

## Introduction

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This document covers the basic features of our 2015 Forest River Berkshire 34QS Motorhome Diesel Pusher Coach. It includes a lot of information not in the Forest River or individual component manuals. It also includes information about items I have installed or modified in our Coach. This information may be relevant to other RV owners, particularly owners of Diesel Pushers and other Class-A motorhomes, as well as owners of trailer RVs of a similar 2015 vintage. I have suggestions for further reading at the end of this document.

I endeavour to keep the latest version of this manual on the Forest River Forums Berkshire Motorhome page, at <http://www.forestriverforums.com/forums/f112/my-manual-for-our-2015-berkshire-34qs-191578.html>

For convenience, I capitalize all components of the Motorhome in my descriptions. I attempt to provide specific component information so that the reader can be alerted that their components may be different and may require a different operating procedure.

Some people may find it convenient to print out a copy of this manual so they can place it on their night table for bedtime reading. It can be a drug-free cure for insomnia.

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## Fire and Safety Issues

The interior walls and ceiling of the Motorhome are 1/8" plywood, with foam insulation behind this, so it has more flammable material than is common in a home or office. Thus, thinking about fire safety, in advance, is a wise idea.

### ***Getting Out of the Motorhome in an Emergency***

There are three exits:

1. The Main Door, which is in front of the Passenger Seat. This is the best exit, if it is available. Note that there are two locks on the door, corresponding to the two locks on the outside, and they can be engaged (perhaps accidentally) by somebody with a key from the outside. Both locks have to be open before the door can be opened, and lifting the door handle *does not* open either lock. The lower lock is a red lever that must be lifted up. The upper lock is hard to see, un-



less you sit on the steps. It is a black, flat knob that must be turned. Normally, when inside the motorhome, we only use the lower lock, so it can be hard to notice the upper lock if it has accidentally been engaged.

2. The Living Room Window has one panel that can be unlatched and opened out like an awning. The latches are red and must be lifted to release the window. This window is



small and hard to exit. Personal injury is likely to occur, but in an emergency, it may be the best alternative.

3. The Bedroom Window has the same latch system as the Living Room. It is also small and hard to go through without injury.

### ***Fire Extinguishers***

Putting out a fire may be safer than exiting the motorhome through the windows, bearing in mind that the walls and ceiling have 1/8" plywood covering foam insulation (which may have toxic smoke). There are three fire extinguishers in the Motorhome:

1. Large Fire Extinguisher by the Front Door. If available, this is the best extinguisher to use. It sits on a

hook and is held in place while driving by some velcro. Pull hard on the Fire Extinguisher to release the Velcro. It may damage the woodwork, but it can be a better alternative to having a major fire. If there is not an emergency, you can remove the Fire Extinguisher by sliding a spatula between the Fire Extinguisher and Velcro to release the Fire Extinguisher.

2. Fire Extinguisher to the right of the Refrigerator. If the Kitchen Slide is not extended, this Fire Extinguisher requires a long reach.
3. Fire Extinguisher inside the Bedroom Door. This can be used for a Kitchen fire or to stop a fire blocking egress from the Bedroom.

In addition, there is one external Fire Extinguisher in the Propane Bay outside the Motorhome. It is the only unlocked Bay in the Motorhome, and is on the Driver's Side just behind the Front Wheel. The purpose of its location is to be available without opening a lock. It is not likely a good choice for a propane fire. If such a fire occurs while filling with propane, it is likely that the filling station has a suitable fire extinguisher.

### ***Carbon Monoxide and Propane Detector***

There is a Detector for Carbon Monoxide and Propane on the lower part of the Hall Wall, outside the Bathroom. This Detector will shut off the Propane supply at the main tank if it senses a problem.

Note that label on this Detector indicates that it has a planned life of 5 years,

at which time it will shut off the Propane System until it is replaced. Thus, this item should be replaced in late 2021. At End of Life (EOL), the LED will flash RED RED GREEN GREEN and a beep will sound every 25-30 seconds. It can be reset for up to 30 days by pressing the TEST/RESET button, at which time it must be replaced.

The Detector is a Safe-T-Alert 70 Series with Valve Control by MTI Industries.





### What's That Noise?

- *Sound of pipes or sticks banging against RV* is the ice dropping from the ice maker in the Fridge. Several are released at one time.

- *Light pumping sound* is the Water Pump when working off the Fresh Water Tank.

- *Loud fan or compressor noise from right rear of RV near the Washer/Dryer* is the induced exhaust fan on the Gi-rard Tankless Water Heater. This makes the Water Heater very energy efficient. Obviously, it comes on when running hot water. Not so obvious is that it comes on automatically when the weather is cold and the Water Heater is in danger of freezing. So, you often hear it come on in the middle of a cold night.

- The Water Heater fan (noted above) can also come on when a cold water tap is opened. This happens when there is a bubble in the water lines at the beginning of the season. When all the water appliances have been used, the bubble and the noise goes away. The Washing Machine is often not used right away, so to solve the bubble problem for it, turn off the Water Valves to the Washer and Drier at the Water Manifolds.

- *Air exhaust sound (short hiss) from engine* occurs when brakes are released. It also happens when the Air Tank pressure is full and Governor cuts out. The Air Dryer Integrated System (ADIS) spits out any water from the air

dryer. This keeps water out of the air lines to prevent freezing and rust.

- *Periodic buzzing sound from the 12v electrical bay outside to left and below the driver.* This is the Evans Tempcon vacuum pump that provides a vacuum to run the A/C, heating and ventilation controls while driving. Cars use engine manifold vacuum, but turbo diesels need a vacuum pump.

## Preparing To Drive for the Day

### *Air Suspension*

**WARNING:** There are situations where the Coach Air Suspension may fail to inflate, which results in a very rough ride that can result in a dangerous loss of control of the vehicle on bumps that commonly occur on paved roads.

A very common source of the problem arises when using levelling Jacks, such as provided by Equalizer Systems. The first step in levelling the vehicle is to deflate the Air Suspension, which process is often called “dumping air”. When the Jacks are retracted to start travel again, the Jack system sends a message to the Air Suspension system to re-inflate the Air Suspension. There must be air in the Air Tanks within 2 minutes of the message being sent — otherwise it is lost. Thus, the Engine should be started immediately after the Jacks are retracted in order to build up air pressure.

If the message to inflate the Air Bags does not get through, the Air Suspension will not re-inflate, and a dangerous situation could occur. Thus, it is recommended that the user check to see that the Air Suspension is inflating when the Engine is started and pressure in the air system has built up. If the Air Bags are inflated, you can insert a fist between the Coach Body and the Tires.

A user who discovers that the Air Suspension system has not inflated should park in a safe place where they can apply the Park Brake and run the Auto-Level

procedure of the Jack system. Once this is complete, they should ensure that the air pressure for the Brake System is at the high cutoff point (about 125 psi), and then raise the Jacks. Then check to insure that the Suspension does inflate and raise the Coach. If two cycles of this procedure are not successful, there may be a more serious mechanical problem to be investigated.

### *Tire Pressure Check*

The tire pressures should be checked at the beginning of every driving day when the tires are cold. Then, during rest stops, the tires should be checked with the back of the hand for overheating.

- Front tires: 95 psi
- Rear tires: 110 psi

This is based on Goodyear’s and Michelin’s pressure and weight ratings, combined with the actual corner weights of the loaded RV (full fuel, propane and fresh water, plus camping food and supplies). More discussion on these choices is given in the [Specifications](#) section.

I have now installed an EEZTire Tire Pressure Management System (TPMS) that reports the pressures of individual tires. The transmitter units are mounted on the tire valve stems and the TPMS is plugged into dashboard power, and turns on when the engine is started. It takes a while to receive the tire pressures, but one can see the progress of the pressure increase as the tires warm up. Occasionally, the inside rear dual wheels fail to send a signal and a warning beep sounds until the wheel reconnects to the TPMS. If

there is a sudden loss of pressure or pressure outside the preset limits, a continuous warning sounds, and it can be turned off, temporarily (tire by tire) by pressing the lower middle button on the digital TPMS.

***Seat Belts***

Our Coach has seating for 7 people while driving.

- Two Seats for the driver and front passenger.
- Two Seats for passengers facing forward at the Dinette Table. The Seat Belts are stored below the Seat.
- Three Seats for passengers on the Living Room Couch. The Seat Belts are stored below the seat.

## Driving

### **Engine**

Our unit is a diesel pusher on a 34 foot Freightliner XCR chassis. It has a Cummins ISB 6.7 engine that produces 340 horsepower at 2700-2800 RPM. The maximum torque of 700 foot pounds starts at 1600 RPM. The horsepower is limited to 340 hp because that is the limit of horsepower to be handled by the Allison 2500 MH transmission.

Cummins rates the Engine as being capable of continuous full throttle output as long as the Engine speed is above the point of maximum torque (1600 RPM).

### **Transmission**

The Allison 6 speed Transmission has a standard Arens push-button Controller. The Controller learns how the driver operates the Throttle and adapts its shifting logic to match the driving style. If you have a conservative driving style, it can be hard to force an automatic downshift for passing. If that happens, you can force a downshift by pressing the down arrow on the Controller. It is hard to see this, but the position can be learned by feel. If approaching a passing lane where you want to pass a slow vehicle, it makes sense to downshift before the passing

lane to get the revs and turbocharger up to speed for a faster pass.

The motorhome can achieve highway speeds in 4th, 5th or 6th gears.

The Transmission will lock out the Torque Converter to be more efficient. This can happen in 2nd through 6th gears. In my experience, it seems to quickly lock out the torque converter in 3rd through 6th gears. But, at low speeds, the Transmission initially shifts to 2nd with the Torque Converter slipping, followed with a later “shift” to lock out the Torque Converter while still in 2nd gear. This can also be noted by watching the tachometer.

There is a Mode button on the Arens Shift Controller, which lights up when engaged. Unfortunately, the display line does not light up on my Controller to say what it does. Documentation says that the Mode switch engages an Economy shifting mode. This seems to be true, but I can't be sure that it isn't a placebo effect that fools me.

### **Air Brakes**

Air brakes are very powerful, but operate differently from standard hydraulic brakes on other vehicles, so we discuss a few details here.<sup>1</sup>

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<sup>1</sup> It is a really good idea to take an air brake course and read a competent air brake manual. Some Canadian Provinces provide their air brake manuals online for free, and they provide much more detail than here. Newfoundland and Labrador: <http://www.servicenl.gov.nl.ca/drivers/driversandvehicles/driverlicensing/airbrake.pdf>. Manitoba: <https://www.mpi.mb.ca/Documents/AirBrakeManualNEW.pdf>. Bendix also has a useful manual at [http://www.suspensionspecialists.com/techinfo/Bendix\\_Brake\\_Handbook\\_2009.pdf](http://www.suspensionspecialists.com/techinfo/Bendix_Brake_Handbook_2009.pdf).

The Rear Brakes are the Primary system. They are a large drum brake that is engaged in either of two ways.

The first way is the emergency and Parking Brake feature, which happens when air pressure falls in the Parking Brake Air Chamber, letting a heavy Park Spring apply the brakes. This is a fail-safe system in that a loss of air pressure will cause the rear brakes to engage automatically. Additionally, pulling on the Yellow Diamond Button to the left of the driver "dumps" air from the parking brake air chamber, which engages the Parking Brake. This Brake is much more powerful than the standard parking brake on a car, so it avoids the need for a park position in the Transmission.<sup>2</sup>

To release the Park Brake, there must be sufficient air pressure built up by running the Engine. The Park Brake is released by pressing down on the Yellow Diamond-shaped Knob. One way to remember this is "Indigo" or "In to go".

There are 2 Air Pressure Gauges on the Dashboard: one for the Primary rear brake (System 1) and the other for the Secondary front brake (System 2). Full operating pressure is about 125 psi, but

the Brakes will work at lower pressures. An audible alarm sounds when the pressure is too low. (You can hear this alarm when you first start the Engine for the day, as the system is not fully pressured at that point.)

If you hear the Air Brake Alarm sound while you are driving, you can confirm that the Brake System is losing pressure by looking at the Dashboard Pressure Gauges. A significant reduction of air pressure will cause the Parking Brake to engage, and it will engage gradually at a rate corresponding to the loss of pressure. *If the alarm sounds, you should look for a safe place to pull over and stop before the Park Brake strands the vehicle in a driving lane.*

The Air Pump on the Engine has a Governor that limits the pressure to 125 psi. When it reaches that pressure, it lets out a shot of air (to eject moisture from the air system) and turns off the pump.<sup>3</sup>

When pressured up, the Brakes also operate with a standard Foot Pedal, which is to the left of the Throttle Pedal. Pressing on the Brake Pedal releases air into a second chamber on the Primary Rear Brakes and the only air chamber on

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<sup>2</sup> Indeed, these park positions can damage a transmission, so it is not available on our Allison Transmission.

<sup>3</sup> When air is compressed, some moisture in the air condenses into liquid water. The Air Pressure Governor has an Air Drier Integrated System (ADIS) that collects this condensed liquid water. This is the moisture that is ejected when the Air Pump generates full pressure. There can still be air entering the downstream system and collecting in the three Air Tanks, where it may cause rust. The three Tanks have spring-loaded Drain Valves. The Valves can be opened by pulling on three Lanyards that reside in the two Front Wheel Wells. Turn the Steering Wheel sharply in on one direction to make it easier to find the Lanyards. I recommend this is a periodic maintenance procedure.

the Secondary Front Brakes. This air pressure engages the Brakes and the driver has control of the amount of pressure, just as with other vehicles.

*To summarize, the Brake Pedal uses air pressure to apply the Front and Rear Brakes. But, the Emergency and Park Brake uses an absence of air pressure to apply the Rear Brake.*

The Front Brake is a disc brake, but the Rear is a drum brake.

An important braking problem that is especially important on a big rig like ours is that continuous operation of the Brake heats and expands the Rear Brake Drum and may make it so large that the brake pads can't reach the drum and the driver loses stopping power. This doesn't happen with a Front Disc Brake, which helps. But, the Front Brake alone is not adequate on a long, steep hill, so it is important to start a hill descent slowly and to pump the brakes to allow the rear brake to cool.

The Front and Rear Air Brakes have an Anti-lock Braking Systems (ABS), just like modern cars.

### ***Engine Brake***

Another way to avoid overheating of the brakes on a hill is to make good use of the Engine Brake. The Engine Brake is activated by an Engine Brake Control Switch at the bottom left of the Dashboard Switch Panel to the right of the driver. The Switch enables the Engine Brake, but doesn't directly engage it. When the Switch is enabled, the Engine Brake is engaged when the Throttle is

released. This means that the Throttle foot pedal is released *and* the Cruise Control is also not supplying throttle power. However, if you have the Cruise Control Engaged and go down a sufficiently steep hill, the Engine Brake will come on if it is set.

You can see that the Engine Brake is engaged by an icon on the Dashboard. It also lights up the Brake Lights. Sometimes, such as in busy city driving, it is convenient to drive with the Engine Brake switch engaged, so that it engages as soon as the Throttle is released. It disengages when the Throttle is depressed. I find this to be particularly convenient when exiting a roadway, since it gives a solid braking effort as soon as I release the throttle at the start of the exit ramp.

When the Engine Brake is engaged, the Allison Transmission downshifts and the Cummins Engine changes the turbocharger geometry to provide a braking effort. It saves the driver from having to downshift manually when descending a hill or stopping from a highway speed.

The Engine Brake on our Cummins ISB 6.7 is quite quiet, because it works differently from the Jackson (Jake) engine brakes on large truck engines. Because it is so quiet, I use it in urban environments, even when they have a sign to say that engine brakes should not be used. The sound from engine braking is similar to the sound that occurs when the driver downshifts without the Engine Brake, and this downshift procedure is strongly recommended in standard dri-

ving manuals. So, I feel justified in using it in urban settings.

### ***Cruise Control***

Our Motorhome has a very nice Cruise Control that is operated by a Sliding Switch on the Turn Signal Lever. When it is turned on, press the Centre Button at the end of the turn signal to set it to the current speed (this only works if the throttle is being depressed by the driver). Repeatedly pressing the Centre Button will *reduce* the target speed in small increments. Repeatedly shifting the Sliding Switch to the right will *increase* the target speed in small increments.

The target speed on the Cruise Control is remembered even after stopping and restarting the engine. It can be displayed on the LBCU (Light Bar Control Unit) on the dashboard.

When the Engine is idling in Neutral, the Cruise Control can be used to get a *fast idle*. This is useful for warming up the engine or quickly bringing the air pressure up to an operating level.

Indeed, starting a cold engine often results in a "Low Battery" warning that occurs because an electric heater in the Engine fuel system is engaged. Running on fast idle helps to speed up the heating and removal of the warning.

### ***Steering Stabilizer***

I have installed a SafeTSteer Steering Stabilizer and a SuperSteer Trim Unit for it.

The SafeTSteer has a two-way shock absorber and centring spring for the

steering, attached to the steering Tie Rod. This works automatically to minimize steering shocks from potholes, tire blow-outs, and wind gusts, including gusts that occur when passing an oncoming truck.

The Henderson SuperSteer Trim Unit allows the return point of the SafeTSteer to be adjusted for crosswinds and road camber. There is a small spring-loaded Switch to the left of the Driver Seat that operates this. Normally, the Switch is off and the Trim Unit grips the SafeTSteer to the Tie Rod. But, when the Switch is pushed forward against its spring, it releases the air pressure to release the grip of the SafeTSteer on the Tie Rod, allowing it to find a new centring point. Releasing the Switch allows air pressure to re-enter the Trim Unit and grip the Tie Rod in the new position.

In a steady crosswind, it helps to be steering into the wind when setting the trim. This lets the Stabilizer springs assist you in keeping the Coach centred on the road. You can do this if steering into a gust or a curve. In really heavy crosswinds, it might be best to stop on a shoulder or rest stop, then turn the Steering Wheel into the wind while stopped and then set the Steering Trim.

### ***Running the House AC Units While Driving***

Later sections in this document describe more details about the House Air Conditioners, AC Power and DC to AC Power Inverter. These items are needed to run the House AC while driving, so we

will discuss their use here and leave the details about the systems for later.

Set the front and rear AC Dometic house Thermostat to the normal temperatures at which you want the Air Conditioners (AC) to come on.

When you disconnect from Shore Power, the AC units will not get power to run from the Inverter. So, they will shut down and the Dometic Thermostat will show an E7 "error" code. But, as soon as you re-connect to Shore Power or start the Generator, the E7 code will clear and the AC units will start again.

This means you can drive down the road with the House AC units set to run. As soon as you start the Generator from the dashboard, the E7 code will automatically clear and the AC units will run as desired. There is no need to go back and adjust the Dometic Thermostat.

### ***Stopping the Generator to Fill Motorhome with Fuel***

The Generator may be set to start automatically with the Auto Gen Start (AGS) feature. The AGS feature can automatically start or restart the Generator at a fuel stop. This is a safety hazard, particularly if the RV is being fuelled from the Driver's Side, since the Generator Exhaust is on that side, near the Fuel Filler.

To avoid this problem, turn off the Generator on the switch on the Driver Control Panel. If the AGS system is set properly on the ME-RC control panel, it will be in RV Mode, and this will turn off the AGS system, preventing a restart. If the AGS is not set to RV Mode, it can

restart even after turning off the Generator at the Driver Dashboard. In this case, you must manually disable AGS mode at the ME-RC Control Panel.

When you are finished fuelling, you need to re-start the AGS mode at the ME-RC Panel.

### ***Fuel Consumption***

Over a long 19,408 km round trip, our Coach consumed 4331.5 litres of fuel, which is 4.48 km/litre. Using the more common inverse metric, this is 22.3 litres per 100 km.

Converted to miles per US Gallon, this is 12,050 miles and 1144 US Gallons, which is 10.54 mpg.

I achieve this fuel economy by driving at 65 mph (105 kmh) or lower if the speed limit is lower. I set the Mode on the Transmission Selector to be "On", which is the Economy Shift Mode. I tow a small car that has a manual transmission.

I was initially surprised at how good the fuel economy is on our Diesel Pusher, but I've since found other people getting similar consumption rates. This surprises people from the trailer world who generally do not get such good fuel economy.

The Fuel Tank holds 100 US Gallons.

The Generator needs at least 1/4 tank of fuel on which to run.

At 1/8 of a tank of fuel, the Fuel Warning light comes on at the LBCU and can be minimized by pushing the LBCU toggle switch to the left.



***Merging Issues on Roadways***

When a road has two or more driving lanes in the same direction, it is customary for a vehicle in the right lane to move over to provide space for a vehicle entering from an on-ramp. Of course, if there is no room to move over, the vehicle on the main road has to stay in its lane and the entering vehicle must move ahead or back to find a gap to enter the road.

On many occasions, I've been in the right lane, but not able to move over one lane because another vehicle is to the left of me. But, on a surprising number of these occasions, the vehicle trying to enter either fails to notice me (distracted driving perhaps?) or simply assumes that I will move over because they don't see the vehicle to my left that blocks this maneuver.

There are two approaches to reducing the risk of an accident in such a situation. I am now in the habit of using my air horn to alert the incoming car that they need to adjust their trajectory to avoid running out of room. It seems to work well.

