

Country Coach Tech Topics

Compiled from the Country Coach Tech Topics site
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ENGINE

A Look at Coolant and Your Country Coach Cooling System - Part 1

Maintenance of engine coolant is often neglected until an engine problem causes a breakdown and interrupts your vacation. Although you might think that neglect leads only to engine coolant overheating, one coolant manufacturer claims that 40% of all engine problems can be traced to improper coolant maintenance. Please be aware that maintaining the engine's coolant quality is of equal importance to maintaining the engine's lubricating oil quality and the engine's fuel quality.

This article will tell you what you need to know about coolants and what you need to do to properly maintain your Country Coach cooling system. (Recommendations apply to both the main engine and the Onan generator.) Also discussed is the special heat transfer fluid used in the Hydro-Hot Hydronic Heat systems.

What is Coolant?

The liquid in the engine radiator is called "engine coolant" if it is composed of three things:

1. Water (about 47%)

The best water for coolant is either distilled or de-ionized. It must not contain high mineral concentrations, particularly calcium or magnesium, which can react with coolant additives to form sediment and scale.

The worst possible water is that which has been "softened". Softened water is typically made by substituting the sodium for the calcium in the water. Sodium (salt) is corrosive to all metals. Never use "softened" water in your cooling system.

2. Glycol (about 50%)

Often called "antifreeze", Glycol provides freeze protection by lowering the freezing point of a glycol/water mixture, and it also acts to increase the boiling point of a glycol/water mixture. Both actions are beneficial for coolant.

The most commonly used glycol is ethylene glycol ("EG"). This has been the predominant glycol in antifreeze for many years. However EG, when ingested, is toxic to humans and animals.

In recent years a more environmental friendly glycol, propylene glycol ("PG"), has gained favor. Pure PG is generally regarded as safe by the FDA. A PG based antifreeze reduces the risk of poisoning the environment. (But don't drink PG coolant! Coolant contains additives which are harmful if swallowed!)

Note that products sold as "antifreeze" are often a concentrate. Before use, concentrates must be diluted with equal parts of water, which should be either distilled or de-ionized.

3. Additives (about 3%)

These act to protect the engine cooling system from rust and corrosion, scale and mineral deposits, foaming, cavitation, and pitting of the cylinder-bore liner where it is exposed to the coolant.

The additive package used in coolant designed for gasoline engines is not formulated to protect heavy-duty diesel engines. In particular, it fails to protect against cavitation and pitting of the cylinder-bore liner.

If all the necessary additives for heavy-duty diesel engine service are in the coolant, the coolant is called "fully formulated". Some coolants are only "partially formulated" because they may also be used in other applications. Partially formulated coolants require the addition of supplemental coolant additive ("SCA") - also known as diesel coolant additive ("DCA") - to make them fully formulated before the coolant is used in heavy-duty diesel engines.

Additives in coolant will wear down from normal use, thereby depleting their concentrations. Additive concentrations can also be reduced by topping off the cooling system with water causing undesirable dilution, and a loose radiator cap or a low coolant level in the surge tank will reduce the coolant additives through oxidation.

Because additives wear down and because additives can be diluted through improper maintenance, additive concentrations must be monitored throughout the life of the coolant. When tests show additive concentrations are low, additives must be replenished or the cooling system will be susceptible to damage.

On the other hand, an over-concentration of additives will also harm the cooling system. Over-concentrated additives will "drop out" of the coolant, forming a sludge or gel which can block radiator tubes and/or settle in the bottom of the cylinder block.

Coolant types and their identification

Coolants come in a rainbow of colors. You can find green, blue, purple, pink, and red to name a few. Unfortunately no commercial standard has been adopted for each color's meaning. Matching colors will not guarantee a match of coolant types even if the coolant is from the same manufacturer.

Fortunately, there are only four basic types of coolant in use.

To properly identify each type, you need to closely read the label on the coolant's container. The identification is made by noting the testing standards which the coolant meets or exceeds.

Coolant testing standards are primarily set by two organizations. The first is the American Society of Testing and Materials (abbreviated "ASTM"). The second is the Technology and Maintenance Council of the American Trucking Association, who issues "recommended practices" (abbreviated as either "RP" or "TMC RP"). If there is no statement on the container which begins, "meets or exceeds ASTM", and/or "meets or exceeds RP-", then look for another coolant brand.

1. "Automotive Antifreeze and Coolant"

Designed for use in passenger cars and light-duty trucks, these are characterized as "meeting ASTM specification D-3306" and/or major auto makers' testing standards, but none of the testing standards for heavy duty coolants. This type should never be used in a heavy-duty diesel engine.

2. "Heavy Duty, Partially Formulated Coolant"

Also known as "Heavy Duty, Low Silicate Antifreeze" to which supplemental coolant additive, or "SCA", must be added before use as a diesel engine coolant. These are characterized as "meeting ASTM specification D-4985". Although this partially formulated coolant type is becoming obsolete, it is the "conventional" type of coolant that has been used in heavy-duty diesel engines for many years.

The SCA charge may be added as a liquid, as a tablet, or as contained within an engine coolant filter. The amount is determined by the coolant and/or engine manufacturer's recommendation, typically based on the capacity of the cooling system.

During the life of the coolant, the SCA concentration levels need to be frequently monitored, with lost SCA replenished on a "test-to-add" basis. Testing is typically done with "test strips" available from the coolant manufacturer which are dipped into a sample of the coolant. The resulting color of the strip is compared to a color table to determine the result. Test results and manufacturer's instructions determine the amount of SCA to add.

Testing is typically done at each oil change or every six months, whichever comes first. If needed, additional SCA is added either by using a liquid SCA, or by using a new coolant filter containing SCA. Note that if liquid SCA is used, the coolant filter should be "chemically free".

Typical service life of this coolant is two years.

3. "Heavy Duty, Fully Formulated Coolant"

This coolant type is ready-to-use right out of the container as it is pre-charged with SCA. It is characterized as "meeting ASTM specification D6210 plus TMC specification RP-329 (for EG); or ASTM D-6211 plus TMC specification RP-330 (for PG)".

Recently specification D-6211 for PG was withdrawn and subsequently incorporated into ASTM specification D-6210. Future packaging for PG coolant will read as meeting specification ASTM D-6210 plus TMC specification RP-330.

Fully formulated coolants also require monitoring of SCA concentration levels. Lost SCA is replenished on a "test-to-add" basis, in the same manner as partially formulated coolants. Typically the test is performed at each oil change or every six months, whichever comes first.

Typical service life of this coolant type is two years. However, the life of this coolant type may be significantly extended by replenishing lost additives with an Extended Service Additive ("ESA") instead of a "conventional SCA". An ESA is similar to a conventional SCA in chemical make-up. The difference is that an ESA is specifically formulated to replenish depleted coolant additives based on their relative depletion rates. Replenishing additives using an ESA (versus a conventional SCA) minimizes the over-concentration of additives which are slowest to deplete, thereby extending coolant life.

Not all coolant manufacturers offer an ESA for this coolant type. However, when available, the use of an ESA is a better choice than the use of a conventional SCA. Check the product listing of your coolant manufacturer to see if an ESA is available for your specific coolant. Also check for the procedural steps to add an ESA to your coolant in place of an SCA as they may be different.

ESA is available in a liquid form and also as a "need release" filter. If the liquid form of ESA is to be used, select a coolant filter which is "chemically free".

4. "Heavy Duty, Fully Formulated, Extended Service Interval Coolant"

This coolant type is also ready-to-use right out of the container as it is pre-charged with SCA. It uses a different chemical formulation than conventional coolant. The formulation is based on an "organic acid technology" abbreviated as "OAT". The OAT advantage is a much slower rate of additive depletion versus conventional additives of non-organic acids.

Extended service interval coolants can be found in two forms, depending on how much organic acid is used. Where the additive package is a mixture of conventional additives and OAT additives, the coolant is called "Hybrid". Where the additives are 70% to 90% organic acids the coolant is simply called "OAT".

A. "Hybrid, Heavy Duty, Fully-Formulated, Extended Service Interval Coolant"

This coolant type is characterized as meeting the same ASTM and RP specifications as the "Heavy-Duty, Fully Formulated Coolant, Pre-charged with SCA", listed above AND as meeting RP-338, the "Extended Service Interval Coolant" specification. This coolant also meets Cummins Engineering Standard CES-14603.

SCA testing must be performed at least twice per year. To replenish additives, use only an ESA (never a "conventional SCA"). Typically the ESA is added once per year. The amount of ESA will be

based on test results and the coolant manufacturer's recommendation. Additive replenishment may be done by either liquid ESA or by "ESA need-release" coolant filters.

Properly maintained, this coolant is designed to last until either testing or visual inspection shows that condemning limits have been reached. This is estimated to be four to six years.

B."OAT, Heavy Duty, Fully Formulated, Extended Service Interval Coolant"

This coolant type is the newest available formulation. It is not yet uniquely defined by ASTM or RP specifications, but rather by specifications from the major diesel engine manufacturers:

Detroit Diesel: 7SE298 9804

Caterpillar: EC-1

Cummins: CES14603

OAT coolant manufacturers indicate that there is no need for periodic SCA testing. However, after two to three years of service (depending on the coolant manufacturer), the only additive ever needed is a liquid "extender", or a new need-release coolant filter. Properly maintained, this coolant need not be changed until it reaches the end of its estimated 4- to 6-years service life, or until it will not pass visual inspection for contaminants. Note, however, that if this coolant is diluted by other coolant types, the extended life properties will be lost and the coolant will have only a two year life.

The New Standards

The New Standards: A look at new emissions regulations and their effects on the motorcoach industry

Cummins Engine

Caterpillar Engine

Country Coach (CCI) and its engine suppliers are committed to contributing to a greener environment. Regulatory issues and improvements to the way CCI conducts business are ongoing and will continue to have a positive impact on our environment.

The Ruling Explained

In 1998, a group of heavy-duty diesel engine manufacturers, including Caterpillar and Cummins, signed a consent decree with the Environmental Protection Agency (EPA), the Department of Justice, and California Air Resources Board committing to meet the January 2004 2.5-gram Nox+NMHC standards by October 2002. This mandate demands that diesel engine manufacturers achieve the government mandated emissions levels of 2.5 total grams of nitrogen oxides plus non-methane hydrocarbons per horsepower hour. Additional diesel standards and test procedures are scheduled to start in 2007.

Compliance Cost Estimates

The EPA has produced a report, Nonconformance Penalties for 2004 Highway Heavy Duty Engines, which includes compliance cost estimates based on data provided by engine manufacturers, independent cost analyses, and the EPA's technical judgment. This report on the implications of the regulation's affect on the diesel engine industry can be found at www.epa.gov

Industry-wide Spirit of Good Stewardship

Environmental and health concerns compel us all to be good stewards. According to an EPA 651-page report released in September 2002 on the health impact of diesel emissions, "persuasive evidence" exists that chronic inhalation of diesel emissions is a potential health hazards including increased respiratory problems. The industry as a whole is committed to lower-sulfur fuel and cleaner burning engines.

Creative Solutions of Engine Manufacturers

Cummins led the way into compliance. On April 2, 2002, Cummins became the first engine manufacturer to have an on-highway engine certified by the EPA as having met the new emissions standards, while achieving a 2 percent fuel economy improvement and a significant reduction of time needed for unaided cold starts. Cummins chose variable geometry turbo-charging developed by their wholly owned subsidiary, Holset. They use EGR technology—exhaust gas re-circulation. Cummins notes that their new engines are improved in engine braking capability and overall engine responsiveness. "Meeting customer requirements while achieving emission requirements is a challenging business. We remain committed to providing our customers with the best possible performance and fuel economy, focusing on providing the lowest cost solution while contributing to a cleaner environment..." according to Joe Loughrey, Cummins Executive Vice President and President, Engine Business, in a Cummins press release.

Caterpillar chose ACERT, Advanced Combustion Emissions Reduction Technology, to address the new EPA standards. It involves the use of new hydraulic electronic unit injectors (HEUI); advanced electronics to manage the combustion process; proposed improved combustion due to redesigned combustion chamber and placement of fuel injectors, and after-treatment of exhaust using oxidizing and reducing catalytic converters, similar to those used in the automotive arena. CAT notes these new electronics deliver twice the computing power and memory of current engine management systems, with circuitry that speeds input/output signals by 20 percent. CAT also notes maximum heat rejection increases only five percent which in turn equates to simplified installation. According to CAT, most vehicles could handle this additional heat as currently configured. Fuel economy, durability, and reliability are all noted as being about equal.

You may ask, what does this really mean to you? First and foremost, we all will enjoy the benefits of cleaner engines, as delivered by government regulation. Although these cleaner engines will indeed be adding a cost increase to the price of your motorcoach we must take care of our environment now. The cost to meet the new federal regulations ensures we are protecting the clean air we breathe today and the air our children and grandchildren will breathe tomorrow.

Sources:

www.epa.gov

www.tougheststandards.cummins.com/
www.landlinemag.com
www.gasp-pgh.org
www.greendieseltechnology.com
www.ryder.com

Below, Suzie Adcock of Caterpillar and Tim Kelly of Cummins share their thoughts on this subject

Cummins - From the Source...

By Tim Kelly, VP of RV Business For Cummins Northwest Inc.

A few years ago, when the EPA challenged all of the nation's engine manufacturers to pull ahead the 2004 emissions standard, Cummins worked overtime to develop the industry's toughest, most reliable and fuel-efficient engines. Cummins already had begun work on cooled exhaust gas recirculation (EGR) in the early 1990s. EGR was introduced on the company's B Series engine in California in 1995. Shortly after that, development work on the heavy-duty ISM confirmed that cooled EGR would provide the best customer solution at a 2.5 gram emissions level. Cummins believed that it had the right engine technology for the new emissions standard - a powerful combination of cooled EGR and the Holset Variable Geometry Turbocharger (VG Turbo) that results in engines with an excellent balance of reliability, durability and fuel economy.

On April 1, 2002, the Cummins ISX engine became the first in the industry to be EPA-certified. The Cummins ISM and ISB engines soon followed, making Cummins the only engine manufacturer with a lineup of fully tested and reliable heavy-duty engines to meet the EPA's emissions standard. These EPA certifications are an indicator of how strongly Cummins believes in the motorhome industry - and in its own technology. The company is pleased to note that more than seven out of every 10 Class A diesel motorhomes are now Cummins-powered.

Cummins is committed to delivering value to the customer while meeting lower emissions standards. Its new cooled EGR technology proves that diesel engines can be certified to the EPA's new, stringent emission standard while at the same time providing customers with the performance, fuel economy, and air quality they expect.

Neither the cooled EGR nor VG Turbo technology is new. It's important to note that there are currently more than 55,000 VG Turbos in use today in Europe, and that cooled EGR has been in use there since the early 1990s. It is the most common technology in use in Europe today.

How does cooled EGR work? A small amount of hot exhaust gas is routed through a cooler and mixed with fresh air going into the engine. The exhaust gas helps reduce the temperature during combustion, which lowers the formation of oxides of Nitrogen (NOx).

What about VG Turbo? The Turbo has the capability of providing significantly more air volume and pressure at lower engine speeds. This provides very satisfying engine response in addition to increased engine braking efficiency. Cummins manages the turbo geometry while braking, thus providing increased manifold pressure while the engine speed is decreasing. Compare the Cummins Holset VG Turbo to all others, and its technology will reveal a simplified design. Instead of individual rotating vanes, our design uses a single sliding nozzle,

eliminating dozens of moving parts. The result: increased reliability and durability.

Cummins is committed to making sure that these engines provide the best fuel economy of any engines performing at this emission standard- they have comparable maintenance intervals and costs to current engines. They are designed to deliver better miles per gallon than any low-emissions engines the competition has to offer. Actual road testing of the Cummins-cooled EGR engines began in late 1999, with truck fleets running from Bemidji, Minnesota to Miami and New York to California. This was necessary to ensure that Cummins products would run strongly in the harshest of environments.

At Country Coach, the Cummins 8.3 ISC 350HP and the ISL 8.9 370HP and 400HP engines are used in the Allure and Intrigue motorcoaches. The ISC offers power, efficiency, and quiet operation. It is EPA-certified, with no mechanical changes at this point in time. The ISC uses a patented constant-pressure fuel injection system with a free-breathing 24-valve design to deliver superior performance across the entire power band. Full-authority electronic controls add efficiency, reliability, diagnostics and prognostics to the package. Plus, it's 50% quieter than previous models, with a noise reduction of 3 dBA. The ISL is Cummins newest and fastest-growing engine in the motorhome market, as customers discover how increased torque helps flatten the hills. Like the ISC, the ISL is EPA-certified, with no mechanical changes at this time. The ISL combines the best features of the ISC (constant-pressure fuel injection, 24-valve design) with heavy-duty features from Cummins larger engines (articulated pistons with forged steel crown, high-capacity cooling and lube systems) for exceptional performance. In Country Coach applications, it is fitted with a Jacobs compression brake, the same kind of engine brake used by big rig operators.

A sophisticated electronic control module coordinates with other vehicle operating systems (brake, transmission and driver information systems) to maximize power, efficiency and clean operation.

Cummins is committed to ensuring motorhome drivers get proven products for family destinations, while complying with established regulations to ensure a cleaner environment. While other engine manufacturers have fought to delay the implementation of new standards, Cummins has taken a very responsible approach, providing the best products to meet the "Toughest Standards."

Caterpillar - From the Source...

By Suzie J. Adcock, Caterpillar Senior Account Manager, OEM Sales Division On-Highway Engine Department

Never before has the need for clean burning, customer valued, on-highway engines been so strong. Emissions regulations are challenging engine builders' ability to meet RV owner expectations of reliability, fuel economy and resale value. Caterpillar engineers have once again risen to the challenge, producing a technology so innovative that it will set the standard for on-highway engines for years to come.

First and foremost, Caterpillar respects and supports the need to protect the environment. Yet at the same time, we recognize that the environmental solution must also provide customers with affordable, fuel-efficient engines. In fact, that's been our challenge ever since the first emissions regulations were developed back in the early 70's. Fortunately, our technology gains over the past

15 years have allowed us to develop engines that meets emissions regulations, while using about 30% less fuel, live about 30% longer and require about 30% less maintenance. That's why Caterpillar has invested nearly one-half billion dollars in response to the new, tougher emissions standards for October 2002 and beyond.

There's no question that the October 2002 EPA emissions standards have had an impact on engine design. Our new emissions technology - ACERT (Advanced Combustion Emissions Reduction Technology) is laying the foundation to meet EPA standards for particulates and oxides of nitrogen in 2007 and beyond, while maintaining customer value.

Full ACERT technology production will begin in early 2003. To better understand why ACERT will provide the best value to RV owners and in other on-highway applications, it's necessary to review why the technology was developed, how it works and the reasons it is superior to other emissions reduction technologies. When the time came to explore new emissions solutions, Caterpillar engineers looked at several different technologies, including cooled-EGR. But as testing and evaluation proceeded, it became apparent that cooled-EGR did not meet the overall Corporate objective of reliability, durability or fuel economy. Our customer needs a reliable and durable product that operates very efficiently in a variety of applications.

ACERT technology is a total "systems solution" reducing emissions at the point of combustion by concentrating on four key areas. They include: combustion air technology, fuel injection systems, totally integrated and enhanced electronic engine controls and a simple, yet effective, after-treatment process.

ACERT positions Caterpillar as one of the few companies in the world to comply with emissions regulations worldwide all intended for improvement of the environment. It's one thing to solve the problem technically; it's another thing entirely to solve it in a way that improves customer value. Over the past two decades, Caterpillar has reduced on-highway diesel emissions by 90%. And by the year 2007, ACERT technology engines from Cat will cut emissions by another 90%. Simply put, ACERT is a technology that makes diesels environmentally friendly and promises the best overall customer benefits for the future.

Caterpillar engines are Country Coach's engines of choice in the Magna, Affinity and Lexa motorcoach lines.

Won't Start?

by Brian Keys (Systems, Training & Resources Manager)

Most starting problems are caused by a tripped breaker, blown fuse, or sticking solenoid, and once the fault has been identified, it can typically be corrected (if only temporarily) within a matter of minutes.

Let's begin by taking a look at the various components of the system and how they are connected. The circuit starts, of course, at the chassis battery itself, as shown on the diagram below and from there chassis power goes directly to the starter motor and to the chassis battery disconnect switch, followed by the chassis breaker which in turn allows power to the chassis fuse panel, ignition solenoid, and start solenoid.

When the key is turned to the ignition position, the ignition switch receives power from the chassis fuse panel on wire #50 and passes it onto the ignition

solenoid on wire #34E. This signals the ignition solenoid to close and pass power from the chassis breaker through to the ignition fuse panel and also to the ECM (engine computer) through an inline fuse (located at the solenoid on Allures or Intrigues and in the electrical bay on Magnas, Affinitys and Lexas) and an 'Engine Kill' switch located in the engine compartment. With the key in the start position, power is supplied from the ignition switch to the neutral start relay on wire #33 and, assuming the transmission is in neutral, this power is forwarded to the start solenoid on wire #33A which signals it to close. Once closed, the start solenoid will pass power from the chassis breaker to the starter solenoid on wire #33B through a breaker or fuse, depending upon the model of your coach.

Now that we know where all the components are located and how they are connected, let's take a look at the four most common scenarios that you might experience should your coach fail to start.

1. Nothing happens when you turn the ignition switch to the ignition or start positions.

Make sure that the chassis disconnect switch is turned on and reset the chassis breaker if it has tripped. Check for loose or corroded chassis battery terminals or cable lugs and use the battery boost if your chassis batteries are severely discharged. If this does not solve your problem then check for power on the yellow wire #34E at the ignition solenoid. If wire #34 has power then check the large terminals on either side, if only one of these has power then the solenoid is sticking and must be replaced. Gently tapping on the solenoid should allow it to close but it may now stick in the closed position meaning that your engine will continue to run when the key is turned off. Tapping on the solenoid again with the key off should release it. This should only be considered as a 'get you home' measure.

If wire #34E does not have power at the ignition solenoid then check the fuse for wire #50 in the chassis fuse panel and make sure that the wiring at the ignition switch is intact.

2. Dash and other ignition systems power up when the key is turned to the ignition position but nothing happens when the key is turned to the start position.

With the ignition on, verify that the transmission is in neutral, and then check for a tripped starter breaker or blown starter fuse. Check for power on blue wire #33A at the start solenoid behind the rear bumper on the passenger side. If wire #33A has power, then check the large terminals on either side of the solenoid. If only one of these terminals has power, then the solenoid is sticking and must be replaced. Gently tapping on the solenoid should allow it to close but it may now stick in the closed position meaning that your engine will continue to crank when the key is turned off. Tapping on the solenoid again should release it but as before, this should only be considered as a 'get you home' measure.

If you hear a loud clunk when the key is turned to the start position and both sides of the start solenoid have power, then the gear on the starter motor is probably unable to 'mesh' with the gear on the engine flywheel. Although extremely rare, this can and does happen, with the only cure being to manually turn the engine a little using a large socket and bar on the crankshaft pulley or

to momentarily spin the starter motor by bypassing the starter solenoid on the motor itself. The latter should only be done by a professional mechanic.

3. Dash and other ignition systems power up when the key is turned to the ignition position and the engine cranks but will not start.

Assuming you have not run out of diesel, then the first thing to check would be the engine kill switch on the right side of the engine compartment. If the engine kill switch has not been activated, then check the inline fuse that provides ignition power to the ECM or Electronic Control Module. This fuse is located at the ignition solenoid on Allures or Intrigues and in the electrical bay on Magnas, Affinitys and Lexas. If the 'Check Engine' light on your dash is illuminated or flashing, then there is most likely an engine fault that you will need to have investigated by a Cummins or Caterpillar dealer.

Earlier coach models used an engine kill relay located on the right of the engine compartment next to the engine kill switch and this relay can prevent your engine from starting, especially if the engine kill switch has been used recently. The relay is available at most local parts stores and can be changed in a matter of minutes.

4. Engine starts but will not continue running when the ignition key is released.

This situation is unheard of on current models with ECM's or Engine Computer Modules. If you have an earlier model coach, however, with a non-electronic engine, this condition could indicate that the coach's Engine Protection Module is preventing the engine from running. This is generally caused by a critical condition such as low oil pressure, hot coolant, or low coolant level triggering that device. These coaches have been provided with a foot-actuated override switch located near the driver's right foot. Depressing this foot switch will allow you to start and drive the coach long enough to pull safely off the road. In these cases, it is prudent to check the obvious things first, such as coolant and engine oil levels. If the problem is caused by a temporary overheating situation, you may be able to wait until the engine cools down sufficiently to re-start and then continue on your way. In the case of low coolant level (one of the most common culprits), replenishing the coolant level and cycling the ignition key off and back on should allow the coach to start and run normally. In addition to these situations, a failed fuel solenoid can cause this no-run symptom, but this is an item that will require the skills of a professional mechanic.

Hopefully, you'll never have to encounter a disabling scenario like those discussed above, but having a bit of knowledge about your coach's chassis electrical system may save you some grief and expense.

DynoMax Chassis Pneumatic Schematic

If you are having difficulty making sense of a DynoMax chassis pneumatic schematic then this high-level overview of the auxiliary air system may help unlock some mysteries. We shall take a look at the brake system in a future article.

With the engine running, pressurized air flows from the engine mounted air compressor to the Bendix air dryer and then continues on to a reservoir commonly referred to as the 'wet tank'. At about 120psi, a purge valve will open on the air dryer to expel water and oil contaminants, and a pressure signal will be sent back to the compressor's unloader valve (or governor) which causes the compressor to cease pumping air.

The wet tank supplies air pressure to the auxiliary air system via a 'pressure protection' valve set to cut off airflow if the system drops below 70psi. This ensures the brake system has an adequate supply of air pressure in the event of a major leak in the auxiliary air system. The wet tank also supplies an accessory air manifold in the steering bay through a second 70psi pressure protection valve.

Upon entering the auxiliary air system, pressurized air is supplied to the front and rear height control valves, and the center port of the HWH air manifolds also located front and rear. The auxiliary air compressor located in the steering bay provides a second source of air pressure for the system and check valves are used to ensure this low output compressor only supplies the air bags, not the auxiliary reservoir tanks which are supplied by the engine air compressor.

Lastly, an air line from the bottom of each air tank provides condensate drainage through a manual or electrically operated pneumatic valve depending on coach model and year.

CHASSIS

Tire Pressure Monitoring for Your Country Coach

Imagine starting out in your Country Coach motorcoach on a holiday without your speedometer or any of your important gauges working. No doubt your first stop would be at a service center since no reasonable person would consider driving without engine, fuel or braking system data. However, most motorcoach drivers willingly start their trip unaware of the ongoing state of their most important safety component: their tires.

There are few situations a coach driver can encounter that are more stressful, dangerous and inconvenient than having a tire blow out at highway speed. What you may not know is that most blow-outs can be traced back to damage suffered from prolonged driving on under-inflated tires. Studies show that almost half of all motorcoach tires are under-inflated. Driving on under-inflated tires causes additional flexing of the tire's sidewall which translates into heat build-up. Heat is the number one enemy of tires, causing accelerated wear and hidden interior damage which can lead to a blowout, usually at the worst possible time.

The easiest and most effective way to ensure a safe drive is to make sure your tires are well maintained and properly inflated. Properly inflated tires not only increase safety, but also maximize fuel economy, tire life and vehicle handling.

Tire pressure monitoring systems (TPMS) are a relatively new technology that has found its way into the RV world. TPMS takes away much of the worrying whether your tires are in need of air or even more importantly, whether you have experienced a puncture while driving.

