'Hot Skin' Explained • Furnace & Water Heater Maintenance

RV ENTHUSIAST

NORTH AMERICA'S PREMIER HOW-TO RV RESOURCE

April 2021

OFF-GRID CAMPING UPGRADES

System Installations

- **Power Inverter**
- **Solar Panels**
- **Water Purification**

Plus! Battery Basics

NOW BOARDING, THE ULTIMATE SOCIAL DISTANCING MACHINE!


Model 2075

OPTIONAL FEATURES INCLUDE:


Lithium Batteries - Lightweight Cutting Edge Power With More Usable Capacity! (Select Travel Trailers)

Power Inverter – Run Conventional Appliances At All Outlets! (Select Travel Trailers)


Roof Mounted Solar Panels – Clean, Quiet Power Anywhere!

Model 2075

Control your environment while creating memories.

Take control of your vacation with a Lance Travel Trailer or Truck Camper. All the comforts of home with the serenity, isolation and beauty the wilderness has to offer. An all-inclusive resort wherever you park!

Make it a Lance. We are social distancing pros with 56+ years of experience building RVs. Unmatched quality achieved through composite construction and lightweight design with off the grid features keeping you powered up and connected with family and friends.

Our dealer partners are open and ready to serve you in a safe environment! LIVE.LANCE.LIFE.


Model 650

LANCE

REV GROUP

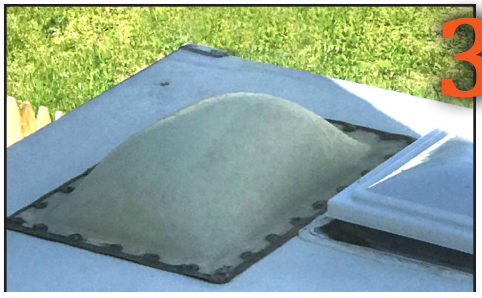
Lance Campers, social distancing since 1965. Visit lancecamper.com to locate your nearest Lance dealer and the RV of your dreams.

RV ENTHUSIAST
NORTH AMERICA'S PREMIER HOW-TO RV RESOURCE
April 2021 Volume 1, Number 2

INSIDE

24 When Wood Won't Work
Water has always been the nemesis of RVs due to their wood construction. Manufacturers are turning to composites to eliminate wood and its potential problems.

30 Chill *Out*
Annual furnace maintenance and cleaning are often overlooked — with predictable results. An annual inspection will help keep it in tip-top shape.



33 Let the Sun Shine In
Replacing and updating a skylight can really improve and help illuminate your RV's interior — while protecting its exterior.

36 Tanks a Lot
RV water heaters tend to be taken for granted. By performing basic maintenance before and after each travel season, you can ensure it will work when you need it to.

59 Hot Skin
A certain amount of stray voltage on the exterior of an RV is normal. Excessive voltage, on the other hand, is potentially life-threatening.

DEPARTMENTS

INSIDE

Special Section!

OFF-GRID CAMPING UPGRADES

EDITORIAL STAFF
PUBLISHER - BOB LIVINGSTON
(800) 830-9729 EXT. 3
BLIVINGSTON@RVEMEDIAGROUP.COM

EDITOR - BRUCE HAMPSON
(574) 584-4616
BHAMPSON@RVEMEDIAGROUP.COM

TECHNICAL DIRECTOR
CHRIS DOUGHERTY
(800) 830-9729 EXT. 5
CDOUGHERTY@RVEMEDIAGROUP.COM

TECHNICAL EDITOR - CHRIS HEMER
(800) 830-9729 EXT. 6
CHEMER@RVEMEDIAGROUP.COM

SOCIAL MEDIA DIRECTOR - JIM MAC
(800) 830-9729 EXT. 7
JMAC@RVEMEDIAGROUP.COM

ART DIRECTOR - MIKE ACCUARDI
MACCUARDI@RVEMEDIAGROUP.COM

BUSINESS OFFICE
RV ENTHUSIAST/RVE MEDIA GROUP INC.
120 ATWATER ROAD, SPRINGFIELD, MA 01107

ADVERTISING
ADVERTISING DIRECTOR
SUE SEIDLITZ
(800) 830-9729 EXT. 2
SSEIDLITZ@RVEMEDIAGROUP.COM

SUBSCRIPTIONS

To subscribe electronically, log onto: www.rventhusiastmagazine.com, click on the "subscribe" icon and follow the prompts to add subscriber and payment information. Alternately, you may also mail to: RV Enthusiast Subscriptions, 120 Atwater Road, Springfield, MA 01107. Subscription rates: Subscriptions for U.S. and Canada: $10/one year, $18/two years. Premier membership subscription rates available upon request.

CORRESPONDENCE

Correspondence is invited from subscribers and readers of *RV Enthusiast*. Technical inquiries relating to RV function, maintenance, repairs and/or upgrades should be directed to either Technical Director Chris Dougherty or Technical Editor Chris Hemer at the above email addresses. Letters to the Editor should be directed to Editor Bruce Hampson at the above email address. Personal replies cannot be sent due to the volume of mail received. By forwarding letters to *RV Enthusiast* magazine, the author consents to allow letters to be published at the discretion of *RV Enthusiast* editors. Letters may be edited for brevity and clarification.

RV Enthusiast is published monthly by RVE Media Group Inc., 3425 East Golden Valley Road, Reno, NV 89506. *RV Enthusiast* magazine is copyrighted in the United States, Canada, Great Britain and other countries.

Everchill

Boondock with Confidence

Keep more food and drinks colder for longer. Even off the grid.

Everchill pioneered high-capacity 12 volt refrigerators and we've delivered more units over the last four years than anyone in the industry. Our 12V platform was built from the ground-up to be safe and efficient, especially in dry-camp settings. When paired with 120W solar panels and two deep-cycle batteries, the Everchill 11 cubic foot 12V fridge will run indefinitely. This means those off-grid adventures can last even longer.

Everchill 12V fridges are available in 3.3, 4.5, 7.7, 11, 12.7 and 17 cubic feet - *all with the largest usable capacities in their size*.

Visit WayInterglobal.com or contact your sales representative to find out more.

WAY Take your home on the road

SCAN ME

(574) 971-4490 | Sales@Wayinterglobal.com | 3002 Coast Court, Elkhart, Indiana 46514
wayinterglobal.com

Not All Memories from the Road Have to be 'Instagram-friendly'

By Bruce Hampson

I've been around recreational vehicles for much of my life, starting with a truck camper my father acquired when I was just a wee lad and was used to transport our family — including my mom and two brothers — across country for bi-annual visits to our East Coast-based brethren.

The memories of those trips are cherished, as are recollections of one amazing summer I spent cruising across the country behind the wheel of a partially restored/modified '78 Winnebago Brave with my then-6-year-old son, Jeremy, and our Siberian Husky. I'm sure more than a few of my friends' neighbors didn't care for that big "eyebrow" Winnebago parked streetside for a week or two at a time as we visited, but local regulations were a lot more lenient at the time.

Just as entertaining, though, are the recollections of "us boys" keeping ourselves occupied when my dad wrenched on his pickup truck at various times during our trips. Ditto my escapades in that old Winnebago, including the time I was forced to search for a couple of aluminum soda cans, cut them open and, using worm hose clamps, cinch them around a broken header pipe on the RV's big V8 until I could find a decent welding shop to close the hole. Yea, I'm a baling-wire kind of guy.

Those kinds of memories surface, too, when I think of my time as a car magazine editor. Sure, the editor of *Popular Hot Rodding* and I (then editor of a magazine titled *Super Chevy*) collected plenty of memories as we spent much of one summer driving around the country in a legendary 1957 Chevy project car known as Project X (you may know the car as Tony Danza's ride in the movie "Hollywood Knights"). But I also remember when the brakes on the big yellow 210 post model went south in a hurry and were parked in a highway median somewhere in southern Ohio while Gary Anderson, the late founder of Soff Seal, chased replacement parts for us by persuading his friends to open their auto parts store in the dead of night.

And then there was the time when the late Kevin Boales and I, then staff editors at *Car Craft* magazine, were part of different crews driving a supercharged 1970 Camaro around the country for a series of stories intended to show the durability of a "blown" street machine. Except, it wasn't the engine that let us down, it was the transmission — and Kevin and I whiled away the days poolside at a Washington state motel, taking our meals at a local eatery that had more than a passing resemblance to Mel's Diner from the old TV show "Alice" until another transmission was built and shipped to us. That month's story focused as much on the restaurant's biscuits and gravy as it did cruising the region's hot rod hot spots.

The point to all this? It isn't always the high points of your travels that make the best memories. Oftentimes it's when the unexpected happens and a wrench gets thrown in the works that truly entertaining stories develop. Why? Because people can relate. Everybody, at one time or another, has encountered travel and vehicle problems.

That's the concept behind "Voices from the Road," a new storytelling project from Roadtrippers. The popular road-trip planning tool launched the project as a way to showcase underrepresented voices in the outdoor and travel space and focuses on every aspect of roadtripping — not just the Instagram-friendly version. As Roadtrippers staffers note, road trips are often depicted with familiar views from picture-perfect locations — but they often don't tell the full story of road travel: vehicles break down, travelers get "hangry" and lost and the weather doesn't always cooperate. And it's often when difficult situations arise that the real memories are made.

The first published stories cover a lot of ground — from escaping Oregon wildfires to moving across country in a vintage RV — but there are more to come. "Last year, Roadtrippers users planned more than 3 million road trips spanning 2 billion total miles," said Sanna Boman, Roadtrippers editor-in-chief. "That is 3 million potential stories about the ups, downs, joys, frustrations, adventures and unexpected experiences that any road trip brings — and we want to hear those stories."

To read these stories and more — or to join the group — visit www.roadtrippers.com or download the app through the Google play store or the Apple app store.

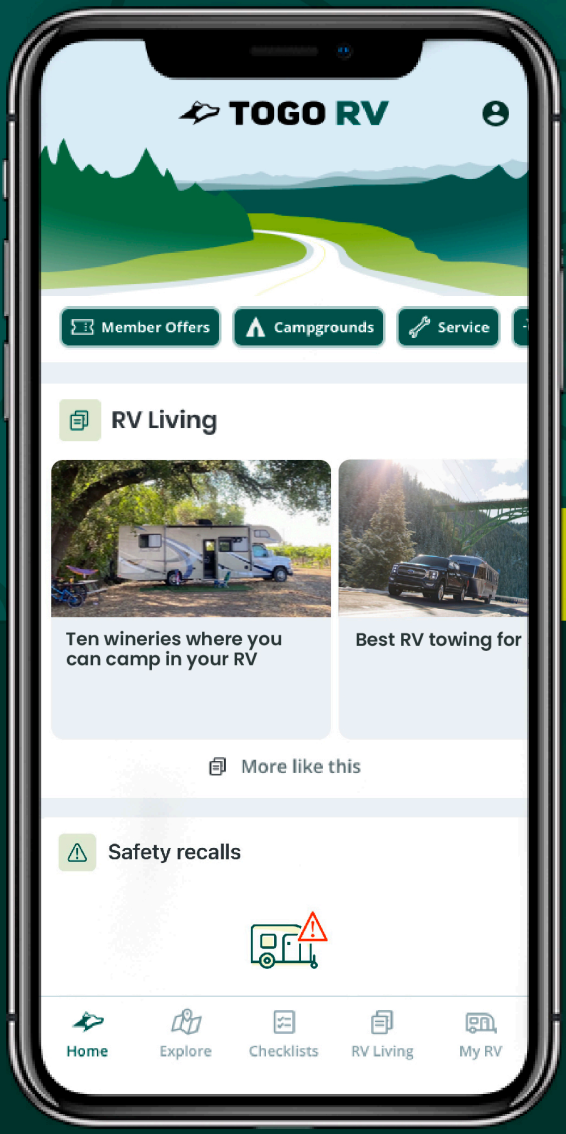
By the way: we'd like to hear your best stories, as well. *RV Enthusiast* is, as you can tell when navigating our pages through your computer, laptop or mobile devices, designed to be user-friendly — and we're also reader-friendly. That includes sharing ideas our readers have developed to solve problems on the road. We truly do want to hear from you, whether it's comments on an issue, what you'd like to see us cover or you have a technical question. Send your feedback to: rvtech@rventhusiast.com.

And we all can appreciate a great story. Just write to us, at editor@rventhusiast.com. You don't have to be a professional scribe; if we select your tale, we'll call you for more details and help compose it. And then, we'll share it in these pages. Just know that we're not laughing at you, we're laughing with you — because, at one time or another, we've probably all been there. RVE

TOGO RV

YOUR RV GPS COMPANION

Install the Togo RV app today for a free 7-day trial of Togo RV PLUS



TOGO RV APP FEATURES

Navigate safely with Togo RV GPS

Turn-by-turn routes and navigation customized to your RV size and weight.

Find free, convenient RV parking

Access over 15,000 free overnight RV Parking locations with OvernightRVParking

On-the-go repair and safety

Find mobile technicians and service help, get vehicle recall alerts, and track maintenance.

Tools to plan your next adventure

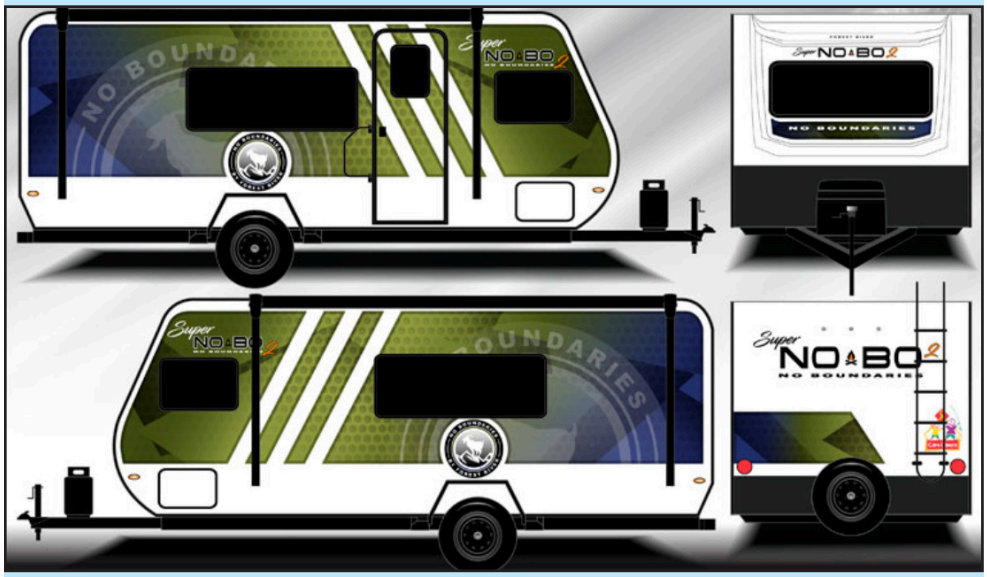
Roadtrippers Plus trip planning and discounts on campsite booking, tires, and outdoor gear.

Download on the App Store

GET IT ON Google Play

Save $10 on Togo RV Plus by visiting TogoRV.com/RVenthusiast

Win a Forest River No Boundaries Adventure Trailer!



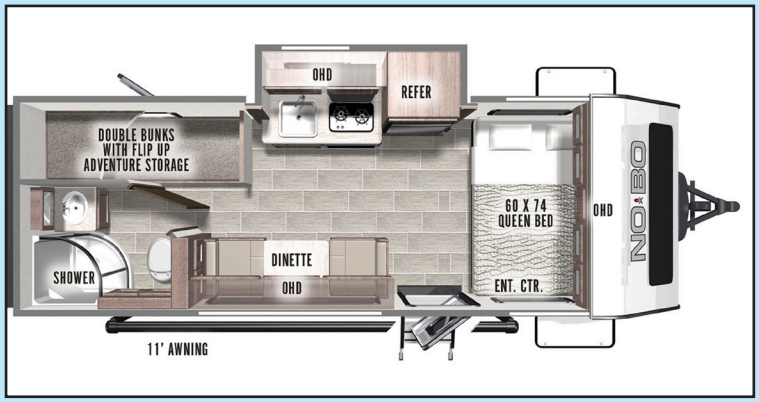
When Forest River Inc. introduced its No Boundaries travel trailer lineup in late 2017, the rugged towable line helped push the envelope in lightweight, versatile trailers that could be towed by the type of smaller vehicles often used to head off-highway. The modified teardrops have proven popular with outdoors enthusiasts by offering such features as a mix-and-match Rhino Rack system for carrying everything from jerry cans on the side to kayaks on the roof.

Built with a 12-volt DC power system and solar prep, the line comes in both "traditional" travel trailers as well as off-road editions.

Small wonder that Rollin' On TV, the nation's premier weekly RV-oriented show, partnered with Forest River in 2020 to offer a specially outfitted "NoBo" travel trailer as the grand prize in a raffle designed to benefit KOA Care Camps. The camps host children with cancer to a fee-free week of camping at various locations throughout the year. Since inception, Care Camps has raised more than $16 million so kids can attend camp.

The first "NoBo" trailer was awarded Dec. 16. Response was, in the words of ROTV Producer Jose Moniz, "tremendous" — so ROTV and Forest River are going to do it again.

The grand prize this year is a No Boundaries 16.6 bunk bed model that will be customized with eye-catching graphics by Graphix Unlimited "and all the latest custom features we can add and build into it," Moniz said. While last-minute additions haven't yet been finalized — the raffle goes "live" May 1 — it's expected that the No Boundaries trailer will be fully equipped for off-grid living with such components as a Winegard 360 Air, Go Power! 300-watt solar system with inverter, No Dirty Water purification system and more.



Floor plan of the No Boundaries 16.6 bunk house model

In addition to the grand prize, there will be a number of other prizes awarded, as well, including an inflatable kayak and electric bike. For more information, visit https://rollinontv.com.

Gas Pains

RV enthusiasts are well aware of the continual ups-and-downs of prices at the gas pump. Graphing fuel prices is like creating an outline of a particularly angular mountain range.

According to GasBuddy, an online firm that tracks fuel prices by covering more than 150,000 gas stations in North America, that graph will be on an upward trajectory for the next few months.

According to the site — which can be downloaded as an app or monitored at www.gasbuddy.com — the national average for a gallon of gas may breach the $3 barrier by Memorial Day. The last time the national average reached that level was October 10, 2014.

There are some things you can do to lessen the pain at the pump. GasBuddy recommends a number of tips to save money during and after the price rollup:

•Shop around — gas prices can vary as much as $1 per gallon in some areas;

•Drive mindfully — aggressive driving can reduce gas milage by as much as 40%;

•Pay and save — joining a gas station loyalty program can save drivers hundreds of dollars per year on fuel. The app, by the way, offers a "free forever" gas card that provides savings of as much as 25 cents per gallon; go to enroll.gasbuddy.com for more details.

Innovation Doesn't Happen Behind a Desk

The All New, All Season Xplorer Package

Tested and developed for over a decade in the Canadian Rockies

5 SERIES isata

Shown with optional 4x4 and Limited Edition Xplorer Package
Full Body Paint available in "Light" (Main image) or "Dark" (Above)

- **Dual Lithium Batteries –** 400 AH with built-in heaters to maximize off-grid efficiency
- **Enhanced Solar Power –** 800 Watts with MPPT controller for up to a 30% better charging rate
- **Dual-Pane Windows –** reduce condensation to help maintain interior temperature
- **Furnace-Heated Utility Bays with Thermal-Foil Insulation –** enhance heat retention
- **Secondary 12V Tank Heater in Utility Bay –** thermostatically-controlled; provides auxiliary/back-up heat
- **Temperature Sensor in Utility Bay –** displays on interior multiplex panel
- **Enhanced Insulation in Walls, Floor, and Roof –** more easily maintains optimal interior temperature
- **Insulated Cab Curtain –** closes off the cab area in colder climates to minimize heat loss

DYNAMAX
A DIVISION OF FOREST RIVER

DIFFERENT BY DESIGN

www.dynamaxcorp.com

Find us on Facebook

Wildlife, from elk to bison, can often be seen at Gros Ventre Campground in the Grand Teton National Park.

Campendium 2020 Campers Choice Awards

Wondering where to stay during your travels this summer? Canpendium, a popular web app that allows users to search, review, preview and even take a virtual tour of more than 21,000 campgrounds thoughout the lower 48 states and Alaska, recently announced its Fourth Annual Campers Choice Awards.

The awards recognize 527 campgrounds that received four or more 5-star reviews in 2020 from the Campendium community.

Among the top winners:

•Best National Park Campground — Gros Ventre Campground, Grand Teton National Park, Jackson, WY

•Best National Forest Campground — Nomad View Dispersed, Buffalo Gap National Grassland, Wall, SD

•Best BLM Camping — Sacred White Shell Mountain, Mosca, CO

•Best Free Camping — Nomad View Dispersed, Buffalo Gap National Grassland, Wall, SD

•Best RV Park — Mountain View Campground, Hiawassee, GA

•Best State Campground — Topsail Hill Preserve State Park, Santa Rosa Beach, FL

•Best County Park Campground — Gilbert Ray Campground, Tucson, AZ

•Best City Campground — Junction City Park, Junction, TX

The site also shows best camping of 2020 by state and best camping overall by state. All awards also provide direct links and additional information on each park.

Beyond campground reviews, Campendium provides visitors to its site with links to camping gear coupons, promo codes and deals, a list of free campgrounds in every state and even a state-by-state rundown of dump station locations. Visit https://www.campendium.com for more details.

Airstream 'Caravan to Carbon Neutral' Initiative

The iconic image of an Airstream "silver bullet" travel trailer is perhaps the most recognizable shape in the RV industry. Founded by Wally Byam, Airstream Inc. is the oldest RV manufacturer in the world. Needless to say, there are a lot of these riveted aluminum trailers (and motorized units) on the road today— with more leaving the company's Jackon Center, Ohio, complex every day. The company recently announced its "Caravan to Carbon Neutral" initiative, which seeks to neutralize estimated carbon emissions created by the driving of the company's products.

Airstream will directly underwrite the planting of a approximately 118,405 trees by the National Forest Foundation (NFF). Those trees are projected to help sequester the estimated carbon generated by the first year of driving of new Airstream travel trailers and coaches manufactured in 2021. That figure also includes the estimated carbon emitted during the manufacturing and transportation of Airstreams to dealerships nationwide.

The initiative also allows any Airstream owner to help through the purchase of "Carbon Reduction Kits" from the NFF. The kits are available in Silver ($50), Gold ($100) and Platinum ($250) levels, are tax-deductible and 100% of the proceeds will directly support the NFF's tree-planting program. The program will be ongoing beyond 2021.

Purchasers of the kits will be recognized with custom decals, flags to display on their Airstream and other signifiers.

Airstream has long been a proponent of reducing its environmental impact. The electricity used at its production facility is offset by renewable energy credits and airstream vehicles are Certified Green by TRA Certification, Inc., a third-party rating system based upon resource consumption, energy and water efficiency and indoor air quality during the manufacturing process.

For more information, visit https://www.airstream.com.

continued on page 72

THE RVer's *Trusted Resource* FOR OVER 50 YEARS

The Campers Inn RV Story

Campers Inn RV began in 1966 after founders Art and Fran Hirsch had a poor experience at an RV dealership. After years of camping in a tent, the Hirsch's saved up some money and decided to find something more comfortable. They gathered their three kids and headed to a local dealership. But when they arrived, the salespeople were more interested in playing cards than helping them find an RV.

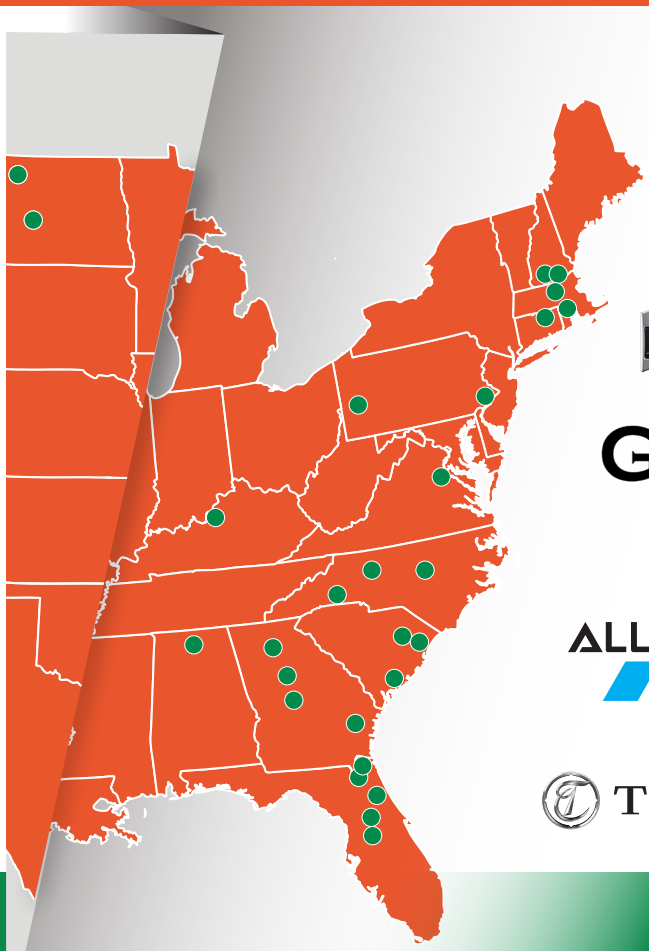
Art was furious. He was wearing clothes from his job as a mold maker, and he felt the salespeople judged him by his appearance. They left angry and empty-handed. On the way home, they decided they could do a better job themselves. They pooled together the family's savings and began selling RVs out of their front yard in Acton, Massachusetts.

Campers Inn RV continued to grow over the next five decades, and we are now one of the largest RV dealership groups in the United States. We are still operated by the Hirsch family, and we remain dedicated to connecting families of all backgrounds with the RV lifestyle and helping them find their "away."

campers® inn RV

AWARDED TOP 5 RV DEALER IN THE U.S. BY RVBUSINESS

2019 Blue Ribbon Winner RV BUSINESS TOP 50 DEALER AWARDS



Pleasure-Way

GRAND DESIGN RECREATIONAL VEHICLES

PHOENIX Cruiser by PHOENIXUSA

NEWMAR

Coachmen

GRECH MOTORS

THOR MOTOR COACH

Made to fit.

FOREST RIVER

ALLIANCE RV

Jayco

INDEPENDENCE TRAIL

TIFFIN MOTORHOMES

EMBRACE ULTRA-LITE

WINNEBAGO

CAMPERSINN.COM

A Thoughtful Eye

Keeping pets left alone inside an RV safe is priority No. 1 — especially in hot weather. A temperature monitor and camera keep tabs on your furry friends.

By Bob Livingston / Photos by author

Nothing is more stressful than worrying about your pet left alone inside an RV. Will your furry traveling buddy tear the place apart, or suffer from crippling heat because of an HVAC issue? Will your dog bark incessantly? Modern technology has made it easier to keep tabs on our pets remotely via a smartphone, and even talk to them to control bad behavior or just to say "hello." I've enlisted two simple-to-use devices that have become indispensable in our fulltime RV household.

The Eyes Have It

Technology has made it possible to "spy" on our pets at a low cost. After studying the field of remote cameras and first settling on a model that just didn't work, I found the Kamtron 1080P WiFi Pet Camera on Amazon. It has all the features needed to keep an eye on our standard poodle and at around $40, the investment was rather low for a camera packed with features. There are dozens of these cameras on the market, so doing a little homework is paramount.