The other approach is one that I see large trucks using. That approach is to avoid driving in the right lane if the road has a lot of on-ramps.

***Night Arrival at a Campsite***

Night arrival at many campsites, such as KOA and Good Sam campsites is usually straightforward. If one arrives after office hours, there are usually instructions at the office for finding a site, including a site that you may have booked.

However, there are some campsites with poor or non-existent lighting. If you are not familiar with the precise layout of these campsites, you should seriously consider avoiding a night arrival by staying the night in a rest area, truck stop, Walmart or casino parking lot. This is because you often cannot get enough light onto your driving path (particularly if raining) to avoid obstacles that could damage your Coach or get you stuck in some mud. We've had some scary night arrivals in rainstorms, and we are not interested in such adventures any more.

## **Towing a Dinghy TOAD (Car or Truck)**

### ***Steering Caster and Towing 4 Down***

I tow my TOAD four down, which is to say that all 4 wheels are on the ground. A lot of people wonder how the TOAD steering turns to follow the track of the motorhome. The underlying principle is that the TOAD has caster built into its steering. The caster in the TOAD (or any vehicle) is the steering geometry that tends to bring the vehicle back into a straight-ahead position after turning a corner. It provides a stable steering situation, so it is standard on all of our vehicles, including TOADs.

Caster works on the same principle as the front wheels of a shopping cart. The front wheels turn about a steering axis that is ahead of the contact point of the wheels with the ground. So if the shopping cart is pointed to the left, the front wheels turn about the steering axis to aim to the left. Bicycles and motorcycles have steering caster. That is seen by noticing that the front forks are on an axis that hits the ground ahead of the contact point of the front wheel with the ground.

If we took the fenders off of a car or motorhome, we would see that the steering axis is tilted backward to give the steering caster. On our solid-axle motorhomes, the steering axis is often called the king-pin axis and the amount or cast-

er is called the king pin inclination. On a car, the steering axis is either the axis of the Macpherson strut or the axis between the ball joints of a wishbone suspension. In both of these cases, the steering axis is tilted backwards to give a caster angle.

I offer this little factoid for two reasons. First, it is interesting. I am most commonly asked how it works by Europeans who visit our campgrounds, and have never seen a vehicle towed 4 down.

The other reason that this factoid is important is that it only works with the car going forward. The caster angle goes the wrong way in reverse, and the front wheels have no reliable direction if you attempt to back up.<sup>4</sup> So don't back up when you are towing a vehicle 4 down.

### ***Connecting the TOAD to the Motorhome***

I have two vehicles that I tow (one at a time!):

- A 2005 Acura EL sedan (essentially a Honda Civic) with a 5 speed manual transmission. Most cars with manual transmissions are towable. This car does not seem to impact my Motorhome fuel consumption.
- A 2019 Ford Ranger 4WD truck with a transfer case that has a Neutral Tow setting. Getting into and out of the Neutral Tow setting requires careful attention to the instructions in the Ford instruction manual. I printed a copy of

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<sup>4</sup> If you want to see this in practice, try pushing a bicycle backwards while holding it only by the seat. You will quickly find that you need to hold the handle bars. Similarly, you may recall getting a shopping cart where the front wheel casters are jammed — you quickly look for another one when you realize that the cart won't go where you point it.

these and put them in a protective cover in the centre console for convenience. This vehicle does seem to reduce fuel economy, perhaps by 0.25 mpg, but this is with an open bed. I expect better fuel economy after having just installed a canopy.

I connect either of the TOADs to the Coach with a Roadmaster All-Terrain Falcon tow-bar system. The tow-bar is attached to the Coach. There is a removable adaptor that is inserted into the TOAD baseplate. The tow-bar connects to this adaptor with a pivot pin. The system is very solid and one can feel that it is latched into place when correctly set up.

The tow-bar has a set of breakaway cables attached, and they are connected to the appropriate holes in the baseplate (Ranger) or tow loops (Acura).

Then, I connect a lanyard cable between the breakaway switch on the TOAD to an eye bolt on the Coach. If the TOAD breaks away from the Coach, this lanyard will close the breakaway circuit on the TOAD, which will engage its Blue Ox brake unit (described below).

I connect the 6-pin electrical cable from the Coach to the TOAD, and then check that the connections are working by turning on the Coach 4-way Flasher and the Coach Parking Lights. If the Parking Lights and Turn Signals light at

the rear of the TOAD, I know that the connections are secure. There is no need to check the brake lights and 4-way flashers separately because of the way the lights are hooked up: the TOAD brake lights run through the same wires and bulbs as the turn signals and 4-way flasher.

I then connect a Protect-a-Tow skirt between the Coach and the TOAD.

If I am towing the Ranger truck, I then follow the Ford procedure for putting the transfer case into the Neutral Tow setting.<sup>5</sup> The truck dashboard indicates when this is configured properly, and lights up to remind of the configuration when the driver door is opened. The steering wheel is unlocked when the Neutral Tow setting is engaged.

If I am towing the Acura sedan, I simply put the manual transmission in neutral and turn a spare ignition key to its first setting, which unlocks the steering wheel.

In the case of both vehicles, I then move the driver seat back and insert the Blue Ox Patriot brake unit between the seat and the brake pedal, fastening it to the brake pedal with the brake claw. I move the seat forward to back up the Blue Ox. I then plug in the breakaway switch wire and the power cord to a 12v power point. Turning on the Blue Ox starts a setup procedure. After this, the Setup button is pushed to get the Blue Ox

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<sup>5</sup> This procedure requires a key in the ignition, turned to the On position. I had an extra key cut and electronically configured to the truck at an Ace Hardware store (about US\$100). Since there is no large remote clicker on this key, it is quite unobtrusive and not readily noticeable to any miscreants who might treat it as an invitation to break into the truck and steal it.

adjusted to the TOAD brake system. If all goes well, it gives a message and I double-check that the transmission is in neutral and the parking brake is off. Then, the driver door can be closed and locked with a spare key.

After returning to the Driver Seat in the Coach, the remote Blue Ox unit can be plugged into a 12v power point and the driver can use it to see and adjust the Blue Ox setup.

When starting out, I set the backup camera to view the tow bar and gently creep forward until both sides of the tow bar are latched. Sometimes it helps to steer from side to side to get both sides to latch.

In the first left corner that I navigate, I watch in the Driver Side Mirror to make sure the TOAD to make sure the TOAD front wheels are turning properly.

At the end of the trip, the TOAD is disconnected in the reverse manner. It is important to remember that the parking break of the TOAD should be engaged, or the TOAD should be taken out of neutral before disconnecting the TOAD from the tow bar. Otherwise, you could have a TOAD rolling away out of control.

If I am camping for just one night and leaving the TOAD attached in a drive-through campsite, I turn off the brake system and the ignition switches. This is because the Coach does not supply 12v to the TOAD when the ignition is off and it could run down the TOAD battery to leave everything on overnight.

Naturally, I have to re-engage the power the next day before driving off, especially since the steering wheel is locked and the TOAD is not in a neutral tow setting (Ranger). To remind myself to do this, I do one or both of two things:

- Put the TOAD key on a lanyard that I drape over the yellow Parking Brake button in the Coach. If the lanyard is bright, I should notice this when disengaging the Parking Brake.
- Leave the Blue Ox remote unit plugged in to 12v, inside the Coach. It will flash when it loses its connection with the Blue Ox unit in the TOAD and is a reminder to set up the Blue OX unit again.

### ***Driving with a TOAD***

Setting the Blue Ox unit to provide its greatest breaking effort, and manually engaging the TOAD brakes from the remote control in the motorhome, I find that neither TOAD is capable of stopping the motorhome from creeping, even at idle. So, the Blue Ox unit is primarily for breakaway safety, rather than assisting the Coach in stopping. On a slippery road, it might provide some stability to the rear end of the Coach, reducing the risk of a jackknife situation.

I typically set the Blue Ox unit to a level of 2, unless the road is slippery, in which case I go a bit higher (the TOADS are supposed to have anti-lock braking engaged when the ignition is on). The highest setting is 10, and I believe that imposes a lot of wear on the TOAD brakes. Having said that, I usually don't

brake hard enough for the TOAD brakes to engage. If I am only using engine braking on the Coach, it will not cause the TOAD brakes to engage.

Both of my TOADs are easy to tow and not a cause for concern. Sometimes I do watch the TOAD in the Driver Side Mirror or the Rear Camera.

When turning a corner

- the Acura sedan car wheels always track inside the motorhome track, so I don't need to watch it while turning corners
- the Ranger truck wheels track slightly inside the motorhome wheels, so I have to watch the truck when I turn a sharp corner with an inside curb.

It is not safe to back up the Coach while the TOAD is connected. The TOAD will go in an arbitrary direction and will quickly find itself cross-ways to the travel of the Coach.

Thus, you need to plan your route when in tight spots to make sure that you won't have to back up. This includes going into fuel stations, propane and DEF pumps, toll booths and campsites.

When I am at a fuel pump, I often walk the route that I will take to leave the station to make sure that I'm not caught by tight turns, curbs, bollards or gutter changes in grade while entering a roadway.

### ***TOAD Weight Limit***

The Allison 2500MH Transmission has a 5000 lb limit for the weight of a TOAD. This is rather perplexing, since the more natural limit would be a limit for the over-

all Coach and TOAD combination, which represents the total load on the Transmission. I am suspicious that this is really an up-sell marketing strategy by Allison. They want the owners to push the coach manufacturers up to the more expensive Allison 3500 transmission.

There are lots of people who tow loads over 5000 pounds with the Allison 2500MH. My situation with the Ranger truck gets close to 5000 lbs, so I monitor the situation by having one of my LBCU lines set to display the Transmission Temperature. I have never had the transmission over 190°F, including the times I have gone up and down long 6% hills. Going downhill generates high temperatures when engine braking is engaged, so riding the Brake pedal will help the Transmission on a steep downhill grade. For uphill grades, downshifting will reduce the load on the Transmission and engine. The Arens Transmission control unit will de-rate the engine if the Transmission temperature rises above 203°F.

### ***Hardware and Electrical Choices for Towing***

This section is not of interest for people on a day-to-day basis, so many readers will find it best to skip to the next section.

However I do have some useful insights into choosing a TOAD and the hardware and electrical connections that are needed to make it work.

A good place to visit in planning for Dinghy Towing of a TOAD is the annual series of towing guides published by Mo-

torhome Magazine in conjunction with Good Sam<sup>6</sup>. Downloads of the towing guide are free because they are supported by the extensive advertising of products that are useful or needed for towing.

Both of my TOADS weigh less than the 5000 lb limit that Freightliner and Allison specify as the maximum towing capacity of the Coach.

Both vehicles need the ignition switch to be turned to a position that unlocks the front wheel steering. This results in a current draw from the battery, so I have installed units to charge the car battery from the 12V charge line coming from the motorhome.<sup>7</sup>

To operate the TOAD brakes, I use a Blue Ox Patriot Unit, which is portable

between the cars, but which requires 3 electrical connections:

- 12V power from a standard power point. It does drain the TOAD battery, so having the battery charger system as above is essential.
- A connection to a breakaway switch on the front of the TOAD, which is connected to the Motorhome by a physical breakaway lanyard.
- 12V power for a remote control unit in the Coach, which lets the driver know how the TOAD brakes are performing. This is for information, and is not required for the TOAD brakes to work.

The Running Lights, Turn Signals and Brake Lights of the Coach need to be connected to the TOAD. The necessary wiring comes from the 7-pin Connector

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<sup>6</sup> These can be found at <https://www.motorhome.com/download-dinghy-guides/> They are issued each year and you should look at the guide for the year of vehicle that you are considering to tow.

<sup>7</sup> On the Acura, I installed an RVi Brake Towed Battery Charger, which has a handy indicator LED to tell me it is working.

On the Ranger, I installed the Roadmaster Battery Charge Line RM-156-25 for the towed vehicle. The Roadmaster RM-156-75 is for installation in the motorhome to provide power to the TOAD, so don't order it by accident. Roadmaster isn't clear about what its unit does, but it seems to be a 15A circuit breaker that automatically resets. I have since found this type of circuit breaker in auto supply stores and on the web. They come in various amperages and 15 amps seems suitable, since Freightliner says that it supplies 40 amps to the 7-pin trailer connection. These units have a silver coloured terminal marked "AUX", meaning the location that needs the current and a copper coloured terminal marked "BAT", meaning the source of the current. Since you want to charge the TOAD battery, connect its positive terminal to AUX and the charge line coming from the motorhome to BAT. I put an inline 20 amp fuse between this unit and the battery, so that I could disconnect it easily if desired and to offer additional protection.



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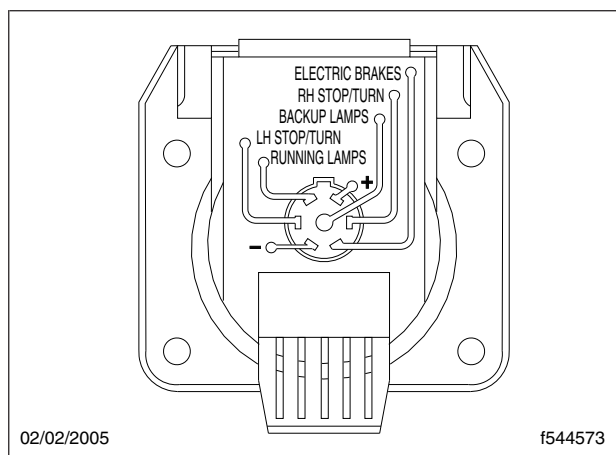


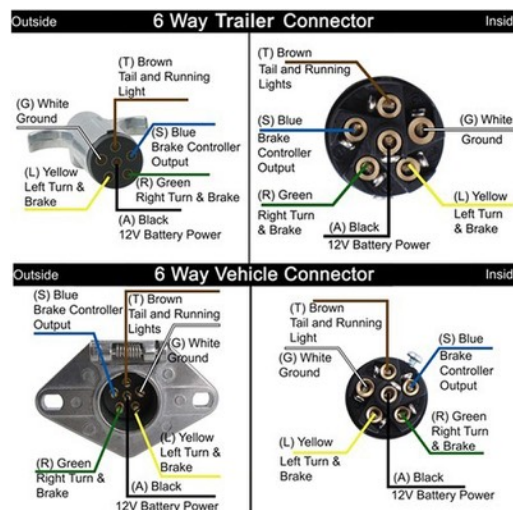
Fig. 13.2, 7-Pin Connector

on the Coach, and a 6-pin connector on the TOAD, which has wires for

- 12V power
- negative ground
- running lights
- left turn
- right turn
- brake light.

The Coach has a standard pin configuration for the wires. Viewing the Coach connector with its rain cover lifted gives the wiring shown in Freightliner's Fig. 13-2. I use the standard 6-pin configuration on the TOAD, shown above (remembering that the "Trailer" is the wire to the TOAD and "Vehicle Connector" is what is on the TOAD).

I found that the Ranger 12V power points turn off automatically after a period of time, even with the ignition switch turned on to unlock the steering. So, I had to install an extra 12V power point that I directly connected to the battery, in order to make sure the Blue Ox unit received continuous power. For simplicity, I



connected it to the same fuse I used for my charge line coming from the Coach.

The tail lights are connected by wires coming back from the 6-pin connector through a system of diodes sold by Roadmaster and/or Blue Ox. The diodes are actually in pairs that allow two inputs (car and tow line) and one output (the relevant lights). The diodes are needed to prevent the TOAD power from feeding back into the car light circuits.

There are several different vendors for TOAD baseplate and tow bar systems. I chose a Roadmaster system because it looked like it was easier to install the baseplate and the materials used seemed to be heavier and better designed from a geometric standpoint than those from other vendors.

On the Coach Towing Receiver, I mount the Roadmaster Falcon All Terrain Non-binding Tow Bar, which has a 6000 lb towing capacity. Roadmaster says that there is no need to install a drop link on the Receiver as long as the tow bar is no more than 3" above or below being level,

so I didn't need to use a drop link for either TOAD.

I installed Roadmaster base plates on my two TOADs. The Acura sedan is a uni-body car, so it doesn't have a full frame for a base plate. While the Roadmaster base plate fastens securely in the sub-frame that holds the front suspension, the Acura has no heavy cross-bar installed between these sub-frames. A nice feature of the Roadmaster system is that it supplies a removable cross-bar that attaches to the baseplate, resulting in a strong triangular geometry in conjunction with the tow-bar arms.

The Ford Ranger has a full box frame, so Roadmaster gives the option of a Cross-bar system or a Direct-Connect system that uses the bumper and frame as the effective cross-bar. To save weight, I selected the Direct-Connect system. The baseplates bolt into the frame where the Ford tow hooks were attached, as well as some unused holes in the frame itself. The baseplates have holes for connecting a safety chain, which provides the same functionality as the tow hook.

I installed both base plates myself. It required removing body panels and disconnecting wires, but it is not an onerous job for a handyman with a decent set of shop tools, or willingness to buy what he doesn't own.

Finally, I bought a "Protect-a-Tow" to go below the tow bar, between the Coach and the TOAD. It is a mesh trampoline-like horizontal skirt that allows air and wa-

ter to flow through, but keeps stones and debris from coming up onto the TOAD. It folds up when not in use. It does keep the gravel off of the hood. But, if I drive over a road after a fresh rainstorm, my TOAD still gets very dirty.



## **Dashboard Radio, Cameras and GPS**

Our Berkshire came with a Magnadyne M4 LCD radio unit with GPS. The GPS unit was poor and the whole unit became unreliable, so I have replaced it with a Sony XAV1000 radio unit, which has Apple CarPlay and allows me to use the rear view cameras, and a Garmin RV 770 GPS unit.

This arrangement gives me two separate GPS systems (Garmin, with a Navtek map system) and Apple iPhone (with an Apple TomTom map system, as well as Google and Waze Maps). The second opinion provided by having two separate systems is valuable.

### ***Garmin RV 770***

The Garmin RV 770 allows for Vehicle Profiles to be set with the Coach height, length and weight, number of propane tanks and desired maximum speed for route calculation. I use 65 mph or 105 kph, which is a common speed for trucks. It can have multiple profiles, so the user can switch between the car and the RV profiles.

The Garmin can be connected to a WiFi network for updating its software and maps. It can be connected to a Smartphone over Bluetooth, but system updates seem to keep breaking this Bluetooth connection.

The RV 770 helps you avoid problems such as low bridges and helps you to find campsites, fuel stations and rest stops. It can also display altitude, road grade and other interesting things.

The Garmin works well, and is necessary for getting maps without a cell tower connection. However, it does have some annoying features. It sometimes gives verbal instructions too late to change lanes and execute a maneuver. It often says that addresses are on the wrong side of the road or in the wrong block. As a result the driver is left to worry whether the Garmin will get to the proper destination or whether it will be necessary to execute a U-turn to find the destination.

It has a nice Active Lane Guidance feature that shows what lane(s) to use for on- and off-ramps on major freeways. However, for complicated ramps with multiple options in a short distance, it won't offer any Lane Guidance, which is really annoying.

I have the Garmin mounted on the Dash with a bean bag. It is restrained from sliding back by the slope of the Dashboard and from sliding forward by a wire sling that I have installed. It can be moved to the Toad for local car directions.

### ***Sony XAV1000 with Apple CarPlay***

The Sony AV Receiver offers standard AM-FM radio service, and optional Sirius XM Radio. It has Apple CarPlay, which works with an iPhone and allows the driver to play music, view and send Messages (translating between written and spoken messages). It also allows the use of the Podcasts and Spoken Books Apps on the iPhone. Curiously, I can also use my NHL App in CarPlay.

CarPlay can also display Apple Maps, Google Maps or Waze Maps, along with the spoken driving directions of those map systems. This provides a valuable second opinion to the Garmin maps, particularly since they allow the user to view the Terrain and confirm the location of a campsite. Also, the iPhone has Apps like Gas Buddy, Allstays, Calendar and Contacts (all with location information), so the Navigator can use the iPhone to get Apple, Waze or Google Map locations from these Apps and set them as a route destination.

Sony's Apple CarPlay works with Siri for voice commands. It has a separate microphone that I have installed on the dashboard and can be started by either "Hey Siri" or by pressing the Volume Control Button on the Sony.

I have the iPhone sitting in a leather-lined slot above the Sony XAV1000, but with a sufficiently long USB cord to allow my Navigator to work with the iPhone while on the road.

While in this slot, the iPhone gets cell tower signals and GPS signals without any problem, despite the fact that it has a metal top. When setting a route while connected to a cell tower data signal, the Apple Maps caches information about the maps to be used along the route, so that they are available even when out of range of a cell tower signal. Moreover, the spoken Siri information about turns continues to work even without the cell tower data connection.

The Apple maps seem to give turn instructions slightly before the Garmin, so they might be able to avoid the Garmin problem of sending directional messages too late. I need to test this more.

The Sony Receiver also displays camera views. It was designed to show the view from only one camera, either by using touch screen commands or by being triggered by the 12V signal from the backup lights. I have adapted this to work with all of the original 3 Cameras that came with the Berkshire Coach. Each Camera and its view is triggered by flipping its own switch, which I have installed on the Dashboard. Don't attempt to use the touch screen commands to view a camera, since this seems to freeze the Sony unit, requiring that it be disconnected from power to restart.

