

# Water Systems Guide

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This guide is intended to assist Heartland Owners in understanding the operation and routine maintenance of their water systems.

## Important Notices

### Who created this document?

This document has been created by Heartland Owners independently of the Heartland RV Company, and is posted to the Heartland Owners Forum as a service to the owner community.

### Errors and Omissions

Because the authors are Heartland owners, not engineers or service technicians, it's possible that this document could contain errors or omissions. Readers are advised to also review the manufacturers' product documentation for more complete information and guidance.

### Additional Resources

The [heartlandowners.org](http://heartlandowners.org) website has a collection of owner-written user guides, including information on water systems, heating and cooling, winterizing, residential refrigerator, water heater and other topics. This information is available at <http://manuals.heartlandowners.org/?man=User%20Guides>

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# Water Systems Guide

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## Overview of Plumbing

The RV plumbing system consists of a collection of water lines, faucets, shower head, toilet, drains, holding tanks, pump, and winterization controls.

On the next page is a generic diagram of the plumbing system and most of the major components. The actual layout of any given trailer will vary from the diagram due to the variety of floor plans, length of the trailer, features, and price point. The diagram is not meant to be an exact representation of the plumbing layout. It's more of a logical diagram that shows how the plumbing system components are interconnected.

Water for your plumbing fixtures can be delivered either from the fresh water holding tank, through the use of the water pump, or directly from city (or campground) water connected to the trailer by way of a hose. Generally you would use one method at a time. If no campground water connections are available, you would use the pump to draw water out of the fresh water tank (which you would have had to previously have filled). Note that if you have city water connected, and turn on the water pump, the pressure from the city water connection may keep the pump from running.

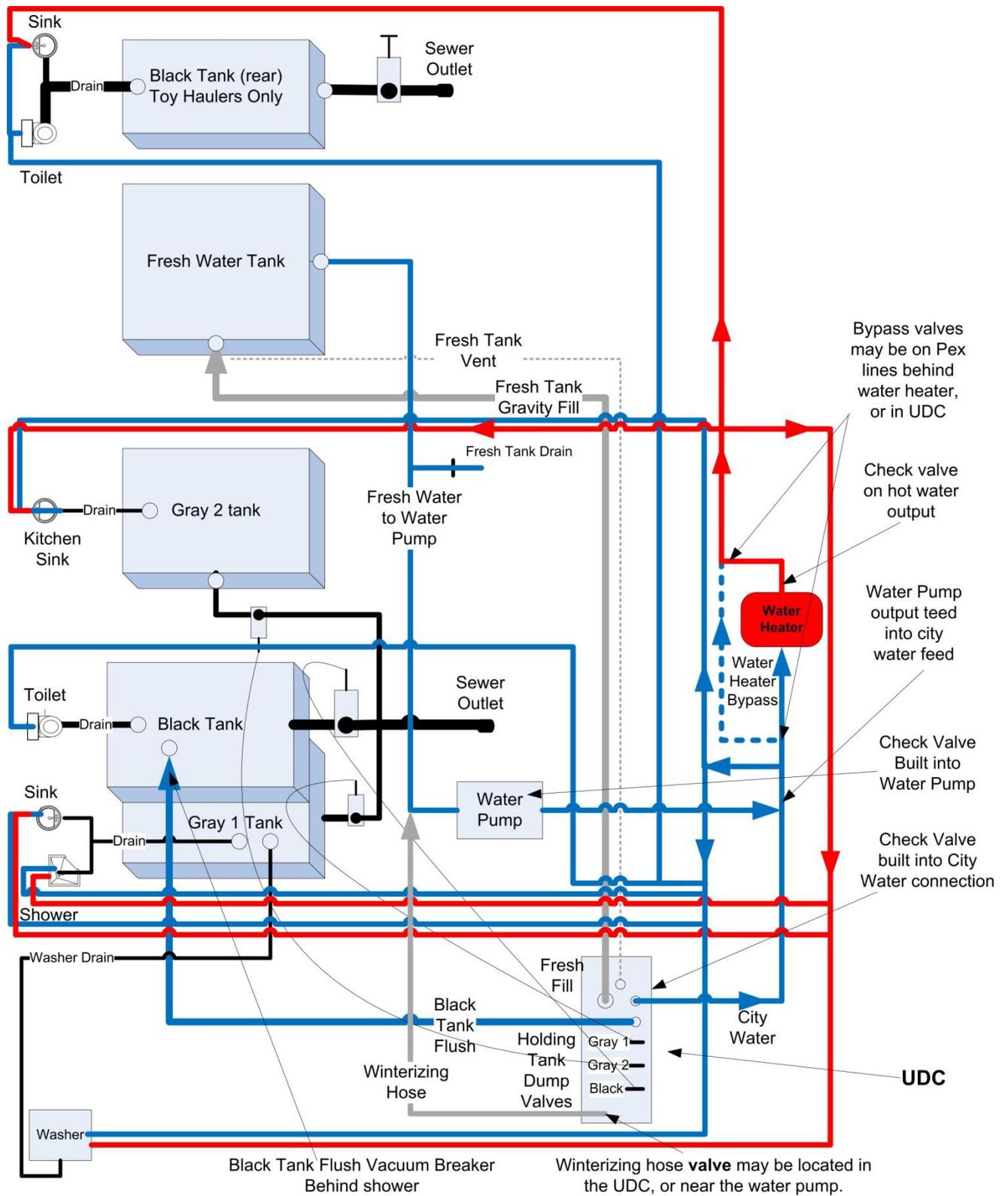
Waste water holding tanks collect water from sinks, shower, washing machine, and toilet(s). The tanks are generally kept closed, accumulating waste water until it's time to dump them into the sewer. The black tank accumulates waste from the toilet. The gray tanks accumulate water from sinks, washing machine, and shower. On toy haulers with a ½ bath in the rear, the sink and toilet may both empty into a black tank.

Valves to drain the tanks are usually located on the side of the tank, along the bottom edge. Each valve is operated independently by pulling the handle on a cable that is attached to its respective valve. The typical trailer will have a black tank and one or two gray tanks. Toy Haulers may have an additional black tank at the rear if an additional sink and toilet are installed in the rear.

Valve handles in many models are located in the Universal Docking Center (UDC). For convenience, all of the water connections, dump valves, as well as cable and satellite connections, are located in the UDC. Toy Haulers may have both a UDC and an additional valve handle in the rear for the 2<sup>nd</sup> black tank. Or they may just have separate handles spaced out along the side of the trailer.

Smaller trailers may not use the UDC approach but rather may have connections at various points around the trailer, with cable handles close to their respective tanks.

Although not shown on the diagram, drain lines will typically either vent up through the roof, or have a vacuum breaker to facilitate drainage while preventing discharge of tank/sewer odor into the interior of the coach. Drain lines at sinks and shower will also have a p-trap underneath to create a water barrier, again preventing discharge of tank/sewer odor into the interior of the coach.



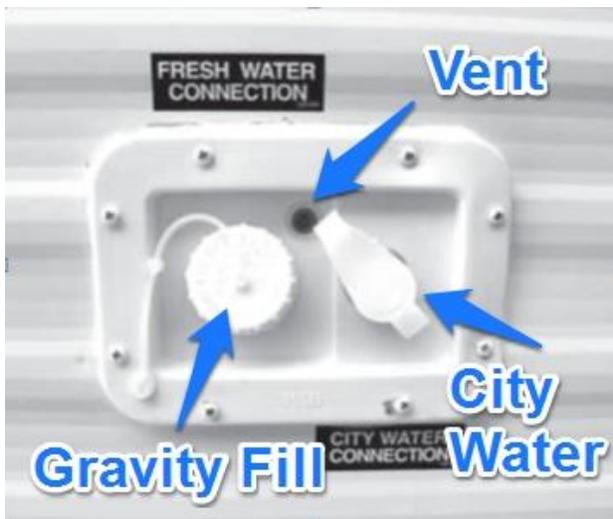
## Using the Fresh Water Tank

In order to use the fresh water holding tank and pump, you first must add water to the tank, using a hose that's connected to a pressurized fresh water supply.

### Gravity Fill

Most trailers have a "gravity fill" hose which allows you to fill the fresh tank by loosely fitting the water hose to the fill hose. Water should be turned on at a slow flow rate, allowing gravity to pull the water through the fill hose and into the fresh tank.

**CAUTION: Don't get distracted while filling the fresh tank and don't force the supply hose into the fill opening to create a water-tight connection. You could overflow the fresh tank and cause severe damage.**



### How Will I Know When the Fresh Tank is Full?

With the Gravity Fill system, as the tank fills, you'll hear gurgling noises at the vent next to the fresh water connection. In the picture above, the dark vent hole is located just above and to the right of the cap. A little water may come out of the vent. Water will also start coming out of the fill connection. If you think the tank is full, shut off the water and use the control panel inside the coach to see what the tank sensors indicate.