The Kamtron camera takes up a tad more than six inches of space and is very easy to mount using the included plastic bracket. Finding the right location will require downloading the MIPC app and setting up the camera, which is easy and supported by voice prompts and loud chimes. You'll have to be connected to a Wi-Fi source, however, which can be the Achilles' heel for RVers on the go. If the RV park Wi-Fi is not suitable, you'll have to use data from a dedicated device, smartphone or tablet — that means leaving one of these devices in the RV. Since you'll only be connecting to the camera periodically, data usage should be minimal. This camera will not work on a modem's 5Gz network, only 2.4GHz.

Once paired, it's best to place the camera in locations temporarily to establish the best overall view inside the RV. Just move the camera while watching the view on the phone. When the right place is found, the bracket can be mounted in a number of ways. In our case, the camera was mounted to the decorative molding around the slideout and removed from the bracket when on the road.

Surprisingly, considering the low purchase price, this camera is chock full of features. Logging on to the app, which takes only a few seconds, the user is able to watch what's going on inside the RV, listen to any sounds and talk to your poochie. You can also set it up to notify you (via alarm) if there's movement inside. Granted, that feature isn't practical for watching animals, but can be useful as a security device when leaving the RV vacant. Controls on the app allow you to rotate the camera side-to-side and up-and-down, which is indispensable when tracking animals. This is accomplished by swiping a finger over the color image, which can be enlarged to cover the entire screen.

The camera has been very reliable, but there were a few hiccups when downloading upgraded firmware and restarting the process. It took a few tries, but we finally got there. One more thought: If you are a little paranoid about hackers spying on you inside the RV (not good if you run around naked), the camera can be covered by using a small nylon ditty bag typically found in outdoor stores. When on the road, it's a simple process to unscrew the camera from the base, unplug from the 120-volt AC source and store it in a safe place.

After moving the camera to various locations inside the fifth wheel, while monitoring the image in the app (on a smart phone), it was decided that a perfect view could be afforded if the camera was mounted on the decorative trim around the slideout. Aiming adjustments can be made by sliding your finger over the image on the smart phone screen.

The plastic bracket that comes with the camera was attached to a flat spot behind the decorative molding using two wood screws. Once in place, the camera can be removed for travel by loosening the hold-down bolt with the knurled knob.

The best source for purchasing this camera is at Amazon. Just Google "kamatron dog camera."

Comfort Zone

Watching over your pets inside an RV is just one part of the equation in providing peace of mind when they are left alone. Interiors that become too hot or cold can make it uncomfortable — and even dangerous — for pets, with emphasis on summer temperatures. Most of us have air-conditioners, but in the event of a power or unit failure, inside temperatures can soar to unsafe levels. Keeping tabs on temperature while away from our RVs with fido inside can be done with a number of devices on the market; we chose a system by Waggle called the Nimble Pet.

What sold me on the Waggle device is its connectivity via the Verizon 4G network — without the support of a cell phone or data card. It works independently, connecting to the Verizon network 24/7. The only caveat is possible service interruption when in fringe areas, but that rarely happens these days, especially when using a cell signal booster. Wi-Fi is not needed.

The device is compact and can be used as a portable or mounted on a wall with the provided bracket. It's powered by 120-volt AC service, but in the event of a power loss, the rechargeable internal battery will keep it going for two days. Once the Waggle app is downloaded on your smartphone or tablet, the device is paired, the service is ready and the high/low thresholds (safety zones) can be set. When outside the safety zones, reporting alerts will be sent via the app, email and text. Temperature and humidity are continually displayed on the small screen in the device mounted in the RV, scrolling between the two values.

After using it for a few weeks, we determined that the numbers displayed on the screen were around 5 degrees F higher than actual temperatures. We

The Waggle Pet Monitor (this one labeled "Nimble" before the name was changed) is mounted on a wall near a 120-volt AC outlet, where the device is plugged in. The read-out scrolls between temperature and humidity. It also shows battery condition and signal strength.

used an accurate digital thermometer to compare the numbers in other areas inside the RV and the difference was always consistent. The likely reason for the discrepancy can be traced to the mounting location, which was chosen because of a nearby 120-volt AC outlet. The temperature there is somewhat higher than the main cabin because of restricted airflow. Nevertheless, it's just a simple matter of mentally adjusting the number displayed on the app or in

Waggle app allows the user to set temperature "safe zones" and see how hot or cold, and the relative humidity, at a glance. The app launches quickly and shows alerts, which are also transmitted via email and text.

the alert.

Once the temperature dips below or exceeds the threshold values, an alarm is sent to your cell phone — and it continues to send alerts until the temperature returns to the preset safe zone. Expect to see a long list of alerts, as long as the temperatures/humidity is outside the thresholds. Alerts can be turned off, if no pets are at home. The device checks in every 15 minutes and the alerts are sent instantly; it will also notify you if power is lost.

The pet monitor with the display sells for $299, while a Waggle Lite costs $199; the main differences are the display screen and the ability to track the RV via GPS in the event the rig is stolen. There's a monthly fee to keep the service active, although it's quite inexpensive when compared to the peace of mind it affords knowing your pets are safe. It's only $12.50 a month when paid a year in advance, with other rates based on frequency. Utilizing auto pay prevents any lapse in service, especially for those who full time.

After three years of use, the device has proven to be reliable with very few instances where the signal was limited or lost. It's one of those products that RVers with pets will learn to appreciate almost every day. And your pet(s) will thank you. RVE

SOURCE:

Waggle
(855) 983-5566
www.mywaggle.com

Go Power!®

TRULY PORTABLE
SOLAR BATTERY CHARGING

NEW

DURALITE PORTABLE SOLAR KITS

100-watts of solar charging power.
60% lighter than aluminum kits.
Expandable up to 300-watts.
Built-in USB charging ports.
Sets up in seconds.
Available now!

Visit **gpelectric.com** to find a dealer near you.

Complete your kit with a Go Power! Inverter

Compatible with pre-wired RVs
SOLAR ON THE SIDE™

By Linda Levister and Joyce Alonge

10 Essentials for RV Food Preparation

When it comes to cooking on the road, it's all about saving space without sacrificing 'necessities'

Most RVers love food. I know we do. We love talking about food, love discovering new flavors, love new recipes and sharing old ones. Like many other RVers, we also love to entertain and often have spontaneous small gatherings. And, after teaching for a combined 50+ years (yikes) we learned several important lessons: Always be overly prepared for everything, bring your own food, pack more food than clothes and definitely have more than one corkscrew handy.

So what is the Culinary Camper? It's all about how to prepare favorite foods and the occasions when they are shared. Simple ingredients, when well prepared, can turn any day into a memorable experience on the road.

Of course, one of the challenges we all face in our RV kitchens is lack of space and the need to not add unnecessary weight. That's okay. One thing we've noticed about RVers is that they are often "gadgeteers" and accomplished DIYers — planning, packing, and provisioning all the essentials (and then some) required for living in their rolling homes.

Knives, Sharpener & Peeler

Photo courtesy of Linda Levister

Here are some recommendations from Joyce, our resident home economist, for kitchen tools to get you started.

Probably the most often used tool in any kitchen is the knife, so choose wisely. Knives with high carbon stainless-steel stay sharp longer. Knives with a blade that extends the full length of the handle, called a full tang, provide the strongest construction. Granted, you can't take a whole knife set with you on the road, but you need a good 8-inch chef's knife, a 4-inch paring knife — and a serrated bread knife really comes in handy, too. These three knives from Mercer Culinary get daily use in our kitchen and will give you the versatility you need for all your basic food preparation tasks. The handy, lightweight Smith's Carbide Ceramic Diamond Knife Sharpener, meanwhile, is an excellent choice to maintain the sharp edge of your knives to prevent bruising foods when cutting.

Measuring Spoons & Cups

Photo courtesy of Linda Levister

Photo courtesy of Linda Levister

Choosing just the right measuring equipment can be a daunting task with so many choices out there. First remember: You should have both dry and wet measuring spoons and cups. We've found the double-ended stainless steel-measuring spoons set from Spring Chef to be an excellent choice. They are magnetic so they stick together in your drawer. Also, the angled plastic measuring cups marketed under OXO's Good Grips brand make it easy to get accurate liquid measurements, read from above.

Cutting Boards

Photo courtesy of Linda Levister

The non-porous, high-density surface of bamboo cutting boards make them more hygienic than many plastic or wood and resistant to warping, cracking and knife scarring. Combine those attributes — plus easy care and maintenance (simply wash by hand and oil monthly) — make such boards a great choice for your RV kitchen.

To avoid cross contamination always use a separate board with side wells to catch juices for meats, and a second board for fruits and vegetables that can be reversed for onions and garlic. Totally Bamboo carries a wide choice of products in a wide array of sizes to fit your space requirements.

Graters, Peelers & Zesters

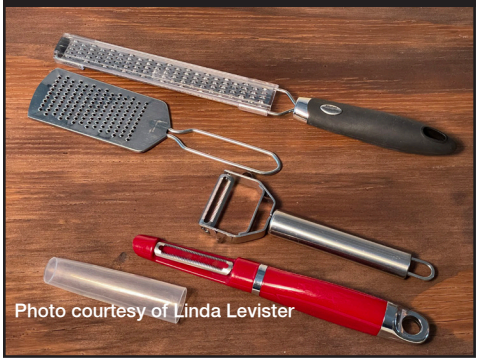


Photo courtesy of Linda Levister

A zester is a small handheld tool used to cut or scrape the rind of citrus to add flavor or garnish. A versatile, sharp stainless-steel model that can zest citrus and also grate cheese, nutmeg, coconut and even chocolate nuts will serve you well and maintain its sharpness. A sharp paring knife can be used to peel the skin from fruits and vegetables, but the unique slotted blade of a vegetable peeler is designed to prevent the blade from cutting too deeply into the vegetable. If space allows, also keep a sharp stainless-steel peeler on hand.

Spatulas, Scrapers, Spoons & Whisks

Photo courtesy of Linda Levister

Photo courtesy of Linda Levister

The utensil drawer of your RV can quickly become overrun with all sorts of wooden, metal and plastic utensils, so make your choices wisely. Silicone-covered spoons and utensils can withstand temperatures up to 600 degrees F and are lightweight. Another nice utensil to have on hand is the spurtle. Originally a wooden dowel used in 15th-century Scotland to keep porridge from getting lumpy, the American Spurtle — a hybrid spoon spatula — easily performs many tasks. The flat surfaces easily scrape the sides of pans or bowls without damaging the surface and contacts the surface better than the rounded bowl of a wooden spoon. A slotted spurtle can be used for scrambling and to drain liquids from mixing bowls and pans. A wire or silicone whisk, meanwhile, can do the work of a rotary hand mixer to produce batters, eggs and, yes, even whipped cream. Look for one with a handle to provide a substantial grip.

SOURCES:

Mercer Culinary
mercerculinary.com

Totally Bamboo
totallybamboo.com

Warther Cutlery
warthercutlery.com

Immersion Blender

Photo courtesy of amazon.com

The versatility of an immersion, or hand-held, blender cannot be overstated. The ease of use helps simplify your meal preparation. Just plunge this tool directly into your soup pan, mixing bowl or drink shaker. Use it to make smoothies, mashed potatoes or pureed soup and salsa. Treat yourself to the most powerful handheld blender you can afford, or splurge on a set with accessories to expand its usefulness

Colanders & Strainers

Photo courtesy of Amazon Basics

Photo courtesy of Linda Levister

The difference between a colander and a strainer is just a matter of size. Strainers are made of fine wire mesh and are used to remove lumps from sauces and gravies, while colanders have larger holes to drain off volumes of liquid from pans and bowls. Collapsible silicone strainers can fit right into the sink and fold up small enough to store in a drawer.

Mixing Bowls

Photo courtesy of amazon.com

Collapsible silicone bowls do double service — as mixing bowls and attractive serving bowls — and take less space in your cabinets. Choose sets with several sizes and lids to meet all your needs.

Tongs & Other 'Indispensables'

Photo courtesy of Linda Levister

Any set of tongs will keep fingers from contaminating food containers and from injury with hot foods, pans, grills, griddles and campfires. Our collection includes a 10-inch stainless steel set, a long silicone coated set, and a cute set of little mitten-shaped tongs perfect for serving ice cubes. A few other "necessities" that should also be on your radar include heat-resistant oven gloves and mitts, potholders, plenty of dish towels and aprons — all of which add a level of comfort and safety. They can also be tucked into nooks and voids when traveling to prevent rattling and jostling of anything in kitchen storage. RVE

Italian Traveler Roast Beef Sandwich

These tasty and fortifying make-ahead sandwiches are robust, flavorful and part of our families' travel menu. You can make them for picnics, as a late-night, no-fuss dinner and for informal entertaining, too. This hearty sandwich travels very well when wrapped tightly and is stowed in a handy cooler. Riding down the highway will only enhance the flavors; you'll soon add this to your sandwich repertoire. You'll need about 15 minutes for some prep-work before assembling your sandwiches.

To make Italian Mix:

Into a quart size locking plastic storage bag add 2 tablespoons each of dry basil, dry oregano, dry marjoram and dry thyme. Next, add 1 ½ Teaspoons of garlic powder, 1 teaspoon of ground black pepper and 1teaspoon of salt. Seal the bag and crush the ingredients until well mixed. I prepackage 1-ounce containers or 1-ounce foil envelopes. Use as a sandwich sprinkle, on sauteed veggies, and when 1 ounce is mixed with ¾ cup EVOO and ¼ Cup vinegar (I like balsamic), a marinade and/or salad dressing is at your fingertips.

Ingredients (makes four sandwiches)

- *one baguette or four rolls*
- *Italian mix*
- *Olive oil and balsamic vinegar*
- *1 lb. deli roast beef sliced*
- *2-3 medium tomato sliced*
- *Crisp lettuce*
- *6-8 marinated artichoke hearts sliced*
- *8-10 Pepperoncini peppers seeded and sliced into rings*
- *Thinly sliced sweet onion (optional)*

Slice rolls or bread lengthwise and drizzle both pieces with olive oil. Lightly drizzle vinegar and dust with the Italian mix. Squeeze the pieces together to evenly coat the bread. Layer sliced roast beef, sprinkle with marinated artichoke slices and rings of pepperoncini. Follow with Provolone cheese slices, tomato slices and crisp lettuce to complete the sandwich. Garnish with olives or pepperoncini. Wrap tightly.

Linda Levister & Joyce Alonge

Writing from the land of Dr. Seuss — western Massachusetts — Joyce Alonge and Linda Levister have an interesting perspective of the world around them. Avid travelers and foodies, they have developed multi-cultural perspectives and expanded palates. Both are former teachers, as well, so educating RVers to the joys of cooking comes easy. Alonge taught Home Economics and General Science, while local historian Levister focused on History and Social Studies. After cooking on cruisers and sailboats, negotiating a land-based RV kitchen was to them an easy transition. The advantage of preparing meals in an RV, they both admit, has a relaxing indoor/outdoor aspect. **RVE**

2021 Ford F-150 PowerBoost

With up to 12,700 pounds of tow capacity and integrated 120-volt AC, the 2021 Ford F-150 PowerBoost pickup flexes its muscle

It's safe to assume that the words "pick-up truck" and "serenity" have rarely been used in the same sentence. After all, trucks were engineered with specific uses in mind — pulling heavy trailers, hauling big payloads and trundling down rutted roads en route to the farm or worksite.

So you can imagine my surprise when I pushed the start button in our test 2021 Ford F-150 PowerBoost hybrid and experienced…nothing.

In a Toyota Prius, for example, the initial absence of an internal combustion engine wouldn't come as any surprise. But in a truck capable of towing up to 12,700 pounds, it felt surreal. A message on the digital instrument cluster told me the truck was ready to drive, so I eased the Antimatter Blue-toned SuperCrew out of the parking lot. It was more than a quarter mile down the street before its 3.5-liter EcoBoost engine finally came to life. When it did, it was with little fanfare — just a subtle purr, like the dutiful hum of a well-worn sewing machine. There are luxury cars that aren't this quiet.

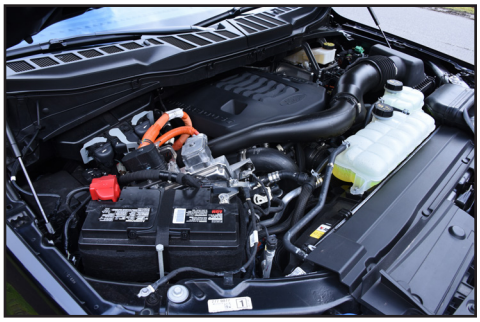
Electric trucks are coming, and soon. But in much the way the buying public was eased into the idea of electric cars with gas-electric hybrids, Ford is working its way to full electrification with the PowerBoost — a combination of the popular 3.5-liter EcoBoost twin-turbo V-6 and a hybrid power system, the key components of which consist of a 35kW electric motor, 1.5kW-hour lithium-ion battery and a Ford-engineered 10-speed modular hybrid transmission.

As with other hybrids, the 35kW electric motor is housed inside the transmission and works in tandem with the engine for more power and torque, for a total of 430 bhp and 570 lb-ft of torque compared to 400 bhp and 500 lb-ft of torque for the non-hybrid EcoBoost V-6. A belt-driven starter motor provides smooth transitions between EV Mode and Engine-On mode.

The 1.5kW lithium-ion battery is liquid cooled and engineered to minimize weight while delivering optimum performance, according to Ford. It is mounted with a unique vibration isolation system between the frame rails and below the load floor, so that it does not impact passenger or cargo space.

Ford's 2021 upscale F-150 PowerBoost SuperCrew in Platinum trim and Antimatter Blue tones. Incredibly well equipped at $62,535, the price of the test unit swelled to $72,605 with optional equipment.

As you might expect, the PowerBoost system does improve fuel economy to an EPA-estimated 25 mpg city/26 mpg highway for 4x2 models and 24 mpg city, 24 mpg highway for 4x4 variants, compared to 18/24 and 18/23 (respectively) for non-hybrid trucks. And as you've likely noticed with hybrid cars, you get the greatest benefit when driving the PowerBoost in the city, whereas highway mileage is comparable.



The PowerBoost F-150 engine compartment looks like an ordinary 3.5-liter EcoBoost truck, save for two noticeable electrical components on the passenger side used for the hybrid powertrain: the ISC and the DC/DC. The ISC converts between the battery's high voltage DC and the motor's 3-phase AC power. The DC/DC converts the high voltage DC to 12-volt DC, keeping the 12-volt battery topped off and fulfilling the role of an alternator in order to keep fans, pumps, lights, electronic control modules, etc. running.

There is, however, another big reason to want a PowerBoost F-150, especially if you're an RVer: Pro Power Onboard.

Unless we're pulling a trailer that's already equipped with a generator, most of us carry a portable unit capable of powering 120-volt AC appliances when we're not hooked up to a pedestal at an RV park or campground. With Pro Power Onboard, the PowerBoost F-150 *is* the generator. A standard 2.4kW inverter converts direct current (DC) from the high-voltage battery to standard alternating current (AC), so you can power up a total of 2,400 watts simultaneously through two 120-volt, 20-amp AC outlets in the driver's side rear of the bed. Optional is the 7.2kW inverter,

Out back, the standard Pro Power Onboard standard 2.4 kW inverter allows you to power up a total of 2,400 watts simultaneously through two 120-volt, 20-amp AC outlets in the driver's side rear of the bed.

The 2021 F-150 features an all-new 12-inch center screen (standard on XLT series and above) that allows customers to split the screen and control multiple functions simultaneously, including navigation, music or truck features. "Generator mode" in the SYNC 4 menu allows full power of the generator (up from the default 400W convenience mode) and suspends the Automatic Engine Idle Shutdown timer. Entering generator mode warns the customer that the engine will continue to run and to not leave the vehicle in an enclosed space. The available new 12-inch digital gauge cluster features a large information-on-demand area, along with truck-specific graphics and animations and can display off-roading data and turn-by-turn navigation.

Bumper features integrated 7-way receptacle and 12-pin receptacle for the available Pro Trailer Backup Assist feature. The test truck was also equipped with the optional Trailer Tow and Tow Technology packages, netting features like a Class IV hitch receiver, integrated trailer brake controller, Trailer Reverse Guidance and 360 Degree Camera.

which includes four 120-volt 20-amp AC outlets and one 240-volt 30 amp outlet — that's enough juice to power up your roof air conditioner. Just keep in mind that the power-generating feature of the Pro Power Onboard system requires the engine to be running, so you'll need to keep a watchful eye on the gas gauge.

Ford reports that the 2.4kW system has a maximum run time of 85 hours on a full tank, while the 7.2kW system has maximum runtime of 32 hours. Both systems also incorporate 120-volt, 20-amp AC outlets in the cab: one for front-seat passengers, one for rear. We should mention that, if you like the idea of mobile power in your truck but don't want to ante up for the PowerBoost option, you can get a 2.0kW system with two bed-mounted 120-volt, 20-amp outlets on 2.7-liter EcoBoost, 5.0-liter V-8 and 3.5-liter EcoBoost (non-hybrid) trucks as an optional feature.

On the road, driving solo, there is almost no noise with the F-150 — no wind whistle, and certainly no squeaks or rattles. The engine and hybrid system transfer power to one another so seamlessly, you won't notice it after a while. But when you mash the accelerator pedal, a completely different personality emerges: The truck lunges forward with urgency and continues pulling until you've arrived at Jail Speed. On a highway on ramp, we floored it around 50 mph and were at, um, 85 mph by the time we merged. This F-150 isn't just fast for a pick-up — it's fast, period. For anything. We have no doubt it will tow within its rated capacity without effort, and it's capable of returning fuel economy figures you'd normally associate with a passenger car when driving solo.

That's progress. **RVE**

SOURCE:

Mobile Electronic Power Solutions (MEPS)
(972) 864 1015
www.meps.com

Power Play

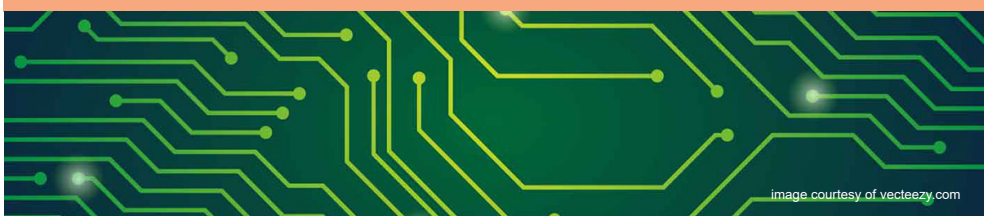
What if you want the benefits of on-board 120-volt AC power in your existing truck or tow vehicle but can't spring for the cost of the new F-150 PowerBoost? Mobile Electronic Power Solutions (MEPS) of Garland, Texas offers a wide range of products to help you power up household appliances (or tools) when RVing off the grid using engine power as the source. The main component of the company's basic system is a generator (resembling a large alternator) that is mounted to the engine via an application-specific bracket. The generator converts rotating mechanical power from the engine into variable electrical power via the alternating current unit (ACU). The ACU controls the generator and converts its power into clean sinewave power. The basic 3kW system includes the generator, pulley, engine bracket, ACU and cabling and retails for $5430, plus 6 to 12 hours of installation time. It's not cheap, but when completed, you'll have a rugged system that has been proven reliable in fire and rescue/EMS, government/military and commercial vehicle applications.

For even more off-grid flexibility, MEPS offers its TruFreedom option, which is added to the generator and ACU that you choose for your application (available in 3kW, 4.1kW, 5kW, 5.1kW, 6kW, 6.3kW, 7.5kW, 8kW single-generator systems). TruFreedom incorporates one or two lithium batteries (depending on the option), ACU box, inverter, control panel and all necessary cables and connectors. The TruFreedom option starts at $9,000.

Once installed, the generator will supply continuous power to charge the trailer battery(ies) whenever it's plugged into the tow vehicle. When the pre-programmed discharge level is reached, the system's auto-start feature will start the tow vehicle's engine to supply power and re-charge the batteries. The system can also support the trailer when the tow vehicle is disconnected, with up to 400-amp hours of juice (dual battery system). That's enough capacity to run a 15,000 Btu roof air conditioner continuously for nearly four hours before the system must be re-charged, according to the company. You can even monitor discharge levels and other data via Bluetooth on your mobile phone.

The fully contained MEPS system is bolted to the bed of the truck. It is available in power ratings ranging from 3kW to 8kW.

The heart of the company's system is a generator (resembling a large alternator) that is mounted to the engine via an application-specific bracket. The generator converts rotating mechanical power from the engine into variable electrical power via the alternating current unit.



When Wood Won't Work

More RV manufacturers are gravitating to the use of composites instead of lauan, allowing them to save weight — and add more accessories — while reducing or eliminating the threat of wood rot.

By Bruce Hampson

Technicians prepare a Hyperdeck at one of Keystone RV's Goshen, Indiana, manufacturing facilities.

Water has been the nemesis of recreational vehicles almost from the moment the first RVs were produced more than 100 years ago. Actually, the problem isn't water by and of itself, but the fact that the average RV today has dozens of openings cut into its outer skin. Some are as small as screw holes to cinch down rooftop vents, satellite TV antennas and the like, while others are major cutouts for doors and windows — and every one of them presents a possible incursion site for water to leak into the RV if they aren't properly maintained and repaired.

Of course, once water does manage to find its way inside, bad things tend to happen. Most RVs continue to be built with wood internals, from framing to floors — and wood has a tendency to attract water like a magnet attracts iron filings. Over the long term, this creates wood rot as fungi attack the wood and cause the fibers to degrade. Most wood craftsmen will tell you that four conditions need to be present for this to occur: wood, oxygen, warmth and, of course, moisture. Obviously, all exist in a typical RV environment. It's a simple problem with complex solutions, because while you can reseal incursion points, once the water is inside the only real recourse is to replace the substrate.

There is another remedy, however: replace the wood at the outset. And that's exactly what a number of RV builders are doing as they move to the use of composites in RV manufacturing.

There are several companies that provide composite panels to the RV industry, among them Azdel and SymaLITE. While each has its own proprietary manufacturing processes, they each are intended to replace lauan, a type of imported plywood that's generally thinner and easier to bend, in the manufacturing process. The benefits of an RV builder opting to use composites is twofold: they are lighter weight and are not susceptible to the same problems — including wood rot and mold — that tend to shorten the lifecycle of lauan.

By far the most extensively used composite in the RV industry is Azdel. Originally a division of General Electric, Azdel was founded to provide the automotive industry with moldable th ermoplastic materials. The auto industry, in fact, continues to be the largest consumer of Azdel products, where the composite is used for everything from headliners to door panels.

This rendering shows the use of Azdel in a typical travel trailer. The composite can be used on sidewalls, ceilings and floors.

Workers at Azdel's Lynchburg, Virginia, manufacturing facility prepare sheets of the composite for use in RV construction.

"It is a lightweight material that replaced shiny cottons and wood particle board, which had a tendency to absorb moisture and, ultimately, warp and develop mold," said Joe Duemah, new business development manager for Azdel. "It's a very stable product that can handle temperature changes — hot or cold — without affecting the material performance."