SmarTire for RVs is a TPMS system specifically designed to meet the unique needs of RVs. The SmarTire system includes wireless sensor/transmitters mounted inside the tires, a robust receiver and a LCD display unit which is mounted in view of the driver. In the case of larger motorcoaches, additional antennas are mounted to the chassis to ensure that tire data is reliably captured by the receiver and sent to the display unit. The sensors are fitted using stainless steel straps on the inside of the rim and continuously monitor air pressure and temperature while the vehicle is in motion. The sensors are specifically designed to withstand the unforgiving environment inside a tire and are powered by lithium batteries designed to last five years in normal driving.

How does the SmarTire system work?

When the motorcoach starts moving, a centrifugal switch activates the sensors which immediately transmit the initial tire information to the receiver using radio frequency technology. The sensor reads tire data every seven seconds but only transmits if the tire pressure has decreased by 3 psi, a feature that extends battery life. If there is a significant change in tire pressure or temperature, the sensor transmits immediately.

The tire data is captured by the receiver which in turn sends the information to the LCD display unit. The display unit has two buttons that allow the driver to toggle through each wheel position and to select the type of information being displayed: tire pressure, temperature or pressure deviation. The unit has a bright red LED light and an audible alert which is activated if a tire loses pressure or if the temperature of a tire goes above a preset level.

SmarTire generates three types of alerts:

Pressure Deviation Alert: This first alert is generated when a tire's pressure deviates above or below the level programmed during installation. This deviation level is normally set at plus or minus 10psi from the cold inflation pressure. The system beeps once and the bright red LED begins flashing, giving the driver both an audible and visual warning of the tire condition.

The pressure deviation alert takes into account the anticipated rise in air pressure that naturally occurs when the tire's temperature increases while driving. This process is called temperature compensation and enables the system to provide an earlier warning of a tire related problem.

Low Pressure Warning: This second alert is generated when a tire's pressure drops below a fixed level that is programmed during installation. The fixed level is normally set at 10psi below the cold inflation pressure and is not temperature compensated. The system beeps regularly and the bright LED flashes, giving the driver a continuous warning of more serious tire problem. The low pressure warning requires the driver to pull over immediately to check the affected tire.

High Temperature Alert: This third alert is generated when a tire's temperature increases above a fixed level that is programmed during installation. Like the low pressure warning, the system beeps regularly and the bright LED flashes to warn the driver of the tire condition. The high temperature alert can indicate a number of problems, not only tire pressure related. For example, it can indicate a brake problem which is generating heat that the tire is absorbing or a wheel that is badly out of alignment.

Installation: Installing a SmarTire system requires a knowledgeable and trusted service center. The sensors must be fitted properly to all the wheels and the antennas mounted in the correct location for the size of the coach. Also, the system needs to be programmed for the specific tire pressures of your particular motorcoach and its anticipated load. Although the system is easy to operate, the RV owner should be thoroughly instructed on how the system works and what to do if they receive an alert.

What about the tires on your towed vehicle or trailer? So now you have the tires of your motorcoach monitored, but what about the tires on your towed vehicle or trailer? Towed vehicles and trailers pose a unique challenge because an RV driver really has no way of knowing if a tire problem is occurring behind them. In fact, once the driver realizes there is a problem, it is likely too late to save the tire.

SmarTire for RVs can be configured to include additional sensors fitted to your towed vehicle or trailer. The additional wheel positions are programmed into the system and an additional antenna is mounted near the rear of the coach to ensure the tire data is captured. If a problem occurs with any of the tires on the towed vehicle or trailer, you'll be alerted in the same way as if the tire was on the RV itself.

A SmarTire system gives owners an easy way to monitor their tires and provides a critical early warning of a tire related problem while traveling. An electronic tire monitoring system results in one less thing you need to worry about as you travel down the road so you can concentrate on more important things, like enjoying the beautiful countryside.

Tire Inflation Pressure

How to properly maintain your tire inflation pressure

Are there any two motorcoach models that should have exactly the same tire inflation pressure? Probably not, due to how each individual coach is loaded and optioned.

We are told by the major tire manufacturers that under-inflation is the number one cause of tire failure, followed by a close second of overloading the tires' rated carrying capacity.

Fortunately, there is a simple answer to these concerns. All major brand tires have the maximum load carrying capacity, and the minimum cold inflation pressure needed to carry that load molded into the sidewall of every tire. Cold inflation

pressure means before your coach is driven and before the tires are warmed up. Ideal cold inflation pressure is with an ambient temperature of 68 degrees Fahrenheit.

Slide room coaches have a tendency to be somewhat heavier on the driver's side, due to the added structure of the slide rooms. Therefore, tire inflation pressures need to be adjusted to handle this difference. Inflate your tires to match the heavy side of your coach. For example, if your left front tire is carrying 5600 lbs. and your right front tire is carrying 5400 lbs., inflate both front tires to the 5600 lbs. load inflation pressure.

To obtain the correct inflation pressure, the following steps should be observed:

1. Load your coach as you would normally travel with your personal belongings, food, etc.
2. Fill your fuel, fresh water, and LP tanks full and leave your black and gray storage tanks empty.
3. Obtain a certified, accurate four-point or six-point weight on tag axle coaches, to determine what each individual wheel location weighs with you and your traveling companions on board.
4. Follow the tire manufacturer tire load limits (lbs.) on various cold inflation pressure charts, like the Toyo tire chart listed below. For example, for a 12R 22.5 single tire to carry 6370 lbs., it would require an inflation pressure of 100 psi. This same tire in a dual application (such as your rear drive wheels) would carry 5960 lbs., at the same 100 psi inflation pressure.

All current models are speed rated to a maximum of 65 MPH. Over inflation will reduce the tires' footprint or contact patch with the road. This will reduce the traction, braking capacity, and handling of your coach. A tire that is over inflated for the load that it is carrying will also contribute to a harsh ride, uneven tire wear, and will be more susceptible to impact damage.

Overloading your coach can be dangerous! In addition to the possible risk of tire failure, other chassis components like wheels, brakes, and drive train failures may occur. Never exceed the Gross Axle Weight Rating (GAWR) or the Gross Vehicle Weight Rating (GVWR).

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

Inflation pressures should be checked on a daily basis while traveling and on a monthly basis when your coach is parked and not in use.

Many current model Country Coaches are equipped with the SmarTire option. This option is very convenient for an instant on-board, in-motion, status check of tire pressures, and tire temperatures to avoid any potential tire failure.

Properly inflated tires on a coach that is properly aligned and not overloaded will last most coach owners (driving an average of approximately 10,000 miles annually), five years or longer. However, regardless of mileage and how much tread is remaining, we recommend replacing all your coach tires every five years, due to effects of weather checking and the elements attacking the exposed sidewall of the tires. It is also advisable to replace your dual drive tires in a set to insure the same circumference tire on each wheel set.

Keep those tires inflated correctly and travel safely!

Tire Maintenance

by James Jordan

Tire maintenance...is this item high on your list of things you check on a regular basis? If it isn't, it should be. Your RV tires work hard for you and in turn, need your attention to keep them in proper operating condition. Proper operating condition includes tire pressure of course, but other items need inspection and care as well. Let's look at tire pressure first.

Proper tire pressure is one of the most important aspects of keeping your coach safely and comfortably on the road. Not enough pressure and the tire may become overheated and stressed to the point of failure. Tire manufacturers report that under-inflation is the number one cause of tire failure.

On the other hand, you should take care to avoid over-inflation as well. An over inflated tire can have a reduced footprint or contact patch, and reduction of the contact patch can, in turn, have a negative impact on braking, traction, and handling. Over-inflation can also lead to a harsh ride, uneven tire wear, and increased susceptibility to impact damage. Considering the potential negative aspects of improper inflation, one can see that getting the correct inflation value for the tires is paramount. Fortunately, the solution to avoiding these concerns is very straightforward: weigh your coach. With accurate weight information, the tire manufacturer's inflation chart can be consulted to find the correct inflation for your particular size tire.

To accurately weigh your coach, a few simple steps need to be followed.

- * Load your coach just as you normally would for a trip. Food, personal belongings, luggage, etc.
- * Fill the fuel, fresh water and LP tanks to normal travel levels. Leave the black and grey tanks empty.
- * Obtain an accurate four point weight from a certified scale.

Take some time to review the results. Evaluate what changes you could make to your cargo to more evenly distribute the weight.

Once the individual corner weights are known, consult the tire manufacturer's chart. Please note that there are different values for single or dual tire configurations. Let's say that your left front tire has a load of 4305 lbs. and the right front tire has a load of 4475 lbs. You should inflate both tires to the value listed for 4475 lbs. Always use the heavier value when the weights for left and right sides of the same axle are not the same. Consider adding 5 psi to the chart value to allow room for weight discrepancies.

Also note that inflation values are always given for cold tires. Cold inflation means that the coach has been driven less than one mile prior to checking or adjusting the pressure. Ideally, pressure should be checked and adjusted early in the day, prior to any driving at all. Once you have calculated and inflated your tires to the proper values don't forget to check them on a regular basis. Consider this a daily check when traveling and a monthly check when the coach is in storage.

Your tires also need to be inspected for foreign objects and damage to the sidewalls and tread. In addition to ordinary wear, the tires will age with exposure to Ultraviolet light (UV), and for this reason you should consider

replacing your tires after five years in service, regardless of the mileage. Consult your local RV tire specialist for assistance with this evaluation. To help prevent damage from UV, consider storing your coach inside or covering the tires if stored outside. Try to avoid long term storage on uneven surfaces or blacktop that is exposed to the sun, and wash the tires with soap and water to remove road grime and chemicals.

Another technique to help prevent premature aging of the tires is to drive your coach on a monthly basis. Regular exercise will force additives in the tires to come to the surface, helping to keep the sidewalls more flexible, and also inhibiting UV damage.

Keep your tires properly inflated, clean and free of debris. You'll enjoy many miles of safe travel if you keep these simple items in mind.

What does the term "siping your tires" mean?

Increased traction and increased tire life due to improved heat dissipation from siped lugs are a couple purported benefits of siping. Many all-season, mud+snow, and all-terrain tires marketed today are siped in the factory mold, yet few mud terrain tires are siped. Tire siping involves cutting small slits, or grooves, into the tread blocks of tires to provide better traction in adverse weather conditions. The sipes allow the tread blocks to spread on contact with the ground, helping expel water from the tread and providing better grip. The simplest way to sipe tires is to take them to a reputable tire shop (like Bob Dickman Tire Center in Junction City, OR) and have them cut. Be sure to check with the tires' warranty issuer (manufacturer or tire retailer) prior to siping. Policies on tire warranty work may be affected or the warranty could be voided if the tires are altered.

Air Brakes

by Brian Keys (Systems, Training & Resources Manager)

Why not ask about going down the other side and the braking capability of these large diesel pusher homes-on-wheels? The answer is that everyone knows that the brakes usually work and that is the end of their concern.

However, some of us not only want the brakes to operate flawlessly, we also want to know how they work. Country Coach, Inc. uses air brakes on all of its diesel pusher motorhomes for three basic reasons: stopping capability, reliability, and ease of maintenance.

Stopping capability is measured in the number of feet required to bring your coach to a complete stop from any given road speed. The engine exhaust brakes used on Country Coaches are wonderful devices designed to slow your coach and/or assist your air brakes, but they will not stop your coach completely. When referring to motorcoaches that weigh in excess of 30,000 pounds, air brakes are the logical and preferred method to stop this much weight. Automatic slack adjusters that continually keep the brakes properly adjusted and ABS (Automatic Braking System) enhance the stopping capabilities of air brakes. Country Coaches are equipped with both of these enhancements on all production coaches.

Reliability is almost legendary on air brakes since they have been used extensively in the commercial trucking and bus industries for over 50 years and millions of miles. Eight to one hundred thousand mile service intervals are commonplace for long-haul commercial trucks when they adhere to the prescribed lubrication and maintenance procedures.

Maintenance

To understand the maintenance required on air brakes, it is also necessary to understand their components and function. The heart of the system is the engine mounted air compressor. This is the same unit that supplies air to your air ride suspension and air-operated accessories like air horns, for example. This compressor is governed and operates between 90 to 125 P.S.I. The compressed air is then stored in the primary and secondary air tanks for use as needed by the air brakes, suspension, and accessories. During engine operation, the compressor continually replaces the air supply because when the air brakes are applied and the air suspension is leveling the coach, large amounts of compressed air are used for these functions. The air brakes are applied via a mechanical "S" cam and lever mechanism that is attached to an air canister at each wheel. The proportioning, or treadle, valve under the brake pedal is activated by pushing on the brake pedal. How hard you push determines the braking force once applied.

The maintenance required on air brakes other than the periodic greasing of the lever mechanism is best left to the professionals at the Country Coach Service Center, or a local truck repair facility. The air brake components are large, heavy-duty items and require some very hefty tools that most of us do not carry around in our coaches. The braking characteristics of air brakes on a large motorcoach are not that much different than those on most power-assisted brakes on your car. A light touch is all that is necessary. With very little practice, you can become a pro. However, always remember these motorcoaches weigh 10 to 15 times as much as your tow car. You should judge your traveling speed and stopping distance accordingly.

The release of compressed air that you hear when the primary and secondary air tanks are full is a normal function of an air brake system. This can be somewhat alarming if you don't know what it is. Standing outside your coach with the engine running when this air release occurs has made many coach owners look at each other and say, "What was that?"

Air Loss

In many conversations, some very experienced coach owners feel they have terrible air system leaks if they lose any air on the dash-mounted air pressure gauge overnight. This is an unnecessary concern since all air systems use air and a small loss is expected and normal. The Department of Transportation states that a two-pound loss of air per minute with the engine not running is within normal specifications.

With a Country Coach, it is also normal to require up to five minutes for your air system to be refilled if your coach has been stationary for a period of time or if the air suspension has had the air dumped during the leveling process. This refilling procedure is best accomplished by running the engine at high idle for approximately five minutes with your air leveling system in the travel mode. Even

though your travel light comes on when you turn off your HWH leveling control, this does not mean your air system is refilled and is ready to travel.

The proper way to ensure the air brakes and complete air system have refilled and are ready for operation is to observe the air pressure gauge on the dash and be sure it reads in the 100-120 P.S.I. range. For your clarification, the 90 to 125 pounds range mentioned previously is the operating range of the engine mounted air compressor. During coach operation the air pressure gauge will be in the 100 to 125 range on the gauge in the dash.

Editor's Note: This originally printed in 1998. It provides timely advice on your motorhome's air brakes. Over the years, we have found that many discussions with customers regarding things like horsepower and torque curves on the diesel engines Country Coach uses ends with "what manufacturer installs the largest engine to climb the steepest grade known to man?"

Preventive Maintenance

Insider tips for properly maintaining your motorcoach

It seems that anytime two or more coach owners are gathered around the campground, it doesn't take long for a conversation to start. Odds are that this conversation will quickly turn to the topic of preventive maintenance; "How often are you changing your oil?" "Have you tried that new synthetic transmission fluid yet?" "Do you rotate your tires?" Seems like everyone has an opinion as to the best way to maintain their motorcoach.

Most of us have heard or read about the most common preventive maintenance tasks: oil change intervals, air filter replacements, and so on. Following are some items that may not have occurred to you in a while.

1. EXTENDED LIFE COOLANTS

Some owners are changing over to one of the extended life coolants (ELC) now on the market. Due to the reduced maintenance schedule, this is an increasingly popular alternative to using standard coolant. However, it is essential to use the correct coolant filter. If you have already changed over to ELC, make sure that your service technician is aware of this and uses the correct filter, at the correct interval, which can be found in your chassis maintenance manual. Correct ELC filters do not contain any of the Supplemental Coolant Additives (SCA) designed for standard coolants. Also, please note that standard coolant and ELC are not compatible. Do not mix the two in the same engine. If you are not the original owner of your coach, you should consider having a qualified service center check your coolant to see which type is in use. At the same time, the technicians can also use a coolant test strip to sample the SCA levels to determine if they need to be refreshed.

If you decide to switch to an alternative specification coolant and wish to reduce the risk of contamination with an incompatible coolant when you have your coach in for service, simply adhere a label to the surge tank that is readily visible, and clearly identifies the specification of the coolant used in the system.

2. AIR SYSTEM

The air system is another important part of the chassis that shouldn't be overlooked in routine preventive maintenance. Purge the air tank regularly (daily if you're driving lots of miles) and note whether any water is expelled from the purge valves. On Allures and Intrigues, these purge valves are located on the forward wall of the steering compartment (first bay, driver's side). On Magnas, Affinitys and Lexas, these valves are located behind the passenger side front bumper, and are operated using the 'Air Tank Purge' switch located on either the shifter console, or the console behind the driver's seat. The ignition must be on when operating this system. A small amount of moisture is normal in humid conditions, or if the system has not been purged for some time. However, greater amounts of water expressed during regular purging could indicate a problem within the system that requires attention. In addition to causing corrosion within the air system, water within the lines can freeze, causing possible damage to control valves and air springs. Also, do not neglect the air dryer desiccant cartridge. For best performance, it should be changed out every two years or 50,000 miles.

3. OVER-THE-ROAD A/C

Another "dryer" that can become easily neglected is the receiver/dryer in the dash (or over-the-road) air conditioner system. This dryer should be replaced any time that the system's refrigerant has been evacuated to allow servicing or replacement of components in the system.

4. WATER HEATER ANODE

Does your water heater have a sacrificial anode? If you have a Suburban heater, the answer is probably "yes". The purpose of the anode is to sacrifice itself to the electrolysis process that takes place in all water heaters where heavy metals and salt are present in the water. To avoid excessive corrosion of the water heater's tank, this anode should be inspected annually for signs of deterioration. The anode should be replaced when it has deteriorated more than 25% (see image below). However, the anode itself is inexpensive and it is wise to replace it annually as a matter of routine. The manufacturer's documentation for your water heater should identify the exact location of the anode if one indeed exists. To inspect or replace the anode, first turn off the water heater at both the monitor panel, and the breaker in the distribution panel. Allow some time for the water to cool before proceeding. Next, turn off the water pump, and disconnect the city water. With this step complete, drain the water from the heater using either the faucet in the water bay, or low point drains, also located in the water bay adjacent to the water pump. Lastly, use a suitably sized socket and handle to remove the anode.

5. A TUNED RIDE

A subject that is especially deserving of periodic focus is ride height, weight, balance, tire pressure and alignment. These can be some of the most important items to check on your coach. Letting any of these areas get out of specification can negatively impact coach handling and tire wear. Have you ever noticed that the bays can mysteriously collect items as you travel around the country? The

weight of these items can add up over time and require some redistribution to bring the balance of the coach back to proper trim. New coach owners should pay close attention to this weight distribution until they are familiar with their coach, and it is a good idea to have the alignment checked once the coach has been loaded with personal belongings, and a few trips have been completed. The coach was aligned carefully at the factory, but this alignment can change with the additional weight of these personal items.

6. TRANSMISSION FLUID

Tired of changing out the transmission fluid so frequently? Consider switching to the 'TranSynd' synthetic fluid recommended by Allison. This will not only extend the service interval but will likely benefit the transmission as well.

The list of preventive maintenance items for a diesel coach is quite extensive and detailed. It's always easy to overlook an item that comes due on a time basis, rather than a mileage basis. Give the manual another reading and you'll probably find something in there that you've forgotten about. Then the next time you get into one of those maintenance discussions with another owner, you'll be able to bring up something new.

SEASONAL

Wintering in Your Motorcoach

by Mark Layton

The Laytons

I meet people all the time that don't understand that you can use your coach to go skiing or whatever you like to do in the winter at temperatures below freezing. I have been skiing out of a motorhome since 1970 and thought that I would like to pass on some of the things that I have learned.

First of all, we are very fortunate to own a coach now that is really well insulated that makes things easier. You do have to remember that coach manufacturers don't put a lot of priority into making sure that nothing freezes, since most of their sales are to people that go to warm climates. When I ordered my last coach, a 2000 Magna with a kitchen slide and heated floor, I made sure that certain things were done before I took delivery. The nice thing is that all of these can be done to any coach and at any time.

Besides what was done at the factory I had my tires siped* which really helps a lot. You are going to say what the heck is that. That is exactly what I said when I first heard about it from a highway patrol officer in Idaho. One day I was talking to the officer and asked what kind of chains they use. His answer was, "We don't use chains; we have our tires siped and therefore don't need chains." So I went to Les Schwab in Junction City and asked them about it and was told that most of the truckers have their tires siped for better traction. Since then I found that my tires wear better because they run cooler, and I have much better traction on slick or wet roads.

The freeze protection that all manufacturers put in your coach is fine up to a point. It takes care of the water and holding tanks but not the water pump. Since the water pump is at the lowest point of your service bay it will freeze if you don't give it some extra protection. There is a very small 12 volt heater available and I had that installed and hooked up to the thermostat which takes care of the freeze protection in the service bay.

Your hot and cold water lines will also need protection if you have a kitchen slide. We heat taped all the water lines going to the slide and put insulation around them. The other thing to remember is that your refrigerator has a water line that goes to the icemaker. This line is plastic and you have to replace it with copper tubing before you can heat tape it as the plastic line will fail from the heat tape. (I found this out the hard way). These are things you should do before going to really cold climate. Other things you will need when you get there are some 60 watt light bulbs, three or four small electric heaters and a good snow shovel. Even though we don't travel when it is snowing any more it is nice to be able to keep your place clean around the coach. We found that since I am retired we don't have to travel when the weather or roads are bad so that is not a problem anymore. I do carry a set of chains just in case but have not used them since we got the Magna.

You ask what in the world are the light bulbs for? They are to plug into your bays. I get the light bulb attachments that have a socket on one side and two prongs on the other so you can plug them into any outlet. Usually the 60 watt bulbs are enough to keep things from freezing in your bays.

Just about all the places we go have 50 amp hook ups. I put one of the electric heaters in the service bay and one in the bay that has the water filter. I found that at 25 below things will freeze even with the light bulbs going. As far as the service bay is concerned, you would not have to use the heater but why burn your propane or diesel if you have power available. The heaters in the outside bays are plugged into a 30 amp cord with the right adapter that is available at all camping stores. All the hook ups that I have seen have a 50 and 30 amp outlet. I use both the 50 amp for the coach and the 30 amp for the heaters. That way I don't overload the breakers in the coach. I also use two electric heaters in the coach to cut down on my cost for diesel or propane and having to move the coach for refueling.

The other thing that is a must is to protect your cooling unit of your refrigerator. The manufacturer of the refrigerator tells you that all you have to do is to turn the switch on which keeps the light on inside the refrigerator. I found that not to be good enough in real cold weather. I use the foam insulating tubing that they use for water pipe and cut it to the right length and cover all but one row of the outside vents. Then I also put a light bulb in the area where the cooling unit is to keep it from freezing. No matter what someone may tell you, I have seen too many cooling units freeze and have to be replaced. Two years ago when we had a real cold spell in Breckenridge the service truck replaced at least five or six units in one day at the cost of about \$2000.00 each. Mine was not one of these needing replaced; it was working fine--and still is.

Now what to do about filling with fresh water and dumping. I see a lot of people making up and using water hoses with heat tape and insulation. I also see the problems they have some of the time with the faucets freezing because they are designed to drain back and are not freeze proof when the water is left on. I fill with water and dump when I need to and empty the hoses and put them away till I need them again. I do it this way so as to eliminate any chance of problems. Since we usually go to the hot tub after a hard day of skiing and take our

showers there, we don't use a lot of water and therefore don't have to fill and dump that often.

Sometimes we do dry camp in the winter when we know that it is not going to get too cold. Then you have to be prepared to run your generator more often. If you have a kitchen slide bring it in at night, when temperatures are at their lowest, so that your furnace will keep everything in good working order.

After I retired, we went to Tiger Run RV Resort** in Breckenridge, Colorado for longer periods of time and found that there were only a hand full of RVers there in the winter. Today there are at least 50 to 75 RVs there all winter long. Tiger Run has an indoor pool, hot tubs and clubhouse. We even have wine and cheese parties every Wednesday evening all winter long. We also found that there are quite a few RV parks near ski areas that are open in the winter.

You will find that if you are prepared and do the things that I have been talking about you will enjoy your coach just as much in the winter as in the summer. |

Preparing Your Coach for Cooler Weather

by Brian Keys

With summer behind us and winter fast approaching, it is time for many of us to winterize our coach. There are two winterizing processes commonly practiced. The simplest and perhaps the most preferable option is to clear out any water from your coach's plumbing system using low pressure compressed air. The second option is to replace the water in your coach's plumbing system with RV antifreeze. This process is a little more time consuming both during winterization, and de-winterization when the RV antifreeze must be flushed completely from the system to eliminate the somewhat unpleasant taste from your water supply.

If making decisions is not one of your strengths, then you may be glad to know that many of the current Country Coach models with a Royal Flush toilet, or diesel fired water heater can only be winterized with RV antifreeze as the compressed air process will not clear the water from some areas of the plumbing system. This includes all-electric coaches where the water heater cannot be easily drained.

There are many variations to the winterization process, and some will use a combination or both air and RV antifreeze especially when the coach will be subjected to extreme cold during the winter months.

Which process you choose to use is mostly a matter of personal preference, but be aware that a coach with the Royal Flush toilet and diesel or electric water heaters will have some unique requirements as detailed below.

Before we begin, let us share a few words of caution.

- * The water you will be draining from your coach can be very hot and may cause scalding!

- * If you have chosen to use the compressed air process, you should ensure that the air supply is filtered to remove both particulate matter, and oil/water emulsion. The air pressure should be regulated to no more than 50psi to prevent damage to the plumbing system.

- * If you decide to go with the RV antifreeze process, then please be aware of the correct terminology as used throughout this article. You will need to

purchase 'RV Antifreeze', not 'antifreeze' or 'coolant' which is for engine use. The RV antifreeze you choose should be specifically designed for winterizing RV plumbing systems, and it should be non-toxic for obvious reasons!

* One last word of caution; wear old clothes! There are many opportunities for messes to occur that will present themselves as you winterize your coach. The RV antifreeze for example is usually colored and can stain clothing, plastic or paint. Spills should be cleaned up promptly!

Winterization using the air pressure process:

1. Turn off both heat sources for the water heater - electric and propane (if not an all electric coach). The electric heat source is typically turned off at the appropriately labeled breaker in the distribution panel.

2. Empty the holding tanks at a suitable location, and drain the fresh water tank also. Use the leveling system to lean your coach to the driver's side to empty the tanks as much as possible.

3. Open all the low point drain valves which are usually located behind the water pump access panel in the water bay.

4. Locate the drain plug at the bottom of water heater and remove it to drain the contents of the water heater tank. Opening the PTR release valve that is usually located above the drain plug will help the water drain faster. Replace the drain plug and close the PTR release valve when the water heater is empty.

5. Adjust the regulator of a clean air source to a maximum of 50psi then connect it to the city water connection using a winterizing adaptor. The city water connection on your coach will exist either as a retractable hose, or a female hose fitting in the water bay. The winterizing adaptor is commonly available at most RV accessory retailers.

6. When water stops coming out of the drain valves, close them and continue by opening the hot and cold faucets throughout the coach until only air comes out, then close them also. Draping a wet wash cloth over the faucet will avoid any undesirable splashes as the air purges. Don't forget to open the shower fixture and the faucet in the water bay.

7. Flush the toilet until air comes out and cycle the washer/dryer on a warm setting to clear water from those lines.

8. Cycle the icemaker (following the manufacturer's instructions) until air purges from the supply line.

9. Set your coach back into a level position and activate the fresh water fill to clear water from this circuit into the fresh water tank. With this step complete, disconnect the air hose from your coach and connect it momentarily to the sewer flush to clear its lines of water.

10. Now cycle the water pump for about one minute until it is only pumping air. Remove the bowl from the water filter housing and drain the contents. The filter should be discarded and the bowl replaced securely. You will need to install a new filter after de-winterizing your coach in the spring.