Two of the three Camera views are the original views from the Berkshire Coach: the Right Mirror Camera, and the Rear-view Camera that shows a view of the Toad and the rear end of the Coach. I have moved the camera that was formerly in the Left Mirror to the rear of the Coach to get a wide, long-distance view of the road and vehicles behind. This helps in observing clearances for lane changes, and also helps to line up the path for backing the Coach into a campsite. It gives a complementary view to the original Rearview Camera.

I have installed a Kenwood KSC-SW11 Powered Subwoofer in the compartment behind the dash controls. It gives a richer sound that augments the tiny 4" ceiling

speakers. There is a remote control for adjustments sitting in that compartment, which allows settings for:

- Volume
- Frequency cut-off (I set it for 125 Hz to get into the midrange)
- Phase (switch has no noticeable effect)

The unit is powered on when the Sony Radio is powered on.

#### **Turning the Radio On and Off**

The Sony AV Radio display turns on when the Ignition Key is turned on, or when the Dashboard Radio Switch is turned on.

The Dashboard Switch receives its power from the House Batteries. However, the overall power for the Sony Radio is provided by a constant 12V power connection, which comes from the Chassis Batteries on my Coach. This is the way the original Magnadyne was connected. This constant power goes to the Radio even when the Radio is Off (and the Display is blank). It is a parasitic power load that drains the Chassis Batteries. The only way to avoid this is to turn the large power Knob in the Chassis Battery to Off.

I have measured this parasitic drain on both the Magnadyne Radio supplied with

the Coach and my replacement Sony radio. The draw is 150mA in both cases. Over a 30-day month, this will total 108 Amp-hours, which is enough to kill the Chassis Batteries in a week. If drawn from the House Batteries, it would take half of the useable capacity from the House Batteries in one month. All this just to keep a clock running!<sup>8</sup>

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<sup>8</sup> I plan to change this to get power from the House Batteries at some point in the future. I can get power from the power source for the Dashboard Switch. As a safety measure, I need to make sure that the House Battery constant power to the Radio is isolated from the Chassis Battery switched power to the Radio. I will do this by putting a diode on each of the lines for constant power and switched power to the Radio (which combines signals from the Ignition Key Switch and the Dashboard Switch). It is likely that Sony has isolated these circuits within the Radio, but if they haven't, a slight mis-match in the voltages of the two Battery systems could force a damaging heavy current through the Radio. Since my Radio didn't burn up when using House Battery power from the Dashboard Switch and Chassis Battery power for a constant power source, it is likely that Sony has built adequate protection into the Radio.

### **Cell-phone Booster**

I have installed a Wilson WeBoost amplifier for Cell phone signals in the Coach.

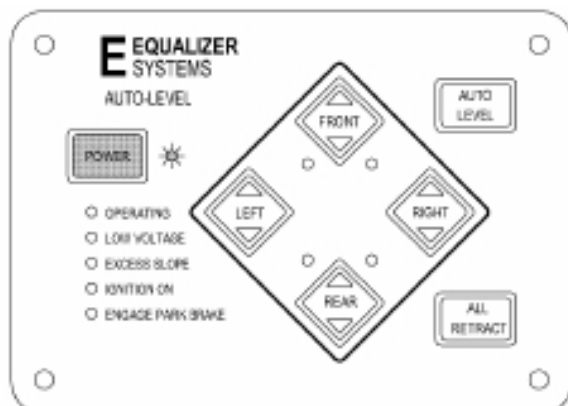
It has a high-gain antenna on the Roof of the Coach (basically above the Kitchen Sink), and a Boost Amplifier on the outside of the Cabinet above the Passenger Seat.

There is an Inside Antenna on a long cable coming from the WeBoost Amplifier. Place this Inside Antenna near any Cell Phones or Tablets that need a stronger signal. To avoid interference between the Inside and Outside Antennas, try to have the Cell device near the front of the Coach.

The antenna adds approximately 1 foot to the height of the Coach (total 13' 7"). I have installed it in such a way that it can be rotated down to lie flat if you know you are going to go under a low bridge. This improves the height to the standard 12'7" for the Coach.

The WeBoost amplifier can be removed and moved to a car to improve cell coverage there. There is a box in the cabinet above the Driver Seat with the necessary adaptors and antenna.

## Setting Up At a Campsite



### Levelling

Before applying the Park Brake, put the Transmission in neutral to see if the Motorhome tends to roll forward or back. This will tell you whether blocks are needed.

Apply the Park Brake and turn off the Engine.

Engage the Auto-Level system to the left of the driver by pressing the Equalizer Systems Auto-Level Keypad Power button. It dumps air from the Air Suspension Bags so that the Coach lowers. Then, it extends the Jacks down and adjusts them so that the Coach is level. It can give a warning that the Coach cannot be levelled, in which case you have to decide whether it is level enough to run the Refrigerator. If not, adjust the position of the Coach. It is easier to level if the Coach sits across a hill rather than headed up or down a hill.

Whether or not the Auto-Level system reports an error, it is possible for the levelling system to lift one or more Wheels

off the ground. It is essential that at least one side of the Rear Axle is firmly on the ground, in order for the Park Brake to function properly. In addition, at least one of the Front Wheels should be firmly on the ground to keep a wind from blowing the Coach sideways, which would damage the Levelling Jacks.

### Manually Levelling the Coach

If the Wheels are being lifted off the ground, or you aren't happy with the accuracy of the levelling job, you can manually adjust the level settings. You can use a bubble level on the floor of the coach to determine which side is high.

With the Auto-Level Keypad power turned on, you can extend and retract the jacks in pairs: Front Jacks, Right Side Jacks, Rear Jacks and Left Side Jacks. The reason for adjusting the Jacks in pairs is to avoid twisting the Chassis.

The logic of the up and down adjustments is somewhat counterintuitive. Pressing the Up Arrow on a Key will move the Jack Up and thereby moving the Coach down on that side!

### Resetting the Null Point of the Levelling System

If you find that you frequently have to manually level the Coach, then you may want to reset the Null Point to which the system attempts to level the Coach. If you find you need to continually reset it, you may be parking on soft ground. If the problem persists on hard ground, it sug-

gests a need to read the Equalizer documentation more carefully.<sup>9</sup>

### ***Chassis Anti-Twist Feature***

Equalizer Systems protects the chassis from twists of more than 3° by preventing any Jack from extending if it is on a corner that is 3° higher than the other jacks.

### ***Jack Pads and Wheel Pads***

I have made 6 Jack/Wheel Pads for the Coach out of 3/4" plywood screwed to 1.5" thick lumber. Their size covers the footprint of the dual Rear Wheels. They are stored under the Sliding Tray in the Main Storage Bay: anything thicker would hit the Tray.

They are very convenient for doing an initial level on rough or soft ground. They can go under the 4 Levelling Jack Pads, with the lumber on top and plywood on

the bottom. Alternatively, if a site is sloped, they can be placed under the wheels that are lower. To get two thicknesses of pad under a wheel, I first back onto one pad and then onto two stacked pads behind the first. Note that the Coach has lower gearing in Reverse than First, so it is easier to back onto the pads.

These pads are also handy for getting space to work under the Coach for maintenance, repairs and upgrades.

I also have a pair of blocks made from 6" by 6" wood posts sliced on the diagonal. They are wide enough to block the rear Dual Wheels. They are stored in the rear-most Bay on the Passenger Side.

Each of these blocks and pads have a rope tether that makes it easy for an assistant to pull them away from the Coach while standing at a safe distance.

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<sup>9</sup> This is discussed in the Equalizer Systems "Auto-Level Installation-Troubleshooting & Warranty Guide" of May 2013, available at <https://equalizersystems.com/wp-content/uploads/2019/08/EQ014-Auto-Level-Installation-Operation-Manual.pdf>.

On page 10, it says: "**Setting the Null: Null is the term used to indicate the levelness of the coach.** The null has been preset at the factory. If the coach is not level following an attempt to Auto-Level, you will need to level the coach and reset the null. To set the null, push and release the Power button on the Keypad to engage power. The LED light next to the Power button should be lit RED when the power is on. Level the coach by deploying jacks manually, or by simply parking the coach on a level site. You do not need to have the jacks deployed to set the null. Use a bubble level on a flat surface in the center of the coach as a reference. Once the coach is level, turn the power off at the panel. Depress and hold the Auto-Level button and press and release the Power button and listen for a series of beep. After the Keypad has beeped 5 to 6 times, release the Auto-Level button (the Keypad will continue to beep as long as the Auto-Level button is held). The new null has been set and the panel will maintain this setting. Press and release the All Retract button to retract the jacks to the stowed position."

Equalizer has more documentation on their system at their website <https://equalizersystems.com/service-and-support-old/operation-and-installation-manuals/>.

### ***Opening the Slides***

Check to make sure that nothing is going to obstruct the Slides outside (tree branches, etc), and that the inside trim on the Slides won't hit anything while opening (shoes on the floor, etc).

Press each Slide switch to open, one at a time. Continue to hold the Switch open for a second or two after the Slide is open, since this allows the Slide to realign itself.<sup>10</sup>

Check the Rubber Seals outside the Slides to see whether they are all properly in place. If some of them are folded inward, use the long shoehorn beside the Passenger Seat to slide up the inside and push them to the proper outward position.

### ***Connecting to Shore Power***

Many electrical power settings are adjusted by the Magnum ME-RC Remote Control, which is behind the door below the Dometic Thermostat. Some of the settings are described next and others are in a later section.

**If the Shore Power is 15A, 20A or 30A**, then it is a 120V system and you need to set the Magnum ME-RC Remote

Control to reflect that amperage available to the Coach, in order to avoid tripping circuit breakers on the campsite power line.

30A Shore Power will run at least one Air Conditioning unit, plus the Residential Fridge and Microwave. Under some circumstances, it might run both AC units and the Fridge, plus some other accessories. See the discussion section on Problems and Solutions for more details.

**If the Shore Power is 50A**, then it is a 220V system. First, plug the SurgeGuard dog-bone into the campsite power post and turn on the breaker to get power, but do not connect the Coach Power Cord to the SurgeGuard, just yet. Check the lights on the SurgeGuard to make sure that the power connections are all OK (green LED lights everywhere). If it isn't all OK, get a new campsite or run off of the Batteries, Solar Power and Generator. If the SurgeGuard reports that the connections are good, *turn off the circuit breaker* at the post and *then* plug the RV power cord into the SurgeGuard dog-bone. *Finally*, turn the circuit breaker back on.

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<sup>10</sup> Three of the Slides are Lippert Schwintek mechanisms. They can give problems, and looking at the Schwintek documentation can help solve problems. There are Relays to control and override the Schwintek slides. One is in the middle rear Passenger-Side Bay where the pumps for the Equalizer Levelling Jacks are located. The other two Relays are on the ceiling of the Main Storage Bay, which is the one with the Sliding Tray.

The Kitchen Slide is 16' long and has a lot of heavy items: Refrigerator, Microwave, Stove, Sink, Cabinets, Drawers and Dinette, along with their thick Corian countertops. The rollers on this Slide started to dig into the wood on the bottom of the Slide floor, which made it hard to open and close the Kitchen Slide. Forest River provided me with 1/8" thick aluminum plates to ride on the rollers and this improved the situation somewhat. However the gear and rack mechanism stripped and I'm in a position of having to replace that mechanism. I will update this Manual when that job is complete.

This procedure (only connecting the Power Cord while the post circuit breaker is off) reduces the risk of a temporary open neutral connection during the hookup, which can damage small appliances and small electronic items.<sup>11</sup>

**Hughes Autoformer for boosting low campground voltage.** In the Center Electrical Bay, I have placed a Hughes Autoformer. It has a surge suppression system like the SurgeGuard. More importantly, it also boosts the Shore Power voltage by 2% in normal circumstances (By-pass Mode when the voltage is above 115VAC). It boosts by 10% if the Shore Power voltage drops below 113-VAC (Boost Mode). The Autoformer turns on a light for each circuit that it is boosting. This feature protects the Air Conditioners and Refrigerator from drawing an excessively high start-up current and potentially burning out. The Autoformer works on all Shore Power: 220VAC 50-Amp, and 110VAC 30-, 20- and 15-Amp power).

I have installed meters in various power receptacles in the Coach so that one can see the voltage being supplied by the Autoformer. Safe voltages are regarded

as being in the range 113 - 127 VAC. I have successfully run the AC units at lower voltages: they started promptly, which is a sign that they received adequate voltage. I have read voltages from the Autoformer of 130 VAC. It would be wise to remove the Autoformer from the circuit in such situations to reduce that voltage by 2%.

When I run on the Magnum Inverter with stepped sine wave power, the voltages do not read accurately: an analog meter reads higher than a digital meter.

To connect the Autoformer, I cut the Shore Power Cord supplied by Berkshire about 2 feet from the Coach's Transfer Switch in the Centre Electrical Bay. I installed Male and Female 50 Amp AC plugs, which allows me to connect them directly if the campground has reliably high voltage, or to run the connection through the Autoformer if it has ordinary or low voltage.

This means that I can store the Shore Power cords elsewhere in the Coach.<sup>12</sup> I pass through a Female 50A plug from outside into the Centre Electrical Bay. I had to remove the plastic Trap Door supplied by Berkshire and have it sitting

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<sup>11</sup> This is also why many power posts only have a circuit breaker for 50 Amps, but not for 30 or 15. The 30- and 15-Amp power sources are only 120V and do not use the neutral wire to get the 220V down to 120V. For them, an Open Neutral would simply mean that they are not getting power. On a 220V system, an Open Neutral is dangerous because it does distribute high voltage.

<sup>12</sup> This is a pleasant convenience. The standard Berkshire Power Cord setup has the Cord stored in the Electrical Bay. The user has to thread enough cord through the trap door to get to the power post, which is tedious. When the cord is stored outside the Electrical Bay, the user only has to feed enough power cord (about 1 foot) from the outside to connect inside. And, that connection is inside the Coach, which makes it hard for someone to steal the cord.



loosely in the Bay to get a sufficiently large opening. The Female plugs that I got from Camco for splicing the original cord are too wide to fit through this hole even with the Trap Door removed, so I must use a separate Extension Cord that I bought as my main power cord. The original Berkshire cord becomes the auxiliary Extension Cord.<sup>13</sup>

**The Generator has priority over Shore Power and Inverter.** If the Generator is running and you connect to Shore Power, the Coach will receive its power from the Generator and not Shore Power.

### ***Cord and Hose Lengths***

There are extensions for cords and hoses:

- 50 Amp power cord is 30 feet (built-in) and will extend to the rear of the Acura Toad. It was originally an extension cord.
- 50 Amp extension is 23 feet. It was the original Berkshire power cord, but turned into an extension cord when the Hughes Autoformer was installed.
- Fresh water hoses: 10', 25' (x2) and 50' (x2).
- Sewer hose plus extension will reach to front wheel of Toad.

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<sup>13</sup> If you don't have an Extension Cord with a small 50A male plug, you could modify the Camco or other brands of 50A male plug by cutting off the hand-grip or finger-grip rings that these plugs have. These are what make the plugs too big to fit through the hole.

## Connecting to Water

### **Water Filters**

I have installed a standard Camco Pur Water Filter in the Water Bay to replace the unreliable and expensive Forest River FR1 filter that came with the Coach. In addition, I have another Camco Pur Water Filter that can be used at the water tap. Both use standard 10" filter cartridges from Lowes, Canadian Tire, Camping World and other suppliers. There are a variety of filter choices and prices.

Normally, I install a 1 Micron filter on the water supply tap. It removes sediment and nothing else. Thus, it passes through any chlorine in the water supply, which can help keep the Fresh Water Tank from developing fungus. The 1 Micron filter is very fine, but gives adequate water flow for showers and laundry.

For the Water Bay filter, I install an activated charcoal filter that removes chlorine and odours just before it is delivered to the Coach Faucets and Ice Maker. I also carry specialized 10" Watts and Rainfresh water filters that I can use if the campground has problems with heavy metals or other contaminants.

The filters that I typically use are Envirogard Rainfresh or Watts filters:<sup>14</sup>

- Rainfresh HP1 sediment filter (1 micron) is my standard first filter, installed at the campground water tap. NSF/ANSI 61 standard.
- Rainfresh CF2 Chlorine, Taste and Odour Filter (5 micron carbon block) is my standard second filter, installed in the Coach. NSF/ANSI 42, 53 standard.
- Rainfresh VC1 Chemical & Chlorine Reduction Filter is a 1 micron filter, so I don't usually use it, given that I have already used a 1 micron sediment filter. If I have concerns about volatile organic compound (VOC) chemical contamination of the water, I will use it. NSF/ANSI 53 and 42.
- Rainfresh LR1 Lead, Chemical and Chlorine (1 micron carbon block), used if there is a suspicion of lead in the water supply. NSF/ANSI 53, 42 B483.1.

These filters will all remove Giardia cysts.<sup>15</sup>

None of these filters will remove enough bacteria to make water safe to drink if there is a "Boil Water Advisory". If there are minor worries about bacteria, putting a small amount of chlorine bleach in the Water Tank and running off the Water Tank is likely safe. Otherwise, a re-

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<sup>14</sup> I find it convenient to use the Rainfresh brand because of their price and technology. But, it is a Canadian company, and I have had trouble finding their products in some US stores. So, I travel with an inventory of their products.

<sup>15</sup> The NSF/ANSI testing system of standards is discussed in greater detail at <http://www.nsf.org/consumer-resources/water-quality/water-filters-testing-treatment>

verse osmosis or ultraviolet disinfection system is needed. Or, as they say, boil the water.<sup>16</sup>

The Camco Water Filter O-ring gaskets need to be lubricated with silicone grease from the plumbing department of a hardware store. Do not use Plumber's Grease (unless it is silicone) or Vaseline to lubricate the O-rings, because they damage the O-ring rubber. The O-rings can be purchased as "APEC Water Systems 3.5 in. O.D. O-Ring Set (3-Pack) for 10 in. Standard Reverse Osmosis Filter Housings" from Home Depot. Camco does not sell them directly, but they have shipped them to me, gratis, in the past. It is the size of the O-rings that is important, rather than the name of the filter.

***If the Campground has Water Service at the Site***

Open the tap to flush the water. Attach the Water Pressure Gauge (stored in Water Bay) to the tap to check the Pressure. If the pressure is above 60 psi, install the Pressure Reducer with its own pressure gauge to the water tap. It is also stored in the Water Bay.

Install the blue external Camco filter (described above and which is stored in the Water Bay) on the tap. Run a white potable water hose into the RV City Supply in the Water Bay.

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<sup>16</sup> If you have put such unsafe water in your Fresh Water Tank, you need to disinfect with bleach before using it with other water sources.

## Electric Power Circuits

### ***Magnum AC/DC Inverter Charger***

The Coach has two electrical systems: Household 120 VAC and Battery-powered 12 VDC. The 12 VDC system has a House Battery and a Chassis Battery, which we discuss later. Most of our discussion involves the House Battery system.

The major connection between the AC and House Battery systems is the Magnum ME2012 AC/DC Inverter Charger, which is located in the Centre Electrical Bay on the Driver Side. User control of the system is done at the Magnum ME-RC panel inside the Coach. It is behind a little door below the Dometic Thermostat.

The Magnum unit is often just called the Inverter because it converts 12 VDC House Battery Power to some "Essential Household" 120 VAC circuits.<sup>17</sup> But, it also charges the House Batteries, and through the Auxiliary Start Circuit, it also charges the Chassis Batteries.<sup>18</sup>

The functions of the Magnum Inverter is discussed in several parts of this document.

### ***120 VAC Household Power Circuits***

There are some "Essential Household Alternating Current (AC) Circuits" that receive their power through a special 30 Amp sub panel that has two Circuit Breakers.

One Circuit Breaker is on the Main Electrical Panel (Power Control System) below the foot of the Bed, which is supplied by Precision Controls Inc. That Panel has three parts from left to right:

- Two 50 Amp circuit breakers for Shore Power
- Twelve slots for Air Conditioners, Engine Block Heater, Washer, Dryer and Inverter. The Inverter Circuit Breaker is rated at 30 Amps, and if it trips, the Inverter/Charger gets no power. Also, because of the pass-through feature described below, it prevents power from going to the Essential Household Circuits.
- Eight Slots for Essential Household Circuits:
  - Kitchen: Kitchen Plugs plus Plug in base of Dinette Seat
  - General Plugs: Bedroom, Living Room TV, and TV Accessories below Living Room TV

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<sup>17</sup> I have invented the term "Essential Household Circuits" to denote the 120 VAC circuits that can be powered by the Inverter. They also have their own part of the Electrical Panel and work as a group even when not powered by the Inverter, so I just call them "Essential Circuits".

<sup>18</sup> On the Driver Dashboard is a Switch marked "Aux Start". It temporarily connects the House Batteries with the Chassis Batteries for an emergency start of the Cummins Engine or the Onan Diesel if one of the Battery Systems is low. What is less known is that this Switch will periodically light up to indicate that the House Battery Charge System is also charging the Chassis Batteries.