### What If The Tank Isn't Full But Won't Take More Water?

Sometimes the gravity feed hose overflows before the fresh tank is filled. This is often caused by water in the vent line, preventing the air in the tank from exiting as you try to add water. If you take a short

piece of hose and cover the vent, blowing gently will usually move the water back into the tank and allow you to continue filling the tank.

Sometimes a sag in the gravity feed hose may allow water to pool in a low spot, preventing you from adding more water. If you open the basement wall to gain access to the back side of the fill hose connector, it may be possible to remove the sag by **gently** pulling on the hose.

**CAUTION: Pull gently. Too much force could damage the hose or pull it off of the fitting at the tank end.**

If you have consistent problems filling the tank, and the unit is under warranty, consider having the dealer open the underbelly to correct the problem.

Some owners have had success inserting a hose into the gravity fill and then filling the tank using the inserted hose. Most local hardware stores carry cut-to-length tubing that's inexpensive (~ \$0.50/foot). A clear hose with inner diameter of ½ inch and outer diameter of 5/8" inch can usually be inserted into the gravity feed without difficulty. A 10 foot length will likely reach all the way to, or close to the fresh tank.

**CAUTION: Insert the tube gently. Too much force could damage the gravity feed hose or the fitting at the tank end.**

### Anderson 4-Way Valve

Most of the 5<sup>th</sup> wheel trailers manufactured since 2012 have the Anderson 4-way Valve. By positioning the valve handle, the plumbing setup is changed to:

- 1) Run off city water (CITY),
- 2) Run off the fresh tank using the water pump (NORMAL),
- 3) Fill the fresh tank while hooked up to city water (TANK),
- 4) Pump antifreeze or sanitizer through the pump, and on to the water faucets and fixtures (SANITIZE/WINTERIZE).

Note that the selector can be rotated in either direction. The position of the selector may be changed when connected to city water.

Note that petroleum-based lubricants must never be used on the 4-way Anderson Valve as the petroleum content will deteriorate the rubber parts inside the assembly. If lubrication is necessary, use only [Dow Corning Molykote 111 O-Ring Valve Lubricant](#).



### Filling the Fresh Water Tank with the 4-way Valve

Connect city water and turn the valve so it points toward **TANK**. This fills the fresh tank using pressurized city/campground water. With Anderson Valve installations, the fresh tank has multiple overflow valves to prevent tank damage. Nevertheless, you should monitor how much water you're adding by checking the Control Panel indicator lights



### Control Panel Tank Sensors

Indicator lights on the Control Panel show the approximate water level in each of the tanks when pressing and holding the appropriate button on the panel.

Note that the sensors are notorious for being inaccurate. The fresh tank sensor is probably the most reliable because it's not contaminated as easily as the others.

If any of the sensors indicate an empty tank, it's usually empty or nearly empty. If the Fresh Tank lights are indicating full, it's probably full. However, the gray tanks and especially the black tank indicator levels may show full or partly full even when empty, because waste material may be clinging to a sensor.

### Why Are the Sensors Inaccurate?

Three sensors are installed in the side wall of each tank, at different heights. If a sensor is wet, it passes electrical current and the light on the control panel is illuminated. As the tank fills, sensors higher on the side wall become wet and their lights are illuminated on the panel.

Sensor accuracy depends upon 1) the trailer being level, 2) the holding tank mounting position, 3) sensors not being contaminated so as to give false readings. If the trailer is not level, water will not be even distributed throughout the tank and there could be more or less than indicated by the sensors. If the tank is not level (if for example, the support rails are not level), the water is not evenly distributed. Finally, if food, or toilet paper contacts a sensor, it may stick, keeping the sensor wet enough to create a false reading.

## Water Pump Operation

**NOTE: If you have the Anderson 4-way Valve, in addition to turning on the water pump, you must also switch the valve to NORMAL.**

The water pump is an on-demand system. When a faucet is opened, the pump senses the drop in water pressure on the output side of the pump and turns on the pump motor. When the faucet is closed, the pump detects the pressure has returned to normal and turns off.

A typical water pump produces 3 – 4 gallons/minute of water flow, which should be enough for a good shower or to run the washing machine without any issues.

Water pumps are generally noisy, but if improperly mounted, they can be extremely noisy. The typical mount consists of 4 screws holding it to the floor mat. If you're experiencing excessive noise, check that all the screws are there. Don't over tighten. Also check that the pump is not in direct contact with anything other than the floor. Also check the input and output water lines to make sure they're not vibrating against nearby parts of the basement. Pipe insulation can help quiet down vibrating water lines.

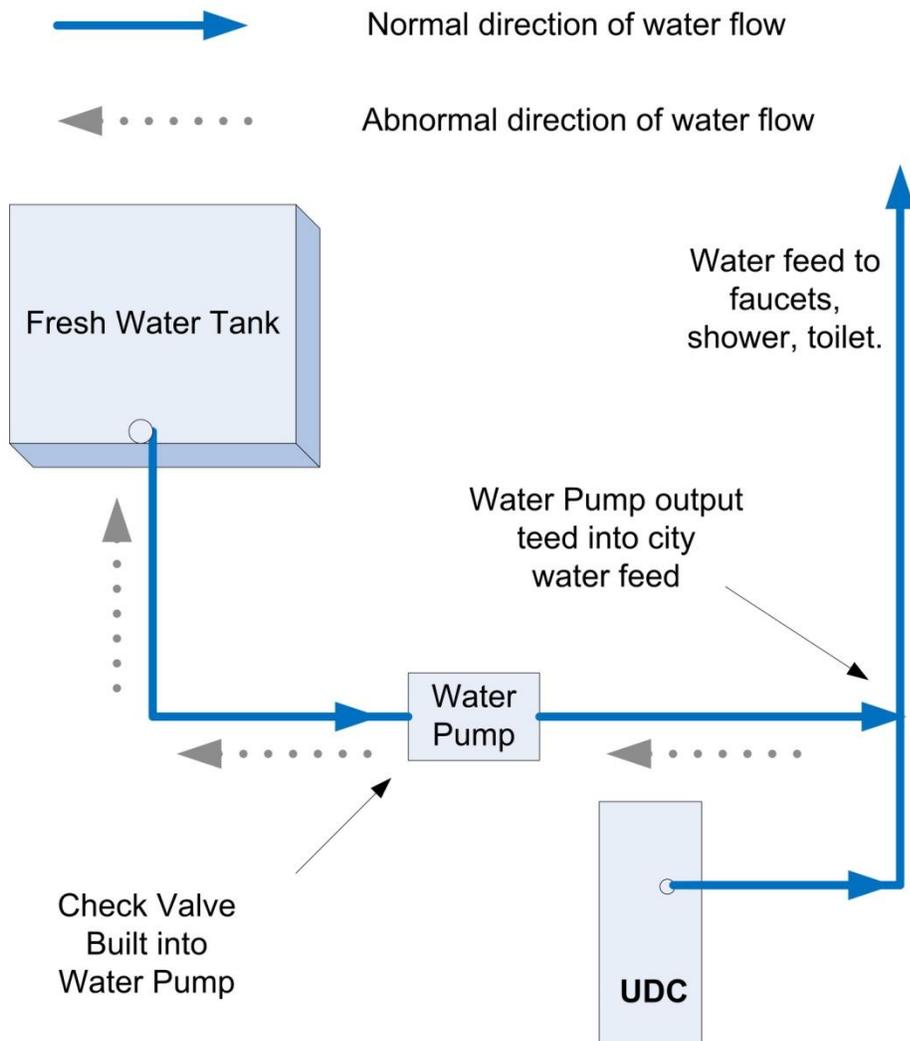
The water pump is usually located behind the UDC, if your trailer has a UDC. On models without a UDC, the water pump may be located anywhere, but generally will be close to the city water connection and to the antifreeze suction hose.

### Fresh Water Tank Fills by Itself, or Overflows While Using City Water

Water flowing backwards into the fresh water tank when connected to City Water can be caused by a problem either in the water pump, or in the Anderson 4-Way Valve (if so equipped). If you have an Anderson 4-Way Valve, consult our ["Fresh Tank Fills by Itself" user guide](#) for more information.

The water pump has a check valve built into it to prevent water from flowing backwards through the pump. Because the water pump output and city water come together at a tee in the water lines, when hooked up to city water, there's pressurized city water trying to flow back through the pump. If the check valve gets stuck partially open, city water will flow to the Fresh Tank (dotted lines in the drawing below), filling it and overflowing. On older designs with fewer vents, this might even cause the fresh tank to rupture. In the short term, while parts are on order, and while connected to city water, you can open the fresh tank drain to prevent tank damage or flooding.

This failure can be corrected either with a new pump, or by adding an [inline check valve](#) to the right of the Water Pump.



### The Pump Runs When No Faucets are Open

If the water pump runs when no faucets are open, there could be a problem with the pressure sensor that detects the drop in pressure that normally occurs when a faucet is opened. Or there could be a water leak somewhere in the plumbing system.