11. Lastly, protect the P-traps throughout your coach by pouring RV Antifreeze into all the basin drains including those in the galley, bathroom and shower. Pour about a half gallon of RV antifreeze into your washer/dryer and run it through a cycle to ensure its P-trap is protected also, then fill your toilet bowl with the remaining half gallon.

Winterizing with RV Antifreeze:

If you chose this option, it is probably because you have an all-electric coach, or your coach has a Royal Flush toilet or diesel fired water heater. This process will require about ten gallons of RV antifreeze, which must be pumped into your coach's plumbing system using one of the three methods below.

* Pour the RV antifreeze into the fresh water tank after it has been emptied, then pump it into the plumbing system using your coach's onboard water pump. This method should be avoided because the water that cannot be completely drained from your fresh tank will dilute the RV antifreeze, thus reducing its effectiveness. It is also difficult to remove all the RV antifreeze from the fresh water tank and any that remains will make your water taste somewhat unpleasant.

* Pump the RV antifreeze into your coach's plumbing system through the city water connection using an external water pump hooked up to 12-volts. This method is preferred but it does require that you purchase a second water pump. This second pump can be retained as a spare, however, should the onboard water pump fail for any reason.

* Disconnect your coach's onboard pump from the fresh water tank and use it to pump the RV antifreeze into the plumbing system. This method may seem like the ideal solution, but disconnecting your pump from the fresh water tank requires a lot of patience and manual dexterity. There is also a risk of damage to fittings which can be difficult to repair. I would caution against this approach.

Now let's continue with the process itself!

1. Complete steps 1 and 2 of the above air pressure process.

2. Open all the low point drain valves, which are usually located behind the water pump access panel in the water bay. Now open all the faucets throughout the coach to help the water drain faster. Don't forget to open the water bay faucet and shower fixture, and flush the toilet repeatedly until water stops flowing.

3. Once the water stops flowing from the low point drains, the next step is to set your coach back into a level position then cycle the water pump for about one minute until it is only pumping air. Next, close all the faucets and remove the water filter bowl to dump the contents. Replace the water filter bowl securely to prevent leaks.

4. With the low point drains still open, pump RV antifreeze into your coach's plumbing system using one of the three methods above until it begins to flow from the low point drains. These drains can now be closed.

5. While still pumping RV antifreeze into the coach, now open the cold water side of the faucets throughout the coach until the RV antifreeze begins to flow then turn them off. Repeat this process for the hot water side of the faucets and be aware that this step will take significantly longer because the RV antifreeze must fill the water heater also.

6. Short cycle the washer/dryer on a warm setting to fill these lines and P-trap with RV antifreeze. Next, cycle the toilet until RV Antifreeze fills the bowl.

7. Cycle the icemaker (following the manufacturer's instructions) until the ice tray fills with RV antifreeze.

8. If you chose to use an external pump to drive RV antifreeze into the plumbing system, it can now be disconnected and hooked up to the sewer flush to clear these lines using about 1/8th gallon of solution.

9. Last, repeat step 2 above to drain most of the RV antifreeze from the plumbing system. This last step provides some room for expansion should the system freeze in severe weather conditions. This is especially important for the water heaters in all-electric coaches which cannot be completely drained, and will not receive the same protection as the rest of the system because the RV antifreeze will have been diluted by the water that remained in the water

heater's tank. This water that remains after draining will not cause any damage to the heater in the unlikely event that it should freeze. The same is also true of the holding tanks which also cannot be completely drained.

If you were able to winterize your coach in a timely manner while managing to stay clean and dry, then you are clearly proficient in the process and might consider winterizing your friends coach also; for a nominal fee of course! The following list of items should also be considered before storing your coach for the winter months.

Additional Steps:

1. Remove perishable items from your refrigerator and also remove any canned or bottled goods from your coach that may freeze and burst.
2. Replace the fluid in your windshield washer reservoir with a wash solution that has freeze protection.
3. Check the coolant in your engine and generator for adequate freeze protection. Also replace the oil and filters to eliminate the contaminants that can settle to the bottom of the oil pan, and acids that can cause accelerated wear to various components of your engine while stationary for long periods.
4. Fill your diesel tank to reduce condensation and add a fuel stabilizer to prevent the fuel from breaking down.
5. Make sure your batteries are fully charged to prevent them from freezing, and consider using solar panels to keep them charged if you cannot provide power to your coach during storage.
6. Increase your tire pressure to maximum rated pressure then park your coach in a location that is away from trees to avoid risk of falling limbs, and to minimize the buildup of difficult to clean tree sap on your coach's exterior.
7. Always remember to protect against undesirable visitors such as ants or mice that may find refuge in your coach while you are absent.

Taking the time to winterize your coach thoroughly will avoid any unpleasant surprises when it comes to de-winterizing in the spring. If you need any help with the information presented here, then give our support people a call at 800-452-8015

Preparing Your Country Coach for Winter Storage

by Jim Cooley (Customer Services Manager)

Heading south to a warmer climate for the winter? What a great way to winterize your coach. Good for you! For the rest of us, as the summer weather recedes we turn to the issue of coach storage and winter prep procedures. Many of the things I will mention in the upcoming list are common sense items, but a little reminder always helps.

Exterior

1. Fill the diesel fuel tank to prevent condensation. Unlike gasoline, diesel fuel will begin to gel at 10 degrees F. Severe gelling can clog your fuel filter. Additives are available, that when combined with your fuel supply, prevent this problem.

2. Service the coach chassis.

3. Wash the exterior of the unit and check all roof seals for deterioration. Reseal as needed.

4. Lock all exterior compartments (if in unsecured location).

5. Store in a covered dry place if possible. If not, try to find a flat solid location without a lot of potential for tree debris accumulation.

Interior

1. Remove all perishable items from the refrigerator. Check all vents and windows to ensure they are closed and locked.

2. If 110volt AC power is available, it is advisable to use a stand-alone space heater inside, to ensure a small amount of heat inside the coach. If no 110volt AC power is available, you might consider running the coach heating system at its lowest possible setting. Just remember to keep the battery charged, as running the heating system will require more frequent recharge cycles.

Plumbing

1. Disconnect 110volt power to the hot water heater by shutting off the breaker in the 110volt breaker panel.

2. Pull the plastic plug on the outside of the water heater unit and open the pressure relief valve.

3. Drain and rinse black and gray water holding tanks.

4. Drain the fresh water tank by opening the low point drain valves. Open all faucets to allow the lines to drain. Attach the air blow out plug supplied with the coach to the city water inlet port and blow the remaining water out of the system with pressurized air.

5. Cycle the fresh water pump for a few seconds to clear the pump mechanism of any remaining water.

6. Manually cycle the ice maker with system pressurized following instructions on inside of icemaker's cover.

7. Follow the washer/dryer manufacturers instructions for winterizing. (See Service Bulletin at right).

8. Remove the water filter and drain the bowl. This is a good time to throw the old filter away and replace with new in the spring.

9. Dump 1 cup of potable antifreeze down each of the p-traps (i.e. sinks, shower).

10. Do a final drain on the black and gray water holding tanks.

Batteries

1. Turn off the chassis and house battery disconnect switches, the LP gas detector and LP shut off valve on the main tank, if so equipped.

2. To ensure your chassis or house batteries do not freeze, keep water at proper level with liquid batteries and fully charged as much as possible. This is possible by connecting to shore power, or use your onboard generator, or thirdly,

a stand alone external charger. This charging process should start when your batteries drop to the 12:00 volt DC level.

Engine Coolant

1. Diesel engine manufacturers recommend the coolant be maintained at a 50/50 mixture of low silicate antifreeze and water. This provides freeze protection down to -34 degrees F. Check with your engine manufacturer if you intend to store your motorcoach at temperatures below -34 degrees F. (Caution: Straight antifreeze should never be used as cooling and freeze-protection requires water to be mixed with the antifreeze for proper circulation.)

2. Your engine coolant additives should be checked annually by your engine manufacturer's dealer service network. They will assess the additive level and contamination levels of your coolant. This is easily done by taking a sample of coolant from your cooling system surge tank.

3. The guidelines above should also be used to assess the cooling system for your on board generator. You may be using your generator during cold weather for battery charging purposes, and proper servicing is a must.

Hoses and Belts

1. Engine hoses and belts should be assessed annually, and now is a good time. Any sign of cracking or fraying is a sign to replace them. Some models of Country Coach motorhomes have more than one belt driven accessory. Some of these drive belts, if broken, will disable the engine (i.e. water pump or the alternator).

Engine Oil and Filter

1. The 15W40 multi-viscosity oil recommended by diesel engine manufacturers for all but most severe weather is a year round oil. Periodic checks to assess possible contamination from the combustion process and condensation should be done, as well as filter changes.

2. However, periodic engine idling with no load and not up to operating temperature is far more damaging to the engine than leaving it alone until you take your coach out of storage.

Windshield Washer

1. Fill the reservoirs with a winter premix solution (20/10 or equivalent).

2. To prevent freezing in the windshield washer system, run your wipers long enough to purge non-winter solution from the wiper hoses.

With these precautions taken, sit back and enjoy the winter, looking forward to sunshine-filled days to come.

De-Winterizing Your Motorcoach

by John Bickel

If you winterized your coach properly, de-winterizing for spring and summer use should be much easier.

Wash and Flush

First, if you stored the coach outside, a complete and thorough wash and interior cleaning is recommended. The holding tanks (fresh water, black water, and gray water) along with the entire plumbing system should be flushed thoroughly to remove any RV-type plumbing anti-freeze that you should have installed for winter storage.

This should be completed prior to hooking up your icemaker water feed line or filling your water heater. Even if the RV plumbing anti-freeze you used to winterize your coach was labeled as non-poisonous by the manufacturer, the taste is terrible and should be removed from your fresh water supply.

Changing the potable water filter cartridge is recommended at this time (prior to refilling the potable water distribution system). Depending on the model of your coach, the filter is located behind an access panel in the plumbing bay on the passenger or driver's side. On Allures and Intrigues, the filter is located in the driver's side compartment immediately forward of the plumbing bay, behind an access cover on the aft bulkhead. When the cover is removed, the filter housing is exposed. By unscrewing the lower section of the filter housing, you gain access to the filter cartridge. Before unscrewing the filter housing, ensure that the city water hookup is disconnected and that the water pump has been turned off. Turn on the faucet in your plumbing bay to depressurize the system and use a small bucket beneath the filter housing to catch any water that may spill as it is removed. Take care not to dislodge or lose the rubber seal that seals the filter housing to the filter head and only tighten the housing hand-tight after replacing the filter. Don't forget to check for leaks after the filter has been replaced and the system has been pressurized. Depending on the quality of your fresh water and your usage, this new filter should be adequate for a full season. Reduced water pressure on all faucets is an indicator that the filter should be replaced.

Batteries

Chassis and house batteries (liquid lead acid type) should be topped off to the proper level with distilled water and fully charged. The correct level is typically 3/16" below the vent tube that is visible with a sealed flashlight after removing the caps. Overfilling the battery will cause loss of electrolyte as the battery charges. Make sure all the battery cables are clean and tight. All Gel Cell and AGM (Absorbed Glass Matt) batteries are sealed and maintenance free. Do not remove the caps from these batteries or permanent damage will occur! These batteries are pressurized so it is normal for their cases to appear slightly swollen. The exterior surfaces of the batteries should be kept clean at all times to avoid parasitic discharge across the surface grime. Always wear chemical gloves and safety glasses when working on or near batteries. Remove any jewelry from your hands and wrists and do not smoke. Lastly, use a spark proof light such as a waterproof flashlight when checking the electrolyte levels. Plastic or

rubber lights are preferable since they will not create a short should they fall onto the battery terminals.

Tires

Tire pressure should be checked and adjusted to the proper cold inflation pressures for the weight of your loaded coach.

Engine Coolant

Engine coolant must be at the proper level in the surge/overflow tank with a 50/50 mixture of anti-freeze and water. Check the system for any leaks. This is a good time to take a small sample of coolant from your cooling system to the engine manufacturer (you may call the country coach service dept. for a referral) and have it checked for the correct pH balance, nitrates and cooling system additives.

Engine Oil & Filter

The engine oil and filter should have been changed when you put your coach in storage. If you did not complete this task, now is a good time to do so. If you did, a quick check of the oil level is all that is needed. While you are in the engine compartment check the rest of the fluid levels and top off as necessary.

Engine Belts & Hoses

Check for the proper belt tension, and for any signs of deterioration and cracks in the belts and hoses. Replace as required.

Windshield Wipers & Washer

Now is good time to replace the windshield wiper blades (nothing like a new set of wiper blades to cut through all those bugs), and fill the windshield washer reservoir with fluid. Don't forget to test the system for proper operation before your first trip out.

Diesel Fired Furnace, (Hurricane)

Check the fuel and coolant hoses for leaks and hose clamps for corrosion and tightness. Start the furnace and check for signs of abnormal operation that may indicate a routine service is necessary. Some smoke and erratic combustion sounds are normal during the initial startup, especially after long periods of storage, but these should quickly clear within a few minutes.

Diesel Fuel

Your diesel fuel tank should have been filled prior to storage, if not go "fill 'er up". Now you are ready to stock up your food supplies and necessary clothing before hitting the open road to your favorite vacation spots. As you can see, the precautions you took in winterizing the coach last fall for storage have really paid off, and have made the de-winterizing process relatively easy as you prepare the coach for summer travel.

PS. If you have been enjoying the warmer climates over the winter months and are preparing to head back home, let me remind you to check tire pressure and fluid levels (diesel, engine oil, hydraulic oil, coolant, LP gas, windshield washer solution, wipers, and battery electrolyte) before heading out.

Above all, enjoy your coach and travel safely. Should you have any questions or concerns, feel free to call us at 800-452-8015. We are always ready seven days a week to help you on your way.

De-Winterizing Tips

by Dennis Wasserburger (CC Service Department)

If your coach was stored outside, a complete and thorough exterior wash and interior cleaning will be required. The holding tanks (fresh water, black water, and gray water) and the entire plumbing system should be thoroughly flushed to remove any of the RV type plumbing anti-freeze you should have installed for winter storage. This should be completed prior to hooking up your icemaker water feed line or filling your water heater. Even though this type of RV plumbing anti-freeze is not deadly to drink (so they say), the taste is terrible and should be removed from your fresh water supply.

Consider changing your potable water filter cartridge at this time (prior to refilling the potable water distribution system). The filter can be accessed from the driver's side compartment immediately forward of the plumbing bay. There is an access cover on the aft bulkhead. Once removed, the filter housing is exposed. By unscrewing the lower section of the filter housing, you gain access to the filter cartridge. This new filter should be adequate for full seasonal usage.

Batteries - Chassis and house batteries (liquid type) should be topped off to the proper level with distilled water and fully charged.

Tires Tire pressure should be adjusted to the proper cold inflation pressures for the weight of your loaded coach.

Engine Coolant Engine coolant must be at the proper level in the surge/overflow tank with a 50/50 mixture of anti-freeze and water. This is a good time to take a small sample of coolant from your cooling system to your engine manufacturer and have it checked for the correct pH and cooling system additives.

Engine Oil & Filter The engine oil and filter should have been changed when you put your coach in storage. If you didn't complete this task then, shame on you. If you did, a quick check of the oil level is all that is needed at this time.

Engine Belts & Hoses Check for the proper belt tension, and any sign of cracked or deteriorated hoses. Replace as required.

Windshield Washer The windshield washer reservoir should be filled and tested for proper operation before your first trip.

Diesel Fuel Your diesel fuel tank should be full from your previous winter storage, so now all that is required is to drive, and start having fun. Stock up your food supplies and necessary clothing and head for your favorite vacation spots for the season. As you can see, the precautions you took to put your coach in storage for the winter have really paid off in the de-winterizing process for summer travel.

PS. If you have been enjoying the warmer climates over the winter months and are preparing to head back home, let me remind you that you should check tire pressure and fluid levels (diesel fuel, engine oil, hydraulic oil, coolant, LP Gas, windshield washer solution, and battery water) before heading out. As noted in your User's Guide, these items should be checked on a daily basis when traveling.

Maintenance Tips for the Mature CC Motorcoach - Part 1 of 3

Tips for properly maintaining your mature CC motorcoach

Has your coach passed its initial flush of youth? Are you apprehensive of system failures and large repair bills as your coach enters its golden years? Many of you have read about, discussed or experienced some of the problems encountered by owners of older coaches, but many of these problems are avoidable through preventative maintenance measures and a common sense approach to whatever problem may arise. This series of articles will focus on coaches that are five years or more in age, but the advice that follows is also applicable to just about any Country Coach you can purchase today.

Filters

Let us begin by taking a look at the various filters used throughout your coach. We all know about the common filter replacements such as the engine air, oil, fuel, and transmission filters, so no need to dwell on these. Other filters that need to be replaced regularly are as follows:

*** Hydraulic System Filter(s).**

These are located within the hydraulic oil reservoir just inside the engine compartment opening. Coaches with a Gillig chassis will use a single filter, while those with a DynoMax chassis will take three filters, stacked on top of each other. The hydraulic oil itself must be replaced periodically also! This maintenance item is often overlooked much like the brake fluid in your car. However, the recommended service interval to change both the oil and the filters is 25,000 miles or two years, whichever occurs first. While on the subject of hydraulics, take some time to inspect the hoses that connect the various hydraulic system components together such as the fan drive motor, fan drive controller (FDCA), steering gear box, hydraulic pump, and the reservoir itself. Look for any signs of chafing or loose/cracked fittings and repair as necessary. All DynoMax coaches use proportional hydraulics for the hydraulic fan, thus eliminating the system shock that can fatigue hose fittings through time.

*** Air System Filter/Dryer.**

Your coach uses a desiccant cartridge to extract moisture from the air system. This is critical to avoid corrosion, and to ensure continued operation of all pneumatic valves and components should the ambient air temperature drop below freezing. This desiccant cartridge is located inside the Air Dryer assembly that is mounted either just forward of the drive axle, or just behind the front axle. This device also contains the Purge Valve which is responsible for the periodic 'whooshing' sound that comes from beneath your coach as you drive. I recommend that this desiccant cartridge is replaced every two years, or 50,000 miles, whichever occurs first. Overlooking this service requirement will eventually lead to an extremely expensive repair bill to extract the fine white powder released when an old desiccant cartridge explodes.

When it comes time to replace the desiccant cartridge, the Purge Valve located at the base of the cartridge should be serviced also. A maintenance kit is available for this valve which includes all the necessary seals and springs etc. However, given the frequent cycling of this valve on coaches with IR (Instant Response) Height Control Valves (HCV) such as all DynoMax models, you should consider the more expensive but reliable option and replace the entire Purge Valve assembly.

*** Refrigerant Filter/Dryer.**

Speaking of expensive repair bills, another filter that is often overlooked with dire consequences is the refrigerant dryer for your air-conditioning system. This inexpensive filter (some coaches have two) is responsible for removing any moisture from the refrigerant thus eliminating the possibility of a frozen metering valve and the resulting loss of refrigerant circulation. Filter replacement is mandatory if the system is opened to the atmosphere either during service, or because of a major system leak such as a hose failure. If this replacement is overlooked then the filter can fail, filling the high pressure side of the system, including the condenser and the metering valve, with small desiccant beads much like the expanded styrene commonly used for shipping packages.

Should this occur, the cost effective fix is to flush out the high side hoses with water and blow them dry with air. The condenser and metering valve should be replaced. Then, most importantly, every last trace of water must be removed using a high vacuum pump and a micron meter, to evacuate the system down to at least 400 microns. This will lower the boiling point of the water to sub zero temperatures, allowing it to be removed as steam.

*** Coolant Filter.**

This filter lives on the engine block with Cummins and Detroit series 40 engines, and is mounted remotely for Caterpillar equipped coaches. It serves two purposes, and these are to passively filter the coolant, and as a means to add conditioning additives to the coolant as necessary. A fresh coolant test strip that is compatible with the coolant used on your coach will determine what level of additives are required, and this test strip should be used on a coolant sample taken from the cycling engine circuit such as at a radiator or engine drain. The long life coolants in use today do not eliminate the need for coolant system maintenance, which is becoming increasingly critical as the power output from

modern diesel engines continues to rise. A future Destinations article will go into detail on this important topic, but until then, do not overlook this vital maintenance task.

Does your coach have a Hydro-Hot heater system? Then be aware that your coolant system requires a special type of FDA approved non toxic coolant. Give our Service Support Department a call at 800-452-8015 for more information.

*** Generator Filters.**

As with the engine on your coach, the generator will also require periodic replacement of the air, oil and fuel filters. Propane powered generators will not require a fuel filter. However, diesel generators do, and this filter will cause some trouble due to algae growth in the diesel fuel if the generator lies dormant for a prolonged period of time. If you remove the fuel filter to find it full of a heavy green tinted liquid, then you are probably not running the generator enough to ensure the fuel in the hoses running to and from the diesel tank remain fresh. I recommend at a minimum that the generator is run for at least two hours on a monthly basis. While the fuel filter may require more frequent servicing due to stagnant fuel, the air and oil filter can safely be replaced according to the generators maintenance schedule.

*** Furnace Filters.**

If your coach uses a diesel fired furnace for interior heat such as the Webasto, Hurricane or Hydro-Hot, then there will be one or two filters in the fuel system that must be replaced when servicing the furnace. This service should occur annually before the cold season begins.

*** Water Filter.**

Most owners are not foreign to water filters and their need for periodic replacement based upon the volume of water used, but we do encounter owners from time to time whom are unaware that their coach has a water filter installed. If you have strong water pressure at your plumbing bay faucet, but the pressure inside the coach is somewhat weak, then this is a good indicator that the replacement of your water filter is long overdue. The filter housing is typically located behind a labeled access panel in the plumbing bay itself, or on the rear wall of the bay just forward of the plumbing bay. The filters are readily available from hardware stores such as Home Depot etc, and you should use an activated carbon filter to both remove particulates, and improve the taste of your potable water.

*** Sediment Filter.**

Does your water pump seem to have less output than before? While water pumps do not last forever, take a look at the sediment trap that separates the water pump from the fresh water tank before you replace the pump itself. Cleaning this sediment trap may alleviate any inlet restrictions to the pump that might exist, and give your system pressure a welcome boost.

*** Air Conditioning Filters.**

The roof A/C's on your coach include a removable, washable screen to collect dust from the air as it enters the unit. This screen can be accessed by removing the grille section from the roof A/C vent cover (no tools required).

*** Cooling Fan Filters.**

Last but not least, be aware that your coach may use a cooling fan to cool an electronics cabinet or inverter compartment. These fans will generally have a removable dust screen which should be cleaned periodically to ensure the airflow is not restricted. Look for cooling fans in equipment cabinets or consoles behind the driver's seat, and in the inverter compartment. Prevost Conversions with the ECC (or Electronic Control Cabinet) will also have a cooling fan that discharges through the forward wall of the first bay into the front axle area.

Maintenance Tips for the Mature CC Motorcoach - Part 2 of 3

by Brian Keys

In Part 1 of this article which was published in the spring issue of Destinations, we began a discussion on the maintenance requirements of aging coaches with information on filters and sealants. In this article, we shall continue the discussion with a look at the remaining maintenance requirements of your coach's chassis. Before we begin however, let's take a few moments to discuss some safety concerns that you should always be aware of should you prefer to tinker on your own coach.

SAFETY FIRST

- Always ensure that your engine cannot be cranked either by you or, more importantly, another party when you are working in the engine compartment area.
- Don't wear any loose clothing when working around moving components, such as the engine, while it is running.
- Never crawl beneath the coach unless it has first been raised off the ground using ramps or other approved lifting apparatus, and is supported on jack stands where applicable. The air system in your coach can lower at any time, and there are easier and less painful ways to achieve the slender look!
- Always wear safety glasses when working beneath the coach.

This list of 'dos and don'ts' is not conclusive of course since there are approximately a bazillion ways to pinch your fingers or get dirt in your eyes. The purpose of this article is to raise awareness of the various maintenance requirements for your coach, and to equip you with some knowledge that you can take along to your next service appointment to ensure nothing is overlooked. With that, let's dispense with the salad and get to the meat and potatoes!

DRIVE-TRAIN

What on earth is the drive-train you say? Simply put, the drive-train is an all inclusive term for the mechanical components that take the power from your engine/transmission, and apply it to the road to get you moving, including the rear axle, and its umbilical cord to the transmission - the driveline (or propeller shaft for the Europeans out there). Another term you may be familiar with is 'power-train'. This is identical to drive-train, only the term also accommodates the engine and transmission.

1. Axles.

Your coach has at least two, and those with a Tag axle have three. The first item we need to discuss here is wheel bearings and their adjustment. A mildly loose wheel bearing adjustment is probably not the end of the world, but you can expect a higher bearing wear rate and other problems that may arise from lateral movement of the hub including ABS sensors that repeatedly go out of adjustment causing a warning light on the dash, erratic speedometer reading on coaches built with a Gillig chassis, and perhaps a groaning sound as you apply the brakes. Wheel bearings that are very loose will be fairly obvious due to oil contamination of the brake linings from leaking rear hub seals.

But what about wheel bearings that are a little on the tight side? This is much less common, fortunately, since tight wheel bearings are at risk of overheating and possible seizure. Early warning signs are oil contamination of the brake linings caused by overheated rear oil seals and elevated wheel temperatures after you have traveled a significant distance. In the latter case, it is generally a good idea to monitor your wheel temperatures after any hubs have been removed from your coach for axle or brake servicing etc. This is best done after having traveled a distance of fifty miles or more on level terrain. Decelerate using the Jake or exhaust brake as much as possible before gently applying the brakes to minimize the heating effect that your brakes will add to the wheels. Then, with the coach stopped, immediately check the temperature of all the wheels. An Infra-Red temperature gun is ideal for this, but you should be able to detect any significant differences in wheel temperatures by simply placing your hand on the wheel. Wheel temperatures should be similar on both sides of the same axle but be careful, that wheel may be quite hot!

The correct procedures for wheel bearing adjustment for coaches with Meritor or Dana axles can be found on the appropriate company website. For Meritor, the web address is www.arvinmeritor.com and for Dana axles this information is located at www.roadranger.com

Still on the subject of axles, let's take some time to discuss seals; not the sea animal variety, but the oil seals that are responsible for keeping your wheel bearings lubricated, and your brakes dry. Each axle hub has two seals, an outer seal on the hub cover or axle shaft, and an inner seal that runs on the spindle. A leaking outer seal should be immediately obvious by unsightly oil streaking on your nice shiny wheels, and is not an immediate cause for concern provided you frequently check your hub oil levels until you can have the problem addressed. Leaking outer seals are frequently caused by overfilling of the oil hub, or a plugged vent hole in the rubber plug that resides in the center of your hub cover sight glass. Leaking inner seals, on the other hand, should be addressed immediately due to the risk of oil contamination on the brake linings. As mentioned above, inner seals generally fail due to out of adjustment wheel bearings, and this seal should always be replaced with a new one when your hub is removed.

Your chassis manual provides valuable information on lubrication types and service intervals, and further information can be found at the web addresses below including newer synthetic lubricants that may be available as a replacement for your existing oil.