- Bathroom: Bathroom and Plugs in Consoles beside Driver and Passenger, TV over the Front Window

- Refrigerator: Refrigerator and Outside TV

- Microwave: Microwave and the GFCI circuit I installed in the Main Storage Bay

- Note that these Essential Circuits can combine to draw more than the 30 Amps supplied to it through the Inverter pass-through, even when on Shore or Generator Power. This will trip one of those breakers, of course.

Some breakers take up two slots, so there are fewer than 12 circuits on the centre part of the Panel and fewer than 8 circuits on the right part of the Panel that supplies the Essential Circuits.

There are Ground Fault Interrupters (GFCIs) on many of these Panel circuit breakers, which can also open a circuit.

***Inverter has a 30 Amp Circuit Breaker That is Used Even on Shore Power***

There is a Circuit Breaker for the Essential Circuits on the Magnum Inverter (in the Central Electrical Bay on the Driver's Side of the Coach). It is labelled (Input CB3 30A). It is reset by pushing the round button.

*Note that this Circuit Breaker can be tripped even while on Shore or Generator*

*Power.* It can prevent the Essential Circuits from getting power even on these power sources, which one would normally not expect to be involved unless the Inverter is being used.

***Generator has a Circuit Breaker***

The Onan Generator has its own Circuit Breaker, which is on the Generator itself.

It is beside the Start-Stop switch on the Generator. Other ways of starting the Generator are from the Driver Dashboard and from the Auto Generator Start (AGS) system.

***Generator Supplies Pure Sine Wave but Inverter Supplies Stepped Sine***

The Onan Quiet Diesel (QD) 6000 Generator adjusts power delivery by speeding up and slowing down, so it can't directly deliver 60 cycle household power. Instead, it uses its own built-in inverter to convert the power to a constant 60 cycles and 120VAC. Onan says that this is a clean (pure) sine wave, so it provides safe power to any type of household appliance, including microwaves and mobile device chargers.

When running on Battery Power, the Magnum Inverter provides a stepped (or modified) sine wave, which is *not* "clean" power. Potentially, this can be damaging

to inductive loads<sup>19</sup>, such as the refrigerator and inexpensive chargers for mobile devices. (The vulnerable mobile chargers are light in weight.) However, our Whirlpool Refrigerator runs fine on the Inverter power. Our Whirlpool YWMH76718AS Microwave runs fine on the Inverter. The Jensen and LG TVs also run fine on the Inverter.

Most high-end electronic chargers for laptops, cell phones and tablets use a switching power supply, rather than simple transformers. These switching power supplies seem to be capable of handling the stepped sine wave from the Inverter. To be sure, put your hand on the power supply to see if it gets unusually hotter than it does when running on the Generator or Shore Power.<sup>20</sup>

Note that our *grey* Magnum Inverter supplies stepped sine wave power, but newer Coaches have the *white* Magnum

Inverter, and these generate pure sine power.

I might replace my grey Magnum Inverter some day with a pure sine model.<sup>21</sup> I'm hoping that waiting long enough will also give me a model with support for solar power and lithium-ion batteries.<sup>22</sup>

### ***Power Circuits That are Available Outside the Coach***

The Coach has a power circuit for the Engine Block Heater in the Central Electrical Bay on the Driver's Side. One can run an extension power cord down from there (through the Trap Door that is designed for the Shore Power Cord) to provide GFCI-protected power. It is only powered when the Generator or Shore Power are powering the Coach. It has no power when the Inverter is supplying Power.

I have installed a separate power plug beside the auxiliary propane outlet that is

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<sup>19</sup> Classic inductive loads are old-style alternating current (AC) electric motors and transformers. However, there are many modern devices that re-shape the power wave themselves before passing them on to a motor, which is often a stepper motor. These include direct-drive washing machines and microwaves that have their own inverters. Many electronic devices are now using switching power supplies that chop up the electricity into a very messy high-frequency non-sine waves before managing it with small transformers and filters. It seems likely that these modern devices don't mind dirty power since they create their own dirty power internally.

<sup>20</sup> There is a large debate about pure sine versus stepped sine in discussion forums regarding uninterruptible power supplies for desktop computers. Most desktop computers use a switching power supply, but some high-powered computers have a special variation of the standard switching power supply that apparently does not work well with a stepped sine source.

<sup>21</sup> Oscar van Loveren describes his replacement of the grey Magnum inverter with the white pure sine model on his blog at <https://dragonship.blog/inverter-upgrade/>.

<sup>22</sup> There are drop-in Lithium Iron Phosphate (LiFePo4) batteries that can replace our standard Lead-acid Golf Cart Batteries. They can operate with the Magnum Inverter-Chargers that are designed for Lead-acid batteries. High performance Lithium-Ion batteries, like those used in electric cars, laptop computers and mobile devices will not run on our Inverter-Charger systems.

in the Main Storage Bay (which is the one with the Sliding Tray) on the Passenger's Side. It runs off the Microwave Circuit and is GFCI protected. It supplies power even when running with the Inverter from the House Batteries. One can run an extension cord through the Trap Door designed for the Auxiliary Propane hose.<sup>23</sup>

**Heater Installed in Water Bay.** I have installed a blower heater in the Water Bay and a power cord for it is routed to this plug in the Main Storage Bay. You can plug it in on cold days to get underfloor heating in the Coach as well as augmenting the Heating Pad under the Fresh Water Tank that is powered by 12V, and switched from a point in the Coach beside the Magnum ME-RC. It is handy when you are on Shore Power and running from the Fresh Water Tank.

### ***Current Draw from 120v Circuits***

To help manage power and avoid tripping circuit breakers (particularly when on 30 Amp Shore Power and the circuit breaker is not accessible), Table 1 shows some current draws of our appliances:

Table 1

Item	Ohms	Amps at 125V
Electric Kettle	9.2	13.6
Black Floor Heater Lo	10.3	12.1
Black Floor Heater Hi	8.6	14.5
L'il Buddy 120V car warmer	15.2	8.2
Cummins Block Heater	20.3	6.2

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<sup>23</sup> I had to try three different GFCI units to get one that worked while on my stepped sine Inverter power, which I believe was a Leviton 6199-801. The ones that didn't work had indicator lights that indicated when they were functional and the indicator lights fluttered when on Inverter power. The Magnum ME2012 manual warns that this can be a problem and notes that it has successfully tested: ShockSentry™ #XGF15V-SP, LevitonSmartLock #8899-A and Hubbell #GF520EMBKA.

The electrical box from which I drew Microwave power also supplied power connections for other circuits that had separate breakers. In such a case, Magnum notes that the ground wires for these circuits should only be connected at one point (the main electrical panel) to avoid ground loops. While my Berk had these grounds connected separately, as required, the ground wires were uninsulated, so they could touch each other and form a ground loop. Putting some shrink wrap insulation on the ground wires in that box should solve that problem.

### ***Magnum Inverter Operating Parameters Set by ME-RC Control Panel***

The ME-RC Control Panel is in the Coach behind a little door below the Thermostat. I will only describe some of the main functions, and will leave the reader to find more details in the manuals for it and for the Generator.<sup>24</sup>

There are Buttons to Turn the Charger On or Off and the Inverter On or Off.

For the remaining buttons, you use them by pressing the button, then rotating the Knob to the right to scroll through menus. Pressing the Knob enacts a menu item and sometimes allows for a scrolling sub-menu.

The *Shore* Power button allows you to set the maximum amperage that can be obtained on Shore Power. If the Coach is

drawing power near that maximum, it will start to reduce the Magnum charge rate.

The AGS button for the Automatic Generator Start is discussed in the next Section.

The *Meter* button allows the Display to show what the Inverter is doing: Charging, Inverting, DC voltages, DC amperages. If you are deep in the menu system of one of the other buttons and want to exit without accidentally changing a setting, press the Meter button to get the standard display on the Control Panel.

The *Setup* button has the following menus and functions:

01 Search Watts allows for the Inverter to go to sleep and conserve Battery power if it can't find a power draw greater



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<sup>24</sup> Hard copies of the manuals are with the Coach documentation package supplied by Forest River. Electronic copies are available: [http://magnumenergy.com/wp-content/uploads/2012/08/64-0002-Rev-B-ME-Series\\_Web.pdf](http://magnumenergy.com/wp-content/uploads/2012/08/64-0002-Rev-B-ME-Series_Web.pdf) and ME-RC Web Rev-G.pdf. If looking for Magnum manuals on the web, note that they are now a division of Sensata and that may change come file locations.



than the wattage set. Setting the Watts to 0 prevents the Inverter from sleeping.

02 LowBattCutOut sets the Low Battery Cut Out (LBCO) voltage, below which the Inverter will shut off to protect the House Batteries from excessive discharge. The default of 10.0 Volts is fine, unless you've read the manual and find some reason to change it.

03 Absorb Time is a technical item that can be left at the default 90 minutes for our Coach, because it has 4 Golf Cart (GC) House Batteries with a 440 Amp-Hour capacity. The Absorb Stage is the second stage of battery charging and it controls the voltage being supplied to the House Batteries. At the end of the Absorb Time, the Charger switches to a finishing Float Stage.

04 Battery Type is should be left at the default of "Flooded", which is the type of lead-acid battery in our Coach.

05 Charge Rate is a poorly documented menu item that sets the Charge Rate for the initial Bulk Charge Stage. The problem is that it is listed as a percentage, but most users would expect an amperage, since the Bulk Stage controls the rate of current flow (amperage) to the Batteries. It turns out that the number is the Bulk Charge amperage as a percent of the maximum charge capacity of the Magnum Inverter/Charger. The Name Plate of our ME 2012 specifies a maxi-

mum charge rate of 100 ADC (Amps DC), but in fact the percentage is based on a maximum rate of 104 ADC in our Coach.

Thus, setting the Charge Rate to the default rate of 80% gives an 83 Amp Bulk Charge rate. This 83 Amps is about 20% of the House Battery capacity (per hour). It is sometimes called a C/5 or C5 rate because 5 hours at this rate would fully charge the Batteries.<sup>25</sup> Such a high Charge Rate does allow for a quicker charge of the House Batteries, which is an issue if the campground wants you to limit Generator Time. If you have more time, you can extend the Battery life by using a lower charge rate of 60%, which gives 63 Amps.

Some people recommend a very conservative C10 rate, which would require setting the Charge rate to 40%.

06 VAC Dropout is rather complex. The default is 80 VAC, and it refers to the voltage from the Shore Power connection that is being passed through the Magnum to its "Essential Circuits". If the voltage drops below this level, the Magnum's Internal Transfer Switch will disconnect the Shore Power and start Inverting.

07 Power Save has nothing to do with the operation of the Inverter/Charger. It simply determines how long the ME-RC display will be lit before being dimmed. If the display is dimmed, pressing the large round Knob will wake it up.

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<sup>25</sup> This holds only in theory. In fact, charging at the C5 rate for 5 hours would boil the batteries dry. The Magnum switches from the amperage-based Bulk charging stage to the voltage-based Absorb charging stage when the Battery voltage rises to the Absorb Voltage for lead-acid batteries, which is 14.6 Volts.

08 Screen Setup controls the brightness and contrast of the ME-RC display.

09 Final Charge sets the mode for the Final Charge of the Batteries, when the Absorb Charge Stage is complete. The default of "Multi" is good.

10 Pwr Up Always is not important in our Coach. It determines whether the Inverter will become available as soon as DC Battery power is supplied to the Magnum Inverter, or whether you need to press the Invert Button to enable inverting. Our Magnum is hard-wired to the House Batteries (through a large fuse) and is not turned off when the Round House Battery Control Knob is turned off. Thus, the Batteries are always supplying power to the Magnum, except when they are being changed out.

The *Tech* button displays technical information and doesn't control any settings. It can provide useful diagnostics.

### ***Automatic Generator Start (AGS)***

The AGS system initially seems to have limited functionality, but the ideas below help in using it. It is operated by the Magnum ME-RC Control Panel and an AGS-N unit in the Centre Electrical Bay. For more details, see the ME-RC Manual. The Generator can auto-start on the following conditions:

- Start Temperature to automatically run the Air Conditioners (AC). The Start Temperature is in coarse 5°F increments. To use this, set the Thermostat to start the Air Conditioner at a temperature that is slightly *higher* than the AGM autostart temperature. When the

Coach temperature reaches the Thermostat program temperature, it will attempt to start the AC, but will fail because battery power isn't strong enough. (Actually, it is because the Air Conditioners are not on the Essential Circuits powered by the Inverter.) This means that the Dometic Thermostat will throw an E7 "fault" code. However, when the temperature rises even further to the point where the Generator starts, the Dometic Thermostat will clear the E7 code and start the AC unit automatically, as desired.

- The AGS can also be set to start on an external command, and for that we need to install a special connection to the Air Conditioners. We don't have them yet.
- Start Volts. Set this for something like 12.1 or 12.2 volts to be able to charge the batteries when the voltage falls below this threshold.

### ***Setting RV Mode for the AGS***

Make sure the AGS of the ME-RC is in RV mode so that it can be stopped at the Driver's Console when desired. Go to AGS > 08 AGS TECH > Status > AGS Mode=RV, rather than AGS Mode = Other.

### ***Setting Quiet Time for the AGS***

The AGS unit has a Quiet Time setting on the ME-RC Control Panel, under the AGS button.

To get the Quiet Time feature, use the first menu item "01 AGS Control" under the AGS button and set it to "Enable with

QT". This will put you into a setting where you must enter the current time of day, even if you have set the time of day elsewhere on the ME-RC. Be careful to set the time correctly as well as the AM/PM setting. If you get the AM/PM setting wrong, the Generator will start in the middle of the night.

You also need to go to menu "07 Quiet Time" to set the time interval when you don't want the Generator to auto-start. It allows for a variety of pre-set Quiet Time intervals of lengths 9, 10, 11 and 12 hours. If you can't find an interval with your desired stop and start time, consider the desired length of quiet time, select one of their pre-set intervals with this length and reset the ME-RC clock so that this interval starts at your desired time.<sup>26</sup>

### ***Setting the Generator Run Time***

You can also set the run time, which determines how long the Generator will run after it has been started by the AGS. For example, if the AGS started on a temperature or voltage condition, and that situation subsequently elapses, the Generator will continue to run until the Run Time is finished.<sup>27</sup>

A setting of 4 hours and 80% Bulk Charge rate will almost fully charge the 4 Golf Cart House Batteries if they start at 12.1 volts. The initial charge is a Bulk

Charge, followed by an Absorb Charge. Once these get the House Batteries charged, the system goes to Float Charge to maintain the charge.

The Generator Run Time setting only works for situations where the Generator started under AGS conditions. If you manually start the Generator at the Dashboard or at the Generator itself, you need to turn the Generator off manually.

### ***Sound Level from Onan Quiet Diesel***

Inside the Coach, the Onan Quiet Diesel Generator has about 70 dB of noise. As one moves towards an adjacent campground, this drops to 60 dB. The ambient sound from walking through a calm campsite is approximately 50 dB.

Onan says that the Quiet Diesel generates sound below the allowable levels set by the US National Park Service.

### ***Camco Gen-Turi Exhaust System on Generator***

I have a Camco Gen-Turi Exhaust System that I can install when parked at campgrounds. It directs the Generator exhaust up above the roof of the Coach. This keeps Diesel smells away from campers, particularly tenters. The Kubota diesel engine in the Onan Generator does not have the pollution control systems of the Cummins Diesel, and it emits

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<sup>26</sup> This is pretty convoluted. It would have been much simpler if Magnum set this in two stages: the start time of the Quiet interval and the end time of the Quiet interval. Perhaps they couldn't go into a deeper sub-menu to accomplish this, so you get to do a bunch of mental arithmetic.

<sup>27</sup> If the Generator has auto-started and you need more run time, you can change this run time while it is running. This is handy if you start the laundry washer and realize that you will need more Generator time to finish.

blue smoke at startup and often has a slight diesel smell when running.

The Camco Gen-Turi equipment is stored in a black bag in the Sliding Tray of the Main Storage Compartment. To install it:

- Remove the D-ring and Chrome Finisher from the Generator Exhaust Pipe. The Pipe is below the Driver's Side Window.
- Use the same D-ring to attach the Exhaust Adapter to the Exhaust Pipe. You might have to rotate it 180° to get it right.
- Use the other D-ring to attach the bottom of the first (curved) Leg of the Camco Gen-Turi.
- Attach the rubber straps at the top of this first Leg to the loops on the body work below the Driver's Side Window.
- Assemble the other two Legs of the Camco Gen-Turi, making sure that the end with the padding is on top.
- Insert these legs into the top of the first Camco Gen-Turi Leg.
- Take two rubber straps onto the Roof of the Coach and tie the top Leg of the Camco Gen-Turi to the rings that are installed in the roof.
- Reverse the steps to remove the Camco Gen-Turi.<sup>28</sup>

### ***Offer Electric Power to Other Campers***

Here is a nice gesture to your fellow campers that makes them feel good about the Generator. Run an extension power cord from the Block Heater Outlet in the Centre Electrical Bay out to some place where other campers can use it. This Outlet is only live when the Generator is running (or you are on Shore Power). You can tell them they can charge their mobile devices with this power while the Generator is running.

This can turn the potential negative of a Generator running into a positive for other Campers.

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<sup>28</sup> I have made some modifications to the commercially available Camco Gen-Turi, so these instructions won't work unless you have made my simple modifications. The original directions say nothing about removing the chrome exhaust finisher, but this is needed to be able to use their adaptor on my Onan Generator. To simplify this, I drilled a hole for the D-ring, of which one was supplied in the Camco Gen-Turi kit. Also, I glued some rubber padding with Silicon caulking compound to the top of the final Gen-Turi piece so that I could attach some rubber straps to pull it against the Coach body. This makes the installation more stable in windy conditions.

## Battery Power

### Two Battery Systems

The Coach has two 12 VDC battery systems. One is the Chassis Battery system, which is located in the rear-most Electrical Bay on the Driver Side of the Coach. The other is the House Battery system, which is located in the third from rear Electrical Bay on the Driver Side of the Coach.

The Chassis Battery system is used to start the Cummins Engine and is directly charged by that Engine. These batteries are designed to deliver a high current for a short time. There are two 12 VDC Chassis batteries connected in parallel.

The House Battery system is used to provide lighting, water pumps and a conversion system through the Magnum Inverter to provide 120 VAC household power. It is designed to deliver power over lengthy periods (deep discharge). The House Batteries are a series-parallel

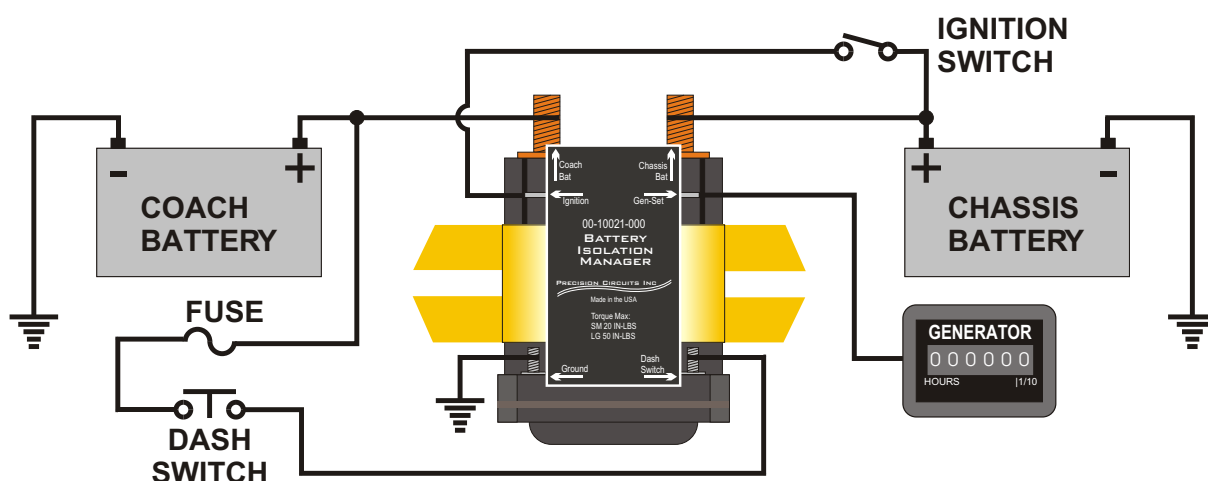
combination of 4 Golf Cart Batteries that produce 12 VDC.

### Battery Isolation Manager (BIM)

The two battery systems are basically isolated from each other to make sure that there will be sufficient power to start the Engine after a long period of camping. Also, deep discharging of a Chassis Battery will shorten its life.

However, the Battery Isolation Manager (BIM) in the House Battery Bay provides a connection between the two systems that allows for an emergency start of either the Cummins Engine or the Onan Generator from the other's battery system. This is enabled by pressing the Aux Start button on the Dashboard while starting either the Cummins Engine or the Onan Generator.

The BIM also allows a primary charge to one battery system to bleed to the other system. Running down the highway with the Cummins engine offering a primary charge to the Chassis Batteries will also charge the House Batteries through



the BIM. Running the Onan Generator or the Magnum Inverter/Charger on Shore Power to charge the House Batteries will also top up the Chassis Batteries through the BIM.