In 2000, Azdel researched the possibility of making flat sheets and providing them to the RV industry. Azdel's first RV OEM customer was Coachmen RV, now a division of Forest River, which began using the product in 2006. Today, said Coachmen General Manager Carson Walter, the company does not use any lauan in its sidewalls for any product, be it towable or motorized. According to Duemah, Azdel probably supplies "more than 50%" of RV manufacturers with composite material for sidewalls.

A blend of glass fibers and polypropylene, Azdel is used behind the FRP (fiberglass-reinforced plastic) exterior walls to give added stiffness and help with thermal expansion. There, it also helps guard against delamination.

"The reason a lauan board delaminates is either enough glue wasn't applied to it or there's an internal delamination going on unseen inside the board," Duemah said. "Also, our substrate is identical to the thermal expansion of FRP, whereas lauan is not; as FRP grows, wood will shrink and as wood grows, FRP will shrink. So that puts a lot of stress on the glue, which can also cause delamination. We take all that stress off by expanding and contracting at the same rate as the unit."

In addition to RV sidewalls, Azdel also is used by gel manufacturers and in RV interiors — including ceilings, floors and laminated sidewalls. And, while it does save weight — a typical 4-foot by 8-foot sheet of Azdel weights just 6 pounds, half the weight of lauan – Dumeah said the real benefit of using the product is in lower warranty claims for the manufacturer and consumer.

"The biggest point is the warranty on the backside that we help eliminate," he added. "I'm not saying we (Azdel) is perfect, but if we ever have a failure in the field, we generally will cover that wall and replace it." That doesn't mean, Dumeah added, that Azdel's warranty is open-ended, "but if we have a failure, we want to know why it failed. So we want that wall back."

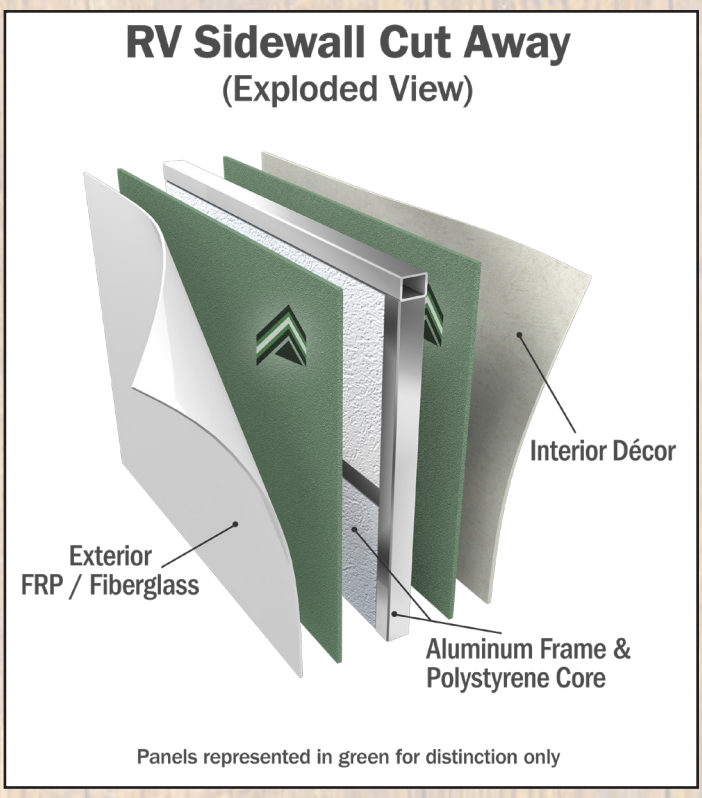
That said, by slicing the weight of traditional lauan in half, it also allows manufacturers to add more features into their units without hitting up against gross vehicle weight rating (GVWR) and gross axle weight rating (GAWR) limits.

But leaks don't just happen outside. As any RV owner knows full well, these mobile homes are built with a mass of interior plumbing fixtures connecting sinks, showers and toilets with holding tanks — and leaks can happen just about anywhere along the lines. Trapped between the floor and sidewalls joints or between the floor substrate and decorative top laminate, the net result can be a soft, sagging floor, delamination and the development of mold.

That's why composites are used inside an RV, as well. Keystone RV Co., for its part, has made a name for itself beyond the manufacture of some of the industry's most popular fifth-wheels and travel trailers. The company has partnered with a number of vendors to push the technology envelope, including iN•Command — one of the industry's first app-based vehicle control systems, created in conjunction with ASA Electronics — and KeyTV. The latter uses patent-pending technology featuring a multisource signal controller with built-in, automatic antenna booster and eliminates the need for splitters, jumpers, many cable connectors and about 50% of coax cable to offer a clean, uninterrupted signal.

More recently, the subsidiary of Thor Industries introduced its Hyperdeck, a composite floor made of 100% inorganic materials that, said Mark Bullock, senior vice president of engineering for Keystone, is "basically impervious to water," lighter weight and stronger than the lauan plywood it replaces.

"We know that RVs, can leak from



This exploded view of an RV sidewall shows Azdel sandwiched between the aluminum frame and polystyrene core and the FRP exterior and interior décor.

time to time, either from customers spilling something on the floor, a plumbing connection comes loose somewhere or a slide allows a little water in once in a while," Bullock told RV Enthusiast. "The problem with laminated floors is that the top layer, when they're built of wood, is very thin layer and will absorb that water and can eventually cause problems. We wanted to address that vulnerability by coming up with a floor that basically can outlast the life of a trailer."

According to Bullock, Hyperdeck is a laminated composite "sandwich" — it's basically a three-layer product with two outer layers of a hard-shell polypropylene with an inner composite weave of short- and long-strand poly fibers that are stitched together; the entire assembly is then heated and compressed into sheet form.

"It gives us the benefit of being rigid, has very good impact strength, is extremely durable and has, surprisingly, better screw retention for cabinet and wall screws than we had with the wood layers on top of the old laminated floor," Bullock said.

Even the two exterior polypropylene layers are unique. Topside, Hyperdeck utilizes FX8 floor composite from TekModo that itself offers water resistance, lighter weight and increased strength and durability. On the bottom, the decking uses Symalite, a low-weight reinforced thermoplastic (LWRT), a mixed-glass-and-polymer fleece.

"It's a common product in the industry," he added, "and companies (including Keystone) often use it as a panel material. But what we've done is apply it as a lower bottom layer to our floor along with a protective film that's been added to the material to withstand rain, road debris —anything the tires might be throwing out." The bottom film

Keystone's Hyperdeck is a laminated composite "sandwich" of two exterior polypropylene layers — TekModo FX8 floor composite topside and, on the bottom, Symalite, a low-weight reinforced thermoplastic (LWRT), a mixed-glass-and-polymer fleece — with an aluminum and high-density foam core.

This closeup shows the individual layers of the Hyperdeck. According to Mark Bullock, Keystone vice president of engineering, the product is stronger and lighter than previous flooring and provides greater screw retention.

essentially replaces the traditional (and sometimes messy-appearing) Darko underbelly protection.

The internal core of the Hyperdeck is an aluminum structure created with a heavier-density foam. The deck, said Bullock, uses a 2-pound foam where often a 1-1/2-pound foam is used. Overall, the Hyperdeck ends up being about 2 inches thick.

The new flooring, he added, was in development for about two years, a timespan that included "an incredible amount" of testing to find the right material.

"Once we narrowed our search down to a couple of likely candidates, we went into a second round of really intensive testing," Bullock said. "We did the typical 'impact test' for glue retention, then performed a lot of deflection testing for the product's elasticity." Then, after determining how much bending strength the material had, Keystone engineers took the same 8-foot sample, mounted it to a simulated RV frame and positioned it in one of the company's plants so hundreds of employees had to walk over it every day. The sample was then remounted to the test fixture for additional "bending moment" testing — where engineers found it still deflected the same amount, depending on the weight added to it, as it had beforehand.

"We were very happy to see that it wasn't degrading with a lot of use of people walking around on it," he noted. A final test had Keystone personnel build a unit with the flooring mounted a kitchen island to the floor and take the rig to the Navistar Proving Grounds in New Carlisle, Indiana, for structural durability testing. There, it was subjected to a 1,000-mile test over multiple road

Keystone technicians prepare a floor to receive the rest of the house build after laying down laminate flooring atop the Hyperdeck.

surfaces.

"The only thing holding the kitchen island down were the screws in the floor — it doesn't have the benefit of a supporting wall or anything to stabilize it," said Bullock. "When we double-checked the screws afterward to see how they had done insofar as retention, we found the cabinet was still locked down tight. It was incredible. We're actually getting about a 20% increase in screw retention strength with this new composite material than we were with the two layers of lauan material we were using before."

Hyperdeck is intended to be utilized on all Keystone models that use a laminated floor and are more weight-conscious, a lineup that includes Bullet, Passport, Premier, Outback, Cougar Half-Ton and Laredo SuperLite brands.

"We did some calculations, and the Hyperdeck saved about 70 pounds on our shortest lightweight unit," Bullock pointed out. "In our longest product in that segment, we saved about 110 pounds over what we had used before — and it's a stronger product."

It is, and one might expect, also a more expensive product — but Keystone didn't pass along the cost to consumers. "We just wanted to give customers some peace of mind," said Bullock. "There are no issues with it: if they spill something or, if a leak occurs somewhere, they aren't going to have a problem down the road." RVE

Available Now!

POLAR® 10DC/8DC

12V/DC Compressor Refrigerators

Residential styling and DC compressor convenience with RV-ready features.

DEMAND THE BEAR.

Residential styling and DC compressor convenience with RV-ready features. The 10DC provides 10-cu. ft. of storage in a standard 8-cu. ft. cutout. 8DC fits in same cutout as typical 6- and 7-cu.ft. models

NORCOLD® INC.

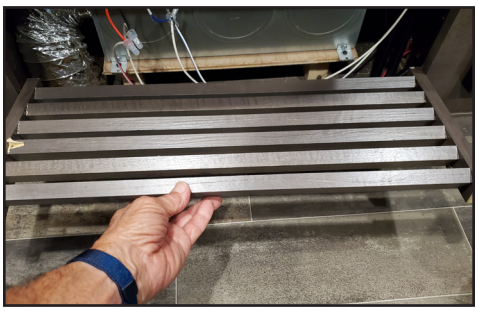
NORCOLD.COM

An annual inspection will help keep an RV furnace in tip-top shape

By Bill Gehr
Photos by the author

Most motorhomes, trailers and truck campers have some form of comfort heating to maintain interior warmth during cold days and nights. The vast majority of RVs use a forced-air furnace complete with a network of ducting that runs through the floor or cabinetry, terminating with registers to distribute warm air.

Unfortunately, annual furnace maintenance and cleaning are often overlooked, which can lead to poor performance, malfunction and even failure. And — you guessed it — problems seem to only crop up when you need heat the most. Annual cleaning is important because the return air system does not include a replaceable filter to prevent dust, lint and pet hair from impacting performance and safety. Following these preventive maintenance procedures will give your heating system the advantage during the cold weather.



It's a good idea to remove the furnace return air grill to check for any debris that might have fallen into this space. In this case, the furnace was mounted in the galley, which can be susceptible to wayward items that have fallen out of drawers and cabinets.

Let's Take a Look

Using a bright flashlight, peer into the exterior exhaust/cold-air intake of the furnace. You'll be checking for mud daubers, spiders and wasps, any of which can block the airflow in both directions during the heating process. A restricted airway could cause short cycling of the flame or an improper flame from lack of oxygen, leading to an over rich gas-air mixture.

Use a flashlight to check for mud daubers or other debris inside the exhaust port. It might be possible to use a coat hanger to pick out any obstructions. If not, the furnace will have to be removed to gain access to anything clogging the airway.

If you discover debris or nests, remove the vent assembly and clean any obstructions. Be sure to replace the gasket or seal before reinstalling the vent assembly. If you suspect a mud dauber has built a nest inside of the blower assembly, you will need remove the furnace in order to gain access to clean out the debris. If you're not comfortable with removing the furnace, leave this job to professional RV technicians.

The next step is to remove the interior or exterior access panel for inspection. You'll be looking for lint, dust and/or debris on the circuit board and blower wheel(s). Be careful not to disturb the wiring or compromise any of the components, which could lead to a furnace malfunction. Use a bright flashlight to inspect the interior of the partially hidden blower assembly to determine if a build-up of lint is present. With the help of a long-nose air nozzle, compressed air (at no more than 125 psi) can facilitate the removal of dust in the hard-to-reach areas. Avoid directing high pressure air toward the circuit board or other electrical components (play it safe and adjust air pressure to 20 psi when cleaning the board.)

Thoroughly inspect all of the wiring; it is not uncommon for rats or mice to chew through electrical insulation and conduit. Damage to wiring or other components may require the assistance of a certified RV technician.

Next, check the return air vent located near the furnace. Manufacturers of fifth-wheel trailers and motorhomes

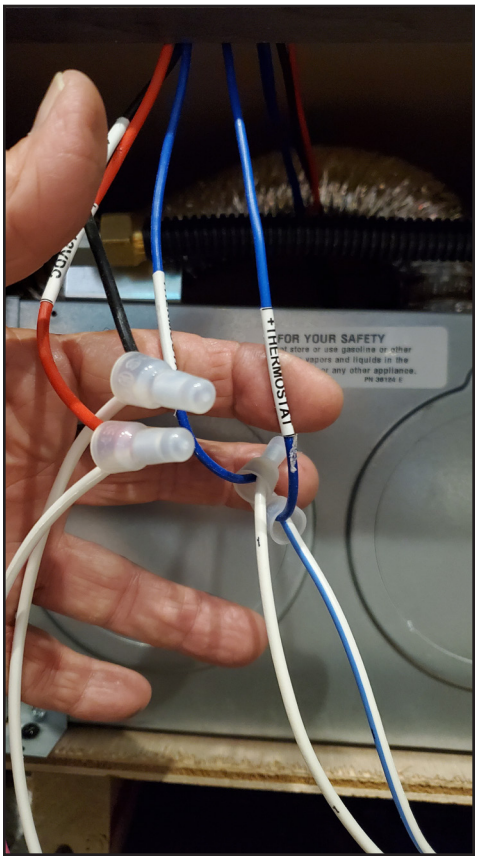
Return air vents can be found in various areas in RVs. This vent is cut into the steps that lead to the bedroom in a fifth-wheel. It's important to keep the area around the return air vent free of stored items. Any obstruction can diminish the efficiency of the furnace.

normally locate the furnace in the basement and the return air vent will be on a common wall inside the RV. The furnace in travel trailers is typically mounted near a galley area compartment with the return air vent directly in front of the furnace. This area is susceptible to towels or other products falling out of drawers that potentially could block the return air vent. Never block the return air vent or install a filter, which can affect the heat cycle and reduce efficiency.

Inspect all ducting from the furnace for integrity. Cuts or cracks will reduce efficiency because the heat will escape before reaching the registers. Furnace manufacturers require a specific number of flexible ducting runs and/or the use of a plenum. It may be possible to repair small areas with certified metal duct tape, but in most cases the tubing will need to be replaced.

Feel the Heat

Ducting and heat registers play a big role in heating efficiency. Every furnace is designed to function with a specific number of ducting lengths connected to the furnace body, so don't use adjustable registers or block off the existing registers. Inspect all accessible flexible ducting and replace if compromised. Floor registers are difficult to clean without removing the covers. Any accumulation of pet hair, lint and other items should be removed regularly with a vacuum cleaner crevice tool.



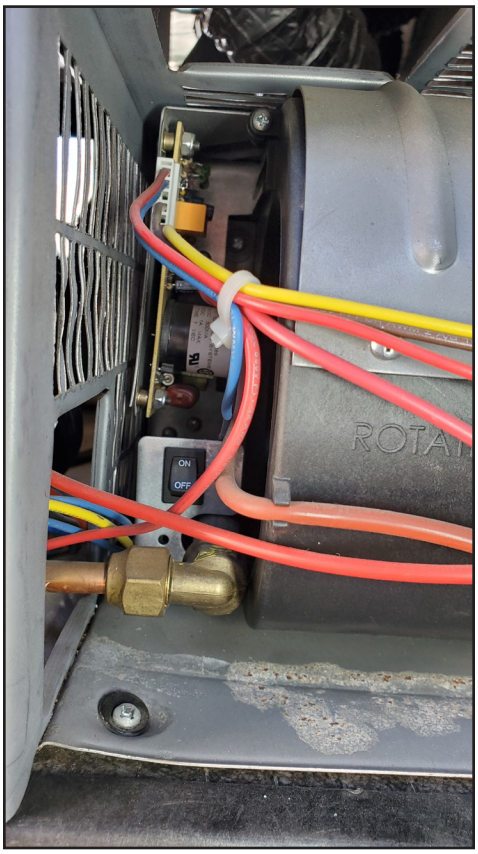
Inspect all the wiring for faulty connections and repair as necessary. Mice and rats consider wire insulation dessert. Vibrations can loosen wire connectors and create issues with furnace operation.

Gas Pains

LP-gas pressure plays an important role during the furnace's ignition cycle. Not surprisingly, LP-gas regulators deteriorate over time — and any dysfunction will cause improper ignition and air/fuel mixture during the heating cycle. Gas pressure should be checked by a professional technician annually using a tool called a manometer. Not only will this confirm proper pressure, but a leak-down test will discover any breaches in the propane piping and/or fittings. Frankly, it's not a bad idea to replace the LP-gas regulator every five years. If you are experiencing ignition problems, seek professional help; gas appliances can be dangerous if not diagnosed or repaired correctly.

The Volts Are In

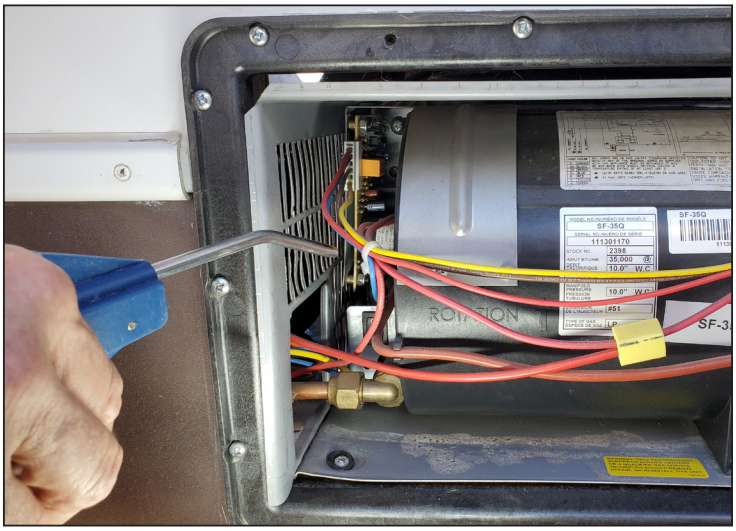
Battery voltage is critical for the proper function of a forced air furnace system. Check to be sure that all the battery terminals are clean and secure. Using an accurate multimeter, confirm power to the furnace, which requires at least 11 volts DC to operate when the blower is running. Should the voltage drop below that in the middle of a heating cycle, the furnace will go into lockout mode and blow cold air unless the circuit board is designed to shut



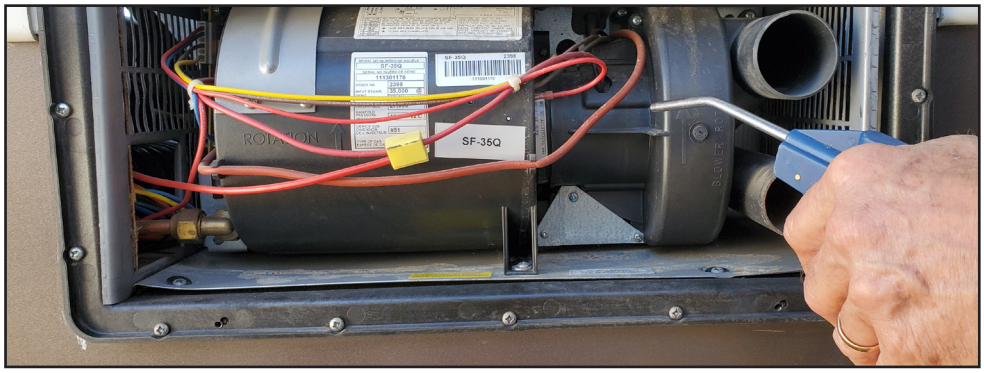
Also check out the wiring to the circuit board and make sure the connector is tight. Dust and debris can affect the performance of the circuit board.

the furnace off. General battery health is also important to keep appliances, like the furnace, running properly.

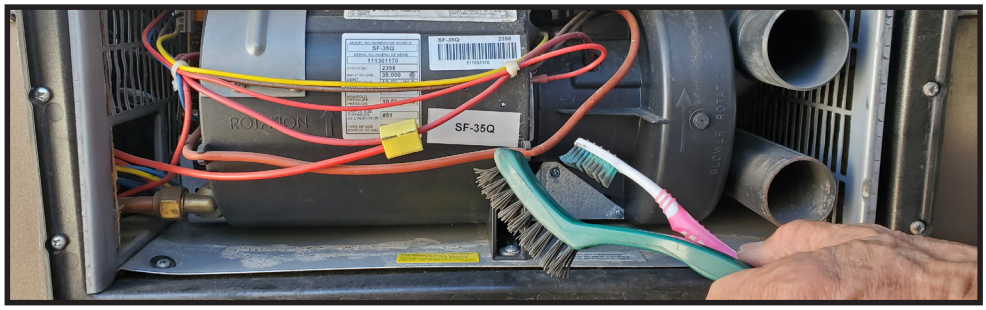
Obviously, there are other things that can impact RV furnace performance, from broken connections & errant thermostats to parts that simply wear out over time. That said, proper and timely maintenance can oftentimes reveal minor problems before they became a major headache. Hot water bottles have their purpose — but cuddling up to one because your furnace isn't functioning shouldn't be one of them. RVE



It's possible to clean out any dust and debris from the area where the circuit board is mounted, but high air pressure can damage the components on the board. Use a long-nose air gun with no more than 20 psi of pressure, using short bursts.



Higher air pressure can be directed at any of the solid components, including the blower wheels, which tend to collect a lot of sticky lint resulting from centrifugal force. Generally, it's always best to keep all the components and housing clean. Don't exceed 125 psi of air pressure.



If the sticky lint is stubborn to remove with air pressure, you may need to use a soft plastic bristle brush or even a toothbrush. Keeping the furnace free of debris and dust will pay off in service longevity.

Registers in the floor have a tendency to collect dirt and lint below the grate. Also, copious amounts of pet hair tend to collect in this area. Here is a radical example of debris that has collected in the register ducting over a long period of time. Remove the register grate to provide access for a vacuum crevice tool for cleaning. Obviously, the furnace register must not be blocked with stored items.

Let the Sunshine In!

Replacing and updating a skylight can really improve your RV's interior — while protecting its exterior

By Chris Dougherty
Photos by the author

If you're like many RVers, walking into a dim, dank RV with a dirty, faded and scratched skylight is downright depressing. From a practical standpoint, unmaintained skylights are a leading cause of water damage. Aesthetically, things aren't much better; the amount of light an ignored or overlooked skylight allows inside does little to enhance the joy of RV ownership.

So, what goes wrong with RV skylights, and why should we replace them? Quality RV skylights are generally made of an impact-resistant polycarbonate plastic that can remain in service for years. But as time goes on, they can become scratched and faded — and many crack as a result of UV exposure. The more brittle they get, the easier they can break from hail or branch hits. Of course, once they crack, they leak. A skylight dome that has a crack is already brittle, so while repairing it with a waterproof tape like EternaBond may work temporarily (and it won't be pretty), the rest of the dome is likely to fail quickly.

RV skylight domes come in a number of sizes and are available in clear, smoke, dark smoke or translucent white. Some manufacturers also use various shapes in their designs. Most skylights consist of an inner and an outer dome; the outer dome is of most concern because it's exposed to the environment.

If you have an inner and outer translucent skylight setup and would like to have more light in the RV, consider replacing both with either clear or smoke-colored domes. The clear model will bring in the most light, but

The outer skylight fortunately hasn't leaked but is badly UV damaged, yellowed and brittle (top). The inner dome is in good condition, but we opted for something else to bring in more light and have a clearer view of the outside. The bathroom is dark, grey and feels closed in.

We removed the inner trim from the skylight and the vent. The project included rebuilding the vent while adding a fan, switch, new lid and gasket. This also allows occupants to see the thickness of the roof, look for damage and take measurements of the openings.

both allow occupants to look up at the trees and the stars, enhancing the "outdoor experience."

When replacing a skylight, make detailed measurements of the existing one. Often, removing the inner dome will give you the best access to the opening for detailed measurements. If you're replacing both the inner and outer domes, make sure to measure the roof thickness as well as the outer dimensions so you can make the best choices when buying the replacement parts. While RV skylights can be found on many sites like Amazon, eBay or your favorite dealer's site, if you're looking for some help in getting a new match for your RV, Icon Direct is a great choice, and its products are always top notch. **RVE**

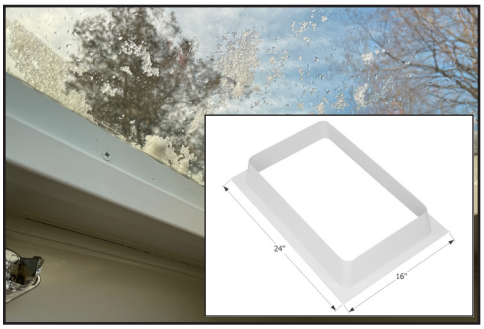
The sealant topside is dirty and the skylight is badly weathered and broken, the victim of an earlier cob job. As seen on this roof vent, removing the sealant from the skylight itself isn't necessary when replacing the skylight as long as you can expose and access the screws for removal.

Carefully cut and separate the skylight from the sealant on the roof. It's okay to scrape on aluminum and fiberglass roofs, but don't do it on a membrane roof. A heat gun used carefully can help to soften the sealant. Use a flat tool to carefully pry up and remove the skylight, working your way around. A long plastic pry tool should be used on membrane roofs to avoid cutting the membrane. If you do happen to cut it, don't sweat it. EternaBond is your friend!

Once the skylight is off, remove as much of the remaining sealant as you can without damaging the roof. Warming the sealant can help.

The new skylight was pre-drilled for screws. One-inch putty tape was applied around the screw line on the underside of the flange, then the skylight dome was aligned carefully with the opening and screwed down. It's best to have someone in the RV to eyeball the skylight alignment in the roof opening. Dicor self-leveling sealant, appropriate for the roof, was then applied.

Moving to the inside, we had a couple of options. First was to custom order a thin inner dome from Icon Direct that would match the depth of the roof and dome. Icon makes them in 2-inch and 5-inch depths, as well as custom models. For our installation, however, we opted to eliminate the inner dome.



Icon Direct also makes a trimmable garnish. The garnish can be cut on a table saw, and then a U-shaped gasket or trim is added to the edge against the inner side of the skylight. We opted to utilize what we had in the shop, which included white aluminum shower trim molding and 1-inch white outer-corner trim. We then sealed around the seam between the skylight and the aluminum with clear Lexel sealant. This was better than using an inner dome, providing more light and more headroom in the shower for six-footers.

The completed bathroom ceiling renovation includes the new skylight and trim (the snaps are for vinyl covers), a reconditioned vent now fitted with an exhaust fan and a new LED light. The sealant was touched up around the perimeter while we were at it.