2. Driveline.

The driveline is the shaft that connects your transmission and drive axle. This shaft is subjected to extreme torsional forces when you stomp your foot on the gas pedal, climb steep grades, or worse still, encounter wheel spin followed by good traction which may occur on roads with icy patches, or when traversing from soft sand or gravel onto pavement. Country Coach fortunately uses very strong drivelines on the DynoMax chassis so problems such as twisted or broken drivelines are unheard of. That said, we still have to respect the critical role that this component plays in 'motorvating' your coach. Your driveline must be well maintained and frequently inspected. When looking over your driveline, take a close look at the universal joints on each end, watching out for cracked 'cross pieces' (the piece that looks like a '+' with a bearing on each end), and failed bearings. Use a pry-bar to exert force between the cross piece and the 'U' shaped yokes it is mounted in to determine if there is any free play that may indicate 'trunnion' bearings in need of replacement. Also check the bolts that secure the trunnion bearings into the yoke to ensure they are tight. There are many different names for this driveline joint such as 'universal joint', or 'spicer joint', but the terminology above is widely accepted and recognized. For lubrication, the cross pieces on each end of the shaft are provided with a grease nipple, and fresh grease should be pumped in until it visibly purges from all four bearings on each cross piece. Once again, please refer to your chassis service manual for specific service intervals.

One maintenance item that is often overlooked when it comes to drivelines is the slip-joint. This is where the two pieces of your driveline come together, and its purpose is to allow the driveline to lengthen or shorten as necessary to accommodate suspension travel. The slip joint should never bind and must therefore also be lubricated when greasing the universal joints on either end of the driveline. The slip joint should be lubricated at its shortest travel which means the coach should generally be at ride height. Pump six to eight shots of grease into the grease nipple on the side of the slip joint (approx 1oz or 28grams). If you find that the grease is purging from a small weep hole at the end of the driveline, just plug this hole with your finger and continue pumping the required amount of grease into the slip joint. Any grease that purges from the aforementioned weep hole, or from the slip joint dust seal should be wiped off before it finds its way onto your driveway or shop floor. Those of you who neglected to ensure that the driveline was at its shortest travel for this operation will be rewarded with some blobs of grease on the ground as your coach returns to ride height.

While in the area of the driveline, take a look at the oil seals where the driveline meets the transmission and drive axle differential housing. Some light oil staining in this area is not uncommon and is not a cause for concern, but significant oil leaks that are evident by a thick coating of wet oil should be rectified as soon as possible.

The following websites provide good information on your vehicles' drive-train.

http://www.arvinmeritor.com/tech_library/techlib_home.asp <http://www.roadranger.com>

Engine/Transmission

Now that we have covered the components that use power and torque to get your coach moving, lets backtrack a little to where it all began... the engine and transmission. In the first of this series of articles, we discussed the filters for both the engine and transmission, and we shall avoid the subject of lubricant types and service intervals because we all have our personal preferences on the former, and the latter. Recommended service information is readily available in your chassis manual. So what is left to discuss? Well, lots actually. Lets begin...

1. Belts.

We are all hopefully up to speed on the importance of regular checks on your engines belts including tension, evidence of wear/cracking, frayed edges, and evidence of perforations on multi-rib belts from driving perhaps a little too fast on loose gravel surfaces. But what about the belt pulleys? With the engine running at idle, do your V-belts run smoothly, or are they oscillating between the pulleys like a heavily struck guitar string? If the latter is true, then try replacing the belt first, ensuring the correct tension is attained. If the problem still exists, then one or more of the belt pulleys on your engine is likely in need of replacement due to uneven wear. This guilty culprit is usually fairly obvious upon close inspection with the belt removed.

Multi-rib belts are less prone to oscillation and uneven pulley wear, but keep an eye on the automatic belt tensioner as the engine is running. Is it bouncing frantically on the belt, or is it relatively stationary as the tensioner pulley spins? If the former is true, then with the engine stopped and disabled, release the tension from the automatic tensioner and remove the multi-rib belt. Check the pulley on the tensioner and all idler pulleys for worn bearings or eccentricity and replace as necessary. Belts that have frayed edges may indicate an alignment problem with the pulleys.

2. Throttle System.

Just what exactly is the throttle system you might ask? Those of you with an electronically controlled engine may be left wondering because your coach doesn't really have one, with the possible exception of the throttle pedal itself. However, those coaches that pre-date the insurgence of electronic controls will require some means of linking the throttle pedal at the front of the coach to the fuel injector pump on the engine. This is done by air on earlier models, and an ETS (Electronic Throttle System) on later models. To discern which type of control was used on your coach, simply explore the area between the carpet and the underside of your throttle pedal. If you see a bulky pneumatic valve in this area with air lines sneaking beneath the carpet, then you have the earlier air throttle. If, however, you see a roller connected to an electrical sensor with its associated wiring, then you will have the later ETS system assuming your engine is not electronically controlled by way of an engine computer. If you have a CAT C9, C10, C12, C13, C15, or Cummins ISC/ISL then the remainder of this section does not apply to you.

Does your engine respond immediately and smoothly as you press your foot on the throttle pedal, or does it ignore your request for more power at first before delivering it in an embarrassing surge as you push the throttle pedal down a little further? This problem may be a result of a worn air actuator on the

engine, or an indication of a throttle linkage that is in desperate need of lubrication. The air actuator is a small pneumatic device that bolts onto your engine and connects to the fuel pump via a linkage of some sort. A worn actuator will allow air to blow by the seal as you initially press your foot on the throttle, before taking hold with a vengeance as more throttle is applied. A replacement actuator is the preferred solution as opposed to a rebuild kit if one is indeed available. A sticking throttle linkage on the other hand is easily rectified with a liberal application of a light lubricant such as WD40. Heavy lubricants are to be avoided as they will cause dirt to adhere to the linkage. Pay particular attention to the throttle shaft as it enters the fuel pump.

How about a different scenario? As you press your foot on the throttle pedal, does your engine build power in a normal fashion before suddenly releasing back to an idle? This is obviously not an ideal situation, particularly when you are trying to merge with traffic on an on-ramp. This is a symptom of a slipping clutch on the later ETS system and, as before, the culprit is most likely a binding throttle linkage caused by insufficient lubrication.

No conversation on the earlier throttle systems is complete without a brief discussion on springs, specifically the throttle return springs that are responsible for returning your engine to an idle once you have lifted your foot of the gas pedal. These springs endure frequent extend/contract cycling as you vary the position of the throttle pedal during driving, and are therefore prone to eventually break. If you haven't done so already, I strongly advise you to replace them (generally two side by side) at your earliest convenience, and every year thereafter regardless of the mileage. These springs are easily located at the throttle linkage on your engine, and should be replaced in pairs. Take care that you use the correct spring however, as an increased pull tension may result in symptoms similar to a sticking throttle linkage.

3. Exhaust Brake.

The Exhaust Brake has been covered several times in recent Destinations articles, but let me go through the drill once again here to ensure this article is complete. If you have been tinkering on your coach as you make your way through this article, then you probably don't want to add burns to your growing collection of nicks, cuts, and bruises. For that reason, please ensure that the engine - in particular the turbo and exhaust brake assembly - has cooled sufficiently before you begin working on it.

Once you have gained access to the exhaust brake, look for any signs of soot on either side of the exhaust brake as it mounts to the turbo and exhaust system. If present, this can generally be rectified by applying more tension to the band clamps as you gently tap them around their outer circumference with a hammer. In some cases, a new band clamp may be required. With the auxiliary air system pressurized, the next step is to ensure your hands are clear of the exhaust brake, and that the exhaust brake switch is in the 'on' position. Watch the exhaust brake closely while your accomplice cycles the ignition switch off and on without cranking the engine. Does it move freely through its complete stroke and release rapidly every time? If yes, then apply some high temperature silicone based lubricant to all moving parts and call it good. This specialized lubricant can be purchased from us as part# 500070, or from PACBRAKE as part# 18037. PACBRAKE can be contacted at 800-663-0096 or info@pacbrake.com

If you find that the exhaust brake binds in both directions then try the aforementioned lubricant first. If this doesn't solve the problem, then

disconnect the pneumatic cylinder from the exhaust brake butterfly flapper and move the flapper itself. If the flapper moves freely then your pneumatic cylinder likely needs to be replaced.

If the cylinder extends rapidly, but is slow to return, first check the small valve at the base of the cylinder for a mud dauber or other insect nest that may have blocked the exhaust port. Next, try to extend the cylinder by hand. If it extends easily, then the cylinder's internal return spring is either weak or broken, which will necessitate a replacement of the complete cylinder.

Another scenario you might witness as the ignition cycles is a pronounced air leak and an immobile exhaust brake. This is usually caused by a failed, or partially missing 'rapid exhaust valve'. This valve, which is located at the base of the pneumatic cylinder, only exists on older exhaust brake systems, such as those used on the Gillig chassis. Newer exhaust brake systems use a two way pneumatic valve located beneath the bed deck to control the exhaust brake cylinder. This valve can easily be retrofitted into earlier coaches and eliminates the need for an often difficult to find rapid exhaust valve. If you would like some specific instructions for this replacement, just send an email to support@countrycoach.com with the words 'exhaust brake instructions' in the subject line. Don't forget to include your suggestions for future articles in the email!

Did I mention that you should keep your hands clear of the exhaust brake at all times when the ignition is turned on or off? Your fingers will appreciate this warning...

4. Coolant.

In the first article of this series I made reference to an upcoming article on coolant that will unlock all the mysteries and provide detailed information on a subject that is critical to the longevity of your engine. That article from one of our coach owners is included on page 12 of this issue.

5. Engine Kill Circuit.

The engine kill circuit is technically part of your coach's electrical system and should therefore be relegated to the third and final article of this series that will publish in the next issue of Destinations. I want to raise the topic briefly in this article, however, for those who have difficulty starting their coach after having spent some time tinkering in the engine bay area.

You see, lurking somewhat menacingly behind, or perhaps adjacent to the emergency stop switch (or engine kill switch) located in the upper right corner of your engine compartment is a small black relay of the single pole, double throw variety (SPDT). This relay is generally well behaved until your coach has quite a few miles or years beneath its belt, at which time it can become temperamental. All is well until you perhaps nudge it with your elbow, close the bed deck a little too hard, or shoot it with a stubborn throttle return spring and now suddenly, you find your coach refuses to start... Well that's not quite true actually. Your coach may start just fine, and continue to run as long as you crank the engine over, but once you let go of the key it immediately dies! Current models have not used this relay for several years now, so if you have

one, it is probably time to replace yours. It may never become a problem. However, the relay is inexpensive and it does play a critical role in keeping your engine running, or more importantly, stopping quickly when you don't want it to run. The relay is readily available in various brands from most automotive stores, and is commonly sold as part of an installation kit for fog lamps or similar. It must have five pins (most do), and the center pin must be marked '87a', not '87' which would indicate an incorrect single pole, single throw (SPST) relay.

Suspension

To bring this article to a close, let's move our attention to the components that connect our driveline to the coach, and keep our teeth from falling out on bumpy highways; otherwise known as the suspension. As with the driveline, your suspension will appreciate a little grease now and then to keep it from binding and to prevent excessive wear and tear. Just about any suspension component that moves will have a grease nipple associated with it, and specific information on grease type, service schedule and grease nipple locations can again be found in your chassis manual. When greasing rod ends with a rubber boot, stop injecting grease when the boot begins to swell to avoid damage to the boot itself. In other areas such as the 'king pin', and suspension bushings, apply grease until it begins to purge somewhere in close vicinity to the grease nipple, and wipe off the excess grease before it finds its way onto your driveway, or brakes. Replace any grease nipples that refuse to accept grease.

If you feel your suspension is perhaps a little on the noisy side, particularly when entering driveways or driving on rough roads, then a re-torque may be in order. This simply involves tightening all the suspension bolts, bits and bobs back to factory specifications, and your chassis manual should provide the necessary service schedule for your specific coach.

Alignment is important for good handling and even tire wear and should be checked periodically, especially after making significant changes in how you load your coach, or if your suspension has been worked on. Uneven tire wear is an immediate justification for having your alignment checked by a qualified alignment technician.

Last but not least are the lug nuts themselves. These should be checked periodically to ensure they are tight. On the rear duals, this will require loosening the outer lug nuts one at a time to check that the inner nut is secure before retightening the outer nut and moving on to the next one. Lug nuts generally don't come loose if they have been tightened correctly the first time, and it is here that the following advice is valuable for both your coach and tow vehicle...use a torque wrench. How many times have you seen lug nuts tightened without a torque wrench? More often than not probably, but this practice applies uneven pressure to the brake drum or disc that is sandwiched between your wheel, and the hub. You probably won't notice this as much on the coach as you will on the tow car where a pulsing brake pedal is a sure sign of a warped disc, but the advice still holds true in both cases.

In the final article of this series to be included in the Autumn 2004 issue, we will take a look at some electrical gremlins that may arise and how to avoid them. Until then, drive safe wherever your journey takes you and have fun along the way. If you have any suggestions for future articles, just send us an email to support@countrycoach.com.

ELECTRICAL

Maintenance Tips for the Mature CC Motorcoach - Part 3 of 3

by Brian Keys

Well folks, this is the last in a series of maintenance articles for the older Country Coach that began in the spring issue with a look at filter maintenance, and continued in the summer issue with a close look at the DynoMax chassis.

This article will focus on the electrical gremlins that might take residence in your coach as the years pass by, and the steps you should take to eradicate them.

Before we continue, let us discuss a few notes of caution that you should be aware of when working on both low and high voltage electrical systems. They are as follows:

- * Low voltage electricity such as 12-volt or 24-volt does not present a risk of electrical shock. Battery and starter cables, however, carry a lot of current which can cause severe burns should a short circuit occur. Always remove the negative battery cable first and never allow the tool you are using to remove the positive cable to contact the chassis.

- * Batteries give off explosive gasses. You should not work in close proximity to the batteries if they are gassing for any reason. If it does become necessary, you can cover the top of the battery completely with a water-soaked towel to absorb the gasses being produced.

- * High voltage such as 120-volts or 240-volts can kill. Make absolutely sure that the circuit is not hot before you work on it. Don't assume that the circuit is dead because you have turned the switch off; use a test meter or similar to verify that the circuit is not powered.

- * Think twice before working on 240-volt systems such as the transfer switch or shore cord. A simple wiring error in this system can result in an 'open neutral' that will typically destroy much of the high voltage electrical equipment in your coach such as the inverter, microwave, entertainment systems, etcetera. For this reason, and to avoid shock hazard, never use a "lollipop stick" or similar device to hold down the contacts of a failed transfer switch. It is a popular band-aid solution, but one that carries a lot of risk to both you and your coach.

With that out of the way, let's continue!

High Voltage Systems!

1. Transfer Switch.

Does your transfer switch shake, rattle and roll? Hopefully not, but it might develop a hum or chatter that would indicate dust or other contamination is preventing the relays from closing fully. With the switch un-powered, try blowing out any dust with high pressure compressed air. If you have an older transfer switch that has a small diode and capacitor

between the relays, the ideal solution is to replace the switch. Those of you who are familiar with soldering can source a new diode and capacitor from Radio Shack, but the relays will often have reached their service life in this transfer switch and will (according to Murphy's Law) fail at the most inconvenient time. Does your coach mysteriously drop just one 'leg' of power after about thirty minutes of running on generator power? Does this leg of power cycle off and on? If this is true, then the likely culprit is a broken coil winding in one of the transfer switch relays. The two ends of the break will make contact when the coil is cold, but will separate again as the coil heats up due to thermal expansion. This is a common symptom with old transfer switches and for this reason, I again recommend that an old transfer switch should be replaced, not repaired.

2. Voltage Monitor or 'GFI' Circuit Board.

Do you regularly hear computer voices warning you that your shore cord polarity is reversed? If so, then you are probably very familiar with the location of the mute switch for the voice monitor system. To cure the actual problem will require replacement of the GFI Circuit Board. This board will probably have been damaged by a voltage spike on shore power and is typically located in the overhead dash above the passenger seat, or in the 'AC Feeder Panel' above the transfer switch.

Charging System

1. Battery Isolator.

This item is located in the engine compartment and was used on coaches with a Gillig chassis to allow the alternator to charge both chassis and domestic batteries while keeping them electrically isolated from each other. If you have a Gillig coach and your alternator is only charging one set of batteries, then the battery isolator has most likely failed. Failed isolators will usually have some cracking around one or more of the battery cable studs. The battery isolator is located in the engine compartment on the passenger side.

2. Charge/Boost Relay.

DynoMax coaches are equipped with a charge/boost relay in place of the aforementioned battery isolator. This relay connects the chassis and domestic batteries together when the engine is running so they both receive a charge. It also connects the two battery banks together when the 'battery boost' switch is operated to start your engine when the chassis batteries are low. If the alternator is only charging the chassis batteries and not the domestic batteries, then this component has likely failed and needs to be replaced.

3. Echo Charger.

This neat device provides a trickle charge to your chassis batteries from the domestic batteries when the latter is at 13-volts or higher, and it serves to keep your chassis battery charged when your coach is connected to

shore power. If you experience problems keeping your chassis batteries charged then check the in-line fuses on the echo charger's wiring harness. These fuses typically fail when the chassis battery positive cable comes into contact with the frame during chassis battery replacement.

4. Battery Cables.

If you have a persistent charging problem that has so far defied all attempts at resolution, then take a close look at the battery cables. In particular, check to ensure the connections are clean and tight at the batteries, starter motor, alternator, and engine-to-frame ground cable.

5. Inverter Charging

Did your Heart Freedom 25, or Freedom 20 stop charging the domestic batteries for no apparent reason? If installed, does your Link 2000 show that the domestic batteries are receiving a bulk charge when they are in fact discharging? If so, then the first thing to check is the 300-amp, or 250-amp fuse on the inverter's positive battery cable. A voltage check across this fuse that measures anything other than 0-volts would indicate that this fuse has failed. If the fuse checks out good, then try hitting the upper right corner of the inverter's front panel with a closed fist (not a hammer!) once or twice. If this restores the inverter to normal operation then the inverter should be serviced when convenient to clean an internal board connection.

Instrumentation

1. Gauge Accuracy.

The accuracy of most analog gauges is limited, but if they are significantly misreading - especially when the dash gauge illumination is at full brightness - then you may have some undesirable resistance at the ground connections behind the dash. The easiest fix is to run an additional 12 AWG ground wire from the chassis framework beneath the dash to one of the daisy-chained ground terminals on the rear of the gauges. Does your coach have the digital gauge package or a digital dash where some of the gauges are not working? This dash instrumentation receives its information from two different sources via two separate twisted-pair 'network' cables. No readings on the tachometer, odometer, oil pressure and boost pressure gauges would indicate a communications failure with the ECM or Engine Computer Module. No readings on the remaining gauges such as speed, fuel level, and brake circuit pressure would indicate a communication problem with the 'DCU' or Data Collection Unit which is located in the steering compartment. In both cases, check the electrical connectors in the steering compartment for loose or corroded connections.

2. Ignition Solenoid.

Should your coach develop intermittent problems where nothing happens when you turn on the ignition switch, the most likely culprit is the ignition solenoid. This is located behind the access panel in front of the passenger seat on earlier Allures and Intrigues, and on the Front Run Board in the steering compartment on earlier Magnas and Affinities. Tapping on the relay with the ignition turned on will usually get you home, but be aware that you may have to tap it a second time when the ignition is turned off for it to disengage.

Domestic Electrical Systems

1. Alarm Systems.

Problems with alarm systems are not uncommon as they age, but how does one determine whether it is the alarm that has malfunctioned, or the much abused key fob? The trick here is to follow the manufacturer's instructions to set the alarm system into transmitter programming mode. If you hear the correct squeaks, squawks and chirps as described in the instructions, it is safe to assume that the alarm system is operational but your key fob transmitters are not. If the alarm system groans or gargles unexpectedly and it has good voltage at its power connection, then it should be replaced. It is usually more cost effective to replace an old alarm system with a new one after about thirty minutes of troubleshooting as opposed to spending three or four hours of diagnostic time trying to coax life into one that has long expired.

2. Poor Antenna Reception.

If your TV picture is somewhat 'snowy' while others near you have great reception, then it is time to check for loose coaxial cable connections behind the TV itself, and also on the rear of the TV-Boost, and A/V switcher control. If this does not improve the reception, then the next item to check is the coaxial cable connections to the antenna itself. You might also consider cutting the cable back a little to install fresh connectors in place of those that may have corroded.

3. Entry Step.

Do your entry steps go out when you close the door, go in when you open it, or exhibit other erratic behavior? If the steps are receiving good voltage, and the ground is clean and secure, then the first item to check is the door switch. If the steps seem to work properly as you cycle this switch in and out with your finger, then it probably needs to be adjusted. If not, then the switch should be tested with an ohm-meter for good continuity and replaced if necessary. In some cases, the entry step's 'brain' may be a little confused. But, I have some good news! Brain transplants are readily available and are easy to replace. If you replace an older 'white brain' with the newer 'black brain', you will also need to add a relay to change the logic of the entry door switch or, better still, replace the entry door switch also. The latter is generally not an easy task so be prepared for battle!

This is not by any means a complete collection of electrical gremlins, but hopefully the solutions presented here will shed some light on a mystery or two that may have plagued you for some time. If you discover some new ones, give our customer support department a call at (800) 452-8015 and let us help you chase them down. You can also send us an email at support@countrycoach.com.

HOUSE

Digital Cinema Package

Remember when projection TV was a cabinet with a cumbersome rollout drawer containing three color projectors pointing at a reflective screen? Then there was the adventure of setting up to watch home movies or the family slide collection, another memorable experience. Even after extending the wobbly screen, the captive audience spent the first reel or carousel debating the true meaning of 'focus'.

To paraphrase an old advertising jingle, we've come a long way, Baby. Combine all the intended enjoyment of those video moments, add the power and full-range realism of a Bose surround sound audio system, and the result is the new cinema solution Country Coach is putting in its motorcoaches for 2004! The engineering team has combined the finest audio and video components into a fine-tuned blend of state-of-the-art electronics. Although handy, easy-to-follow instruction sheets detailing system setup and operation are included with your coach, we wanted to share some of the exciting technical features with you here. Welcome to the Digital Cinema Projection Package. After the included blackout curtains darken the room, the lights are dimmed, and the 68" motorized projection screen lowers into position. A momentary touch on the power button of the NEC IR-transmitting (infrared) remote control unit will activate the LCD projector in the ceiling, and with the Bose system on, prepare for a home theater experience not soon forgotten.

The latest in opto-electronics technology projects VHS, DVD, satellite, broadcast antenna, or cable movies and shows with the clarity of picture and richness of sound most often experienced in a fine movie theater. In addition, complete audio and video control is at the user's fingertips, with access to pause, zoom in and out, adjust the picture quality, the sound, as well as change the aspect ratio of the projector for better viewing. Logical on-screen menus, using the projector remote control, make this all possible from the comfort of your favorite seat.

To pause a movie and zoom in on a portion of the image, go ahead, and move around in the image while zoomed in. An arrow-style cursor can be created and manipulated by the remote to point out pictures on the screen. In addition, the remote projects a tiny bright red laser as an alternate pointer. (Caution: lasers can damage the eye, if improperly used.)

And hey, the afore-mentioned slide shows? That's an enjoyable proposition, as well. Just insert an image CD into the DVD player, and flip through them just like on a PC.

Country Coach's 2004 Digital Projection Cinema package includes a 68" diagonal, electrically operated projection screen with remote, the state-of-the-art NEC

ceiling-mounted projector with remote, and blackout shades for the living room, with dinette and cab privacy curtains. Owners of Intrigue and Allure coaches will be offered the Projection TV system as an option, while Magna, Affinity, and Lexa owners will find it included as standard equipment on their 2004 models.

Oh, did we mention the optional universal remote? Specifically pre-programmed for each individual coach, this handy little gizmo puts all mentioned functions into one compact little unit, as well as the operation of all the other audio and video systems. Country Coach dealers across the country are well equipped to demonstrate its wonders. Any questions? Contact the Customer Care Team at (800) 654-0223 for more information.

The Hurricane Heater

by Doug Beaudry (Technical Services Manager)

The Hurricane heater provides heat to the coach and on-demand domestic hot water. The Hurricane Heater is a modern diesel fired heating system that is used to heat the interior of the coach. A revolutionary feature of this heater is its use of a low pressure fuel system where fuel is drawn into the air stream by a Venturi effect similar to that found on carburetors used for gasoline engines. A governor maintains the correct stoichiometric air/fuel ratio, which is then passed through a specially designed aspirating nozzle. A small compressor delivers air to this nozzle to ensure complete fuel atomization and the nozzle features a wide orifice so clogging is virtually eliminated. This process produces a very fine mist of fuel into the combustion chamber resulting in complete combustion and very low emissions.

About the control system.

An electronic control system monitors the furnace operation and will safely shut the furnace down should any problems occur. This control system is mounted in close proximity to the furnace and uses a seven-segment LED display to report normal operation or a fault condition. Earlier versions of this control panel utilized a row of eleven LED's to provide this information.

In the event that the furnace will not operate, it is important to record any faults before cycling the system off and back on again since this action will clear the fault condition.

Remote control panel.

A remote control panel is installed in the front or rear of the coach depending on the model. The remote panel has an on/off rocker switch and a single seven-segment LED display to indicate the furnace status. In normal operation, the following will be displayed:



Illustration 1: The Hurricane Heater provides heat to the coach and on-demand domestic hot water.

- * 't' ' Furnace is enabled but inactive because no connected thermostats are requesting heat.
- * '.' ' Furnace has ignited and is currently on a combustion cycle.
- * 'C' ' Furnace is cycling coolant around the system but is not on a combustion cycle. This means that the furnace has reached its temperature limit but a thermostat on the interior of the coach is still requesting heat. This is normal operation especially in cold weather.
- * 'c' ' Central heat switch is turned off.
- * 'U' ' Service switch on the electronic control box is turned off.

Earlier remote control panels incorporated a red and green LED with an audible alert buzzer. An illuminated green LED on this control panel indicates that the heater is currently on a combustion cycle and an illuminated red LED indicates that the heater has shut down or failed to ignite.

Operating the Hurricane Heater is a breeze.

Simply turn on the "Central Heat Control" switch to enable the system, then, select "Furnace" on the "Comfort Control Center" that is also used to operate the air conditioners on the roof of your coach. You can now set the temperature to your desired comfort level. Some models have additional controls to adjust the fan speed on the heat exchangers inside the coach.

Freeze protection.

Another thermostat is installed in the plumbing bay and will cycle the heater as necessary to prevent your plumbing system from freezing. This thermostat is preset at the factory and is only enabled when the "Central Heat Control" switch has been turned on.

CO45XL.

Some coach models use a new variant of the Hurricane heater called the CO45XL. In addition to providing heat to the interior of the coach, this system also acts as an "on demand" water heater that will provide continuous hot water without the need for a large storage tank or accumulator. To enable the water heater, simply turn on both the "Central Heat Control" and "Water Heater" switches.

When hot water is not being used, the furnace will cycle periodically to maintain temperature around its internal water jacket and will run continuously if you are using hot water such as when washing dishes or taking a shower.

The furnace also incorporates two supplemental electrical heating elements that can be enabled or disabled via breakers located at the distribution panel in the rear of the coach. These heating elements will maintain the temperature around the Hurricane Heater's internal water jacket and provide enough hot water to wash your hands without cycling the furnace. The heating elements operate independently of the furnace itself and will still heat the water in the heater jacket when the "Central Heat Control" and "Water Heater" switches have been turned off.

Service Tips.

To ensure reliable operation, the heater should be serviced annually before the cold season begins. Service should be completed by trained technicians. They will replace the fuel and air filters, followed by a thorough cleaning of the nozzle and combustion chamber. Should any problems occur, always remember to jot down any faults displayed on the electronic control box adjacent to the heater before cycling the system off and on again. This information can be invaluable to the technician working on the system especially if they are diagnosing an elusive intermittent fault.

Advantium Speedcook Technology

Advantium is a breakthrough in cooking technology. The Advantium delivers oven-quality meals in a fraction of the time it takes in today's conventional ovens. Not a traditional oven and not a microwave, it is the first truly new major appliance introduced in over 25 years. Upon its introduction, this oven won the Grand Award in the 1999 Best of What's New Awards from Popular Science magazine, recognized as the best new product in the category of Home Technology. Since the ultimate Advantium oven's introduction it has gone on to win seven national awards for its advanced cooking technology. Recently the entire Advantium line received the 2001 American Building Products Award from Home magazine.