When the BIM is bleeding a charge between the House and Chassis Batteries, the light on the the Dashboard Aux Start switch will momentarily light up.<sup>29</sup>

### **Solar Charging**

Starting in the winter of 2015-16, I installed 2 x 100 Watt GoPower Flexible Solar Panels on the roof and have them connected to a Zodre Solarmate MPPT Charge Controller in the Middle Electrical Bay. The Charger is connected directly to the House Batteries, even if the Battery Disconnect Switch in the Battery Bay is off.

In the same Middle Electrical Bay I have installed a Xantrex control unit above and to the left of the Magnum Inverter/Charger unit. It has wires to the House Battery Bay (to the left), where it is hooked to the House Batteries (at the positive terminal) and the Chassis Batteries at the Emergency Start Relay where there is a heavy duty connection to the Chassis Batteries.<sup>30</sup>

I have wired the Solar panels so that they will charge the House and Chassis

Batteries even if their large Rotary Knob Switches are off.

The Solarmate controller has a rotary control switch that is turned by a flat-bladed screw driver. Unfortunately, it is



hard to determine which end of the slot is pointing to the desired number. The Solarmate manual says the default Switch setting is 7, which is a Deep Cycle Lead Acid Battery with a Float Voltage of 13.4V and a Bulk

(really Absorb?) voltage of 14.6V. I found that this setting boiled water out of the batteries in a Tucson 3-month winter storage. So, I have gone to Switch Position 6, which is ostensibly for sealed car batteries with PCCa-lead calcium chemistry. For this, the Float Voltage is 13.2V and the Bulk (really Absorb?) voltage is 14.3V. With this setting, I find that the Controller will stop charging on a sunny day if the batteries are fully charged, so I believe that it is suitable for storage in Tucson. However, when the batteries are discharged and it is sunny, the batteries are getting charged.

<sup>29</sup> The manual for the BIM is available at <http://www.PrecisionCircuitsInc.com>. I am grateful to a Forest River Berkshire Forum member using the handle GoneSouth for the link to the detailed description of how the BIM works.

<sup>30</sup> I have since learned that the BIM may provide all the functionality of the Xantrex unit that I need. I will test this and disconnect the Xantrex unit if this proves to be correct

In a Calgary Winter (51° Latitude), this provides enough trickle charge to keep the batteries up, as long as I clear snow off of the Solar Panels. This is useful, since there are often long cold periods when I don't want to start the Generator.

### ***Fuse Locations***

There are 12VDC fuses located throughout the Coach, often near the component that is fused.

There is a Fuse Bay outside the Coach just below the Driver's Side Window. It contains fuses for Chassis, Ignition/ACC and Coach. The first two fuse panels are powered by the Chassis Batteries and the last is powered by the House Batteries.

On the left side of that Bay (toward the front of the Coach) is a Freightliner Fuse Panel.

On the right side of that Bay is a group of Circuit Breakers for the Slides and Levelling Jacks.

In the Middle Electrical Bay, I have an Inline Fuse on the wire coming from the Solar Panels to the MPPT Charge Controller. This allows an easy way to disconnect the Solar Panels. I also have an Inline Fuse on the wire supplying battery power to the Coach from the MPPT Controller. It can be removed and replaced by a shunt to measure the current being delivered by the charge system.

### ***Parasitic Drain on House Batteries***

There can be a large parasitic drain on the House Batteries. For example, the TVs and TV Accessories below the Living Room TV draw approximately 3A from

the batteries through the Magnum Inverter, when they are in standby mode. This is 72 Amp-hours per day, which is approximately one third of the useable House Battery capacity of 200 Amp-hours. This is slightly less than the capacity used by the Refrigerator over the course of a day. A quick way to eliminate this parasitic draw is to turn off the "General Plugs" Circuit Breaker in the Panel at the foot of the Bed.

To stop all the parasitic drains on the House Batteries, you need to turn off the large Knob in the House Battery Bay and *also* turn off the Inverter at the ME-RC panel inside the Coach. If you want to run the Refrigerator while stored, leave the Inverter on but turn off the Circuit Breakers below the Bed to all the other circuits. This is discussed in the Storage section.

### ***Parasitic Drain on Chassis Batteries***

The Chassis Batteries have a parasitic drain that can be stopped by turning off the large Knob in the Chassis Battery Bay.

One parasitic drain is to maintain the Clock setting in the LCBU on the Dashboard. It is not crucial to lose this setting.

Another parasitic drain is the "Constant +12V" wire under the Dashboard cover. Currently, it is used to power the Dashboard Radio.

### ***Using Electricity in Storage***

There is more discussion of using the Generator in storage at Storing RV with Refrigerator On and No Shore Power.

## **Boondocking: Without Water**

### ***Water Pump and Heater***

When Boondocking, you need to run from water in the Fresh Water Tank.

There are two switches that provide power to the Water Pump. One is in the Water Bay and the other is in the Coach beside all the controls for the ME-RC and Thermostat. Flipping either switch reverses the on-off setting of the other switch, just like a two-way switch in a house.

There is a 12V UltraHeat Tank Heater switch in the Coach beside the Water Pump Switch. Flipping the Switch turns a red indicator light on. This only enables the Tank Heater Pad below the Fresh Water Tank. It comes on if the Tank temperature falls below 44°F (7°C). When the temperature rises to 64°F (18°C), it shuts off.

*If you have no water in the Fresh Water Tank, you should turn the Tank Heater off to avoid the risk of melting the plastic tank. I've made this mistake and not melted the tank, but it sure worried me.*

It is sometimes hard to be sure that the Tank Heater is actually heating the tank, since the Indicator Light will be on even if the Heater is not supplying heat. A quick check is to watch the current draw shown on the ME-RC Panel while on shore power and charging the Batteries. Switching the Tank Heat between On and Off will show a noticeable change in the current draw if it is working.

I have also installed a Fan Heater in the Water Bay that runs off of 120VAC. The plug for it is in the Main Storage Bay, beside the Propane Outlet.

### ***Dry Camping Water Strategies***

Fill the Fresh Water Tank Fill with the RV set to be level or high on the Passenger side. Use the blue Camco Filter on the campground fill tap to remove any sediment. If you want to get a complete fill, put a Ball Valve hose shutoff between the fill hose and the Coach's Fill Tank connection. Once filled, close the Ball Valve before disconnecting the hose. This prevents air from coming into the tank while driving to your campsite. This air can allow the tank to empty via the overflow tube. Simply putting the plastic cap on the Fill Cover is not sufficient, as it does not engage the inlet sealing gasket and lets air leak into the Tank. When air can flow into the Tank, water can come out of the Overflow Tube.

Many campsites have a nearby water tap for refilling the Tank without having to drive to a fill station. It is convenient if these water taps have a threaded end for a hose. But, especially in Ontario, these taps often do not have a thread. For such sites, there is a blue rubber Water Thief adaptor in the Water Bay. Place it over the tap and connect the hose to it for filling. You can use a hose clamp to tighten the rubber onto the tap. I have hose clamps stored in the Tool Bay on the Passenger Side, just behind the Right Front Wheel.



Note that the Grey Water plus the Black Water tanks will hold a total of 104 gallons, while the Fresh Water tank only holds 84 gallons. This means that the Fresh Water tank can be refilled to create some waste water without overflowing the waste water tanks. Obviously, some care is advisable.

When dry camping, you should pay attention to the LED Water Gauges behind the little door below the Thermostat. The Black Water Gauge often reads full or partly full, even when that Tank is far from full. You can check the Black Water level by turning off the water pressure (or turning off the Water Pump) and looking into the toilet with a flashlight. (If you don't turn off the water, pressing the Toilet Dump Valve turns on the flush water and you can't see the level in the tank.)

In practical usage, the Grey Water tank fills before the Black Water tank, so it is useful to wash the dishes in a plastic pan. Then you can dump waste water down the Toilet. It is a good idea to add Borax or Calgon Water Softener to the dishwasher before dumping, as this will soften the water. It will work with the dish soap to keep the Black Tank Sensors clean. This is a variant of the GEO method of cleaning the sensors.

When the Grey Water tank is full, it will back up at the bottom of the shower, which causes no harm. But, this is a good

sign to stop adding waste water to the Tank.

**Thermostatic Shower Valve Saves Water.** To conserve water when showering, run the water until it is warm and then put water on your hair. Shut off the water valve and lather in the hair shampoo. Turn on the water to rinse off the shampoo and get water on your body. Shut off the shower water and lather your body. Finally turn on the water to rinse your body. The Delta Shower Head that I installed in our Berk has a maximum flow of 2.5 gallons per minute, but will work on a lower water flow. I have installed a Delta TempAssure Thermostatic Shower Valve on our Berk, which means that the balance of hot and cold water is automatically adjusted to keep a constant shower temperature.<sup>31</sup> This makes it possible to turn off the water Valve while lathering, and still get water at the proper temperature when the Valve is opened again.

A good strategy is to have people shower one after another so that water is not wasted while running the water to get hot water to the shower. Similarly, you can turn on the hot water in the Kitchen sink to fill a kettle to heat and create warm washing water. This means that the rinse water from the tap can be warm.

**The Washing Machine** adds a lot of water to the Grey Water tank, so it is best to avoid using it when dry camping. If you

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<sup>31</sup> Note that a Thermostatic valve is superior to and more expensive than the more common Pressure-Balanced shower valves. The latter only control the balance of hot and cold water lines, but do not adjust for the temperature of the water. They are of no help in a dry camping situation.

are about to leave a dry camping site and see that you have extra Grey Waste water capacity, you can run a load in the wash just before you leave.

**How Long Can You Dry Camp?** In practice, dry camping for 3-4 days with three people is possible, if they are careful with water usage. Indeed, 3 of us men have dry camped for 5 nights, taking 15 showers and cleaning breakfast dishes 5 times, while at the Montreal Grand Prix. Lunch and dinner were eaten in restaurants.

**Enhancements to Useable Tank Capacity.** I have revised the Fresh Water Pickup so that the Water Pump pulls from the bottom of the Tank. This adds approximately 20% to the useable capacity of the Tank.

In addition, I have installed an anti-siphon feature on the Tank water overflow, which allows you to fill the tank to the top without it siphoning down to the level of the overflow outlet, which is well below the top of the tank.

When you get near the bottom of the Fresh Water tank, you can use the Leveling Jacks to tilt the RV slightly toward the Passenger Side, since the Water Pickup is on that Side.

### ***The Girard Gen II Tankless Water Heater***

The subject of Tankless On-Demand Water Heaters is one of the most heated (pun intended) topics in RV discussion forums.

We have a Girard Gen II Tankless Water Heater (Model GSWH-1M) and it works well.

Other people aren't so lucky and have gone to the expense of installing other systems, including systems with a water tank or a pre-heater.

There are two advantages of a Tankless Water Heater. They are inherently more efficient, because they only heat the water when it is needed.<sup>32</sup> They will provide endless hot water for people who like long, hot showers, since they don't rely on a finite reserve of hot water in the tank.

The Girard Gen II has a Temperature Control in the Bathroom Medicine Cabinet. Set the Control higher if the incoming water is cold and lower if the incoming water is warm. This Control sets the intensity of the flame. If the flame gets too hot, the Water Heater will shut down, so it is not wise to set the Control too high when ambient temperatures are warm.

The Water Heater is behind a Louvered Panel outside at the back of the

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<sup>32</sup> The Girard Gen II also gains efficiency from its Induced Exhaust Draft design. Old-style heaters keep the exhaust hot so that they can get a chimney effect to draw the exhaust gases out of the heater. The Induced Draft system has a blower to push the exhaust gases out. This allows the heater design to extract more heat from the flame because it does not need a chimney effect. It also means that the Heater generates significant noise when operating, unfortunately. If you get up in the middle of the night to use the washroom, don't use the hot water tap, to avoid waking your partner.

Coach on the Passenger Side. There is a white Reset Button on the Water Heater that you may need to press to restart the Heater. The white Button is at the centre of a circular white mounting to which is connected a blue push-on electrical connector. The Button is on the left side of the Heater assembly, towards the rear. You can also observe the flame to see how well the Heater is working.

There is an On-Off switch on the Heater assembly. It is wise to turn off the Water Heater if you are storing the Coach with no water in the Heater. The pipes could be damaged if the flame comes on when there is no water in the pipes.

Take care in replacing the Louvered Panel to make sure that the pins on the bottom are seated properly and that the Heater exhaust is properly centred in its hole in the panel.

## **Boondocking: Without Shore Power**

### ***Solar, Battery and Generator Power***

As discussed in detail below, there is up to 200 Watts of Solar Power available, but this is only a best-case scenario with direct Sun. Moreover, it is not clear that the system is generating full power without full Sun. Generally, the Solar Power is not good enough to run the Refrigerator for a day. It must be augmented by running the Generator, usually on a daily basis.

### ***Shedding Non-essential Loads***

There are some Non-Essential 120-VAC on the Essential Circuits powered by the Inverter. Here are some that can be shed by turning off circuit breakers:

- General Circuits will shut off about 3 Amps of Inverter DC parasitic power for the Living Room TV and TV Accessories, as well as the Bedroom
- Microwave will shut off the parasitic power for the Microwave clock, as well as any items such as Insect Zappers that are plugged into the Outlet that I installed in the Main Storage Bay.

Non-essential 12 VDC loads can be shed as follows:

- "Salesman Switch" that is lighted and beside the front door.
- Main Power Knob for the Chassis Batteries will shut off any parasitic items that run off the Chassis Batteries, such as the Clock in the LCBU and, with the default Berkshire wiring, the Constant +12V power to the Radio. It

will also stop the Steps from extending and retracting.

- Main Power Knob for the Coach Batteries will shut off all 12 VDC loads (lights, etc) powered by the Coach Batteries, except the Inverter, which has a direct connection to those Batteries. So, for example, you can run the Refrigerator off of the Inverter while the Coach Battery Knob is off.

### ***How Long Does the Generator Need to Run?***

Turning off the General Circuits, but leaving the Refrigerator Circuit on, draws 21 DC Inverter Amps for the Refrigerator (when running). The Refrigerator runs for 12 minutes every half hour, which is 40% of the time. Thus, one day of running the Refrigerator requires 201.6 AmpHours, which is almost half of the nominal 400-440 AmpHour capacity of the House Batteries. Indeed that amount is the full useable capacity of the House Batteries, if one wants to avoid damaging them.

If the Microwave Circuit is left on, it causes the Inverter to draw 3 Amps parasitic power for the Microwave Clock and Bug Zapper. That is 72 Amp Hours over a 24-hour period, so this circuit should be turned off unless the Bug Zapper is needed. Turning off the circuit means that the Microwave Clock must be reset whenever its Circuit Breaker is turned back on.

The default setting of the ME-RC for Bulk Charging is 80%, which gives an 83 Amp Bulk Charging rate. This is the initial charge rate for discharged batteries.

To get the 201.6 Amp Hours for the Refrigerator requires 2.4 Hours of Bulk Charging per day. Additionally, 0.9 Hours of Bulk Charging is needed for the Microwave, for a total of 3.3 Hours of Generator Run Time each day.

If we reduce the Bulk Charge setting to 60%, we get a 62 Amp Bulk Charge rate. This rate will extend the life of the House Batteries. At this reduced rate, the Refrigerator needs 3.25 Hours and the Microwave an extra 1.16 Hours, for a total of 4.4 Hours of Bulk Charge per day.

Note that when the Generator is running, the Refrigerator and the Microwave aren't running off of Battery power, so these are conservative estimates of the Generator time required.

## Thermostat, Heating and Cooling

Our Berk 34QS has two Air Conditioning units and a propane Furnace, which are controlled by a Dometic Comfort Control Centre (CCC) 2 Thermostat that is located on the interior wall opposite the Kitchen Sink.

**The only way to adjust the temperature is by programming the Thermostat.** There is no way to temporarily adjust the temperature, as in a typical house thermostat.

### Programming the Dometic Thermostat

**Turn on the Thermostat.** There is a push button power switch at the top left of the thermostat. Press it until the display lights up.

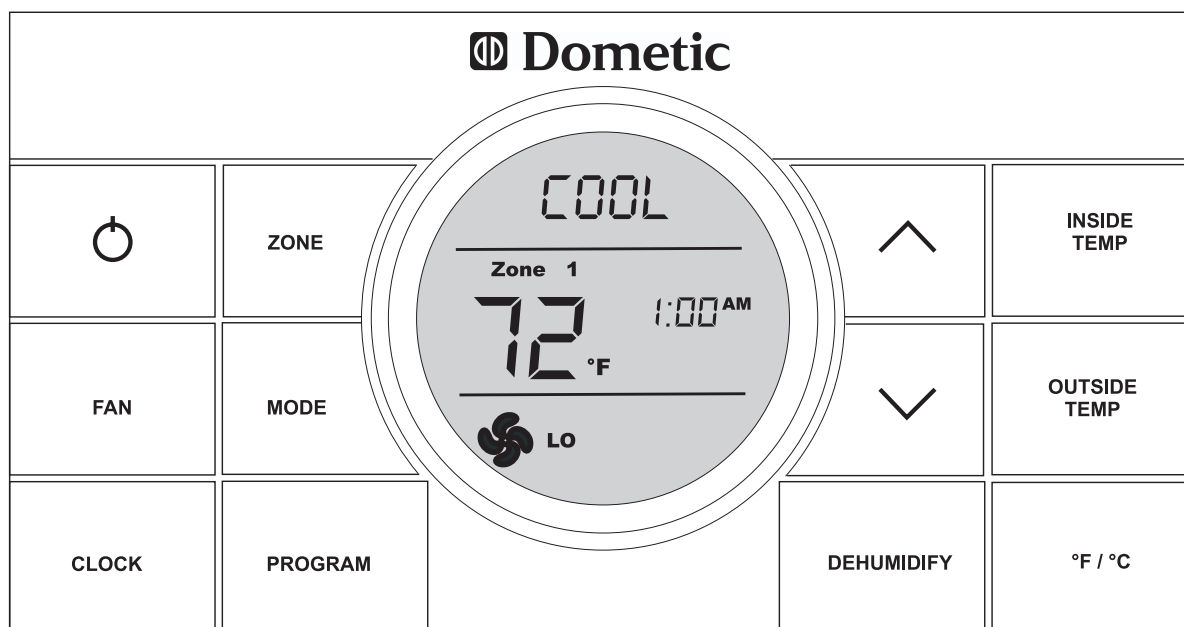
**Make sure the Thermostat Clock is set correctly.** If power has been disconnected from the heating system, such as in storage, the Thermostat will reset itself and the clock will not be set. *If the clock*

*is not set, the thermostat will not work, despite what other settings you have made, as described below.* To set the Clock, press the Clock button on the bottom left of the Thermostat and use the up-down arrows to the right of the display to adjust the Hours, Minutes and finally the AM/PM setting. Press the Clock button again to exit the menu.

If the Thermostat has been reset (eg power disconnected), you can just set the Clock and then just check whether the default settings are what you want. If they aren't, you must adjust them.

There are two Thermostat Zones.

**Zone 1** controls the Front Air Conditioner (AC), Heat Pump, and Furnace — you can only have one of these functioning at a time. The heat pump is noisy, so your choice is typically between AC and Furnace for Zone 1. **Zone 2** is the Bedroom Air Conditioner.



Note that both Air Conditioners are ducted to carry cool air to the each room, unless the slide on the AC unit cover is set to dump air just below the AC unit and nowhere else. For cooling, it is convenient to set the daytime cooling to be done by Zone 2, since you spend most time in Zone 1. Then, set the evening cooling to Zone 1 for quiet sleeping.

- Program each zone separately. Start by pressing the Zone button between the On-Off button and the Display to show the Zone that you want to program.
- Then, press the Program button that is between the Clock button and the Display. The Display will show a flashing PROG 1 or PROG 2, according to the time being programmed. PROG 1 is for the day and PROG 2 is for the night. First, you work with PROG 1.
- The Display clock should show the start time for the program (PROG 1 or 2), and you can adjust it so that it starts at your desired time. You can adjust the Clock setting to get the desired time by pressing Clock and using the Up/Down buttons and finally pressing Clock again to get out of the clock-setting mode.
- Next, press the Mode button until it shows the unit that you want to run in this program interval. If you set the Mode itself to Auto, it will switch between cooling and heating, but the heating will be by the Heat Pump. Normally, you want either OFF, FURN or COOL.

- As long as you are not in the mode to set the clock time for the program, you can press the Up/Down buttons to set the desired temperature for the program.
- Press the Fan button and set it to Auto for the AC and Furnace to work properly.
- Press the Program button to save the settings for PROG 1 (Day).
- Do the settings for PROG 2 as above and then press the Program button again to save both programs.
- At this point, the Thermostat will function for the Zone that you have set.
- Press the Zone button to program the second Zone by pressing the Program button again and proceeding as above.

Once you have done this, you have everything programmed. *To adjust the temperature settings for “Now”, just go to the appropriate Zone and then proceed to adjust the Program: PROG 1 first and PROG 2 next.*

**Thermostat Problems.** If the Thermostat doesn't seem to be acting correctly, try turning it off and then on. If it is showing an Error Code, you may need to read the Manual for the Thermostat. Code E7 just means that there wasn't enough power to start an AC unit. So, run the Generator or connect to suitable Shore Power to solve the problem.