**CAUTION:** If the pump runs unexpectedly, you should assume there is a water leak until you determine otherwise. Water leaks can create significant damage and need to be repaired without delay. If you are not able to investigate the problem immediately, turn the pump off to prevent damage to the trailer.

If no leaks are found, check for an adjusting screw on the top of the pump to change the pressure adjustment. Try adjusting the screw  $\frac{1}{4}$  turn in one direction or the other to resolve the problem. Consult the pump manufacturer's documentation or website for additional details on adjustments that may be possible.

### The Pump Runs Continuously but Little or No Water Comes Out

If the winterizing valve is left partially in the winterize position, the pump will suck air into the water lines while trying to draw water from the fresh tank. Also check that the connections at the pump are hand-tight.

### Using City Water

Using City Water is the generic term for using a hose to connect a faucet at the campground to the City Water connection of the trailer. The campground water system supplies water to the trailer's plumbing

**NOTE:** If you have the Anderson 4-way Valve, in addition to connecting the water hose, you must also switch the valve to CITY.

### Water Pressure and Water Flow

Water pressure at the campground faucet can vary tremendously. At one location it might be 30psi or even less. At another, it could be 200psi. Your plumbing system is designed to operate at 40-50psi, and should never be subjected to water pressure greater than 60psi.

**CAUTION:** Water pressure greater than 60psi could cause plumbing leaks inside your trailer and could loosen fittings and connectors, causing leaks later even after normal pressure is restored. Always use a pressure regulator set between 40 and 50 psi.

### City Water Connection Check Valve

Note that the city water connection has a check-valve built into it to prevent water from coming out of the connection when using the pump. In order for water to go through the check-valve, it has to have a minimum amount of water pressure to open the check valve. Normal water pressure coming out of a faucet will open the check valve. If you intend to use an external water tank hooked up as an alternative to a faucet, it's possible that gravity may not supply enough water pressure to open the check valve.

### Water Coming Out of the City Water Connection

The city water lines and the output of the water pump come together in a tee connection in the basement so that water goes to all plumbing fixtures regardless of whether you're using city water or

pumping from the fresh tank. When using the water pump, to prevent water from being pumped back out the city water connection, there is a check valve at the connection that ensures water only goes in.

If you ever find water coming out of the city water connection, it means the check valve has become stuck open. Taking the filter screen off and pressing on the inlet may restore normal function.

### Why Don't I Have Good Water Flow?

You may have great water pressure, but poor water flow. A typical complaint is that it's difficult to get shampoo rinsed out of your hair. A good explanation of the difference between water pressure and water flow may be found at [RVWaterFilterStore.com](http://RVWaterFilterStore.com).

There are many things that can cause poor water flow. The most common causes are low water pressure, a kinked water hose, a clogged water filter, or an inexpensive water pressure regulator.

**NOTE: If water flow is good when using the water pump, but poor when connected to city water, that's a very strong indication that you have an external problem. Conversely, if flow is poor with either the pump or city water, it's a strong indication that there is an internal restriction, such as a clogged filter screen.**

Start by using a good water hose and making sure it's not kinked. If you have a problem with low water flow, before assuming anything about the inside of the trailer, disconnect the hose at the RV's City Water Connection and check the water flow coming out of the hose. You'll never get better water flow inside than what you see coming out of the hose.

If using water filter(s), check water flow with the filters removed. If it improves, replace the filter(s). Keep in mind that the smaller the filtration spec, the more likely the filter is to reduce water flow. A 5 micron filter will pass fewer contaminants than a 10 micron filter, but also less water. Also note that smaller diameter, inexpensive in-line filters will generally not allow as much water flow as a larger diameter canister.

### Water Pressure Regulators

Poor water flow may be the fault of the Pressure Regulator. Most inexpensive water pressure regulators in the \$10-20 price range are preset to 40psi. While the pressure setting is specified, what's not specified is the water flow. Inexpensive regulators usually have small diameter openings inside that may allow only ¼ to ½ gallon of water per minute, which is not much. A more expensive regulator, such as the Watts Brass Model 263A Adjustable Regulator, offers a pressure adjustment range of 10-65 psi, and delivers water flow of 4-4.5 gallons per minute. One online source for this is the [RV Water Filter Store](http://RVWaterFilterStore.com).

### Other Flow Restrictions

Flow restrictions may also result from sand or other contaminants clogging the filter screens at the city water connection, or in faucet screens. Examine these screens and clean as necessary.

**CAUTION:** If disassembling a faucet to examine the screen(s), first cover the drain so you can't lose any parts that might be dropped.

Once disassembled, it's not always obvious how the parts go back together. As you disassemble, carefully note the way the parts go together. A picture may be helpful.

## Shower Head

The shower line may have a plastic disc with a hole in the center acting as a flow restrictor. Some people have unscrewed the shower hose, removed the restrictor, and drilled a larger diameter hole in the restrictor to improve water flow to the shower head.

It's also possible to improve shower performance by changing the shower head. Many owners prefer the [Oxygenics Shower Head](#).

## Is there a Workaround if the Campground has Poor Water Flow?

If you've done everything you can do, but the campground has poor water flow, or low pressure, you may want to use the campground water to fill the fresh water tank and then run using your water pump.

## Water Filters

Those of us who live in homes with city water may be used to using water treated by the city for quality and clarity. When visiting RV parks and other types of campgrounds, the water may be supplied from a well. Campground well water may not meet the standards of a city water system for quality and clarity.

Water filters remove sediment and other contaminants from the water before it reaches your plumbing system. Many people opt for dual canister filtration systems where water first goes through a sediment filter to remove coarse particles of sand and dirt. The second canister usually contains a carbon filter that improves taste and odor. Some secondary filters can also remove chemicals, bacteria, cysts, lead and other heavy metals.

It's important to follow the filter manufacturer's recommendations on filter life as they can stagnate and build up bacteria over time.

Filters come in various materials and screen particles or contaminants of various sizes, with filtration size usually measured in microns. A 1 micron filter will usually block more contaminants than a 5 micron filter, BUT it may also severely reduce water flow. Larger diameter filters and canisters typically provide better water flow at any given filtration size because there's more surface area on the filter for water to pass through.

Many people use dual canister systems and filters from big-box stores like Lowe's or Home Depot. Others use systems sold by [RVFilterStore.com](http://RVFilterStore.com). [RVFilterStore.com](http://RVFilterStore.com) is a great source of information about the different choices.

## Placement of Pressure Regulators and Filters

When using pressure regulators and water filters, a question arises as to which goes first, or is closest to the faucet.

If the regulator is placed first, it will protect the canisters from possible damage if you connect to a system with very high water pressure. But putting unfiltered water through the regulator may result in sediment clogging the filter screen on the regulator. So some people put the regulator after the water filter to keep it clean.

## Tub to Hold Water Hose, Filters and Regulator

Some owners (shout out to JohnDar) have used tubs to hold their water filters, regulator, and hose. In the picture below, you can see the pressure regulator (with gauge), a 2-stage filter system, and a cut-off valve. The tub has a hose-sized hole cut in each side and there are quick-connects on each end. A short hose connects the output side to the city water connection on the RV, and the longer hose goes to the faucet. Everything is self contained in the tub so that setup and breakdown take just a minute. Appropriately sized plastic tubs are available at many grocery stores and at Walmart.



Note that the pressure regulator is positioned to the far left of the tub, after the filters (output side). There is also another water pressure gauge at the right side of the tub (input side), and a water meter further to the left, outside the tub. There is also a water meter to the left, just outside the tub. Having a gauge on both sides of the filter system allows you to see if the filters are causing a significant drop in water pressure. The water meter keeps track of how much water has gone through the filters, helping you to know when it's time to change the filters. Of course the gauges and water meter are not required in order to filter your water. But they are helpful.

## Mounting Water Filters Inside the Coach

Permanently mounting the water filters inside the coach is a modification that some owners have done. The installation below (shout out to recumbent615) is on the inside of the basement wall in a Cyclone. A key advantage of this type of installation is that it requires no setup time at all. For an interior mount, be sure to use canisters that are strong and durable because a cracked canister, like any broken plumbing fixture, would flood the interior of the basement.



## Hot Water

The hot water heater supplies water heated to between 130 and 140 degrees F. On larger trailers, the capacity of the water heater is 12 gallons. On smaller trailers it could be 10 or even 6 gallons. The capacity combined with recovery time (to heat incoming cold water as you use the previously heated water) determines how long you can use hot water without running cold.

Some newer hot water heaters may claim an effective size of 20 gallons. While the tank size has not increased, the recovery time has been improved so as to function as though the tank actually contained 20 gallons. This is a very clever design that provides the benefits of a 20 gallon tank without consuming the additional space and weight that would be required.

## Operating with Gas, Electric or both

If you're boon docking and don't have shore power or generator power, you have to run the water heater on LP. Note that if your battery runs down, the water heater circuitry that depends on 12V will shut down and the LP controls will not operate.