The new Advantium 120 cooks up to four times faster than a conventional oven. It does not require preheating, so you can start cooking your food as soon as you're ready. Besides speed, cooking with light doesn't discriminate like a microwave with what food you can put in it. It can cook a steak or a pie just as well as your oven and do it in half the time. This works faster than a combination microwave + convection oven unit.

How does Advantium work? This oven is a combination microwave and halogen lamp oven. By harnessing the power of light, Advantium cooks the outside of food much like conventional radiant heat, but it also penetrates the surface so the inside cooks at the same time. The microwave needs little explanation as we understand how that works (energy waves excite atoms within liquids to produce heat almost like internal friction). It is a penetrating energy source and heats whenever liquids are present. The halogen lamps also produce high heat, but it is a surface heat. This provides an added heat source in the oven cavity and does the browning that microwave ovens cannot do. The build-up of oven cavity heat also helps to accelerate the cooking process. The microwave cooks deep internally and the halogen browns the surface and adds to the total heating process.

But, you may ask, how does food taste coming out of Advantium? This unique method of cooking is much faster and causes little loss of moisture. Cooking with light is safe both from the standpoint of the food cooked and the operation of the oven. The light is contained in the cavity of the oven and is shut off instantly if you open the oven door during operation. Fast cooking isn't helpful if the food doesn't taste great. Cooking with light allows you to make fantastic oven-quality meals. Advantium browns and crisps foods on the outside but leaves them tender and juicy on the inside. Biscuits, cookies and cakes rise and brown, while meats and seafood stay moist and full of flavor.

Advantium 120 operates on 120 volt power. While light cooking products have been on the market for a couple of years, GE is introducing the first high-speed light

cooking oven to incorporate a standard 120 volt plug. The Advantium 120 simply plugs into a standard 120-volt/15-amp outlet. The Advantium 120 allows the convenience of a 120-volt installation while providing a wide spectrum of cooking power. The perfect combination of speed and versatility, the Advantium 120 oven offers four cooking modes including speedcook, traditional oven, microwave and warming capabilities.

Significant reliability testing while creating Advantium resulted in specially designed halogen cooking bulbs that last for the life of the product. The Advantium 120 carries a 3-year parts and labor warranty on the bulbs. The Advantium is easy to use and comes preprogrammed with recipes. The program menu is flexible, allowing you to customize them and add your own. Chewy, chocolate chip cookies, browned top and bottom? Yum yum, let's bake! GE, (NYSE:GE) America's most admired company, has been bringing good things to life for more than a century. GE sells products under the GE, Monogram, Profile, Profile Performance series, Hotpoint and GE SmartWater brands. For more information about GE Appliances, consumers can call the GE Answer Center at 800-626-2000 or visit on-line at www.geappliances.com.

Editor's Note: The Advantium speedcook microwave/convection oven is available as an option on Country Coach Allure, Intrigue, Magna, Affinity and Lexa product lines.

Coach Command

Coach Command works from a network of six node boards, which individually monitor the power sources, appliances, and other devices found on a coach. Once the data has been collected, it is transmitted to two touch screen displays for real-time viewing (driver's screen is located on the dash and the passengers' screen is located in the living area). The user-friendly touch screen displays feature six main options: Power, Loads, Tanks, Faults, Coach Engine, and Setup. For a quick start reference point, we've included brief summaries for the basic functions and components found with each of these options. To best understand the Coach Command System and all of its specialized features, you should refer to the Coach Command System user's manual.

Power

Features include genset, shore, and invert.

- * Genset allows you to turn the automatic generator start on or off.
- * Shore enables you to monitor shore power and set the shore power circuit rating to either 15, 20, or 30 amps. (*when connected to 120VAC only)
- * Invert allows you to monitor the amount of power used throughout the coach. Power levels include: battery voltage, charger input current (AC), and charger output current (DC).

Coach Engine

(only available with driver's touch screen)

Features include leg, trip, gauges, engine faults and past faults.

* Leg allows Coach Command to display information for a portion of the current trip. Features include: instant miles per gallon (MPG), leg MPG, average miles per hour (MPH), fuel, miles traveled, miles to go, hours traveled, hours to go, and reset leg.

* Trip enables you to gauge the MPH, MPG, fuel, miles traveled, and hours traveled from point of reset.

* Gauges allows you to monitor engine gauges including: boost pressure, average miles per gallon, battery level, engine level, coolant temperature, intake temperature and oil pressure.

* Faults enables you to monitor any of the engine faults that may have occurred during the designated travel time.

Loads

This option will allow you to monitor the various controlled loads like the hot water heater, AC, engine block heater, electric heater, and washer and dryer.

* Tanks, Faults & Setups Tanks will display the tank level-monitoring screen. View the levels for fresh water, black water, gray water and liquid petroleum (LP).

* Faults will display any faults that the system might encounter.

- Setup enables you to view the Coach Command display settings. These include: time/date, contrast levels, backlight timer, and tank level warning setting. 'Quiet time' can also be set here.

Xantrex Prosine 3.0 Inverter/Converter

by Brian Keys

Providing true sine wave AC power from a DC source

Effective with CC # 6237 (which shipped from Country Coach in November, 2002), Magna, Affinity and Lexa motorcoaches are equipped with the Xantrex Statpower true sine wave Prosine 3.0 inverter/converter 12V model, (CC Prevost Conversion will use the 24V model). The Prosine 3000 uses advanced high-frequency switching technology in the power conversion process, with circuits similar to those used in power supplies for computers and other electronic equipment.

Prosine 3.0 benefits

- * Easy installation due to its lightweight design
- * Quiet operation with no transformer buzz
- * Eliminates hum in audio systems
- * Eliminates rolling lines on TV screens
- * Operates computers and DC power supplies without overheating
- * Clean regulated and filtered DC output for ideal battery charging
- * Operates microwave ovens at full efficiency
- * Operates variable speed motors smoothly
- * Digital clocks keep accurate time
- * Starts motor (inductive) loads more effectively

* High surge capability for the hard-to-start AC loads

For clean true sine wave electrical power to all your appliances the Prosine inverter charger from Xantrex is unsurpassed as an all-in-one power solution. This system includes a battery temperature sensor, and an ACS (Advanced Control System) Remote Panel, which provides system control in a menu-driven, multi-functional LCD display.

Inverter Features

Automatic Transfer Switch.

When shore power fails, is disconnected, or falls below 90 volts (known as a brownout), the Prosine automatically switches to inverter mode and begins utilizing the stored energy in your domestic batteries to produce AC power inside the coach. This transfer from shore or generator power to inverter power, typically occurs within 20 milliseconds, which is fast enough to keep a computer and most appliances, audio/video equipment etc. running. That said, the Prosine, as with most inverter/chargers, is not certified as an uninterruptible power source and should not be considered as such. Some situations such as overloaded shore power circuits at busy campgrounds, or the gradual decrease of AC voltage as your generator slows to a halt, can delay the transfer to inverter power causing digital clocks to reset and occasionally, entertainment equipment to turn off. When shore or generator power is next available, the inverter will monitor the AC power for about 8 seconds, synchronize the AC waveform, and then (with the inverter switch set to 'ON') automatically switch your loads back to the incoming AC supply from shore or generator. It also returns to charging the batteries.

Automatic Waveform Regulation.

The Prosine monitors and regulates the AC waveform when inverting, delivering a true sine wave with typically only 1 percent total harmonic distortion (THD). This is usually cleaner than generator and utility waveforms.

High Surge Capacity.

The inverter will deliver up to 4000 watts of power for up to five seconds to start large motors and other inductive loads that require high power level's to start. The Prosine 3.0 delivers up to 3000 watts continuously.

Load Sense.

This feature reduces power consumption during idle periods to conserve battery capacity by 'searching' for loads that exceed a specified threshold. When a load is detected, the inverter 'turns on' and delivers full voltage. When no load is detected, the inverter stands by consuming less than 3 watts of power. The threshold can be set at 10, 25, or 50 watts however, due to the non-linear and often complex loads found in many modern electrical appliances; the preferred setting for this programmable option is zero which effectively disables it. It is a useful tool, however during long periods of dry camping to minimize the discharge rate on your domestic batteries.

Integral Protective Circuitry.

A built-in protection circuit, guards against damage to the inverter from high battery voltage, low battery voltage, AC overload, and high temperature conditions. This protection circuit includes, but is not limited to the following:

Automatic Low Battery Shutdown.

This protects your batteries from damage due to over-discharge by shutting down the inverter when battery voltage drops to 10volts for 12volt models. The unit will resume inverting when battery voltage rises above 12.3volts.

Automatic High Battery Shutdown.

This occurs when battery voltage reaches 16volts for 12volt models. The unit will automatically restart when the battery voltage drops below 15.5volts. High battery voltage is typically caused by a defective or maladjusted regulator on the engine alternator.

Over Current Protection.

When the AC loads connected to the inverter/charger exceed 50amps, the inverter will instantaneously reduce the output voltage until the loads on the inverter are reduced. If the overload continues, the inverter will shut down and automatically restart after a predetermined recovery time.

High temperature Shutdown.

When the inverter detects a high temperature internal condition, it shuts down until the internal temperature cools by at least 110F at which point, the unit will automatically restart.

Audible Fault Alarm.

An audible alarm alerts in the event of a fault condition and is accompanied by a fault code displayed on the ACS remote control panel. The four fault conditions which trigger the alarm are high battery voltage, low battery voltage, system over temperature, and communication error or temporary fault.

Visual Fault Code Display.

If an error occurs the control panel displays a fault code so that you may determine the problem, and take the necessary steps to correct it. A table of fault codes and likely causes, along with corrective measures, is provided in your User's Guide in Appendix C: Troubleshooting.

Source: Information provided by David M. Norman, Account Manager, Recreation Markets, North American Sales, Xantrex Technology Inc. Additional sources includes www.heartinterface.com, Prosine 3.0 User's Guide and Country Coach technical resources. For more information on the Prosine 3.0, you may also visit www.statpower.com.

Battery Charger Features

Dead Battery Charging.

The charger begins recharging batteries even if voltage is near zero.

Power Factor Correction.

High power factor correction equals increased efficiency, resulting in faster charging due to the lower AC current required from your generator or shore power. With your coach connected to a 30-ampere shore power circuit and your batteries taking a heavy 'Bulk' charge, The Prosine will deliver 120amps DC to the batteries while only using 17 amps AC. This leaves you with 13amps for the remainder of the coach. In contrast, a non power factor corrected charger operating under the same conditions will require 26amps AC to charge the batteries with 130amps DC leaving you with only 4amps for the remainder of the coach. As your batteries charge, the Prosine's charge rate will gradually drop and free up more AC amps for your interior appliances. When your batteries are fully charged, you can expect to have almost the full 30amps of shore power available to use at your discretion.

Automatic 3-stage Charging.

When AC power is supplied to the inverter/charger, the 'Smart' charging capability of the Prosine provides a 3-stage charge to quickly bring deep cycle batteries to full charge. Through microprocessor control, it precisely regulates voltage and current delivered to the battery, accurately charging without risk of over charge and battery damage. Depleted batteries are taken through the recommended 'Bulk', 'Absorption' and 'Float' stages.

Manual Equalization Charging.

Initiate an equalization charge to optimize your battery capacity and rejuvenate your batteries. Equalization for flooded batteries helps reduce sulfating and extends battery life. Gel cell batteries and some brands of AGM batteries should not be equalized under any circumstances.

Battery Temperature Sensor.

Using a temperature sensor, the Prosine will monitor the battery temperature and adjust the charge voltage automatically according to a preprogrammed temperature compensated charge algorithm. This ensures the batteries are fully, but not over charged in all ambient temperatures.

Battery Temperature Shut Down.

The charger will shut down if it detects excessively high or low battery temperatures (in excess of 122oF or below 5oF).

Power Sharing.

To avoid nuisance tripping of the AC breaker for your shore power outlet or generator, use the ACS remote panel to set the maximum AC input current parameter to match the breaker's rating. The Prosine reduces its charging current automatically to keep the sum of all loads on the inverter circuit from exceeding this setting. The Prosine has no control over the non-inverter loads you apply such as water heater, refrigerator and roof top air conditioners, so if nuisance-tripping still occurs, try removing one or more of these loads. This feature is particularly useful when storing your coach at a location where the only power source is a 15amp outlet. Simply turn off all non-inverter circuit loads such as those listed above then use the ACS panel to set the maximum AC input current parameter to 15amps. You can now connect your shore power to the 15amp outlet and safely keep your batteries charged while storing your coach.

The Motherboard (Prevost)

In the Prevost Conversion by Country Coach, you'll find a series of touch button switch panels placed throughout the coach to offer complete control of coach electrical systems. Turn on the lights, engage the generator and start up the block heater via these buttons, or a myriad of other things. Behind these switches, a sophisticated series of wires, and electrical circuits are evidence of innovative ideas from the brightest minds at Country Coach. It's called the Motherboard and it is the central 'brains' of almost everything that can be switched on or off.



*Illustration 2:
Country Coach
technician testing the
Motherboard.*

The Motherboard accomplishes several goals and advantages:

- * It is centrally located and self diagnostic for ease of troubleshooting
- * It uses smaller wire, thus lightening coach weight
- * It expands to accept new devices
- * It allows more than one button to control a device using matrix configuration
- * It uses 12 volt DC to control 120 volt AC and 12 volt DC circuits
- * It can be custom programmed to match the floorplan selected as well as the customer's choices of optional equipment.

Turning on a light is both a simple and a complex technological feat.

Inside the Box.

The Motherboard is located on the forward wall of the first bay just behind the front tires. You will find all of the wires, diodes, relays and electrical components which are assembled into a smartly designed system that has the ultimate goal of Flexibility located inside a metal box built specifically by the Country Coach steel fabrication department.

But, before we talk flexibility, let's talk nuts and bolts. At the heart of this system there is a main electrical circuit board mounted on end. Called the Motherboard, this card acts much like the main circuit board you might find in

your office or home computer. This main 'card' offers a central location for all the circuits, fuses and common functions needed by the entire house electrical system. For example, a part of the Motherboard is set aside to provide power to the 5 volt LED lights that back light the buttons on the interior switch panels. The Country Coach Conversion's Motherboard is also like your home or office computer in that it allows a variety of cards to be connected to it. These are called daughter cards and they are mounted perpendicular to the Motherboard. Unlike the daughter cards on an office computer, like a sound card, these secondary cards control dimmers, switching and other electrical functions.

You will notice a large copper bar across the length and on the bottom of the daughter cards. This power bus bar supplies the main power supply from a 200 amp feed on a 200 amp breaker. Eventually, this power will be stepped down through the bus bar to the 7.5 to 20 amp circuits on each daughter card.

Several bundles of wires come into and out of the Motherboard. Basically, the Motherboard is configured with high amperage systems on one side, like a water pump, and a low amperage system on the other side. The high amperage circuits require a larger gauged wire to be used between the electrical device and the Motherboard. A lighter gauge wire is used between the switching panels and the Motherboard.

These smaller wires are similar to computer cabling offering the advantage of reducing coach weight. A pair of these cables is sent to each switching panel in either strands of 15 or 25, depending on how many switches are on the panel.

Each daughter card is numbered and etched with the number of circuits on the board, as well as the amperage at which each circuit is rated. Notice that a similar copper bar travels down the edge of each daughter card and connects to the main power bus bar. Each circuit on the daughter card receives power from this path; a standard automotive type ATC fuse guards from overload.

Function and Flexibility

The Motherboard offers a great deal of flexibility in designing both standard and uniquely custom electrical packages on a Country Coach Conversion. Each Motherboard is configured specifically to each floorplan and the equipment installed. If a special chandelier is specified, it will be added to the configuration.

The basic function of each switch circuit is simple. For example, let's turn on a light in the bathroom. When the button in the switch panel is pushed, it sends a signal down the low amperage computer wiring to the Motherboard. At the same time, the button's amber back light turns to green to indicate the control circuit is on. These touch button switches are momentary (meaning they push, then rather than stay down). Technically, they do not make the completed circuit that turns on the light. Instead, the signal they send to the assigned circuit trips a series of relays that 'latch' and turn on the bathroom light. When a circuit is latched it allows the high amperage current to travel to the bathroom light. The circuit on the daughter card remains latched until it receives a second signal from the same switch that turned it on or another one assigned to the same circuit.

In terms of flexibility the design allows for the matrix configuration of switches. More than one switch can turn devices like the generator on or off and from various locations. All of the buttons on a switch panel assigned to turn the

generator on or off are connected to the same circuit on the daughter card. With convenience in mind, this flexibility lets you set up switches in the entryway to turn off the lights in the bedroom when leaving the coach. Another key feature is the empty buttons left on a number of the switch panels allowing additional functions, like a special water heater, to be programmed into the system.

Self Diagnostics

The fit and finish normally associated with features like cabinetry is also found in the Motherboard box. Here, wires are neatly bundled, each meticulously labeled. Each circuit on every daughter card is labeled with the amperage of the circuit and replacement fuse.

Each circuit features self-diagnostics using green and red LED lights. If a green LED is extinguished, it indicates that a fuse has blown. The red LED indicates whether the circuit is on or off. There are also test switches on the board so you can troubleshoot whether the problem is with the board or in the wiring. It is important to note that all of the daughter cards, as well as the circuit boards behind the switch panels, can be replaced should something happen to them - yet another example of the flexibility of the design.

CC Design and Construction

Where does all this flexibility originate? It begins with the company's founding concepts. Bob Lee was a long time RVer before he began building motorcoaches, and as such he developed a keen sense of what he expected to be built into a Country Coach. It shows today, in all aspects of motorcoach production, including the Motherboard. You'll find thorough research and development is invested, followed by the engineering of each circuit board that is used to construct the Motherboard, daughter cards and circuit boards behind each switch panel. Country Coach electrical engineers draw every inch of each circuit board in a special computer program. These files are then sent to a manufacturer who will etch all of the circuits on each card.

All of the blank cards, now etched with circuitry, return to Country Coach to be put together in a special electrical assembly room. Technicians take the blank circuit boards and solder every diode, relay and electrical component that is required. Schematic charts are used as well as cut out jigs that overlay the circuit cards. These overlays help the technician focus on areas where they are to solder on components. A clear protectant is placed on the cards to guard against moisture damage or corrosion.

Once the individual cards are constructed they are assembled on a loom that helps position all of the components in the right place. It aids in the building of wire leads and connectors so they are in the right location once the Motherboard box is put into place.

Wrapping It Up

Considering all of the thought invested into each circuit, diode and wire, the Country Coach Conversion has one of the most sophisticated electrical control systems on the road. The CC Motherboard has been custom designed especially to

meet the needs of a luxury motorcoach. To examine this system and other innovative technologies in the Country Coach Prevost Conversion, call the Customer Support Team at (800) 654-0223 and ask for a Prevost Conversion Representative. Or, visit the company web site at www.countrycoach.com. Mention you read about the Motherboard in Destinations when you call.

Frequently Asked Questions

CHASSIS

Q My chassis user's guide indicates that my coach is equipped with Automatic Slack Adjusters. Since they are "automatic", is there anything that I need to do in the way of periodic maintenance?

A That's a great question, because the answer is not as obvious as it may seem. As you may already know, in an air brake system, the Automatic Slack Adjuster (ASA) is basically a lever that transforms energy provided by the coach's air system into torque. This torque, or twisting power, applies the vehicle brake linings against the brake drums (or rotors in the case of disc brakes).

Additionally, as its name would indicate, the ASA is the point in the brake system where slack between the brake linings and the drums or rotors is monitored and corrected. This is necessary because as the brake linings wear due to normal usage, the slack adjuster must twist farther in order to obtain the same application force between the brake linings and the drums or rotors. At some point in this process, if no adjustment were to be made, you would find yourself pushing ever harder on your brake pedal, even as your coach became more difficult to stop. So ASA's are designed to make constant, small adjustments as the brake linings wear, thereby maintaining optimum brake adjustment. Before the advent of ASA's, slack adjusters had to be checked and adjusted manually and at regular intervals based on mileage in order to avoid this situation.

So then, ASA's have made the old manual slack adjuster inspection and adjustment requirements obsolete, right? Well, actually, yes, with some qualification. With a properly engineered brake system like the one on your coach, no manual adjustment of your ASA's should be necessary until normal brake wear makes a standard brake re-line necessary. It is still a good idea to have these components checked at each chassis service. The most effective and straightforward test of proper ASA adjustment is the Chamber Power Stroke Measurement Test. This straightforward test takes just a few minutes, and will confirm that your ASA's are adjusting properly. Any qualified chassis shop will be familiar with the tolerances recommended by various brake manufacturers. If your coach is a 2000 model year or newer, the coach User's Guide should contain a Merit or Appendix section which lists the recommended tolerances for your vehicle's brake system. Of course, regular lubrication of the ASA's, along with a minor inspection of the brake system at the intervals outlined in your coach User's Guide is a necessary part of your overall chassis maintenance program.

If you have any other questions about brakes, contact one of our DynoMax Technical Representatives at (800) 452-8015.

by Brian Keys, Country Coach Service Specialist

- As published in the SPRING 2002 issue of Country Coach Destinations

Q The ATC light on my 2001 Magna stays on while driving. What should I look for and how does this affect the drivability of my coach?

A The first step in diagnosing this ATC (Automatic Traction Control) warning light would be to check the 'Blink Codes' using the diagnostic switch located in the steering compartment (first compartment, driver's side) of your coach. This switch should be labeled 'ABS' (Automatic Braking System) and will be illuminated with the ignition in the on position. With your coach parked and ignition on, press this switch for one second (not three!) then release. The lighted switch will flash the two digit blink code with a series of rapid flashes for the first digit, followed by a 1/2 second pause, then a series of rapid flashes for the second digit. If the code is 'Active' meaning the fault is occurring right now, then the ABS system will flash this single code repeatedly until the ignition is turned off.

Confused?

Let's look at your specific example with the ATC light that remains on. Assuming the coach is parked with the ignition on, pressing the diagnostic switch for one second might reveal a series of seven rapid flashes followed by a 1/2 second pause then 1 flash. This would indicate a 7-1 fault code which is the most common error that causes the ATC light to remain on. Now we need to look at the blink code identification table on the right to identify the fault.

As you can see from this table, a 7-1 code would indicate there is a fault with the J1939 datalink, but what does this mean?

The ABS system must communicate with the engine computer at all times so, if your wheels lose traction, it can send a request to the engine computer causing it to derate and hopefully allow the wheels to regain grip on the road surface. The ABS system communicates to the engine computer via a network infrastructure that is shared with the transmission, and other optional devices. This network meets the SAE J1939 protocol and is commonly referred to simply as J1939 or CAN (Computer Area Network). If there is a problem with this communication, the ABS system will disable the ATC feature and turn on the ATC warning light. The braking system will operate normally, and the coaches drivability will not be affected however caution should be observed on slippery surfaces.

This 7-1 fault is most often caused by a defective 'terminating resistor' (see image below) of which your coach has two. One is located in the steering compartment and the other is located just behind the rear bumper on the passenger side. The terminating resistor is a small triangular gray colored plug that connects to a mating connector on the end of a three wire harness. To test the terminating resistor, simply unplug it from the harness and measure the resistance across its two pins. You should obtain a reading of 120ohms; any other reading would indicate that it is defective. With both terminating resistors in place, and the ignition turned off, you should measure 60ohms across pins C and D of the nine pin reader port (black) located in the service bay of your coach. A reading of 120ohms at this location would indicate that one of the terminating resistors is defective or that there is an open circuit. Any resistance readings other than 60ohms or 120ohms would indicate a shorted, loose or corroded connection in the harness.

Once all faults have been repaired, simply hold down the diagnostic switch for three seconds with the ignition in the on position. A series of eight rapid flashes indicates that the codes have been successfully cleared and these will be followed by a repeated series of flashes at four second intervals which is the system verification code. This verification code identifies the configuration of the ABS system, and should not be confused with a fault code. If you do not observe eight rapid flashes when clearing the codes, then faults likely still exist, and this process should be repeated until they have all been resolved. The ATC (or ABS) light will remain on until the coach is driven above 4mph.

If the system displays a variety of codes that seem inconsistent and no problems can be found, make sure you check for adequate ignition power on pins 1&2 of the gray connector at the ABS ECU located in the steering compartment. More importantly, check the grounds on pins 11&12 of the same gray connector to ensure they have less than 1ohm resistance to the frame of your coach.

Fortunately, the ABS system is extremely reliable and any problems that do occur are typically easy to diagnose and repair. While an ABS or ATC warning light that comes on when driving will indicate there is a problem with the system, the coach can still be driven safely (but with caution on slippery surfaces or during hard braking to avoid wheel lockup) until the system can be repaired at your earliest opportunity.

Should you have any questions on your ABS system or need some assistance with diagnosing it, feel free to call our support department at 800-452-8015.

by Brian Keys, Country Coach Service Specialist

- As published in the SPRING 2003 issue of Country Coach Destinations

ENGINE

Q We sometimes store our coach for several months and stop by to check on it every couple of weeks. Is it OK to start the coach engine and let it idle for awhile to recharge the batteries?

A The short answer is no. I wouldn't endorse this practice because ultimately it's not good for the engine. My first preference is that you find a way to keep your coach plugged in while stored; even a 5 amp connection is sufficient to keep both house and chassis batteries charged by your inverter/charger. If that's not possible then I would use the generator to keep the batteries charged. See the previous question and be sure to put additional loads on the generator besides the inverter/charger. You didn't mention it in your question but are you driving the coach at all during the storage period? I recommend regular monthly operation of the coach to keep the mechanical systems, driveline seals and tires in optimal condition. Just take the coach out for a drive until all the fluids are up to normal operating temperature. This exercise will benefit your tires by helping to keep the sidewalls moisturized and flexible. If driving the coach during the storage months isn't practical then I wouldn't start the engine at all. Follow the recommendations in your owner's guide to properly prepare your coach for storage.

by James Jordan, Country Coach Service Technical Resources Manager

- As published in the AUTUMN 2007 issue of Country Coach Destinations

Q What kind of antifreeze should I use in my Hydro-Hot?

A The answer depends on the internal construction of your unit. Early models used by Country Coach had a double walled heat exchanger and used standard automotive anti-freeze in a 30/70 mixture. That's 30% anti-freeze and 70% water. Newer units have a single wall heat exchanger and therefore require the use of a boiler coolant that the FDA rates "Generally Recognized as Safe" or GRAS. This coolant should always be used in a 50/50 solution and in fact, is usually purchased in a pre-mixed formula. How do you tell which style you have? You can always take down the model and serial number and give Technical Support a call, or you can identify the vintage by noting the size of the cap on top of the unit. New style units use a standard automotive style radiator cap while the original units have a large (approximately 4") round metal cap with a bail handle on top. Important Note: If in doubt, give Technical Support a call at 800-452-8015, or use boiler coolant to top off your system. If you use automotive anti-freeze in the single-wall units it will be necessary to drain, flush and refill the entire system. This is an expensive and labor intensive undertaking.

by James Jordan, Country Coach Service Training Manager

- As published in the WINTER 2007 issue of Country Coach Destinations

Q Do I need to use a specific coolant to top off my Hydro-Hot unit?