**Resetting the Thermostat.** In more dire cases, you need to reset the Thermostat. Turn the Thermostat off and then simultaneously press the Mode and Zone

buttons until the display reads "Init". Press the On/Off button to turn on the Thermostat and re-program it.

### ***Operating the House Air Conditioners While Driving, with or without AGS***

On a really hot day, the Engine Air Conditioner is not sufficient to keep the motorhome cool while driving.

In preparation for such a day, program the Zone 1 and or 2 Air Conditioners to come on at a desired temperature. When disconnected from Shore Power, this will cause an E7 "fault" code to appear on the Dometic CCC thermostat control panel. But, this is no problem. When the driver determines that the Coach needs the extra cooling from the House Air Conditioners, he simply needs to turn on the generator at the dashboard with GEN START. This can be done while driving. When the Generator starts to supply AC current, the E7 codes will clear automatically, and the Thermostat will start to follow the set program and run the air conditioners. There is no need to stop and go back to re-program the Dometic CCC Thermostat while travelling.

### ***Cabin Air Filters***

Our Berk 34QS has several systems for circulating air inside:

- Dashboard air, which does not have any air filters
- Furnace air, which does not have any air filters
- Ceiling air conditioners, which have foam air filters behind the intake grille. They can be vacuumed and washed.



## Television and Sound Bar Systems

Elsewhere, we have described the Dashboard Radio system, which can be used while camping if the Dashboard Radio Switch is turned to on to provide power to that system. The Switch lights up when power is provided. In this section, we will discuss the other entertainment systems.

### Sound Bar

There is a sound bar below the main living room TV. Since the sound quality did not seem to improve upon the LG TV that I've installed, I only use it as a radio or Bluetooth receiver.

### Four Televisions

The Coach has four TV sets:

- Jensen TV outside on the Passenger side, behind a locked door that swings upward.
- Jensen TV in the Bedroom. It swings up to a storage space behind it.
- Jensen TV over the Cockpit.
- LG TV (Ultra High Definition) in the Living Room, which slides sideways to sit in the hallway for a better view.

The latter two TVs can be viewed from the Dining Table, with people sitting to face each other. It is convenient to have them on the same channel and the sound being provided by the LG TV.

The Jensen TVs all have 720P resolution and accept commands from any of the Jensen remote controls. The LG has its own remote. All 4 TVs get signals from the Antenna or Cable, as discussed below.

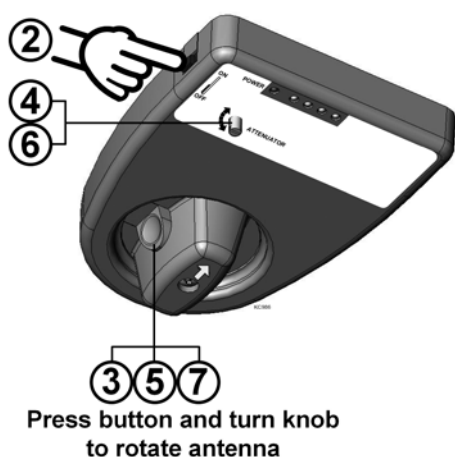
Below the Main TV is a Samsung Ultra High Def BluRay Player, which is directly connected to the LG UHD TV above it. There is also a Sony BluRay Player that feeds into an HDMI switch that accepts 4 inputs (the Sony BluRay and other optional inputs) and 4 outputs (the TVs). The operation of the switch is sufficiently convoluted that we usually just use the Samsung UHD BluRay with the LG UHD TV, or a direct HDMI connection to the LG from iPads or laptop computers.



### Television Antenna and Cable Connections

The Televisions can receive Cable or over-the-air (OTA) high-definition TV signals. To switch between the inputs, drop down the Panel below the Main Living Room TV to see the King Jack signal injector. It is already wired up, so you can ignore the TV connection jack on the front. The important thing is the Push Button beside the connection jack. Depressing the Button illuminates a green light to

indicate that the rooftop Antenna is powered. Depressing the Button again turns off the power to the rooftop Antenna and connects the Cable input to the TV system. The source for the Cable input is in the Middle Electrical Bay on the Driver Side of the Coach. It is a white coax connector plate beside the 50 Amp cables that connect to shore power. The campground needs to supply a cable signal and we have always found them to provide a simple standard-definition signal. But, they usually have more channels than are available locally OTA. To get high definition signals, you usually need to use the rooftop antenna, which we describe next.



### ***Adjusting the Rooftop Antenna***

The rooftop King Jack Antenna draws power from the King Jack signal injector, so you need to make sure the injector push button is depressed to give a green light, as discussed above.

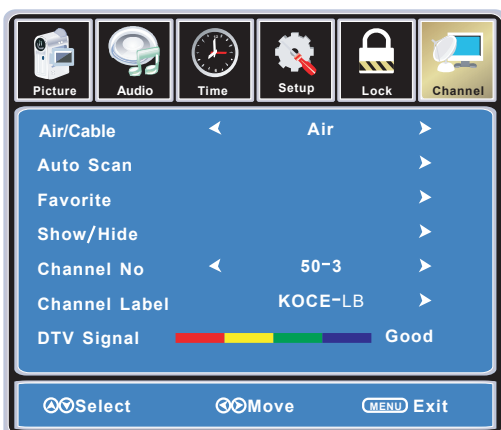
In the ceiling above the Driver Seat is a white unit for powering up the Antenna, adjusting the signal boost and aiming the Antenna.

Slide the power switch (2, on the side) to On, which will cause the blue power LED and signal strength indicators to light up. Rotate the Attenuator dial (4, 6) clockwise to get the maximum signal strength. While holding the locking knob, turn the Antenna to different positions (3, 5, 7) to get the maximum signal strength. If the same number of signal strength LEDs stay lit over a wide range of motion, turn the attenuator dial to the left until one of the LEDs starts to flicker. Now, adjust the antenna direction to get this LED to light up solidly.

This often gives you the best TV signal for all local stations. It is possible that you are in a location between two urban centres so that their signal antennas are in different directions. You may have to adjust the antenna to point to the station antenna that you desire.

## Setting the TVs to Learn Available Channels

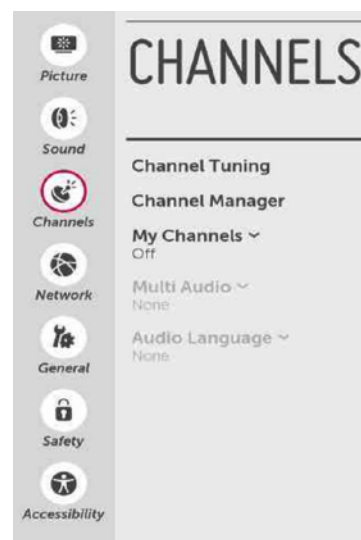
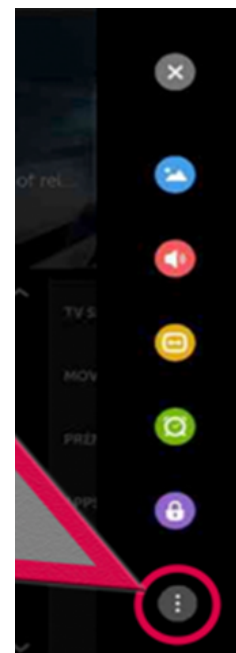
When going to a new campsite, the TVs must be set to learn the available channels through an automatic search procedure.



For the Jensen TVs, press the Menu button on the Remote Control. Scroll sideways to the Channel menu and switch between Air or Cable. Press Auto Scan and it will learn what channels are available.

For the LG TV

- Click the Home button on the remote (the icon looks like a home) to get a list of inputs, for which you select My Channels.
- Then, select the Menu Setting on the Remote. It looks like a gear.
- Scroll down to the Advanced Settings Menu, which is three vertical dots.
- Scroll to the Channels Menu.
- Select Channel Tuning and let the LG TV scan for channels.
- You are ready to go.



## **Leaving a Campsite**

### ***Closing the Slides***

Make sure that there isn't anything blocking the slides from coming in. Warn anybody standing outside that water may come off of the slide toppers if it has been raining. Retract the slides, one at a time and leave the switch depressed for one or two seconds, to allow the Slides to realign themselves.

### ***Retracting the Jacks***

Press the button on the Auto Level system beside the driver to Retract all Jacks. When the system reports that all the Jacks are retracted, start the Engine within two minutes, if it is not already running. This will run the Air Compressor. Shortly after the low air warning sound goes off, the Air Suspension system should inflate. You can check this by watching the Coach Body lift, relative to the Wheels. Normally, it is possible to insert a fist between the wheels and the bodywork when the Air Suspension Bags are properly inflated. If the Airbags do not inflate, set the Auto Level system to level the Coach again. After it is levelled, retract all the jacks.

Note that Equalizer Systems says the system needs air pressure to change the position of the Master Dump Valve after the Jacks are retracted. This change in the Master Dump Valve is required in order to allow the Air Suspension Bags to inflate. This can be accomplished by having the Engine running while the Jacks are retracted, or by starting the Engine

within two minutes after they are retracted to build air pressure.

While checking the Air Bags for inflation, you should also look under the Coach to make sure that none of the four Levelling Jacks is still extended. They are just behind the Wheels and have a chrome leg that can be seen when they are extended.

### ***Securing the Refrigerator Doors***

I have installed two Latches that can be rotated onto a Post at the side of the Refrigerator. They will keep the Doors from opening while travelling.

The same Latches have another setting that holds the Refrigerator Doors secure, but slightly open. This position is good for storage, since it lets the Refrigerator dry out and not get moldy.

### ***Disconnecting the Shore Power***

If the Shore Power circuit is a 50A circuit, switch off the circuit breaker at the campsite post. Then disconnect the SurgeGuard dog-bone and the RV power cord. This is necessary to protect against a potential momentary open neutral that can damage small electrical items while disconnecting. This problem does not arise with a 30A, 20A or 15A power connection because they are only 120V.

### ***Dumping Waste Water***

There is a Waste Hose for dumping in a Cubby Hole on the right of the Driver Side Water Bay. I also have the threaded connections for connecting it to a campground dump waste pipe. If there are no threads on the campground pipe, try to

put some weight (a rock or brick) on top of the Elbow of the Waste Hose, since it can pop out of place with the flow pressure of waste. I store an Extension Hose in a Tube mounted on the Wall of the Storage Bay that has the Sliding Tray. That Bay also contains Flexible Stands to prop the Hose up to improve drainage.

Our Berk has two Holding Tanks for waste water: Grey water (sinks, shower and laundry) and Black water (toilet). The Dump Valves are located in the Water Bay on the Driver Side. The Rear Valve is black and for black waste. The Forward Valve is grey and for grey waste.

There is a hose inlet for Tank Flush in the Water Bay and it flushes the Black Water Tank. There is an anti-siphon vacuum break located high behind the shower, so clear, clean water will run back out of this line when it is disconnected. The Tank Flush fills water into the Black Tank on the Passenger Side, so that it can move residual waste towards the Dump Valve on the Driver Side.

I have installed a series of pipes and valves to the Cold Water Drain on the Driver Side of the Coach. The first Valve in the sequence is the Top Feed Valve (as supplied by the Berkshire factory), which opens or closes the cold-water drain system. Below that, there is a T-connection that leads to two Valves. One,

the Lower Drain Valve, allows water to drain out below the Coach, which is the original purpose of the Drain. The other Valve feeds a pipe that goes to the Black Tank Flush inlet.<sup>33</sup>

Thus, to flush the Black Tank with fresh water from the Coach, close the Lower Drain Valve and open the Top Feed Valve and the Valve going to the Black Tank Flush inlet. This sprays the Black Tank.

When finished spraying the Black Tank, close the Top Feed Valve, open the Lower Drain Valve and open the Valve going to the Black Tank Flush Inlet. This allows the anti-siphon feature to drain the pipe feeding the Black Tank Flush. If it is not drained, it will contain fresh water that can expand and drip out the anti-siphon mechanism, into the Coach woodwork between the Shower and the Bedroom.

This feature can speed up dumping, since one does not have to set up any hose connections at the dump site.

### ***Flushing the Black Tank Sensors***

Unfortunately, the Black Tank Flush does not direct spray against the Tank Level Sensors, which are located on the Driver side. Thus, residue can build up on the sensors, so that they misread too high. Fortunately, normal use of the RV fills the Grey Waste tank well before the Black Waste tank fills, and the Grey Waste tank sensor is accurate. So, deci-

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<sup>33</sup> When not flushing, the normal setting for these valves is to have the Top Feed Valve closed and the other valves open. If you want to empty water from the Cold Water Drain, close the Valve to the Black Flush Inlet and open the Top Feed Valve and the Lower Drain Valve. Note that I've attached a hose bib to end of the drain so that one can get water for a hose to wash the Coach or fill a bucket.

sions to dump should be based on the Grey Waste readings at the Control Panel opposite the Kitchen inside the Coach. If that Tank does overflow, it will back up onto the Shower floor, where it will pool and be noticed.

The Grey and Black Dump Valves lead to a common outlet, which can be aimed downward to run through an opening in the floor below, which is handy for hooking up at a full service campground for several days. It can also be rotated outward to allow the hose to run out the side of the Coach.

### ***Summary of Tank Flush Procedure***

This leads to the following procedure for dumping waste water:

- Connect the 3" flexible Dump Hose to the Coach and secure it into the campground sewer. You may want to place a rock on the Pipe Elbow so that the water flow doesn't push it out of the sewer hole.
- Open the Black Dump Valve first to dump the toilet water.
- Run the flush water into the Black Tank Flush to clear any extra toilet residue.
- Close the Black Valve.
- Open the Grey Valve, and build a backup in the drain hose by lifting it.
- Open the Black Valve to allow a surge of Grey water to cross-feed into the Black Tank. Since the Berk has a large 3" outlet from the Grey Tank, this comes with sufficient force to send water into the Black Tank as a back flush.

- Close the Grey Valve before it finishes draining. This allows the back-flush water to come out of the Black Tank. It helps to flush the Black Tank sensors, which are located near this point.
- Close the Black Valve when it has finished emptying.
- Open the Grey Valve to allow the Grey Water tank to complete draining.
- When the Grey Tank is finished draining, leave the valve open and lift the Dump Hose sequentially from the Coach to the sewer. This allows the remaining water in the Grey Tank to dump. If the valve is closed, the water won't empty from the hose because of the siphon vacuum effect, so leave the Grey Valve open while doing this.
- Close the Grey Valve, disconnect the hoses and continue on your way.

### ***The GEO Method of Cleaning the Black Tank Sensors***

Put detergent (dish or laundry) into the Toilet, along with some bleach and Calgon water softener (available at Walmart in the US) or Boraxo (available at Walmart in Canada or the US). Add water to the tank with the Tank Flush, and drive with this and an otherwise-empty Black Tank. This helps to clean the Black Tank sensors, but they don't stay cleaned for long, unfortunately.

### ***Lubricating Black and Grey Water Tank Flush Valves***

I drilled into the plastic housing above the pull sliders for my black and gray drain valves. Then, I installed a nominal 1/8" brass plug into the holes.

This area does not get tank fluid on it at any time, so there is no risk to getting sewage backing out of the hole.

When the valves get a bit sticky, I remove the plugs and spray silicone into the holes. I can do this when the valves are closed if I am having trouble opening them. And, when the tanks are drained, I spray silicone into the holes while operating the slides back and forth.



## Weekly and Monthly Periodic Tasks

### **Daily**

- *Check Tire pressures when cold.*

Use the gauge in the driver side front compartment. Front: 95 psi; Rear: 105 psi. Tire pressures can also be checked with the Tire Pressure Monitoring System (TPMS), discussed above.

- When on break during a road trip, *check tire temperatures* to see if any tires are hotter than others, considering the way the sun and brakes are affecting tire temperature. This can be done by the back of the hand on the sidewall or using the digital readout gauge in the compartment above and to the left of the driver.

### **Weekly or Monthly**

- Turn Front Wheels sharply to left or right while parked. Pull the 3 Air Tank Drains in the Front Wheel Wells to *purge water from the air tanks*.
- With the Front Wheels turned for easier viewing, *examine the Front Tires for cupping or blistering*. This can indicate a need for an alignment.
- While stopped at a traffic light, with Brakes not too hot, apply full pressure to Service Brake Pedal, once or twice. This *resets the Slack Adjusters on the Brakes*. Note that, if the Rear Brakes are too hot, the Drum is enlarged and the Slack Adjusters could be set too tightly, causing excessive Brake wear.

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## Hidden Storage Spaces

### ***Storage Inside the RV***

- Behind the Bedroom TV. Pull out the TV from the bottom to get a tall, wide cabinet between the cabinets on either side that have doors. Other models of the Berkshire motorhomes have similar storage, but it is accessed in different ways.
- Removable panel under the Bedroom Closet. It gives access to some pipes.
- Square panel under the Washer and Dryer. This also contains a low-point drain for the Water Heater.
- The Bed lifts up and is held by a gas strut. You might have to remove some bedding to get it to stay up. A sign says "Not for Storage" but this area does give access to the back of the 120V Circuit Panel and convenient access to the channels alongside the Bed pedestal, which are allowed for storage. This area also provides access to the top of the Engine
- Above the Microwave Oven is a removable panel.

### ***Storage in the RV Basement***

These storage areas are all fully visible, but it might not be obvious how to use them.

- Storage Bay for the hydraulic pumps for the jacks. This Bay tends to be a bit dirty, so I find it convenient to store oil bottles and funnels (inside a plastic bag) there.

• Propane Bay is not locked, so I've put a Fire Extinguisher in there. If there is a fire somewhere, I don't have to find a key to get the Extinguisher.

• Propane Bay is exposed to outside air. I install my outside thermometer sensor here to get the right temperature, while being protected from theft and road damage.

• Electrical Bay below Driver Window. I need to open this Bay to release the Generator and get to my compressed air chuck. So, I put my flexible air hose and air accessories there. I am careful to keep the metal fittings of the air hose out of the way of the electrical connections. However, a short in this area is not really devastating, since all of the hot points are 12V. There is no ground wire in this bay, and the only ground is high on the metal frame.

• Space below the Sliding Tray in the Main Storage Bay. I put my Jack Pads here. I made the pads out of 2" by 6" boards screwed to 3/4" plywood.

• DEF Tank Bay. I'm not using this yet, but I may buy some tire chains so that I am legal to drive in some jurisdictions like British Columbia between October and March. I don't intend to drive in snow, but an inexpensive set of chains might avoid a fine if I'm driving through in clear weather. There is some framework behind the Rear Wheel that could be used for hanging the chains in this Bay.

## Winterizing and Storing

### ***Long-term and Short-term Storage of the Electrical System***

The concern is to avoid having the batteries drain, which makes them vulnerable to freezing and which puts a discharge cycle into them, which reduces their life.

If the RV is connected to Shore Power, make sure the Magnum ME-RC control (inside the Coach behind a little door to the right of the Bathroom and below the Thermostat) is set to Charge. Its primary purpose is to charge the House Batteries, but when they are fully charged, it is supposed to also charge the Chassis Batteries. It will not overcharge either of the Batteries.

### ***Storing RV with Refrigerator On and No Shore Power***

The Solar Panels do not provide enough charge to run the Refrigerator, so the Generator must be set to Auto-start to keep the Refrigerator running.<sup>34</sup>

- Leave the Battery Bay Disconnect Switch set to on, as this is needed to start the Generator.
- Set the Auto Generator Start so that it starts when the voltage drops below 12.1 volts, and have it run for 3-4 hours. 12.0 volts is too low to start the Generator. Some people say that this is too low a voltage and will draw the House Batteries below their recommended 50%

battery charge. However, the charts of voltage vs charge assume no load on the batteries. The Refrigerator and Inverter will draw the batteries down to the low voltages, even if the batteries have a charge greater than 50%. To avoid the Generator from coming on too often, set the AGS threshold as low as possible, while allowing enough Battery capacity to start the Generator.

- Set the Magnum ME-RC Control Panel to Invert.
- To avoid parasitic draws from other 120v accessories, turn off their circuit breakers under the bed. The only circuit breakers that need to be on are for the Inverter/Charger and the Refrigerator.
- Turn off the “Salesman Switch” at the front of the Coach near the steps. This turns off DC power to a lot of circuits.

### ***Storing the Unit with the Refrigerator Off***

To avoid parasitic draws from draining the Battery System, during storage without shore or solar:

- Turn off the House Battery Disconnect Switch, which is located in the House Battery Bay on the Driver Side of the Coach. Note that this turns off more items than when simply turning off the “Salesman Switch” by the Steps at the Front Door. Turning off the Rotary Knob House Battery Disconnect Switch turns off everything it does, and more. Note that this switch is a bit finicky. It

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<sup>34</sup> I haven't completely ruled out the possibility of using my Solar Panels to run the Fridge. In a lower latitude with no snow and bright sun, like Tucson, this might be possible. I need to conduct some tests.

has three positions: On (notch is turned to top), Off (notch is turned to left) and Remove Switch Cap (notch is turned 1/8 turn past off). If you get it to the Remove position, you have to fuss with the Cap to get it to move back to the regular positions. Note that the House Battery Disconnect Switch does not turn off all power drains, so you should also turn off the following:

- Turn off the Thermostat so that the Furnace doesn't try to come on.
- Turn off the Power Inverter at the Magnum ME-RC Control, which is located inside the RV just below the Thermostat, behind a little door.
- Turn off the Chassis Battery Disconnect Switch, which is located in the Chassis Battery Bay.

