

Introduction

Welcome to the RV Maintenance Manual.

Thank you for your purchase and support and we wish you the best of luck with your RV.

This manual is not meant to be the "be all - end all" of repair manuals. It is meant as a *maintenance guide* only. A guide to help you extend the life of your RV, avoid costly repairs and thoroughly enjoy your RVing experience.

This book is presented to you by the <u>RVers Corner</u> - an RV owner's do-it-yourself paradise!

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If you choose to follow any instructions or procedures in this manual, you must satisfy yourself thoroughly that neither personal nor product safety will be compromised or jeopardized.

The manual is setup to allow you to access information on the subject you are reading via hyper links. Text items that are colored and underlined are hyper links to other sections of the manual. Simply place your mouse pointer over the hyper link and click to go there.



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Awnings

The awning is one of those have-to-have accessories that at 3 am, with a howling wind, you wish you didn't have. Who can remember the dozen or so steps required to lower the thing under these conditions? Have you ever awakened after that midsummer overnight thunderstorm and your awning is sagging alarmingly? Have you ever tried to empty the hundred or so gallons of water that has collected in that sagging awning? Trust me when I say that you don't need to go through that "joy " of camping.

The awning is designed as a sunshade, period. If, perhaps, it starts to sprinkle a bit and also kicks up a mild breeze - don't worry - your awning can handle that. But if those dark clouds are building on the horizon and the birds are seeking shelter, then you really should consider rolling up. And you really should consider rolling up, NOW.

Practice rolling up your awning on a calm day until you have the procedure memorized. Then do the same thing while blindfolded, with someone spraying a hose in your face. This will simulate a typical emergency storm take-down. Except for the wind, of course. For this simulation you will need three fairly burly guys, all yanking the awning in a different direction at once. Once you have gone through the preceding exercise, you will understand why the experienced camper will take down the awning at the first sign of trouble.

After being rolled up and possibly damp for several months your awning will appreciate a good airing out and a bath with warm water and a mild detergent. Use a car wash type brush to scrub the surface of both the top and the underside. A little WD-40 on the moving parts helps to free up and protect these components. Dry it thoroughly before re-rolling it.

Lower one end of your open awning to allow rainwater to drain off. Peg down the awning feet when the awning is free standing so that a gust of wind will not flip over the awning. Also, the awning may be strapped down with the special awning straps available at your local RV store. If

you suspect a strong wind or storm is coming the safest thing to do is roll up the awning.

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Awning Operation

These instructions pertain to the A & E model 8500 awning ... most awnings are operated in a similar fashion.



Release the travel locks on both awning arms. ...

... the travel locks may be released by squeezing the release tabs on some models, or swinging them out of the way, on other models ...



Loosen the rafter knobs...

... these should be snugged up when traveling to prevent them from vibrating loose and falling out ...



Switch the ratchet mechanism to roll out position with the awning rod ...

Always travel with the latch in the roll up position - this puts tension on the awning fabric to help keep the awning in place ...

... only switch it to the roll out position when you are ready to roll 'er out!



Hook the pull strap with the awning rod and roll out the awning ...

... note the protective wheel on the entry door in this picture. This wheel prevents the awning from being cut by someone inadvertently opening the door before the awning has been raised to position ...



Slide the rafters up into position on the awning arms ...

- ... with the rafter knobs loosened, they should slide easily
- ... an occasional spray with silicone will keep them lubricated ...



... and lock them into position ...



Tighten the rafter knobs on both rafters ...



Lifting on the handle releases the lock and allows you to raise the awning to the desired height ...



... then release the lever to lock the awning.



You may set out either awning arm into the patio position so that the arm is out of the traffic area ... leave one side of the awning lower than the other to allow rainwater to drain off stake the legs to the ground with tent pegs to prevent the wind from lifting them ...

...Remember that the awning is designed as a sunshade and will only withstand so much wind or rain loading. If bad weather is imminent, roll 'er up!

Awning Retraction Steps

- 1. Lower the awning arms to the rest position.
- 2. Loosen the rafters knobs and release the rafter catches.
- 3. Slide the rafters down to the rest position.
- 4. Grasp the awning to prevent it from rolling up by itself.
- 5. Switch the ratchet mechanism to the roll-up position
- 6. Control the roll-up with the pull strap and awning rod.
- 7. Secure the travel locks and snug up the rafter knobs.

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Awning Repair

Special note:Caution: care must be taken to control the spring tension at all times. Considerable force is stored in the spring and this force is easily able to break a wrist or inflict a severe cut.

This step by step guide contains instructions for the A&E awning. Other brands are similar and all precautions apply.

Awning removal

Release the travel locks on the awning arms and position the cam lock to the roll down setting. Roll the awning out about a foot or so. If the cam lock mechanism is not working, you will have to prop the awning in this position with a short board.



At both end caps, there is a hole through which a cotter pin is inserted to lock the spring tension. The inner shaft must be rotated until the holes line up, insert the cotter pin and bend the ends to prevent it from slipping out.

Remove the two lag bolts that hold each of the rafters to the top of the trailer.

Remove the screw at each side of the awning fabric that holds the fabric in position on the

awning rail. The complete awning is now ready to remove from the coach. Have two sawhorses setup at the proper distance apart to place the awning on. The awning rail must not be crimped or flattened out or the awning cord will not slide out. There is a special tool to straighten the awning rail if this is the case.

With a helper, grasp the awning arms, release the arms from the foot that is attached at the bottom of the arm and walk the whole assembly off the end of the trailer until the fabric is completely out of the awning rail. Lay the awning tube on the sawhorses and rest the bottom of the awning arms on the ground.

Releasing the spring tension

Caution: care must be taken to control the spring tension at all times. Considerable force is stored in the spring and this force is easily able to break a wrist or inflict a severe cut.



A pair of adequately sized vice grips are clamped onto the removable top part of the awning arm. To prevent scratching the finish, insert cut pieces of rubber inner tube or other similar material, between the jaws of the vice grips before clamping. Be sure to have a firm hold with the vice grips and be sure to have a firm hold on the tool itself. It is best to straddle the awning tube and use both hands to control the vice grips. Have your helper remove the 7/16" bolt holding this part to the awning arm and to then move the awning arm away. Next remove the cotter pin that

was previously placed and unwind the spring until all tension is removed.

If the awning fabric is to be removed, repeat this procedure on the other end of the awning to remove that torsion assembly.

Removing the torsion assembly

The torsion assembly consists of the spring, end cap and cam lock mechanism. It is held on to the awning tube by two rivets that must be drilled out. First mark the position of the cam handle on the awning tube so that you can replace it in the same position. Using a 1/8" drill bit, drill out the rivets and remove the end cap/torsion assembly.

Replacing the cam lock/end cap

The end cap (with the cam lock mechanism) is attached to the torsion shaft with pins that must be driven out to replace the cap. Drive out the pin with a hammer and punch and replace the cap with the new one. Reinsert the pins.

Removing the awning fabric

Both torsion assemblies must be removed to be able to slide the fabric off the awning tube. See Removing the torsion assembly section for instructions. Lift the awning tube at both ends and manually unroll the fabric by turning the awning tube by hand until the fabric is fully rolled off. Be sure to mark the awning tube so that the replacement fabric can be inserted into the same position. Slide the fabric off the tube. It is often easier to hold the fabric itself and have a helper or two to slip the awning tube off and away.

Replacing the awning fabric

If you are replacing the awning fabric with a new one, it helps to lay out the old fabric in such a way as to protect the new one from damage as you "thread" it on to the awning tube. A few helping hands are required and some patience is involved. Take care not to rip the fabric as

you are sliding it into the awning tube. If you carefully file down the sharp edges on the tube this will help considerably. Once the fabric is in place make sure it is centered on the tube and tuck the cord ends into the tube.

Re-installing the torsion assembly

Install the torsion assembly and line it up with the marks that you made when disassembling it. Rivet the assembly in place.

Awning Length (FL)	Number of Turns MODEL NUMBER			
	8	6		8
9	8	1.	8	
10	6	8	8	-
10'8"	8	8	8	
11	8	B	8	
12	8	8	8	
13	7	9.	ê .	-
14	7	9	8	
15	8	10	10	-
16	8	10	10	6
16'6'	- · ·	0.	12	•
17	10	12	12	6
18	10	12	12	7
19	11	13	13	7
19'8'			13	-
20	11	13	13	
21	11	13	13	8
22	12		111111	8
23	12			8
24	12			9
25	12			9

See Spring Indentification Chart for No. of Turns



Retensioning the spring

Grasp the end piece with vice grips and have your helper be ready to re-insert the cotter pin. Wind the spring by the number of turns indicated for your model, in the direction indicated on the end cap. Insert the cotter pin to hold the spring tension. Replace

the awning arm on the end piece and replace the bolt.

	Standard	Heavy Duty	
Wire Dia.	.120	.140	
RH	Painled red cap end and no paint on stabilizier end.	Painted red cap end and white on stabilizier end.	
LH	No paint on either end.	Painted white on cap end and no paint on stabilized end.	
Length	TURNS OF TENSION		
22'	14	8	
23'	14	8	
24'	14	8	
25'	14	8	

Re-installing the awning

Sometimes it helps to have three people when replacing the awning on the coach - two to handle the awning arms while one to feed the awning cord into the awning rail. While the awning fabric is fairly robust, care must be taken not to snag it on the awning rail. The end of the awning rail can be spread out slightly with a screwdriver and the sharp ends filed down to prevent tearing of the fabric.

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Cable TV Connection Woes

Fuzzy or no picture ...

I run into this problem on perhaps 10% of the units that I PDI (Pre Delivery Inspection) and most times it is a bad crimping job on the cable connections. When I come across the problem, I simply cut off all the factory installed connections and crimp on a new connection - this solves most of the problems in short order.

Anyway, here's a step by step that you can do to find the glitch ...

- <u>1.</u> Remove the booster and label each cable so that you know where it attaches to the booster.
- 2. Disconnect all the cables on the booster.
- 3. Disconnect the cable connection on the roof that is attached to the antenna.
- <u>4.</u> Remove the outside cable mounting plate and disconnect the cable there.
- 5. If you have a second TV outlet in the coach, remove the mounting plate and disconnect that cable too.
- <u>6.</u> Check for continuity between the center wire and the cable mounting fitting on all disconnected cable ends one by one with an ohm-meter. (You can buy one of these at Radio Shack for under \$15.00)

- 7. Replace any connector that shows continuity.
- 8. Re-check that connector if the meter still shows continuity, replace the other end of that cable.
- 9. Repeat number 7 until all connections are corrected.
- <u>10.</u>If the problem is not corrected by installing new connections, it is probable that the cable has been pierced by a screw or staple inside the wall or ceiling. If this is the case, it is wise to run a new cable to the outlet(if possible).
- <u>11.</u>Reassemble everything.

This *should* solve the problem 99.99% of the time. I would be interested to know if it doesn't!!!!

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Installing a Slide Topper

A slide topper is a small awning that automatically extends and retracts as the slide out section moves. The awning helps protect the slide roof - any debris that collects on top off it is rolled off as the awning retracts with the slide out room.

The Hardware Kit ...



The kit comes complete with all the hardware necessary for installation.

Install the brackets ...



Locate the mounting brackets, as show, and predrill the holes. Apply a daub of silicone sealant in the holes before screwing down the brackets to seal them. The screw heads may also be covered with clear silicone sealant.

Slide in the tarp ...



Open the channel of the awning rail a little to prevent the fabric from hanging up and possibly ripping as it is slid along the rail. A helper is needed to help lift and slide the awning into place.

Locate the awning ...



The awning is located in the correct position and the arms are riveted in place. The awning fabric is anchored to the awning rail with a couple of self-drilling screws.

Thats it, done!



The completed job! Back to Table of Contents

Rooms ... to go!

RV Slide Outs

RV slide-outs are becoming more and more popular and fortunately they are also becoming more reliable. Various methods have been used to provide the means to move the room in and out as required. These included a simple hand crank screw type mechanism on very small slide rooms, a cable system that was used with limited success, and the more modern electric motor operated systems in use today.

The majority of the manufacturers are using one of two methods to power their slide out rooms. Both use electric 12 volt motors to provide the power. All manufacturers provide a means to retract the room by hand in the event of battery failure.

Gear driven slides

- the motor powers a gearbox on either side of the slide room (smaller slides only use one) and then the force is transmitted to a rack and pinion arrangement on the telescoping supports that hold up the room. While this method is far less complicated (and less expensive)than the hydraulic system, it requires more periodic maintenance.

Hydraulic slides

- the electric motor powers a hydraulic pump and then this force is transmitted to the slide room using hydraulic hoses, a series of control valves, and hydraulic rams or cylinders to move the room. Multiple slide rooms on the RV can be powered by one pump and motor unit. Hydraulic systems are under high pressure and repairs should only be done by a qualified repair depot.

Troubleshooting tips

The electric motor draws considerable current and needs a fully charged battery to operate. Plugging in to shore power will help supply the needed voltage and current and prevents over straining the 12 volt system.

The motor is usually controlled by a circuit board and relay. There will be a fuse located on the circuit board or in the power line that supplies the motor.

Maintaining your slide

Maintaining your slide in good condition is fairly straight forward. The room is basically free floating as it moves in or out. Typically there are rollers in the mechanism that carry the weight and rails that guide the room to its resting point. The rollers and rails need to be lubricated from time to time to prevent wear and to protect the metal components from rust and corrosion. Each manufacturer has different lubrication points and you should consult your owners manual for instructions specific to your unit.



Special lubricants are made to be used on the slide mechanism. These lubricants displace moisture and prevent rust while providing a non stick coating on the moving parts. Oil or regular grease should not be used because they will attract and hold the dirt and grime.

<u>Protect All Slide Lubricant</u> - Dry Lube Protectant penetrates around moving parts to prevent rust and corrosion. Also excellent treatment for leaf springs, steering and suspension components, battery connections and any other

metal surfaces that are subject to rust and corrosion.

Slide Out Seal Maintenance

The seals on your slide out keep the weather and the critters outside where they belong. Keeping the seals working and looking like new requires periodic maintenance. Keep an eye out for unusual wear areas or places where the seals may become dislodged by the movement of the slide room.



Protect All Slide Out Rubber Seal Treatment - Keep your slide-out rubber weather seals looking and working like new. Seal Treatment extends the life of rubber seals by protecting from excessive wear and the damaging effects of the sun, road grime, and pollutants. Produces a slick surface to reduce friction and wear as the seals rub against the slide-out. Advanced polymer formula with UV inhibitors. Spray on application requires no rubbing or wiping.

Adjusting the slide

On most slide rooms there are some adjustments that can be made to facilitate the smooth movement and sealing of the slide. Very small adjustments can make big changes in the alignment of the room. A misaligned slide can cause severe damage to both the slide room and the RV itself. Adjustments by the RV owner are not recommended and should be left to a qualified service person.

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Stabilizer Jacks

How they work



There are various types and styles of stabilizer jacks, but they all are designed to steady the parked RV from unwanted movement when people are walking inside.



This is a two-leg 5th wheel king pin stabilizer ... tripod models are available and offer additional front-to-back stabilizing

A stabilizing jack is only meant to carry some of the weight of the trailer ... do not attempt to use these devices to lift the wheels off the ground or other heavy duty applications.

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Bearing Service

Servicing Wheel Bearings



Cotter pin

Step by step instructions

- 1. Safe Jacking
- 2. Removing the wheel and hub
- 3. Removing the grease seal and rear bearing
- 4. Inspection
- 5. Hand packing the bearings
- 6. Reassembly
- 7. Pre-loading the bearings
- 8. Replacing the bearings

Safe Jacking

- 1. Park the trailer on firm and level ground.
- 2. Block the trailer tires on the opposite side securely so that no forward or rearward movement is possible.
- 3. Jack up the trailer following the manufacturers instructions.
- 4. Secure the trailer on jack stands of adequate capacity front and rear.

Removing the wheel and hub

- 1. Undo the wheel nuts and remove the wheel
- 2. Pry off the dust cap using a flat bladed screwdriver
- 3. Straighten out the cotter pin that holds the bearing nut and remove it

- 4. Remove the bearing nut and washer
- 5. Gently pull the brake drum forward while cupping the hub opening with your hand to keep the front bearing from falling to the ground. The outer race stays in the drum, while the inner race and roller bearings come out as an assembled unit.
- 6. Place the front bearing, bearing nut and the bearing washer in a clean container

Removing the grease seal and rear bearing

- 1. Place the brake drum face down so that the back of the drum is accessible
- 2. Pry out the grease seal. This will be replaced in a further step.
- 3. Lift out the rear bearing and place it in the container with the rest of the parts
- <u>4.</u> Don't mix up the bearings if you are doing more that one wheel at a time each bearing must mate with it's original race (no prejudice intended). The bearings wear in by a certain amount and need to be matched with their respective counterparts.