Truck Camper Revival

This article is part of a series that will showcase the restoration of a neglected 2005 Lance Lite 1025 truck camper. It was purchased after it had been sitting on a farm in upstate New York. The 15-year-old camper had been through numerous owners, including racers, musicians and drug users, discovered by digging into the renovation. Needless to say, none of the previous owners were super careful about maintenance although some service had been done, which kept most of the structure intact.

SOURCES:

Dicor Products
(800) 837-2059
dicorproducts.com

Icon Direct
(888) 362-4266
icondirect.com

Tips & Tools

Before beginning a skylight or vent replacement project, make sure:

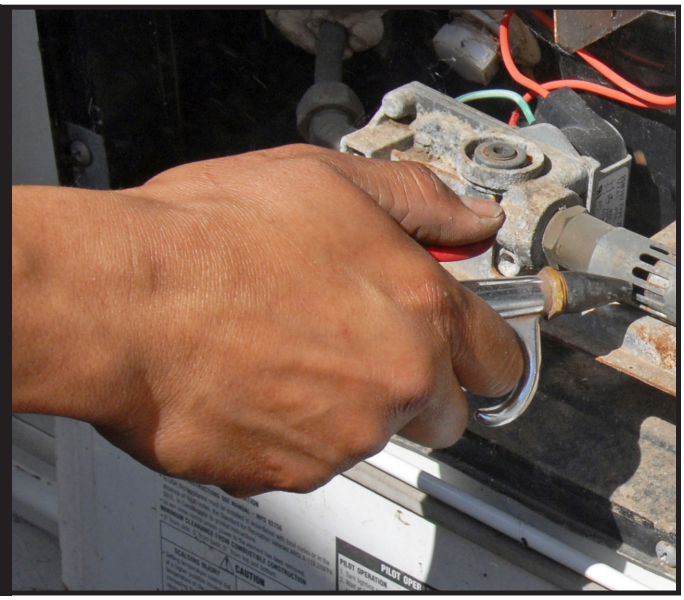
- *The weather will be dry and clear for the day.*
- *You have the correct parts.*
- *You have all the tools and supplies needed for the project.*
- *You can access the roof safely and are comfortable working at that height.*

What You Will Need

- *Outer skylight dome*
- *Inner dome (if replacing)*
- *Self leveling sealant compatible with your roof type (EPDM, TPO, PVC, aluminum) or elastomeric sealant included with skylight if required by skylight manufacturer. Just make sure the sealant won't damage roof membrane.*
- *Putty tape roll*
- *Box of screws (as recommended by skylight manufacturer, usually #8 x 1 or 1 ½ inch)*
- *Utility knife*
- *Screw gun*
- *Caulk gun*
- *Scraping and prying tools*
- *Adhesive remover*
- *Shop towels*
- *Heat gun (optional)*
- *Roll of EternaBond tape (optional)*
- *Special items (if fabricating inside trim, etc.)*

Products linked to articles in RV Enthusiast are our personal and/or professional recommendations. We may earn a commission on products linked on Amazon.com if you purchase the item using the provided link.

Tanks a Lot



By Chris Hemer / photos by author

The RV water heater is something we sometimes take for granted. By performing basic maintenance before and after each travel season, you can ensure that it will work when you need it

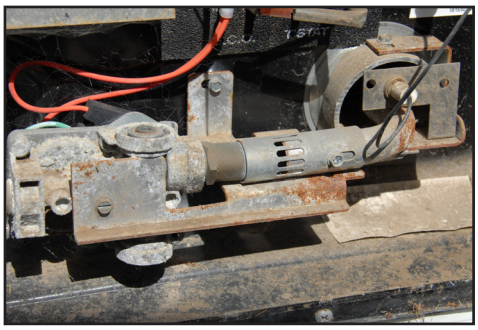
It's hard to imagine life on the road without a water heater. From washing hands to bathing and doing dishes, it is one of the key appliances that makes life in an RV comfortable.

Until it doesn't work.

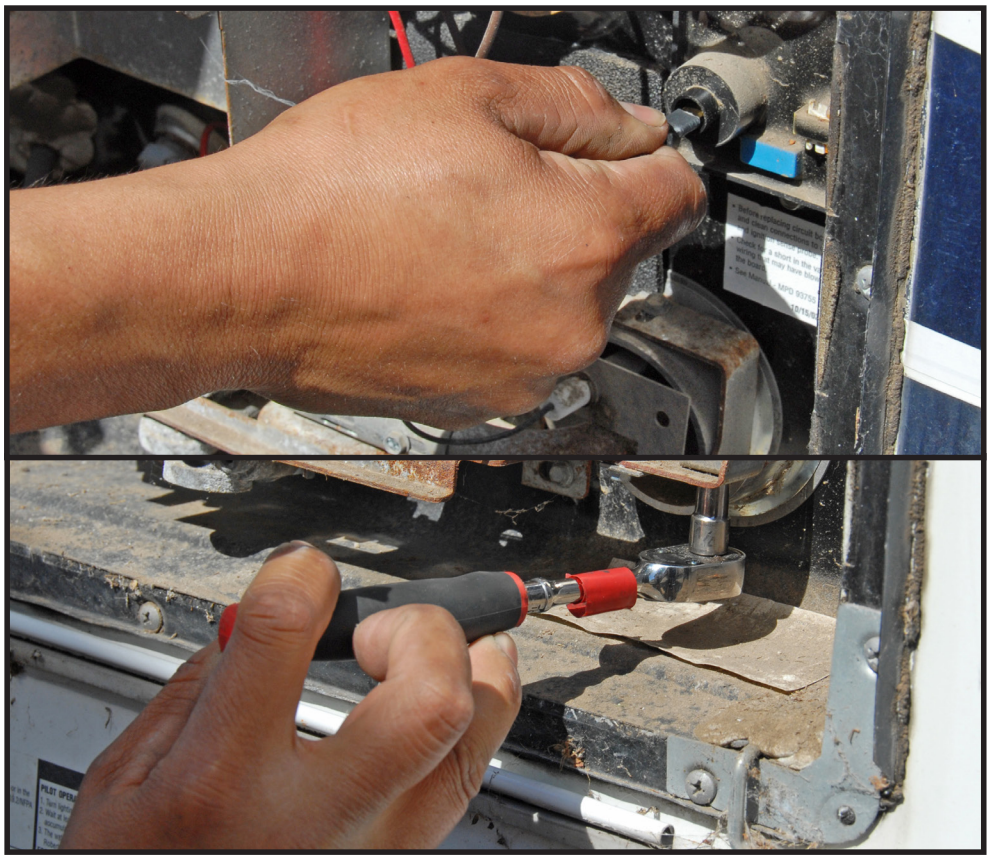
RV tank storage hot water systems are not complicated devices, and in fact are much like the units found in most residences, albeit smaller. The fact that they have not changed much through the years is testament to their reliability; the bulk of RVs on the market today still use 6- or 10-gallon units manufactured by either Atwood or Suburban, and they can last for years if they're properly maintained. However, if they're stored for months outside without being maintained or were not properly drained before the end of the season, you could be repaid this spring by a water heater that won't fire or produces water that smells like rotten eggs. The good news is, these problems are easy to repair yourself, even if you're new to RVing.

The main difference between Atwood and Suburban water heaters has to do with the tank design: Atwood uses an aluminum-clad tank that does not require an anode rod, while Suburban

If your RV has been in storage for a season or more, this is likely what you'll find when you remove the cover — dirt, dust and spider webs.



While dirt and other debris in the water heater enclosure aren't attractive, they don't necessarily do any harm. However, spiders and other critters love to build their homes in the burner tube (they are attracted to the smell of propane for some reason), and that can reduce or obstruct the flow of LP-gas to the burner. If you have access to compressed air, blow out the burner tube to clear any spider webs or other debris (after removing the ignitor assembly, as seen in the following photos). If compressed air isn't available, you can go with canned compressed air (used for cleaning electronics like computer keyboards) or remove the slotted burner tube cover (held in place with one screw) and carefully run a flexible brush through the burner tube. Once finished, re-install the ignitor assembly and plug it back in.



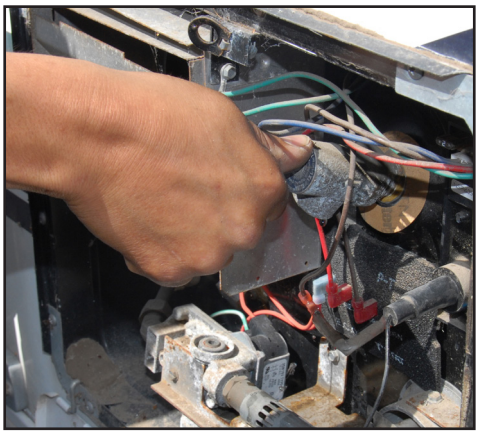
Another reason a water heater may not fire can be traced to an oxidized igniter/ground. On this Atwood water heater, the unit igniter is unplugged, then the single screw that holds the bracket in place is removed.

models are porcelain-lined steel and do use an anode rod. Atwood claims that the aluminum tank lining acts as the anode and the metals in the water serve as the cathode, so an anode rod isn't required. Suburban uses an anode rod to draw the harmful electrolytic process away from the water heater tank lining, focusing corrosion on the anode rod and sparing the tank walls. Both systems work — it's just a difference of engineering philosophies.

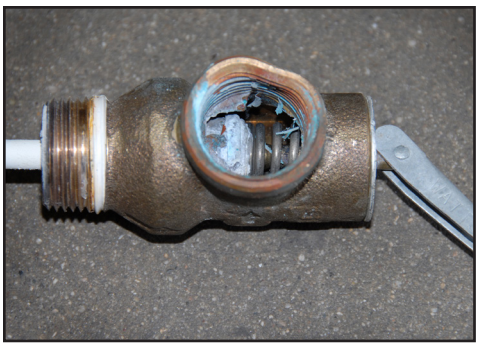
Both types should be drained and flushed at the end of every season. If you live in an area where winter temperatures drop below freezing, a full water heater tank can rupture — and we don't need to tell you that will require a trip to the RV repair shop and a fistful of hundred dollar bills. But even if you live in a warmer climate and put your rig away at the end of the travel season, you should still drain the tank; otherwise, the stagnant water can lead to unpleasant odor. Typical city water supplies contain naturally occurring sulfate, which in small amounts poses no risk to human health. However, certain bacteria feed off the sulfates in water, reducing them to hydrogen sulfide — and that's where you get that rotten egg smell. Another possible cause is a corroded anode rod, mentioned earlier. That's why it's so important to completely drain and flush the water heater tank at the beginning and end of each travel season.

With the screw removed, the ignitor bracket assembly can be lifted out of the way.

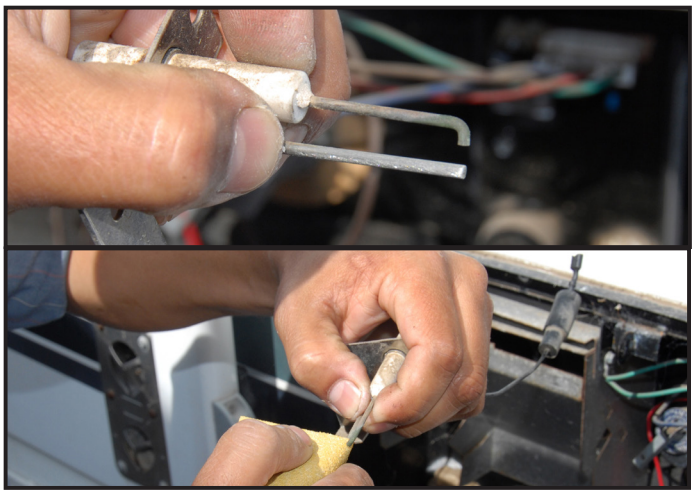
Regardless of brand or how the RV is stored, another common problem is a water heater that just won't fire; you turn it on and hear that familiar, "tick, tick, tick" but nothing happens. This could be because the burner tube is blocked by debris (like a bug's home), the igniter electrode is oxidized and no longer makes good contact with the ground, or there is insufficient power



After blowing out the burner tube, check the emergency relief valve by pulling up on the handle. Water from the tank should start to trickle out of the valve if it is working properly. If the valve is sticky or won't move, it must be removed with a pipe wrench and replaced.



Here is a good example of a frozen emergency relief valve. Note the calcium deposits and rust that eventually prevented the valve from functioning.



Use a piece of sandpaper (120 grit will do) or emery cloth to clean the igniter electrode and ground wires. Make sure to hold the igniter assembly by the two wires as shown, not by the white porcelain, as this can crack if you're not careful. For the purpose of comparison, we cleaned just the bottom ground wire; compare it to the electrode, which has a greenish brown appearance. It's still in good shape, but further oxidation could cause future problems.

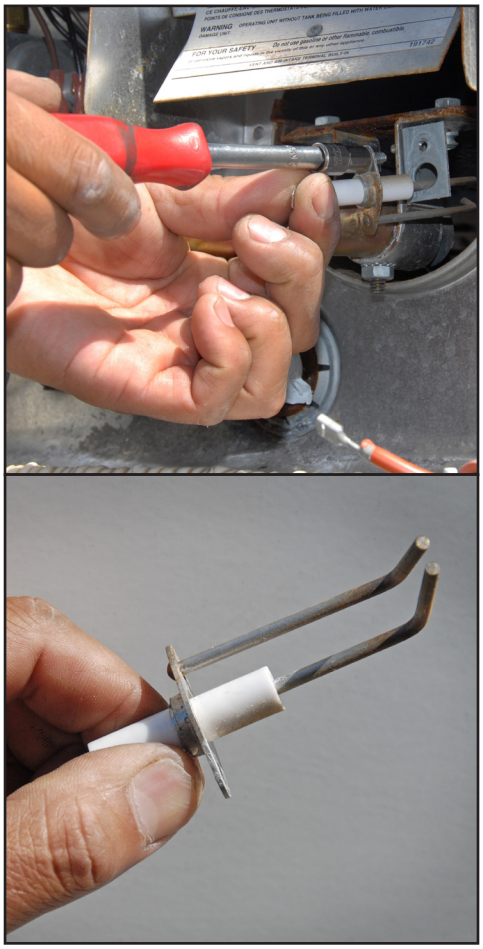
and/or gas to the appliance. It's pretty simple stuff — it takes both fuel and spark to make a fire.

Fortunately, solving these common problems is easy in most instances. To see how it's done, we visited C&S RV Service Center in Oxnard, California, and watched as its technicians performed routine pre-season maintenance on a 6-gallon Atwood and a 10-gallon Suburban. With proper maintenance and basic knowledge of RV water heater function, you can ensure your water heater will work properly when you need it. RVE

The water heater should be drained at the end of every season. Atwood water heaters use a plastic plug that is easily accessed using a ratchet, extension and appropriate socket. This plastic drain plug from an Atwood unit is several years old — note the silt residue caused by water tank corrosion and infrequent maintenance.

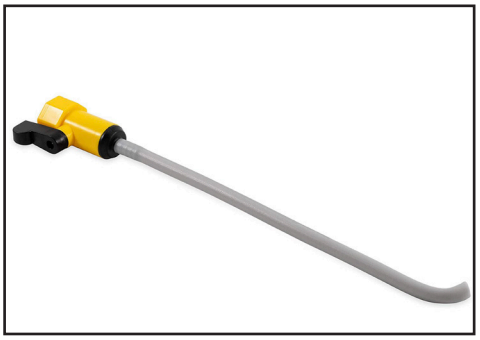
All of the magnesium on this anode rod from a Suburban tank has been eaten away by corrosion, leaving only the metal core. Obviously, you shouldn't wait this long to replace the anode rod; it should be checked twice a season for signs of corrosion and replaced when it has lost 50-75% of its material. Be sure to apply anti-seize or Teflon tape when replacing the anode in the water heater.

Although it looks different, servicing a Suburban water heater is a similar process. First, unplug the electrode wire, as shown.



The electrode assembly is secured with one screw. The Suburban electrode assembly is cleaned in the same manner as the Atwood. A few passes with a piece of sandpaper and it will be good as new.

Checking the pressure/temperature relief valve involves operating the valve lever and allowing water to flush the valve. A leaky valve may need replacement. Be sure to get an exact replacement. The biggest difference between the Atwood and the Suburban is that the Suburban comes with an anode rod drain plug from the factory. The plastic plug that Atwood uses is intentional as a safety and anti-corrosion concern; do not replace with a metal plug.



The Camco Water Heater Tank Rinser is an inexpensive and easy way to mitigate a build-up of harmful sediments that can accumulate below the drain plug line. After opening the pressure relief valve on the water heater, remove the drain plug and attach the tank rinser to a garden hose. The tank-rinser wand is then directed into the tank to remove any deposits, which are flushed around the wand.

SOURCES:

Airxcel, Inc.-Suburban Div.
(423) 775-2131
www.airxcel.com/suburban

Atwood Mobile Products
(800) 546-8759
www.atwoodmobile.com

C&S RV Service Center
(805) 982-9900
www.candsrv.com

Camco
800) 334-2004
(www.camco.net

MAGIC POWER

An inverter makes it possible to use household appliances in an RV–without a generator

By Chris Hemer

OFF-GRID CAMPING UPGRADES

Try to imagine if electricity were like cellular service, where some places you travel have it while others don't.

That's the gamble that all RVers take when they head out onto the open road with no agenda. You might find yourself at a cozy local RV park with full hook-ups. Then again, maybe you'll stop for the night under the stars of a national park campsite accompanied by little more than the hum of an absorption refrigerator fan and a few 12-volt DC lights to remind you of civilization.

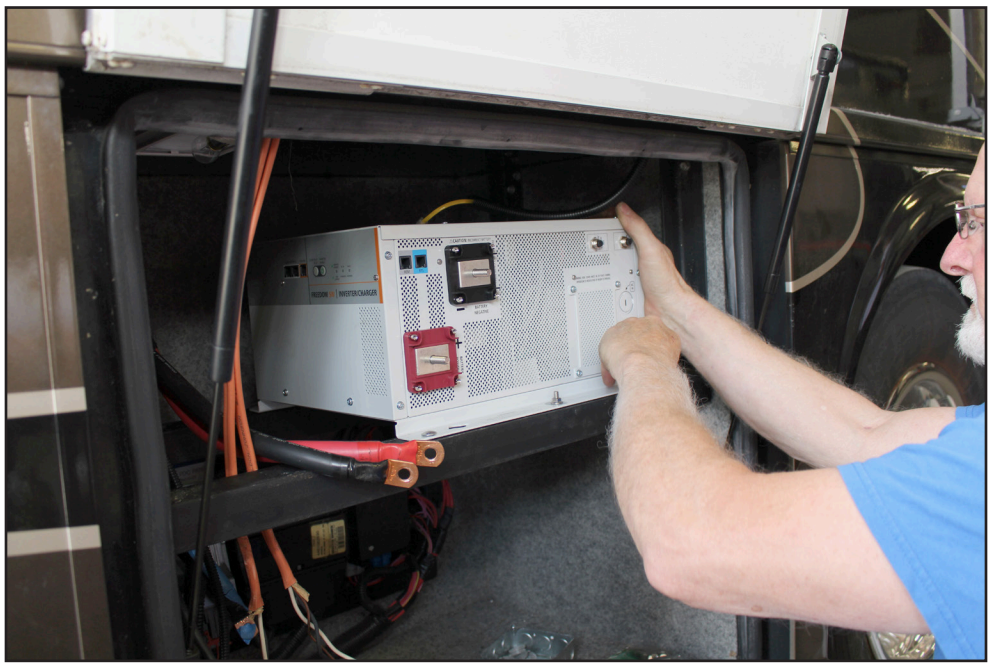
That's not necessarily a bad thing — unless you're really hungry and the only thing you have is a frozen dinner. You turn to find the microwave staring back at you with its sullen, tempered glass eye…mocking you. The TV, meanwhile, offers only a cold and expressionless field of empty space in exchange for your longing glance. Thank goodness for a dogeared copy of Huck Finn and an old bag of potato chips.

It doesn't have to be this way. With the right power inverter, you can take advantage of the 12-volt battery power in your trailer or motorhome to run the household appliances you've become so accustomed to — anywhere. Sure, we all like to get away sometimes, but it's nice to know that if you want to use a hair dryer to get ready for your glam hike, or the convection microwave to crisp up some sustainably raised, uncured apple wood smoked bacon, you can. That is the beauty of having an inverter in your RV: it changes 12-volt DC power into household-quality power, without generator noise.

What is an Inverter, Anyway?

At the risk of going too far back to basics, consider that there are two types of electricity in an RV. The most common type is 12-volt DC power, which comes from the "house" battery(ies). The other, less-frequently used type is 120-volt AC power — which is the same thing you get in a house when you plug into a wall socket.

"Each type of power has its own benefit," explained Don Wilson, sales application engineer for Xantrex, one of the leading manufacturers of inverters for RV and marine applications. "DC power is storable, so you can use energy to charge a battery, then move it to a remote location and use that stored energy to run your devices. AC power is easily changed if you think about different types of appliances that you have." For example, Wilson notes that some AC devices run on 17 volts, some run on 12 volts and some small electronic devices run on just 5 volts. "AC power is easily changed if you think about different types of appliances that you have," Wilson explained. "AC power can easily be changed, where DC power isn't easily changed. So if you need



The Freedom SW features premium sine wave output with high surge capability and temperature compensated, power-factor corrected, multi-stage charging to meet power needs of demanding loads including inductive motor loads. Available in two 24-volt DC models (which requires special wiring, and comes as an option in some new Class B motorhomes), the Freedom SW offers series and parallel stacking capability to enable twice the rated output and operation of 240-volt AC applications, respectively.

Series vs. Parallel

If you own, or plan to own, an RV at some time, you'll undoubtedly come across the terms "series" and "parallel," usually with reference to battery banks. But these terms also refer to circuits in general. What's the difference? To put it simply, in a series circuit, all components are connected end-to-end, forming a single path for current flow. In a parallel circuit, all components are connected across each other, forming exactly two sets of electrically common points. In an inverter application, parallel stacking enables the inverter or inverter/charger to double the current in inverter mode. Series stacking enables the unit to generate 120/240-volt AC split phase output, provided the AC system in the RV is wired for split phase as well.

The first step to choosing an inverter is to add up the wattage of all the appliances you will be using (or may use together) and size the inverter appropriately. Electrical appliances should have a label on them somewhere that indicates the required current, like this coffee maker, which requires 900 watts. If you think you would use it while watching the morning news on your 400-watt television, for example, you'd want an 1,800-watt inverter. If battery or inverter wattage is limited, you may have to run one high-wattage appliance at a time.

to use AC power in a remote location, like dry camping in an RV, that's where the inverter comes in. You can take that stored energy in your battery(ies), plug in your AC device and use it wherever you need it." So whether it's something as small as a portable electronic device, a flat-screen TV computer or a power saw, a properly-sized inverter is designed to cope with your power needs.

What Kind of Inverter do You Need?

First, let's talk about sizing. Inverters are sized in watts, so the first thing you need to do is add up all of the wattage of the 120-volt AC appliances you have or are likely to use at the same time. For example, you may have a 1,000-watt microwave and a 400-watt television. Is it possible that you may be using both, for a total of 1,400 watts? Certainly. Who doesn't microwave popcorn while watching a movie? So, for this example, you'd want 1,400 watts. However, it's best to go for a higher-rated inverter to allow for circuit changes or power surges — so an 1,800-watt inverter would probably be ideal.

"Another thing to consider is surge capability," said Wilson. "Some loads, like motors, which need more power to start (like roof A/C units), need inverters with either higher output power or higher surge power. Most inverters surge at twice the rated output power, but if you need more than that, upsize the inverter for more surge capability." There's no need to worry about draining your battery more quickly with a larger inverter, either, since drain is related to the actual load, Wilson said.

Among Xantrex's most popular inverters are the PROsine 1000 and 1800 standalone power inverters, which are ideally suited for electrical systems that already have a quality multi-stage battery charger. Designed for recreational and industrial applications, its 120-volt, 60 Hz AC power output is capable of handling both heavy duty and smaller, multiple AC loads. PROsine inverters also include a backlit LCD display panel, which can be mounted remotely.

Compatible with all FREEDOM X inverters and FREEDOM XC inverter chargers, the FREEDOM X Bluetooth remote panel allows the user to view key system information via the FXC Control app on his/her smartphone or tablet. You can configure and monitor important parameters and settings, read fault/error codes and more.

When in doubt, it's better to have more inverter power than you think you need than to find out you don't have enough.

In an RV application, there are other things to consider as well when shopping for an inverter. One of the most important — if you ever plan to plug into the electrical utility grid (aka "shore power") or a portable generator — is to use one with a built-in transfer switch. These units can sense when shore or generator power is present, then shut off the battery feed and use the incoming AC power instead. Next, consider if you want an inverter only, or an inverter/charger.

"Chargers use many of the same components as inverters, so purchasing one with an integrated charger can ultimately save money and make installation simpler," said Wilson. "An inverter charger works just like an inverter with a transfer switch, but when transferring the incoming AC it also powers an onboard charger using the same wiring." An inverter charger will charge

The FREEDOM XC PRO inverter/charger is rated up to 3,000 watts continuous power and weighs just 18 pounds. All models with built-in battery charger are programmable to use with lithium ion batteries.

The PROwatt SW inverter is available in 600-, 1,000- and 2,000-watt ratings and is designed for applications where the user will have direct access to the unit (as opposed to it being on a wall or in a compartment, for example). These entry-level, pure sinewave inverters feature dual GFCI AC receptacles to plug appliances into, plus a USB connection to provide power to most USB-chargeable devices.

and maintain your battery when AC is available; when it's not, the system can automatically switch to invert mode. On the other hand, if you already have a new or good-quality charger in your RV, then you may choose to purchase an inverter only.

Besides the wattage rating, you may also want to consider how the inverter will be used and the type of appliances that may be powered by it — now and in the future. For example, maybe all you need right now is a 2,000-watt inverter, but perhaps you've considered adding more appliances later on. In this case, it may be wise to seek an inverter/charger that features built-in parallel stacking. "Two inverter/chargers with parallel stacking can work in synergy to provide up to twice the rated current and charging output," said Wilson. "This allows you to expand your onboard AC power system." Inverters can also operate 240-volt AC applications, like a dryer, but only if the inverter is designed as series stackable so two inverters can be stacked to produce a 120/240-volt AC split phase (see sidebar).

Once you've established what you need, it's time to compare features. Not all inverters within the same wattage rating are equal. "There are a lot of considerations when choosing an inverter for your application," said Mitul Chandrani, director of marketing for Xantrex. "Do you want an inverter with a built-in transfer relay so incoming AC power can pass through and power downstream loads? Our Freedom X and PROsine do that. Are you going to mount the inverter where you will have access to it? Our PROwatt inverter has dual GFCI AC receptacles, plus a USB port."

In a compact RV application, a comprehensive inverter system may be easier to package than an on-board generator. The Coachmen Galleria is just one example of a small motorhome that uses inverter/charger and battery power exclusively.

Finally, consider how the inverter will be installed. Freedom X and PROSine, for example, can be hardwired, where PROWatt can't be. Some are low-profile, lightweight and are slim enough to be installed in tight spaces, while larger, low-frequency inverters (typically required to handle one or more high surge loads) are not designed for space considerations. If you're not sure exactly what you need, don't hesitate to contact the manufacturer for specifics.