A A resounding YES! Older units use engine coolant-type antifreeze while the newer units MUST use boiler coolant. Do not add antifreeze to a newer style Hydro-Hot unit! This requirement is due to a change in the internal construction of the heat exchanger of the unit. Newer units require a coolant that is rated as "Generally Recognized as Safe" (GRAS) by the FDA. This rating is most commonly found on boiler coolants. Boiler coolant is generally available at heating or plumbing contractor supply houses - as well as some hardware stores. It's easy to identify which generation of Hydro-Hot you have by taking a look at the pressure cap on top of the unit. Older units have a large 4" diameter cap, while the newer units have a smaller, standard automobile size radiator cap. If you have any questions about this or are uncertain as to which generation Hydro-Hot you have, please give us a call at 800-452-8015.

by James Jordan, Country Coach Service Training Manager

- As published in the SUMMER 2006 issue of Country Coach Destinations

Q How accurate is my transmission temp gauge (Inspire only)?

A The gauges in the 2004 through 2006 Inspire 360 motorcoaches are reasonably accurate; with a combined tolerance (sender and gauge) in the neighborhood of +/- 5%. These gauges are designed to supply relative as opposed to absolute - information for the operator who, over time, learns the "normal" range of temperatures for their coach and driving patterns. One distinct advantage that an analog gauge has over a digital version is that the operator can tell with just a quick glance if things are OK without having to mentally process the absolute numbers. An issue that causes concern to some drivers is that their transmission seems to operate about 50 degrees F or so higher than the temperatures which owners with a SilverLeaf report. This apparent discrepancy is due to the difference in the location of the sensors in the two systems, not the accuracy of the gauges. The SilverLeaf is reporting the temperature of the oil in the sump of the transmission while the dash gauge is reporting the temperature of the oil as it leaves the torque converter. It is entirely normal for these locations to have a 50 degree difference or more, depending on operating conditions such as speed, load, idling in traffic, pulling a steep grade, etc. For 2007 the Inspire 360 motorcoaches now have analog style gauges that are actually displaying the temperature as reported on the internal data bus of the coach, directly from the engine or transmission, just as a SilverLeaf would. Employing a stepper motor to operate the needle, these gauges are very precise and similar to the level of accuracy that a consumer would experience in a current automotive product. The accuracy of digital information displayed in an easy to read, analog style!

by James Jordan, Country Coach Service Training Manager

- As published in the AUTUMN 2006 issue of Country Coach Destinations

Q After running on generator power for about thirty minutes I lose one leg of power in my coach. The power will return on this leg after another five minutes or so but will go off again after a few minutes and this cycle will repeat continuously for as long as the generator is running. I've had the generator and transfer switch checked out by a shop and they can find nothing wrong. Where do I look next?

A The good news is that the problem seems to be consistent, so it shouldn't be too difficult to reproduce the symptoms and diagnose the source of the problem as it occurs. Have someone take a close look at your transfer switch as the leg of power drops out. Does one of the relays open up? The relays in your transfer switch are closed by a magnetic field as current passes through a coil located within the relay. These coils get quite hot in use and consequently expand. After shutting down the generator, these coils are de-energized and will contract again as they cool down.

This cycle of expansion and contraction can over a number of years cause one of the windings in the coil to break. When the coil is cool, the two ends of the break meet and allow current to flow so the coil pulls in the relay and transfers power into the coach. As the coil heats and expands, the two ends of the break can separate and break the path of electrical current, causing the relay to open which in turn interrupts the leg of power. As you can guess, the coil cools, contracts, the ends meet and you have a heat/cool cycle that will continue until the generator is shut down or the coil fails permanently.

This scenario is not very common by any means but it can occur with older transfer switches. You might be tempted to forgo the expense of replacing the entire transfer switch by only changing out the failed relay, but this usually turns out to be a false economy since Murphy's Law dictates that the remaining components in the transfer switch will become disgruntled with the new blood in their midst and quickly fail in rapid succession.

by Brian Keys, Country Coach Electrical Engineering Department

- As published in the SUMMER 2005 issue of Country Coach Destinations

Q If AGM batteries drop below 6 volts will they recharge completely?

A Given time they will re-charge to a fully charged state as long as they have not been left in a depleted state for a long period of time (this period varies but a good rule is to recharge within 1-7 days. The longer the delay, the greater the damage to the batteries). To get all of the available power back into them once they have fully charged to float they should be equalized for 4-6 hours. Equalizing is done with no load from the coach (all circuits off with the house battery disconnect) and then putting the charger into equalize mode for the stated period of time. This is an elevated voltage with minimum amperage and it tops off the batteries especially after a deep discharge.

by Jim Smith, Country Coach Engineering Department

- As published in the AUTUMN 2005 issue of Country Coach Destinations

Q Can AGM batteries be over-charged to the point that the batteries will be fried?

A The answer is yes. AGM batteries should not be kept above 14.4 volts for extended periods of time. When the battery voltage is kept above 14.4 volts for extended periods of time, the battery's life will be shortened. The 14.4 volts should be when it is cold and the battery charger is in "bulk" or "absorb" modes. Basically when the charger is in "bulk", it will charge with full amperage until the battery reaches the voltage threshold that is dependent on ambient temperature. The warmer the temperature, the lower the voltage is set by the temperature sender. Once the voltage is reached, the voltage will be held at this value and the amperage is allowed to drop until the amperage threshold is met. This is usually at 10-15% of the charge amperage where the charger will now go into "float". Now the voltage is released to drop to about 13.4 volts, and stays in this mode for a couple of hours to top off the battery. When one is heavily depleted as listed above and an equalize mode is desired, allow the batteries to stay at float for a couple of hours to cool down from the charging they just received. This will help the equalize mode be more effective and will be easier on the batteries.

by Jim Smith, Country Coach Engineering Department

- As published in the AUTUMN 2005 issue of Country Coach Destinations

Q IF batteries drop below 6 volts, does each battery need to be recharged individually for 72 hours?

A I have never seen this to be true, other than if there is a damaged cell caused by the heavy depletion. This symptom would point the issue out quickly rather than fighting the bad battery during a recharge attempt.

by Jim Smith, Country Coach Engineering Department

- As published in the AUTUMN 2005 issue of Country Coach Destinations

Q Are AGM batteries a required option when the residential style refrigerator is ordered?

A With our current configuration, the AGM batteries are part of the "all electric" option. The AGM batteries have a longer hold rate of the voltage for the refrigerator, which is drawing close to 100 amps when it is in full cool mode. These batteries pump out the amperage for this type of application better than other batteries based upon our experience. Additionally these batteries do not require standard maintenance like water checking and have proven very reliable for us in our coaches from our Bus product on down.

by Jim Smith, Country Coach Engineering Department

- As published in the AUTUMN 2005 issue of Country Coach Destinations

Q What is the procedure for replacing the oil in the hydraulic reservoir on my 2001 Magna?

A The correct procedure is to first ensure that the engine is not running and cannot be started accidentally by a colleague. Next, locate the hydraulic oil reservoir that is typically mounted to the right of the engine compartment on a DynoMax chassis. Loosen the top band clamp that secures the lid in place and set both the clamp and the lid aside.

Using a handheld fluid transfer pump, commonly available in most auto parts stores, extract as much used oil from the reservoir as possible and discard it into a suitable waste oil container. Now unscrew the wing nut and washer that clamps the three hydraulic filters together and replace them with new filters. Don't forget to replace the wing nut and washer and tighten them down to secure the new filters in place.

Lastly, fill the hydraulic reservoir with fresh oil of the correct type and viscosity for your coach until it just covers the top surface of the upper oil filter. Replace the lid and band clamp; then continue adding oil through the dipstick opening until it reaches the cold full level on the dipstick. Recheck the oil level when the system has reached normal operating temperature and add or remove oil as necessary.

by Brian Keys, Country Coach Electrical Engineering Department

- As published in the AUTUMN 2004 issue of Country Coach Destinations

Q The transmission on my Intrigue occasionally shifts rather harshly. I have taken it in for service several times, but the technicians are unable to reproduce the symptoms. How can this problem be resolved?

A The Allison transmission has evolved through the years (along with other components of the power-train) into the world of computerized logic and electronic control. Many of the Electronic Control Units or ECUs in modern motorhomes now communicate with each other across one of two dedicated networks that run from the front of the coach to the rear. These networks (J1587 and J1939) allow for reduced harness wiring, while enhancing drivability through increased interoperability between the Engine Computer Module (ECM), and the Transmission Control Module (TCM). The disadvantage however, is that a technician can no longer diagnose most problems that might occur with a basic test meter, or even a test light. Instead, an electronic reader - in this case the MSI ProLink -, or a laptop computer along with the necessary adaptor and software (Allison DOC) is required to monitor the system, and identify the problem. Due to the high cost of this equipment, it is important to determine if a shop is suitably equipped for this type of work before scheduling your coach in for service to this system.

Let's look at the four common scenarios that can cause harsh shifting, and the equipment required to diagnose and repair them.

Adaptive Learning

If your coach has a six button shift panel with two green digits to indicate 'Selected' and 'Attained' gears, or a six button shift panel with a single red digit to indicate 'Attained' gear (WTEC II and WTEC III respectively), then your transmission has a feature called Adaptive Learning. Once enabled, the Adaptive Learning feature will monitor your shift quality as you drive over a period of 50 or so ignition cycles, during which time, it will adjust the various shift modulations to ensure a smooth shift from one gear to the next. The problem however is that this transmission has many different shift points to learn according to external factors such as Vehicle Speed, and Throttle Position. Depending on your driving habits, many of these shift points do not occur during this Adaptive Learning period, or even after several years of driving so it is not uncommon for an owner to occasionally 'trip over' an unlearned shift point at which time you may experience a harsh up or downshift. If you only encounter this harsh shift once in a while, then it is not a cause for concern. If you are experiencing frequent harsh shifting with your transmission, then it is time for a quick visit to an Allison Service Center to have them reactivate the 'Fast Adaptive' feature. With this Adaptive Learning feature re-enabled, it is important to remember that the goal is for your transmission to learn your 'normal' driving habits. It is common in these circumstances for an owner to change their driving habits significantly during this period where the transmission is keeping a close watch on your every shift, and this can cause the harsh shifting to return as your old driving habits come back to haunt you! Other reasons for having the Fast Adaptive re-enabled include purchasing a used coach where the transmission has learned the previous owner's driving habits - not yours - and also perhaps moving to a new area where you might be driving regularly through different terrain.

Tools required: MSI ProLink with standard Allison WTEC II/III cartridge, or a laptop running Allison DOC software.

No Throttle Position Sensor signal (TPS)

Your transmission needs certain external information in order to determine which shift modulation is the most desirable from a preprogrammed matrix called a 'Shift Schedule'. This information generally consists of the Throttle Position Sensor (TPS) which as its name infers, monitors the position of your throttle pedal, and the Vehicle Speed Sensor (VSS) which of course monitors the vehicle's speed. Should the TPS sensor fail for any reason, your transmission will continue to shift albeit rather harshly. Generally speaking, a failure of this nature will not illuminate any warning lamps, or log any codes in the Transmission Computer. Therefore it is critical to ensure that this TPS sensor is functioning as the first step in diagnosing any shift quality complaints. The TPS sensor can be located as follows:

If your coach doesn't have electronic engine controls, then the TPS will be physically bolted to the top of the transmission's 'bell-housing', with a control cable connecting the sensor to the throttle linkage on the engine itself.

Coaches with an electronic Engine Control Module (ECM) will have a TPS integrated into the throttle pedal itself. However, this TPS sensor is not actually connected to the transmission. Instead, the TPS sensor is connected to the engine, and the engine communicates the throttle's position to the transmission via either of the aforementioned J1587, or J1939 networks. If one of these networks is down for some reason, or is unplugged from the transmission then the problem will arise. The transmission generally defaults to monitoring the J1587 network for this TPS signal, however a technician with the necessary programming tools can force the 'throttle AutoDetect' over to the J1939 network to determine if the problem lies in the network, or elsewhere perhaps with the throttle pedal, or Engine Computer itself.

On later non-electronic engine coaches with the King Cruise Electronic Throttle System (ETS), the Throttle Position Sensor (TPS) signal is provided by the King Cruise system via a three-wire harness to the Transmission Computer. If your coach does not have an electronically controlled engine, and reaching below the throttle pedal you find wires instead of a bulky pneumatic valve, then this applies to you!

Tools required: MSI ProLink with standard Allison cartridge, or a laptop running Allison DOC software will diagnose the existence of a good TPS signal. The programming cartridge or a programming license for the laptop will be required to force the aforementioned throttle Autodetect from the J1587 network over to the J1939.

No CRUISE Status signal (networked)

Does your transmission only shift hard while the Cruise Control is operating? If you are certain that this is the case, then it is likely that your transmission is not aware that you are no longer using the throttle pedal to control the coach's speed. With the Cruise Control operational, your foot will generally be off the throttle pedal so the transmission has to look elsewhere to determine which shift modulation will best suit your current driving conditions. The transmission monitors the Engine Computer's 'Cruise Status' parameter, which it receives via the faster J1939 network. When this parameter is enabled, the transmission knows that it can no longer use the throttle signal to determine which shift modulation is best. Instead, it looks at the 'Engine Load' parameter, which is also broadcast from the Engine Computer via the J1939 network. If either

of these two network communications are missing, then the transmission will likely shift harshly.

When approaching this problem, the technician must first make a determination on the health of the J1939 network, and in particular, that the transmission is connected properly to the network. A complete outage of the J1939 network will cause some issues with the Automatic Traction Control system resulting in an ATC warning lamp on the dashboard, with a 7-1 code logged in the ABS/ATC computer. This is generally the only fault condition that can produce the aforementioned symptoms, and there are currently no tools available to monitor how the transmission is receiving the networked 'Cruise Status' parameter mentioned above.

Throttle Position Sensor calibration issues

If your coach doesn't have an electronically controlled engine, and there is a pneumatic valve directly beneath the throttle pedal, then perhaps this applies to you! A coach of this configuration will have the TPS sensor mounted to the bell-housing of the transmission as mentioned earlier in this article. Being a mechanical sensor, and therefore prone to wear, the transmission cleverly uses an automatic calibration sequence to ensure that it always sees 100% TPS when you have the throttle pedal mashed to the floor. The system works by backing off the physical throttle pedal angle at which the transmission 'sees' 100% throttle by three degrees every time you turn on the ignition. The next time the throttle pedal is fully applied, the transmission will see that the TPS has moved beyond 100%, and will recalibrate the system back to this number thus automatically compensating for wear.

Confused?

Let's look at the scenario that might cause a rough shifting problem. Perhaps you drive mostly in an area where there are no mountains, and you like to 'go easy' on the engine and transmission by avoiding full throttle applications. With the TPS sensor correctly calibrated, the transmission will see 100% throttle when the pedal is fully applied, but with each successive ignition cycle, the transmission will back off the throttle pedal angle at which it 'sees' 100% TPS until it arrives at the point at where you generally position the throttle pedal during normal driving. Let's say this point is 'half throttle'. The engine will not be producing full power, because you do not have the throttle fully applied. However, the transmission due to the automatic calibration process now believes that you are at 100% throttle and therefore shifts quickly from one gear to the next. This rapid shift from one gear to the next or 'modulation', is only required when the engine is under load and in this case, will result in a harsh shift. When you take your coach in for service, you may have encountered a steep incline, which necessitated full throttle, which means you would have recalibrated the throttle position sensor (TPS) before the technician had an opportunity to diagnose the problem. Similarly, the technician may have used a full throttle application at some point during a test drive with the same results!

The good news is that you don't have to change your driving habits to avoid this scenario, simply make a slight change to how you start your coach as follows:

- * Turn on the ignition
- * Press your foot fully on the throttle pedal then release
- * Start the engine
- * Done!

For further information on this or other technical issues, please call our Technical Support Department at 800-452-8015, or send us an email to support@countrycoach.com.

by James Jordan, Country Coach Training Developer

- As published in the WINTER 2004 issue of Country Coach Destinations

Q Why will my coach not maintain cruise speed when climbing grades or overpasses?

A With the continually increasing power and torque available in modern cars and sport utility vehicles, many of us have become accustomed to our vehicles effortlessly maintaining cruise control speed when climbing even relatively steep grades. Motorcoaches have also experienced continual improvements in engine performance and it is natural to assume, for example, that an Affinity with a Caterpillar C12 rated at 505 hp and 1550 lb/ft of torque should effortlessly power your coach up almost any grade.

In reality we must remember that a luxury diesel-powered motorcoach may easily weigh over 40,000 lbs and this weight, while not a significant factor when driving on level ground, does become a significant load on your engine when climbing a grade. We should also remember that the turbo diesel engine in your motorcoach only has an optimum torque/horsepower range of about 400 rpm - 600 rpm compared to that of modern gasoline powered vehicles at up to 5000 rpm.

You might think that heavy trucks seem more capable of maintaining cruise speed than your motorcoach, however, any truck that is coming close to staying with your coach on a grade is probably running lightly loaded or empty, and certainly not maintaining speed with the cruise control. With any loaded truck/trailer, ascending a grade will keep the driver busy utilizing the clutch and the gear shift in order to keep the diesel engine in its power band. To summarize, it is normal to lose some cruise speed on slight grades such as overpasses, etc. If optimizing your top speed ascending a steeper grade is your priority, you can use some of the trucker's 'tools of the trade' to assist you. Try disabling the cruise control when approaching a steeper grade, taking over control of the throttle pedal yourself.

As you begin your climb, note the point at which you are required to apply full throttle to the engine and then manually downshift the coach to a lower gear, such as 4th. This manual override will enable the transmission to downshift earlier in the ascent and will optimize the help that the engine can give you to get over the hill. Of course, when you are able to pick up enough speed to leave your selected gear range, you will need to manually upshift the transmission or return it to 'Drive'.

by Country Coach Service Team

- * As published in the AUTUMN 2001 issue of Country Coach Destinations

Q The exhaust brake on my 2000 Intrigue occasionally sticks on. What steps should I take to correct the problem?

A A variety of problems may be the cause including a weakened return spring, sticking pneumatic cylinder, 'butterfly spindle' seizure, carbonization, distorted butterfly plate or an electrical problem such as a sticking relay or poor ground. Begin your diagnosis by accessing the exhaust brake. With the ignition switch in the off position, and the engine cooled, remove the clevis pin (see 'A' on drawing) that attaches the pneumatic cylinder to the butterfly spindle. This spindle is attached to a round disc (butterfly) inside the exhaust brake housing that blocks off airflow from the engine exhaust system when in the engaged position. Manually engage the exhaust brake butterfly and check for smooth operation throughout its full travel. If significant resistance is observed, apply a high temperature synthetic lubricant such as PACBRAKE part# 18037 to the locations shown at points 'B' on the drawing, and cycle the butterfly spindle several times to work the lubricant in. If this does not correct the resistance, or if the butterfly spindle sticks in the fully engaged position, the exhaust brake assembly must be removed for further inspection, cleaning, and possible replacement. Replace the complete assembly if the butterfly plate is stiff, distorted, or touches the interior surface of the exhaust brake housing in the fully engaged position. To check the pneumatic cylinder, reconnect it to the butterfly spindle using the clevis pin removed earlier. With your hands at a safe distance from the assembly, have an assistant cycle the ignition switch on and off a few times to actuate the exhaust brake. Assuming that the air system is fully pressurized, the pneumatic cylinder should extend and retract with a sharp 'snap'. A cylinder that drags during this test may need lubrication both to the rod while in the extended position, and to the piston by placing a few drops inside the air port once the valve has been removed. A cylinder that snaps out but is lazy on the return stroke may indicate a defective rapid exhaust valve (see 'C' on drawing), or a weak internal return spring which will require replacement of the cylinder needed at minimum, but preferably the complete exhaust brake assembly (depending on condition).

If everything checks out, with the ignition on and the engine off, check the voltage at the power wire to the exhaust brake pneumatic solenoid valve (see 'D' on drawing) located at the forward end of the bed deck engine access opening. With the headlights on, and dash gauge illumination set to full brightness, the voltage measurement at this wire should be less than 0.5volts DC. If higher, then add a lamp diode to the ground wire for the exhaust brake warning light on the dash (see 'E' on drawing). The stripe on the diode (cathode) must be directed towards the ground away from the warning light, and this test should be repeated after installation to ensure voltage is now within specifications. The exhaust brake relay should be replaced when problems with this system arise. To access the relay, remove the cover from the Allison VIM (Vehicle Interface Module), which is a black plastic enclosure approximately 9" square, and 3" deep, mounted on the ceiling of the steering compartment. Nine small metric hex head bolts retain this cover. With the cover removed to reveal six Bosch relays and two fuses, locate the relay identified SF02 on the circuit board and replace it with a similar 12volt, single pole, double throw relay. These relays are available at most parts stores and are typically used during accessory fog or driving lamps installation. Most come with a mounting tab that should be cut off in this application due to the close proximity of the relay to the enclosures cover.

Should the exhaust brake continue to stick, with no perceptible problems with the electrical and pneumatic control circuit, the exhaust brake assembly should be replaced. The exhaust brake is designed for frequent cycling during daily transit and can develop problems - such as a stiff or seized butterfly plate - with infrequent usage. Starting the engine and stopping it before it has reached normal operational temperature will amplify the problem, particularly in humid conditions where moisture is developed within the engine and exhaust system at initial startup. To avoid problems after periods of extended inactivity, here are

a couple tips: 1) Lubricate all moving parts of the exhaust brake assembly (see 'B' on drawing) every four months. 2) Periodically start your engine, allow it to reach full operating temperature, then with the engine not running, cycle the ignition switch from off to on several times to actuate the exhaust brake.

by James Jordan, Country Coach Service Training Developer

- As published in the SUMMER 2003 issue of Country Coach Destinations

HOUSE

Q How should I maintain the seals on my slide rooms?

A We recommend good old fashioned soap and water! Use a mild detergent solution to keep the seals clean and free of debris. If there is some squeaking you may use baby powder – yes, I said baby powder – to lubricate the seals and eliminate unwanted noise; just wait until the seals are dry and apply enough to get a good coating on the seals. Any product with petroleum distillates should be avoided as it may cause the seals to deteriorate. Pure silicone would be acceptable, but it tends to be expensive and difficult to locate. 303 Aerospace Protectant™ is also acceptable and will provide UV protection to the seals that are exposed when the slide is extended.

by James Jordan, Country Coach Service Training Manager

- As published in the WINTER 2007 issue of Country Coach Destinations

Q What do I need to do to winterize my Amana residential style refrigerator?

A The fresh water system for drinking water and ice making needs to be evacuated. We recommend that you use a properly filtered and regulated (45 psi max) supply of compressed air to perform this task, just as you would for the rest of the plumbing systems. We are assuming at this point that you have in fact winterized the rest of the coach and that the water supply is turned off and the air supply is connected in its place, but turned off for now. Next, locate the water reservoir for the cold water dispenser (in the crisper drawer) and carefully remove the fastener holding it in place. You may now either remove the reservoir – and use a barb union to join the two waterlines together – or you may turn it upside down so that both lines are on the bottom. With either choice, you would now turn on the air supply and operate the dispenser until the all the water is blown out of the supply lines. The ice maker should be operated until no more water flows into it and no ice is made. We do not recommend using RV anti-freeze to winterize any of the fresh water lines in your coach.

by James Jordan, Country Coach Service Training Manager

- As published in the WINTER 2007 issue of Country Coach Destinations

Q How much do my fuel and holding tanks hold?

A Tank capacities vary significantly depending on model year, coach and floorplan. On the www.countrycoach.com website we have tank capacities and many other specifications for coaches going back as far as 1983! From the Owner Services page follow the link in the Information section to Model Archive. Or you may type the address directly into your browser as: www.countrycoach.com/showroom/archive While you're at our Owner Services page be sure and check out some of the technical articles and resources available there.

by James Jordan, Country Coach Service Training Manager

- As published in the AUTUMN 2006 issue of Country Coach Destinations

Q Something strange happened as I was driving our 2000 Magna at dusk. The gauge lights suddenly started to flicker and there was a faint crackling sound in the dash area. I played with a variety of switches from the driver's seat and the problem cleared...what happened?

A The headlight switch in your coach incorporates a wire wound rheostat to dim the panel lights on your dash. With time, the wiper contact may wear, lose tension or the wire turns on the switch may corrode all of which could result in poor electrical contact and the symptoms you describe. To correct the problem, this inexpensive switch needs to be replaced and please remember to remove the copper foil connecting two of the spade terminals from the new switch before it is installed.

by Brian Keys, Country Coach Electrical Engineering Department

- As published in the SUMMER 2005 issue of Country Coach Destinations

Q The fan controller on my 2000 Intrigue seems to be acting somewhat erratically. Just this week, after the coach got up to temp the SilverLeaf showed the coolant temperature cycling from 191 to 202 or 203...then after a few miles it went back to normal.

A The fan controller uses a technology called open loop proportional hydraulics. This essentially means that the fan speed is infinitely variable by the electronic fan controller but the controller can only assume that the fan is rotating at the necessary rpm since it doesn't actually monitor the fan speed itself. The following scenarios could explain these symptoms.

1. The fan controller is requesting an incorrect fan speed based upon erroneous information from the coolant temperature sensor and/or charge air temperature sensor inputs. This could be a problem with loose or corroded connectors at the sensors or at the fan controller which is located on the rear end of the radiator package. It could also be due to a damaged harness to the sensors or defective sensors. Given the low cost of the sensors it is probably advisable to replace them both as a matter of course after first checking all the connectors, harnesses, and ensuring good power and ground in the next step.

2. The fan controller is not receiving adequate voltage from its two pin connector. One contact in this connector should have a minimum of 12V when the ignition system is powered up. The other contact should show less than one ohm resistance to a clean frame ground.

3. There may be a problem with the fan controller programming and this would need to be verified by a service center familiar with the system.

4. The fan controller is requesting the correct fan speed but the proportional valve on the controller or the switch valve on the fan motor is not responding properly. This is fortunately very unlikely but would need to be diagnosed by a service center familiar with this system.

5. The fan cooling system is operating correctly but is responding to inconsistencies with the coolant or charge air temperatures. The coolant temperature shouldn't be an issue here unless there is a problem with the engine thermostat. The charge air temperature however may cause these symptoms if the air filter is plugged or you may be losing turbo boost pressure due to a leaking boot at one of the large diameter tubes between the turbo charger and the intake manifold.

Please note that the coolant temperatures quoted above are not typical of all coaches. Normal operating temperature will vary with engine manufacturer and age. The general trend is for newer engine designs to run hotter as the manufacturers seek to reduce emissions and improve efficiency.

by Brian Keys, Country Coach Electrical Engineering Department

- As published in the SPRING 2005 issue of Country Coach Destinations

ELECTRICAL

Q I have a question about the Genstart screen on the SilverLeaf VMS panel in my coach. What's the difference between the Start Volts and Topoff Volts settings? Aren't these the same thing?

A These settings are very similar in that they are both "set" or "trigger" points that will initiate an automatic generator start if the Autocharger function is enabled. Start Volts is the threshold for a generator start at any time of day - other than Quiet Time - while Topoff Volts is the threshold for a generator start just before Quiet Time begins; precisely how long before Quiet Time is specified by the Topoff Run Time.

In the sample screen shown, the Topoff Volts setting is 12.2V and the Topoff Run Time is 60 minutes. If Quiet Time begins at 22:00 the VMS will look at the battery voltage at 21:00 to see if it is above or below 12.2V. If it is lower than 12.2V a start command will be sent to the generator; then when Quiet Time begins at 22:00 a stop command will be sent. For these Auto Charger Settings to function properly it's important that the VMS Quiet Time and Clock values are set accurately; it's very easy to forget that you've crossed into a different time zone and that the VMS clock is now off by an hour.

by James Jordan, Country Coach Service Technical Resources Manager

- As published in the WINTER 2008 issue of Country Coach Destinations

Q I have a question about the LED indicator on the Xantrex Echo-charger. Sometimes the green LED is flashing and sometimes it's on solid. I never have any trouble with my batteries but I'd like to know what that green light means.