### ***Wheel Protection During Storage***

- Place 6.75" of blocks under the Levelling Jacks so that the Jacks can settle onto the blocks and reduce the load on the wheels.
- Make sure that the blocks are the same distance from the bottom of the Jack pads so that the chassis doesn't twist when it settles onto them. Equalizer Systems suggests that the chassis might tolerate a 3° twist, but it would be best to have less.
- Dump air from the air bags so that the coach settles onto the blocks. To "dump air", park the coach and turn on the Equalizer Auto-level system. Press the auto-level button to start dumping air and then turn the Auto-level system off before it starts to extend the Jacks.

One it starts to dump air, it continues, even if the Auto-level system is turned off.

- If the Auto-level system starts to extend the jacks, just press the retract button before storing the Coach.
- Put covers on the tires to protect from the sun.

### ***Winterizing the Water System***

The water system is a little more complex than for a standard trailer or motorhome, so some care should be taken to understand these instructions. In particular, a lot of RV maintenance people might not understand all of the subtle issues when they do a winterization. So, do it yourself or show them these instructions before they start and query whether they followed them when they claim to have finished.

The task is simplified by the presence of an Air Hose Chuck located on the Front Firewall above the Onan Generator. (There is a Brass Adaptor to go from air hose fittings to male garden hose fittings and I normally store it with the Freshwater hose fittings in the Driver Side Water Bay.) I have installed an air pressure-reduction device and a pressure gauge so that you can drop the air pressure to 30-50 psi, since the 125 psi that the compressor attains is too high. You may have to periodically start the engine to build up pressure until you hear the ADIS system release air when the governor gets to full pressure. (You can use the fast idle feature of the Cruise Control for this, but knock the engine off of fast idle and let it

go to a lower speed before turning off the Ignition Key, because the Turbo Charger bearings don't like to lose oil pressure when they are running at high speed.)

The task is complicated or altered by the presence of the Girard Tankless Water Heater, the Refrigerator Ice Maker and the Washing machine. These problems are addressed below.

If you do all of the steps below, you have a full winterization. If you only do the steps marked "Shoulder Season Protection", you have covered the most vulnerable item (Water Heater), but not the items that are inside the insulated portions of the RV. Thus, "Shoulder Season Protection" will protect against a light frost, but not continuous freezing.

1. Dump the Grey Water and Black Water tank, as per normal procedure at the end of a camping trip.
2. While returning from the last trip of the season, open the Freshwater Low Point Tank Drain, which is located on the Passenger Side Water Bay. Conveniently, the camber of the road makes this a low point, so that the tank will drain to a level below the pickup points for the Water Pump and the Drain, which you don't want to contain water during Winter. If you forget to open this drain at the end of the last trip, park the RV and use the Automatic Levelling System (to left of driver) to level the Coach. Then push the button to raise the left side of the Coach to drain the water until it stops coming out. Note that you should only

raise or lower a side or end of the Coach after it has been levelled — otherwise, the jacks won't all start with the same ground pressure and they can twist the Coach Frame.

3. At the end of the last trip, open the Passenger Side Water Bay and close the Freshwater Low Point Tank Drain.
4. Turn the Water Pump on (switched either from inside the RV near the Thermostat or in the Driver Side Water Bay, which is just in front of the Rear Wheels). Open the Low Point Drain that is to the Left of the Water Pump until the Water Pump is delivering Air. (Note that this drain is on the left side of the Bay, while the Freshwater Low Point Drain and Water Pump are on the right side of the Bay, and you drained that already.) Close the Low Point Drain that is to the Left of the Water Pump.
5. Open the Low Point Drain Valve for the Cold Water Supply Manifold, which is located in the Driver Side Water Bay. Continue until the supply line between the two sides of the RV is blowing air.
6. Unscrew the Water Pump Intake filter, which is to the left of the Water Pump. Dump any water and remove any sediment. Reinstall it.
7. *Shoulder Season Protection Plus Full Protection:* When you have not air or water pressure in the water system, remove the Water Filter from the Driver Side Water Bay first as well as the Filter that connects the hose to

the outside water supply bib, Discard the water in the Water Filter Bowl (Canister).<sup>35</sup> (There is a plastic box-end wrench that can be used to undo the Filter Housings.) Return the screw-on Housings to their normal position and tighten lightly enough to hold air pressure in the following steps. You may find this to be a good time to discard the filters, particularly the white sediment filter that attaches to the water supply, since it quickly gets dirty.

8. Optionally, there is a short hose in the Passenger Side Water Bay connected to the T-valve between the Water Tank and the Water Pump. You can take the plug off this hose and suck Pink RV Antifreeze into the Water Pump if you want to install it in the water system. This has the advantage of allowing you to see the antifreeze in the lines for confirmation that the job is done. But, it presents two complications. First, the antifreeze needs to be cleared out before drinking the water, which takes a while, particularly from the Refrigerator Ice Maker.

9. *Shoulder Season Protection Plus Full Protection:* The next few steps will be performed in the Driver Side Water Bay, which is just in front of the

Rear Wheels. Connect the Air Hose (coming from the Air Hose Chuck as noted above) to the Tank Supply (leftmost) fitting using the Brass Adaptor and blow out the line that goes to the back of the Fresh Water Tank. It will only take a few seconds to clear the line.

10. *Shoulder Season Protection Plus Full Protection:* Connect the Air Hose to the City Water Supply (middle) fitting using the Brass Adaptor. Open the Low Point Drain Valve for the Cold Water Supply Manifold to clear this line. This valve is on the right side of the Bay. Close the Drain Valve.

11. *Shoulder Season Protection Plus Full Protection:* Turn Off the Girard Tankless Hot Water Heater Switch, which is located behind the Hot Water Tank Access Panel on the Passenger Side at the rear outside of the Coach. (You don't want the Hot Water Heater to come on without water in it.) Open the Low Point Drain Valve for the Hot Water Supply Manifold to clear water from the Tankless Hot Water Heater. This valve is on the front end of the Driver Side Water Bay. Close the Drain Valve.

12. Remove the wooden panel below the Washing Machine to expose

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<sup>35</sup> There is also a problem where the Forest River FR1 Water Filter Bowl (Canister) blows off during the process of blowing air through the system or filling the system with RV water line antifreeze. Some instructions suggest that this FR1 Water Filter needs a filter installed before pressure is applied. But the Filter just complicates the winterization process. I have replaced the FR1 Water Filter with a much more reliable Camco Water Filter. I remove the Filter from the Camco unit to winterize. Other people have simply bypassed the FR1 and rely on an external filter.

plumbing for the Water Heater. Open the Low Point Drain Valve there.

Close it when it is clear of water and blowing air.

13. Close the Ice Maker Supply Line Valve. It is located under either the Bathroom Sink or the Kitchen Sink. This allows you to get a head start in getting air to the Ice Maker a few steps later.

14. Remove the Water Filter in the Water Bay and replace the Filter Bowl without a Filter in it. Apply air pressure on the hot water lines and the cold water lines, go through the RV and open the following faucets (open hot and cold separately) until you hear air running: Outside Shower (located in the Water Bay), Kitchen Faucet, Bathroom Faucet, Bathroom Toilet (push the Dump Valve), Shower. Put 2 or 3 cups of Plumbing Antifreeze ("Pink") into the drains of all of these items to flush water from the P-traps. Note that the toilet doesn't have a P-trap, but these procedures will leave some water in the Black Water Waste Tank above its Dump Valve, and some Pink Antifreeze should be put there, as well.

15. With air pressure in the hot and cold lines, turn on the the Washing Machine to a short cycle to blow out those lines. This might result in an A09 code, but that can be cleared by pressing the Spin and Drain button. In any event, you can do a Spin and Drain to speed the process up, once

the compressed air is coming in. Add Pink Antifreeze to the washer drum and press the button to Spin and Drain to get the Antifreeze into the P Trap.

16. Open the Ice Maker Supply Valve and turn on the Refrigerator while there is air pressure on this Ice Maker Supply Line. Make sure the Refrigerator is set to make ice (the Wire Bar in the Freezer is in the down position). Here is a procedure by a technician on how to perform a proper winterization on a Whirlpool-style Ice Maker in a residential style refrigerator. First, tape the Freezer door open button in the closed position. Remove the cover from the end of the Ice Maker. Use a towel to catch water spray. You should see a large gear and directly under this there are two test ports marked T and H. You will need a short piece of insulated wire with the ends stripped to a 1/2" bare. Bend the wire and push both ends into the ports. The gear will start to move and you should hear a small click in about 5 seconds. Remove the wire. The Ice Maker will cycle and the water solenoid will open allowing air to blow through the system and blow out the water. Do this several times to clear all water from the lines. Once no more water comes out of the line when activated, you should be good. An alternate, but more tedious procedure that I followed in 2015: The Refrigerator needs to run for several

hours in order to freeze. Go through several ice-making cycles. Periodically empty the Ice Bucket so that you can see when the Ice Maker finally stops making ice. When that happens, you have flushed the Ice Maker line and can turn off the Refrigerator for storage.

You can also run Pink Antifreeze into the Ice Maker line in a variety of ways, such as using the Antifreeze line into the Water Pump or replacing the Whole House Filter in the Driver Side Water Bay with a bowl (canister) full of Pink Antifreeze. But, this procedure will require the tedious job of removing the Antifreeze before you can enjoy the ice next summer.

In either case, the air pressure will have to be maintained on the Fresh Water Supply line while the Refrigerator runs for several hours. You can run the air hose under the RV and into the Water Bay through the bottom hose door. This allows you to close the Bay Door and Onan Generator Slide while you leave the RV unattended during this lengthy process.

17. Flushing the P-traps to the Grey Water Tank with Pink Antifreeze will leave a mixture of water and Pink Antifreeze in the tank, which might freeze. You can drain the Grey Water Tank into a bucket and discard this mixed solution. To do this, turn the drain valve to point directly down and open the drain opening on the floor below.

18. Connect the Air Hose to the Tank Flush (rightmost) fitting using the Brass Adaptor to blow out the line that goes to the back of the Black Water Holding Tank. It will only take a few seconds to flush this line, but it is a long line and should be cleared for the Winter. If you have finished emptying the Black Water Tank, you can put a bit of antifreeze into it through the Toilet, to keep water from freezing at the valve connection.

***Winterizing the Engine and Fuel System***

- Store the RV full of diesel fuel to minimize the air gap at the top of the tank. The air contains moisture and the cool air condenses the moisture to water.
- Discharge air/water from the Air Brake Tanks. They don't have to be emptied, according to Freightliner, but try to see if any water comes out — if it does, you need to drain more and more often. There are two Lanyards beside the passenger side front tire (high on the chassis) and one inside the driver side front tire.

***Block Heater Cord***

There is a Block Heater Cord for the Engine with a plug located in the Middle Battery Bay. You can plug the cord into the 120v outlet located in the Middle Electrical Bay. It only receives power if the Coach is connected to Shore Power or the Generator is running.

The Block Heater helps the Engine to start on cool days, but is not essential, given that we use 5W40 oil. It would be essential if starting the Engine in sub-zero temperatures.

The Block Heater only warms the Engine Coolant and not the oil, which sits in a pan below the Engine. The more important thing for running the Engine shortly after starting is our use of 5W40 synthetic engine oil, which, in cold temperatures, flows better than the standard 15W40 oil.



## Summerizing

### ***Filling the Hot Water Heater***

This routine is needed if you have just drained the Hot Water Heater after doing a Shoulder Season Protection.

1. Fill the Tankless Hot Water heater, either from the Fresh Water Tank or from the City Water Supply. To make sure it is full, open the Low Point Drain Valve for the Hot Water Supply Manifold (Driver Side Water Bay) to clear air from the Hot Water Heater.
2. Turn on the Hot Water Switch, which is located behind the Hot Water Tank Access Panel on the Passenger Side at the rear of the RV.
3. Turn on the Propane Valve in the Propane Bay on the Driver Side. It is the only Bay that does not have a lock.

The *full routine below* is needed to get the RV going after a Full Winterization.

It involves:

1. Flushing any Pink Antifreeze from the lines
2. Sanitizing the lines with chlorine bleach. Forest River recommends 1/4 cup of household bleach (5% sodium hypochlorite) for each 15 gallons of tank capacity. We have 84 gallons of fresh water, so we need 1 1/2 cups of bleach for our 88 gallons tank. You can put the bleach into a Camco water filter housing without the filter and then run it through all the fresh water hoses to get to the tank. Then run it

into the fresh water lines in the RV, clearing out any pink antifreeze. Drive around with the Fresh Water Tank full to get the roof of the tank disinfected. Then, flush the lines to remove the chlorine smell.

Note that the Ice Maker can take some time, as the refrigerator needs to run for several cycles. Alternatively, you can repeat the instructions for Winterizing the Ice Maker, but with the chlorine bleach, rather than air pressure: Open the Ice Maker Supply Valve and turn on the Refrigerator. Make sure the Refrigerator is set to make ice (the Wire Bar in the Freezer is in the down position).

Then, tape the Freezer door open button in the closed position. Remove the cover from the end of the Ice Maker. Use a towel to catch water spray. You should see a large gear and directly under this there are two test ports marked T and H. You will need a short piece of insulated wire with the ends stripped to a 1/2" bare. Bend the wire and push both ends into the ports. The gear will start to move and you should hear a small click in about 5 seconds. Remove the wire. The Ice Maker will cycle and the water solenoid will open allowing the chlorine bleach to enter the system. Do this several times to get enough bleach into the line.

3. Removing the bleach from the system
4. Filling the Hot Water Heater

## 5. Turning on the Propane Valve.

### ***Starting the Coach when All Batteries are Dead***

You may find yourself with your House and Chassis Batteries dead after a period of storage. Consider the scenario where you have driven up to the Coach in a car with batteries that are too small to start the Diesel Engine of the Coach, but you have jumper cables.

The first step is to get the Generator running, even with dead House Batteries. You are lucky if the car battery is strong enough to start the Generator when you run jumper cables to the House Batteries.

But, you may find that the dead House Batteries are sucking all the current from your car and preventing you from getting enough voltage to start the Generator. In this case, you need to disconnect the House Batteries from the Generator, but still get a battery connection to the Generator from your car. You can access a +12v Generator wire in the Front Left Electrical Bay below the Driver Window. Look at the circuit diagrams on the Bay Door to figure this out. The problem is that you also need a ground connection. The steel frame around that bay is grounded, and I've installed a small piece of copper pipe to that frame to get a connection. You might need to scratch the paint to get a good ground if you haven't done this already.

With this approach, you can turn off the large red Knob Switch in the House Battery Bay to isolate the Generator from the House Batteries. Then, jump start from the car battery to start the Generator. Once the Generator is running and producing AC current, turn on the Charger at the ME-RC panel inside the Coach. This is needed to provide power to the House Batteries: the Generator does not have its own Battery and needs the House Battery power in order to run.<sup>36</sup> Next, turn the large red Knob Switch in the House Battery Bay back to On so that the Generator will get its power from the House Batteries and Magnum ME-RC Charger. Finally, disconnect the jumper cable from the car.

At this point, you have the Generator running and charging the House and the Chassis Batteries. You can combine the House Batteries and the Chassis Batteries by pressing the "Aux Start" Switch on the Dashboard while you turn the Ignition Key. This may be enough to get the Cummins Diesel Engine started. Otherwise, you may have to wait a while until the Generator charges up the House and Chassis Batteries sufficiently.

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<sup>36</sup> Yes, I know that simple Diesel engines will run without electrical power. However, the Onan Diesel has some control circuitry that is needed for it to run, and it needs 12V power.

## Problems and Solutions

### ***Shore, Generator and Inverter Power***

**Shore Power** 30 amp may not provide enough power to run both air conditioners, if the campground has voltage sags, so set one AC to the Off or Fan Mode and the other will run as desired. There may not be enough power to run the Microwave and one AC simultaneously. It can be the front (Zone 1) or rear (Zone 2) AC. However, on another occasion, 30 amp power was sufficient to run both air conditioners and an 800W Sous Vide cooker simultaneously (along with the Refrigerator). The voltage stayed at 110v while these were being used, so it may be that earlier problems were from campground wiring that was not capable of providing 30A to a lot of sites.

**Generator Power:** An overload can trip the breaker on the Generator (before it trips the breakers under the bed). The Generator continues to run, but does not generate power. Open the Front Sliding Tray to access the Generator and flip the Breaker to the up position. To open the Generator Tray, open the Driver-Side Bay at the front and pull the T-handle at the top right.

**Inverter Power** will not provide power to the block heater plug in the electrical bay beside the inverter. Thus it will not run accessories like a bug zapper. Turning off the big switch in the battery bay does not turn off the inverter, so you can turn off that switch and still run the fridge.

But, when the big switch is off, the generator will not start.

### ***Thermostat, Heat and Air Conditioning***

Thermostat control faults occur when an Air Conditioner (AC) tries to run, but has inadequate power. This results in an E7 fault in the Zone where the air conditioner tried to run. But, the Thermostat may be showing the other Zone and you can't see the fault code. Press the Zone button to see the other code. When you have sufficient power (Shore or Generator) for the AC to run, the E7 fault code clears and the AC will start automatically.

This is more of a feature than a problem, because it allows the Auto Generator Start (AGS) to turn on the basis of temperature and thereby turning on the AC while unattended.

### ***Problems with the Forest River FR1 Whole House Water Filter***

A whole-house Water Filter is located in the Driver Side Water Bay. Fortunately, that Bay is located outside of the living area, so leaks and problems might not put water into the living area. Nevertheless, it is a good idea to turn off the water supply to the RV when it is unattended because this Filter is problematic.

The FR1 Water Filter Bowl or Canister is the clear plastic part with the Water Filter inside. This Bowl often works itself loose under air or water pressure and can come off explosively, making a mess.

I have replaced the FR1 Water Filter with a more reliable Camco Pur Filter. A Camco Pur water system (from Walmart,

Camping World or Canadian Tire) or a GE water system (from Home Depot or Lowes) fits nicely into the space, after a bit of plumbing. They also take industry-standard 10" filters with a variety of prices and choices of filter properties: sediment, metals, VOCs and chlorine.

But, if you still have the FR1 water filter, here are some of the issues:

- I have only had the Filter Bowl blow off when winterizing the RV. I had removed the Filter and was using either air pressure or water pump air pressure on the water line. Some people say that the Water Filter needs to be in the housing in order for it to seal properly.
- Some people claim that the Filter Bowl has blown off under water pressure even when they had the Filter in place. This would be while the RV is in normal operation and would be a real concern as it could flood the inside of the RV (although not likely the Berkshire because it is in an "outside" Bay).
- The FR1 water filter has a White Plastic Wrench to tighten it. Tightening the Bowl might get it to hold in place, particularly if it has a Filter inside (according to some reports). As delivered, the Bowl has a notch system that clicks when the Bowl is installed. But, now, I find that the clicks do not happen (at least without a Filter installed). I can't see any wear on these teeth.
- A lot of the problems with the Bowl blowing off seem to occur when winterizing, during which time the Filter must be removed, for example, to blow Pink

Antifreeze through the system. One could drill holes into an old Filter for this process, allowing the Antifreeze to pass through the filter.

### ***Water Shutoff and Supply Valves***

Washing Machine water is behind a panel in bedroom closet on left that is attached with 4 screws. There is a drain clean out, presumably for winterizing, in the same closet floor on the shoe shelf.

Ice Maker supply valve was below the Bathroom Sink. That line is now disconnected and has been moved to be under the Kitchen Sink. The Wire Bar needs to be down to make the ice maker work.

### ***Reflections on Driver Side Window Block Mirror View***

Berks have had problems with reflections coming off the Driver's Side Window and impairing the view through the Side Mirror.

The problem is that Berkshire mounts its mirrors higher than other motorhomes and trucks (although they seem to have recognized the problem and are now mounting them lower). This means that a lot of drivers must look up to see the Side Mirrors. At that angle, light from bright objects, such as the sky and clouds, is on a path to reflect off the flat Side Window glass and enter the driver's eye on the same path as the view from the Side Mirror.

The problem is particularly acute if the driver is backing into a dark spot and the sky in front is very bright. So, many drivers only identify the problem when they are backing into a treed campsite. And

some have noted that the lower Convex Mirror doesn't have the problem, and this is because it is lower than their eyes. Nor does the problem occur with the Camera mounted in that Mirror. That is because the Camera view does not go through the Side Window.

To identify whether you have this problem, check to see whether you must look upward to see your Left Side Mirror.

The correction for the problem is simple. You need to place something to block the light from going through the Front Window and reflecting off the Driver Side Window. This solution must not block your view looking forward.

I have installed a black Coroplast slat that is about 6" wide and 24" high in a groove that sits in the molding around the Side Window. I was able to hold it in place with some wire that extends to one of the mounting screws. I haven't had the problem since.

### ***What are Those Funny 8-point Body Screws?***

Forest River, like some other RV manufacturers is starting to use an odd self threading metal screw to hold body pan-

els together. For example, they are used on the storage panel doors.