Inverter chargers, when used in combination with an appropriately sized battery bank and solar system, are a great choice for compact applications where there may not be room for a generator (like a camper van, Class B motorhome, truck camper or small travel trailer). Chandrani noted that the Coachmen Galleria is just one example of a contemporary Class B motorhome that uses only a 630-amp hour (Ah) lithium ion battery pack and a FREEDOM XC PRO 3,000-watt inverter/charger to power the on-board microwave and all wall outlets.

As battery and appliance technology continues to improve, RVers will have more options when it comes to powering household devices. And that means the freedom to use modern conveniences when we need them. **RVE**

Sine of the Times

When it comes to inverters or generators, you'll often hear the terms, "modified sine wave" or "pure sine wave." Years ago, when portable generators like the Honda EU2000i and Yamaha EF2000is were introduced, the "pure sine wave" or "clean power" distinction was made so that users would know that the power these units produced was identical to the power that comes from a wall outlet in their home. Prior to that, lower-cost, modified-sine wave generators were designed for basic power needs like lights and power tools on a construction site, for example.

"Modified sine wave is fine for some electronics," said Mitul Chandrani, director of marketing for Xantrex. "But they won't work well on some electronics like digital clocks, laser printers and electric blankets. Today, most inverters on the market are pure or 'true' sine wave, as they are sometimes called. The cost to produce pure sine wave inverters has come down dramatically over the years, so there is no longer a big cost difference between modified and pure sine wave inverters."

Boondocking on Batteries

Installing a Magnum Energy MagnaSine 3000 Hybrid inverter/charger

By Bob Livingston
Photos by the author

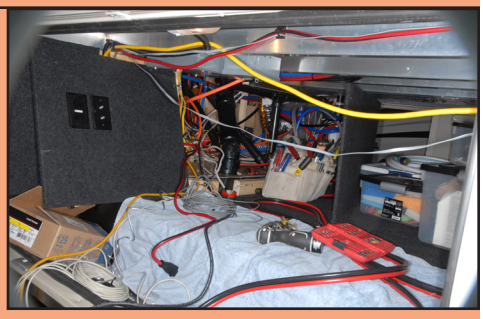
Power inverters are available in a number of sizes — with correspondingly greater wattage output — to fit the requirements of just about any RV. Smaller, portable inverters with fewer features can be found for less than $400, while larger units usually require a permanent installation and can set you back as much as $2,000. Those prices, by the way, are only for the inverter. If you only need a portable unit, you can hook it up yourself. Permanent installations, on the other hand, usually require the expertise of a knowledgeable technician.

The owner of this fifth-wheel had a number of requirements for the unit's inverter: pure sine output waveform technology, the ability to charge lithium iron phosphate batteries, maximum off-grid power output and the ability to charge onboard batteries when hooked into shore power or when using the AC generator. The inverter selected — the MagnaSine Hybrid 3,000 MSH3012M inverter/charger from Magnum Energy — provided yet another benefit: the ability to combine energy from both incoming AC power and batteries to power loads. (With most inverters, it's an either/or proposition.)

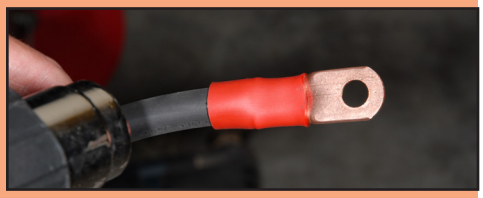
Rated at an output power of 3,000 watts (3,900 peak watts), the inverter is able to power virtually all of the fifth-wheel's 120-volt AC components — induction stove, microwave, coffee pot, satellite TV and theater seats — albeit not all at once. "3,000 watts is a lot of power," the owner noted during a multi-day installation that saw the inverter tied into an expansive power-management system on the fifth-wheel. "It's a very good charger and works well with lithium batteries."

Magnum Energy's MagnaSine 3000 Hybrid inverter/charger was chosen for this installation to accommodate lithium batteries and the projected power usage on a typical day of boondocking.

Before the inverter was installed, the technician identified the various circuits in the fifth wheel and made sure the circuit breakers were marked properly, which was not the case. You'll have to determine which circuits will be serviced by the inverter. In this case, everything except for the air conditioners is serviced by the inverter.

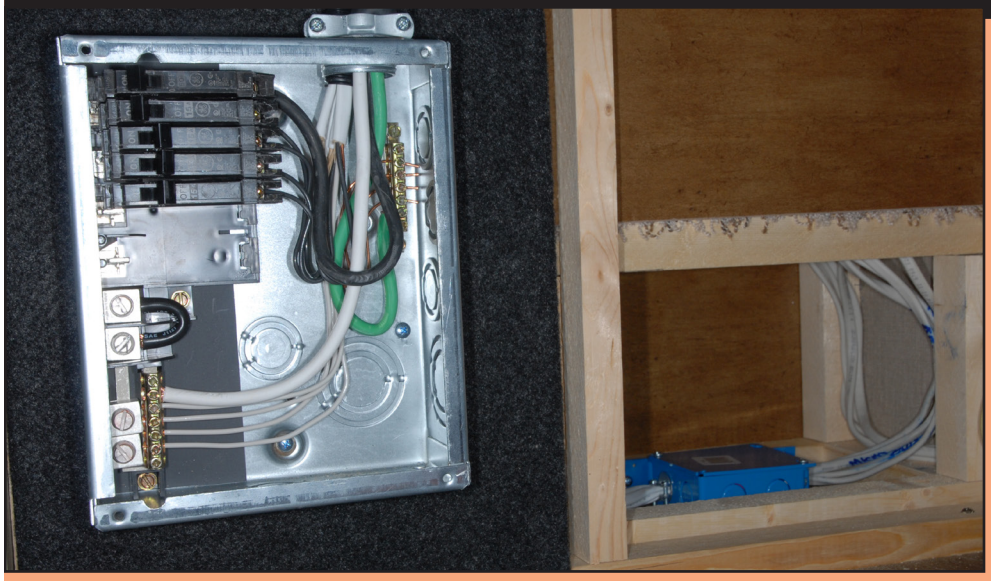


It took the better part of a day to straighten out the "spaghetti bowl" of wiring before running the cabling/wiring from roof-mounted solar panels and the inverter/charger.

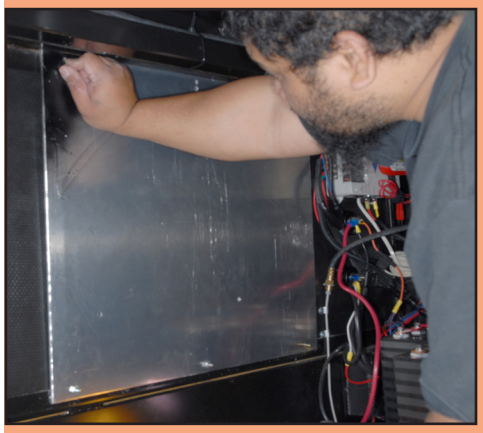


Color-coded, heat-shrink tubing was used to protect all the terminals connected to the cabling throughout the system. Not only does this protect the terminals, the color coding makes it easy for future service people to identify cable polarity.

Boondocking on Batteries

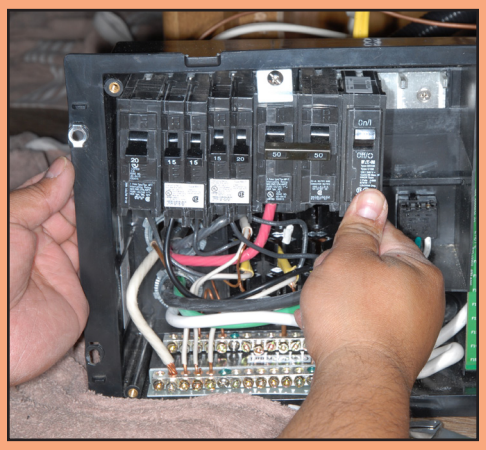


A sub-panel was installed in the storage compartment. The sub panel is necessary for distributing the power from the inverter to the designated circuits/appliances and requires properly sized circuit breakers.



Since the Magnum Energy MagnaSine 3000 Hybrid inverter/charger is quite heavy, an aluminum panel was cut and mounted to the steel bracing in the front fifth-wheel compartment. The aluminum panel was painted black before mounting the inverter/charger. Once in place, the inverter/charger was solid as a rock; without this panel, the inverter/charger would have lasted maybe one day on rough roads.

Magnum requires a minimum of 6 AGW wiring for the sub-panel and 4/0 AGW battery cables. All cables in this installation were wrapped in split loom for added protection.



The inverter/charger was wired into the existing distribution panel and a 50-amp breaker switch was added.

A conduit box was added to the bottom inverter/charger, which provides protection for the wiring in the event stored items shift during travel. The box is required by Magnum when the inverter/charger is mounted in a vertical position and may be required by code. Regardless of the requirements, adding the conduit box cleaned up the look of the installation. Cables routed to the batteries fit nicely in the conduit box, along with the wiring needed to connect the remote panel mounted inside the fifth wheel.

Mounting the inverter/charger along with all the solar system components and lithium batteries made perfect sense — keeping them isolated from other stored items.

Boondocking on Batteries

All the cables, required breakers, fuses and disconnect switches are connected to meet code and provide a neat and clean presentation, one that makes servicing easy. Once everything was in place, a custom metal mesh divider (not shown on left) was fabricated and installed to prevent stored items on the passenger side from shifting to the area with all the components and cables.

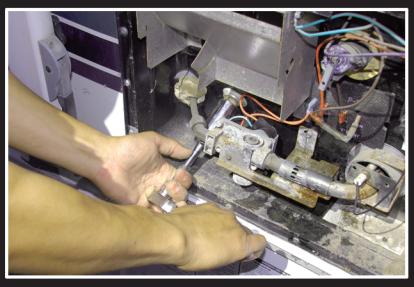
Remote panel allows complete control of the inverter/charger functions and can be installed in a convenient location. Here the panel was mounted next to the solar regulator remote, among other accessory panels.

SOURCE:

Sensata Technologies Inc.
(800) 553-6418
Magnum-dimensions.com

RV ENTHUSIAST

NORTH AMERICA'S PREMIER HOW-TO RV RESOURCE



Created by – and for – hands-on RV enthusiasts!

RV Enthusiast magazine was developed to take the mystery out of RV maintenance, repairs and upgrades, as well as providing how-to tips to make RVing better. We get it: Things happen as time and untold miles of bad roads will take their toll on your RV. But we also know that you don't have to be a mechanic to be able to confidently deal with problems that may crop up. All you really need is truly accurate information you can rely on — fully illustrated every step of the way and written in a friendly, conversational manner you can understand.

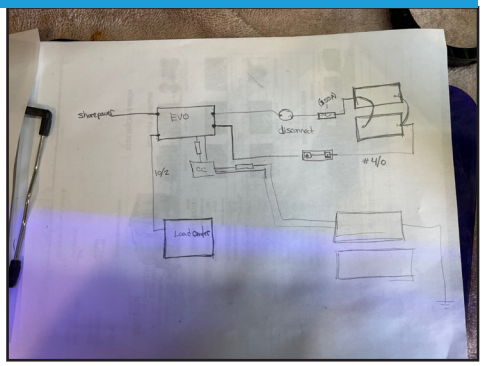
As this issue shows, each monthly edition of ***RV Enthusiast*** will be filled cover-to-cover with the kind of information and instruction you need to continue to enjoy your RV for years to come. In fact, there are nearly 50 pages of 'how-to' stories in this issue — just imagine the wealth of topics to be covered and the knowledge gained in a year's time!

If you like what you see, don't miss an issue. It's less than $1 a month! Go to our website — www.rventhusiast.com — click the "subscribe" icon risk-free and simply follow the prompts.

Coming in the May issue:

Our next issue will feature just about everything you need to know about towing — whether it's pulling a dinghy behind your motorhome or a fifth-wheel or travel trailer behind your pickup truck. We'll address towing equipment and features, hitches, baseplates, tow bars, tires, truck prep and all the accessories you need to take the pain out of traveling with a vehicle in tow. Available April 24.

Fun from the Sun



Always carefully plan your system first by reviewing all the documentation, the NEC551 for RVs, drawing diagrams and schematics of how you'll put the system together. Make sure you have everything needed before starting the project.

Installing a Bluetooth-monitored 320-watt solar array on a towable camper/garage

By Chris Dougherty / Photos by the author

OFF-GRID CAMPING UPGRADES

Renewable energy is a huge topic in the RV space, and for good reason. Not only are RVers, as a community, environmentally adept, but solar systems — especially when combined with the latest power inverter and battery technology — allow electrical independence for off-grid camping. Renewable energy systems in RVs are nothing new, but technology is advancing, prices are dropping and RVers' interest in off-grid travel is off the charts.

That's not surprising to anyone who has been RVing for any length of time. In fact, the popularity of harnessing "free" power — to say nothing of the various systems available — is such that you will see this technology covered in the pages of *RV Enthusiast* regularly as power from the sun, wind and other sources become more widely available.

We recently worked on a project with our friends at Tim's RV in Erving, Massachusetts, installing a hefty solar, inverter and lithium battery system in a new 2021 In-Tech Flyer Discover "next generation" toy hauler. Tim's RV is well suited for this work because the service manager, Brandon Turner, besides being an accomplished RV tech, owned a solar power company previously. As the word has gotten out, more and more RVers in the northeast have turned to Tim's RV for solar installations and upgrades.

The Flyer Discover is interesting in that it has a small galley, no bathroom and minimal storage. The sleeping arrangements in this off-road toy hauler are tip-out beds, one on each side, which sit flat on the wall when not in use. For the right adventurer, this does the trick.

What the buyer of this rig is doing, however, is turning it into a garage to tow behind his motorhome. Not only will this trailer garage his motorcycles, but it will be both a solar- and lithium-powered workshop plus guest quarters, all wrapped into one neat package.

In this article, we'll focus solely on the solar aspect of the installation, as other articles in this issue provide detailed information on batteries and inverters.

The Project

The buyer of this trailer wanted to have a self-sustaining power system on board the trailer that could handle power tools, lighting, the refrigerator and limited air conditioning while off the grid. When the sizing calculations were being performed, the customer decided to install 320 watts of solar panels with a 30-amp MPPT charge controller, a 2.2kW inverter system and a 210-amp-hour lithium battery bank. For a towable that is more utility trailer than RV, this system would seem like overkill but, again, the owner has different plans.

Because of the limited cabinet space,

Z-brackets were purchased to mount the solar panels. The brackets and hardware were modified to make them easier to install.

which is all located in the nose of the trailer, Turner needed to do some clever planning and fabrication to install the system. The plumbing and water system were removed and relocated so that the batteries, inverter and components could be installed in this space. Running the wiring was quite simple because most of the system was in one location, with a straight run to the roof — even the AC breaker panel was in this location.

For this project, two 160-watt Newpowa rigid monocrystalline solar arrays were used. These 12-volt DC panels are designed for mobile applications and high wind/snow loads, according to the company. The panels are mounted using Z-brackets, which Turner modified slightly for ease of installation. The panels were connected to a Victron Energy Smart 30-amp MPPT solar charger with Bluetooth interface for monitoring the system. This is fed through a FMX brand solar circuit breaker setup.

Be sure to use plenty of sealer that's appropriate for the particular type of roof. Do it right the first time, because the panels are a chore to remove and reinstall, as is resealing the brackets.

There are many choices when it comes to solar panels, and while these were a legacy type of panel, Turner believed they would work well. "I often prefer to use the newer flat panels that adhere to the roof" Turner told RV Enthusiast, but noted that for this installation there wasn't room.

Completing the package for the new owner's trailer were a Samlex Power EVO-2212 pure sine inverter charger, dual Battle Born BB10012 100-amp-hour lithium iron phosphate (LiFePO4) battery units, cabling and circuit protection and a Victron BMV-712 smart battery monitor with Bluetooth remote interface.

The Install

Turner is a conscientious technician who thinks out and plans his systems carefully before beginning the install, as evidenced during this particular project. As noted earlier, the installation of this system required removal and reconfiguration of the freshwater system and building out a wall mount for the large, heavy inverter/charger. So, a cabinet designed to simply house a battery box, water tank, pump and plumbing now also holds two batteries and the rest of the components.

A green energy system for most RVers should be designed for even-

It's important to find structure in the roof to screw down the panels. Turner marked and measured the location of the roof structure, figured out the best alignment of the panels, lined up the brackets, marked and drilled the panels, test fit them to the panels, removed the brackets, screwed them to the roof using putty tape and sealer, then mounted the panels to the brackets with modified hardware to make them easier to attach.

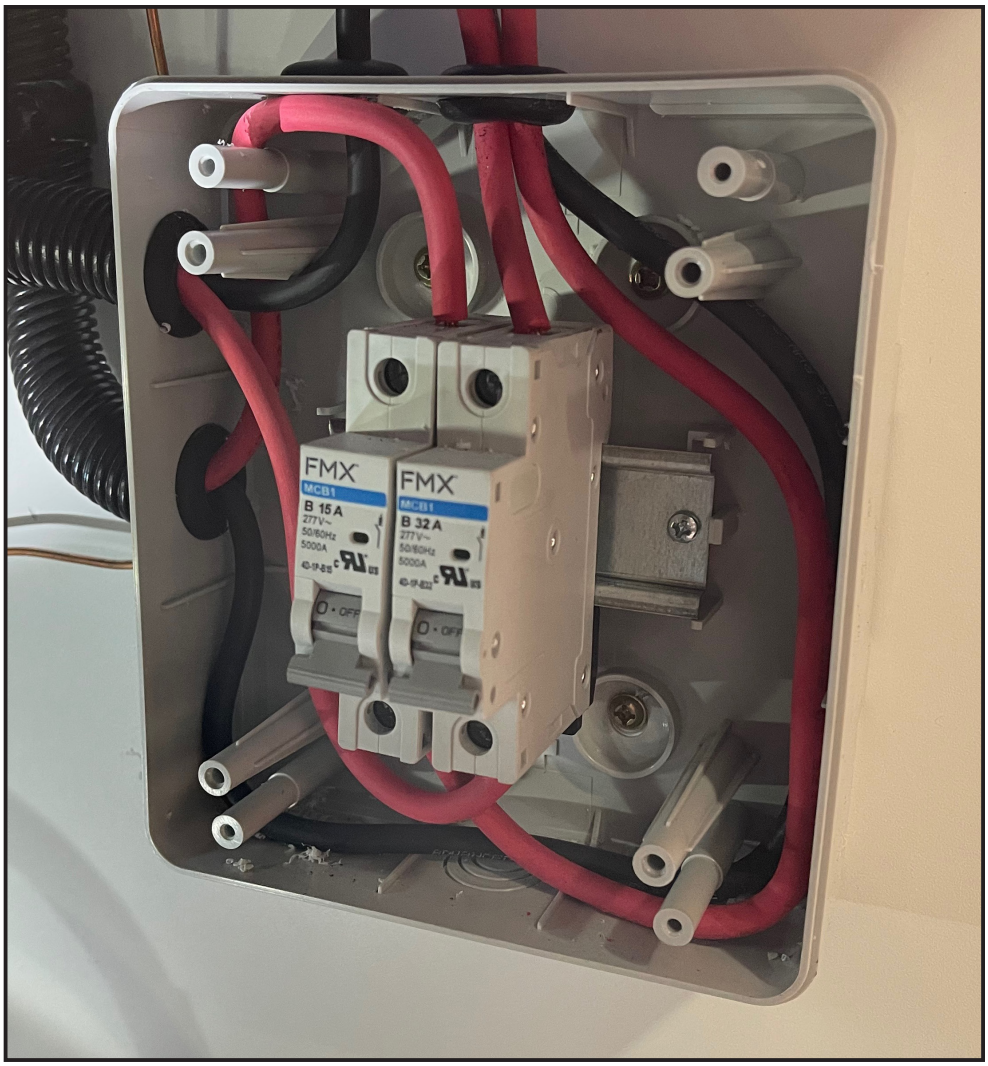
A hole will need to be drilled in the roof to route cables for the solar array. This needs to be planned carefully. In this instance, because of the trailer design, there was one spot to cleanly run the cables, and we still hit structure underneath — but just slightly.

tual expansion from the bottom up. A house is only as good as its foundation, and the same goes for a solar system. Turner built this one with the possibility of minimal expansion, slightly upping cable sizes — but because of the space restrictions and trailer design, there wasn't much more that could be squeezed in. That said, because of the physical size of the inverter, a more robust model could be swapped out and batteries added on the trailer A-frame, theoretically, if needed. Additional solar panels could also be added.

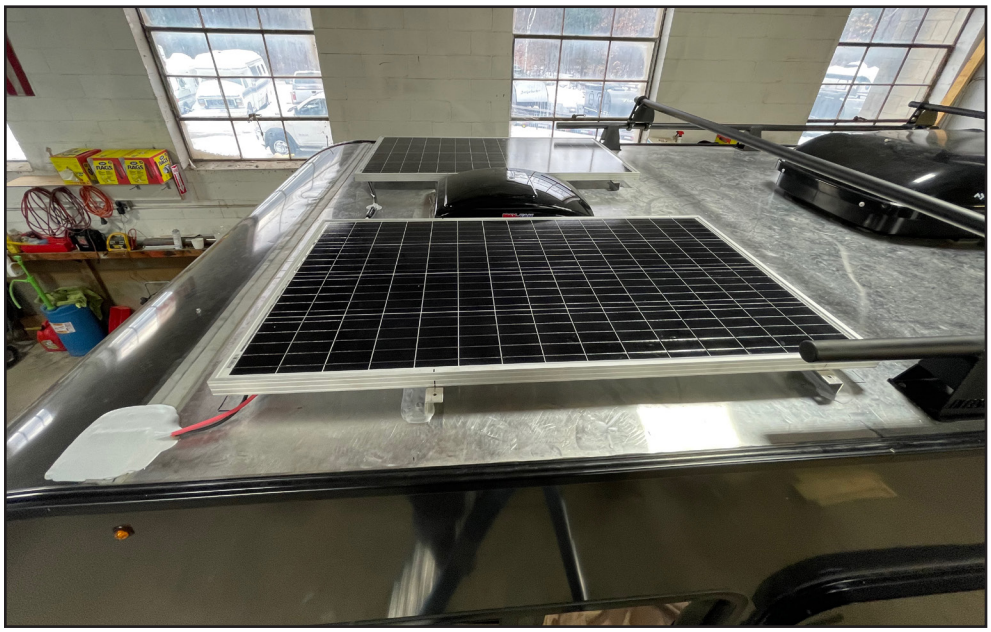
How Does It Work?

As expected, the system is able to power the air-conditioner on battery power, but for only a limited time based on the 200-amp-hour battery capacity. The heating element in the trailer, which is the only source of heat, is too much for the system. As this Flyer Discover is to be used primarily as a garage and workspace, this is fine and within the owner's expectations.

The Victron smart solar controller and battery monitor are accessible via a smartphone app. In addition, the battery monitor has a remote display and controller mounted in the galley overhead structure along with the remote controller for the Samlex inverter charger. This assures all parts of the system can be monitored via smart device or remote panel. And, since the LiFePO4 batteries are non-vented and maintenance-free, they can be installed and largely left alone. **RVE**



The solar cables were run down from the roof inside the wardrobe and into the utility cabinet. They were then fed into the solar circuit breaker box, then back up to the solar charge controller.



The finished panels are strong and out of the way of anything on the roof, and the roof rack is still usable. The cables have been tied together and routed down to the charge controller. A Winegard cable cover was used with putty tape below and plenty of roof sealer on top. Cables, fuses and connectors must be secured to the roof, and the attachment points sealed.

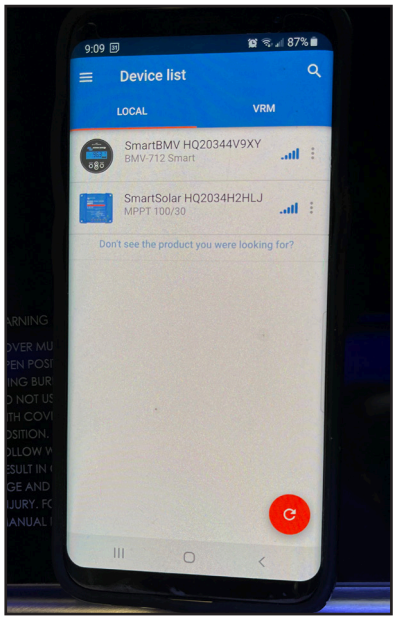
The equipment was tough to mount in such a tight space and required Turner to become a ninja to get in there and do all the work.

Once completed, the Victron SmartSolar charge controller is tucked up out of the way and fully functional.

The finished project gives a glimpse into the complexity of the system. The entire water system was removed and re-engineered for the space. The Battle Born LiFePO4 batteries were secured to the floor with a custom mounting system and strap. The rest of the components were mounted above and behind the batteries. The original battery switch was too small to handle the loads, so a new, larger switch was installed. The original converter was removed, turning the bottom of the fuse and breaker panel into an air vent. An additional air vent was cut into the cabinet door.

The inverter/charger is a sizable unit, which required building a mounting frame from the wall stout enough to secure the unit.

The Victron battery monitor is also viewable and controllable via a remote panel, which was installed along with the Samlex inverter/charger remote panel in the galley.



The Victron SmartSolar charge controller and battery monitor can be controlled via the company's smart device app, which combines displays for each device in the system.

Topside, the clean installation will provide 320 watts of solar power. Along with the 30-amp MPPT charge controller, 2.2kW inverter system and 210-amp-hour lithium battery bank, the panels will deliver more than enough power for the trailer's intended part-time use as a mobile workshop and sometime guest quarters.

SOURCES:

Battle Born Battery
(855) 292-2831
battlebornbatteries.com

Samlex
(800) 561-5885
samlexamerica.com

Tim's RV Inc.
(413) 522-3410
timsrvinc.com

Victron
victronenergy.com

Part One Battery Basics

Comparing Lead-Acid, AGM and Lithium batteries by weight, energy capacity, maintenance, mounting considerations, longevity — and cost

OFF-GRID CAMPING UPGRADES

By Mike Sokol

Do you really need a battery in your RV?

Let's get this question out of the way first. If you're plugged into shore power 100% of the time and only rarely move your RV, then there's nothing forcing you to have a "house" battery at all. That's because even though most of your RV's electrical system (such as lighting, furnace control and monitoring systems) is likely powered by 12 volts DC, all modern RVs include something called a "converter." This component's job is to provide around 12 to 14 volts DC (direct current) at 40 to 60 amperes of current for general electrical needs.

Of course, this 12-volt DC power doesn't include heavy appliances such as your convection microwave oven, rooftop air-conditioner or electric water heater, each of which require a dozen or more amps of current at 120 volts AC. But if you're plugged into shore power (or a generator) the converter takes care of the 12-volt DC requirements of your RV while your power center distributes 30 or 50 amps (two 50-amp legs for 100 amps total) to all your 120-volt AC power hungry appliances. But that's a different story altogether.

If you're not boondocking, then whatever battery came with your RV is likely good enough to power the hydraulic jacks or move the slides in and out. However, if you're part of the ever-growing community of boondocking RVers who want to camp unhooked from campground pedestals without any generator noise, then this article is definitely for you.

