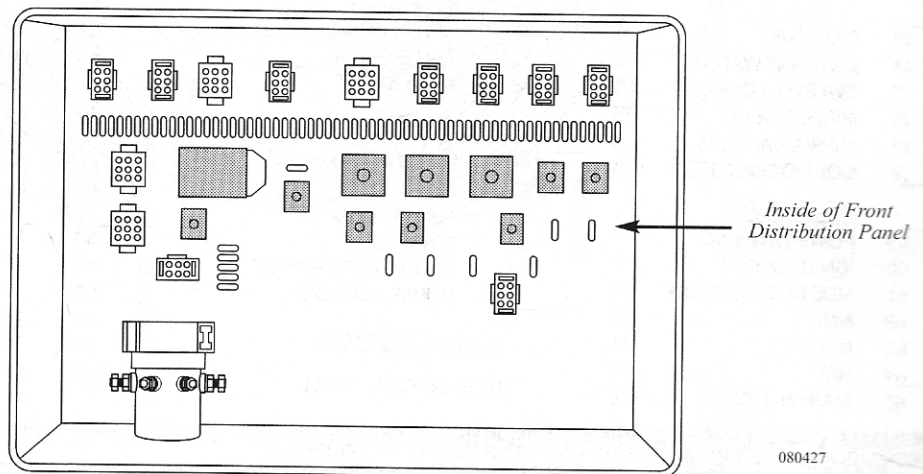
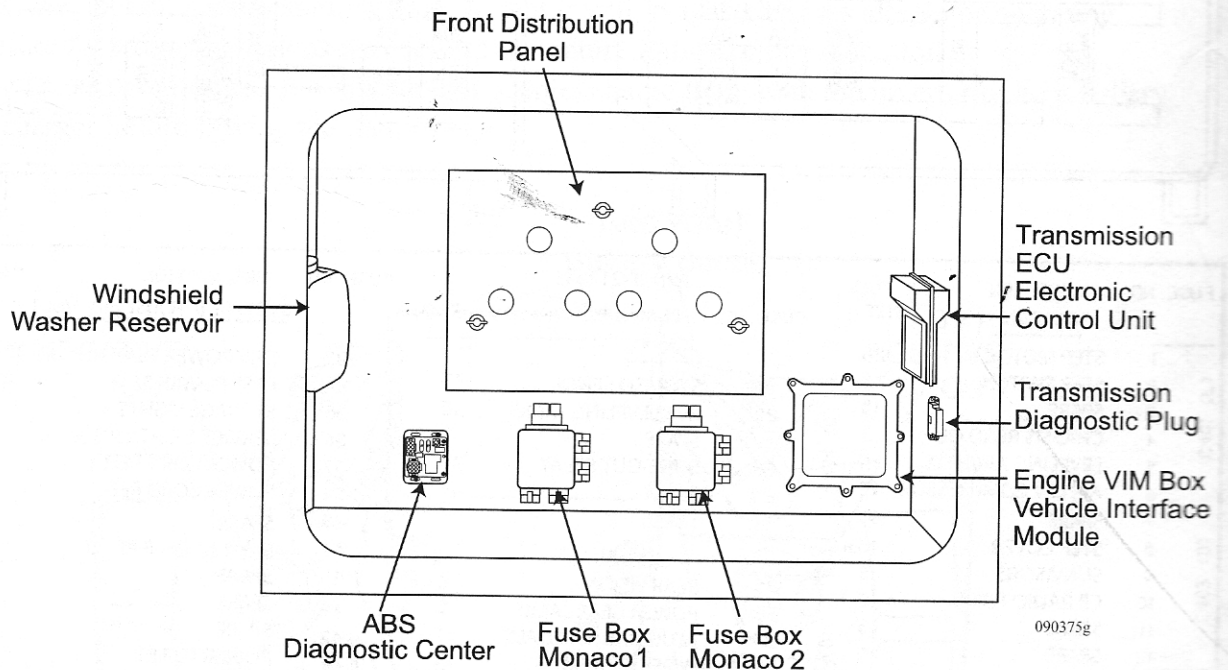
Wiper OFF: Causes all operation of wipers to be canceled. Turning off the ignition also resets this mode. Pull headlight switch to **ON** then back to **OFF** to cancel automatic headlight operation.