Inspection

- 1. Thoroughly clean the bearings and other parts in a solvent (not gasoline!) until all the old grease is removed. Set the aside to dry completely or blow dry with compressed air. Don't use the air pressure to spin the bearing, as damage could result to the bearing or to your person!
- 2. Clean the hub and spindle.
- 3. Inspect the bearing races for heat discoloration, pitting, scoring and any unevenness.
- 4. Inspect the bearing for damage as above. Any out of round rollers, cracked roller cages and rough running will indicate replacement is required.
- 5. The bearing and both inner and outer races must be replaced as a set.
- 6. Inspect the brake drum for pitting and excessive wear especially if the brake shoes were allowed to wear down to bare metal.
- 7. Inspect the brake magnet surface for excessive or uneven wear.
- 8. If the brake drum and magnet have been saturated with grease from a failed seal, replace the shoes and magnet, and have the drum turned or machined to renew the surfaces.

Hand packing the bearings

- 1. Place a walnut sized gob of wheel bearing grease in one palm.
- 2. Grasp the bearing with the other hand so that the wider end is facing the grease.
- 3. What you want to do is force the grease into the gap between the inner race and the outer cage so that it squeezes up through the rollers and out the top.
- <u>4.</u> Press the bearing down into the grease in a rocking motion and continue until the grease oozes up.
- 5. Rotate the bearing 1/4 turn, at a time, and continue until the bearing is completely filled with grease.

Reassembly

- 1. Put some grease into the interior of the hub with your fingers. A walnut sized amount is sufficient. Spread it around the circumference of the hub.
- 2. Place the inner packed bearing into it's place in the hub.
- 3. Place a new seal on the hub and tap it into place with a hammer until it seats fully.
- 4. Be sure to wipe off any grease that finds it's way onto the outer flat surface of seal.

5. Replace the drum onto the axle spindle, insert the outer bearing, thrust washer and axle nut.

Pre-loading the bearings

- 1. Tighten the axle nut by hand until it is tight. Tighten another 1/4 turn with pliers or wrench.
- 2. Spin the drum several times to distribute the grease evenly in the bearings.
- 3. Back off the nut with the pliers or wrench, and re tighten by hand as tight as you can.
- 4. Insert a new cotter pin to lock the nut in place and bend it over the spindle.
- 5. Re-install the dust cap, wheel and tire, and hubcap.
- 6. Now is a very good time to adjust the brakes. See the . next page for more info
- 7. Wash hands vigorously for 15 minutes!

Replacing the bearings

The bearing must be replaced with a complete new bearing with the inner and outer races.

- 1. The inner races are pressed into place in the hub and must be driven out.
- 2. Use a brass punch to catch the edge of the race by passing it through the inverted hub. A few good whacks with a hammer should drive out the old race.
- 3. Place the new race into position and tap it in with the hammer and punch. Take care not to mar the surface of the race.
- 4. Pack, reassemble, and preload the bearings.

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Adjusting Trailer Brakes

Trailer brakes should be adjusted at least once a year, more often depending on the miles traveled, the severity of the downhill grades, and the amount of stop and go traffic that is encountered.

This is a chore that most people with average mechanical skills should be able to handle. You will need a brake adjusting tool, available at most tool supply stores, a jack capable of safely lifting the trailer, and a jack stand to hold the trailer in the jacked position.

The following steps are a guide to properly adjusting your trailer brakes. What this entails is the adjustment of the star wheel which in turn sets the brake shoe to brake drum clearance. This adjustment is important - as the brake shoes wear down, the clearance increases. The actuating mechanism must travel further to effectively apply the brakes and a point can be reached where the mechanism is no longer able to so.

- <u>1.</u> Park the trailer on firm and level ground.
- 2. Block the trailer tires on the opposite side securely so that no forward or rearward movement is possible.
- 3. Jack up the trailer following the manufacturers instructions.
- <u>4.</u> Secure the trailer on jack stands of adequate capacity front and rear.
- 5. At the back of the wheel, on the brake backing plate, there is a small rubber plug near the

bottom of the backing plate. Pry out this plug to give access to the star wheel adjuster.

- 6. Some trailers have a drop axle suspension system and the axle covers most of this adjusting hole making it difficult to use the brake tool. Patience will win out in the end if you keep at it.
- 7. Insert the brake adjuster tool and maneuver it so that the tool engages with the teeth in the star wheel. The star wheel looks like a gear with exposed teeth on the perimeter. On most trailers you would pull down on the tool handle which levers on the bottom of the hole and turns the star wheel up (as you are looking at it from the back of the wheel.
- 8. Turn the adjuster until the brake "locks up" i.e. you can no longer rotate the wheel by hand. This centers the brake shoes on the brake drum so that they are in the correct position.
- 9. Now back off the star wheel 8 to 10 clicks or as specified by the manufacturer. The wheel should spin freely with no apparent drag to slow it down. A slight scraping noise is normal as the wheel turns.

<u>10.</u>Repeat this procedure for all the wheels.

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Replacing Suspension Bushings

Bushing replacement ... The trailer is jacked up and placed on jack stands. This allows the axles to hang freely so that the work can proceed.



Tires and wheels removed ... the axle is supported by a floor jack and the spring hanger bolt is removed



The old worn out bushing is driven out with the new bushing ...



There are 7 bushings per side on a tandem axle trailer ... 14 in total. The spring hanger bolts and nuts should be replaced when replacing the bushings.



Inspect the other components of the suspension system ... these shackles are worn out ... the holes are elongated and will result in too much suspension play ...



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Hitches and Hitching Systems

Fifth Wheel Hitches



A fifth wheel hitch is necessary when towing a fifth wheel style trailer. This hitch is mounted in the bed of a pickup truck and carries more of the weight of the trailer than does a conventional type of hitch. Since the pivot point of the truck and trailer combination is over the rear axle, the turning radius of the combination is less and the handling characteristics are improved.

Single Pivot

A single pivot fifth wheel hitch refers to the way the hitch pivots during towing. This hitch will pivot from front to back as the trailer and truck go over dips and humps in the road.

Double Pivot

The double pivot hitch operates as the above single pivot hitch and in addition will allow a certain amount of side-to-side movement. This is especially beneficial when hooking or unhooking the trailer on uneven terrain.

Towable Hitches

Towable hitches are mounted at the rear of the tow vehicle and are used to pull conventional travel trailers. (Or utility and boat trailers)

Receivers

- Class 1 weight carrying hitch 2000 lb maximum trailer weight 200 lb tongue weight
- Class 2 weight carrying hitch 3500 lb maximum trailer weight 300 lb tongue weight
- Class 3 weight distributing hitch 5000 lb maximum trailer weight 500 lb tongue weight
- Class 4 weight distributing hitch 10000 lb maximum trailer weight 1000 lb tongue weight

Weight Carrying Hitches



A trailer towing hitch that carries the total hitch weight of the trailer. Utility and small boat trailers are

examples of trailers that can be towed with this hitch.

Weight Distributing Hitches



A trailer towing hitch that utilizes spring bars to distribute some of the hitch weight to the tow vehicle front wheels and also the trailer wheels. This helps to relieve some of the "rear-end sag" when the trailer is coupled to the tow vehicle.

So often I see folks working too hard to get their equalizer spring bars connected/disconnected to/from their trailer receiver. During hookup, if you connect the ball to the hitch, then jack the trailer receiver up several inches, you relieve the spring pressure required to connect the spring bars. Then connect the spring bars and lower the receiver, placing the jack in the traveling position. To unhook, you jack up the receiver several inches until the spring pressure is relieved from the spring bars. Then with little effort, you can release the spring bars.

Sway Control Devices



Devices designed to damp the swaying action of a trailer, either through a friction system or a "cam action" system that slows and absorbs the pivotal articulating action between tow vehicle and trailer.

Other terms

HITCH WEIGHT - is the amount of weight that the trailer imposes upon the tow vehicle. With a towed trailer the ideal hitch weight is 10 to 12% of the total trailer weight.

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RV Suspension and Alignment

There are various suspension systems used on RV Trailers with the most common being the leaf spring or "buggy" spring system. This worked well in the horse and buggy days and is a carry over from that time.

It is referred to as a leaf spring because there are several slender sections layered upon each other to provide the required stiffness or load carrying capacity while at the same time being flexible enough to absorb the shocks of road travel.



Either end of the main leaf spring is attached to a spring hanger on a single axle trailer or to a spring hanger and an equalizer on a tandem axle setup. The ends of the springs are rounded into an eye shape to allow them to be mounted onto a bolt and each point must be able to pivot around that bolt. A plastic or nylon bushing is inserted in every pivoting point on the suspension system to take the wear and tear on these parts. These bushings should be inspected periodically, depending on mileage, and replaced as required. As they wear, they allow more "sloppiness" in the suspension, resulting in unnecessary tire wear and other related problems.

The weight of the coach is carried by the ends of the springs and the center of the spring is bolted to the trailer axle which, of course, is attached to the wheels and tires. This whole arrangement provides a smooth ride for the trailer, with the springs absorbing the unevenness of the road surface. Further dampening of road bumps is provided by the use of shock absorbers.

To minimize wear and stress on the wheel bearings and tires, it is imperative that the tires are pointed in the right direction and at the proper angle relative to the road surface. This is called camber and castor by wheel alignment gurus and it is beyond the scope of this writers expertise to explain the complexities of these matters.

However, tire wear patterns will indicate certain alignment problems and suggests the repairs required to fix the misalignment. An out of balance wheel or a bent wheel will cause a cupping wear pattern in the tires circumference. An improper camber alignment will wear the tires on one side more that the other and an improper castor angle will scrub off rubber in various ways.

The average RV dealership or repair facility is not equipped to handle this type of repair and it is definitely not a do-it-at-home project. Only an alignment shop with the necessary equipment and trained personnel should be called upon to adjust the trailer wheel alignment. Most major cities will have at least one of these specialized shop. Check with your local dealers for a reference.

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RV Water Systems

The Fresh Water System

The typical RV fresh water system is a combination of advanced technical accomplishment balanced by the economic principles of profit and loss. The manufacturer desires a functional water supply system at a "cost effective" level, and generally this is the case.

Modern RVs are equipped with pressure demand type automatic pumps, polyethylene fresh water storage tanks, and polybutylene water lines. The various and innumerable joints and connections are of the compression ring type which are very quick and economical to assemble at the factory level when everything is exposed and in the open.

Water Pump

These systems are designed to be operated at a certain maximum water pressure level in the neighborhood of 35 to 45 pounds per square inch. The on-board pump has a built in pressure switch that shuts off the power to the pump when this pressure has been reached. The water pump runs on 12 volt DC power so that you have water pressure where ever you go.



Newer Shure Flo water pumps have an adjustable pressure setting to fine tune the system water pressure. This is a screw located on the head of the pump and allows you to increase or decrease the pressure setting, as required. If your pump is cycling rapidly when only one tap is opened, you can slightly reduce the operating pressure by turning the adjusting screw counter clockwise a little bit at a time.

Water Pump "burps"

The water pump switch is turned on to activate and pressurize the system. Then the pump shuts down until a tap is turned on. The drop in water pressure reactivates the pump and it will run until the tap is turned off and pressure is built up again.

A slight drop in pressure may be caused by a leak or by pressure bypassing back through the pump. The pump will momentarily start and stop almost immediately (burp). Check your water heater pressure relief valve for evidence of a drip there. It is fairly common for that valve to drip occasionally and that may cause the pump to burp every other hour or so. If you can't locate a leak, then you can get a replacement diaphragm kit for the pump that is fairly easy to install, although if the pump is 10 or 15 years old, it may be more cost effective to replace the entire pump. There may also be debris in the

pump that could simply be cleaned out to restore correct operation.

These pumps are easy to dismantle and re-assemble, just be sure to lay out all the parts in order.

Water Pump Leaks Back into Fresh Water Tank

If you are connected to city water pressure and your fresh water tank fills up over a period of time, the water pump diaphragm is faulty and is allowing water to flow through the pump in a reverse direction.

RV Water Pump Noise Wakes Me UP!

RV WATER PUMPS - RV Water pumps are NOT created equal ... and neither is the water system in your new RV!

The typical RV comes equipped with a medium cost demand type water pump. These pumps were adequate for the RV water supply systems of a few years ago.

For various reasons, the water supply pipes have changed in the last few years. The popular pipe material is now "pex" type tubing. This material has advantages over the materials used for the last decade or so, but does come with its own set of problems.

One is the rigidity of the tubing. It is much "harder" than previous tubing and tends to 'chatter' more than ever. By 'chatter' I mean that it vibrates with the pulses of the water pump and creates vibrations against the floor, the walls, and the cavities within the cabinet spaces. This can result in very loud and disturbing "hammering" noise from the RV water system. One solution is to install a flexible braided hose to both the inlet and the outlet sides of the water pump. Allow enough length to include a loop in the hose so that the hose has room to move a bit to absorb the vibrations of the pump. Another possible solution is to install sections of foam insulating material wherever the pex tubing comes in contact with the cabinets or walls. These come in tubular sections 4 feet long (available at your local building supply store) and can be cut to the needed length with a utility knife.

Various "fixes" can be attempted, but one of the best of all is the pump featured below.

This pump has no pressure switch, thus it creates no pulsations to bang the pipes against the walls!. It has a sensor that controls the motor speed, depending on the demand, so that the water flow and pressure is consistent. An added bonus is the lower amperage draw at low water flow levels ... an important factor for campers without hookups.

So ... if you need a new water pump ... or you just can't take that hammering anymore consider the <u>Flojet Water Pump</u> .

City water inlet



This inlet allows the coach to be connected to the campground water supply and the water system to run on the pressure supplied by that system. There is a built in one way valve inside this inlet to prevent water from being pumped out of this opening when the water pump is operating.

Water Tank

The fresh water tank holds an on board supply of potable water, usually around 30 to 40 gallons, for use when you are not hooked up to a water supply. This is the water that the water pump uses to supply the system when not hooked to "shore" facilities.

Water supply piping

The water system piping has changed over the years. In the fifties and sixties water lines were made of black iron pipe and or copper tubing. These systems were hard to repair and prone to damage by freezing.

The next piping used was **polybutylene tubing.** This is the gray colored tubing and was connected by crimp on or compression fitting. There has been some problems with this type of tubing and there are several lawsuits filed by homeowners with this tubing in mobile homes and permanent homes. With the low pressure used in RV's there is not a major problem, however a water pressure regulator should be



used when hooking up to city water. information.

Go to www.polybutylene.com/ for more

Most modern RV water systems use **Pex** tubing or **CPVC** water pipe. The Pex tubing is translucent white in color (new tubing may be colored red for the hot water system and blue for the cold side) and is semi-rigid. It uses crimp on fittings or Flair-it compression fitting.

CPVC pipe is white in color and rigid in construction. The plumbing joints are "glued" together with solvent cement.

Sensors

There are basically two types of sensors used in the fresh water tank. One type has four different lengths of probes connected to a central core that screws into the top of the tank and extends down into the water. As the water level drops each probe is uncovered in turn and stops conducting electricity, thus extinguishing that indicator light.

The second type uses individual probes that are inserted into the side of the tank at different levels to indicate what the water level is. They are a special rubber plug with a collar to prevent them from being pushed into the tank when they are installed. There is a small nut embedded in the rubber at the other end of the probe. The probe is inserted into a pre-drilled hole and the screw is turned in after the wire is attached with a ring type of terminal. As the screw is tightened the rubber plug "collapses" and is drawn up against the tank wall to make a seal.

If you can gain access to these screws, back them out and then pry out the rubber plug. Make a note of what color wire goes to which sensor. Install a new sensor (about \$2.00 each) and a new ring terminal on the wire.

It is often necessary to remove the tank if access is limited.

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Water System Sanitation

Use the special RV drinking water hose when connecting your RV to the campground water supply or when filling your on board water tank. This hose will prevent the rubber taste in your water from a regular garden hose.

Fill your on board water tank 3/4 full and add one or two cap fulls (not cup fulls) of household bleach. Take the unit around the block to slosh the mixture to all parts of the tank. This solution will kill any bacteria that have accumulated in the tank during the storage period.

Turn on the water pump and open all taps one by one to allow this solution to fill every water line and flush out the system. Once this is done, let it sit overnight, if possible.

Connect the hose to your city water connection and flush every outlet for at least 5 minutes to purge out the bleach solution.

Drain your fresh water storage tank and refill with fresh water. You can add a capful of bleach every time you fill the water tank to keep it fresh and sanitary. However, due to the unknown quality of campground water supplies, and the fact that the water in your tank may stand for several days or weeks in the hot sun, it is recommended that you use bottled water for drinking supplies or install a quality water filtration unit for you drinking water.

The on board water tank holds approximately 30 gallons of water and at about 10 pounds per gallon this adds up to a fair amount of weight. If you are traveling from RV park to RV park, it is only necessary to carry the amount of water that you will need on the road for the day.

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Waste Water Tanks

Modern RV's are equipped with separate holding tanks for the "gray" (shower and sink waste water)

and the "black" (toilet waste water). Also some larger units will have another gray water tank for the galley sinks.

Gray Water

"Gray water" is water that is used in the sinks and the shower stall. It normally drains into a dedicated holding tank for gray water only. The contents are held in this tank until a dump station is available.