The Candidates

I'm currently experimenting with a number of batteries to determine how long each of them will run an air-conditioner, Instant Pot, RV furnace or CPAP machine. More details on each one can be found further on, but for now I'll divide them into the following chemistry types:

•Flooded Lead-Acid (FLA) 6-volt
•Flooded Lead-Acid (FLA) 12-volt
•Absorbent Glass Matt (AGM) 12-volt
•Lithium Iron Phosphate (LiFePO4) 12-volt

This article will only cover 12-volt battery systems, so there will be no discussion of high voltage (48-volts DC and above) systems that are becoming popular on some all-electric RVs.

For an apples-to-apples comparison I'll discuss specifications of common size batteries for each of the chemistry types. Note, too, that this article only compares deep-cycle batteries — which is why it includes 6-volt FLA batteries, which are rated as deep cycle, but no 12-volt FLA batteries, which are becoming less popular these days.

First up is a pair of US Battery US2200XC2 6-volt FLA batteries rated at 232 amp-hours of storage (20-hour discharge rate). Since it takes two 6-volt batteries to make 12-volts DC, I'm considering all the weight and cost issues as twice that of a single battery.

As noted below, flooded lead acid batteries do indeed have liquid electrolyte inside of them (sulfuric acid and water) so they must be shipped and mounted vertically. Insofar as safety, getting sulfuric acid on your clothes quickly rots them away in a matter of hours, while getting it in your eyes can be very painful and possibly lead to blindness, so old clothes and safety goggles are the uniform of the day when working with any flooded-cell battery.

Next, let's take a look at a VMAX 1200WH (actually 100 amp-hour) AGM battery. Note that this battery includes an on-board solar panel charger, which is very handy for upgrades where you want to include a few solar panels for charging. Nothing fancy, just an on-board solar charger as well as an AGM deep-cycle battery. Please note that calling it a 1,200-watt-hour battery is the same as calling it a 100-amp-hour battery (at 12 volts DC).

This is a true deep-cycle battery that offers a few advantages over the typical flooded lead acid battery. It requires zero maintenance, which is an advantage in an RV that has its batteries located in an inconvenient location. And, because there's no actual liquid sloshing around inside, you can mount it on its end if you want. Since this technology can be discharged down as low as 20% SOC (state of charge) you can use about 80% of its rated 100 amp-hours, which works out to 80 amp-hours of usable storage. However, for optimal life expectancy, discharges below 50% should be kept to a minimum. Also, since there's no significant out-gassing (unless something goes terribly wrong) its venting requirements are much less stringent compared to an old-school flooded-cell battery.

Finally, here's the new kid on the block The Lithium Iron Phosphate (LiFePO4) battery. As seen with this Ion-Ready Battery from Briter Products, this is a completely different chemistry than the lithium-ion batteries in a cell phone,

laptop or vaping pipe — there's really very little chance of a runaway chain reaction that will cause a Lithium Iron Phosphate battery in your RV to catch on fire.

Most of the latest-generation lithium iron phosphate batteries for RVs can be discharged down to 0% SOC, which is really irrelevant as the internal battery management system (BMS) limits the discharge to an optimal level for that battery. Lithium batteries can be discharged and charged thousands of times and some manufacturers even provide a 15-year warranty. Lithium batteries provide more useful amp-hours of service since voltage barely drops throughout the discharge cycle.

Another benefit of lithium batteries is they can be recharged at a much faster rate than a FLA or AGM battery. In many cases you can recharge it from 0% to 100% SOC in less than 2 hours. That may not be important to you if you can use a smaller charger all night, but if you're boondocking and want to only run the generator a short amount of time, you may be able to go from 20% to 100% SOC in an hour or so instead of the four to six hours of generator running/charging time for FLA and AGM chemistries. Also, charging via a solar system is more efficient.

Granted, there is a drawback. All good things cost serious money — at least at the beginning of a new technology's lifecycle — so you can expect to pay $1,000 to $1,500 for a high-quality lithium battery. You're getting more than just a "better battery," however: Many lithium batteries also include built-in SOC monitors just like your cell phone, while some of the more advanced on-board battery monitors will show charge or discharge current, voltage and percentage of storage capacity left. And, given the overall improvements in lifecycle, lithium batteries end up cheaper over the long term than FLA batteries. Very nice, indeed.

The Choice is Yours

What type of battery should you choose to power your 12-volt DC needs? If you're not planning to keep your RV for six or seven years, then paying $1,500 for a lithium battery doesn't make economic sense. However, if you're a serious boondocker who takes his/her batteries to the limit, then it's a great deal.

Also, while flooded-cell batteries are the least expensive to purchase initially, they do require constant checking of their water level or you'll soon kill them. However, there are systems available (including a battery watering system from Flow-Rite) that should simplify this chore considerably, especially when the RV builder mounts the batteries under the steps or in a compartment with limited access.

AGM batteries are a good middle ground, offering zero maintenance and more usable storage capacity than flooded lead-acid batteries.

So, you pay your money and make a choice for your own RVing lifestyle. With a little care, any of these battery technologies should give you many years of solid service.

In the next issue of RV Enthusiast, part two of Battery Basics will cover charging characteristics of each battery type and how to select the proper converter/charger for each battery chemistry. It also will discuss how much battery capacity is needed to operate things like coffee makers, hair dryers and CPAP machines while boondocking; show a number of solar panel and DC-to-DC charging solutions; and illustrate how to recharge your batteries quickly with a portable generator. **RVE**

SOURCES:

Briter Products, Inc.
(574) 703-1873
briterproducts.com

U.S. Battery Mfg. Co.
(800) 695-0945
usbattery.com

VMAX USA, LLC
(248) 827-1021
vmaxtanks.com

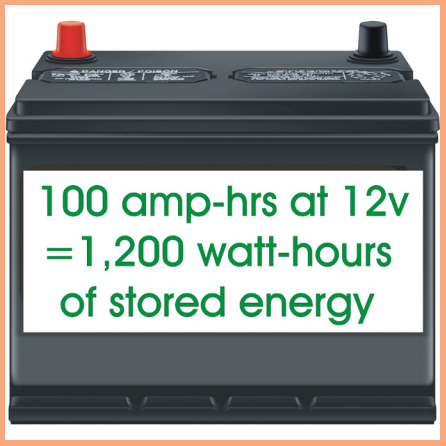
Batteries by the Numbers

US Battery US2200XC2 6-volt FLA batteries
Chemistry: Flooded Lead Acid (FLA)
Weight per pair: 124 pounds (62 pounds each)
Energy capacity per pair: 232 amp-hours at 12 volts with 0% SOC (State of Charge). 116 amp-hours of available energy at 50% SOC.
Max Charging Rate: Approximately 40 to 50 amperes (20% to 30% of rated amp-hour capacity, depending on the manufacturer)
Minimum SOC: 50%
Lifespan: From 500 to 1,000 charge/discharge cycles
Maintenance: monthly level checks and refill with distilled water
Mounting Orientation: Must be mounted with fill caps on top
Safety: Can outgas sulfuric acid fumes so they must be installed in a vented compartment
Temperature Limitations: None
Cost: $185 ea. /$370 per pair

VMAX 1200WH AGM battery
Chemistry: Absorbent Glass Mat (AGM)
Weight: 73 pounds
Energy capacity: 100 amp-hours at 12-volts
Max Charging Rate: 30 amperes (20% to 30% of rated amp-hour capacity, depending on the manufacturer)
Minimum allowable SOC: 20%
Lifespan: 300 to 1500 charge/discharge cycles (depending on depth of discharge and manufacturer)
Maintenance: None
Mounting Orientation: Any
Safety: No outgassing under normal conditions, so can be mounted with limited ventilation requirements.
Temperature Limitations: None
Cost: $290

Briter Products Ion-Ready Battery
Chemistry: Lithium Iron Phosphate (LiFePO4)
Weight: 41 pounds
Energy capacity: 100 amp-hours at 12-volts
Max Charging Rate: 100 amperes (depending on the manufacturer)
Minimum allowable SOC: 0%
Lifespan: From 1,500 to 5,000 charge/discharge cycles, depending on depth of discharge
Maintenance: None
Mounting Orientation: Any
Safety: No outgassing possible, can be mounted with no ventilation
Temperature Limitations: 32F to 104F during charging, and -4F to 140F during discharge
Cost: $1,500

What are Watts?



What's all this talk of amps, amp-hours, watts and watt-hours? Well, it's pretty simple once you understand the basic concepts.

A watt is a unit of power. Let's say you have a 100-watt light bulb, for example. By definition it draws 100 watts of power from its electrical source. It will also make 100 watts of light and heat energy (mostly heat if it's an old-school tungsten bulb). Other common things with wattage ratings would be an electric space heater (1,200 watts), a hair dryer (1,800 watts) and a laptop computer (75 watts). A watt-hour is a unit of energy. If your 100-watt light bulb is drawing 100 watts of power for 1 hour, it will use 100 watt-hours of energy. Turn it on for 10 hours and it will draw 10 times that: 1,000 watt-hours of energy (because 100 watts x 10 hours = 1,000 watt-hours), which could also be called 1 kwh (for kilowatt hours).

But what about batteries that are rated in amp-hours of storage? Well, since Ohm's law tells us that volts x amps = watts, we have to convert the typical 100 amp-hours of storage at 12 volts DC into watt-hours of storage. That's pretty easy, because we know that volts x amps = watts. So, a 12-volt battery rated for 100 amp-hours of storage can be defined at 1,200 watt-hours of storage. All you have to do is multiply 12 volts x 100 amp-hours to calculate 1,200 watt-hours (12 volts x 100 amp-hours =1,200 watt-hours) of stored energy.

Once you get everything converted to a common energy currency (watt-hours) it's pretty easy to calculate how long you can run the appliance before you discharge the battery. As an example, let's suppose you have a CPAP machine that draws 200 watts of power to operate. If you have 1,200 watt-hours of battery storage (100 amp-hours at 12 volts) then you can easily see that 1,200 watt-hours/200 watts = 6 hours. It doesn't matter if you're using a 12-volt DCD connection or a 120-volt AC wall plug, because watts is watts. Once you get everything converted into watt-hours of energy, you can simply multiply and divide to estimate the available run time on a battery charge.

If you double the number of batteries you will now have 200 amp-hours of storage at 12 volts, which is 2,400 watt-hours of energy storage. With four 100 amp-hour batteries, you would have 400 amp-hours times 12 volts of storage which equals 4,800 watt-hours of stored energy. Simply put, if you double your battery amp-hour capacity, then you double the time you can run your microwave or hair dryer or Instant Pot.

See how it all works?

Mike Sokol

Mike Sokol taught himself the basics of electricity while other 8-year-olds were learning how to ride a bike, and by the age of 14 had taken the U.S. Navy's course on tube theory. He graduated with a mechanical engineering degree, then studied electrical engineering at Cornell University while working at Corning Glass as a robotics control designer; there he also served as an industrial power engineer working on 3-phase power distribution and troubleshooting electrical problems for the plant. He earned his Master Electrician license in 1978 before building and calibrating nuclear missile guidance systems for a military contractor. That was followed by his own computer integration business, performing board-level diagnostics and repair, before embracing the Internet. He is the moderator of the AC Power & Grounding Forum and has been participating on dozens of forums through the years. In 2020 he formed No Shock Zone Inc. to fund many of his electrical projects found on his RVelectricity Facebook group and YouTube channel. An accomplished musician, he also has presented more than 1,000 seminars on surround-sound production and large-sound-system design and operation around the country and is a guest professor on the subject at major universities. He can be reached at mike@noshockzone.org.

Life Force

Water filtration and purification units improve water quality and protect your health

By Chris Hemer / photos by Bob Livingston

How much do you know about the drinking water where you live? Odds are, you know enough to purchase bottled water, a filter pitcher, or some other solution to protect yourself and family from the nasties that can sometimes be present in a municipal water system. But what about when you travel by RV? Once you arrive at your destination, you may have no knowledge of the water quality in your area, where it comes from or how it has been treated. That's probably fine for showers and washing dishes, but there's nary an RVer who will drink water right out of the tap — unless they treat it themselves before it enters through the city water inlet or before filling the storage tank.

Water filtration systems are definitely a step in the right direction, as many can filter out particles one micron (about 70 times smaller than a human hair) or smaller, reduce harmful contaminants like chlorine and lead, and improve the overall taste and smell. What they don't do is remove or kill harmful pathogens like bacteria, viruses and parasites that can cause illness.

While all water suppliers in the U.S. are required to uphold certain levels of water quality — which theoretically make tap water safe to drink — violations are still alarmingly common. According to a 2017 report by the Natural Resources Defense Council (NRDC), nearly 77 million Americans got water from systems that violated federal protections in 2015. More than a third of this number relied on systems that did not comply with standards put in place to protect public health. For RVers, these concerns may be compounded by a poorly maintained local water supply at an RV park or campground, and/or a spigot that may not be sanitary. With all this in mind, a system that both filters and purifies the water entering your RV would be a smart investment.

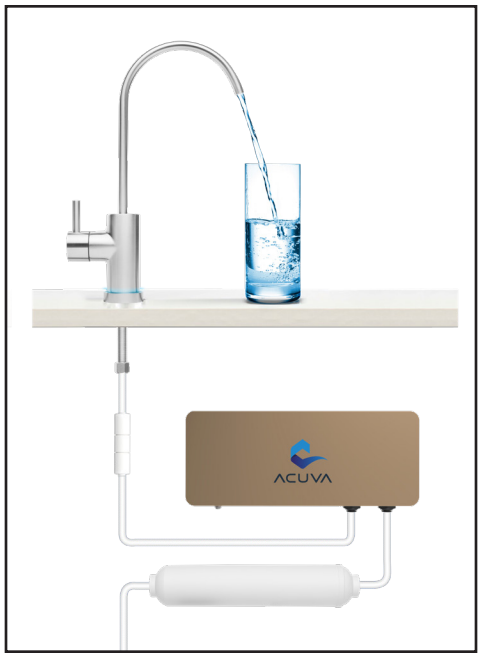
John Sztykiel ("stee kee ill"), former CEO of Spartan Motors (manufacturers of RV and commercial chassis) is obsessed with clean water — and with good reason. When he arrived in Ethiopia about 13 years ago to adopt his daughter, Ana Grace, he was appalled to learn that residents of the country had very limited access to clean, safe drinking water. Retiring from Spartan after 30 years of service, he and his wife, Joni, made it a mission to develop a water purification system that could solve the world's water problems. That's a pretty lofty goal by anyone's measure, but Sztykiel and his company, No Dirty Earth, has been working on developing high-quality water filtration systems under the No Dirty Water (NDW) brand.

The No Dirty Water Solo filtration system includes a readily available cannister and the company's Premium 0.2 filter. Shown is the 5-inch filter/housing; NDW also offers a 10-inch filter housing for the same price.

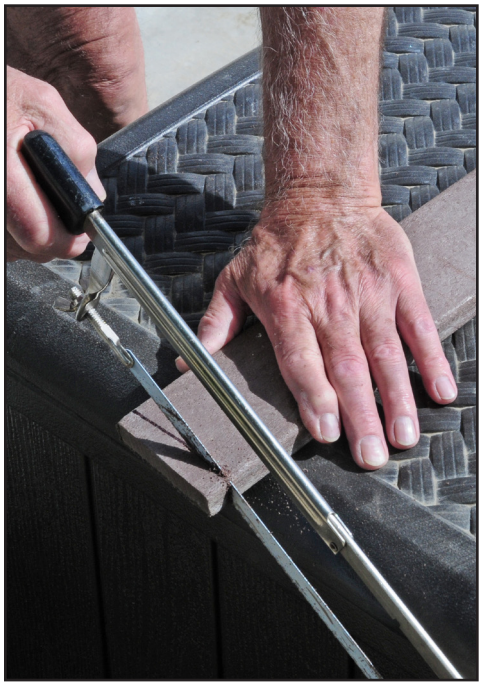
NDW Duo system includes a carbon sediment prefilter, Premium 0.2 filter and housings.

NDW's philosophy is to keep water filtration inexpensive and accessible for everyone, while giving its customers the best possible product. "Anything in a mobile environment, it has to be built to last," said Sztykiel. "But in addition to that, we want people to be able to repair the system themselves, using as many standard parts as possible. Our systems use standard plumbing pieces — you can find replacement parts at the local hardware store."

There's nothing "standard" about the company's filtration capabilities, however. Though its Solo and Duo filtration systems use readily available housings, the company's Premium 0.2 filter can, said Sztykiel, remove particles as small



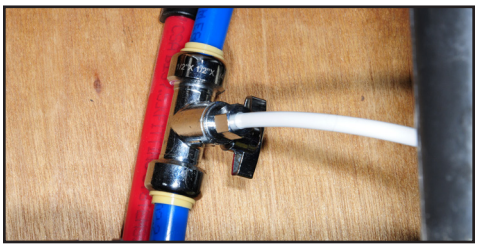
The Smart Faucet can be placed in any convenient location near the sink. In our installation, the location was predicated on access to the underside in order to tighten the hold-down spacer and fitting for attaching the ¼-inch water line. Make sure there is adequate clearance to swing the main sink faucet without contacting the Smart Faucet.



The kitchen island counter/sink structure is made of single sheets of paneling, and not stout enough for mounting the ArrowMax 2.0 box. It was obvious that some sort of support structure was needed. We used a piece of bender board and cut it to fit across the end of the island structure. The support board may not be necessary if the island structure is made of thicker material. Once the board was cut to size, holes were drilled in the ends to accommodate the fasteners.

The bracket for the ArrowMax 2.0 unit was fastened to the support board before installation on the island cabinet wall. This is easily accomplished using the provided screws. With the bracket attached, the support board was bolted in place using a large washer on each bolt. The unit slides on to the mounting bracket, requiring enough space on either side to keep it flat while maneuvering it into place. If there is not enough room to slide the box in place, it can be mounted before attaching the support board.

There was just enough room to slide the box in place after mounting the support board. There are specific requirements for positioning the unit. It can be mounted to a wall, floor or ceiling, as long as it remains in a horizontal position, with the fittings on top or bottom. It cannot be mounted vertically.



The water is sourced from the cold line leading to the existing sink faucet. A ½-inch Pex to ¼-inch O.D. tee/shut-off valve is attached after the water line is cut. Make sure city water is shut and/or the demand pump is off before cutting the water line. Forget this step, and you'll be sopping up water for a while. Use a rag to catch excess water after cutting the line. We were not overly excited with the quality of the tee fitting provided in the kit but installed it anyway for now. While it didn't leak, we would prefer to use a SeaTech reducing union tee, which has a sterling reputation for reliability. The water lines simply pushed into each side of the supplied tee fitting, but the ¼-inch tubing requires the use of a compression ferrule and wrench for tightening. The SeaTech requires no tools and would be easier if working space was an issue.

as 0.2 microns (hence the name). The Premium 0.2 incorporates proprietary, patented, electroabsorptive media technology, which the company claims is even capable of removing submicron pathogens and inorganic contaminants through electro adhesion and ion exchange. The result is not only a filter that removes particulates, but also biologicals, heavy metals and organic/inorganic chemicals. To remove larger particles first, thereby improving the life and flow capacity of the Premium 0.2 filter, the NDW Duo system incorporates a carbon sediment pre-filter in the same housing type. The Solo filter and housing retails for $74.99, while the Duo is $99.99 — and both prices include filters. A single filter replacement is $29.99, while a two-pack retails for $44.99.

Of particular interest to those who frequently enjoy off-grid camping, No Dirty Earth is planning on releasing its Rugged Water system in May that will incorporate a 12-volt DC-powered pump as well as two filters in a tough, portable housing.

"Rugged Water allows off-grid campers to have access to clean drinking water anytime, anywhere," said Pierce Fitzpatrick, co-owner of No Dirty Earth. "The 12-volt pump will allow the user to draw from any public or outdoor water source, filter it, then collect it in a container and use it as is." Because the Rugged Water system will likely be used somewhat infrequently and stored the rest of the time, it will come with the same carbon pre-filter as used in the Duo system, plus the company's brand new Premium Plus 0.2 filter, which incorporates an antimicrobial element to prevent bacteria growth. The new filter will also be available for use in the Solo and Duo systems.

Filtration vs. Purification

As mentioned earlier, water filters catch small particles — but a purification system kills bacteria, viruses and other pathogens. The two most common purification methods include ozone and LED UV light treatments, both of which are generally claimed to be up to 99.99% effective at removing bacteria, viruses and cysts like cryptosporidium and giardia. Ozone treatments work by oxidizing the organic material in bacterial membranes, which weakens the cell wall and leads to cell rupture, causing immediate death of the cell. As an oxidizing agent, ozone is stronger than chlorine and has a kill rate that is more than three times faster — but as of this writing, ozone purification systems aren't terribly practical for an

RV application. They are installed as a point of entry treatment system — in other words, where the water would enter your RV at city water hookup.

The trouble is (for now, at least), the flow rate required to properly ozonate the water isn't compatible with the plumbing system of an RV. The benefit of an ozone water-treatment system is an RV application (and there are some that are under development as you read this) will be that, once the ozonated water is introduced to the RV's plumbing, it will disinfect everything it comes in contact with — the plumbing, the freshwater holding tank, every tap in the RV.

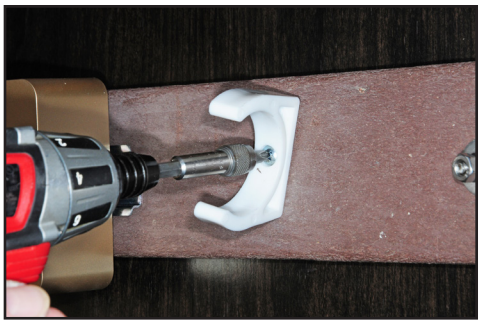
A simpler, more practical way to purify your drinking water in an RV is with an LED UV light system. As water passes through a UV water treatment system, living organisms are exposed to UV light of a specific wavelength that disrupts their DNA, making it impossible for the little critters to function and/or reproduce. UV light purification systems install inside the RV and treat the water before it exits the faucet and goes into your glass. The only caveat with an LED UV light system (and it's a small one) is that the water must be filtered beforehand, or the UV light may not be able to penetrate the water sufficiently for adequate contact time.

Best of Both Worlds

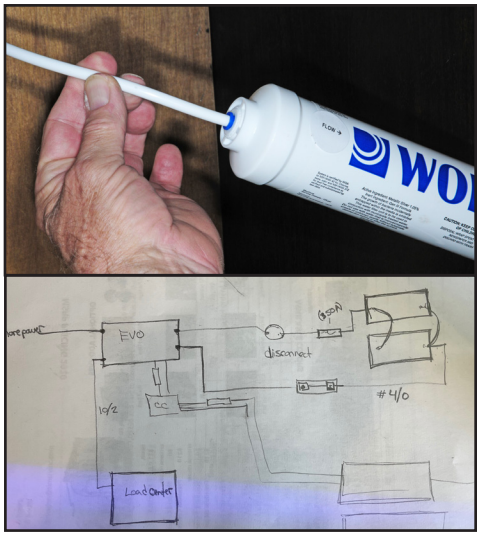
With all this in mind, it makes sense to use both a high-quality filtration and water purification system. Installing most water filter setups is as simple as mounting the cannisters and connecting a hose to the inlet of the filter (or filters), but what about a purification system? A company called Acuva Technologies Inc. recently introduced its ArrowMAX 2.0 UV-LED Water Purifier with Smart Faucet that seems to meet both demands.

Founded in 2014, Acuva Technologies designs, develops and manufactures advanced UV-LED systems for water, air and surface disinfection applications around the world. The company offers products for both OEM (manufacturer) applications as well as purification systems for boats and RVs — but the ArrowMAX 2.0 system was of particular interest to us because at $549 USD, its cost was roughly one third that of its high-end Arrow 5 product, but with better performance than its entry-level NX-Silver system.

"The flow rate is the true differentiator here," said Romina Puno, marketing manager for Acuva Technologies. "The Arrow 5 is actually an evolved



An inline prefilter was also mounted on the support board using the provided plastic clip. The clip is very rigid, making it difficult to seat the filter. It takes quite a bit of pushing, but once in place, the filter is very secure.



The ¼-inch water line from the tee fitting was cut to size after routing in such a way to protect it from being jostled by stored items inside the cabinet. Only use a parallel jaw cutter to ensure the end of the tubing is straight and not squashed. The ¼-inch water line is pushed into the filter without the need for tools. Just make sure the flow direction is maintained (marked on the filter) and there is enough room when routing to avoid crimping the tubing.

There's no specification for mounting the inline filter. Here, it's mounted in such a way to prevent the ArrowMax 2.0 unit from sliding off its bracket. Again, consider interference from stored items when making decisions where to mount the components. A section of ¼-inch water line is cut and run from the filter outlet to the inlet on the box. No tools are required.

Once the location for mounting the faucet is determined, a ¾-inch hole must be drilled into the counter top. It goes without saying that you only get one shot at this. The counter top for this project is 1-inch thick, which presented an issue when mounting the Smart Faucet.

The Smart Faucet rod and wire that plugs into the ArrowMax 2.0 is routed through the hole in the counter top. It takes two people to complete this step: one to hold the faucet in place while the other person tightens the plastic threaded fastener. An O-ring in the faucet base prevents water on the counter from leaking into the cabinet.

Since this Smart Faucet was an early production model, the rod provided was too short to get through the 1-inch counter top and provide enough threads for connecting the ¼-inch water line. Normally, the wire will go through the spacer before tightening the plastic fastener, but in this case, we had to cut the spacer to expose the correct number of threads to connect the water line. While it worked fine, we're told the threaded rod in subsequent kits will be long enough to accommodate counter tops up to 1½ inches.

A flow restrictor was placed in the ¼-inch water line from the unit outlet to the Smart Faucet. The restrictor can be placed in a convenient location in the line and requires no tools for connecting the water line at each end. Here, it's placed near the unit; flow direction is marked on the body of the restrictor. Connecting the power was the last step and a hole was cut in the side of the island structure to route the cable for plugging into the 120-volt AC outlet on the other side. The power adapter is used to provide 12-volt DC service to the unit. We selected the 120-volt AC model because there was no 12-volt DC service in the island structure and the fifth-wheel is equipped with an inverter as part of a solar system, so power will be available when unhooked.

The Smart Faucet has a ring light built into the base, which informs the user when the unit is active and water is being treated. This works in concert with the logo light in the unit itself. There's no light when the system is idle and a green light signifies the system is undergoing self-cleaning. The valve on the Smart Faucet works smoothly and water flow is pretty decent, considering pressure is restricted on purpose. With clean, great-tasting water out of tap, we can finally say "goodbye" to bottled water.

version of our original UV-LED system design, which was originally intended for marine applications with its rugged aluminum enclosure and stainless-steel interior parts. Inside the Arrow 5 are more high-intensity UVC-LED lights that leverage our patented IntenseBeam technology. As water passes through the Arrow 5 in a serpentine pattern, it is exposed to multiple beams of focused UV energy to deliver the required disinfection at a 5-liter-per-minute flow rate." Puno noted that the Arrow 5 may still be the best solution for RVers that want to treat more than one tap, or a tap and an icemaker, for example.

By comparison, the ArrowMAX 2.0 features a polymer housing and a different reactor design, which reduces cost but not effectiveness, according to Puno. "The ArrowMax has a more compact reactor design and the water flows in a U-shape through the reactor," she said. "It features our patented IntenseBeam technology as well. Inside the polymer enclosure is our stainless-steel UV water disinfection module. Both the Eco-NX and ArrowMAX systems are also certified against NSF/ANSI 372 Standards, meaning the systems are lead-free."