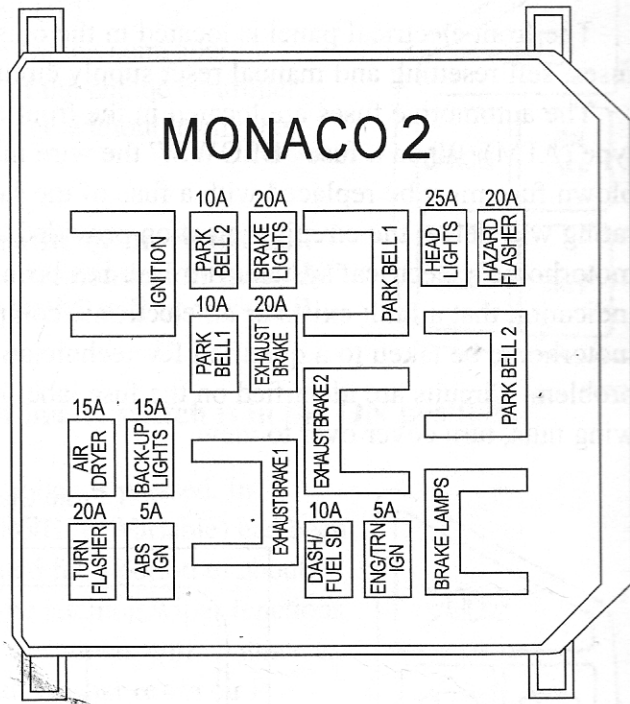
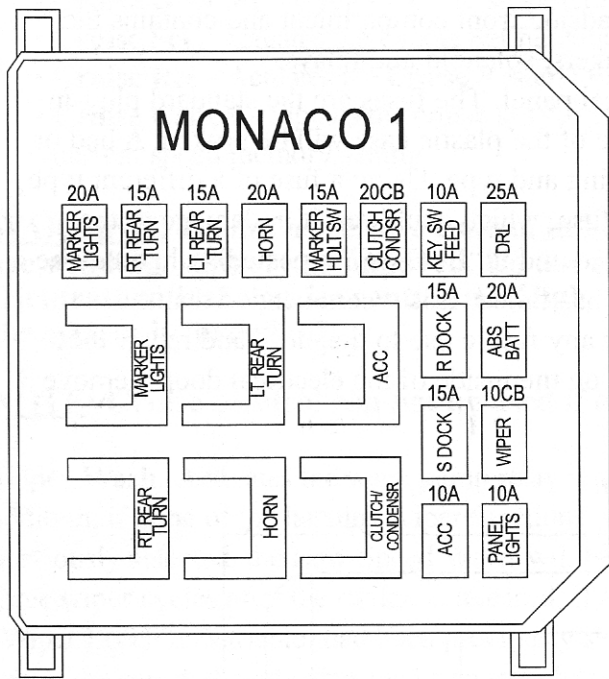
NOTE: Headlights will come on when any wiper mode is selected.

FUSE & CIRCUITS - Front Distribution Panel

The front electrical panel is located in the outside roadside front compartment and contains the fuses, self resetting and manual reset supply circuit breakers, solenoid and relays.

The automotive fuses are located in the front electrical panel. The fuses are the standard plug-in type (ATM). When a fuse "BLOWS," the wire in middle of the plastic case will be broken. A bad or blown fuse must be replaced with a fuse of the same rating and type. Using a fuse of a different type rating will defeat the circuit protection provided by the fuse, which could result in damage to the motorhome's electrical system. If a fuse has been replaced and it "BLOWS" repeatedly, that may be an indication that a fault exists or an electronic component has failed. It is recommended that the motorhome be taken to a qualified RV technician before any future use to diagnose and repair the problem. Circuits are identified on the fuse label located on the inside of the electrical door. Remove 3 wing nuts, turn cover over to view.





FUSE NO.	DESCRIPTION	MAX FUSE SIZE	FUSE NO.	DESCRIPTION	MAX FUSE SIZE	FUSE NO.	DESCRIPTION	MAX FUSE SIZE
<u>CHASSIS</u>			<u>IGN #1</u>			<u>SWITCHED HOUSE 12 VOLT</u>		
1	STEP MOTOR	25	19	STEP/ISO SENSE	7.5	33	DRV POWER SEAT	15A c.b.
2	STEP SWITCH	7.5	20	RVA LEVELING JACKS	15	34	PASS POWER SEAT	15A c.b.
3	SPARE	15	21	SPARE	2	35	STORAGE LIGHTS	15
4	CHASSIS READ OUT	3	22	SLIDE-OUT RELAY	15	36	SERVICE LIGHT/LP SOL	7.5
5	LEVELING AIR/HYD	15	23	SPARE	15	37	POWER CORD REEL	15c.b.
6	AIR LEV COMPRESSOR	15	24	SPARE	15	38	POWER CORD REEL	15c.b.
7	SPARE	15	<u>ACC #1</u>			39	SPARE	20
8	STEP COVER	15cb	25	REAR VISION	5	40	BAY 12V/CPTR RECEP.	15
9	SUNVISORS	5	26	POWER GEAR JACKS	5	41	SPARE	5
10	CB RADIO PREP	5	27	ADJUSTABLE PEDALS	10	42	SPARE	15
11	SPARE	15	28	WIPER SYSTEM	15	43	SPARE	3
12	SPARE	15	29	ACCESSORY	15	44	POWER TOILET	15
<u>IGN #1</u>			30	AIR DUMP	15	45	STEP WELL LIGHTS	15
13	DASH A/C	20	31	AIR LEVELING	15	46	SPARE	15
14	JACK/ANT WARNING	5	32	FOG LAMPS	15	47	LP/CO DETECTOR	3
15	TV/LEVEL LOCK OUT	7.5	<u>NON SWITCHED HOUSE 12 VOLT</u>			48	FREEZER	15
16	MIRROR HEAT	15	66	RADIO MEMORY	10	49	DRVRS S/O PWR #1	15
17	MIRROR MOTORS	2	67	REFER	5	50	PASS S/O PWR	15
18	SIDE DOCKING LTS	15	68	AIR LEVELING	15	51	DRVRS S/O PWR #2	15
<u>RELAY FUSE</u>			69	SPARE	10	52	PASS S/O PWR BED/LAV	15
59	POWER AWNING	15	70	SYST.HEAT/SNAP DISC	5	53	MAP LIGHT	7.5
60	IGN LOCK OUT	10	71	HOUSE READ OUT	3	54	12V COMPUTER RECEP.	15
61	SIDE DOCK LT RELAY	15	<u>CIRCUIT BREAKERS</u>			55	BATT.BOOST/TV BOOST	5
62	N/A	15	INTERIOR FUSE PANEL			56	DASH FANS	15
63	N/A	15	50			57	SPARE	15
64	N/A	15				58	SERV.LT/AUX 12V PWR.	15
65	MARKER LIGHTS	10						