They look like Torx screws at first glance, but Torx screws have 6 points and these have 8 points.

The correct screw driver to use on these is a Square Bit S2. The screw drivers usually have a red handle, as shown below.

Interestingly, these screw heads don't provide as much bite as a pure square-head screw, which is well-known to Canadians as a Robertson screw. I'm not sure why the RV manufacturers decided to use the flimsier screw, while still requiring the square driver. Maybe they were trying to work around a patent.



## Chassis and Power Train Maintenance

### ***Draining Water from the Air System Tanks***

The Air Brake System has three Air Tanks, which are located at the Front of the Coach. Two of the Tanks feed air to the Front and Rear Air Brakes, respectively. The third Tank feeds air into the other two Tanks. By having this system of reservoirs, the Brake System can function for a while, even if the Engine stops or the Air Compressor stops.

The three Air Tanks each have a Drain Valve at the bottom. These Valves should be periodically opened to drain water out of the bottom of the Tank. The spring-loaded valves are connected to lanyard loops that are in the Front Wheel Wells. Two on one side and one on the other. An easy way to find the lanyards is by parking the Coach with the Wheels turned sharply to one side. Pull the lanyards to release air from the Tank. If you are parked on pavement, you can see if moisture comes out of the Tank with this procedure. If so, keep draining the Tank until all the moisture is discharged. If you do see moisture coming out, you should

increase the frequency with which you perform this service.

This procedure is technically recommended to be performed daily, so it should be up with the daily driving information. I think that most people are like me and have found that the Air Dryer system is good at delivering dry air to the Air Tanks, so that this procedure doesn't need to be done on a daily basis.<sup>37</sup> But, if you are in a humid climate and your Air Dryer system is poorly maintained, this procedure should be done regularly.

### ***Working Under the Chassis***

The Freightliner Chassis is very low to the ground and it is hard to get under it without raising it somehow. The question is how to raise the chassis safely.

Roadside service technicians will sometimes use the levelling jacks to raise the Coach, in order to get under it. This is not a really safe procedure, since the jacks could fail or somebody could retract them accidentally.

My preferred method of working under the Coach involves driving the Coach onto my Jack Pads, which are 2.25" thick. I have 6 of them, and can put the front or rear wheels onto two thicknesses of Jack

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<sup>37</sup> The Air Compressor is connected to an Air Dryer Integrated System (ADIS) that turns the Compressor on and off to maintain pressure in the system. It also feeds the pressurized air into an Air Dryer at the rear of the Coach, which collects condensation moisture from the compression process. When the Governor senses that the air pressure is high enough (125 psi on our Coach), it turns off the Air Compressor and briefly opens a Drain Valve at the bottom of the ADIS unit. This squirts water out of the Air Dryer. On our Coach, this ADIS system works effectively (albeit requiring service every 4 years), so that water does not seem to collect in the Air System Tanks.

Pad by first backing<sup>38</sup> onto one thickness and then onto the double thickness. I use an assistant to tell me when I am fully on the jack pads, or I use a stopping block. At this point, the Coach is also elevated by the Air Bags, which slowly lose pressure over time. To delay this pressure loss, I place a 20 ton bottle jack under the rear Engine cradle mounting bolt, which is in the centre of the chassis. I can also use two bottle jacks or blocks under the un-extended levelling jack feet. This latter choice is more stable, but it often takes up the space I need to work under the Chassis.

### ***Finding Replacement Filters***

There are lists supplied by various people and groups that try to be helpful in documenting what filters are needed for our motorhomes. Be particularly careful, since the correct filters change over the years and with changes in design specifications.

For example, the manual for our Cummins ISB 6.7 engine specifies filters for the fuel system that are wrong for our Berk 34QS because Freightliner has installed filters on the Chassis and doesn't use the Cummins Filters.

The authoritative information is supplied by Freightliner's PartsPro, since it is based on the Vehicle Identification Number (VIN) of the Coach. Go to <http://www.dtnaconnect.com> and press the *New User* link or the *Log In* link on the

top right, as appropriate. For our Coach, the login ID is G70GOSIC. You need to put in the last 6 digits of the VIN, which, for our Coach is GN2083. If a Freightliner parts technician asks you for those 6 digits, you know they are using Parts Pro and are likely to get you the correct parts.

Once you Log In, you will see a box with "My Applications" and PartsPro is one (perhaps the only one) of them.

<b>Filters for our Berkshire 34QS</b>	
Fuel-water Separator: Primary Fuel Filter	RAI R50419 aka Racor S3226T
Fuel-water Separator Collection Bowl (Spare)	RAI RK30063
Fuel Water WIF Probe (Spare)	RAI RK56140 04 or RAI RK56237
Fuel Filter Stage II	Cummins FF63009
Cummins Engine Air Filter	FAR 114880 003 or FAR 114810 003?
Transmission Filter	ALI 29539579
Engine Oil Filter	Fleetguard LF 3970
Serpentine Drive Belt for Engine	Cummins 5264021
Onan Fuel Filter	Onan 147-0860
Onan Air Cleaner	Onan 140-2897
Onan Oil Filter	Onan 122-0833 or Fleetguard LF3591
Bendix ADIS Desiccant Cartridge Kit	BW 107794

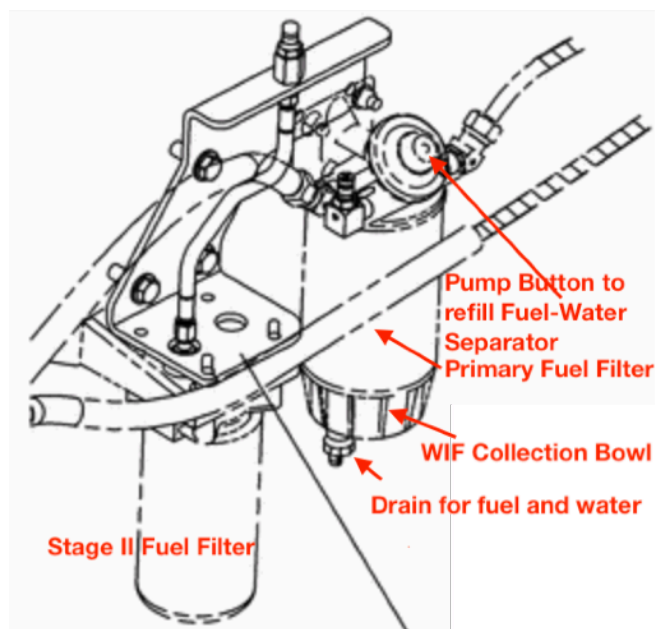
<sup>38</sup> The gearing for reverse is much lower than for first gear forward, so backing onto a pad gives more control.

### Changing Fuel Filters

The Primary Fuel-Water Separator and the Secondary Stage II Fuel Filter are located beside each other on the Chassis, as shown in the first figure below. The Fuel Filters are visible when you open the DEF Bay door. The Primary Filter has a filter part and a clear water (WIF) Collection Bowl below as shown in the second figure above. You only need to change the filter part, but having a spare Bowl is handy, as discussed below.

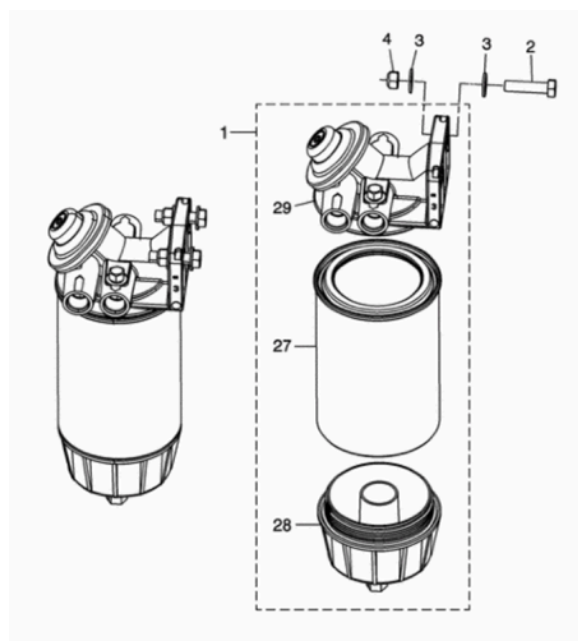
When changing filters, you will need to catch some fuel that is spilled, so have a collection pan. The fuel can be disposed of at waste site separately from used oil. Read all of these instructions before starting. You will spill diesel fuel in this process, but it is not as flammable as gasoline, so you are unlikely to start a fire. If the engine is warm, have a fire extinguisher handy.

1. Change the Primary Fuel-Water Separator first. Attach a spare bowl



with a spare Water in Fuel (WIF) sensor and wiring harness to the Collection Bowl and attach this assembly to the new filter. Lubricate the gaskets as per the enclosed instructions. With a Q-tip, clean the fuel drain hole at the bottom of the Collection Bowl that you will install. Make sure the drain is closed.

2. Disconnect the wiring harness on the WIF sensor of the old Bowl. Unscrew the whole assembly, perhaps using a strap wrench for leverage. At this point, you will be spilling fuel, because it is draining from the fuel tank by gravity. Plan ahead to minimize the time that no bowl is installed.
3. Screw on the new Filter and Bowl assembly, using a strap wrench to apply modest torque. The only pressure in this filter is the gravity pressure from the fuel tank, so hand torque is adequate.





4. Reconnect the wiring for the WIF Sensor.
5. Press the pump button at the top of the top of the Fuel Water Separator several times until back pressure is felt, indicating that the filter is full of fuel.
6. In the Driver's Cab, cycle the Ignition Switch On and Off without starting the Engine. The purpose of this is to operate any electric pumps to move fuel and remove air bubbles.
7. Start the Engine. It might not start instantly, but should start without much delay. While the Engine is running, check the Fuel-Water Separator assembly for leaks. Stop the Engine.
8. Next, you will install the Stage II Fuel Filter. It comes with a removable red cap over the centre hole. Leave the cap on and put the filter under the drain from the Fuel-Water Separator. Open the drain and fill the Stage II Filter with fuel. By leaving the cap in place, the fuel is going to the outside of the filter, from where it will be filtered before it goes to the Engine. Any small amount of debris that goes into the filter will not get to the engine. Set the filter in a place where it will not fall over and spill fuel.
9. Remove the old Stage II Filter. Note that there is a 25 mm bolt head at the bottom. Since 25 mm sockets are rare, but 1" (25.4 mm) sockets are common, use a 1" socket.
10. Screw on the new Stage II Filter, after lubricating it as per the instruc-

tion sheet. As per the Instruction pamphlet, torque it to 28 ft-lb.

11. As before, cycle the Ignition Switch several times to pressurize the fuel system and remove air bubbles.

12. Start the Engine and check for fuel leaks.

### ***Oil Changes***

Our Cummins ISB 6.7 340 horsepower engine recommends 15W40 oil that meets the CK-4 specification. The latest Cummins manuals, however, broaden this to allow 5W40 oil for all the temperature ranges allowed for 15W40, plus lower temperatures, as well. Moreover, they point out that the 5W40 oil reduces wear on engine startup. My reasoning is that engines are lubricated by oil pressure (main bearings and big ends), by drip (camshaft lobes) and by splash (cylinder walls). The first of these is not badly inhibited by a thick oil on startup, but the later two don't work well if the oil is thick on startup. Using the Engine Block Heater doesn't help this process, since it doesn't warm the oil pan.

Thus, I always use a 5W40 synthetic oil that meets the CK-4 specification. I find it convenient to use Shell Rotella T6. Cummins suggests oil changes every 15,000 miles or yearly, whichever comes first. So, the extra cost of premium synthetic oil is modest over these long oil change intervals.

The capacity of the Cummins ISB 6.7 engine is 15 litres of oil, and the biggest oil drain pans I can find are exactly 15 litres. This results in some spillage with-

out a smart procedure. Fortunately, my ISB 6.7 has two oil drain plugs. One is half way up the side of the oil pan, which I think it is originally intended for an oil heater. The other is at the bottom of the oil pan. So, I drain from the upper plug first and move the oil to a disposal jug, leaving room for the remaining oil in the pan.

Another logistical problem arises when refilling the engine with oil. The fill tube is very high and it is hard to get large oil jugs and a funnel high enough to go into the tube without spilling. So, I bought an inexpensive rotary pump that is powered by an electric drill. It has garden hose fittings, so I attached some old, but clean, garden hose to both fittings and fill my Engine with oil that way. I take care not to overfill.

I store the pump and hoses in an empty 5 gallon oil bucket to keep them clean.

## Specifications

### ***Tires***

- Michelin X Multi-D traction tires (M+S rating) (Rear)
- Michelin XZE (Front)
- OEM tires were Goodyear G670RV Unisteel, but the front tires had rivering problems whereby the second groove from the edge wore heavily. The rear tires had a sidewall delamination. All tires were replaced with Michelins at 50,000 miles.
- 255/70R 22.5
- Load Range H
- Max Load 5510 lbs (Single Tire) and 5070 lbs (Dual Tire)
- Max Cold Pressure 120 PSI
- Max Speed 75 mph

When purchasing tires, it is good to have a full discussion with the vendor about how they will be installed and balanced, and what extra products will be added to the tire, such as sealants. The vendors tend to do things without getting approval first.

In particular, I unknowingly did have a set of steer tires installed without balance weights, but with balance beads instead. These beads are supposed to move around the tire each time you start to travel and “automatically” rebalance the tire. In one case, it seems that these beads didn’t rebalance for me, and the tire developed a flat spot from the out-of-balance condition. The condition rapidly got worse before I was able to diagnose

the problem and I had to replace the damaged tire.

### ***Load Capacity (Weight)***

The maximum axle loads (GAWR) in pounds for the Berkshire according to its brochure and the white sticker above the driver are:

- Front: 10,500 lbs or 5250 lbs/tire
- Rear: 17,500 lbs or 4375 lbs/tire
- Total GVWR 28,000 lbs

The Yellow door sticker suggests a lower allowable weight of 27,200 lbs:

- Dry Weight of 22,976 lb, which gives an allowable cargo capacity of 1916 kg or 4223 lbs.
- A full 85 gallon load of fresh water is 324 kg or 716 lbs. or 180 lbs for each rear tire.
- A full 100 gallon load of fuel is 340 kg or 750 lbs, almost all of which is on the front axle.

### ***Water capacity***

- Fresh Water 84 gal or 318 litres
- Grey Water 60 gal or 227 litres
- Black Water 44 gal or 167 litres
- Shower head has a max flow of 2.5 gal/minute

### ***Typical Loads with Four-Corner Weights***

I have weighed the Coach on several occasions, with results that varied. The heaviest loadings per axle and per corner that I have measured are:

Four-corner weights with Fuel and Propane Tanks Full; Water Tanks Empty; Driver and one Passenger; Food and supplies for camping:

- Left Front: 2070 kg or 4554 lb
- Right Front 2010 kg or 4422 lb
- Front Axle (doubling the larger of the two corner loads): 4140 kg or 9108 lb, or 1392 lb below the allowable Axle load (GAWR) of 10,500 lbs.
- Left Rear Duals: 3650 kg or 8047 lb (4023 lb per wheel)
- Right Rear Duals: 4290 kg or 9458 lb (4729 lb per wheel)
- Rear Axle (doubling the larger of the two corner loads): 7940 kg or 17505 lb, which is 5 lb above the allowable load of 17,500 lbs.
- Total theoretical Vehicle weight 12,080 kg or 26,632 lb. This is theoretical because it uses maxima of the corner weights and the largest of the resulting axle weights over several days of observations.

### ***Tire Pressure Recommendations and Weigh Scale Maximums***

Given these weights above, it is prudent to set the recommended tire pressures at:

- **Front: 95 psi**
- **Rear: 110 psi**

At these pressures, the axle weigh-scale maximums are:<sup>39</sup>

- Front GAWR: 4240 kg or 9350 lbs (limited by 95 psi of tires)

- Rear GAWR: 7938 kg or 17,500 lbs (limited by chassis axle specs)
- Rear GAWR: 8480 kg or 18,700 lbs (limited by tire capacity)

For a 4-point weight, the maximum loads per corner, given these tire pressures, are:

- Front corners limited by tire weight limits at 95 psi: 2120 kg or 4675 lbs
- Rear corners using Axle limits: 3969 kg or 8750 lbs (per dual pair)
- Rear corners using Tire limits at 110 psi: 4240 kg or 9350 lbs (per dual pair)

It is wise to stay below the tire weight limits for safety. The chassis weight limits can probably be exceeded for brief trips to carry a full load of water, if the road is smooth and not requiring lots of suspension travel.

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<sup>39</sup> Michelin and Goodyear both supply inflation charts for their RV and truck tires. The charts seem to be the same for Load Range H tires, independent of manufacturer or tire model. The data here are from the Michelin Truck Tire charts, because it does not list any traction tire such as the Michelin X Multi-D as an RV tire. Michelin lists the X Multi-D as a Regional Truck tire. I chose the M+S rated X Multi-D tires because I periodically find myself in a surprise snowstorm on a mountain road in the Fall or Spring.

***Torque Specifications***

- The Wheels need 450 to 500 Ft-Lbs of torque. Use the X4 Torque multiplier and assume 10% to 20% torque loss from friction. This means the input torque to the X4 should be about 135 Ft-Lbs.
- Oil Pan Drain plugs: 44 Ft-Lb (60 Newton-Metres) for plug on side of Pan and 35 Ft-Lb (45 Newton-Metres) for plug on bottom of Pan.

***Parts Numbers***

- Windshield Wipers:
  - Trico 67-324 RV
  - NAPA 6-3255.
  - The NAPA wipers have more pressure points than the Trico, which can make a cleaner wipe.
- Headlights: Toyota Highlander 2001-03. Original equipment was Eagle Eyes. As installed, they are generally aimed very high. Check the results by backing away on a flat road from a wall. If the low-beam cutoff is rising as you back up, they are aimed high. If it is falling, they are aimed low. The trick is to find a very flat road with a wall at the end.
- Taillights: Dodge Truck? To change bulbs, remove the whole assembly from the Coach. Then, undo 8 Philips screws, which apparently gives access to the bulbs.
- Serpentine Belt Cummins 5264021
- Cummins Engine
  - Cummins 3937736 Fleetguard oil Filter LF3970

- Cummins 4934879 Fleetguard Primary Fuel Filter FS1065
- Cummins 4934845 Fleetguard secondary fuel filter FF5632
- ISB02 Inline fuel strainer RAI 025RAC10
- Cummins Onan filters:
  - Oil filter Onan 122-0833 or Fleetguard LF3591
  - Fuel Filter: Onan 147-0860 or 541-1442
  - Air Filter: Onan 140-2897
  - Coolant: Fleetguard ES Complete EG
  - House Water Filters (Camco) gaskets APEC Water Systems 3.5 in. O.D. O-Ring Set (3- Pack) for 10 in. Standard Reverse Osmosis Filter Housings from Home Depot

***Lubrication Specifications***

- Engine and Generator Oil: Shell Rotella T6 Synthetic 5W-40. The latest Cummins manuals rate Synthetic 5W-40 oils as covering a wider ambient temperature range than 15W-40, which was previously their primary oil recommendation. They note that the 5W-40 has the advantage of reducing wear when starting the Engine, in addition to the obvious advantage of starting in cold weather.
- Transmission: TranSynd or BP Au-tran 295
  - Cold transmission oil check at 15° - 40°C
  - Hot transmission oil check at 71° - 93°C

- Grease: Shell GADUS with MO2 solids
- Power Steering: Dexron III Automatic Transmission Fluid (ATF)
- Equalizer hydraulic pump for jacks: Synthetic ATF (so that it runs in cold weather).
- Oil for wheel hubs: 80W-90 hypoid gear oil. 0.5 to 0.7 litres per hub.

## Other Sources of Information

Forest River produces annual updates to its Class A Diesel Motorhome Owner's Manual and makes it available on its website.<sup>40</sup> I and other Berkshire owners have found it short on some details, so I commenced to write my own manual. Their manual is definitely worth reading.

There is an active Berkshire group on [www.forestriverforums.com](http://www.forestriverforums.com). Updates to this manual are posted there. I use the handle GordonSick.

Another Berkshire owner, using the handle OscarVan on the Forest River Forums, has a very informative website, [Dragonship.Blog](http://Dragonship.Blog) and you can find many useful things there.

Forest River delivers a briefcase full of documentation of the components that go into a Berkshire, and it is all useful. For updated information, they often give a web location of PDF copies of manuals, or a web search can find them.

You can get detailed web-based information on your vehicle by supplying your vehicle VIN (on sticker above the Driver's Seat) to Freightliner (Parts Pro). Similarly, you can get information on your Cummins Engine and Allison Transmission by using the serial numbers that Freightliner provides you at Parts Pro.

Other component manuals can often be found for free on the manufacturer's websites, by using a Web Search.

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<sup>40</sup> An electronic version of the manual is at <https://forestriverinc.help/#/forestrivervv/guide/2020/932-berkshire/browse>, although the location will change for years later than 2020. They have a PDF copy of the manual at <https://s3.amazonaws.com/cd-content.fr-1.prod.tweddle.com/70a7a230-5b98-4a89-82df-e79180723f75/pdf/feaf77af-9384-4898-b40a-a021fe35ad70.pdf>