Black Water

"Black water" is water and waste from the toilet and is deposited into a dedicated holding tank for black water only. This waste water is stored in this tank and dumped with the gray water at a suitable dump station. It is recommended that the black water tank be dumped only when it is at least 2/3rds full. Add water through the toilet if needed. This allows enough liquid to aid in flushing out the solids.

Never leave the black water valve open when you are connected to a sewer station at your RV site. If this valve is left open, the liquids will drain off, leaving the solid material to build up in the tank. This material will compact after a period of time and lead to some very nasty problems!

Holding tank chemicals

HOLDING TANKS - There are normally two different holding tanks on most RVs; the gray water tank and the black water tank. The gray water tank holds the waste water from the sinks and showers. The black water tank holds the waste from the toilet.

RV waste water holding tanks are meant only as a temporary storage facility for waste and are not designed to be a water processing or water purifying system. That is better left to septic systems or municipal water treatment plants. When you dump the contents of your holding tanks into an approved dump station, the disposal and treatment of these wastes become the responsibility of the station.

In the past few years many free dump stations have been closed down and more will follow. Why? ... Some RV holding tank treatments are harmful to septic systems, especially formaldehyde-based chemicals. Formaldehyde is a preservative and destroys the bacteria that are needed to break down waste materials. In addition, unscrupulous people have been illegally dumping everything from paint to oil to hazardous materials of all sorts into these dump stations. <u>RVers Guide to Dump Stations</u>

However, there is much that the RVer can do to control odors and help keep the holding tanks clean and functioning as they were intended to. The use of appropriate holding tank treatments and RV friendly toilet products are a good step in this direction. An enzyme-based holding tank treatment uses "good" bacteria to digest waste solids and keep the odor under control. One very effective treatment is <u>Enviro-Chem</u>

The use of quick dissolving toilet paper helps to keep the waste in a liquid form. To test your toilet paper, fill an empty jar half full with water. Drop in a sheet or two of your favorite toilet paper. Shake the jar for a few seconds. If the toilet paper dissolves it's RV holding tank friendly. If it fails this test, experiment with another brand.

Dumping procedures

Empty the holding tanks when near full by first dumping the black water tank and then, after it's drained and with the black tank valve still open, the gray water tank. When all the sewage has drained,

close both valves.

If you have fresh water available, you can flush out the tanks by adding a quantity of clean water to the tanks, and then re dumping the contents. There are several after-market devices that can aid with this procedure.

Tank flushing accessories

The Hydro Flush



The Hydro Flush device is available at most RV supply outlets.

The device goes between the tank dump connector and the sewer hose, then a garden hose is attached (with a back flow prevention device). Once the tanks are dumped, the water supply is turned on with the valves still open. This water flow flushes out the tank and the clear construction allows you to see when the water is running clear.

The Sewer Solution



The Sewer Solution

Portable Waste Water Tanks



Portable holding tanks can be used when the RV is parked where there is no sewer hook-ups. By using the "tote tanks", as they are called, the RV does not have to be moved to a dump facility. The tote tanks are filled with the waste water and then towed to a dump location. As you can see, the wheels and the construction of these tanks, does not allow them to be towed far or over rough ground. They will help, though, during an extended stay with no sewer connection.

Monitors



Monitor panels use tank mounted sensors to detect the level of the contents of each tank and display the levels on the panel board. Monitors come in various shapes and configurations, but all of them operate in basically the same way.

A monitor will usually read the levels in the fresh water tank, the gray and black water tanks, the battery charge, and some may read the level of the propane supply tanks.

Holding Tank Sensors

One of the more common complaints we hear about RVs these days is holding tank sensor failure. Although not an earth shattering problem, it is a real irritant, nonetheless, especially for those unlucky enough to have a black water holding tank that's not located directly under the toilet. Not being able to see directly down into the tank has definite drawbacks.

The malfunction usually becomes noticeable when waste water starts backing up into the toilet, sink, or shower, but your gages show that the tank is only a quarter full. Yuck! Aside from cleaning up the disgusting mess, the problem is usually relatively easy to diagnose and correct.

The problem is either mechanical, electrical, or the result of a dirty in-tank sending unit. Here's a good, inexpensive way to find out if a dirty sending unit is indeed the culprit, and most times fix it if it is.

The next time you put your RV up between trips make sure you've emptied and thoroughly rinsed the holding tank. Then fill it with fresh water to nearly full, add the correct amount of an excellent quality bacteria type liquid holding tank chemical for the capacity of the tank, and fill it the rest of the way with water.

Let the RV sit as long as you can without adding anything to the tank. This will allow the bacteria and the enzymes they produce to do their job of digesting any toilet paper or organic debris that may be clinging to the sensors. Finally, before your next outing, simply empty and thoroughly rinse the tank once again. If you have allowed sufficient time (a week or so should do it) for the product to work the sensors should read correctly. If they don't then the problem is either mechanical or electrical and you'll want to ask Les to help you troubleshoot via the RVers Corner bulletin board. If all else fails you'll have to take the RV to a service center for additional diagnosis and repair.

We also recommend that this procedure be performed on an annual basis to keep both your gray and black water holding tanks, sensors, and dump valves pristine clean. At about a dollar to treat a 40 gallon holding tank, this is the least expensive insurance you'll ever buy.

Remember that extremely dirty holding tanks didn't get that way overnight. Be sure to allow the enzymes enough time to 'eat' their way through all of the accumulated crud.

Regular use of a high quality liquid enzyme producing bacteria type holding tank chemical, along with proper holding tank dumping techniques, should prevent any re occurrence of fouled holding tank sensors.

Okay, now you ask, what IS the 'proper' way to dump your holding tanks?

Here's what we recommend. Empty the holding tanks when near full by first dumping the black water tank and then, after it's drained and with the black tank valve still open, the gray water. When all the sewage has drained, close both valves.

You'll want to rinse out the sewer hose before storing it but, if using a good liquid bacteria holding tank chemical, will be pleasantly surprised at how clean it is even before it's rinsed. As for rinsing out the tanks after draining, well, our customers tell us they usually don't have to. Again, if using a quality product, the contents of the tank will be almost completely liquid and will empty fast and clean.

We also suggest that you add a couple of gallons or so of water and the appropriate amount of chemical to your empty holding tanks before storing your RV. The chemical will continue cleaning your tanks and you'll be ready to go without having to worry about that minor chore before your next outing.

If you can gain access to your tanks you can determine their capacity with the following simple formula. All measurements are in inches.

 $L \times W \times H$ divided by 231 = capacity in gallons.

Example (my fresh water holding tank): 50" x 21" x 16" = 16,800 divided by 231 = 72.72 gal. capacity (close approximation).

Dirty sensors can give false reading, not only showing fuller than they really are but under reporting as well.

The Roof

The first step in any roof inspection is to get out the step ladder and take a good look at the roof condition. If the roof is metal, especially if it is the seamed type, (has crosswise seams every 48" or so), then lay a plywood strip or some wide boards (lengthwise) to walk on. This way the boards span the roof rafters and distribute your weight evenly over several supports. A rubber covered roof has an underlying layer of material, usually a 3/16th to 1/2 inch plywood or particle board sheeting that evenly supports your weight.



The membrane on a rubber or metal roof is made of a very tough and durable material but it is fairly thin and can be punctured by a sharp object. Yes, you can carefully walk on the surface, however first check your shoes for embedded stones and such, that could do damage to the roof covering.

Natural weathering will occur on a roof of any material and various contaminants will discolor all or portions of the surface. Aluminum will "age" to a slate colored state and a rubber roof may present a chalky residue. In any case be prepared with casual work clothing and footwear to conduct a proper inspection. You WILL get dirty.

An aluminum roof can and does last for many years if it is maintained properly. The same goes for rubber, fiberglass or any combination of the above materials. The sealants that are used may last for several years, but the conditions they are subject to vary so widely in the extremes between hot and cold and humidity. Sealants may have to be renewed or repaired in as little as 6 months!

The roof should be inspected at least twice a year and any developing condition corrected immediately. Different brands of sealants preform better than others. For example, our Fleetwood trailer line (Wilderness and Mallard), have recently changed the brand of sealant used on their rubber roofs. (I don't have access to the name of the brands they use, as yet, and getting an answer from them is a time consuming process! Even for a Dealer!). The new one is very poor and needs touching up almost as soon as they come onto the lot. They may have solved the problem because the 2001 models seem to be better.

For rubber roofs use a self-leveling sealant - Dicor makes the rubber membrane and also a line of sealants that are compatible under the Dicor name. See: <u>http://www.dicor.com/</u>

Aluminum and fiberglass roofs use a fiber impregnated roof coat material to seal the seams and accessory openings. These materials are applied with a paint brush or putty knife and should be applied

to a clean prepared surface for best results. Any loose or flaking roof coat should be removed and the surface cleaned with soap and water. A wire brush can be used to "rough" up the surface. A heat gun will help soften the old roof coat to aid in removal. So will the hot sun on a 100 degree day, but that is no time to be up on the roof!

Remember, it's not the roof material that leaks, it is all the extra holes cut into it for various items and the sealant used on these openings that creates the leaks.

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Renewing the roof coat ...

This photo shows a very neglected roof - the roof coating is cracked and actually has been lifted away from the surface by heat and moisture. This area is very liable to be a source of leaks and needs immediate attention! The old roof coating must be scraped away - some old fashioned elbow grease is needed. A stiff putty knife, similar to a mechanics gasket scraper, is used to scrape away the old material. An electric heat gun will soften the material for easier removal, although this still remains a tedious job.



Another area of this same roof ... this roof has not seen any attention for many years!



The repaired area.



The roof coat has been re-newed and this vent is again sealed.



The finished roof. Depending on the original state of repair, this job would take between one and six or eight hours. The roof coating should be inspected at least once a year and touched up or re-newed as needed.

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The Rubber Roof

What is it?

From the <u>Dicor Website:</u> "EPDM sheeting is the only rubber roofing membrane that is extruded. This process enables the production of a consistent single-ply membrane with a white surface and a black back. The cohesion of compounds results in a single-ply EPDM sheeting that is highly puncture resistant, has superior tensile strength and tear resistance, and is both reflective and refractive to UV rays."

Cleaning and Maintenance

It is recommended that the rubber roof be cleaned about 4 times a year, using a mild detergent solution.

Caution: the rubber membrane is very slippery when wet and extra care must be taken.

Recommended cleaning procedure:

- Hose off the entire roof to remove loose material, leaves, etc.
- Use a medium bristle brush to actively scrub the surface with the detergent solution.
- Rinse well with clean water.
- See: the <u>Dicor website</u> for more information on removing stubborn stains.
- •

DO NOT use cleaners or conditioners containing petroleum solvents, harsh abrasives, or citric based cleaners. You may cause irreparable damage to your roof

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Exterior Care

The exterior finish of your RV is continually being assaulted by the sun, the rain, the bugs and road debris. Oxidation is a natural process and will attack your shiny new paint leaving it with a dull-looking, chalky surface. This is actually the paint itself in the process of self destruction through the action of the elements.

Wash the exterior with specially designed car washing products. Household detergents and cleaners can actually harm the surface due to the alkaline or acidic nature of these products. Apply a quality automotive wax periodically or use the cleaner and wax combination when washing your unit to provide continuing protection.

A good set of mud flaps on your tow vehicle or motor home will eliminate a great amount of the damage caused by road grit being flung back on the trailer. The brush type of splash guard that mounts to the rear bumper is also very effective when used in combination with the mud flaps. If you regularly travel on gravel surface roads then consider installing a rubberized stone guard material on the front lower portion of your trailer. It only takes a few miles of loose gravel to demolish the aluminum panels or permanently mar the fiberglass top coat.

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The Absorption Refrigerator

Dometic

THE ABSORPTION SYSTEM

Illustration courtesy of Dometic Corp.

At the rear of the modern absorption (RV) refrigerator, there is a maze of steel tubing called the cooling unit. It is a self-contained, sealed system containing ammonia, hydrogen, water and a corrosion resisting agent. (usually sodium chromate)

In the lower portion of the cooling unit there is a bulb shaped container, called the absorber, holding a solution of ammonia and water, which is connected by a passageway to the siphon pump. The siphon pump is similar in operation to the center pipe of a coffee percolator. A heat source is applied (by a gas flame or an electric heating element) at the bottom of the siphon pump causing the ammonia/water solution to "boil" and form large gas bubbles. These bubbles push the ammonia/water solution to the top of the siphon pump where the now gaseous ammonia continues upward and the water separates out to flow down to a point where it is reused later.

The ammonia gas enters the finned condenser at the top of the cooling unit, where heat is dissipated to the atmosphere. As a result of this cooling effect, the ammonia vapor condenses to a liquid form and gravity takes over. The liquid ammonia flows down to the evaporator tube located inside the freezer compartment, where it mixes with pure hydrogen gas, again allowing the ammonia to "boil". It takes heat to produce this change of state (liquid ammonia to vaporous ammonia) and this heat is extracted from the freezer compartment and the food contained within.

The weight of the ammonia/hydrogen mixture carries it down to the absorber bulb at the bottom of the cooling unit, where the water in the system absorbs the ammonia. The released hydrogen (a very light gas) rises through the absorption tube passing over the water that is running down from the siphon pump (discussed above) and the remaining ammonia is absorbed. Therefor pure hydrogen is available again at the evaporator and the water/ammonia mix in the absorber bulb can continue the cycle.

This is the basic operation of the absorption cooling unit. Other components are involved to control the temperature settings.

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The RV Refrigerator



The absorption style RV refrigerator is a low maintenance device, but there are some things that you can do to help it do it's job. The most important thing is to keep it clean and prevent any obstructions in the venting system. See <u>how it works</u>.



When operating in the LPG gas mode, the products of combustion are removed by the flue. After a period of time, soot and rust particles accumulate on the inside surface of the flue. Road vibrations will loosen these deposits and they crumble and fall to the burner below. The finer particles fall into the burner itself, while the larger pieces remain on top of the burner and cause problems with the flame sensor. As the fine particles build up inside the burner, they alter the burners volume and shape. This results in an improper flame and affects the heat output of the burner. The flame may look normal, but it is not producing the required amount of heat to operate the cooling unit.



It is hard to tell by looking at the flame - a proper flame and a slightly reduced flame will look the same. There is no adjustment that you can make. The <u>orifice</u> should be soaked in alcohol (no, NOT Vodka!) and allowed to air dry. Replace the orifice if you suspect it is partially blocked after cleaning it. Blow out the burner with compressed air. Check the gas pressure at the refrigerator gas pressure test port using a manometer. You can build your own manometer for a few dollars (see <u>manometer</u>) for details and instructions. If the gas pressure is not 11" w.c., you may have a thermostat problem or a main regulator problem.



The BTU input (meaning the amount of heat) is about the same for the propane flame or the AC heating element by design. This is because the cooling unit is fabricated to process a certain amount of heat to make the "cool". It does not matter to the cooling unit whether this heat comes from a flame or an electric heating element.

The heat source, meaning the propane flame or the electrical heating element, is used to "elevate" the ammonia/water mixture to the top of the cooling unit. There after it is gravity and the PHYSICAL change of state of the chemicals that does the rest of the cooling work.

The air flow across the back of the refrigerator is also gravity controlled - hot air rises and flows out the roof vent. Cooler air is drawn in through the bottom or side vent to replace this rising air. This rising air collects heat from the evaporator fins as it passes by, thus removing heat from the cooling unit.



Any assistance, especially in HOT weather, will help with this heat dissipation. A fan to move the air need not be a large one to effect a higher efficiency. Also, the addition of sheet metal baffles to direct the moving air through the evaporator fins can be very effective.

Use a mirror to look up into the back of the refrigerator compartment. There should be a maximum of one inch clearance between the evaporator coils and the facing wall. If the clearance is more than this then your refrigerator will benefit by the addition of baffles. It may be necessary to remove the refrigerator to install the baffles, but that is not a hard task to do and may result in a very much improved cooling efficiency.

If your unit cools better/faster on one source as compared to the other, there is most likely a deficiency with the other system.

On-line resource - Cooling Unit

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Refrigerator Problems

No Cooling on any fuel source

This situation indicates a problem with the cooling unit, itself. Follow the steps below to determine the cause.

Testing the Cooling Unit

Testing by " Feel "

For this method of testing the only tools required are your hands! CAUTION: some of the components may be HOT! Be careful!

If a cooling unit is operating properly, there should be approximately the same amount of heat in the middle sections of the boiler and absorber. See the following diagram to locate these components.



Cooling unit blockages

When a cooling unit malfunctions due to a blockage, the boiler section may be too hot to touch and the absorber will be relatively cool. Any blockage reduces the free flow of the solutions and will inhibit or completely prevent proper operation.

A blockage is caused when the fridge is operated in an off level condition. The heat that is generated by the propane flame or the electric heating element is the force that initiates the cycling of the solutions inside the cooling unit. This action is similar to the familiar coffee percolator where the water is lifted by the heat and flows by gravity down over the coffee grounds.