When you have shore power, you'll probably want to run in electric mode using the 120V switch. Save your propane for other uses where electric operation is not available, like the stovetop and the furnace.

If you have a lot of people using taking hot showers in a short span of time, you may want to run both gas and electric modes at the same time. This will result in faster recovery time and allow more shower time before you run out of hot water.

***CAUTION: It's critically important that you check that the water heater is full of water before turning on the 120V heat. If there's no water, the heating element will burn out very quickly and will have to be replaced.***

Some newer Atwood and Suburban Water Heaters may come with a new type of electric heating element that won't burn out if operated without water in the tank. However, you should never assume you have one of these. Always make sure the tank is full before turning on the heater.

## Detailed Information on the Hot Water Heater

For more information on the water heater, please consult the [detailed Water Heater Usage Guide](#) and the [detailed Water Heater Troubleshooting and Repair Guide](#) that are located in the manuals section of the Heartland Owners Forum.

## Holding Tanks

### Monitors

As mentioned earlier, the control panel inside the trailer has a display that indicates approximately how full each holding tank is at any given time. Because these sensors and monitor readings are notoriously inaccurate, many owners ignore them.

### Dumping the Tanks

#### General Procedure to Dump the Tanks

**CAUTION:** Do not allow yourself to get distracted while dumping the tanks. If you get distracted while the black tank flush is adding water to the tank, the results could range from unbelievably messy to disastrous. Use a timer when appropriate to avoid overfilling the black tank (smart phones all come with timer/stopwatch apps).

**CAUTION:** It's also a good idea to notify people inside the trailer so that they don't press the toilet flush valve while you're going through these procedures. Under some circumstances, doing so could create a terrible mess inside the trailer (and on the person).

#### Dump the Black Tank First

Dump the black tank first. To prepare, you'll need to connect a water hose to the black tank flush connection, and connect the sewer hose securely at both ends.

**CAUTION:** The black tank flush has an inline anti-siphon valve and hose routing that is intended to prevent backflow of waste water into your water supply. Fresh water contamination can have extremely serious consequences. Adding a check valve between the hose and the black tank flush connection is an inexpensive additional step you can take to prevent water contamination.

Pull the handle to open the black tank gate valve. Turn on the black tank flush. If the tank was nearly full, a fast moving stream of waste water should come rushing through the sewer pipe, into the sewer

hose, and down into the sewer. (See the section below on accessories that will make it easier to observe the waste water.)

In normal operation the stream of waste water will diminish in about a minute. After a few more minutes, the stream should be running clear at a slower rate that is based on the water being added at the black tank flush.

After running clear for a while, close the black tank dump valve. Now add at least 5 gallons of fresh water back into the black tank. You can continue to use the black tank flush, or add water directly at the toilet. This will prevent solids from sticking to the bottom of the tank the first time you use the toilet after dumping the tank. **DON'T FORGET TO TURN OFF THE BLACK TANK FLUSH!**

You may want to add a deodorizer to the black tank to help control odors.

### **Dump the Gray Tanks after the Black Tank**

After you're finished dumping the black tank, next dump the Gray #2 (kitchen) tank. When it's empty, then dump the Gray #1(bathroom) tank. The gray water will flush most of the black water out of the sewer lines and out of the sewer hose.

### **When Camping, Should the Gray Tank Valves be Left Open or Closed?**

Some people keep their gray tanks closed until it's time to dump the tanks. Others leave the gray tanks open all the time.

If the gray tank valves are open all the time, it's possible for vapors from the sewer system to enter your trailer when other campers are dumping their tanks. It's not common, but it's also possible for pests to get into the tanks.

If you keep the gray tank valves closed, you'll have to monitor the levels closely. The gray tanks, especially Gray #1 which the shower and washing machine empty into, will usually be the first to be filled and will typically be full long before the black tank is full. You might have to dump Gray #1 every other day, whereas it might be a week or longer before you need to dump the black tank.

In any case, it's good to capture some water in the gray tanks before it's time to dump the black tank. If you plan to dump the black tank every Saturday, you may want to close the gray tank valves on Thursday or Friday so there's gray water to clean the lines and hose after dumping the black tank.

**CAUTION: Do not leave the gray tank valves open if you have Tank Heating Pads and have turned them on. The heating pads can damage an empty holding tank.**

### **When is the Black Tank Ready to Dump?**

As a rule, it's better to empty the Black Tank when it's full or nearly full. This is because a full tank empties with a forceful flow that carries bulky waste material through the gate valve, pipes and sewer line more reliably. Emptying a ½ full tank can be more difficult as some waste material may tend to get stuck or even block the gate valve.

There are several strategies for determining the Black Tank is nearly full. One is to use it until it “burps” when flushing. This is an indication that the tank is full or very nearly full. Another approach is to empty the tank on a calendar basis based on past experience. If you know that the tank is fairly full after 7 days use, you can plan on emptying it on the same day each week.

### Black Tank with a Leaky Gate Valve

If the black tank gate valve leaks a bit when closed, it creates several problems for the owner. When setting up camp, as you remove the cap from the end of the sewer line, a gallon or two of waste water may come pouring out. Watch where you put your feet! While a small amount of water may not indicate a leaky valve, a large amount does.

The more serious problem caused by a leaky gate valve is that the waste water can leak out, leaving solids behind to build up and solidify on the floor of the tank. When this happens, the tank outlet can easily become blocked by the solids, restricting water flow and making it extremely difficult to dump the tank completely.

Sometimes the only way to tell what’s wrong is to take the valve apart to evaluate. Most owners will leave this job to a service tech because it involves dropping the underbelly material (coroplast) and dealing with the mess that’s stuck in the tank.

### Accessories to Help with Dumping the Tank

A clear sewer pipe extension with backflush and a twist-on external gate valve are a great help to dumping the black tank successfully, and also to keeping your shoes dry.



By placing the twist-on external gate valve on the end of the sewer line, you can close the valve before traveling. When setting up, attach the sewer hose before opening the external gate valve. Any waste water in the lines will go harmlessly down the sewer.

The clear extension pipe allows you to see what's coming out of the pipe when dumping the black tank. You can easily evaluate whether all waste material has been cleaned out because only the fresh water introduced through the black tank flush mechanism will be draining.

These devices are readily available at most RV dealer parts departments, or from Amazon.com or Camping World or Tweety's.

### Blockages While Dumping the Black Tank

Sometimes when dumping the tank, waste material will block the tank outlet at the interior gate valve. You'll know this has happened because water coming out the sewer pipe will taper off to a trickle even while the black tank flush is still being operated.

When blockages occur, because the black tank flush is adding water to the tank, they usually will break free as the water level inside the tank increases, increasing pressure on the blockage. You'll see a bit of waste material added to the trickle, and then a bit more, finally a large quantity will come through, washing the blockage down the sewer.

### Clearing Stubborn Blockages

Occasionally, the blockage may be stubborn and not break free on its own. Back-flushing may help. Turn off the black tank flush and attach the hose (with check valve) to the back-flush connector on the clear sewer pipe. A powerful stream of water pushing back toward the tank may dislodge the blockage.

If you don't have a back-flush connector at the sewer outlet, you may be able to dislodge the blockage by lifting the sewer hose in the middle. If held up several feet so that it's higher than the black tank gate valve, after the hose fills, there will be some back pressure that may clear the blockage.

Another technique is to close the external twist-on gate valve. This will allow the trickle of water to fill the sewer pipe, again creating a back flush effect that may remove the blockage.

**CAUTION: When running the black tank flush, you are adding water to the black tank. If a blockage occurs, the tank begins filling and could overflow, causing damage to the tank, and to the toilet.**

**To avoid this, it's a good idea to time the blockages (use your smart phone timer). You can generally assume the water flow into the black flush mechanism is no more than 5 gallons per minute. So 4 or 5 minutes could add 20-25 gallons. That's half the content of a 45 gallon tank.**

**After a maximum of 5 minutes, turn off the black tank flush and allow the water to soften the blockage.**

**It's also a good idea to notify people inside the trailer so that they don't press the flush valve while you're going through these procedures.**

### Cleaning the Black Tank Thoroughly

With an external gate valve, it's easy to give the black tank a very thorough cleaning. Before dumping the gray tanks, continue cleaning the black tank as follows.

Once the black tank has run clear for at least a minute, and continues to have water running from the black tank flush, close the external gate valve accessory mentioned earlier (you really do want to get one of these). Leave the black tank flush running to add water to the tank.

Using a timer, and assuming water flow of 4 to 5 gallons per minute, the tank should be about ½ full in 4 or 5 minutes.

**CAUTION: Don't guess. Use a timer or you could end up overfilling the tank, creating a mess, and possibly causing damage. Don't get distracted while adding water to the tank!**

When the timer goes off, open the external gate valve. You may be surprised to see more waste material come out.