A The green light is used to display the voltage conditions on the two battery banks. When the light is on solid it means two things; the domestic battery bank voltage is somewhere between 13.0 & 17.0 VDC, and that the difference between the domestic and chassis banks is not greater than 10 volts. If both conditions aren't met, the light will flash. The echo-charger will only provide a charge current to the chassis battery bank when both conditions are met; the amount of charge current available will depend on the difference in voltage between the two banks with the maximum amount produced when the difference is approximately 1.5 VDC. To verify that the charger is working properly I would suggest using a DC amp clamp on the red/yellow wire to measure the output current. The manual for the echo-charger has a graph indicating how much current one can expect for a given voltage difference between the two banks.

If a coach is plugged in to shore power, or the generator is running, and the inverter is charging the domestic bank, one would normally expect to see a solid green light. Similarly, if the coach engine is running the light is normally on solid. If the light is flashing during either of these two situations I would first suspect the fuse or output wiring (red/yellow wire) that connects to the chassis bank. No green light at all would indicate a problem with the fuse or input wiring (red wire) connected to the domestic bank. A red LED indicates that the unit has shutdown due to overheating.

by James Jordan, Country Coach Service Technical Resources Manager

- As published in the WINTER 2008 issue of Country Coach Destinations

Q Since the weather has gotten colder I've noticed that my domestic batteries aren't fully charged most of the time. They've even been almost dead a couple of mornings but seem to recover during the day, especially if we're driving. I've had the systems checked a couple of times and no one can find anything wrong. What's going on?

A We've seen this issue before and it can indeed be a tricky one to troubleshoot. By any chance are you using any portable 120V space heaters in a coach equipped with a Xantrex RS2000/3000 inverter? If so, I think we've found the cause. Your inverter is connected to a 30A circuit breaker on the house distribution panel, so that's the maximum current that can flow through it. The 120VAC receptacles in your coach are all wired to go through the inverter so that things can still work when you're not connected to shore power. So far so good, right?

The problems may arise when the inverter senses that you're using a lot of power to run those portable heaters - two or three of which could easily pull a total of 20-25 amps or more. Add to that any other 120V consumption from lighting or the entertainment system and you're pushing the 30A limit of the system. The RS

series has a power share feature which monitors the AC load on the system. This feature will reduce the charge current and give priority to the AC load to avoid nuisance tripping of the breaker. So while those heaters may be keeping you warm, they're diverting power from the charger and it can't maintain the domestic battery voltage which is being drawn down by all the 12V lights and loads in your coach.

This also could explain why the batteries seem to recover during the day or when you're driving. The heaters don't run as much during the day and you're not using as much 12V power for lighting, etc. Plus, the engine alternator is charging both battery banks when you're driving. Try using only one portable heater and see if the situation doesn't improve.

by James Jordan, Country Coach Service Technical Resources Manager

- As published in the WINTER 2008 issue of Country Coach Destinations

Q How should I maintain my chassis and domestic batteries during storage to ensure long life?

A If used conservatively and well maintained, the batteries on your coach should last about two years for Flooded Lead Acid (FLA or simply Lead Acid) batteries, and up to four years for Absorbed Glass Mat (AGM). This life expectancy will vary considerably from owner to owner, but long term dry camping, or repeated deep discharge cycles can easily cut it in half. The most important maintenance considerations are:

Charge Range

Always operate all styles of batteries in their upper 50% of charge range. Imagine that your battery is a bank account and that maximum deposit is \$100. You would never want to draw that account lower than \$50. With your battery, you never want to draw them down much below 12.5 volts for an extended period of time. Keep them fully charged, especially while your coach is being stored. If Flooded Lead Acid or Absorbed Glass Mat batteries remain discharged for long periods of time, a lead crystal will grow in the electrolyte. This crystal will increase in size until it punctures the plates inside the cell resulting in a shorted or 'dead' cell.

Trickle Chargers

When storing your coach, I would strongly advise using some form of trickle charger to keep your batteries fully charged. A trickle charge can be provided by a small automotive charger, solar panels, or by connecting your coach to shore power. By ensuring that your batteries are fully charged prior to storage, and by turning off all electric appliances including, the often forgotten water heater and refrigerator/icemaker, you can connect your shore cord to a 15A service for storage purposes. Solar panels are the best option for long-term storage outdoors.

Automatic Generator Start Systems

Automatic Generator Start or 'AGS' systems, are generally not an ideal solution for storage purposes, since they often rely on some form of battery capacity measurement, to determine when the generator should be started. Over a period of

time, inaccuracies in the battery capacity measurement can accumulate, and 'fool' the system into thinking that the batteries are charged, when they are effectively 'dead'. When this occurs, the batteries will continue to discharge, until there is insufficient energy remaining to start the generator. AGS systems that use battery voltage to determine when the generator should start, usually have limited control over much charge actually enters the batteries. This can result in an undercharge condition that again accumulates with time, until the batteries become so discharged that there is insufficient energy to start the generator.

This information may not be applicable to all AGS systems, but checking your batteries charge status periodically is advisable when using these systems during long periods of storage. If you cannot provide a trickle charge to your batteries during storage, then you should ensure they are fully charged every two to four weeks, depending on what type of batteries are installed and the rate of discharge from parasitic loads and internal losses within the battery. Absorbed Glass Mat batteries will typically hold their charge significantly longer than Liquid Lead Acid batteries in these conditions.

Check Your Levels

Check the electrolyte level on Lead Acid batteries frequently to avoid damage due to exposure of the plates to air, or dilution of the electrolyte from repeated overfilling. Use a sealed flashlight to look inside the cells after removing the caps. You should see a short vertical 'vent tube' inside the filler hole, and the correct electrolyte level is 3/16" below the bottom of this tube. Always wear safety glasses and chemical gloves when working with automotive batteries, and clear the area of any ignition sources including drop lights and cigarettes, etc. I prefer using watertight flashlights when working around batteries since they are sealed, and will not present an explosion hazard.

This information only applies to Flooded Lead Acid batteries. The battery caps on AGM batteries are sealed, and removal will void the warranty, and drastically reduce the life expectancy of the battery. If you or someone else has already broken the seal on these caps, then you should contact the battery manufacturer, who may supply you with replacement caps and adhesive, if not much time has elapsed. Another solution is to essentially convert the battery into a Flooded Lead Acid battery, and the manufacturer will have details on this process as well.

The Cleaner The Better

Keep them clean! The presence of dirt and moisture on the exterior surface of the batteries can provide a conductive path that allows current to flow between the battery terminals. This creates a parasitic draw that will increase the speed at which your batteries discharge during storage. Clean the battery exterior regularly paying special attention to the area around the terminals. Clean the terminals with a wire brush, and ensure that the cable connections are tight and secure, before coating them with a battery terminal anti-corrosion compound which is commonly available at most automotive parts stores. This information is also applicable to AGM batteries. However, there is no need to coat the terminals because the battery is sealed.

The Equalizing Debate

Equalizing is an interesting topic and one that is frequently raised during discussions on batteries. There are many theories on when and how batteries should be equalized and instructions vary from one manufacturer to another. It is

my personal opinion that batteries should only be equalized as a last resort to partially restore severely depleted capacity prior to replacement, or as an attempt to correct a dead cell. Periodic equalizing will typically increase your batteries capacities, but at the expense of their life expectancy. This is of course a personal opinion, but one that is supported by several of the major battery manufacturers.

Regardless of what advice you choose to follow, some non-Flooded Lead Acid batteries cannot be equalized including all Gel Cell batteries and selected AGM's. Please contact the manufacturer of these batteries for further information.

Your House Has Batteries, Too

An important point to consider is that your coach has two 'battery banks', one for the domestic (otherwise known as coach or house) batteries, and one for the chassis (otherwise known as starting or cranking) batteries. Both battery banks must receive a charge current during long-term storage, and this can be facilitated with a device manufactured by Xantrex Corporation, called the 'Echo Charger'. This device, which is installed on all late model Country Coaches, will transfer a trickle charge from the domestic batteries to the chassis battery, when the domestic battery voltage is 13 volts or higher. Installation on earlier model coaches is simply a matter of connecting three wires, one to ground and one each to the chassis and domestic battery bank.

Confused by the seemingly endless battery terminology? Let's see if this helps.

Flooded Lead Acid batteries (FLA) otherwise known as Lead Acid or Wet Cells are the most commonly used battery due mainly to their low price and adequate performance. If you can easily remove the caps and see liquid inside then the battery is likely a Flooded Lead Acid.

Sealed Lead Acid batteries (SLA), which are also known as Sealed Valve Regulated (SVR) or Valve Regulated Lead Acid (VRLA), are used in the majority of late model cars, light trucks and SUVs etc. These batteries are sealed for life. No maintenance is required other than cleaning the exterior and checking the connections.

Absorbed Glass Mat (AGM) or Recombinant is a variant of the Sealed Lead Acid battery, with the addition of fiber matting that is placed between the plates of each cell. This type of battery has superior charging characteristics to that of the Flooded Lead Acid batteries, along with a dramatically enhanced life expectancy.

Gel Cells are another form of sealed battery however, unlike the AGM, they have a relatively high internal resistance which causes the battery to heat up dramatically during rapid charging. The heat produced can easily cause permanent damage to the battery. The technology is good but not suited to most high end RV applications.

A parasitic load is an otherwise negligible battery current draw that does not present a problem when the coach is plugged into shore power, but will discharge the batteries over a period of a few weeks, or less, while the coach is in storage. Parasitic loads are typically caused by the memory circuits on modern dash radios etc., and they can be disconnected for storage purposes. Doing so however will reset the dash radio, and other systems that rely on this circuit to default settings, and may make important functions such as the back up camera inoperative until the correct settings are reprogrammed.

Equalization is a process of increasing the voltage to the batteries to about 16 volts for a timed period, while limiting the charge current to about 10 amps to avoid battery damage. All coach loads should be disconnected during the process to avoid damage from the elevated voltage, and to ensure that the limited charge current is only directed to the batteries.

by Brian Keys, Country Coach Training and Resources Manager

- As published in the WINTER 2003 issue of Country Coach Destinations

Q Why does my Heart Link 2000 display "Low Batt" when the batteries appear to be charged?

A An impressive feature of the Link 2000 is its ability to display how many 'Amp hours' (or charge) has been used out of the batteries. A momentary push of the button labeled 'A hrs' will give a reading for the domestic batteries (bank 1) or the chassis batteries (bank 2). Note however that the chassis battery readout is not available on Prevost Conversions, as this is a 24 V system.

Let's use the above image of a Link 2000 as an example. The green LED's on the buttons labeled '1' and 'A hrs' mean we have chosen to display the Amp hours for the domestic batteries (bank 1). This reading indicates '-110' meaning that 110 Amp hours have been used out of these batteries. This number in itself is meaningless unless you know how many Amp hours your battery bank can hold. The Magna, for example, has a battery bank that has 440 Amp hours so this reading would indicate we have used 25% of the batteries' capacity. The 'Low Batt' warning will appear on the upper left corner of the display when you have used 50% or more of your batteries capacity and when this occurs you should start recharging your batteries as soon as possible.

As your batteries charge, this Amp hour reading will increase (approach zero) until the batteries are fully charged at which time the display should read '0' or a small positive number. The next time your batteries begin to discharge, the Link 2000 will recalibrate itself and reset any positive number to zero before continuing to 'count down' as the batteries discharge.

By recalibrating itself in this manner, the Link 2000 ensures the Amp hour reading remains accurate however certain circumstances can prevent this recalibration from occurring and this results in an erroneous reading that can accumulate over time. The result of this erroneous reading is a 'Low Batt' warning that remains on even when the batteries are fully charged. One of the most common situations that causes this error to occur is when you dry camp with your coach. Many owners will run their generator for two to four hours to charge the domestic batteries. However, the batteries will not fully charge in this time frame. Therefore, the Amp hour reading is still negative when the batteries begin to discharge. When this happens, the Link 2000 cannot recalibrate the Amp hours as they are not positive. Therefore, the reading 'counts down' from where it left off and not from zero as it should. If this cycle is repeated over the course of several days, then a situation arises where the Amp hour reading can never reach zero even if the batteries are charged for long periods of time. When this occurs the reading needs to be manually reset.

Another situation that can cause this error to occur is when the coach is connected to shore power and has not been used for several weeks. A good

explanation of this situation is provided by Heart on their website www.heartinterface.com. The explanation is located in the 'Reference Library' section under the heading 'Negative or Positive Amp Hour Accumulation'.

To manually reset the Link 2000 Amp meter reading, complete the following steps:

1. Select battery bank. (Momentarily press the button on the upper right labeled '1'.)
2. Hold down the 'Setup' button for five seconds (not ten!) until the LED on the setup button begins to flash slowly.
3. Release the 'Setup' button and hold down the bank 1 button located on the upper right (labeled '1') until the Amp hour display resets to zero.

This process should be repeated for battery bank 2 also. Note that this procedure does not affect the manner in which your batteries charge or discharge in any way, it simply resets the Amp hour reading and this reading will self correct itself when the batteries are fully charged.

by Brian Keys, Country Coach Service Specialist

- As published in the SUMMER 2001 issue of Country Coach Destinations

Q We tend to stay in parks and connected to full hook ups most of the time. Do we need to run or "exercise" our generator?

A Yes, your diesel powered generator should be regularly exercised to keep it in tip top condition. An important key to this task is to ensure that there is a substantial electrical load present while the generator is running. You may easily accomplish this objective by turning on a couple of your roof air conditioners (or heat pumps depending on the season) and maybe the convection oven as well. The generator should be working at 50% capacity or more so that the engine gets a good workout for 30+ minutes. Doing this at least once a month will keep fresh fuel in the supply lines and lubricate the seals which helps avoid leaks and failures. You don't even need to disconnect shore power while you do this; the transfer switch will automatically connect the coach's electrical load to the generator once it detects that it's running.

by James Jordan, Country Coach Service Technical Resources Manager

- As published in the AUTUMN 2007 issue of Country Coach Destinations

Q My Magna has a system that remembers how my co-pilot and I like to position the driver's seat and controls. How does that work? Is it tied into the memory system for the interior lighting?

A You've asked a great question. In answer, allow me to share some detailed information about that Driver's Area Memory System. At the touch of a switch this system automatically adjusts the cab-mirror heads, steering column, adjustable pedals, and the driver's seat to user programmable positions.
Operation

This standalone system operates primarily on a data bus network (Figure 2), allowing the Intellitec PMC Column/Pedal Control Module as well as control modules in the cab mirrors and driver's seat to communicate over a single pair of wires. The discrete 12VDC position commands sent over dedicated wires from the Intellitec PMC control module directly to the steering wheel and pedal positioning mechanisms are the only non-networked signals in this system.

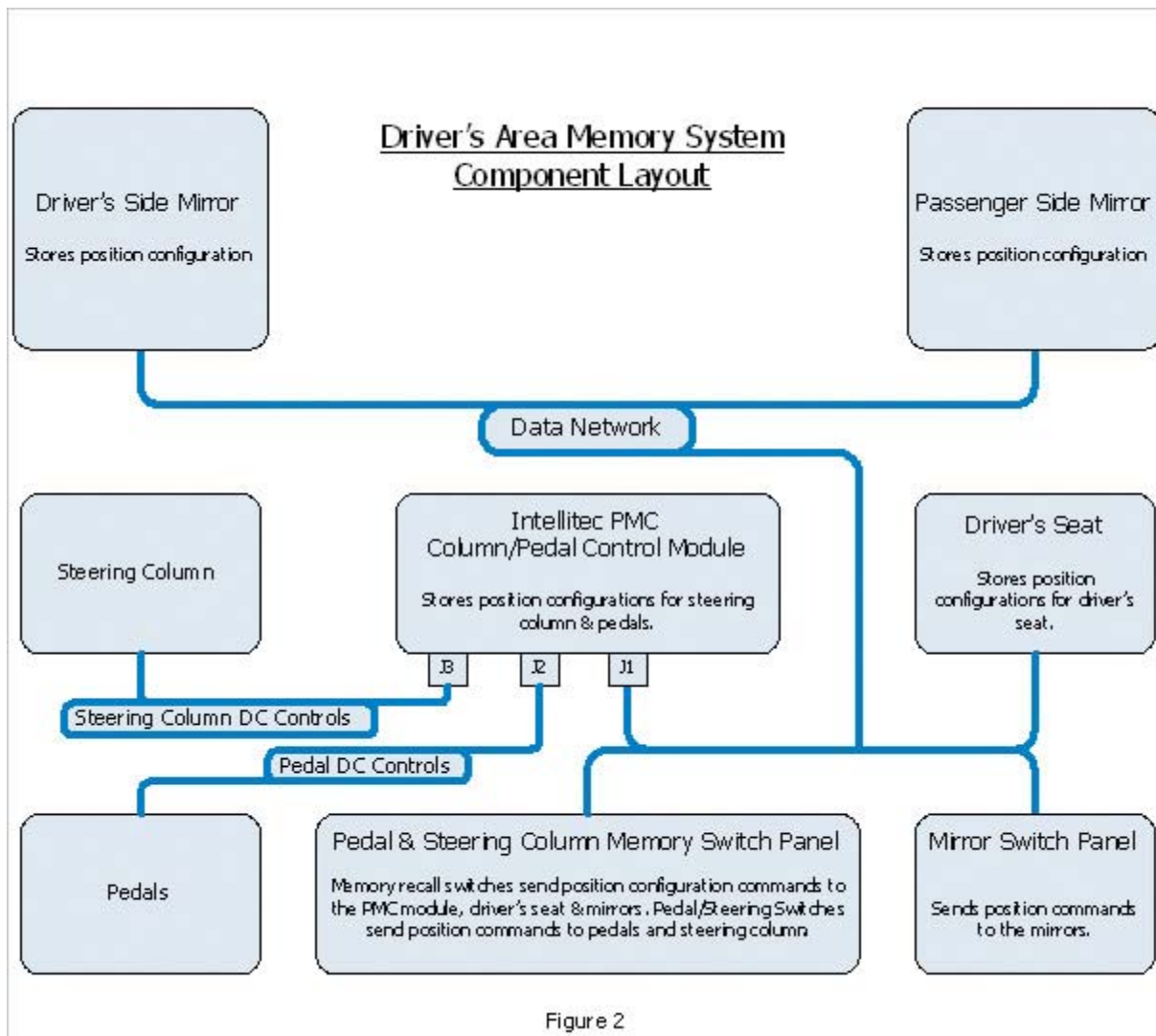
<i>Component</i>	<i>Positioning Commands</i>
Driver's seat	Forward/backward, recline, etc.
Exterior cab mirrors	Mirror pane right/left, up/down
Steering wheel	Tilt and telescope
Pedals	In closer/out farther

Table 1



Figure 1 Memory Switch Panel

Individual positioning commands (Table 1) for every component are stored together in a group. This group of positioning commands is called a positioning configuration. There are two of these groups; recall the desired configuration by pressing either the "1" or "2" switch on the Memory Switch Panel (Figure 1).



by James W. Jordan, Manager, Service Technical Resources

- As published in the SUMMER 2007 issue of Country Coach Destinations

Q Is providing a “boost” to my chassis batteries the only function of the Boost Switch on my coach?

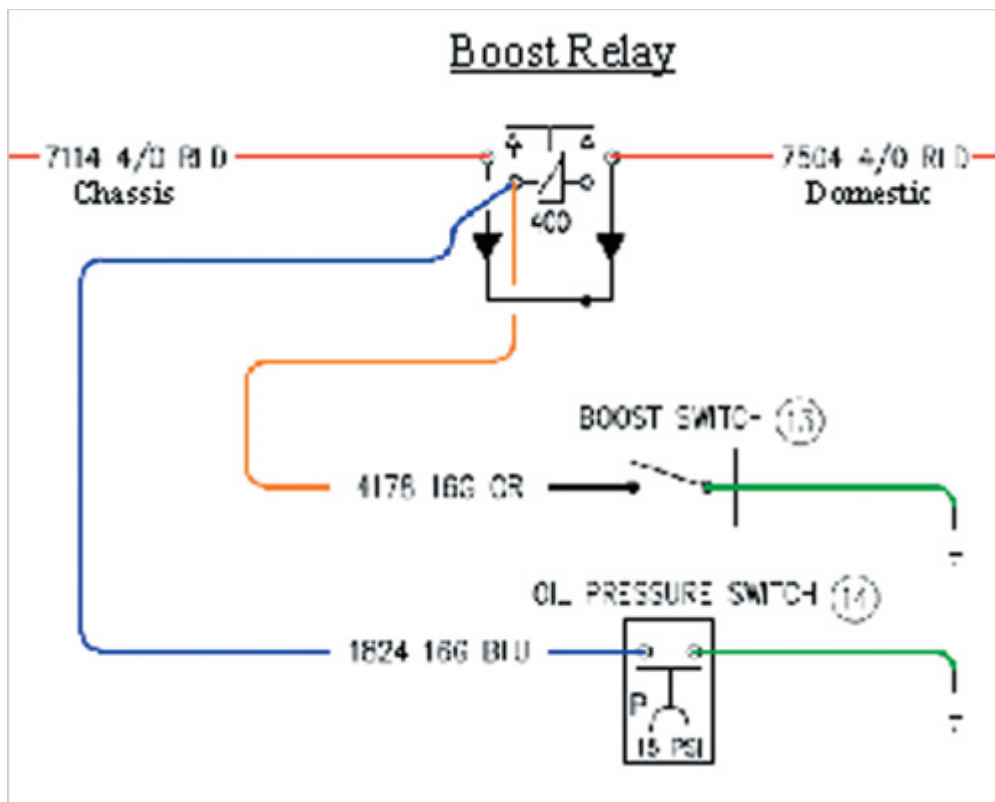
A I usually recommend using the boost switch in three different situations.

1. The traditional usage is the one with which most people are familiar; the chassis batteries are undercharged and can't start the engine. Pressing and holding the switch allows the domestic battery bank to assist in starting the engine. I recommend holding the boost switch down for 30 seconds or more before attempting to crank the engine. The more severely depleted the chassis batteries, the longer you should wait to crank; 2-3 minutes is not too long in worst-case cold weather scenarios. By waiting for the banks to

equalize voltages you will minimize the risk of tripping a domestic circuit breaker.

2. For a number of years now CC has used the domestic batteries to start the generator. What if the domestic bank has run down and now doesn't even have enough energy to start the generator? Well turn about is fair play. Pressing and holding the switch this time will allow the chassis bank to assist in starting the generator.
3. The third circumstance is fairly uncommon but worth noting. Let's say that both the chassis and the domestic banks are significantly undercharged. By using the boost switch the generator was successfully started and now the inverter/charger has started charging the domestic bank. On single inverter coaches, the domestic bank is now receiving a bulk charge of between 75-150 amps. However the chassis bank is receiving much less, typically about 10-15 amps via the Xantrex echo-charge™ unit. This is normally an acceptable rate of charge but what if you'd like to charge the chassis batteries faster? You could start the engine; but what if you don't want to leave the coach engine running, perhaps in an unattended situation? Gently wedge a small object under the boost switch to keep it engaged, thus allowing the inverter to charge both banks at the same time.

The diagram in Figure 3 is typical of current production wiring for the boost relay. Note that the boost relay is normally engaged by the oil pressure switch whenever the coach engine is running. The purpose of this design is to allow the engine alternator to charge both banks while driving so that you arrive at your destination with all of your batteries fully charged. The two diodes allow the boost relay to be engaged as long as either of the battery banks has sufficient level of charge.



by James Jordan, Country Coach Service Training Manager

- As published in the SUMMER 2007 issue of Country Coach Destinations

Q I lost back-up camera display on my Pioneer AVIC screen. Will you tell me how to program it?

A This can be easily optioned in the Pioneer unit but first we will need to verify some basic settings. If the house batteries have been disconnected for service - or deeply discharged - the rear camera will need to be reactivated through the "A-Menu" setup screen. The settings required for activation will vary, depending on the Pioneer model installed. The "A-Menu" is accessed either with a remote control or the touch screens. Please consult the setup guide in your coach or the Pioneer documentation for your display.

On the most common Pioneer model, the AVIC-N1, the monitor has a split mode that will display both the rear camera and the GPS map. This mode is the default and will automatically be displayed if the rear camera is activated from the A-menu setup screen. (This is the same for the AVIC-N2.)

On other models the rear camera has to be activated through a setup menu. If there is a camera switch it must be turned on to monitor the rear camera. If the camera switch is on and the screen has been changed to A/V with the button on the front of the display; the camera switch has to be turned off and then on to display the rear camera again. The "A-Menu" is accessed either with a remote control or the touch screens depending on the model; please consult the setup guide in your coach or the Pioneer documentation for your display.

by James Jordan, Country Coach Service Training Manager

- As published in the SUMMER 2006 issue of Country Coach Destinations

Q How do I install a brake controller for my trailer with electric brakes?

A Brake controllers vary in design and features but all will by necessity require power, ground, and a control wire from the brake controller to the brakes on the trailer. Some also require a connection to the brake light switch while others use an internal inertia sensor in place of this connection.

Start by mounting the controller somewhere in the dash area that you can easily reach while driving since most will have manual controls and adjustments. Now connect the ground wire to a bare metal surface on the coach's chassis. Coat this connection liberally with an anti-corrosion paste which can be found at most auto parts stores.

The power wire for the controller must be supplied by the ignition circuit and should therefore be routed to an empty position on the ignition fuse panel. This panel will be located in the steering compartment or by the driver's left foot under the dash depending on coach model and vintage. Make sure you have the correct size fuse according to the brake controller's instruction sheet but don't insert the fuse until all the wiring is complete.

The control wire is probably the most difficult step since it needs to be routed from the brake controller at the dash to an empty position on the tow socket at the rear bumper. Your coach will have spare wires that you can use for this purpose and our Support team at (800) 452-8015 can help you identify the specific spare wire labeling and location. Once you've identified the wire, simply connect one end to the control wire from your brake controller, and the other end to an empty position on the coach's tow socket. Make sure the electric brakes on your trailer are wired to the same position on the making tow plug.

If your controller does need a brake signal, then look for wire #52 in the steering compartment. This wire will be energized with 12V when the brakes are applied. Make sure your controller can accept a 12V positive brake signal before connecting this wire. If your brake controller requires a ground signal for the brake input, then a relay will be necessary to 'flip flop' the coach's positive brake signal. Wiring instructions for the 'flip flop' relay are shown in the diagram. Please note that a fuse will be required to protect the controllers brake input if the wire is smaller than the twelve gauge wire used on circuit #52.

Make sure you don't overlook the ground connection between your trailer and the coach's chassis. This connection doesn't always get the respect it deserves and is often left out completely so the only ground path between the trailer and the coach is the tow hitch itself. This will not only result in flickering lights on the towed vehicle but can also cause accelerated wear on your tow hitch. Electric brakes will greatly intensify the problem due to the higher current requirements of the brakes themselves and should not be grounded through the tow hitch under any circumstances. Use a twelve gauge ground between the framework of your trailer and the ground position on the trailer's tow plug. Make sure this ground position matches up to the ground that is provided on the coach's tow socket and keep these connections clean to ensure trouble free braking and bright tow lighting.

by Brian Keys, Country Coach Electrical Engineering Department

- As published in the SPRING 2006 issue of Country Coach Destinations

Q I am concerned with the brightness of the lighting on my tow vehicle. Ideas?

A Dim tow vehicle lighting such as the brake and turn signals is often caused by a grounding problem in the wiring for the tow vehicle itself, small gauge wiring in the hook-up cord or excessive use of everyone's favorite electrical Band-Aid, the trusty diode. Also to be considered are damaged connectors on the tow hookup cord and improper wiring modifications to the coach or tow vehicle.

If a close inspection of the tow hook-up cord and receptacles on both the coach and tow vehicle reveal no damaged wiring or contacts, then the next item to check is the grounding.