The refrigerator depends on gravity to move the solutions through the system once the heat source has lifted the solutions to the top of the cooling unit. The passages that the solution must travel through have only a slight slope to them and any off-level condition will hinder this gravity flow. Parking on a hill, with your refer running while you go off to lunch, starts the degradation of the system and every time you do this, it adds up. There is no way to reverse this problem.

What happens in this situation, is that the solution in the cooling unit gets overheated, and a component of this solution crystallizes and becomes solid particles that float around and lodge where they're not supposed to.

Tipping the refer upside down, may or may not, dislodge the particles, but they are still in there and will (sooner or later) plug things up again.

You have two choices ... replace the cooling unit (new or recharged) or replace the entire refrigerator.

A new refer or a new cooling unit, comes with a one year warranty. In my area, a rebuilt cooling unit comes with a five year warranty - figure that one out!

Leaking Cooling Unit

If the boiler is warm and the absorber is hot this indicates that a leak has developed and the hydrogen gas has escaped. The liquid ammonia does not change to a vapor without the hydrogen gas atmosphere and circulates as a liquid. A strong ammonia smell is a definite sign of a leak. The cooling unit must be replaced or re-built.

There is a chemical called sodium chromate in the solution that circulates inside the cooling unit. It is there to prevent the ammonia/hydrogen/water solution from corroding the steel tubing. If a leak develops, this chemical changes from a liquid state to a powder in the presence of air. A yellow residue on the outside of the cooling unit indicates a leak.

Advanced testing methods

Dometic recommends the following method for testing the cooling unit:

1. Make sure the unit is level.

2. Hook up the 110 VAC element directly to a 110 volt source, in effect bypassing the thermostat and control systems. To do this, locate the two white wires coming from the 110 volt heating element. The heating element is located in the cylindrical tin casing surrounding the burner flu, and is accessible through the removable panel on the side of the casing. If you have a three way refer there should be two elements side by side. The 12 volt element can be identified by noting the way the wires are connected. The 12 volt element has one wire connected directly to the element and the other wire connects with a spade type of terminal. The 110 volt element has both wires connected directly to the element. Also, if you fully remove the elements, the voltage will be stamped on the casing.

Disconnect the two wires at the terminal block and connect these wires directly to a 110 volt source. If you are not comfortable or sure about what you are doing, then this test is best left to your RV Technician.

3. Place a thermometer in a glass of water and place in the food compartment. It is important to use the glass of water for this test as it equalizes the temperature reading.

4. After 12 hours the temperature should be 43 deg. F or less.

5. After 24 hours the temperature should be between the low 20's to high 30's maximum. If these temperatures are not reached and maintained, then the the cooling unit is faulty and should be replaced or rebuilt.

LPG Flame Outage Problem

The first steps to undertake are to clean the flue, the burner tube and the orifice. Remove the rear access cover on the outside of the coach. On the right lower side of the refrigerator, there is a tin cover which you remove to access the burner. The flue, or chimney, is located right above the burner flame. Often, a flaky rust colored residue falls from the flue and clogs up the burner (this is a result of combustion and is a normal occurrence). This residue will also interfere with the sensor probe and flame outage will result.



Use compressed air to blow out the flue and the surrounding area. Remove the screw holding the small tab that holds the thermocouple in place. The thermocouple is a narrow rod with the end that sticks into the burner flame. Pull out the thermocouple to access the two screws that hold the burner assembly in place.

Remove the burner tube and soak it in alcohol for 15 minutes, then let it air dry.

The orifice is located just to the left of the burner tube and is a brass colored nut with a very tiny hole in it. Remove this a let it soak in alcohol also. Do not probe or poke anything into the orifice to clean it - this will drastically affect the flame characteristics and will render the orifice useless. Once soaked and dried, you should be able to hold it up to a light source and see the light shining through the orifice opening.

Re assemble every thing and light the burner flame. A normal flame will be a "hard blue" color with no yellow tip, and will emit a slight roaring sound. If you still have a flame outage problem then the electrical circuitry is most likely the cause.

The Electric Heating Element

The electric heating element supplies the necessary heat for refer operation on shore power. It is located at the rear of the refer as shown here (under the cover marked #6).



The element can be checked with an ohm-meter. Be sure to disconnect the 110 volt power cord and the 12 volt supply before working on the unit. On three way refrigerators there will be two heating elements - on a two way model, there will be only one. Note: some older models had a combination 110 volt and 12 volt element in one casing.

Locate and disconnect the wires leading to the element. With the multi-meter set on ohms reading, check the resistance of the element.



A zero reading indicates an internal short inside the element - an infinite reading shows an open circuit - in either case, replace the element. The correct reading varies from model to model.

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The RV Furnace

Many people find that the slender spaces beside their forced air furnace is ideal for storing such items as cookie sheets, cutting boards, even paper or plastic bags. In addition to the obvious fire hazard, I would like to point out another dangerous situation that could result from this practice.

The air intakes (for the fan that supplies return air to the furnace blower) are located on either side and the top of the metal furnace housing. These air intake slots draw air from the surrounding area and the blower fan forces this air past the sealed combustion chamber in the furnace and on to the warm air duct work.

If this intake air flow is restricted, (with loose plastic bags, aforementioned cookie sheets, etc.) the fan motor speeds up. (the same effect is observed when the intake hose of a vacuum cleaner is plugged off).

There is a separate combustion air system, sealed from the inside of the coach, that feeds fresh air to the burner assembly inside the furnace. This system draws in outside air to allow the proper combustion of the fuel gas and then forces the exhaust products out again. The fan for this system is powered by the same furnace motor that runs the blower, therefor it speeds up at the same rate.

The increased air flow in the combustion chamber alters the burn characteristics of the flame producing a leaner, hotter flame. This overheating can lead to failure of the furnace safety devices, damage to the electronic components of some models or in the worse case a cracked combustion chamber. Exhaust products, including CARBON MONOXIDE, will now be forced into the living area !!!! CO is odorless, colorless and extremely toxic - a silent killer.

Please check your furnace compartment for air flow restrictions.

If you have any doubts or concerns regarding your furnace's condition, have it inspected by a licensed, qualified RV gas technician.

A carbon monoxide detector installed in your unit is a very inexpensive life insurance policy.

Troubleshooting:

- the <u>The DSI RV Furnace</u>
- the <u>The Pilot Model RV Furnace</u>

The DSI Furnace - sequence of operation.

- 1. The thermostat is turned on and calls for heat.
- 2. Electrical current is sent from the thermostat to the time delay relay. The relay closes after a delay of 10 to 20 seconds and energizes the blower motor.
- 3. The blower motor must come up to 75% of it's rated speed to continue the ignition sequence. If it doesn't the motor is faulty, voltage is too low, the return inlet air is blocked, or there is a blockage in the exhaust.
- 4. Once the motor comes up to speed, the sail switch is physically moved by the air flow and closes a micro-switch to continue the circuit. It must have a certain force to close it and if the motor is not running fast enough, or there is a blockage of some kind, or a "sticky" switch, then the current is interrupted

Note: This circuit is totally independent of the thermostat or motor circuit and only comes into play when the fan blow "hard enough" to close the sail switch.

Locate the two wires that come and go to the sail switch - with your test light, probe each one - you should have power at both wires, with the furnace fan operating. If not, replace the sail switch.

- 5. The sail switch closes and sends the power to the limit switch. The limit switch is normally closed, but will open at a preset temperature to prevent furnace overheating. With the fan running, probe each terminal of the limit switch you should have power at each terminal. If not replace the limit switch.
- 6. The limit switch then sends power to the circuit board the circuit board delays ignition for 10 to 20 seconds to allow the blower to purge any gas from the combustion chamber.
- 7. After this delay, the circuit board opens the gas valve and sends a high voltage current to the electrode. This ignition TRIAL will last for about 10 seconds. If ignition occurs, the electrode senses the flame and returns this information to the circuit board. The circuit board then stops the high voltage spark but keeps the gas valve open. If ignition fails, the board will go into lockout (new boards will try three times before going to lockout).
- 8. Lockout can be caused by a faulty circuit board, faulty gas valve, a faulty electrode or any of the above conditions.
- 9. If the ignition sequence is interrupted at any point, there will be no ignition. Safety is utmost!

Troubleshooting the RV DSI Furnace

The following descriptions are based on the Hydro Flame 8500 series furnaces, but the operating principles are similar for other manufacturers.

- Low battery voltage
- Obstructed return air intake
- <u>Obstructed exhaust</u>
- Low gas pressure

- Time delay relay
- <u>Blower motor</u>
- <u>Sail switch</u>
- <u>Limit Switch</u>
- <u>Circuit board</u>
- Burner assembly
- <u>Electrode assembly</u>
- <u>Thermostat</u>

Low battery voltage

The furnace is designed to operate at voltages between 10.5 to 13.5 VDC. Low voltage will not run the blower motor at the proper speed to commence the ignition sequence. This is a safety feature that ensures the blower will be able to provide enough combustion air to operate the burner at it's designed efficiency.

Obstructed return air intake

Return air is the air that flows in to replace the heated air that the blower pushes out through the ducting. This air is pulled in by the furnace through louvered openings in the side of the furnace cabinet, and any items stored near these openings could interfere with this air flow.

Obstructed exhaust

The exhaust venting must be clear of all obstructions for proper furnace operation. Inspect the vents for insect or bird nests or other debris.

Low gas pressure

Low gas pressure will affect a burner in several ways. When a malfunctioning burner is encountered, the first step is to make sure the gas pressure is correct.

Gas pressure to a propane fueled appliance should be 10.5 to 11 inches of water column pressure. This is controlled by the main system regulator.

Time delay relay



This relay performs two separate jobs - one to handle the relatively high current needed to run the blower motor - and two, to allow the blower to run for 45 to 90 seconds after the thermostat is satisfied. This allows excess heat in the chamber to dissipate before the blower stops.

The relay is normally open and should always have power from the circuit breaker. Only when power from the thermostat is present does the relay close after a 20 second delay. Power then flows to the blower motor.

Blower motor

Next in the ignition sequence is the blower motor. It drives two squirrel cage fans to provide separate air flow for the combustion process and for distributing the heated air to the coach. A heat exchanger is used to separate the heat from the burning gas while preventing exhaust gases from entering the living space.

Sail switch



The sail switch (air prover switch) is an on/off device. (normally in the off position) It gets it's name from the "sail" or paddle that is attached to the switch mechanism. As the blower comes up to speed, it blows air onto the sail with enough force to push the switch closed, thus allowing electrical current to flow to the next component in line.

It's job is to determine if there is adequate air flow for proper combustion to take place. If the battery voltage is low or the fan does not come up to 75 per cent of it's design speed, the sail switch will not close.

Possible causes of this malfunction are: low battery, restricted return air inflow, restricted or inadequate outlet vents, restricted combustion air inlet or exhaust, faulty sail switch or faulty blower motor.

Limit switch



The limit switch is a simple temperature controlled switch. It's function is to monitor the combustion chamber heat level. If the temperature of the combustion chamber exceeds the preset limit, the switch will open and disrupt the flow of current to the circuit board, in effect, shutting down the main burner. Once the chamber temperature cools sufficiently, the limit switch resets. This initializes the ignition sequence and starts another cycle. This condition is referred to as "limiting".

Circuit board



The circuit board will not receive power until the sail switch is closed by adequate air flow from the blower. The power must also flow through the limit switch.

When the circuit board is triggered by this current, it delays ignition for about 15 seconds to allow the blower to purge the combustion chamber of any unburned gases.

The circuit board then sends high voltage pulses to the electrode assembly, providing a series of sparks to ignite the gas/air mixture.

At the same time, the circuit board sends power to open the gas valves allowing the fuel to flow to the burner.

If everything is okay, the main burner ignites.

The circuit board monitors the burn cycle through a sensor that detects the presence of the flame. If the sensor does not detect a satisfactory flame within about 10 seconds, the board then shuts off the gas valves and discontinues the ignition spark.

Depending on the board design, it will try for ignition up to three times. Beyond that point, it goes into lockout mode, will not retry for ignition until reset and the blower will continue to run.

Burner assembly



This illustration shows the burner assembly for the Hydroflame 8500 series furnace.

Many older furnaces used a very different burner configuration, but the principles remain the same.

The burner needs an ignition source (pilot or electronic spark), an appropriate combustion air supply, and proper fuel metering (orifice) to operate at it's designed capacity.

Electrode assembly.

Electrodes are designed to provide an ignition spark - to initiate the burn - and to provide feedback to the circuit board when the flame is established. The propane flame creates a tiny electrical current which is sensed though the electrode assembly. This current is sent back to the circuit board, which in turn, decides if the flame is adequate. If not, the circuit board will shut down the burner.

The electrode assembly may have two or three probes, depending on the furnace make and model. Some systems used the extra probe for a ground circuit, others incorporated the ground circuit into the second probe. In any case, the gap between the spark probe and the ground (or other probe), should be 1/8 inch.

The electrodes must be clean and free of carbon or other deposits. Do not file or sand the surfaces as you will damage the protective coating and shorten the electrode life. Simply wipe off the contacts with a cloth and solvent, and replace them if needed.

Furnace thermostat



The thermostat is an on/off switch controlled by a bi-metal coil that senses the changes in temperature and opens or closes an electrical contact. This signal is sent to the furnace to start or stop the heating cycle.

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<u>The Pilot Model RV Furnace - sequence of operation.</u>

- 1. The thermostat is turned on and calls for heat.
- 2. Electrical current is sent from the thermostat to the time delay relay. The relay closes after a delay of 10 to 20 seconds and allows current to flow to the circuit breaker.
- 3. The circuit breaker is placed in line to monitor the draw of the motor. Excessive amperage draw due to a faulty motor will trip the circuit breaker at it's preset limit. The current flows through the circuit breaker and on to the blower motor.
- <u>4.</u> The blower motor must come up to 75% of it's rated speed to continue the ignition sequence. If it doesn't the motor is faulty, voltage is too low, the return inlet air is blocked, or there is a blockage in the exhaust.
- 5. Once the motor comes up to speed, the sail switch is physically moved by the air flow and closes a micro-switch to initiate a separate circuit. The sail switch must have a certain force to close it and if the motor is not running fast enough, or there is a blockage of some kind, or a "sticky" switch, then the sail switch is not blown closed and the circuit is interrupted

Note: This circuit is totally independent of the thermostat or motor circuit and only comes into play when the fan blows "hard enough" to close the sail switch.

Locate the two wires that come and go to the sail switch - with your test light, probe each one - you should have power at both wires, with the furnace fan operating. If not, replace the sail switch.

- 6. The sail switch closes and sends the power to the limit switch. The limit switch is normally closed, but will open at a preset temperature to prevent furnace overheating. With the fan running, probe each terminal of the limit switch you should have power at each terminal. If not replace the limit switch.
- 7. The limit switch then sends power to the gas valve.
- 8. The gas valve will send gas to the main burner, if the pilot light is lit. If the pilot light goes out no gas will go to the main burner for obvious safety reasons!
- 9. The main burner is ignited by the pilot flame and will continue to burn until the thermostat is

satisfied. Once the room temperature comes up to the thermostat setting, the thermostat contacts open and cut off power to the gas valve, thus shutting off the gas supply to the main burner. The pilot flame continues to burn.

10. If the ignition sequence is interrupted at any point, there will be no ignition. Safety is utmost!

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Troubleshooting the Pilot Model RV Furnace

- Low battery voltage
- Obstructed return air intake
- Obstructed exhaust
- Low gas pressure
- <u>Time delay relay</u>
- <u>Blower motor</u>
- <u>Sail switch</u>
- Limit Switch
- Burner assembly
- Electrode assembly
- <u>Thermostat</u>

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The RV Range and Oven



The RV stove top/oven is a relatively simple appliance. There are few adjustments and few problems encountered due to this simplicity.

The stove top burners may be ignited with a push button or rotary piezo lighter, a pilot flame or a simple match. If the stove top is equipped with a pilot ignition, it will have a pilot shut off valve located beneath the stove cover or it will be controlled by the oven control knob. Newer stove tops can have an optional electronic ignition.

Older stoves (some) used a thermostat setting called "Off" and another position called "Pilots Off". The "Pilots Off" setting shut off the gas supply to both the stove top pilot and the oven pilot, while the "Off" position merely meant that the oven itself was turned off. The pilots were still running in this setting. This created a problem when people left the setting in the "Off" position and then shut down the propane system. When the propane supply was later turned on, often the pilots were forgotten but were still emitting gas. Newer stove tops eliminate the pilot and use a piezo sparker or an electronic ignition system to light the burners. (or the trusty manual match method). The oven control has an obvious "Off" setting which shuts everything off. Less confusion!

The stove/oven has a built in regulator just below the stove burner lid. This works in conjunction with the main coach regulator. The stove burner valves must not be subjected to high propane gas pressures to prevent leaks at these points. The stove top regulator will block any high pressure is the main regulator fails.