Repeat this process several times until you get fairly clear water after opening the external gate valve.

### Avoiding Blockages

Water is your friend. It dissolves the waste material in the tank. Don't be stingy when flushing the toilet. Use lots of water to help dissolve the waste material.

Toilet paper should be a type that dissolves quickly and easily. Start with a toilet paper that's safe for septic systems. You may want to test it by putting 2 sheets into a quart container of water. Shake a few times. If the paper falls apart, it should be ok to use in your black tank.

Baby wipes, flushable wipes from Cottonelle and other suppliers are stronger than toilet paper and may take longer to dissolve. While they may be septic safe, because they don't have time to dissolve in your holding tank, they may contribute significantly to blockages.

Other materials such as diapers or feminine products may also contribute significantly to blockages that could be very difficult to clear. Do not flush them in your RV.

### Tip when Repairing the Black Tank Gate Valve Yourself

While most people will leave this type of repair to a service technician, some adventurous souls may do it themselves. Before taking anything apart, drain the black tank and clean it as thoroughly as possible. Then to drain any residual water, elevate the side of the trailer opposite the gate valve.

Then to minimize the possibility of any bit of remaining fluid coming out when you take the valve apart, elevate the side of the trailer with the gate valve to move any remaining fluid to the other side of the tank.

## Sanitizing the Holding Tanks

### Black Tank

Many people successfully use the GEO Method or a variant of the GEO Method. It's based on laundry detergent, bleach, and Calgon powdered water softener.

Before starting a day of travel, dump the black tank and afterward dissolve 2 cups of Calgon Water Softener in a gallon of hot water. Pour directly into the black tank through the toilet. Allow it to agitate from vehicle motion. The water softener will coat the walls of the black tank making it more difficult for solids to stick.

Adding a cup of laundry detergent at the same time as the water softener will clean the tank while you travel.

Occasionally adding bleach to the black tank during normal use will help control odors from the tank. Add ½ gallon of household bleach through the toilet when the black tank is half full. Don't let the bleach sit in the toilet; keep the flush valve open while adding the bleach. Continue using the tank and dump when full.

### Gray Tanks

You may want to use the same GEO method to clean and sanitize the gray tanks.

Another approach is to dissolve 1 cup of dishwasher detergent gel in a gallon of hot water and add to a half full gray tank. Let it agitate as you travel and empty the tank when you arrive at your destination.

### Fresh Water Tank

Heartland recommends a solution of 1 gallon of water and ¼ cup of household bleach for each 15 gallons of tank capacity. A 90 gallon tank would take a mix of 6 gallons of water and 1 ½ cups of bleach.

1. Add the recommended solution to the fresh tank and complete filling the tank with fresh water.
2. With pump on, open all faucets to release trapped air. Close the faucets and allow the pump to pressurize the system.
3. Let stand for 3 hours.
4. Drain and flush with fresh water.
5. A solution of 5 gallons of water with 1 quart vinegar may be used to eliminate excessive chlorine taste. Allow the solution to agitate in the fresh tank by vehicle motion. Do this over a period of several days if possible.
6. Drain the tank again and refill with fresh water.

If you have a gravity fill fresh tank, the bleach solution may be poured into the gravity fill opening. If you have a 4-Way Anderson Valve, you can fill your water hose with bleach before connecting it to the water inlet and city water faucet and use the pressurized water from the faucet to push the bleach in.

### Winterizing

There are 2 basic methods for winterizing: adding antifreeze or evacuating the water lines. Regardless of which method you use, you must start by doing the following:

1. Open a faucet inside the trailer
2. Open the fresh tank drain valve and completely drain the fresh water tank.
3. Dump the black and gray tanks.

4. If you have low-point drains (most recently built trailers do not), open those valves and drain the water lines.

## Draining the Water Heater

Before doing anything else, you need to drain the water heater. If it remains full, and the water is not heated, the contents will freeze, damaging the tank.

**WARNING: Before draining the tank, turn the water heater off and allow the water to cool. Then lift the pressure relief valve on the back of the water heater before loosening the anode rod/drain. If you skip these steps, you could be scalded by hot water, or the water pressure could cause the anode rod/plug to be propelled away from the RV at high speed, causing personal injury or property damage.**

1. Turn off the water heater (110V and LP) and allow it to cool completely.
2. Turn off the secondary 110V switch on the back of the water heater
3. Turn off the city water and the water pump.
4. Open hot and cold water faucets
5. Open the pressure relief valve
6. After pressure is relieved, use an anode rod removal wrench, or standard 1-1/16" socket wrench to rotate the nut counter-clockwise and unscrew the anode rod. Note that Atwood water heaters will have a drain plug, but no anode rod.
7. Allow the water to drain completely. You may want to take this opportunity to clean the residue at the bottom of the water heater tank using a wand attached to your water hose.
8. Reinstall the anode rod/drain plug at this time, using Teflon tape or equivalent to prevent water leaks. Teflon tape will also make future removal easier. **Do not over tighten.**
9. Atwood only: The following is a quote from the Atwood Manual.

"After draining the tank, because of the placement of the Drain Plug, approximately two quarts of water will remain in the tank. This water contains most of the harmful corrosive particles. To remove these harmful corrosive particles flush the tank with either air or water. Whether using air or water pressure, it may be applied through the inlet or outlet on the rear of the tank or the Pressure Temperature Relief Valve. (If using the Pressure Temperature Relief Valve the Support Flange must be removed). The pressure will force out the remaining water and the corrosive particles. If you use water pressure, pump fresh water into the tank with the assistance of the on-board pump or use external water for 90 seconds to allow the fresh water to agitate the stagnant water on the bottom of the tank and force deposits through the drain opening. Continue repeating adding water and draining until the particles have been cleared from the water remaining in the tank."

## Antifreeze Method

**WARNING: Automotive antifreeze is toxic and should never be used in your water system. Be sure you are using RV/Marine antifreeze that is non-toxic and safe for potable water systems. Look for a label statement that the antifreeze is non-toxic. Propylene Glycol is a safe type of RV antifreeze that is also not harmful to the seals or other components of your water system.**

### First Bypass the Water Heater

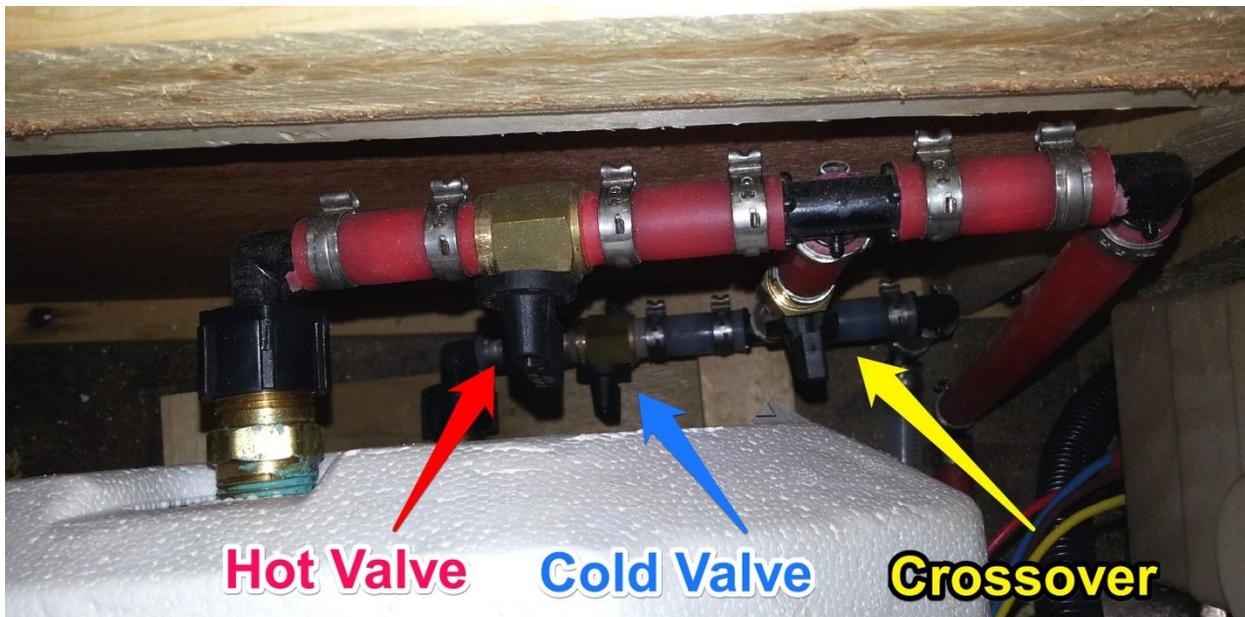
Be sure the water heater controls have been set to bypass. Antifreeze can damage the tank lining and inadvertently adding 12 gallons of antifreeze at \$4.00/gallon would also be expensive.