For smaller RVs, or those with only one source from which drinking water would be pulled, the ArrowMAX 2.0 would seem to fill a void in the RV market. "We definitely received feedback for a more compact and lower-cost system," said Puno. "When we released our first Arrow system in 2016, UVC-LEDs were a very new and expensive technology. In recent years, they have come down in price and have become more powerful. This means we are now able to deliver higher levels of disinfection with fewer UVC-LEDs. This ultimately means more powerful and compact UV-LED water disinfection system designs."

To put the ArrowMAX 2.0 to the test, we installed the system in a fifth-wheel trailer with a kitchen island. The kit includes the UV-LED disinfection system, plus the Smart Faucet, which as its name suggests incorporates certain "smart" features. A self-cleaning function activates every 12 hours with a UV burst that ensures all water within the UV-LED unit is sanitized. The system is activated the moment you turn on the faucet, which saves energy compared to older UV-lamp systems that had to remain on to be effective. The base of the faucet also has a blue LED ring light that illuminates to let the user know the system is operating.

Also included is a composite inline 5-micron prefilter, which is useful if you don't already have a filter system where the water supply enters the RV (or even if you do). The standard filter provided is said to be good for approximately 2,000 gallons and removes chlorine and organic molecules while improving odor and taste. An advanced 5-micron prefilter (a $50 upcharge) is also available, which according to Acuva can filter 5,000 gallons and removes lead, heavy metals, 99% of chorine, chromium-6, mercury and other contaminants, as well as turbidity (cloudiness), unpleasant odor and taste. The kit also includes mounting hardware, necessary plumbing and a power supply for connecting to 120-volt AC service, or it can be hard-wired to a 12-volt DC source.

The kit we installed was one of the first on the market, so it did require a few modifications, bringing total install time to about four hours. It's expected that the production version will cut about an hour off that time on most RV applications.

With a good filtration and purification system onboard your RV, you'll have one less thing to worry about as you travel to new destinations. **RVE**

SOURCES:

Acuva Technologies, Inc.
(800) 980-8810
acuvatech.com

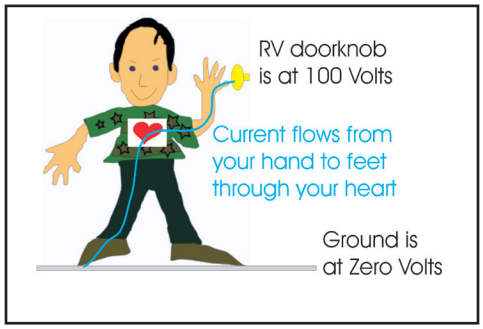
No Dirty Earth LLC
(574) 383-9277
nodirtyearth.com

HOT SKIN Part One

A certain amount of stray voltage on the exterior of your RV is normal, but anything in excess of 30 or 40 volts is potentially life-threatening to anyone that comes in contact with it.

By Mike Sokol / Photos by the author

Those of you who are seasoned veterans of camping have likely encountered "hot skin" situations a few times over the years. New RV owners, however, may be surprised and alarmed the first time they touch the side of their RV while standing on the ground and feel a shock. Is this normal? Can it possibly be dangerous?
No, it's definitely not normal. And yes, it can be dangerous under certain conditions and circumstances. But first, let's get a few definitions out of the way.



Hot-skin voltage can be dangerous if you touch the metal exterior of an RV while standing on the wet ground. A ground-fault current can pass through your heart and put it into ventricular fibrillation, stopping the heart's pumping action. If you don't receive immediate medical care (using a defibrillator now called an "AED") you could die in minutes.

What is "Hot Skin"?

There's really no formal definition of a hot-skin voltage in the National Electrical Code (NEC). In fact, the phrase "hot skin" is unique to the RV industry. In nearly all other industries and trades it is called a "contact voltage" or "stray voltage." However, I'll stick with the term "hot-skin" since that's what the RV industry has been calling it as far back as the 1960s.

RV hot-skin voltage is defined as, "a significant voltage potential between the chassis/skin of the RV and earth ground." Understand that there can be normal electrical potential of up to 5 volts between the RV chassis and earth, which is caused by the power company, but that's not what I'm describing here. I consider a hot-skin condition to be any voltage potential over 10 volts AC between the RV chassis and earth ground, with any voltages around 30 to 40 volts being potentially dangerous depending on the condition of your heart and how long you're in contact with it. And it's certainly possible to have up to 120 volts AC on an RV skin/chassis, which can definitely be deadly under certain conditions.

What causes a Hot-skin Voltage?

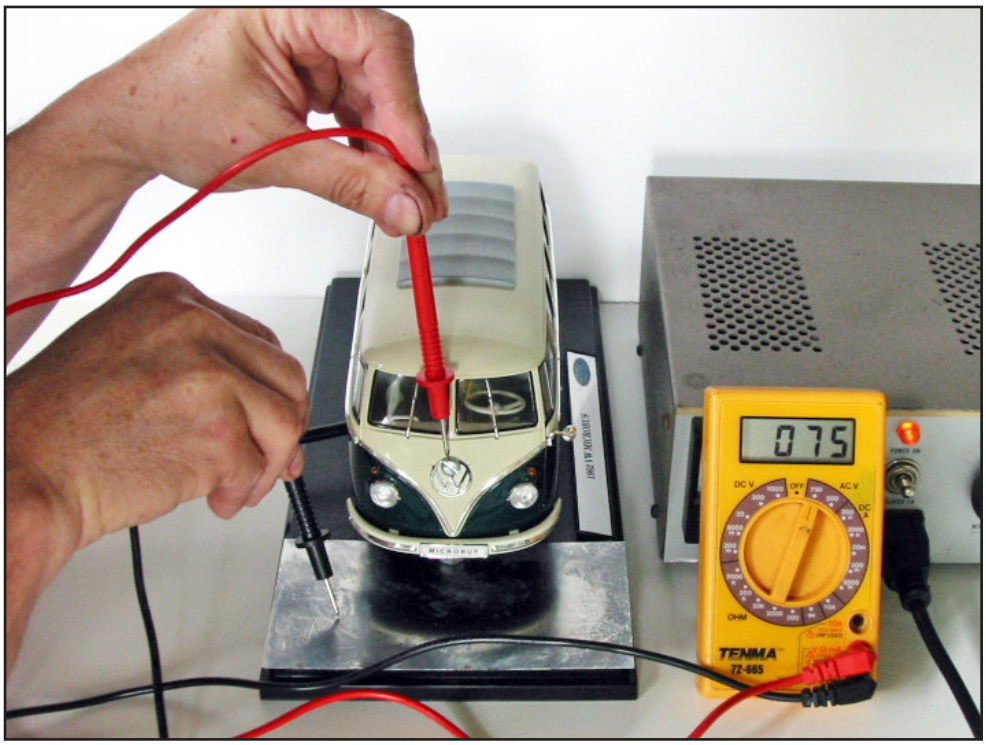
Glad you asked. There needs to be two conditions for a hot-skin voltage to occur: First is a poor or missing ground connection between your RV and the service panel's ground-bonding point. That means that your RV and all of its shore power cords, adapters, extensions and whatever it's plugged into (such as the campground pedestal) need to be properly grounded (specifically called "bonded" by the NEC). If your RV is properly grounded to the campground or home service panel's bonding point, it should be impossible for your RV to develop more than 5 volts between it and earth ground.

Second, you need a have a source of a ground-fault current, which can turn into a hot-skin voltage since it's not drained away by the ground wire. Please be aware that a ground rod really doesn't "ground" an RV (more on that later).

Why is This Dangerous?

If you feel a tingle while touching any part of your RV, there's likely at least 20 or 30 volts AC of hot-skin voltage on everything metal — not only is the skin of the RV electrically energized on aluminum-sided models, but the RV chassis is energized as well, along with the wheels, trailer hitch, propane tank/cylinders and even your tow vehicle. That's because virtually everything metal in and on the RV is tied (or bonded) together. If you have 40 volts on the RV skin, you'll have the exact same 40 volts everywhere else.

The danger comes when a human body gets between earth ground (stand-



To find the actual hot-skin voltage, you can use a digital multimeter to measure between a metal part of the RV (such as the hitch or wheel lugs) and earth ground. That's most easily accomplished by using a screwdriver stuck into the wet dirt.

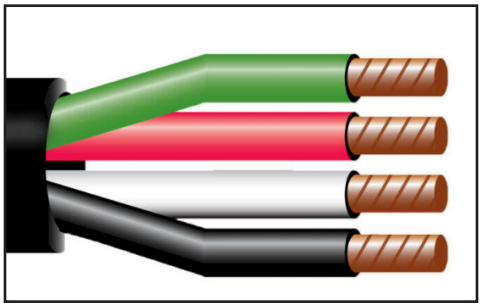
ing on the damp dirt, lawn or concrete) and touching anything metal on the RV (such as the steps, door handle, metal skin or bumper). Even the lug nuts on the wheels and the wheels themselves can be dangerous if you touch them while they're energized and you're standing on the ground.

If you touch any of these energized parts with your hands or other body part while standing on the ground, there's a fault current that will pass through your body on the way to ground — and right in the middle of your body is your heart. Depending on your age and fortitude, as little as 10 mA (milli-amperes or 0.010 amperes) of current passing through you can put your heart into fibrillation. If this happens and you don't receive medical attention in a few minutes, you'll likely die from this hot-skin shock.

Normal or Dangerous Hot-skin Voltage

If you measure a small voltage potential between earth ground and the chassis ground of the RV (in the range of 3 to 5 volts), that can be caused by the power company's unbalanced 3-phase power lines feeding the service panel. This can be annoying but it's not really dangerous to human life. However, if you're measuring 30 to 40 volts — with up to 120 volts AC possible between the RV skin/chassis and earth — then there's definitely a broken or loose connection somewhere in the RV's electrical grounding system between the RV chassis and the service panel's ground-bonding point. In many cases, this can be as simple as a missing ground lug on an extension cord or a worn-out pedestal outlet in a campground that's too corroded to make a good connection. The campground pedestal in the accompanying example was so worn the park operator had to use a bungee cord to keep the surge protector from falling out of the outlet. Note, too, the lack of circuit breakers —

Many campground owners perform little or no maintenance on their pedestals, resulting in poor electrical connections that can melt the shore power cord or create a hot-skin condition. Note that this one has eliminated the circuit breakers, a clear violation of the National Electrical Code (NEC).



In your RV or shore power cord wiring, green-insulated or bare-copper conductors are always designated as the Equipment Grounding Conductor (NGC), commonly called the "safety ground" or even just the "ground". Note that this may not be connected to actual earth ground at all when running on an AC generator or inverter power.

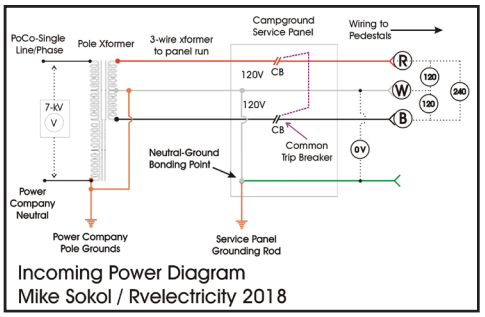
another big code violation.

The green or bare-copper ground wire in a shore power connection is so important because it's the safety ground (technically called the Equipment Grounding Conductor or EGC). Its primary job is to drain away any ground-fault currents to keep them from turning into hot-skin voltages that can shock you. Obviously, any situation with a missing or corroded safety ground connection is always dangerous.

Making the Connection

The EGC conductor extends from the bonding point inside the RV's power panel, though the shore power cord, dog-bone adapter, campsite pedestal outlet and all the way back to the campground's service panel. There, it's "bonded" to the neutral conductor of the transformer from the power company as well as at least one (and possibly two) eight-foot-deep grounding rods.

Ground rods are probably not what you think they are. The job of the grounding rod is not to "ground" the RV. In fact the earth itself is a pretty poor ground, believe it or not. Ground rods are there to direct any lightning strikes deep into the earth before these can take secondary paths through your home or RV wiring. So, a ground rod by itself will not "ground" the RV; that's the



Campground power distribution

RV converters can have up to 3mA (3 milliamps or 0.003 amperes) of leakage current to chassis ground and still pass UL listing requirements. This leakage is typically due to the noise filter capacitors on the 120-volt AC line input used to prevent electrical RF noise from feeding back in the electrical grid. That's an FCC requirement to avoid radio interference.

job of the safety ground wire (ECG).

Fault currents come from nearly everything you plug into power. Anything that's plugged into an electrical outlet will leak at least a little fault current to the chassis. But UL (and other code-making bodies) limit the allowable amount of leakage current to below the threshold of what a person can normally feel, which is typically around 1 mA (milliamps or 0.001 amperes) of current. When the available leakage current gets above 5 mA, that's what trips a GFCI. But that's another entire article.

Larger ground-fault currents can also occur in an RV. For the most part, the prime suspects are often the 120-volt AC noise filter capacitors in the RV converter/charger (up to 3 mA), a corroded-through electric water element (up to 2 amperes) or even a dead short circuit between a conductor and the chassis of the RV (up to 20 amperes) which can be caused by something like a screw or nail piercing a wire inside of a wall.

Measuring for Hot-skin Voltage

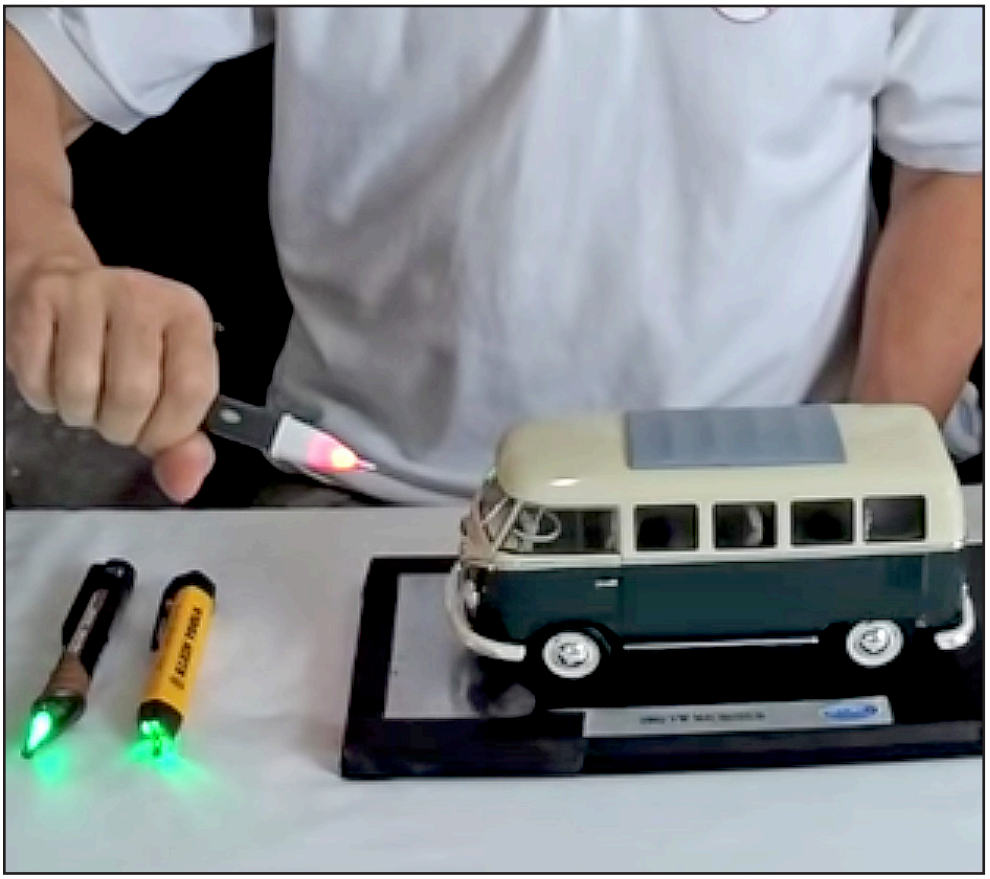
The "gold standard" method to test for hot-skin voltage is to drive a short ground rod into the damp dirt — a 12-inch-long screwdriver will do — and measure between the metal screwdriver shaft and a bare metal spot on the RV chassis (a lug nut usually qualifies). If you measure up to 5 volts AC with a digital meter, there may not be anything wrong at all — but if you find in excess of 10 volts AC with this measurement, then there's definitely some kind of failure in the RV's safety ground connection (the EGC in code language).

That said, there's an easier way to test for hot-skin voltage, which I developed and pioneered with the late Gary Bunzer more than 10 years ago — and I've found it to still be the quickest and safest way to test for a hot-skin voltage of 30 to 40 volts (where it begins to become really dangerous). A product called a Non-Contact Voltage Tester (NCVT) or Tik-Tester (electrician slang), available from any big-box store, will beep if you get close to an RV skin (or chassis) that's energized with at least 30 volts. Remember to always check any NCVT on a known-energized electric source like a pedestal outlet first to confirm that it's actually working and hasn't failed from a dead battery.

In fact, if your RV has a hot-skin potential of 60 to 80 volts it will typically beep from several inches away — and if your RV has a hot-skin potential of 120 volts AC, it will usually beep from

These are the four different non-contact voltage testers that I use in my demonstrations, manufactured by Amprobe, Southwire, Klein and Fluke. All of these will beep, blink or buzz reliably when touching an RV with at least 40 volts of hot-skin potential.

You should grasp a non-contact voltage tester (NCVT) firmly in your hand because it needs to capacitively couple to you as its ground-plane reference. Always test a NCVT first on a live circuit such as the pedestal outlet to make sure its batteries are still good and it is operating correctly. These are safe to make contact with electrified objects up to 1,000 volts, so there's no possibility of getting shocked.



Even on my scale model of a VW micro-bus, a NCVT will beep from several inches away from a 120-volt AC hot-skin condition. On a full-size RV this distance is typically more than one foot, with up to two feet being possible.

one to two feet away. That should get your attention.

What to Do if You Find a Hot-skin Voltage

Well, don't leave your RV plugged into power and hope for it to go away. You need to unplug from shore power immediately until you or the campground operator locates the source of the voltage and repairs it.

You may feel a stronger tingle if the dirt is wet — and it may even seem to go away when the dirt dries out — but that usually doesn't mean that the hot-skin voltage has magically disappeared. What probably has occurred is that you're now in dry shoes standing on dry ground, so there's so little current passing through your hand that you can't even feel it as a shock. But the hot-skin voltage — and the potential fault current causing it — in all likelihood has not gone away. It's probably just disguised by the dry dirt. The next time it rains, the real danger lurks if anyone touches any metal part of the RV while standing in a puddle outside.

Above all, if you suspect that you are experiencing a hot skin condition, unplug the RV from shore power and either diagnose the issue yourself or arrange for a professional to help you as soon as possible.

In the next issue of RV Enthusiast, Part Two of Hot Skin will demonstrate advanced troubleshooting techniques to find the source of all ground fault currents as well as how to repair them. It also will show how to use an inexpensive line splitter from Italy with a low-amperage (1mA) clamp meter from China to find very small (5 mA)I ground fault currents that can cause GFCI "nuisance-tripping" in campgrounds as well as more elaborate test gear which can confirm that campground pedestal grounds actually meet National Electrical Code standards. RVE

Did You Know?

Did you know that many, if not most, hot-skin incidents happen when an RV is plugged into an improperly wired or maintained home outlet? If you are plugging your RV in at home, invest in an RV connection box (30AMP / 50AMP / 50/30/20AMP) and have it installed by a licensed electrician.

Down in the Boondocks

A look at some of the latest off-grid RVs

By Chris Dougherty

Reprinted courtesy of *RVBusiness*

There was a time when being "down in the boondocks" carried a bit of a negative connotation. It was slang for an isolated, rural environment that was often difficult to access — the backwoods — and, sometimes, just as hard to get out of. It was a place where the trappings of civilization usually ended and you were on your own.

Today, "boondocking" — RV-speak for camping off-grid — is perhaps the fastest-growing segment of the RV lifestyle as Millennials and Gen-Zers, the biggest group of new RVers through the past five years, look beyond campgrounds and RV resorts for "experiential" outdoor adventures.

Not surprisingly, the RV industry has embraced these younger buyers by tooling up to design and manufacture everything from single-axle "adventure" trailers to fully outfitted truck campers and Class B motorhomes designed to function for days — and sometimes weeks — without hooking up to sewer or electrical connections. Indeed, even fully electrified higher-end fifth-wheels are now offered with enough solar panels and batteries to meet camper demands when heading off into the outback.

Granted, some owners may never take their off-road-capable RVs beyond the nearest campground, but the point is they could if they wanted to. For others, the call of the wild includes the comforts of home, and that's what an adventure camper offers. These smaller, more compact RVs can be easily taken into remote locations that may require 4-wheel-drive to reach. Additionally, with the advancement of technologies like lithium batteries, inverters, water filtration and electronics, these off-roaders can stay out for a longer time. And the onset of 12-volt DC televisions, refrigerators and other components has only added to the adventure trailers' capabilities.

Did we mention that many also have expanded storage, from garages to exterior rack systems designed to carry a raft of outdoor toys and equipment? Of course, many of these new RVers — of all ages — are spending a great deal of time on the road and are choosing to live full-time in their RVs. The four-season capabilities now being built into these RVs help them accomplish that, as well.

Another reason for the skyrocketing popularity of these smaller trailers is their weight, which allows them to be towed by smaller pickups and SUVs. But there's more to these non-traditional campers than their tow vehicle; many Millennials and Gen Zers are using their trailer as a basecamp while they pursue outdoor adventures from rock climbing to kayaking.

We couldn't cover every single adventure RV built but have highlighted a cross-section of the off-grid RVs on the market. For anyone seeking the path less traveled, the choices have never been better.

Coachmen Apex Tera

The Coachmen Apex Tera 16T, noted the product manager for Apex and the Tera line of off-road-ready adventure trailers, is a one-stop-shop for adventure. New for 2021, the Apex Tera comes with everything in the mandatory Wilderness and Tera packages, including 100-watt solar, bike rack, tank heater pads and more.

Available to two floorplans, the 16T is designed for adventurous couples who want to have a comfortable flop while still bringing all the toys in a compact, rigid, lightweight package with a GVWR of 3,800 pounds. A unique feature of the 16T is the rear garage door. The rear queen bed lifts for large-item storage from the back door. At under 20 feet long, the 16T has an MSRP of $23,765.

Cruiser Hitch

All-new for 2021, ultra-light travel trailer manufacturer Cruiser RV is introducing the Hitch. According to the company, Hitch is an ultra-lite travel trailer built to handle extreme terrain but towable with lightweight vehicles and equipped with unique features for today's adventurous camper. The industrial-built travel trailer will include an all-aluminum superstructure, Azdel composite walls and plywood floors.

Hitch will feature four-floor plans approximately 18-22 feet long and weighing between 3,500-4,000 pounds dry. One of the smallest and lightest units Cruiser RV has made, each unit features 15-inch tires with a torsion axle and European-an two-toned designer cabinetry. In addition, it will come with a solar package, Wi-Fi, stainless steel appliances, larger showers, and full-size beds. Base MSRP in the mid-$20,000s.

Lance 960

Lance is one of the oldest and most respected truck camper manufacturers in the business and offers a wide range of models designed for everything from half-ton pickups to one-ton duallies. Its latest model is the 960, which the company said was created based on input from experienced truck camper owners from across the country. Designed for simplicity, comfort and functionality, the 960 is a long-bed (8-foot), non-slideout camper with essentials like a wet bath, roomy closet, full galley with large pantry and space-saving swiveling chairs and table(s) instead of a traditional dinette. Or, you can opt for theater seating with dual tables and an armrest. Up top is a queen-size inner spring mattress, another closet and storage cubbies. An AM/FM/DVD stereo is standard, and 28-inch, 12-volt DC LED television is available.

Though truck campers are inherently designed for back country camping, the 960 (like most truck campers in Lance's lineup), is available with serious off-grid equipment like two 100-watt rooftop solar panels, two lithium batteries, charge monitor, CumminsOnan RV QG 2500 watt LP-gas powered generator and Truma Combi Eco Plus water and comfort heating system (the latter is available on 960 only). If cold weather camping is in your future, you'll be glad to know that the 960 is also available with the Lance Four Season Comfort Technology package, which includes insulated hatch covers and battery/propane compartments, heated holding tanks and junction valves, water heater bypass/winterization valves and an insulated cabover bed mat. You may also opt for the Lance Load Roof Rack system to make carrying extra gear easier. With generous holding tank capacities (45-gallon fresh, 30-gallon gray, 28-gallon black) two 5-gallon LP-gas cylinders and a floor length of 9 feet, 11 inches, the 960 is great choice for truck camper living off the grid.

SPECIFICATIONS
Length: 19' • Weight: 3,331 pounds (base model with fresh water and LP-gas cylinders full) • Base MSRP: $44,460

Forest River IBEX

In its debut year, the 2021 Ibex is, according to Regional Sales Manager Derek Massing, designed to account for more camping situations, offering all-terrain tires with increased ground clearance, an enclosed underbelly with heat pads on the tanks, a 15K A/C, on-board solar and invertor, and customizable Rhino Rack rooftop storage.

More of a standard size travel trailer, the 20BHS is a bunkhouse model with added features for adventure camping like heated and enclosed tanks and termination valves, solar, inverter, all-terrain tires, Rhino Rack RVT tracks and an outside "bush kitchen." At 25 feet long and a GVWR of 7,510 pounds, the IBEX 20BHS is designed for family adventure RVing while still being at home in the campground. Starting MSRP's in the low $30,000's.

Airstream Basecamp

The elder statesman of trailer manufacturing has a unique model for adventure travel: the Basecamp. Adventure seekers generally want to be connected to nature, and the Basecamp delivers with its aerodynamic, heavily windowed design. A small trailer with four available floorplans with GVWR's from 3,500 to 4,300 pounds, BaseCamp is towable with many smaller trucks and SUVs. The off-road capabilities come with the optional X-package, which adds 3 inches of lift for ground clearance, 15- or 16-inch Goodyear off-road tires and stone guard protection for the front end. Add to the living space with an optional fully enclosed inflatable tent; a lithium power system and 180-watt solar package are available as dealer-installed options. MSRP for the new Basecamp 20 is $45,900.

Venture RV Sonic X

Introduced in 2020, the Sonic X by Venture RV is ideally equipped for extended off-grid living. Starting at the front, a black rock guard transitions to a one-piece fiberglass front wall, roof and back wall. An LCI Jack-It bicycle rack is attached to the front power tongue jack; a fold down rack on the back of the trailer is designed for kayaks and other gear.

The sides and back of the trailer are protected by rugged tubular steel nerf bars and rear bumper, while off-road tires and wheels (fitted with 3,500-pound torsion axles) add to the aggressive stance of this full-body-width trailer. If that's not enough, standard "hi-definition" LED front and rear bar lights put out enough light to signal the space station. Underneath, the front third of the frame is protected by a full-size skid plate, which then transitions to the coroplast underbelly material. Being a "four-season" unit, this is all sealed up with electric heaters applied to all the tanks.

A large exterior hatch reveals a utility garage that's home to a 2kW inverter system powered by a 250-amp hour lithium battery, which is charged by four 100-watt roof mounted solar panels. The Go Power! system, when coupled with the low-consumption 11,500-BTU air conditioner, is said to provide up to five hours of air conditioning before a recharge is required.