The oven pilot is lit by manual means - a match or a lighter and is controlled by the oven control knob. The oven pilot is actually two pilots in one - a standby pilot that, well "stands by" waiting for the oven temperature control to be turned - and the heater pilot. When the oven temperature knob is initially set to the desired temperature, the thermostat sends more gas to the oven standby pilot resulting in a larger heater pilot flame. This larger flame heats up the safety valve sensor which in turn allows the safety valve to open and the main burner is ignited by the pilot. When the set temperature is reached the thermostat reduces the flow of gas to the heater pilot which reverts back to the standby flame. This allows the safety valve sensor to cool, the safety valve to close and the gas supply to the main burner is shut off. This cycle will repeat until the oven control knob is turned off or reset to a different temperature. If there is no heater pilot, the safety valve prevents the main burner from lighting.

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The RV Range and Oven

Trouble Shooting



Stove top burners won't light or stay lit

- Plugged orifice <u>Clean orifice</u>
- Low gas pressure check pressure with a <u>u-tube manometer</u>
- Incorrect air/gas mixture adjust air shutter.
- When cleaning the stove top burners, be sure to remove any of the cleaner residue. This residue, when dried, can plug the holes in the burner. If you have a burner that only lights on part of the circle, it is most likely that the burner ports are clogged. Use a toothpick or similar item to clean out the burner ports.

Burner flame lifts off burner

• Allow the burner flame to stabilize Often it is simply air in the lines or a cold burner that causes

the problem. If the flame does not settle after a few finites of operation, check the following:

- Gas pressure too high check pressure with a <u>u-tube manometer</u>
- Incorrect air/gas mixture adjust air shutter.

Burner flame too small

- Low gas pressure check pressure with a <u>u-tube manometer</u>
- Incorrect air/gas mixture adjust air shutter.
- Faulty burner valve replace burner valve
- Partially blocked orifice Clean orifice

Stove top pilot won't light or stay lit

- Low gas pressure check pressure with a <u>u-tube manometer</u>
- Plugged pilot orifice -<u>Clean orifice</u>
- Pilot supply valve closed check and open
- Pilot flame adjustment too high or too low adjust pilot flame
- Carbon build up on pilot orifice Clean orifice

Oven flame lifts off the burner

- Allow the burner flame to stabilize Often it is simply air in the lines or a cold burner that causes the problem. If the flame does not settle after a few finites of operation, check the following:
- Gas pressure too high check pressure with a <u>u-tube manometer</u>
- Incorrect air/gas mixture adjust air shutter.

Oven standby pilot won't light or stay lit

- Thermocouple out of position re-position thermocouple.
- Faulty thermocouple -replace.
- Low gas pressure check pressure with a <u>u-tube manometer</u>

Oven standby pilot won't go to heater pilot setting

• Replace oven thermostat.

Oven cooks unevenly or food burns on the bottom

- Faulty thermostat replace thermostat.
- Poor air circulation remove shelf lining, unblock oven vents

Oven main burner will not light

- Pilot does not go to heater pilot setting replace thermostat.
- Main burner orifice plugged Clean orifice
- Low gas pressure check pressure with a <u>u-tube manometer</u>
- Faulty oven safety valve (mercury valve) replace safety valve.

Oven temperature incorrect

• Adjust thermostat

To check the thermostat operation, turn the oven control knob to the pilot on position and light the stand by pilot. Next increase the temperature setting and check to see if the stand by pilot increases in intensity. If it does then the thermostat is probably okay. If it doesn't, replace the thermostat.

If the stand by pilot increases to the heater pilot mode, but the main burner will still not light, check to see if the main burner orifice is clean and clear. If so, the safety valve is faulty.

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Orifice

An orifice is a precisely machined opening that meters the correct amount of gas for proper flame characteristics of the associated burner.

Never poke anything into an orifice when attempting to clean it. Distortion of the orifice will result in improper flame properties and the orifice must be discarded.

Clean the orifice with alcohol and allow to air dry. Hold it up to a strong light while looking through the opening to verify that the blockage has been removed.

Water Heating Systems

The hot water system doubles the plumbing in an RV. Beyond the pump and the city water valve, are the hot water tank and a complete separate plumbing system to each sink and shower installation.

The water heater consists of an insulated storage tank of six to ten gallon capacity, and a propane gas burner that is used to heat the water. The storage tank is made of aluminum or glass-lined steel, depending on the model. The steel tanks use an anode rod to help prevent corrosion of the tank material. The corrosive elements in the water attack and "eat up"the anode rod rather than the material of the tank. These anode rods should be inspected and replaced annually, if required. Aluminum tanks do not require an anode rod.

Additional options include electrical heating elements and motor assisted hot water systems in some motor homes.

Electronic Ignition models

Pilot Ignition models

Temperature/Pressure Relief Valve

The cold water in the water heater expands as it is heated thus increasing the water pressure. This additional pressure may cause the temperature/pressure relief valve to "weep" and cause other leak problems. The RV water system is designed for water pressures of about 45 PSI. If the city water connection is hooked up to a water source, a water pressure regulator should be

used to control the higher pressure. This pressure, along with the added pressure from the heated water may cause leaks to develop.

The water heater is designed to trap a pocket of air above the water level in the tank. This air pocket compresses as the water is heated. The air pocket can eventually be absorbed by the motion of the vehicle and should be restored from time to time.

To restore the air pocket, turn off the water pump or city water supply and open a hot water tap to reduce the water pressure to zero. Remove or open the water heater drain plug or valve. Allow the water heater to drain and flush it by running water through it for several minuets. Insert the plug or close the drain valve and re-fill the water heater tank until the water appears at the opened hot water faucet.

Another solution would be to add an accumulator to the system. An accumulator is basically a sealed tank in the water system that has an air pocket to absorb extra pressure.

Anode

An anode rod is used to help prevent corrosion of a steel water heater tank. The corrosive elements in the water attack the anode rod instead of the steel tank. The anode rod should be inspected yearly and replaced as needed.

Aluminum tanks have a special inner coating and do not use an anode rod.

Atwood tanks are lined with a material that acts as an anode rod, so therefore no anode is needed. Suburban uses a glass-lined steel tank and a sacrificial anode rod (magnesium) is used to prevent the steel from being attacked.

I don't see more Atwoods with corroded tanks as compared to Suburban tanks. (in my neck of the woods). I have seen anode rods in Atwood tanks that were impossible to remove, and a welder friend explained that it is the different metals that causes this. The anode rod threads are steel and the tank threads are aluminum. This is why Atwood uses a nylon plug for the drain and does not recommend replacing it with a brass or steel one. I suppose if the anode rod was installed with teflon tape or a plumbers pipe sealant this problem would be eliminated, but would the customer remember to do this every time the anode is removed and replaced?

I hesitate to recommend anything to a customer that the manufacturer advises against. If something goes wrong the customer comes back, even years later, and says "You recommended such and such, now you owe me a new thingy"! Also, I figure that the manufacturer is the best one to recommend something to do with their product.

I do recommend flushing the hot water tank occasionally to get rid of the sediment and corrosive deposits in the bottom of the tank. Just pull the drain plug, allow it to drain, and direct a stream of water into the drain hole to agitate the sediment. Then allow it to drain, repeat until the water comes out clean. Do this about every other month (or more if your water has a lot of minerals) The flushing also helps to eliminate any hydrogen sulfide that may build up in the tank (causes the rotten egg smell in the water), and makes the heater more efficient.

Electronic Ignition Water Heaters

How they work



When the inside switch is activated to start the water heater operation, an electrical current flows through the thermostat, through the E.C.O. (energy cut off) and to the electronic control circuit board. This circuit board controls the gas valve, the sparking ignition probe and uses the sensor probe to monitor the flame.

A small electrical current is generated by the main burner flame. This current is picked up by the sensor probe and relayed to the circuit board. The circuit board then allows the gas valve to stay open to supply gas to the burner. If the flame is blown out or quits for some other reason, the circuit board will immediately re-establish the ignition sequence and will continue to do so for approximately nine seconds. If there is no re-ignition, the circuit board will "lock-out", close the gas valve, illuminate the warning light and remain locked out until re-set.

If all is well, the main burner will run until the water reaches the preset thermostat temperature (about 140 degrees F.) The thermostat now opens the circuit, shutting off electrical flow to the circuit board. This closes the gas valve and extinguishes the flame.

When the water cools or hot water is drawn off to the point where the thermostat again calls for heat, the ignition sequence is restarted. The circuit board initiates the sparking mechanism, opens the gas valve and waits for the sensor input.

If the thermostat fails to shut off the gas flame once the water has reached the set temperature, the E.C.O. (energy cut off) switch will open to break the circuit and close the gas valves when the water temperature reaches it's preset value (about 180 degrees F).

Finally, there is the pressure relief valve that will physically open to release water pressure if the water temperature exceeds 210 degrees F. or if the water pressure exceeds 125 to 150 PSI.

No ignition

Many non-ignition problems can be linked to dirty or corroded electrical contacts. The first step, when dealing with this situation, is to clean all the electrical contacts. Pull off each terminal, one at a time, to avoid confusion when replacing the wires. A spray on electrical contact cleaner is the best product to use for this chore. There is a plating applied to the contacts to help prevent corrosion. If you file off this plating, rust will soon develop.

If this does not solve the problem, refer to the troubleshooting chart below.

Troubleshooting

Gas pressure

Check that the main propane pressure regulator is set to deliver 11" of water column pressure with two or more appliances running.

See <u>u-tube manometer</u> for instructions

Flame spreader and air shutter



The flame spreader "A" should be aligned at 90 degrees to the flame. The air shutter should be adjusted to 1/4 open and then fine tuned to produce a quiet flame (slight roaring sound), with a solid blue color (no wavy or yellow tip to the flame)

Other models will use a different air shutter adjusting mechanism, but the principle is the same.

Water Heater Burner

If the pilot flame is established and burning properly, the main gas valve should open when heating is required.

- Make sure that the temperature selector lever or dial is set correctly.
- Clean the burner tube of possible obstructions.
- Clean or replace the main burnerorifice as required.
- Replace the gas valve

Water Heater Valve Alignment



Pilot Ignition Water Heaters

How they work

Once the pilot flame is lit, it provides a stand by flame to ignite the main burner when the thermostat calls for more heat. The pilot flame is lit manually by turning the control knob to the pilot position, depressing or turning the pilot knob (depending on manufacturer), and applying a match to light the pilot gas.

Keep the pilot valve pressed for 15 to 20 seconds to allow the thermocouple to heat up. This keeps the main valve in a "ready state". If the pilot flame is extinguished by a passing breeze or other cause, the thermocouple cools and shuts off all propane flow to the pilot and the main burner. This is a safety feature built into the gas control.

Once the pilot flame is lit and burning steadily, turn the gas control knob to the "on" position. If the water is cold the main burner will ignite and burn until the water temperature reaches the setting of the thermostat. Once the water comes up to the preset temperature, the thermostat shuts of the gas to the main burner. The pilot continues to burn, awaiting the next cycle.

On-Line Appliance Manuals

- Bryant RV Website list of free refrigerator and furnace manuals that you can download.
- <u>RV Mobile</u> refrigerator manuals and how-to's ...

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The 12 Volt System

Types of Batteries

• **Starting Battery** - this battery is designed to supply a large amount of current when needed to start the engine on a motor home or tow vehicle, and then be immediately recharged by the vehicles alternator. Deep discharging of this type will drastically shorten the life of the battery.

- Marine Starting Battery This battery is a compromise between the starting battery and the true deep cycle battery. The plates are heavier and more firmly mounted to endure the pounding of a marine application.
- **Deep Cycle Battery** this battery is built with heavy plates and other internal modifications to enable it to deliver a relatively small amount of current over an extended period of time. Care must be taken when recharging at high amperage settings and limitations exist to prevent plate warping.

Batteries and Battery Charging

The battery (or batteries) supply your RV with 12 volt DC electrical power to operate the lights, water pump, furnace and other appliances. They should be viewed as a storage tank for electricity and as such they have certain limitations.

The capacity of the battery relates to the amount of electrical power that the battery can store and that capacity will determine how long your lights will burn and how long your furnace will operate, before the battery will need to be recharged. You can increase the storage capacity of your battery by installing a larger size or by installing multiple batteries, depending on your camping requirements.

If you normally travel from RV park to RV park, where hookups are available, then one battery will be sufficient. However, if you "dry camp" at remote locations for more than a day or two, you will need more storage and some way to refill that storage capacity.

Deep cycle batteries (or any battery, for that matter), should be recharged as soon as possible for longer service life. A deeply discharged battery should be slow charged over a long period of time, say at 2 amps for 72 hours or more to avoid excessive heat in the battery.

If you leave your battery on a charger, either the one built into the converter or a separate charger, for long periods of time, make sure charger voltage is between 13.25 and 13.75 volts. Anything above 14V will overcharge the battery and "boil" off a lot of the battery water.

State of charge chart for 12 volt batteries:

- 12.70 volts 100%
- 12.50 volts 90%
- 12.42 volts 80%
- 12.32 volts 70%
- 12.20 volts 60%
- 12.06 volts 50%
- 11.90 volts 40%
- 11.75 volts 30%
- 11.58 volts 20%
- 11.31 volts 10%
- 10.50 volts 0%

Batteries should be checked after at least 3 hrs. rest.

Batteries Isolators and Charging Relays

Battery isolators are devices used to allow the RV battery to be charged by the vehicle alternator while the engine is running. When the ignition is turned off, the RV battery and the starting battery are effectively disconnected or "isolated" from each other. Relays are an alternative method of achieving the same thing.

Isolators use electronic circuitry to divide the alternator output between the two batteries. Diodes (one way electrical components) are used to prevent the RV battery from draining the starting battery when dry-camping.

Relays are electro-mechanical devices that basically do the same thing as a battery isolator. Relays are simple switching devices that use a trigger current from the ignition system to connect the RV battery and the starting battery together when the engine is running. When the ignition switch is turned off, the trigger current is also turned off and the switch opens (disconnecting the two batteries). This allows the RV battery to be charged from the vehicles alternator when the engine is running, but prevents the RV electrical system from depleting the staring battery while camping. A continuous duty relay should be used as opposed to the typical starting relay. These are available at most RV supply outlets.

The Converter



The converters primary job is to convert 110VAC to 12VDC for use when plugged in to shore power. The battery charging part is a secondary function and the charger is not very "smart". Meaning that it's meant for a maintenance charge and does not monitor the requirements or state of charge of the battery to any great extent.

Note: the newer converters are doing a little better in this regard. Using a quality external charger that charges fast and the tapers off when the battery comes near fully charged helps to prolong the life of the battery. In the old days, before converters, trailers had two separate lighting systems. 12 volt lights that were run from the trailer battery, and 120 volt lights that were used when plugged into shore power.

Newer trailers eliminate the need for these two systems and convert the 120 volt incoming AC power to 12 volt DC power to run the 12 volt lighting system. The converter also has a built in charge circuit to charge the trailer battery when on shore power.

The Inverter

Inverters are used when boon-docking to provide a limited supply of 110 volt AC power. They take the electrical energy developed through chemical reactions in the battery bank and convert it to usable 110

volt AC current. The amount of current is limited by the battery storage capacity.

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Solar Power



Solar power is energy supplied from sunshine. This energy is converted by a solar panel into electrical current.

This electrical current is stored in a battery bank to be used as required at a future time.

The panel on the left has 36 cells - each cell produces about 1/2 volt - and results in a panel output of 18 volts.

This voltage is controlled by a regulator to provide useful energy to charge the battery bank.

See installing a solar panel

Internet links to solar related websites:

- <u>Solar power worksheet</u> at rvsolarelectric.com
- <u>http://www.rvsolarelectric.com/index.html</u>
- http://www.backwoodssolar.com/
- <u>http://www.solar-electric.com/</u>
- <u>http://www.amug.org/~lanegarr/pv/power/rv.html</u>
- <u>http://www.windsun.com/PV_Stuff/pv_pricing.htm</u>

Internet links to battery related websites:

- <u>Deep Cycle Battery FAQ</u>
- <u>Trojan Battery</u>
- <u>US Battery</u>
- Interstate Battery
- More good battery info here

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Installing a Solar Panel

- First disconnect the coach battery.
- Disconnect the shore power cord.
- Do not run the generator.
- Cover the solar panel face with cardboard to prevent a current from being generated.

Install the panel ...



Find a good mounting location for the panel, face it so that the width end is forward - less wind resistance! The location should be near a logical (meaning an easy) place to route the wiring. This panel has been mounted so that the wiring can be run down the refrigerator vent ... a ready made avenue!

Seal all roof mounting points ...



There are four panel mounting screws that must be sealed ... the wire tie-downs have been incorporated into the existing structures to minimize the roof penetration points ...

Locate the Regulator ...



Select a location to install the regulator and display panel. This space above the refrigerator is a "natural" ... it is unused space with no obstructions behind it. It also minimizes the length of wire need for the connections.



The opening is cut out and the two wires from the solar panel are fed down through the refrigerator vent ... another set of wires is fished down through the refrigerator access compartment to later connect to the battery circuit.

Connecting ...



The solar panel is connected to the corresponding terminals of the regulator. All connections are clearly marked. Be sure to connect the wires with the correct polarity.