There are two types of bypass controls. Larger trailers with a Universal Docking Center (UDC) will usually have a lever in the UDC marked Water Heater Bypass. Turning the handle 90 degrees will bypass the water heater. There is usually a large instruction label on the cargo hatch door that shows which way to turn the valve handle.



The other type of bypass uses three separate valves to bypass the water heater. These valves are usually located on the inside of the trailer, where the hot and cold water lines attach to the water heater inlet and outlet. Each of those lines will have a valve and there will be a third water line that bridges between the hot and cold lines. That third water line will also have a valve.

Rotate the hot and cold line valves 90 degrees to close off those lines and rotate the bridge line valve 90 degrees to open that line. The valve handles are usually constructed so that the handle is parallel to the water line when open, and perpendicular when closed. This picture from an MPG trailer illustrates.



Access to these valves varies on different trailers. On toy haulers, the valves may be accessed by removing the basement wall to gain access to the water heater connections. On travel trailers, there may be a panel that needs to be removed to gain access.

If you're not sure how to gain access, start by noting the position of the water heater and look on the inside of the trailer for a cabinet, drawer, or removable panel that is close to the water heater.

### **Preparing to Add Antifreeze**

You'll probably need at least 2 gallons of antifreeze. If you have a larger trailer, and if you have a washing machine, you may need 3 or 4 gallons.

Locate the antifreeze suction hose. On trailers with a UDC, the suction hose is usually in the UDC. It may have a ½" plastic screw-on fitting on the end. There is usually additional tubing behind the UDC. Pull gently to extend the hose to a convenient position and insert into an antifreeze jug.

Some trailers have a second valve handle in the UDC that needs to be rotated 90 degrees in order to suck antifreeze through the hose. Check the label on the valve handle or the diagram on the cargo hatch door.

### **Antifreeze and the 4-way Anderson Valve**

If your trailer has the 4-way Anderson Valve, you'll need a short piece of garden hose. Screw one end into the city water connection and put the other end into the antifreeze jug or a bucket of antifreeze. Turn the 4-way valve to the Winterize position.

After winterizing all fixtures, quickly rotate the Anderson Valve selector knob through all 4 positions so that a little antifreeze is spread throughout the valve assembly.

### **Adding the Antifreeze**

Start with the faucet furthest from the city water connection, usually the kitchen. Open the faucet and turn on the water pump. As soon as the pink antifreeze starts flowing out of the faucet, close the faucet.

Move to each faucet in turn opening it until antifreeze flows out of it.

Operate the toilet flush control to run it until antifreeze flows into the toilet.

Operate both hot and cold shower controls one at a time until antifreeze comes out the shower head for each.

Repeat this for the outside shower.

If you have Washing Machine Prep, but have not yet installed a washing machine, you need to protect the hot and cold water lines that supply water, and the p-trap in the washing machine drain. Insert one of the hoses into the drain and open its valve until antifreeze comes out and then close the valve. Repeat for the other hose, but let the antifreeze run into the drain for a few seconds to displace water in the p-trap with antifreeze.

Change antifreeze jugs as necessary.

***TIP:*** To avoid running out of antifreeze in the middle of the procedure, and having to switch jugs, put all of your antifreeze into a 5 gallon bucket and insert the suction hose into the bucket.

### **Adding antifreeze to the Washing Machine (Ariston/Splendide Stacked Unit)**

Set the washing machine temperature control on HOT to run water through the hot water line, solenoid and into the drum. Then set the selection dial to Wash Setting 3 (Permanent Press) and start the machine. When you see pink antifreeze in the drum, stop the cycle.

Set the dial to DRAIN to pump the mixture of antifreeze and water out of the washing machine.

Run the RINSE cycle to pump antifreeze through the RINSE solenoid.

With the temperature control set on COLD, set the dial to Wash Setting 3 (Permanent Press) again. When you see antifreeze in the drum, stop the cycle.

Set the dial to DRAIN again to pump the pure antifreeze out of the washing machine and through the drain hose and into the p-trap.

### **Adding antifreeze to the Washing Machine (Ariston/Splendide Combo Washer/Dryer)**

The procedure is essentially the same, but the controls differ a bit.

With WASH TEMP knob set to HOT, turn the selector knob to REGULAR in Cotton Heavy Duty. Start the cycle and wait for antifreeze to start filling the drum. Advance the selector knob to RESET and wait 5 seconds for the Status/Door Lock LED to begin blinking.

Use the SPIN cycle to drain antifreeze from the drum.

Advance the selector knob to RESET and wait 5 seconds for the Status/Door Lock LED to begin blinking.

Turn the WASH TEMP knob to COLD.

Again turn the selector knob to REGULAR in Cotton Heavy Duty.

Let the machine fill until you see antifreeze in the drum.

Advance the selector knob to RESET and wait 5 seconds for the Status/Door Lock LED to begin blinking.

Advance the selector knob to SPIN and let the antifreeze drain from the drum.

### **Icemaker/Water Dispenser Water Line**

**Note that it is not a good idea to get antifreeze in the icemaker/water dispenser line. It may be very hard to get rid of the taste.** Winterizing this line will be covered as part of the compressed air method.

### Adding antifreeze to drains and p-traps

Pour about ¼ cup of antifreeze into each kitchen drain and bathroom drain and shower drain. The p-traps under the drains hold water and need to have the water displaced by antifreeze to protect them from freezing.

### De-winterizing

To remove the antifreeze from the system, you'll need to flush fresh water through the entire water system. An easy way to do this is to hook up to city water and add a few gallons of water to the fresh water tank. If you don't have city water available, you can bring a 5 gallon jug of fresh water and use the antifreeze suction hose as an alternative water supply (check that the antifreeze valve is set correctly).

Turn on the water pump and open each faucet in turn to let the fresh water push the antifreeze out of the faucet and down the drain. Do the same for the shower, toilet and outside shower. If you have Washing Machine Prep, put each hose in the drain and open its valve until fresh water comes out and then close the valve. Repeat for the other hose.

If you do have the washing machine, alternately run the Wash Setting 3 (Permanent Press) and DRAIN cycles several times to flush the antifreeze out of the drum completely (you may need additional water if you only brought a 5 gallon jug). Also run the RINSE cycle to flush antifreeze out of the RINSE solenoid. The additional RINSE and DRAIN cycles are needed to avoid staining clothing with antifreeze the next time you use the washing machine. You may want to also run a complete wash cycle placing a ½ TBSP of powdered detergent (or liquid equivalent) in the machine's detergent compartment.

After flushing out all the antifreeze, remember to set the antifreeze valve and water heater bypass valve(s) back to the normal positions.

### Compressed Air Method

You'll need an air compressor and a blowout fitting that connects the air compressor to the city water inlet. [Water System Blowout Plugs](#) are available at most RV dealers and from many online sources.



The air pressure on the compressor should be set between 20 and 40 psi. If your compressor doesn't have an adjustable output pressure control, you'll need to obtain one to insert in-line.

**TIP:** When using the compressed air method, the hot water heater tank can be used as a compressed air cylinder to provide a constant supply of compressed air to the faucets. To use it this way, do not bypass the water heater.

Attach the blowout plug and air compressor, but don't turn it on yet.

### **Clearing the Water Pump Lines**

The compressed air won't clear the water pump. With the fresh tank having already been drained, open a faucet and run the water pump to draw any remaining water out of the water line to the pump. Do this before evacuating the rest of the water lines. When no more water comes out the faucet, turn the pump off.

Now turn on the air compressor. If using the hot water tank as an air cylinder to maintain constant pressure, do not bypass it (you should have already drained it).

Starting with the faucet furthest away, usually the kitchen, open the faucet and allow the air pressure to evacuate all of the water from the faucet. Be sure to do so for both hot and cold settings to evacuate both water lines.

Repeat with each faucet, the shower, and the toilet flush valve. Also evacuate the water from the outside shower.

If you have Washing Machine Prep, but haven't yet installed a washing machine, you'll need to also protect the hot and cold water lines that go to the washer area. Place one hose in the drain and open its valve to let compressed air evacuate that line and then close the valve. Repeat for the other line.

It's a good idea to make two passes through the trailer to make sure all water is evacuated. It's normal for a mist to come out of the faucets as the residual water is pushed out by the air.

### **Adding antifreeze to the drains and p-traps**

Although you've evacuated the water out of the pex lines, you still have to protect the drains and p-traps. Add ¼ cup of antifreeze to each drain to displace the water in the p-trap with antifreeze. Don't forget the washing machine drain if you have one.

### **Draining the Water Pump Filter Housing and Pump Assembly**

Unscrew the filter housing on the input side of the water pump and dump the water out. Reinstall the housing. Unscrew the water line connection on the output side of the pump and lay it on a towel. Run the pump for a few seconds to make sure any remaining water is evacuated.

### **Protecting the 4-Way Anderson Valve**

Continue applying compressed air to the water inlet while rotating the 4-way Valve selector through all 4 positions to evacuate water from the valve assembly.