THIS FUSE LABEL COVERS STANDARD AND OPTIONS THAT ARE ASSOCIATED WITH THIS FUSE PANEL. CHECK YOUR BUILD ORDER TO SEE HOW YOUR COACH IS EQUIPPED.

Fuse label chart inside cover of distribution panel.

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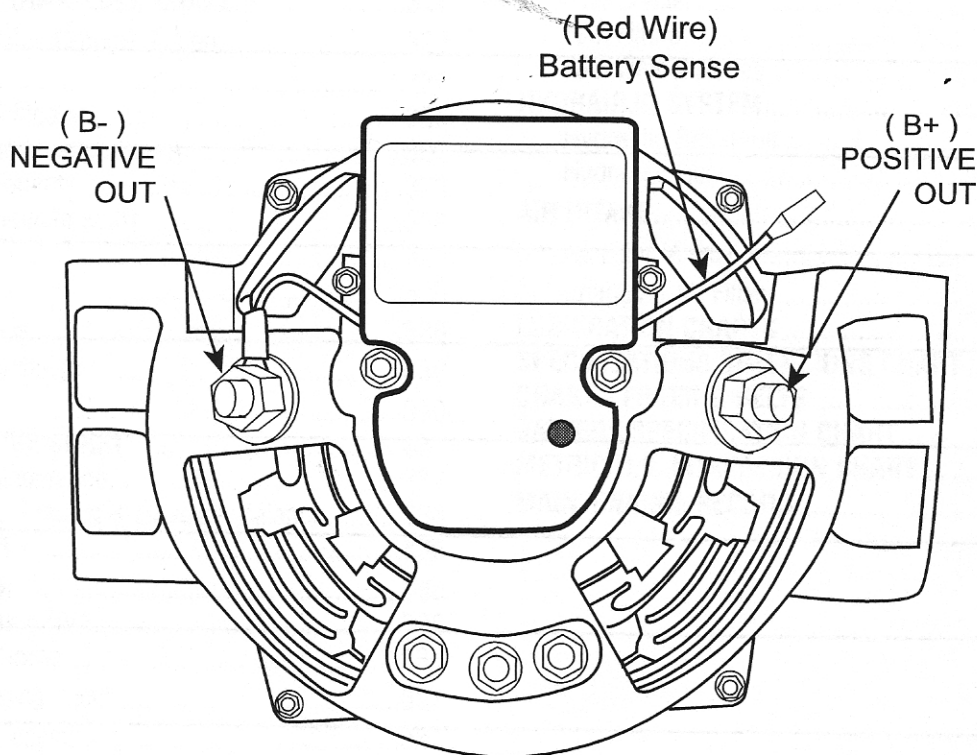
ALTERNATOR

The alternator is designed for output through the engine operating range. When traveling, keep an eye on the voltmeter in the dash area. Normal readings should be between 13.5 and 14.2 Volts DC. Higher or lower voltage indicates a potential problem with the charging system. If the alternator output drops below an acceptable level, a charge indication warning lamp will illuminate.

The alternator replaces amp hours the chassis battery uses to start the engine. The charge amount 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 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 alternator operating temperature for extended periods may lead to premature failure of the alternator.

If the house batteries are in a low state of charge, charge them with the inverter or an auxiliary battery charger before driving the motorhome.



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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.