Next, the battery connection at the regulator panel is made. Polarity is important, so double check your connections.

The Final Connections ...



The battery connection wires are fed down the refrigerator compartment to where the refrigerator is connected to the battery. This is a good place to connect the solar panel because the refrigerator wiring is 10 gauge heavy wire and is direct to the battery.



Remember that in most RV's the white wires are the ground (negative) connections and the black wires are the positive connections. The wiring from the solar panel regulator has a red wire and a black wire. The black wire is the negative wire and is connected to the white coach wiring bundle. The red wire from the solar panel regulator is the positive wire and it is connected to the black RV wiring bundle. This may be somewhat confusing, at first, but do it step by step and double check everything.

The Finished Job ...



The completed project looks neat and professional!

This project can be completed in an afternoon and will be charging the battery for many trouble free years.

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120 VAC power

Shore Power

Shore power is the electricity provided to the RV when the electrical cord is pugged into the campground electrical supply box.

The RV electrical cord connects directly to the circuit breaker panel and is controlled by the main circuit breaker. The electrical power is distributed from the breaker panel to all the various power outlets in the RV, through one or more circuits. Each of these circuits is protected by a circuit breaker of it's own.

RV Campground electrical supply outlets must be wired to code when installed to pass inspection. In a lot of parks, that was 20 or 30 years ago! As the receptacles wear out or break, the maintenance guy or owner replace them as needed. Whether they wire them back the way they were or not is up to the competence or knowledge of the replacer guy!

120 VAC power

Polarity is important!



120 VAC circuit polarity tester

You can purchase a 120 volt circuit polarity tester for under ten dollars at a hardware store or electrical supply store. (Or on-line from Amazon.com - <u>Order it from Amazon.com here!</u>) The device plugs into an electrical outlet and has three lights on it to tell you if there is a problem and where the problem is. Everyone should have one of these to test every campground shore power outlet BEFORE hooking up the coach to the power source. Incorrectly wired outlets are hazardous! If the tester shows a problem, do not plug your RV into the source - ask for a different site or move to another RV park!

Voltage Problems

Also, the electrical demands of the RV's in the park (25 years ago), is very different from the electrical requirements today. The park was wired to accommodate the demand at the time and may be woefully inadequate today. As each RV arrives and plugs in, the line voltage of the park electrical system may begin to drop, especially in hot weather, when air conditioners are running. If the voltage drops below about 105 VAC, your AC appliances could be damaged. There are low voltage monitors available in a variety of price ranges that sound an alarm if the voltage falls to a dangerous level.

Another problem is that the transformer that supplies the RV park may have had the voltage turned up to counteract the drop at peak demand. If there are few RV's in the park, the voltage may be too high, also endangering your equipment. An inexpensive voltmeter will enable you to monitor the voltage levels. There is a plug in model that continually shows the voltage on the line.

Ground Fault Interrupter or GFI

A GFI is usually found in the bathroom and/or near the kitchen sink. It is a safety device to prevent electrical shock when an electrical appliance is used near a water source. A GFCI monitors the amount of current flowing in an appliance, and if there is any imbalance then it trips the circuit. It is able to sense a mismatch as small as 4 or 5 milliamps, and it can react as quickly as 1/30th of a second.



Ground Fault Circuit Tester...

The GFI in your RV may protect several other outlets down line from the actual GFI outlet. If you find that several outlets are not working check the main circuit breakers and the GFI outlets. A GFI outlet has a "Test" button and a "Reset" button. To reset the GFI, press the reset button. If the GFI trips again then you have an electrical problem in the circuit. Do not use the outlet until the problem is corrected.

Circuit Breakers

The 120 Volt AC circuits in the RV are protected by **circuit breakers**. These are the same as circuit breakers used in your house electrical system. If a short circuit happens or an overload occurs on the circuit, the circuit breaker will trip and interrupt the current flow. As with any mechanical device, circuit breakers can wear out. If you have a circuit that constantly trips, measure the current flow with an ammeter to find the actual current flow. If the breaker trips at an amperage below its rated value, it is defective and should be replaced.

Generators

Generators are engine driven devices that provide 120 VAC power when a connection to a shore power source is not available. Repair of the generator is beyond the scope of this book.

On-Line Resource -

- Don't Damage the Generator
- <u>Onan Generator website</u>

Inverters

Inverters are used when boon-docking to provide a limited supply of 120 volt AC power. They take the electrical energy developed through chemical reactions in the battery bank and convert it to usable 110 volt AC current. The amount of current is limited by the battery storage capacity.

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Cosmetic touch-ups

... by Les Doll

RV interiors are rife with woodwork and wall paneling that can often get easily scratched or nicked from various sources. There are several products on the market that can help cover up and make these defects 'disappear'.

One such handy product is the common 'White-Out' used to correct spelling errors in typewritten documents. It comes in a convenient bottle with a brush attached to the cap and costs a buck or two. Nail or staple holes in white wallpaper, paneling or ceiling areas are easily filled with this substance and the repair is invisible. I've heard that toothpaste will also work, although I have never tried this.

There is also a white filler for drywall that comes in a squeeze tube - ready mixed and easy to apply. This material dries to a hard finish that can be gently sanded to blend in.

Also available in squeeze tubes, are colored fillers to match oak, walnut or whatever color your paneling may be. These can cover holes or scratches with ease. Often an application of a slight amount of matching stain will hide small surface scratches and blends in with the color. Try this in an inconspicuous area first to make sure.

Larger holes can be covered by pictures, various hanger hooks, or other accessories, depending on where they are located. Sometimes a matching baton strip can be added in the same material finish as the wall. These don't look out of place if they match.

With a little ingenuity, many defects can be made invisible.

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Emergency Check List

You can pick and chose what you think you might need.

Emergency Kit Check List

12-volt compressor Bailing wire Brake fluid Bungee straps CB radio (hand-held) Come-a-long Crowbar Drill and bits ____ D-rings and chain ___ Duct tape Electrical repair stuff (wire, crimp connectors, crimping tool, tape, etc.) Engine oil (3 quarts) (1qt) ___ Epoxy glue ____Fan belt(s) (spare for each belt) Flares and reflectors ____ Flashlight (with spare batteries) ____ Fuel filter Fuel line and clamps _____Fuses (for both truck and trailer) Hacksaw and replacement blades Hammer Hand cleaner _____ Hand tools (varied assortment) Hose repair kit (for both radiator and heater hoses) ____Ignition parts (plugs, cap, rotor, cables etc.) Jack and handle (for truck & trailer) Jumper cables Leather gloves ____Nuts and bolts (varied assortment) Permatex (non-hardening) and RTV silicone sealant Pipe wrench ____Plastic tarp (6 x 8-foot) Power steering fluid Puncture-Seal (2 cans) ____ Rags or shop towels ___ Rope ____Sandpaper (for epoxy, etc.) ____ Small holding tank & fiberglass re-pair kit Spare H.D. flasher Spare light bulbs (turn signal, brake, etc.) Spare lug nuts Spare bearing set and wheel seal for trailer

____Super glue ____Extra fire extinguisher ____Tow strap ____Transmission fluid ____WD-40 ____Wheel chocks ____Windex (cleans anything) ____Wiper blades

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Wintering in Your RV

Wintering in an RV in cold weather is possible with adequate preparations, iron-willed fortitude and a good sense of humor. My wife and I have survived three winters and have several suggestions for you:

Sub "0" weather RV'ing is not only possible but it can even be pleasurable ... the act of surviving very cold weather in an RV is an accomplishment to be proud of. Thinking of new and innovative ways to thaw out frozen pipes (inside your RV !) stimulates the mind and invigorates the soul.

Skirting is essential - we have used 2" Styrofoam in 4 X 8 sheets, cut to fit between the ground and the trailer. I screwed them to a 2" X 2" strip that is hung on brackets fastened below the trailer walls. With this method you get lots of fun and exercise collecting the various pieces of Styrofoam that are scattered all over the campsite after a windstorm. We now cover the insulation with 1/4" OSB (oriented strand board) that is waterproof and inexpensive. However, if you move to a new location chances are the custom fitted pieces will no longer fit. Probably a better long-term solution would be that quilted vinyl material cut to fit generously, with snaps to fasten to the RV sides. Come spring you would simply unsnap, roll up and store until next year.

Holding tanks - as our tanks hang below the floor and between the tandem wheels of our trailer a permanent enclosure is not practical. There are heating panels available that you can attach to the tanks that are electrically powered (120v or 12v). I just use fiberglass batting to build a "cave" surrounding the tanks and including the dump valves. A small 40 watt light bulb supplies enough heat in any weather we've encountered to keep things flowing.

Dump Valves - ALWAYS keep your black water valve closed and only dump when full. If left open the liquids will drain off leaving only the solids (they become very solid after a short period of time). In cold weather we close both valves and dump when full as a trickle of gray water can freeze and build up a dam in the sewer line totally blocking the flow.

Sewer Line - the coiled plastic hoses are best kept in their storage space in the winter. Just one frosty night and they are brittle and full of cracks. Buy 3" PVC solid sewer pipe that has one flared end (\$7.50 for a 10 ft. length), cut a 1 foot length of your plastic hose leaving the trailer connection in place and insert the other end into the flared end of the pipe and tape securely. Cut the pipe with a hacksaw to the correct length to reach your sewer dump and then install an elbow fitting on that end. Insulate the whole thing with fiberglass batting (15" wide will wrap around the pipe nicely) and cover this with poly sheeting taped in place. This all may seem a bit of an inconvenience but try dealing with a 12' long "poopsickle" at 20 below zero some night for comparison.

Water Connection - install a heat tape the same length as your hose by taping it to the hose barbershop pole fashion. The instructions say to put the thermostat on the coldest part of the hose, but since that part is not heated it will be sure to freeze. I leave the thermostat just hanging out in the air and have never had a problem using that method. Cover the hose and the heat tape with those insulating foam tubes for pipes and tape securely. Where the water supply enters the trailer wrap some fiberglass batting around the hose, cover with plastic and tape to hold it on. We keep our on-board fresh water tank full just in case all these measures fail. Good luck and pray that you have water in the morning.

Condensation Problems- The condensation is a result of the warn moisture laden air contacting the cold window glass. Keeping a roof vent open helps. Those added roof vent covers help to prevent cold air from dropping down through the vent while still allowing moist air to escape. Using the roof vent fan when showering or the stove vent fan when cooking also helps prevent excess moisture buildup.

A better cure is to add another layer of window glass to provide an insulating dead air space between the panes. After-market storm windows can be custom made of glass or Plexiglas and clip on to your existing window frames during cold weather use. For those on a budget, the clear plastic film that is attached to the window frame with double-sided tape works well. You then heat shrink the plastic membrane with an ordinary hair dryer to work out the wrinkles. The downside to this method is that the tape leaves a residue when it comes time to remove the film in the spring. If the plastic is left on during the hot summer months, it will become very brittle and almost explode into hard-to-remove plastic shards everywhere.

During extremely cold weather, water vapor will collect and freeze on the cold metal skin directly above your overhead lights where the insulation has been cut away at the factory. When you turn on the lights, the heat generated melts this condensation, causing more gray hairs to appear on your head. Pull off every overhead fixture and stuff the hole in the ceiling panel with insulation.

Roof Vents - make a box 18" X 18" X 12" high to place over every roof vent. Drill three 1" holes in both sides of the box to allow for air circulation. Leave your roof vents open about 1" at all times to vent excess moisture. The box helps to keep cold air from cascading down through the vent. Or your can buy the maxi-vent style of vent cover that is permanently mounted top the roof vent to do the same thing. Try this - it works.

Storm Windows - unless you want to view Jack Frost's creations in all their drippy splendor, you should install storm windows of some sort. Ours are sheets of plexi-glass cut to fit each window that install on the inside with plastic L-brackets every foot or so. Foam tape supplies a seal to the window frame. Plastic storm windows that you heat shrink into place work well, too, although the tape used can be messy to remove. If you leave them in place all through the year, the heat in the summer will make them brittle and explode them.

Storm Door(s) - most RV doors have little or no insulation in them and are a prime heat loss area. Also the aluminum frame conducts the cold into the unit whereupon the moist inside air condenses to form frosty strips down the wall. Our solution is a door blanket, made of a nylon quilted material similar to a sleeping bag, that snaps on over the opening at night.

Inside Plumping - through necessity (and just to generally make life miserable) inside plumbing pipes are routed through the most inaccessible parts of the RV and that is exactly where they will freeze first. Merphy's Law. Insulating foam tubes are fairly inexpensive and will help here.

RV Coach Battery - take care to check your coach battery regularly in the winter months - you are using your 12v lights, furnace, etc. more than usual, and your converter may or may not be keeping up to peak demands. Your battery fills in on those occasions, then gets recharged. That means more water loss and more wear and tear on this often neglected device. A discharged battery will freeze easily and
at a higher temperature than a fully charged one.

Phone - Every RV park that we have wintered in have had phone hookups available at their monthly sites. Cost to hookup is \$25 to \$30 hereabouts.

Snow Shovels - don't even think about buying one ! The reason we are living in an RV in the first place is to get away from all that lawn mowing, painting ,landscaping, property tax-paying kind of mind-set. If the snow gets too deep to kick away with your boots then -hook'er up, head'er south.

On-line resources:

More on winter camping!

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RV Articles by Other Authors

RV and Auto Insurance Basic tips

By Mark Polk

There is a great deal of overlap between RV and auto policies. If you have a motorized RV, you will need some of the same coverage's provided by an auto policy plus specialized RV coverage's. I will attempt to explain a few things to consider without confusing you.

Regardless of the insurance company you decide to use, there are a handful of basic coverage's you will need to have in your policy. Again, this coverage is very similar, if not identical, to the coverage you have on your personal auto insurance policy. This coverage can be broken down into two different categories; liability and physical damage. All motorized RV's will have some form of liability coverage. Towable RV's like travel trailers and 5th wheel trailers do not have any liability coverage. However, if you own a travel trailer or 5th wheel the section on liability may contain information helpful to you regarding the vehicle you use to tow your trailer.

There are many things to consider, here are just a few:

Liability Coverage

There are a number of coverage's that fall under the category of liability coverage including Bodily Injury, Property Damage, Uninsured Motorist Bodily Injury, Underinsured Motorist, Uninsured Motorist Property Damage, Personal Injury Protection and Medical Payments. Some of these coverage's vary by state.

Note: The Department of Insurance in the state you live in can be an excellent resource for additional information regarding state specific coverage's. Most states offer a Consumer Buyer's Guide on their website that will explain state specific nuances to each of these coverage's.

Bodily Injury is third party coverage. This means it provides protection for claims due to injuries to a passenger in your vehicle (other than you or a family member) or passengers in another vehicle, or pedestrians. It provides you, the owner/operator of a motor vehicle, with protection for your legal liability due to the ownership, maintenance or use of your RV. It is very important to select a limit that

is high enough to protect your assets. You may be responsible for any amounts, related to injuries received to the third party, over and above the limit on your insurance policy. You can also purchase a separate umbrella policy that sits over all of your liability limits on your cars, your house and your motorized RV.

Property Damage is also a third party coverage, and provides protection for claims due to damage to other people's property. For example, Property Damage would pay to repair damage to the bumper of a car that you rear-end in an accident. Bodily Injury and Property Damage limits typically work together and can be either a split limit or a combined single limit. A typical split limit has a different limit for damages to each person, each accident and property damage. For example, a common split limit would be \$100,000/\$300,000/\$50,000. This means that for Bodily Injury coverage you have a maximum limit of \$100,000 per person for each person injured not to exceed \$300,000 per accident and a \$50,000 limit for Property Damage. A common single limit for Bodily Injury and Property Damage is \$300,000 meaning you have \$300,000 to pay for all injuries and property damage arising from any one accident. It can be split any which way between injured parties and damaged property. Bodily Injury and Property Damage are required for all motorized RV's. For travel trailers and 5th wheel trailers liability follows the unit towing the trailer, so Bodily Injury and Property Damage coverage's are not necessary.

Uninsured Motorists (UM) and Underinsured Motorists (UIM) coverage's can be first or third party coverage's. UM provides protection for injuries you or someone else sustains in an accident due to the fault of another party when the at-fault party does not have any insurance. UIM provides protection for injuries you or someone else sustain in an accident due to the fault of another party when the at-fault party does have insurance, but not enough insurance to cover your damages. UM and UIM are sold on a split limit and combined single limit basis, just like Bodily Injury and Property Damage.

Your RV insurance can and should fit your RV. To get a free RV insurance quote with absolutely no obligation, I recommend Explorer RV Insurance Agency, Inc. you can call 1-888-774-6778. Happy Camping,

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RV Expert Mark Polk, seen on TV, is the producer & host of America's most highly regarded series of DVD's, videos, books, and e-books. <u>http://www.rveducation101.com/</u>

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The Propane System

Propane is stored in portable and detachable cylinders, such as those on your barbecue --- or tanks, which are permanently affixed to a vehicle.