## Washing Machine

Set the water temperature to HOT and turn the wash cycle dial to Wash Setting 3 (Permanent Press). The compressed air will evacuate water from the hot water line into the drum. After all of the water is out of the hot line, switch to COLD and run the Wash Setting 3 (Permanent Press) cycle again. Also run the RINSE cycle to evacuate water from the RINSE solenoid.

After both hot and cold lines are blowing air only, set the wash cycle dial to DRAIN and allow the pump to empty the water out of the drum.

Pour antifreeze into the washing machine until you can see it coming just above the holes in the drum. Then run the DRAIN cycle to flush antifreeze through the pump, drain hose and p-trap.

When de-winterizing, use the Wash Setting 3 (Permanent Press) cycle to add water to the drum, and the DRAIN cycle to pump it out. Do this several times to get all of the antifreeze out of the drums so it doesn't stain clothing.

## Refrigerator with Water Dispenser/Ice Maker

Some of the components that carry water to the icemaker/dispenser are exposed to outside air and will freeze if not winterized. This will occur even if you're using the RV and it's a nice comfy 72 degrees inside.

Dometic recommends leaving this to qualified service personnel, but if you have an air compressor and a few basic tools, you should be able to do it yourself.

The essence of this job is to evacuate all of the water from 1) the ¼" clear plastic water supply line that brings water to the back of the refrigerator, 2) the solenoid that controls water flow, 3) the water lines in the refrigerator that go from the solenoid to the icemaker and water dispenser.

If you're winterizing the rest of the RV with RV Antifreeze, you'll have to follow the procedure outlined in the RM1350 manual that came with your refrigerator. You can download a copy from the Heartland Owners Forum, in the TOOLS/Heartland Owners Manuals section.

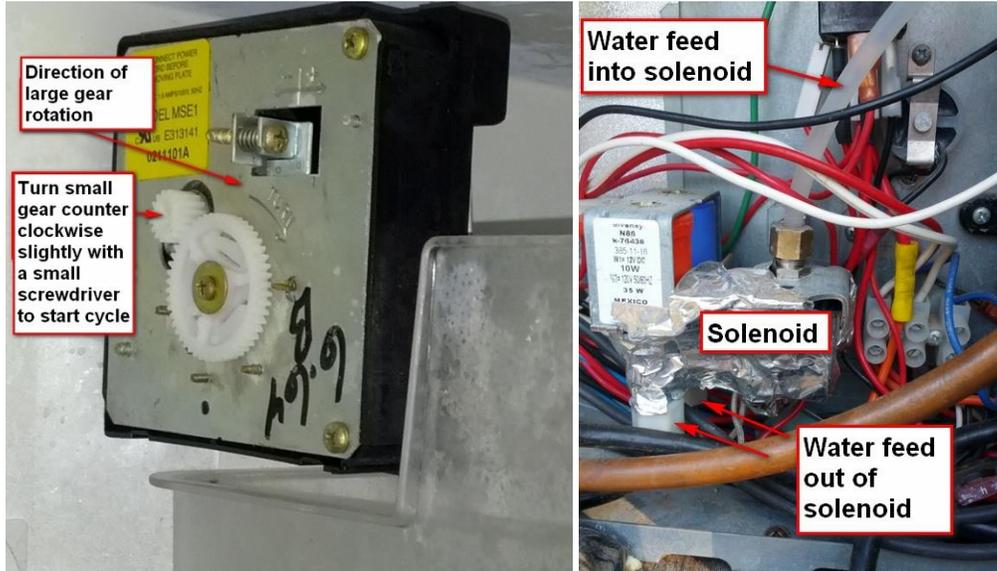
If you're winterizing with compressed air connected to the city water connector in the UDC, it's easy to winterize the refrigerator.

1. After you've used 20 psi of compressed air to evacuate water from the rest of the water system, leave it hooked up with the compressor running.
2. If you have a water dispenser, operate it to dispense water into a large container until only air is coming through. This will evacuate water from the supply line, the part of the solenoid that controls water flow, and the feed line to the dispenser.

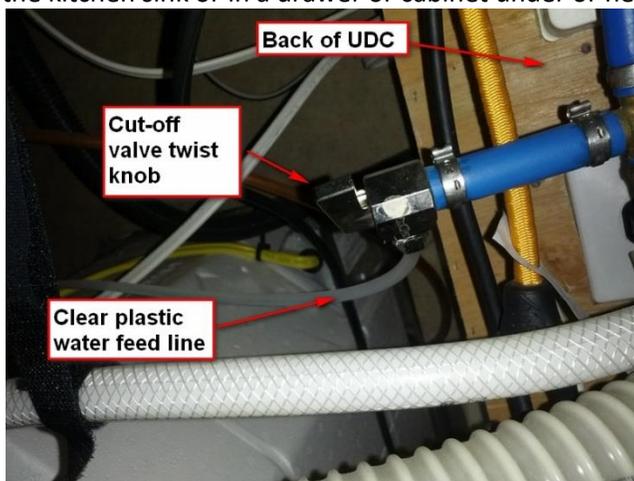
If you don't have a water dispenser, with the compressor off, disconnect the solenoid end of the ¼" clear plastic water feed line and turn the compressor on to blow the water out. Then reconnect the water hose to the solenoid. See pictures below.

3. Inside the freezer, remove the cover from the gear box by pulling it to the left. Use a small screwdriver to rotate the small gear counter-clockwise slightly to start the icemaker cycle. This

will apply power to the solenoid, allowing air to push the water through the solenoid and water feed line and into the icemaker. The gears will turn until the cycle is complete. Repeat for several harvest cycles. Note: the bail arm must be in the down (ON) position.



4. After several cycles, the icemaker should be receiving only air.
5. If you have it, run the water dispenser again to flush out any remaining water.
6. Unscrew both large white plastic nuts on the bottom of the solenoid and allow any remaining water in the tubes to drain (there's only one if no water dispenser).
7. Run the water dispenser again (if you have one) and cycle the icemaker one more time.
8. Reconnect the nuts on the bottom of the solenoid.
9. Put the icemaker bail arm in the UP/OFF position.
10. Locate the icemaker water cut-off valve. On Landmark, Bighorn and many other models, it's behind the UDC. The basement wall will have to be removed to get to it. On some models it may be located elsewhere. If your refrigerator is NOT in a slide out, the cutoff is probably under the kitchen sink or in a drawer or cabinet under or near the refrigerator.



Rotate the cut-off valve arm 90 degrees away from the outlet of the valve to shut it off. Leave it that way until ready to use the icemaker again.

11. Disconnect the compressed air. You're done.

### Using a "Cheater Cord" to operate the Icemaker

As an alternative to manually operating the icemaker in the steps above, you can build a cheater cord that will allow you to energize the icemaker solenoid without turning the gears.

Hardware stores such as Home Depot sell lamp wiring kits for a few dollars. You'll also need some spade lug connectors similar to the ones on the solenoid.



Cut the bulb fixture off the end and install spade lugs on the wires. There's an inline switch already on the wires.

Remove the existing wires from the solenoid connectors and connect the cheater cord spade lugs to the solenoid. If you're not sure which part of the solenoid is for the icemaker, use a voltmeter to check. On models with both water dispenser and icemaker, the water dispenser terminals will have 12V on one terminal.

Take care or how the existing wires are left hanging in case they become energized and make note of which one goes where so you put them back correctly.

Before running the ice maker solenoid, if you have a water dispenser, operate it to evacuate water from the 1/4" feed line and from the dispenser section of the solenoid and water line going into the refrigerator. Catch the water in any large container.

Leave the ice container in place in the freezer to catch the water that will be forced through the lines and solenoid. The air compressor should still be on, with the water system pressurized with air.

Plug the cheater cord into an 110V receptacle, and turn it on for up to 20 seconds to energize the solenoid. The compressed air will force the remaining water that's in the ¼" feed line through the solenoid, up the line to the freezer, and into the ice container.

**CAUTION: DON'T LEAVE THE SOLENOID ENERGIZED FOR MORE THAN 20 SECONDS. It's not meant for continuous duty and you could damage it. If you need more than 20 seconds, give it a few minutes to cool down before energizing it again.**

## Freeze Protection While Using the Trailer

Any time that outside temperatures drop below freezing, you could have parts of your water system freeze. Some parts of the water system are susceptible to freeze damage and must be protected unless the trailer has been winterized.

### What if the Forecast is for only 1 or 2 Degrees below Freezing?

It's very dangerous to assume that the weather forecast will be accurate for your location. In addition to the limits of weather forecasting technology, the forecast may actually be for a different location. Many times the forecast is for an airport. Your campground temperatures could vary by more than a few degrees. If the forecast is for 32F, do not assume that you will be ok.

### City Water Hose

The city water hose outside the unit will often be the first part of the system to freeze. If you don't have a heated water hose, an easy solution is to fill the fresh tank and run off the pump. Drain the hose to protect it from damage. If temperatures are slightly below freezing, this will allow you to have running water with little chance of freeze damage.