With the tow vehicle connected electrically to the coach via the hook-up cord, but with the tow bar disconnected, have an assistant turn on the headlights in the coach and engage the brakes. Use a voltmeter to measure the DC voltage between a clean frame ground on the tow vehicle, and a clean bare metal surface on the chassis framework of the coach.

A reading higher than about 1 volt indicates that a significant grounding problem exists and this may be caused by dirty contacts or corroded wiring at either end of the hook-up cord and their mating receptacles. Additionally, check the other end of the ground wire that is connected to the tow vehicle receptacle to ensure that it is securely fastened to a clean bare metal surface on its body.

If the voltage measurement is about 2 volts or higher, your tow cord hookup installation may not include a ground circuit at all! If the tow bar is used to provide the ground connection between the coach and the tow vehicle, it is a poor quality ground connection that often causes the lights on the tow vehicle to flicker while in transit.

Another big enemy to bright tow vehicle lighting is voltage drops. Voltage drops can be caused by poor electrical connections but is more often caused by excessive use of diodes from the tow wiring installation. Diodes will drop the voltage by about 0.5 volts every time they are used. Multiple diodes used in series (not uncommon), together with small gage wiring in the tow vehicle may result in a voltage drop as high as 3 volts!

The best practice to ensure bright lighting on your towed vehicle is to eliminate diodes from the circuit altogether including any traditional store-bought 3-2 Converters' that may have been installed behind the rear bumper of your coach to convert the amber turn signals on the coach to red turn signals on the tow vehicle. This is simply a matter of drilling a small hole in the rear of your car's brake lights into which you can install an additional lamp holder. The additional lamp holder means your tow wiring will now be completely isolated from the car's existing lighting system so no diodes are necessary. If you do need to convert amber turn signals on the coach to red turns on the tow car, then contact the folks in our Technical Support department at (800) 452-8015 for a copy of a drawing that will show you how to make an easy relay based 3-2 converter to ensure your tow car lighting receives full circuit voltage for maximum brightness.

by Brian Keys, Country Coach Electrical Engineering Department

- As published in the WINTER 2006 issue of Country Coach Destinations

Q The brake lights on my tow car are very dim, and it is difficult to distinguish them from the taillights, especially during the daylight hourse. What can I do to make them brighter?

A Dim tow car lighting such as the brake and turn signals is often caused by a grounding problem or large voltage drop between the power source for the affected light (usually at the front of the coach) and the light itself. Also to be considered are damaged connectors on the tow hookup cord and poor wiring modifications to the coach or tow car.

If a close inspection of the tow hookup cord, and receptacles on both the coach and tow car reveal no damaged wiring or contacts, then the next item to check is the grounding. With the tow car connected electrically to the coach via the hookup cord, but with the tow bar disconnected, have an assistant turn on the headlights in the coach and engage the brakes. Using a basic multi-meter, measure the DC voltage between the battery ground terminal on the tow car, and a clean bare metal surface on the chassis framework of the coach. A reading higher than 1.0volts DC would indicate that a significant grounding problem exists, and this

may be caused by dirty contacts or corroded wiring at either end of the hookup cord and vehicle tow receptacles. Additionally, check the other end of the ground wire that is connected to the tow car receptacle to ensure that it is securely fastened to a clean bare metal surface on the tow car body. This connection is usually made in the engine compartment of the tow car, within a few feet from the receptacle. If the voltage measurement is about 6 volts DC or higher, your tow cord hookup installation may not include a ground circuit! In this case, the tow bar is typically used to provide the ground connection between the coach and the tow car. This is a poor quality ground connection that often causes the lights on the tow car to flicker while in transit. This example of poor wiring should be corrected at the earliest opportunity.

Grounding problems aside, another big enemy to bright tow car lighting is voltage drops. Voltage drops can also be caused by poor electrical connections. In the case of the power wires for the brake and turn signals, a voltage drop is more often caused by long wire runs (from the front of the coach to the rear of the tow car!). In addition, excessive use of diodes from the tow wiring installation will drop the voltage by about 0.5 volts every time they are used. Multiple diodes used in series (not uncommon!) can reduce the voltage by several volts, which together with the voltage drop caused by the long wire run from the brake switch in the steering compartment of your coach, may result in a terminal voltage at the brake light bulbs that is 8 volts or lower! The solution for this problem is to use a relay circuit located at the rear of the coach. This relay circuit will switch battery voltage directly to the lights on the tow car when the brakes or turn signals are applied. All 2002 and newer Country Coach models include a dedicated controller for this very purpose and this controller is readily configurable - via a jumper located on the circuit board - for amber or red turn signals on the tow car. This controller is available for installation on earlier coaches. However, care must be taken to ensure that it is protected from water spray and road grime. A better alternative for earlier coaches is to use three commonly available, single pole, double throw relays in place of the aforementioned controller, or to replace any tow signal converter that may be lurking behind your rear bumper from a previous tow installation. These tow signal converters typically cause a voltage reduction of about 1.2volts and therefore often contribute to the problem. Contact our Technical Service Department at 800-452-8015 or support@countrycoach.com for more information on our tow controller, or for a wiring diagram and procedure to hook up the relays.

by Brian Keys, Country Coach Electrical Engineering Department

- As published in the SPRING 2004 issue of Country Coach Destinations

Q I have a problem with the fuse that supplies power to the tow car lighting on my 1996 Prevost Conversion. The fuse will intermittently blow for some inexplicable reason. I have had the tow wiring checked on both my tow car and the coach with no problem found. I assume there is a short in the wiring somewhere, but how do I go about tracking it down?

A Circuit #420 that supplies power for the lights on your tow car also supplies power to the compressor clutch for the chassis air conditioning system. You most likely have a failing winding in your compressor clutch that will cause the fuse to blow anytime the clutch is energized to cool your coach on a hot day or to defrost your windshield. Open up your engine compartment and locate the air conditioning compressor on the right of the engine. Disconnect the single wire

that feeds power to the clutch at its connector on top of the compressor. Supply fused 20A power to the clutch through this wire and use a clamp on amp meter to measure the current being drawn. A brief burst of current as the clutch energizes with a sharp clunk is normal but it should settle down to about 8A within a split second. A current of 10A or more might indicate a failing winding in the compressor clutch that should be replaced at your earliest opportunity.

While in the area, take a close look at the two hose fittings on the rear of the compressor. The seal for these hose fittings can wear with time due to engine vibration and begin to leak as evident by any oil streaks around the connection. The fitting may also develop a leak where it is crimped onto the hose and both of these should be inspected annually in the spring so timely repairs can be made if necessary in preparation for the hot summer months. Remember to always replace the filter/dryer in the system once it has been opened for repair!

by Brian Keys, Country Coach Electrical Engineering Department

- As published in the SUMMER 2005 issue of Country Coach Destinations

Q Can you help me make sense of my DynoMax chassis pneumatic schematics?

A If you're having difficulty making sense of a DynoMax chassis pneumatic schematic, this high-level overview of the air system may help unlock some mysteries. With the engine running, pressurized air flows from the engine mounted air compressor to the Bendix air dryer and then continues on to a reservoir commonly referred to as the 'wet tank'. At about 120 psi, a purge valve will open on the air dryer to expel water and oil contaminants with a noticeable 'whooshing' sound and a pressure signal will be sent back to the compressor's unloader valve (or governor), which causes the compressor to cease pumping air.

The wet tank supplies air pressure to the primary and secondary brake tanks via check valves and they in turn supply air to the auxiliary air system via a 'pressure protection' valve set to cut off airflow if the system drops below 70 psi. This ensures the brake system has an adequate supply of air pressure in the event of a major leak in the auxiliary air system. The wet tank also supplies an accessory air manifold in the steering bay through a second 70 psi pressure protection valve. From here, air is supplied to your air horns and the quick release couplers that may have been installed in the engine and steering compartment of your coach.

Upon entering the auxiliary air system, pressurized air is supplied to the front and rear height control valves, and to the HWH air manifolds also located front and rear. In 'Travel' mode, the HWH systems allows air to flow freely through the manifolds from the height control valves to the air bags to control ride height. In 'Leveling' mode, the air manifolds block off the air from the height control valves and control the air bag height directly using separate raise and lower solenoids for each corner of the coach (4 point leveling). The 12 volt auxiliary air compressor located in the steering bay provides a second source of air pressure for the system and check valves are used to ensure this low output compressor only supplies the air bags, not the auxiliary reservoir tanks which are only supplied by the engine air compressor.

How about the brakes you say? Releasing the parking brake will send pressurized air to the park brake chambers on both the drive and tag axles, causing the parking brakes to release from their default (spring loaded) applied position.

Pressing the brake pedal will send air pressure to all the brake chambers on front, drive and tag axles to apply the brakes. As you apply more force to the brake pedal, the air pressure to the brake chambers rises progressively to increase the braking force at the wheels. A brake relay valve is incorporated in this circuit to ensure rapid application and release of the brakes, and a modulator valve is used for each wheel to reduce the braking force should a wheel lock up under heavy braking. On slippery surfaces, an ATC valve causes the brakes to be applied partially on either of the drive axle wheels should they lose traction while accelerating.

An anti-compounding valve ensures the parking brakes on the drive and tag axles are never applied together with the service brakes since their combined force could permanently damage the brake mechanism.

Lastly, when you purge moisture from your air tanks, an airline from the bottom of each air tank drains through manual or electrically operated pneumatic valves depending on your coach model and year.

by Brian Keys, Country Coach Electrical Engineering Department

- As published in the WINTER 2006 issue of Country Coach Destinations

Q The generator on my 2003 Affinity will no longer start from the SilverLeaf system but it starts and stops just fine from the bedroom rocker switch. What fuses should I check and where are they located?

A The interface between the SilverLeaf and the Onan generator is quite interesting. When you press the rotary controller on the SilverLeaf display to start the generator, this display unit sends a 'Start' command to the SilverLeaf Power

Management module or PM-002, which is usually located inside your coach's shifter console. The PM-002 then communicates this 'Start' command to an Onan interface node in a 'language' that it can understand, and the Onan interface node in turn politely asks the generator to start. The advantage of modular electronics such as this is that faults that might occur are much easier to diagnose, and more cost effective to repair because you only have to replace the failed component and not the entire system. The only real disadvantage to this architecture is that like young children, the individual components don't always want to cooperate with each other 100%.

One possibility that may have occurred is that the generator was perhaps started from the SilverLeaf, and stopped from another manual switch such as that in the bedroom, or on the generator itself. This can occasionally confuse the system, but the problem is easy to resolve. With your SilverLeaf on the generator screen, just hit 'Stop' twice and then try 'Start' to see if it works.

If this doesn't resolve the problem, then turn off power to the system using the domestic battery disconnect switch for about one minute and you should find the system to be fully operational once power is restored.

by Brian Keys, Country Coach Electrical Engineering Department

- As published in the AUTUMN 2004 issue of Country Coach Destinations

Q I sometimes have difficulty getting power inside my 2001 coach. Are there any checks I can do to identify the problem?

A The electrical system in your coach is relatively complex and can be confusing if you are not aware of the various stages power must go through before it reaches your convenience outlets etc. Lets take a look at the flowchart on the right and go through these stages from top to bottom.

First of all, your coach needs power from somewhere and this is supplied by either shore or generator power. The power to your coach is, of course, protected by breakers. The shore power breakers are usually located on the 'power pole' while the generator breakers can be found on the generator itself.

Since your coach cannot operate on both shore and generator power simultaneously, a device must be installed that chooses between the two. This device is called a 'Transfer switch' and will allow the generator power to safely override shore power after a 30 second delay.

The Surge Guard is a device that protects your coach from potentially damaging electrical faults that might occur on shore power due to poor campground wiring etc. This device will impose a 2 minute time delay before it passes power onto the next stage. The key switch on this device should always be set to 'On' to enable this protection. The power now flows to the distribution panel and it is here that the first 'split' occurs' After making its way through the distribution panel breakers, the power is split between what we call the 'Inverter Circuits' such as microwave, TV, VCR and outlets etc and the 'Non Inverter Circuits' such as the roof A/C's, washer/dryer and water heater(s).

The power for the 'Inverter Circuits' now flows through the inverter(s) and it is here that the second 'split' occurs'

After making its way thru these breakers that may be located on the inverter itself or on a 'sub panel' mounted inside one of the bays, the power is now split between the 'Non GFI Circuits' such as the microwave or refrigerator (on all electric coaches) and the 'GFI Circuits' such as TV, VCR, satellite and interior convenience outlets. Before reaching the GFI Circuits, the power must of course pass through the GFI (Ground Fault Interrupter). This is located in the bedroom of the coach and can occasionally 'false trip' when switching between inverter and shore or generator power.

Confused? Well lets assume you have plugged your coach into shore power and have waited the obligatory three minutes for the power to transfer thru the Surge Guard in 'stage 4'. You might now find that you have no power for your TV or VCR, but where should you start to identify the problem? Since the TV and VCR are on a 'GFI Circuit', lets start by checking a 'Non GFI Circuit' such as the microwave. If your microwave is working then you know power is getting to the 'Non GFI' circuits thru the inverter in 'stage 7' so the problem must be between the inverter and the 'GFI Circuits'. Simply check the breakers on 'stage 8' or the GFI on 'stage 9' and you should quickly find the problem.

If your microwave is not working then you can assume that there is no power coming through the inverter on 'stage 7'. You should now check for power on the 'Non Inverter Circuits' such as the roof A/C's or washer/dryer. Remember of course that the roof A/C has a two minute time delay before it starts. If your roof A/C or washer/dryer is working then you can safely assume that power is reaching the distribution panel in 'stage 5' so you should start here by checking the breakers on 'stage 6'. Good luck with your troubleshooting.

by Brian Keys, Country Coach Service Specialist

- As published in the WINTER 2002 issue of Country Coach Destinations

GENERAL

Q Should I dump all the air from my leveling system before I level the coach?

A While there is no requirement to do so, it won't harm the system and is a completely acceptable practice. There are two main advantages to dumping first which may appeal to you. The first is that the entry steps will be as low as possible once the coach is leveled. The second is that the coach may feel more "solid" and less "spongy" with some of the air springs completely empty and resting on their internal stops. The only downside (sorry, I just couldn't help myself) is that under certain conditions it may take longer for the coach to level.

by James Jordan, Country Coach Service Technical Resources Manager

- As published in the AUTUMN 2007 issue of Country Coach Destinations

Q How do I hook up a brake controller for my trailer or towed vehicle?

A This is a common DIY (do it yourself) modification that's not too high on the difficulty meter and doesn't require a lot of specialized tools. Depending on the weight of your trailer or tow car, an auxiliary braking system may be a legal requirement in some locales. A little research is necessary to confirm this, however, as many states have reciprocal agreements that may or may not exempt one from compliance. Legal issues aside, many coach owners report that their coach actually brakes better with an auxiliary braked trailer than it does with no trailer attached. Another issue to consider is the safety factor of having a break-away feature for your trailer or tow car; there's nothing quite as exciting as recognizing your car...as it passes you on a steep downhill!

On the technical side of the issue, there are some wires that you'll need to access in order to tie the auxiliary braking system into your coach. You'll need to supply +12V power to operate the controller and you'll need some way to let the controller know that you have applied the service brake of the coach.

#52 - this 16g yellow wire comes from the brake switch relay and goes to a number of components, including the tow board. You will find it under the dash as well as in the steering bay. It provides a +12V signal when the service brake is engaged.

#34 - this 16g yellow wire is the ignition power wire. As you can imagine, it is connected to quite a few components both under the dash and in the steering bay. It provides a +12V source when the ignition is on.

Ground - you may connect to any of the ground studs available in the dash area or steering bay; or you may create your own with a good mechanical connection to a clean metal surface.

Spare wires - there are spare wires that run from the steering bay to the back of your coach. Depending on which model coach you have, they will be found on a terminal strip located in either the engine compartment or the service bay. You will need one of these to connect the output signal from your brake controller to the trailer or tow car portion of the auxiliary system.

Some auxiliary braking systems require a connection to the pneumatic system of your coach. Due to the complexity of this system, please give us a call us for additional information if you are installing this style of controller.

by James Jordan, Country Coach Service Training Manager

- As published in the SUMMER 2006 issue of Country Coach Destinations

Q When we purchased our used 2002 Prevost Conversion, we weren't provided with the code for the keyless entry system. Can you help?

A The keyless entry system on your coach has two codes, the 'dealer' code which is fixed, and the user programmable customer code which you can change as often as you wish. If you weren't provided with your dealer code, then good news! The code can be found on a label on the keyless entry module located behind the dash on the passenger side. The module is white in color, and the code can usually be viewed with a flashlight, simply by removing the entry door's upper hinge cover.

Once you have the five digit dealer code, simply punch it in using the keypad on the door. Next, press the 1/2 button followed by your desired five digit customer code. Don't delay longer than five seconds between any of the aforementioned button presses or you will exit the programming mode prematurely. To clear the customer code, punch in the dealer code followed by the 1/2 button and stop there.

Assuming you were successful in programming the customer code of your choice, then simply punch it in to unlock the entry door. Pressing the 3/4 button after entering your code will unlock the bay doors, and pressing 7/8 together with 9/0 will relock all the doors including the entry door.

by Brian Keys, Country Coach Electrical Engineering Department

- As published in the SPRING 2006 issue of Country Coach Destinations

Q What should I be aware of in the unlikely event that my coach will need to be towed?

A Hopefully your coach will never require the services of a tow truck. If it does become necessary, here are some tips that should save time and prevent costly damage.

Make sure the tow truck company you contact is up to speed on your coach's length and gross vehicle weight to ensure they arrive properly equipped. Current Country Coach models require a tow truck with a longer reach and a special cradle designed for attachment to the independent front suspension. These specialized

tow vehicles should also have a low profile in order to fit under the front of the coach without damaging the bodywork. The cradle should attach to the suspension subframe and never to the suspension components themselves such as upper/lower control arms, steering tie rods, sway bar, and king pin/knuckle post assemblies.

The tow truck operator will likely want to connect an air line to your coach to maintain pressure in the suspension and braking system. There are a variety of ways to make this connection and they change from model to model, but there is one solution that is both easy and consistent across all DynoMax chassis. Simply locate the 'Pressure Protection Valve' (see image) that is mounted to the forward wall of the steering compartment. Disconnect the airline that is closest to the center of this valve and connect this same airline to the tow truck. This will allow the tow truck to back feed air into the coach's auxiliary air tanks which feeds both the suspension and brake systems.

With the air system pressurized, don't forget to release the park brake and leave the ignition switch turned on with the leveling system in the travel mode. The tow truck operator should stop periodically to make sure the chassis battery has sufficient charge and that the coach is at proper ride height.

Last, but just as essential as the previous points, is to be sure to remove the driveshaft completely from the coach. This will prevent permanent damage to the Allison transmission, which will not have oil pressure for lubrication while the engine is not running. Some might question the need to remove the driveshaft completely from the coach, but it is a highly recommended precautionary measure to prevent damage from (a) a swinging driveshaft that was disconnected at the wrong end (transmission instead of rear axle) or (b) a swinging driveshaft that was not reconnected before starting the engine and putting the transmission into gear.

When the coach arrives at its destination, the air system should be returned to normal and the driveshaft reinstalled with its fasteners torqued to their proper specifications. Extreme caution should be practiced when removing the tow cradle from beneath the coach to ensure it doesn't catch on the fiberglass bodywork.

Hopefully you will never need to have your coach towed but keep these tips handy just in case. The advice given here is quite basic, but overlooking these items could be very costly and inconvenient.

by Brian Keys, Country Coach Electrical Engineering Department and Jake Smith, Senior Service Specialist

- As published in the WINTER 2005 issue of Country Coach Destinations

Q I experienced a sudden loss of air pressure in one of my rear duals from a puncture, yet the SmarTire® continued to display normal tire pressure. Why did this happen?

A Is your SmarTire® a first or a second generation product? I assume it is the former, with its own dedicated display. Those of you who have the SmarTire® system installed will probably applaud the genius who invented it for the comfort level of knowing that all is well where the rubber meets the road. Like any good design, however, compromises are made to accommodate the inescapable laws of physics and other limitations. This system uses sensors mounted in the wheels to

monitor temperature and pressure. These sensors require battery power and the batteries must last for a prolonged period since replacement involves removing the tire from the rim. To extend battery life, the sensors will only transmit a signal every thirty seconds once the wheel has started rotating. The display unit may not act immediately if it receives signals from a sensor indicating a dramatic change in air pressure. To avoid false alarms, it will interpret the first one or two transmissions as bad data or noise interference. This is entirely normal with signal transmissions of this nature that are influenced by external factors such as electrical noise from other vehicle systems. For this reason, the system may not immediately catch a sudden and dramatic loss in tire air pressure that may have been caused by road debris or tire failure. A gradual loss in air pressure, which is much more common, should be readily detected.

Sensors with weak batteries or intermittent transmission can also cause short term anomalies in the information presented on the display unit. Fortunately, a problematic sensor will generally make itself known to you as your coach begins to move. If one or more of the sensors are not providing valid pressure information within 1/8th of a mile, then these sensors should be investigated at your earliest convenience.

by Brian Keys, Country Coach Electrical Engineering Department and Jake Smith, Senior Service Specialist

- As published in the WINTER 2005 issue of Country Coach Destinations

Q The fiberglass on my roof surface seems to be oxidizing, causing white streaks on the sides of my coach as the oxidation is washed off with rain. What can I use to clean the white streaks, and how can I prevent the oxidation from reoccurring?

A The oxidation is a result of the sun's UV exposure on the gel coat, which is the smooth outer layer of the fiberglass used to build your coach. The oxidation itself does not present any structural concerns, but it can be unsightly as it washes off and regular maintenance is required to protect your roof's surface from the sun's ultraviolet radiation.

To clean the oxidation from the sides of your coach, try washing with a solution of one cup of detergent and a gallon of warm water. This together with the a little elbow grease will usually remove the streaks, and adding a cup of bleach to this solution will quickly take care of any mildew that may have formed on your roof during the winter months. If the streaks refuse to wash off with a regular soap solution, then look for a fiberglass cleaning product that should be readily available at any good RV or marine accessory store.

To prevent the oxidation from reoccurring, apply a coating of 303 Aerospace Protectant to your roof's surface every six months to one year depending on the level of sun exposure. This product is available in many stores and more information is available on the manufacturers web site at www.303products.com.

by Brian Keys, Country Coach Electrical Engineering Department

- As published in the AUTUMN 2004 issue of Country Coach Destinations

Q When using the air system in my Inspire to put air in my tires, I cannot seem to inflate them higher than about 95 PSI. The air pressure gauge on my dash reads 120 PSI. Why?

A The air pressure gauge on your dash reads the air pressure in your primary and secondary brake tanks, not the pressure of the auxiliary air system that you are using to inflate your tires. The gauge may indicate 120 PSI, but your auxiliary air system pressure could be anywhere from the compressor governor's 'cut-in' pressure (about 95 PSI), to its 'cut-out' pressure at 120 PSI, assuming of course that the engine is running. Notice how the cut-in pressure of 95 PSI is similar to the pressure boundary that you are having difficulty surpassing when inflating your tires?

There are several pneumatic components between the auxiliary air tank on your coach and the tire inflator including a series of fittings, the tire inflator itself, and pressure protection valves that cut off the auxiliary air supply in case of a major leak thus leaving some air pressure for continued operation of the brakes. These combine to restrict the air flow that you have available to inflate your tires so when you have about 95 PSI in your tires, the auxiliary air tank will be at about 120 PSI which is the cut-out pressure for the compressor. The compressor stops pumping air into the system, and does not restart because you are still above the 95 PSI cut-in pressure.

To get more pressure in your tires, listen for the whooshing sound from the purge valve as the compressor 'unloads'. Now force the compressor to cycle again by releasing some air from the inflator after it has been removed from the tire. A brief subdued hiss will indicate that the compressor is once again producing air, at which point you should continue to inflate your tire. You will have to repeat these steps several times to inflate your tires over say 110 PSI, but it is possible. Inflating your tires at a truck stop is, however, a lot easier and quicker!

by Brian Keys, Country Coach Electrical Engineering Department

- As published in the SUMMER 2004 issue of Country Coach Destinations

Q How can I improve my dry camping capability?

A The simplest answer, and by far the most economical, is to reduce your use of the coach's electrical system. Here are some suggestions:

1. Turn off the inverter when AC power is not required. Although the inverter has an energy saving idle or 'search' mode, in practice it never activates due to parasitic loads such as the microwave clock and 'standby circuits' in TV's and VCR's, etc. Turning the inverter off when you are sleeping, for example, can gain you as much as three to four hours of dry camping time. When plugged in, the inverter can safely remain on.

2. Avoid or limit your use of AC heat producing appliances such as small heaters, the microwave, toasters, curling irons, and coffee makers, etc. If making coffee, just make enough for one cup each and then turn the coffee maker off to prevent the 'hot plate' from discharging your batteries further. A microwave, for example, can pull over 130 amps from the batteries in use.

3. Avoid using bay freezers when dry camping, but if necessary, these should be powered by 12V with the temperature setting adjusted to a minimum.

4. When using your propane or diesel heating system, reduce the temperature settings and use warmer clothing or bedding.

5. Turn off any lights and fans, etc. that are not being used. If the icemaker in your refrigerator runs on inverter power, then this should also be turned off.

An important consideration when recharging your batteries is how long the generator will have to run to obtain a full charge. For heavily discharged batteries, this can vary from three hours for two 8D liquid cell batteries, to over ten hours for four AGM batteries. Owners of coaches with larger battery banks will unlikely run their generator long enough to fully charge their batteries and therefore usually experience reduced dry camping time after their initial arrival.

If your budget allows, installing solar panels will significantly increase dry camping time, and the energy they produce is free, silent, and environmentally friendly. Solar panels do have a limited output however, so maximum gains will be achieved when they are used in conjunction with the energy saving suggestions above.

by Country Coach Service Team

- As published in the AUTUMN 2001 issue of Country Coach Destinations

Q I have an intermittent fault on my coach that the service technicians cannot reproduce. What can I do to get this problem repaired?

A Unfortunately, an intermittent fault can be a nightmare for both you, the owner, and the service technician that is attempting to locate and repair it. There are many reasons why even a regularly occurring intermittent fault can suddenly become difficult or impossible to reproduce following a change of location from where the coach was parked at the time of the fault. The location where it has been taken for service may have different climatic conditions, altitude and hookup quality, etc. Another reason is that while in for service, your coach and its equipment will not be used or operated in the same manner that you, the owner, would when living in it daily. If you can reproduce the fault, then please demonstrate it to the service technician and make yourself available for any further questions he or she might have.

When diagnosing intermittent problems, a service technician will often only have the information provided by you to rely on. It is vital that you be observant and take note of anything that may relate to the fault when it occurs. This might include both chassis and domestic battery voltage and shore power or generator volts/amps etc. Perhaps the fault only occurs at night or when it rains. Perhaps the fault causes the ceiling lights to dim. If you hear a sound such as a clunk or buzz when the fault occurs, try to determine its exact location. It is also important to note what you had running in your coach such as the refrigerator, air conditioning, etc. Commonly forgotten are the electric heating element in the water heater (controlled by a breaker in the distribution panel), a bay freezer and perhaps a small plug in electrical heater.

For those faults that are persistent and elusive, you should learn as much as you can about the affected system, which in turn will help you provide more accurate

diagnostic information to the service technician. Ask the technician lots of questions, including what to look for when the fault next occurs. If the fault is a minor inconvenience and seems to be getting worse with time then you might consider letting it develop until it fails completely. At that time it should be easy to diagnose.

by Brian Keys, Country Coach Service Specialist

- As published in the SPRING 2002 issue of Country Coach Destinations