Cylinders are filled by weight and the pertinent information for each individual cylinder is stamped on the protective flange surrounding the valve. This information includes the empty weight of the cylinder (tare weight) and the water capacity in pounds and allows the re-filling attendant to calculate the exact amount of propane to put into the cylinder.

Most tanks and some cylinders are equipped with a bleed valve, that when opened, shows when the

cylinder is filled to 80%. However, the present valve on the cylinder may not be the original valve and may or may not be the proper valve for that particular cylinder, possibly resulting in an over filled condition. Newer cylinders have the OPD (overfill protection device) which mechanically prevents the cylinder from being overfilled.

A motor home tank is filled by volume using the 80% bleed valve to indicate the proper fill level. Motor home tanks required to be equipped with an automatic valve that shuts off the propane flow at the 80% capacity level. The bleed valve is an extra safety device that should be used in addition to the safety shut off valve.

Propane is an odorless, colorless gas that is heavier than air. The common "propane" smell is a chemical called Ethyl Mercaptan that is added to propane to allow it to be detectable by odor.

Any person dispensing propane in Canada must, by law, be certified by the Propane Gas Association of Canada by successfully completing a training course in the safe handling of propane.

Also, by law, it is an offense to fill a propane cylinder or tank beyond 80% of it's capacity and that law is in place for a very good reason. Propane is stored in a liquid state by compressing it in a cylinder or tank. At 80% full there is the remaining 20% of the storage capacity to allow for expansion of the liquid due to temperature changes. If the tank is over filled this expansion room is decreased to the point that the built in pressure relief valve will vent off enough propane to avoid tank rupture. If the cylinder is lying on it's side when this happened it would vent off enough liquid propane to reduce the internal pressure to below the preset pressure of the relief valve. When liquid propane is released it will expand to 270 times it's volume. Propane is heavier that air and tends to collect at the lowest spot, such as the lowest deck of a ferry, where enough can be present to cause an explosion.

An LP gas inspection on a recreational vehicle or the installation of a new gas burning appliance should only be preformed by a licensed RV class Propane Gas Fitter and you have every right to ask for qualifications.

In short, propane gas is a clean, efficient and convenient fuel source and very safe to use when all safety precautions are observed.

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Propane system owner maintenance and leak test ...

The propane system is the most important and potentially deadly system in your RV. Propane is a very safe and convenient fuel if all safety considerations are followed and many regulations are in effect to enforce these safety measures.

A simple leak test can be preformed in a few minutes by a qualified RV Gas fitter, and the cost is minimal. An effective "home" test can be done using an ordinary spray bottle with a squirt or two of dish washing detergent mixed with water. Spray this solution on each and every connection of your propane system, including all the connections under the coach, all the connections to every appliance and all the connections to your supply tanks and cylinders. ANY bubbles (of any size) indicate that a leak is present and the system should be shut down immediately. Propane is heavier than air that means that it will settle to the lowest point that it can find ... and will collect there if a constant leak is present. A mixture of 5 to 10 per cent, propane to air, needs only an ignition source to explode with violent results.

I must stress the point that NO propane leak is tolerable.

Propane is a very clean fuel but refining is not 100 per cent perfect, and during transport and transferring from tank to tank, it may well pickup some contaminants.

From the refinery to your tank, the propane may be off loaded a dozen times - each time some contaminants may be introduced. Most bulk plants transfer propane by using a compressor to pressure up the delivering tank. The higher pressure in this tank drives the liquid propane into the receiving tank. A compressor needs oil to help seal the rings on the piston and a minute amount of this oil gets by the rings on every piston stroke. Most of this oil remains in the bulk tanks, but some is held in suspension in the propane vapor and ends up in your cylinders and eventually in your appliances. This residue is extremely "sticky"! (and STINKY!)

While not, as a rule, a common problem, this could cause sticking valves in the appliances as well as the main regulator.

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U-Tube Manometer

A manometer is a device used to check the pressure in your propane system. The correct pressure is required to allow the various appliances to operate at their best level of performance. The manometer measures pressure in units of water column inches and a simple, yet very accurate one can be constructed for a dollar or two. These simple devices are so accurate that they are used to calibrate our more elaborate test instruments!

The propane appliances in your RV are designed to operate at 10.5 to 11 " of water column. This is about .5 PSI (pounds per square inch) and is a very low pressure, indeed. The job of the regulator is to reduce the tank pressure (250 +or - PSI) down to this operating pressure, regardless of the outside temperature.

The u-tube manometer can be used to check and adjust the propane regulator to the proper operating pressure. Also, it is an essential instrument for preforming a propane gas leak test. Both of these tests are simple to do and are described further below.

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Build your own U-tube Manometer

You will need these materials:

- Piece of wood 6 " wide by 24 " long.
- 1/2 " vinyl tubing 60 " long.
- 4 or 6 clamps to hold the tubing to the wood.
- Construction Details
 - Measure 12 inches down from the top of the board and draw a line. Mark this as zero.
 - Draw a line across the board at 1/2 inch intervals above the zero line and mark these as 1, 2, 3, etc. up to 16.

- Clamp the vinyl tube onto the board so that it forms a large " U "e shape with one end even with the top of the board and the other end extending.
- Fill the "U" with colored water until the level reaches the zero mark.
- When measuring the propane pressure, the water in one side of the tube is raised while the water in the other side is lowered. Therefore, each 1/2 inch on the scale (previously drawn on the board, (and numbered zero to 16) represents one water column inch of pressure.

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How do I do a leak test with the u-tube manometer?



- 1. Remove the stove top cover and remove one of the burners assemblies.
- 2. Attach the long end of the manometer tube to the burner outlet and turn that valve to the on position.
- 3. Open the valve at the propane tank and then light one of the other burners on the stove top Once the flame is established and burning steadily turn it off and shut the valve at the propane tank.
- 4. Bleed off the pressure until the manometer reads 8 inches water column. You may want to light a burner to burn off this gas. This is done to equalize the pressure across the regulator, to be sure that more gas is not fed through the regulator to the low pressure side.

• 5. Let everything stand this way for 15 minutes - if the manometer

drops any amount, you have a leak in the system.

Note: this leak test checks the system up to the individual shut off or electrically operated valve at each appliance. A leak on the other side of these valves will not show up with this test. See below for leak testing the appliances.

If the manometer shows a leak, then what do I do?

If a leak is shown by this test, then it means that gas is escaping somewhere between the propane tanks and the appliance valves, or possibly, through one of the appliance valves. You will need a soap solution in a spray bottle. You can use a few squirts of ammonia free dish detergent mixed with water. (Ammonia will react with the various brass and copper components, turning them black) A better alternative is to purchase an approved leak detector solution from your RV supply store.

- Turn on the main supply valve on the propane tank to re-pressurize the system. Shut it off.
- Spray the soap solution on every joint in the supply system, from the tank fittings to every appliance including the piping underneath the coach.
- A leak will show itself as bubbles forming at the faulty connection.
- Tighten or repair the connection and repeat the first two steps.
- Repeat the manometer leak down test for 15 minutes to verify that no more leaks are present.

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How do I check the regulator with my u-tube manometer?



First of all, if you have a single stage regulator, replace it before you proceed with these tests. Single stage regulators are OLD and not considered safe. New two stage regulator design has a first stage that reduces the tank pressure to a few PSI, and the second stage reduces that to the working pressure.

• You first need to tap into the system to provide a place to attach the manometer. If your stove does not have it's own regulator then you can do this test by attaching the manometer hose to one of the stove top burner nozzles. Most newer stoves have a small additional regulator built in and it is located under the stove top cover on the left hand side.

- If your stove has a regulator you can disconnect the LPG line before the regulator at the flare fitting. Next you'll need a flare union and a flare nut with a short piece of 3/8 inch copper tubing. The union is a fitting with a male flare on either end and you should be able to buy this and a flare nut with the short piece of tubing at any RV outlet or heating supply outlet. Screw the union into the flare that you removed from the stove regulator and attach the flare nut and short piece of copper tubing to that. Tighten all fittings snugly. You now have a place to attach the manometer tube.
- The first test is the working pressure of the regulator.
 - Turn on the gas supply valve.
 - Fire up the rest of the appliances. (the refer, the water heater and the furnace.)
 - With the appliances running, the manometer should read 11 inches of water column if it above or below this value, adjust the regulator.

Adjusting the regulator

Note: never increase the working pressure over 11" w.c. The appliance burners are designed to use this pressure - a higher pressure will negatively affect the flame characteristics.

- Remove the plastic cap on the front of the regulator. Beneath this is the adjusting screw (a large plastic disk that screws in or out)
- If your pressure is lower than 11 w.c. turn the adjuster in (clockwise) until the manometer reads 11 w.c. with the appliances running.
- If your pressure is too high, turn the adjuster out (counterclockwise).
- The next test for the regulator is the static pressure test.
 - With all appliances off and the service valve opened, the reading on the manometer should register below 14 inches of water column.
 - Leave everything as is for 5 minutes, if the reading climbs above this value, replace the regulator.

On-line resources

- <u>Manchester Tanks and OPD Valves</u>
- <u>National Propane Gas Association Website</u>
- <u>National Fire Protection Association</u>

• Basic Systems and Design of LP Gas

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RV Terms - Glossary

DUCTED AC is air conditioning supplied through a ducting system in the ceiling. This supplies cooling air at various vents located throughout the RV.

DUCTED HEAT is warm air from the furnace supplied to various locations in the RV through a ducting system located in the floor. (similar to house heating systems)

HEAT STRIP - A heat strip is an electric heating element located in the air conditioning system with the warm air distributed by the air conditioner fan and ducting system. They are typically 1500 watt elements (about the same wattage as an electric hair dryer) and have limited function. Basically they "take the chill off"

HEAT EXCHANGER - A heat exchanger is a device that transfers heat from one source to another. For example, there is a heat exchanger in your furnace - the propane flame and combustion products are contained inside the heat exchanger that is sealed from the inside area. Inside air is blown over the surface of the exchanger, where it is warmed and the blown through the ducting system for room heating. The combustion gases are vented to the outside air.

CONVERTER - A converter is device that converts 120 volt A/C (alternating current) to 12 volt DC (direct current). The RV devices mostly run on 12 volt DC power that is supplied by the battery, which allows the RV to function independently.

When "shore power" (an electrical supply) is available, the converter changes the voltage from 120 to 12 volt to supply the appliances and to recharge the battery.

INVERTER - An inverter is a device that changes 12 volt battery power to 120 volt AC power. It is used when "boon docking" (camping without hookups) to power certain 120 VAC only devices like a microwave oven. The amount of available power depends on the storage capacity of the batteries and the wattage rating of the inverter.

BLACK STREAKS - streaks of dirt that run vertically down the sides of an RV. Generally found to be caused by tree sap, weather, rubber window caulking, rooftop dirt carried by "creeping water", oxidation of aluminum, oils seeping from putty sealants, and/or pollution running off a roof. Fortunately, many easy cures exist, including black streak removers from just about every major cleaning product manufacturer.

RECEIVER -- The portion of a hitch that is bolted to the tow vehicle frame and permits a hitch bar or shank to be inserted. The receiver may be either 1 1/2-, 1 5/8- or 2-inch square; the smallest being termed a mini-hitch.

SAFETY CHAINS -- A set of chains that are attached to the trailer A-frame and must be connected to the tow vehicle while towing. Safety chains are intended to keep the trailer attached to the tow vehicle in the event of hitch failure, preventing the trailer from complete separation. They should be installed using an X-pattern, so the coupler is held off the road in the event of a separation.

SHANK -- Also called a hitch bar or stinger, the shank is a removable portion of the hitch system that carries the ball or adjustable ball mount, and slides into the receiver.

SPRING BAR -- Component parts of a weight-distributing hitch system, the spring bars are installed

and tensioned in such a manner as to distribute a portion of the trailer's hitch weight to the front axle of the tow vehicle and to the axles of the trailer.

SWAY -- Fishtailing action of the trailer caused by external forces that set the trailer's mass into a lateral (side-to-side) motion. The trailer's wheels serve as the axis or pivot point. Also known as "yaw."

SWAY CONTROL -- Devices designed to damp the swaying action of a trailer, either through a friction system or a "cam action" system that slows and absorbs the pivotal articulating action between tow vehicle and trailer.

TAIL SWING -- Motor homes built on chassis with short wheelbases and long overhangs behind the rear axle are susceptible to tail swing when turning sharply. As the motor home moves in reverse or turns a corner, the extreme rear of the coach can move horizontally and strike objects nearby (typically road signs and walls). Drivers need to be aware of the amount of tail swing in order to prevent accidents.

TONGUE WEIGHT -- The amount of weight imposed on the hitch when the trailer is coupled. See "hitch weight."

TOW BAR -- A device used for connecting a dinghy vehicle to the motor home when it's towed with all four wheels on the ground.

TOW RATING -- The manufacturer's rating of the maximum weight limit that can safely be towed by a particular vehicle. Tow ratings are related to overall trailer weight, not trailer size, in most cases. However, some tow ratings impose limits as to frontal area of the trailer and overall length. Tow ratings are determined by the vehicle manufacturer according to several criteria, including engine size, transmission, axle ratio, brakes, chassis, cooling systems and other special equipment.

TRAILER BRAKES -- Brakes that are built into the trailer axle systems and are activated either by electric impulse or by a surge mechanism. The overwhelming majority of RVs utilize electric trailer brakes that are actuated when the tow vehicle's brakes are operated, or when a brake controller is manually activated. Surge brakes utilize a mechanism that is positioned at the coupler, that detects when the tow vehicle is slowing or stopping, and activates the trailer brakes via a hydraulic system (typically used on boats).

TRANSMISSION COOLER -- A heat exchanger similar to a small radiator through which automatic transmission fluid passes and is cooled by airflow.

TRAVEL TRAILER -- Also referred to as "conventional trailers," these types of rigs have an A-frame and coupler and are attached to a ball mount on the tow vehicle. Travel trailers are available with one, two or three axles. Depending upon tow ratings, conventional trailers can be towed by trucks, cars or sport-utility vehicles.

WEIGHT CARRYING HITCH -- A trailer towing hitch that carries the total hitch weight of the trailer. Utility and small boat trailers are examples of trailers that can be towed with this hitch.

WEIGHT DISTRIBUTING HITCH -- A trailer towing hitch that utilizes spring bars to distribute some of the hitch weight to the tow vehicle front wheels and also the trailer wheels. This helps to relieve some of the "rear-end sag" when the trailer is coupled to the tow vehicle.

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RV Articles by Other Authors

RV and Auto Insurance Basic tips

By Mark Polk

There is a great deal of overlap between RV and auto policies. If you have a motorized RV, you will need some of the same coverage's provided by an auto policy plus specialized RV coverage's. I will attempt to explain a few things to consider without confusing you.

Regardless of the insurance company you decide to use, there are a handful of basic coverage's you will need to have in your policy. Again, this coverage is very similar, if not identical, to the coverage you have on your personal auto insurance policy. This coverage can be broken down into two different categories; liability and physical damage. All motorized RV's will have some form of liability coverage. Towable RV's like travel trailers and 5th wheel trailers do not have any liability coverage. However, if you own a travel trailer or 5th wheel the section on liability may contain information helpful to you regarding the vehicle you use to tow your trailer.

There are many things to consider, here are just a few:

Liability Coverage

There are a number of coverage's that fall under the category of liability coverage including Bodily Injury, Property Damage, Uninsured Motorist Bodily Injury, Underinsured Motorist, Uninsured Motorist Property Damage, Personal Injury Protection and Medical Payments. Some of these coverage's vary by state.

Note: The Department of Insurance in the state you live in can be an excellent resource for additional information regarding state specific coverage's. Most states offer a Consumer Buyer's Guide on their website that will explain state specific nuances to each of these coverage's.

Bodily Injury is third party coverage. This means it provides protection for claims due to injuries to a passenger in your vehicle (other than you or a family member) or passengers in another vehicle, or pedestrians. It provides you, the owner/operator of a motor vehicle, with protection for your legal liability due to the ownership, maintenance or use of your RV. It is very important to select a limit that is high enough to protect your assets. You may be responsible for any amounts, related to injuries received to the third party, over and above the limit on your insurance policy. You can also purchase a separate umbrella policy that sits over all of your liability limits on your cars, your house and your motorized RV.

Property Damage is also a third party coverage, and provides protection for claims due to damage to other people's property. For example, Property Damage would pay to repair damage to the bumper of a car that you rear-end in an accident. Bodily Injury and Property Damage limits typically work together and can be either a split limit or a combined single limit. A typical split limit has a different limit for damages to each person, each accident and property damage. For example, a common split limit would be \$100,000/\$300,000/\$50,000. This means that for Bodily Injury coverage you have a maximum limit of \$100,000 per person for each person injured not to exceed \$300,000 per accident and a \$50,000 limit for Property Damage. A common single limit for Bodily Injury and Property Damage is \$300,000 meaning you have \$300,000 to pay for all injuries and property damage arising from any one accident. It can be split any which way between injured parties and damaged property. Bodily Injury and

Property Damage are required for all motorized RV's. For travel trailers and 5th wheel trailers liability follows the unit towing the trailer, so Bodily Injury and Property Damage coverage's are not necessary.