### Icemaker Water Line

When the refrigerator is located in a slide out, the water line to the icemaker may be exposed to outside air. It's usually a small diameter unreinforced hose that will easily freeze and break. When it thaws, the water coming through the hose could flood parts of the trailer. The only practical method of protecting this water line is to close the cutoff valve, often located behind the UDC, and evacuate the water from the line between the cutoff valve and the solenoid on the back of the refrigerator. This can be done by disconnecting both ends, putting a bucket under one end, and blowing on the other end. Of course if you have an air compressor on hand, that will be easier.

### Icemaker Solenoid

The solenoid on the back of the refrigerator is energized to feed water to the icemaker and on some refrigerators, to the water dispenser. The solenoid has a little water inside and may be damaged in a freeze. Because it's close to the air intake on the back of the refrigerator, it's exposed to outside air temperatures. However, the solenoid may have heat tape wrapped around it to protect it in mildly freezing temperatures. To survive freezing temperatures without damage to the solenoid, it's preferable to evacuate the water from it, or after cutting off the water supply, to remove it completely

and store it in a warm place. Note that in most cases, freeze damage is not covered by warranties or service contracts.

### Water Holding Tanks

If you have the Tank Heating Pad option, or the YETI option, which includes Tank Heating Pads, simply turn the switch on to keep the tanks from freezing.

***CAUTION: Tank Heating Pads generate a substantial amount of heat. You must have at least a small amount of water in the tanks when the heating pads are turned on, or you could have damage to the tanks and subsequent water leaks.***

If you don't have tank heating pads, on units with sealed underbellies, running the furnace will usually provide enough heat to keep the tanks from freezing down into the mid 20s (F), and perhaps even lower. But there is some risk because without monitoring the underbelly temperature, there's no way to know how effectively the furnace heat is protecting the tanks. Also, if the furnace malfunctions, or you run out of propane, the tanks could be damaged in freezing weather.

### UDC Connections

To keep the water connections, short hoses, and valves in the UDC from freezing, hang a drop light in the UDC with a 60W incandescent light bulb. That will generate enough heat to keep the UDC warm even in very low temperatures.

### Water Pump and Internal Water Lines

In temperatures close to the freezing mark, the water pump and internal water lines may receive enough heat from the furnace, along with radiated heat from the trailer interior, as not to have much chance of freezing. As temperatures drop to the mid 20s and below, this is more problematic. To protect the pump and nearby water lines, hang a reflector with 100-150W incandescent flood lamp above the water pump to keep the area warm.

### Sealed and Heated Underbelly

On trailers with a sealed and heated underbelly, there is a 2" diameter hose from the furnace that terminates in the underbelly. This duct will provide some heat to the underbelly area to prevent water lines from freezing. However, it relies on running the furnace. If you set the thermostat to a low temperature or use space heaters to conserve propane, the underbelly will not receive much if any heat overnight.

Trailers that don't have a sealed underbelly have water tanks and water lines directly exposed to outside air temperatures and are likely to freeze at a higher temperature than with a sealed, heated underbelly.

## What if the Forecast is for Extreme Weather?

### Heated Water Hose

You can purchase pre-made heated water hoses from various sources, or you can make your own.

### **Pirit Heated Water Hose**

**Pirit** is a popular choice for a heated water hose. One thing to be aware of is placement of the end of the hose that has the thermostat. If you place that end in the UDC, the thermostat will not read the outside temperature and the water in the hose is likely to freeze. You will probably need to purchase adapters to change the gender of the hose connections so the thermostat is at the faucet end.

### **Making Your Own Heated Water Hose**

You'll need a length of heat tape to match the length of the hose, heat-resistant electrical tape to hold the heat tape tightly to the hose, pipe insulation that will close completely around the hose and heat tape, and high quality duct tape, such as Gorilla Tape, to seal the joints.

It's a good idea to briefly test the heat tape before constructing your heated hose.

The hose should be laid out as straight as possible. Starting at one end, position the heat tape against the hose and secure it with the electrical tape in a straight line. When finished, cover with the pipe insulation. Then use the Gorilla tape to hold the pieces of pipe insulation together and to tape over the joints.

### **Skirting**

There are various methods to keep the underbelly warm. One of the most effective is to add skirting all the way around the trailer. Unfortunately, while professionally made skirting works very well, it's also extremely expensive.

### **Quick and Easy Skirting**

As an alternative, it's possible to quickly construct very inexpensive skirting that goes under the trailer. Two 4x8 foot sheets of ¾" foam board can be quickly cut to create a box under the trailer. Cut the pieces to fit the distance between the ground and the bottom of the underbelly. Use duct tape to hold the corners together and tape the top of each piece to the underbelly. With drop-frame trailers, the pieces might be approximately 16" high in the front section and 24" in the rear.

If you have tank heating pads, it's not necessary to outline the entire trailer. The enclosure needs to protect the internal plumbing lines that are often located on the off-door-side, between the pump and the front of the fresh water tank (near the axles). The enclosure can be aligned to the frame on the off-door-side and cross perhaps 2/3 of the way to the other frame (about 4 feet across).

You'll have to make some additional cuts to fit the pieces around the sewer pipes.

Cut an access panel in a convenient location on the off-door-side and use duct tape as a hinge. Then place a heat lamp or thermostatically controlled ceramic disc heater into the enclosure to keep the area warm. Place the heating device on a support to keep it off the ground in case water should run across the campsite. Set the heater on low and you'll find it keeps the underbelly quite warm even in temperatures well below zero (F).

## Insulate the UDC

In addition to keeping a drop light in the UDC to provide heat, for extreme weather, cut a piece of foam board insulation to sit in the opening.

## Dedicated Outlets

In extreme weather, you'll be counting on lamps and heaters to keep water from freezing. Be aware that the outlets in the basement are on the same GFCI circuit as the bathroom. It's easy to trip the circuit breaker while using the hair dryer. If the person using the hair dryer was almost finished, they may forget to mention it to you and you'll wake up with everything frozen.

A solution is to install an outlet in the basement that is on a dedicated circuit breaker. The parts are inexpensive and your RV tech should be able to handle this for about an hour of labor charges.

## Engine Block Heater

This has nothing to do with the water systems, but in extreme weather, you need to have an engine block heater plugged into a reliable electrical source or you'll have trouble starting your vehicle in the morning.

## Other Modifications

### Manifolds

Some owners have added simple manifolds in the UDC to distribute water for various purposes without having to use a second hose or move hoses around to different connections. Manifolds can be constructed out of readily available plumbing parts. Short hoses or plumbing connections can be run from the manifold outputs to the water connections.

Using a manifold makes it very simple to hook up and use city water, the black tank flush, and have a connection for an additional hose to use outside.



Here's an example of a simple manifold (shout out to JohnDar). Each output has a separate cutoff valve. There's a single input at the bottom of the manifold.

**WARNING: If the manifold output is connected to the black tank flush, you should add a check valve to prevent contamination of your fresh water supply. The black tank flush has an anti-siphon valve to protect you, but if it were to fail, you could contaminate the manifold.**

### UDC Opening

The UDC has a round disc that unscrews to allow hoses, coax cables, and other items to be routed into the trailer while the cargo hatch door is closed. However, with the disc removed, pests can enter the UDC. Also, in cold weather, it creates an opportunity for cold air to cause freeze damage. In the picture above, notice that there is a replacement disc, fashioned from 2" furniture pad foam, which has a slit from the edge to a hole in the center allowing the quick-connect water hose and cables to pass through, but otherwise sealing the opening. The disc is cut to ½" larger diameter than the original plastic disk.

Another approach is to use an inexpensive garden kneeling pad found in the garden section of many hardware stores. Cut it to fit the bottom of the UDC. Then cut a slit as shown on the right that allows you to fold one corner back when running hoses and cables. Push the corner back into place to seal the opening.



### Antifreeze Uptake Tube

Sometimes the antifreeze suction hose can curl up inside the antifreeze jug or bucket. If it does curl up, the flow of antifreeze may be interrupted before you actually run out, causing the pump to lose its prime. Constructing a simple Uptake Tube as shown below will solve this problem.

Use a 12" or longer piece of ½" PVC pipe with a small notch at one end. Insert the other end into a length of 5/8" clear vinyl tubing. Use a barbed male ½" nylon screw-on fitting at the other end of the vinyl. The male fitting screws onto the female fitting already on the antifreeze suction hose. If you have the 4 way Anderson Valve, instead of ½" male screw-on fitting, you'll need a barbed male garden hose fitting.

## Revision History

July 22, 2013	Version 1 released
October 22, 2013	Version 1.1 released: update winterization instructions on stackable washer for both compressed air and antifreeze methods to use Wash Cycle 3 instead of Rinse cycle.
May 10, 2018	Update information on winterizing the 4-way Anderson Valve, and on Fresh Tank Filling by Itself. Update description of 4-way Valve function.