Uninsured Motorists (UM) and Underinsured Motorists (UIM) coverage's can be first or third party coverage's. UM provides protection for injuries you or someone else sustains in an accident due to the fault of another party when the at-fault party does not have any insurance. UIM provides protection for injuries you or someone else sustain in an accident due to the fault of another party when the at-fault party does have insurance, but not enough insurance to cover your damages. UM and UIM are sold on a split limit and combined single limit basis, just like Bodily Injury and Property Damage.

Your RV insurance can and should fit your RV. To get a free RV insurance quote with absolutely no obligation, I recommend Explorer RV Insurance Agency, Inc. you can call 1-888-774-6778. Happy Camping,

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RV Expert Mark Polk, seen on TV, is the producer & host of America's most highly regarded series of DVD's, videos, books, and e-books. <u>http://www.rveducation101.com/</u>

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Winterizing Your Own RV Water System



Between the last camping trip and the first cold night, the majority of RV owners are scrambling to get their units prepared for winter's cold.

Winterizing an RV water system can be quick and painless or an experiment in total frustration, depending upon how you go about it. By following these step by step instructions, almost any RV can be completely protected from the harsh winter's ravishes.

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Winterizing your RV is a fairly simple procedure if you follow these steps in the order they are presented. If you are still not comfortable winterizing your own unit, see the Winterizing Video at the end of this e-book.

DO NOT USE AUTOMOTIVE ANTIFREEZE !!! This is TOXIC - use only plumbing antifreeze approved for drinking water systems.

Step ONE Drain the Fresh Water



Locate the fresh water tank drain valve or plug and open it to drain the fresh water ...

Drain the fresh water tank



Some coaches use a simple plug ...

STEP TWO

Drain the Water Heater

Locate the water heater tank drain plug and open it to drain the water heater ...

Open an inside faucet to allow air to enter the system. This speeds up the process ...



Drain the water heater tank.

If your water heater is equipped for electric heating, turn off the heating element at this point. This will prevent damage to the heating element if the coach is plugged into shore power. The on/off switch will be located on the water heater itself, some at the back (inside) and others on the front (outside).

STEP THREE

Bypass The Water Heater

The Water Heater Bypass is used when winterizing the water system. It is a series of valves or a single lever valve that allows the water flow to be shut off from the water heater and still be pumped to the rest of the hot water piping. This eliminates the need to fill the water heater tank with 6 gallons of winterizing antifreeze ... the tank is bypassed and then drained of water.





Single valve bypass in the normal flow position.

valve in bypass position.

Single

Three Valve System





Two Valve System



A variation of the two valve bypass uses one valve on the bottom outlet with a one-way check valve at the hot water (top) outlet ...

No Bypass

If your RV does not have a bypass installed you will need to disconnect the top and bottom hoses from the water heater and insert a temporary hose between these lines.

First, drain the water heater using the drain plug in the front side. Next unscrew the top and bottom fittings on the water heater (have a few rags ready as there will be some water left that did not drain out).

Obtain a short length of hose and two fittings that will mate to the fittings on the removed water lines. Insert this hose as shown below. You are now ready to proceed ...



Here's a good article on installing a water heater by-pass kit (Internet connection required) <u>Read it</u> <u>here!</u>

There are other kits available where you do not have to make any cuts, simply remove two fittings and install the bypass kit in their place. A good example is this one from <u>Camping World</u>:



Bypass the Water Filter

If your coach is equipped with an inline water filter it must be removed and bypassed to allow the antifreeze to fill these lines.



Some water filters use an inner filter cartridge encased in a housing. Remove the cartridge and reassemble the housing ... it will fill with antifreeze during the winterizing procedure.STEP FOUR

Connect the Winterizing Hose

Locate the water pump, disconnect the inlet fitting ... many newer RV's have a pump winterizing kit installed at the factory - this eliminates disconnecting any lines. You simply turn the valve so that the antifreeze is drawn from the jug and the water line from the fresh water tank is shut off.

Here's the quick way to find the water pump:

Look on the outside of the trailer for the water fill ... the water tank will be just under that.

While you are there, check for a drain valve on the exterior side of the trailer or just underneath on the belly of the trailer. If it is there open it to begin draining the tank. Other manufacturers put the drain valve inside the unit, so if you don't find a drain valve on the outside, it will be inside near the tank.

Go inside the unit and locate the water storage tank according to your outside observation. The water pump will be very near the water tank.

Also, it helps to open a tap and turn on the pump ... the sound will help locate the pump.



Disconnect the inlet side fitting ...



... and install the winterizing hose ...

The winterizing hose is hooked up to the water pump inlet side ...

... insert the other end of the hose into the antifreeze jug ...

Everything hooked up and ready to go!



... an aftermarket kit is available for a permanent installation ... this is easily installed and comes with easy-to-follow directions.

STEP FIVE Filling the System



Turn on the water pump and open the taps, one by one ...

Open the taps, one by one ...



... until the antifreeze appears ...

Do the hot and cold taps ...



... at every sink or shower faucet ...



Tub and shower ...



... don't forget the toilet! ...

Operate the toilet valve or step pedal ...



... or the outside shower, if you have one ...

STEP Six The City Water Valve

IMPORTANT!

Make sure to relieve the water system pressure before proceeding!



Turn off the water pump and de-pressurize the system by opening a cold water tap ...



... at the city water connection, pry out the screen and washer ...



...and press in on the valve stem until the antifreeze runs out ... Normally the antifreeze will run out under gravity alone. It may be necessary to repeat this step several times. STEP SEVEN Finishing Up



Pour about a cupful of antifreeze into every drain to displace the water and protect the trap.



Finally, dump the holding tanks and pour a pint or so of antifreeze directly through the toilet and the



tub drain ...

... to protect the dump valves.

That's it ... Done!

FAQ Section

I turned on water pump but no antifreeze will come out. The pump was working fine before. Any ideas will be appreciated. Thanks in advance.

Obvious things first ... you do have the winterizing hose on the inlet side of the pump, right? No kinks in the hose?

Sometimes the pump may have to be primed. This usually involves the older style of pump.

To prime the pump insert a small funnel in the open end of the hose, hold the end high and fill the hose with antifreeze. Then turn on the pump.

The antifreeze should prime the pump and away it should go.

The outside of my unit has printed "low water point". I am wondering what that means?

The two low point drains you see are to drain both the hot and cold lines. Open a hot and a cold water tap and then open these drains.

Gravity then drains most of the water although some still stays in areas where the tubing rises and falls within the RV.

Once drained, close these valves before adding antifreeze through the pump.

These lines are not part of the water heater bypass system.

I can't find the fresh water drain valve. Is it always on the outside of the RV?

The fresh water drain can be inside or outside the RV. Look on the exterior where the water fill is located - the fresh water fill that you insert the hose in to fill the tank.

The water tank will be located near this area. Look under the trailer on both sides of the coach for a drain valve.

If your tank is located inside the coach under the dinette or in a cabinet the drain valve will be inside also.

How much anti-freeze should it take to fulfill the winterizing of my camper?

I normally go through 1 1/2 gallons to winterize the lines and use the other half gallon to pour down the "p" traps.

Some smaller slide ins or pop ups use only one gallon. Large motorhomes with a washer dryer, 3 to 4 gallons.

If winterizing for the first time, buy 4 gallons. If something goes wrong you have extra antifreeze to

finish.

If all goes well (as it should) you will have next years supply on hand. :)

New Video/DVD - Winterizing & Storing your RV

You've had a great year camping, now it's time to put your RV away for the winter. What do I do? Where do I start? Don't worry, you're not alone. These are common questions, and ones that this video answers for you. The Winterizing and Storing Your RV video/dvd provides you with step by step on how to properly winterize and prepare your RV for long or short term storage.

The RV Winterizing video/dvd by Mark Polk is a step by step RV winterizing guide. Mark demonstrates the easiest and most effective way to winterize your RV water system in this easy to understand video format.

Mark says "Winterizing the RV protects the RVs water system, but what about the tires, batteries, generator and other components that can be damaged if they are not properly prepared for short or long term storage?"

The video/dvd explains in detail what to do for these and other items.

At only \$24.95, this video/dvd is a bargain!

More information - Click here!

RV Winterizing Methods

To Blow or Not to Blow?

Using an air compressor to blow out your RV water lines vrs winterizing with RV antifreeze.

The debate rages on, as it has for years - Do I blow out the water lines with compressed air or use RV antifreeze to winterize the RV water system.

Many people argue that they have "blown out my RV water lines for umpteen years, and never had a problem"

This article is meant to express my opinion, as a certified RV technician (15+ years), who has personally winterized in excess of 3000 RV's over the years.

1. Compressed air does push most of the water out of the lines, but not all. Any remaining water does what water naturally does - it runs downhill and collects in the lowest point. RV plumbing has many up and downs as it runs through various cabinets and over various obstacles and the water that collects at these places will freeze.

2. The compressed air does not blow out the water that is inside the water pump. It can't do this because

the pump has internal valves to prevent back flow and is designed this way.

3. Air compressor air can be dirty and contaminated with traces of oil - without a very good filter, do you want this in your water lines?

4. RV water systems are designed to operate at 45 PSI pressure - any air pressure used should be regulated to not exceed 45 PSI - you can't just run down to the gas station and use the tire filler to blow out your RV lines!

5. Most RVs will take about 2 gallons of antifreeze to winterize - at \$2.50 or \$3.00 a gallon, that's 5 or 6 bucks. And the time for either method is about the same.

I live and work in central BC, Canada where winter temperature go to -30 and lower. I have worked for 4 separate RV dealers in my career and all of them use the antifreeze method to winterize the lot units. (maybe 100 to 300 RVs per dealer!) The cost to winterize these units with antifreeze is substantial. If they could just "blow out the lines" don't you think they would do that?

The final choice is up to you, of course, but I am reminded of that old TV comercial slogan - "pay me now or pay me later!"

Winterizing the ice maker

This is cut & pasted from the Dometic manual ...

* Follow these Steps: 1. Shut off water supply valve to ice maker.

* 2. Place a shallow pan under water solenoid valve.

* 3. Remove inlet fitting to ice maker water solenoid valve. Drain water from the supply line.

* 4. Remove the plastic nut and water line from outlet side of water solenoid valve. Drain water from the line.

* 5. Cycle ice maker several times while blowing compressed air through water solenoid valve. Be sure all water is out of the solenoid. NOTE: Up to 40 PSIG air pressure can be used to clear the valve.

* 6. Reconnect and tighten lines on water solenoid valve. Leave the water supply turned off until temperatures are above $32^{\circ}F/0^{\circ}C$.

* 7. Dry out ice maker mold assembly with soft cloth. Place bail arm in UP/OFF position.

Winterizing the washer/dryer combo:

* Set the water temperature control to warm - this will fill both the cold and the hot lines with antifreeze.

* Turn on the unit and run about a gallon of antifreeze into the unit.

* Turn the control to spin - this will allow the pump to run the antifreeze through itself and then through the drain hose.

* Pour a cup down the drain to be sure that the "p" trap is filled with antifreeze.

Dewinterizing the RV Water System

Dewinterizing is simply the process of removing all traces of the RV antifreeze that was used to protect the water system.

- 1. Put several gallons of water into the fresh water tank.
- 2. Turn on the on-board water pump, and open a cold water tap.
- 3. Allow the water to flow for several minutes.
- 4. Connect the water hose to your city water supply inlet. Turn on the supply.
- 5. Open all taps one by one and allow the water to flow for several minutes.
- 6. Flush the toilet several times.
- 7. Now open the water heater bypass and fill the water heater with fresh water.

(You may want to allow a few gallons to flow through the water heater, then let it drain completely before re-installing the water heater drain plug)

8. Run water through all the hot water faucets.

That's it!

Congratulations!

CHECK LIST

- Fresh water tank drained
- Water heater drained
- Water heater by-passed
- Water filter by-passed
- All hot & cold lines filled
- •____Outside shower
- •_____ Toilet
- •____ City water inlet
- •____ Tanks drained

RV Storage Tips

Controlling Humidity

The air in a closed up RV will contain varying amounts of moisture, depending upon the local climate and the storage methods utilized. If you are able to connect to shore power, during the storage period, an electric dehumidifier is a very good safeguard against a high humidity condition. Otherwise, one or better yet, two, DriziAire dehumidifiers is advised. Open a roof vent or two, if you can, to allow moist air to escape.

To Tarp or Not to Tarp

As a concerned RV Technician, I am totally against the tarping of an RV. If your roof is maintained and in good condition, it will withstand the forces of Mother Nature. If you simply must "tarp" your unit, build an "A" frame type of structure to repel rain or snow while allowing air to circulate beneath the tarp and above the roof of the RV. A tarp laid on the roof and draped down the walls, is an invitation to dry rot - you want the moisture to escape - not to be held in, as a tarp will do. Also, a tarp will move with the wind, regardless of how well it is secured. This results in chaffing of the sidewall paint, and we don't want to discuss that in this article!

Batteries

Clean and remove your battery(s) and store in a cool place. Top up the water level and check/recharge them monthly. Deep cycle batteries will self-discharge in a month and a discharged battery is not a happy battery. Use only distilled water to top off the water level in the cells. An uncharged battery will freeze in sub-zero weather if left outdoors.

RV Storage

If you store your RV for any length of time, it is best to provide a dehumidifying device.

Why?

RV's are not constructed to be houses ... they are made to be vacation homes.

Normal house construction includes a vapor barrier between the insulation

and the outside environment. This prevents moisture build up in the walls.

RV's do not have a vapor barrier.

Why?

Houses are designed to maintain an even temperature and a more or less even humidity level ... therefor a vapor barrier works to keep that level constant. RV's are used for a period of time, and then stored.

The temperature and humidity level in an RV will vary greatly from periods of activity to periods of storage.

Even during storage periods the temperature and humidity levels will vary greatly according to the prevailing outside conditions.

A vapor barrier would trap moisture inside the RV ... not a good idea!

What does this mean?

Moisture!

Is this bad?

Yes! Moisture breaks down the bond in laminated walls and leads to dry rot in stick and glue RV framing. Moisture promotes mold growth and other nasty things.

If your RV is near an electrical source, a powered dehumidifier is a good idea. If no power is available there is a product called Dri-Z-Air that uses crystals to absorb moisture from the air.

RV Water Sanitizing Tip

If you notice a stale odor when using water from the fresh water tank, this indicates that water was left in the system for quite some time and has grown stagnant.

The best thing to do when this happens is to sanitize the entire water system. First drain all of the water out of the system, and then close all of the drains.

Take one cup of household bleach for every 15 gallons of water that your fresh water tank holds. Mix the bleach in one gallon of water and pour it into the fresh water tank. Fill the fresh water tank with potable water. Turn the water pump on and open all faucets, one at a time, and run water until you smell the bleach. If possible drive or tow the RV to assist in cleaning the entire fresh water tank.

Let it sit for twelve hours and then drain the entire system. Refill the fresh water tank and run water

throughout the system (every tap) until you no longer smell the bleach at that location. It may be necessary to repeat this more than once. When you no longer smell bleach, the system is sanitized.

This tip contributed by Mark Polk at <u>RV Education 101</u>

RV Water Sanitizing

Use only a special RV drinking water hose when connecting your RV to the campground water supply or when filling your on board water tank. This hose will prevent the rubber taste in your water as from a regular garden hose.

Fill your on board water tank 3/4 full and add one or two cap fulls (not cup fulls) of household bleach. Take the unit around the block to slosh the mixture to all parts of the tank. This solution will kill any bacteria that have accumulated in the tank during the storage period.

Turn on the water pump and open all taps one by one to allow this solution to fill every water line and flush out the system. Once this is done, let it sit overnight, if possible.

Connect the hose to your city water connection and flush every outlet for at least 5 minutes to purge out the bleach solution.

Drain your fresh water storage tank and refill with fresh water. You can add a capful of bleach every time you fill the water tank to keep it fresh and sanitary. However, due to the unknown quality of campground water supplies, and the fact that the water in your tank may stand for several days or weeks in the hot sun, it is recommended that you use bottled water for drinking supplies or install a quality water filtration unit for your drinking water.

The on board water tank holds approximately 30 gallons of water and at about 10 pounds per gallon this adds up to a fair amount of weight. If you are traveling from RV park to RV park, it is only necessary to carry the amount of water that you will need on the road for the day.

RV Waste Water Dumping Tip

Never leave your black tank valve open when you are hooked up to a sewer equipped RV site. If left open, the liquids will drain off and leave the solid material behind to build up in the tank.

Always dump your black tank first and always when it is at least 2/3rd full. Add water if necessary. This will ensure adequate flow to dump all the contents.

Dump the gray water tank last to help rinse out the valves and sewer hose.

Another good Tip ...

Many people think that using hot water with chlorine bleach will make their system even safer. Using hot water will actually reduce the effect of sterilizing the system since the chlorine evaporates quickly when it is exposed to heat. Always use cold water only.