There's also a Boondocker water filtration and purification system built by Clearsource in cooperation with No Dirty Water. This system, which is unique to the Sonic X and optional for 2021, has the ability to draft water from a static source, purify it and fill the two 45-gallon fresh-water tanks. Above this, the wall is fitted with garage wall racks that can be fitted with hangars and baskets for all kinds of gear. Four power stabilizer jacks with independent motors take the bounce out of the parked unit.

SPECIFICATIONS
Length: 27' 6" • GVWR: 7,285 pounds • Base MSRP: $47,555

KZ Escape Hatch

Toy haulers are for any toys, and KZ paid attention when the company came up with the Escape Hatch line of travel trailers. The Hatch is just like the bigger toy hauler travel trailers, only on a small scale — and with a hatch door that raises instead of a ramp door that lowers.

The E17 Hatch has an overall length of 22 feet but has a GVWR of only 4,000 pounds. The rear dinette floor plan has removable tables for each side, which opens up the floor to carry various toys inside. The Off-Grid/Off-Road package adds 100 watts of solar, a 1kW inverter, A-frame-mounted bike rack, griddle, mud tires, extra ground clearance and electronically controlled heated holding tanks. MSRP is $22,133.

Braxton Creek Bushwhacker Plus 17BH

The Bushwhacker Plus is bigger (18 feet) and bolder than the traditional teardrop trailer offered by Braxton Creek and provides adventurists with more sleeping spaces and convenience features. The queen-size bed folds down from the E-Z bed/dinette system in less than 60 seconds and the dinette table swivels both ways, making coming and going easy. Nestled in the front cap are bunk beds for the kids.

The 2,360-pound (GVWR) teardrop trailer also features a private toilet/shower enclosure inside the unit, a fully featured kitchen with two-burner stove — and a host of standards and options including a TV antenna with Wi-Fi prep, Go Power! solar prep package, 12,000-Btu furnace, rear BAL stabilizing jacks, LED interior and exterior lights and an expanded wet bath. MSRP: $16,052.

Winnebago Hike

Described by Winnebago as “a towable built for beyond,” the Hike travel trailer is on the larger side, with five floorplans and two lengths — 20 feet, 7 ½ inches and 25 feet — in both single- and tandem-axle designs. Built into the exterior design is a patented tubular exoskeleton that not only makes the unit stand out aesthetically but also functionally as a gear-hauling adventure trailer.

The upper bars are designed first as a rack system upon which to attach any variety of outdoor equipment like kayaks and skis, as well as provide some limited protection to the body. The belt line is equally protected by a series of tubular bumpers that can help in the event of a “close brush with damage.”

The front gear garage was changed for 2021. The original box created problems for turning radius as well as attaching weight-distributing hitch brackets. The new box is slightly smaller in size, still allowing for storage of propane cylinders and batteries plus a little extra gear. Additionally, a riser system was attached to the frame below the box to hold it up, giving freer access to the A-frame for WD hitch bracket attachment. On the rear, a strong, frame mounted 2-inch receiver is standard.

The narrow body design, while slightly reducing the interior footprint, makes the unit much more stable in rough terrain. Diamond plate wheel skirts sit atop all-terrain wheels and tires, and an electric awning provides cover in sun and inclement weather.

Inside, the interior sports water-resistant woven vinyl flooring. Other amenities include stainless-steel sink, microwave, gas range, and an LED TV and audio system for entertaining. It also comes ready for solar panel and Wi-Fi integration. All the materials inside the Hike are rugged and easy to clean.

SPECIFICATIONS
Length: 20’ 7.5” • GVWR: 4,200 or 6,000 pounds • Base MSRP: $27,978

Forest River No Boundaries

For 2021, NOBO has seen some updates to its line to align the product with current adventure trends. With more than a dozen floorplans, NOBO has offerings for most adventure-seeking families.

Enhancements for '21 include a new outdoor "bush kitchen," additional aluminum framing in the construction process and more dry-camping features — including increased solar capacity, 12-volt refrigerator and Showermiser shower system. The NB19.6 is a couple's floor plan with a front queen murphy bed with couch, sofa slide out, and rear corner kitchen. At 4,200 lbs. dry weight and GVWR of 7,490 pounds, the NB19.6 is towable by a truck or SUV that many customers may already have. At under 25 feet, the standard build MSRP for the NB19.6 is $35,975.

nüCamp TAB Boondock Edition

The TAB Boondock Edition is a teardrop trailer on steroids. Around the exterior, a molded black guard rail with built-in grab handles surrounds the body. In front, aluminum diamond plate is used to make a utility platform and stone guard; out back, a Yakima roof rack is for attaching the toys while a custom aluminum rear cage provides protection while off-road. All this sits atop a heavy-duty pitched axle with 15-inch off-road tires.

The 2,082-pound (dry) Boondocker also features acrylic dual-pane windows, air conditioning and Alde heat and hot water. The Nautilus water management system by B&B Molders has all the utility connections and valves in one convenient spot. A solar package is included to extend the off-grid time as well. MSRP is $31,809.

Jayco Jay Feather Micro

Jayco's new Jay Feather Micro taps into both the demand for off-grid capabilities and the ability to be towed by smaller vehicles. The Micro trailers have floorplans ranging from 13 to 23 feet long and dry weights starting at 1,500 pounds. The light weight of these models is, to some extent, a result of using Azdel composite panels for assembling the box.

The smallest model, the 12SRK, resembles a teardrop camper, featuring a rear-facing outdoor galley with a flat-screen TV, Dometic portable refrigerator and Blackstone griddle. Inside, a futon and some simple cabinetry allow adventurists to sleep up off the ground, while an optional Thule awning is attached to a roof rack for gear. A simple camper, the 12SRK has a 25.5-gallon fresh-water tank and no holding tanks, but there is an optional air conditioner for the cabin.

Like the 166FBS, the larger models have an optional customer value package with an 11-foot-long power patio awning with LED lighting. Standard are exterior speakers with LED effect lighting and an LCI Jack-It bike rack. There's ample storage on the outside, an exterior refrigerator, and black tubular nerf bars guarding the lower edges of the body. Black fender flares further complement the unit's aggressive stance atop Goodyear 16-inch off-road tires. The package rides on a single rubber torsion axle, which is lifted to improve ground clearance.

The 166FBS also features a slideout and all the features expected in a modern RV, including an inside galley, corner bath, front bed and a jackknife sofa. The relatively roomy interior of the 166FBS includes fold-up patent-pending table trays for the two outside seating positions and a well-equipped galley with a surprising amount of prep space and storage. The trailer's rear holds the 6-cubic-foot refrigerator (an 8-cubic-foot, 12-volt model is optional), pantry and corner bath.

166FBS SPECIFICATIONS
Length: 19' 8" • GVWR: 4,995 pounds • Base MSRP: $25,950

SylvanSport GO

The SylvanSport GO camping trailer hauls gear, transports equipment and provides spacious shelter. This ultra-light pop-up camper sleeps four, offering a tent pod, gear deck, equipment rack and storage box. In transit, the 11-foot, 7-inch GO folds down to a small tow-behind trailer — yet campside, it blossoms with a spacious waterproof pop-up tent that deploys and retracts from the hinged case mounted below the equipment rack. The accommodations allow setup for multiple dining and sleeping options, including either oversize twin beds (80 x 34 inches) or one 116-inch-wide king bed.

Built of high-quality, proprietary aluminum extrusions that create a strong, corrosion-free and lightweight frame, the $8,995 MSRP trailer also boasts a gear deck during travel that's able to accommodate up to 960 pounds.

AWOL Outdoors Camp365

In development for nine years, the $23,449 MSRP Camp365 trailer is the "transformer" of adventure trailers. Folded down, the camper stands just 6 feet, 8 inches high and 4 feet wide. Campside, it expands into a 700-cubic-foot weekend cabin of durable Aqualon with a 7-foot, 6-inch ceiling — and offers hardwall R7 insulation, electric air conditioner and electric or propane heater. The interior also features a queen-size folding bed, two-burner pull-out stove, pull-out stainless-steel sink and faucet, 12-volt DC-powered refrigerator/freezer and 12-gallon freshwater and graywater tanks.

If all that wasn't trick enough, the Camp365 is built with a patented expandable axle — on the road, it employs a 6-foot-wide wheel track, but can be adjusted down to just 48 inches when on trails.

Forest River Rockwood Geo Pro & Flagstaff E-Pro

The Geo Pro and Flagstaff E-Pro sit squarely in the adventure trailer category, each having 12 floorplans to choose from, ranging from 11 to 21 feet in length and weighing in with a GVWR range of 1,962 to 4,455 pounds. The Rockwood and Geo are towable by many of today's smaller trucks and SUVs.

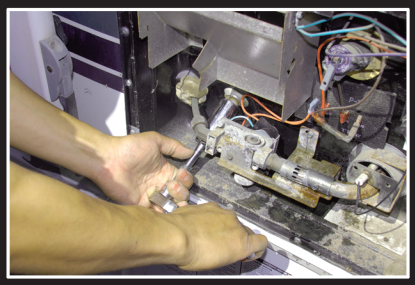
Both lines of travel trailers have received some notable updates for 2021, with the addition of three new floorplans each, including a new toy hauler model and two new slideout configurations. Underneath, Dexter TORFLEX axles have been added as standard with the off-road package. The body is aluminum-framed and laminated with Azdel on the side walls, rear walls, roof and slideout walls, and the aluminum framing now extends to the dinette and bed framing. A 190-watt roof-mounted expandable solar panel system is paired with a 1,000-watt inverter that powers all outlets except the microwave and A/C with 12-volt DC refrigerators.

New for '21 is added technology, including a tire pressure monitor system and LCI One Control app-driven multiplexing system that powers all the lights, awning and slideout.

SPECIFICATIONS
Length: 20' 7.5" • GVWR: 4,200 or 6,000 pounds • Base MSRP: $27,978

RV ENTHUSIAST

NORTH AMERICA'S PREMIER HOW-TO RV RESOURCE



Created by – and for – hands-on RV enthusiasts!

RV Enthusiast magazine was developed to take the mystery out of RV maintenance, repairs and upgrades, as well as providing how-to tips to make RVing better. We get it: Things happen as time and untold miles of bad roads will take their toll on your RV. But we also know that you don't have to be a mechanic to be able to confidently deal with problems that may crop up. All you really need is truly accurate information you can rely on — fully illustrated every step of the way and written in a friendly, conversational manner you can understand.

As this issue shows, each monthly edition of ***RV Enthusiast*** will be filled cover-to-cover with the kind of information and instruction you need to continue to enjoy your RV for years to come. In fact, there are nearly 50 pages of 'how-to' stories in this issue — just imagine the wealth of topics to be covered and the knowledge gained in a year's time!

If you like what you see, don't miss an issue. It's less than $1 a month! Go to our website — www.rventhusiast.com — click the "subscribe" icon risk-free and simply follow the prompts.

Coming in the May issue:

Our next issue will feature just about everything you need to know about towing — whether it's pulling a dinghy behind your motorhome or a fifth-wheel or travel trailer behind your pickup truck. We'll address towing equipment and features, hitches, baseplates, tow bars, tires, truck prep and all the accessories you need to take the pain out of traveling with a vehicle in tow. Available April 24.

graphic courtesy of pch.vector

NEW ! STUFF

One Key For All

BOLT Lock makes it easy to protect your gear with its unique locking system that can protect valuable trailers and gear with its line of lock systems featuring the company's one-key lock technology that works with a vehicle's ignition key. Once the ignition key is inserted into the BOLT Lock cylinder, spring-loaded plate tumblers are moved into alignment, making the cylinder uniquely coded to only that key. BOLT locks feature an automotive-grade lock shutter for protection against weather and debris, and a six-plate tumbler sidebar that prevents picking and bumping, according to the company. BOLT offers receiver locks, a coupler pin lock, an off-vehicle coupler lock for unattended trailers and more.

Bolt Lock and Strattec Security Corp., (844) 972-7547, boltlock.com

Spring Cleaning

Dicor Products, an Airxcel brand, has launched a full line of premium RV exterior cleaning chemicals and tools. Safe to use on a wide range of RV surfaces, Dicor cleaning chemicals are formulated for maximum effectiveness with minimal elbow grease, according to the company. The line includes Exterior Wash, Black Streak Remover, Bug & Tar Remover, Awning Cleaner and Mold & Mildew Remover. The Dicor cleaning care brush line consists of a 3-meter telescopic pole with a standard ¾-inch female garden hose fitting, a roof scrub brush with medium bristles and a five-sided exterior wash brush for gently and safely scrubbing the sides and windows. The exterior wash brush with squeegee, meanwhile, is designed to cut down on drying time.

Dicor Products, (800) 837-2059, dicorproducts.com

No Payne No Gain

Lippert is proud to announce the launch of its new Thomas Payne Premium RV Mattress Collection. The Thomas Payne mattress comes into the market as a quality bedding solution that delivers comfort, coolness, and support, according to the company. It is part of the Thomas Payne furniture line that is known for providing a wide range of stylish, comfortable furniture that meets the needs of RV owners. Featuring a 10-inch dual foam layer, a one-inch top layer infused with cooling gel and a 9-inch comfort base, the mattress offers moisture wicking materials for a comfortable night's sleep. Available in four sizes: Short Queen, Queen, Narrow King, and King for both RV and residential use.

Lippert, (574) 537-8900, store.lci1.com.

Home On The Range

Usually we go RVing to forget about the tethers of society, but sometimes we simply need cell service. The new Winegard RangePro cellular booster is uniquely built for RVers who want the best cell signal for a more reliable stationary or in-motion 4G LTE connection and improved data speeds, according to the company. Cell tower signals are captured by the exterior antenna and transmitted via a low-loss coax cable inside the RV. The signal is then boosted and rebroadcast throughout the vehicle using the indoor booster with attached indoor omnidirectional whip antenna. With a high-gain antenna for maximum signal strength, and direct signal communication to the booster, Winegard claims RangePro users will experience steady cellular connections, even in weak cell service areas.

Winegard Company, (800) 288-8094, winegard.com

graphic courtesy of pch.vector

NEW ! STUFF

A Step in the Right Direction

It wasn't long ago that nearly every RV came with those manually deployed, fold-able steps. They did the job, but they left something to be desired when it came to stability. MORryde changed that with is aptly named Step Above line of entry steps, which make climbing into your RV easier and safer. Now the company has taken the concept one step further (pun absolutely intended) with its new Motion Activated Step Lights. The sleek, low-profile design mounts easily with a magnetic strip and conveniently illuminates the steps with bright LEDs. A daylight sensor extends the life of the included battery pack.

MORryde, (574) 293-1581, morryde.com

Air for Your Spare

We all know it's important to carry a spare tire on your motorhome, truck or trailer — but do you know if it's ready to use? Typically hidden away underneath a vehicle or in the trunk, spare tires are often forgotten, and even if you remember, refilling them can be a pain. With that in mind, Truck System Technologies (TST) recently introduced its new Spare Air Kit, which allows the user to easily check spare tire inflation pressure and add air when necessary. The kit includes 6 feet of hose with attached fittings, mounting brackets and hardware — you can even add a TST TPMS sensor to monitor the spare's pressure in real time.

Truck System Technologies, (770) 889-9102, tsttruck.com

Get a Handle on It

Fiddling with an entry door lock, especially at night, has always been a frustrating experience. Bauer Products makes it much easier with its new NE Bluetooth entry handle, which leverages close-field technology to make it easy to lock or unlock the door using your Android or iOS smart phone. Simply download the app, pair one or more phones and you're living key-free. The app also keeps track of locking/unlocking history and the condition of the four AA lithium batteries used to power the lock. Incorporating bank-grade encryption, according to the company, the handle also features a touch pad, and yes, can still be operated by an old-fashioned key, if necessary.

Bauer Products, (866) 682-2837, bauerproducts.com

Portable Panels

If you'd like to give your batteries a boost but don't necessarily want to install a solar system, Zamp Solar offers a number of solutions with its new Obsidian Series portable solar kits. Featuring the slimmest panels in the company's line, the Obsidian comes in customizable kits ranging from 45 to 200 watts, and you can combine one or more units to scale your off-grid power needs. Regulated kits include the panel(s) 15-foot wire extension(s), 15-amp charge controller, fused alligator battery clamps, 6-foot ATP-SAE and ATP-ATY Y adapter and integrated carrying case. Unregulated systems are also available, as are a range of accessories.

Zamp Solar, (541) 728-0924, zampsolar.com

continued from page 11

The Blackstone grille mounts into the side of the travel trailer in much the same way you would add a hitch. When not in use, the receptable remains covered.

Jayco JayPort Features Blackstone Griddle

The number of trick new accessories found on the latest model-year RVs can be mind-numbing — but when we ran across this one, we had to share it. Buyers of select 2021 Jayco towables will have the ability to add the JayPort, a patent-pending system that converts their exterior into a convenient cookout space utilizing a Blackstone griddle.

Given the exploding popularity of the Blackstone griddle line with RVers, the JayPort should find a ready audience. The system incorporates a 2-inch receiver hitch that fits into a campside receptacle on the Jayco trailer and mounts either a 17-inch single-zone or 22-inch duel-zone Blackstone griddle.

"We worked extensively with Blackstone on a way to offer their griddles in our campers in a way that is unique and functional for our customers," noted Matt Fisher, Jayco director of product development-Jay Flight.

In conjunction with the launch of JayPort, Jayco has also kicked off a series of cooking videos utilizing the Blackstone griddles featuring famed chef Kari Karch. The videos, titled "Cooking with Kari," are available on Jayco's social media channels. For more information, visit https://www.jayco.com/blog/product-features/jayport/.

FMCA Offers Membership Discount

One of the oldest and largest RV clubs in America — the Family Motor Coach Association (FMCA) — is currently offering a discounted enrollment fee of just $60 to welcome new RV owners to its community and introduce them to the support the group provides.

Among the benefits of an FMCA membership are the FMCAssist Medical Emergency and Travel Assistance Program; a tire-purchasing program; group rates on roadside assistance; RV and auto insurance; and discounts on mobile Internet access through Sprint. Then, too, there's the camaraderie that develops among people enjoying the common interest of RV travel — the world's largest nonprofit association for RV owners, FMCA currently has nearly 150,000 active members. FMCA also annually holds several major rallies each year featuring technical seminars, products, new RV displays, games and plenty of fellow members. After a hiatus due to the pandemic, the association recently staged its 102nd International Convention & RV Expo in Perry, Georgia; the 103rd International Convention & RV Expo is slated for July 7-10 in Gillette, Wyoming.

Available for a limited time, the discounted rate is $25 off a regular membership — a 30% savings. For more information, visit http://join.fmca.com/join60-b/.

News & Notes is a compilation of interesting facts garnered from a variety of sources, including the trade publication RVBusiness. To read daily updates on what's happening within the RV industry at large, visit rvbusiness.com.

Advertiser Index

MAKING MEMORIES By Sue Strauss

A Salty Sojourn

A visit to Antelope Island on Utah's Great Salt Lake nets boondockers a date with nature and plenty of solitude

Boondocking is gaining in popularity every day, and there's a little-known camping spot on Antelope Island in Utah that is a must see. This island is one of 17 on the Great Salt Lake, ranging from small to large, in all corners of the lake. In fact, the number of islands actually varies, depending on the elevation of the lake's surface. This area is a closed basin, which means there is no drainage outlet for the lake — yet water depth can vary as much as two feet a year.

Because of this great range of water levels between years, what may be considered an island in a high-water year may be considered a peninsula in another, or an island that appears in a low-water year may be not be visible in a high-water year. Antelope Island is the largest island in the Great Salt Lake and the only island with reservable primitive campsites.

The history of Antelope Island is quite interesting, and signs of early inhabitants can still be seen on the island today. Thousands of years ago, the area's native Ute people inhabited Antelope Island, later followed by settlers from the Mormon Church. Fielding Garr established a ranch on the island in the late 1840s and brought the Mormon church's cattle to the ranch. The ranch later bred horses and became a sheep ranch. Several original buildings of the Fielding Garr Ranch still stand on the island, and visitors can take a self-guided tour of the ranch during daylight hours. There is no charge to tour the ranch, though a donation is requested for the tour guide booklet. It is well worth the stop, and it will take approximately 90 minutes to tour the buildings and the ranch.

Another historic site to visit on the island is the Frary Homestead Interpretive Site. This is the site where George Frary built a home for his family and lived there for 10 years in the 1890s. A short half-mile hike will take you to the original homestead site, and interpretive signs provide a brief history of the area and the family that once lived there. The land passed through several owners until 1981, when the State of Utah purchased it and established Antelope Island State Park.

An easy hike on Antelope Island is the Lady Finger Trail. The short half-mile hike that leads to Bridger Bay requires climbing over some rocks. This trail offers great views of the Great Salt Lake and is a popular place to watch the sunset. Canon EOS Rebel T7i; Canon EF 28-200mm lens; f/7.1; 1/200s.

Wildlife abounds on Antelope Island and offers some great opportunities for photography enthusiasts. A herd of 700-plus American bison roam Antelope Island and can often be seen resting in campsites, crossing the island roads or gathering along the shoreline of the Great Salt Lake. Each October, cowboys on horses will assist park personnel in rounding up Antelope Island's bison and guiding them into corrals. The bison receive vaccinations and health screenings and will either be released back onto the island or later sold at auction. Members of the public can apply to be riders in this bison roundup, and applications are usually taken one month prior to the roundup. The island and campgrounds are open during this annual event, and the public is welcome to view the roundup each year.

American Bison roam freely on Antelope Island. Due to the large population of bison on the island, it's quite common to see these animals along the roads, trails or even in the campgrounds. This bull weighs upwards to 2,000 pounds and can stand 6 feet tall. Canon EOS Rebel T7i; Sigma 150-500mm zoom lens; f/9; 1/640s.

Other wildlife found across the island include pronghorn antelope, bighorn sheep, coyote, red fox, bobcats, mule deer and thousands of raptors, waterfowl and songbirds. I was thrilled to spot a red fox crossing our path as we entered the island, and to find bison resting in the campsite adjacent to ours in Bridger Bay campground. As I hiked and explored the island during our three-day stay, I also captured sightings of pronghorn, coyote, mule deer, burrowing owls, dozens of birds and waterfowl with my digital camera.

Birdwatching is a recreational activity that brings thousands of visitors to Antelope Island. Millions of shorebirds and waterfowl migrate through the Great Salt Lake region each year. Antelope Island has many other types of birds actually living on the island, which makes it a very diverse place to go birding. More than 40 freshwater springs can be found on the island, supporting the millions of birds and other wildlife. The Great Salt Lake is the largest saltwater lake in the western hemisphere and is too saline to support fish life. The lake is known for its brine shrimp and brine flies that feed on the

The Buffalo Point Trail on Antelope Island provides beautiful views of the lake and the campgrounds. Pictured here are some of the 25 primitive sites in Bridger Bay Campground. Sites are relatively spread out, giving people privacy and space. Permanent shade structures are a much-needed and appreciated amenity, as well. Canon EOS Rebel T7i; Canon EF 28-200mm lens; f/9; 1/400s.

algae in the water. It is this high content of shrimp and flies that makes the Great Salt Lake one of the most important avian breeding and migratory staging areas in the U.S. If you are an outdoor photographer or simply a nature lover, Antelope Island is a "must see" stop in your travels.

The historic Fielding Garr Ranch is located on the southeastern portion of Antelope Island and is an easy drive from the campgrounds. Several of the original ranch buildings still remain, including a bunkhouse, spring house, blacksmith shop, milk house and a rock stable structure. Walking tour brochures are available on-site, and you can explore the grounds and tour buildings at your own pace. Canon EOS Rebel T7i; Canon EF 28-200mm lens; f/7.1; 1/160s.

If you are a hiker, there are dozens of trails to follow on the island. AllTrails, a fitness and travel mobile app and website, is a great resource to hikers, mountain bikers and runners. AllTrails lists 13 great hiking trails on this island. The Antelope Island Visitors Center will also provide maps and personnel will recommend trails. In addition to hiking, visitors can swim in the lake, which is actually several times saltier than the ocean, making the water extra buoyant for people to easily float on its surface. The Bridger Bay Day-Use Area is a popular place to spend part or all of a day, to go swimming or simply to enjoy the sandy beach. Be sure to stop at the Island Buffalo Grill and try a buffalo burger or enjoy your own picnic lunch under shaded picnic tables at Bridger Bay Beach.

While we spent three days on Antelope Island, it really was not time enough time to explore all that there was to do at this remote destination. Antelope Island is an amazing outdoor destination for adventurers and our memories of this fascinating island will grow with each return visit. **RVE**

This fancy birdhouse sits outside the Visitor Center on Antelope Island. Birding is a popular activity on this island, where millions of birds flock to each year. The Great Salt Lake can be seen in the distance. Apple iPhone XS Max; f/1.8; 1/502s.

If You Go

I discovered this out-of-the-way camping spot while searching for wildlife or birding spots in the book National Geographic Guide to Birding Hot Spots of the United States by Mel White and Paul Lehman. This book is an excellent resource for discovering out-of-the-way places to see birds and perhaps other wildlife to photograph, or to simply observe. I knew our travels in the Fall of 2020 were taking us through the state of Utah, and the chapter in this guidebook highlighted Antelope Island. I also picked up a brochure entitled Scenic Byways – Utah, from the Utah Office of Tourism. This brochure lists the Legacy Parkway Scenic Byway, traveling on Highway 67 from Farmington to North Salt Lake (I-215). Driving this route will take you from pastoral landscape and national migratory bird flyway along the shores of the Great Salt Lake to Antelope Island.

Antelope Island is located north of Salt Lake City. From Interstate 15, you will take Exit 332 (Antelope Drive) and head west for approximately 15 miles to the causeway, which takes you out to Antelope Island. There is a ranger station at the entrance to the causeway, where you will either pay a $10 fee per car or check-in for your campground reservation. The causeway is 7 miles in length and is only open between the hours of 9a.m. - 6p.m. (hours vary seasonally).

After doing more research on Antelope Island, I was surprised to discover that there are four campgrounds on the island: Ladyfinger Campground is tent camping only; Lakeside Campsite provides group camping only and is a popular area for family reunions and large groups; White Rock Bay Campground (20 sites) is the smaller of the two campgrounds that can accommodate self-contained RV's; and Bridger Bay Campground offers 26 primitive sites. No shade is available at Bridger Bay, but sites do include picnic tables and fire pits/grills. Campsites are half-circle pull-throughs up to 90 feet long and can accommodate RVs up to 45 feet.

No amenities are offered at any of the campgrounds on Antelope Island. However, water is available at Bridger Bay Beach. A dump station is also available at the Visitor Center. Generators are allowed to be run during daytime hours and fires are allowed in designated fire pits only. Site fees range from $20/night at Bridger Bay Campground to $40/night at White Rock Bay Campground. The causeway fee of $10 is included in the campsite reservation, which can be made up to four months in advance by going to https://utahstateparks.reserveamerica.com.

Simply Better

Truma systems are Simply Better.

Whether it's on-demand hot water, near silent heating systems, or portable fridge/freezers, ensure your outdoor adventures are Simply Better with Truma On Board.

www.truma.net

truma

More comfort on the move

SEISMIC

FEATURING The Patented 4113 Model

Jayco

JAYCOMMAND®

Control Jayco RVs from your smartphone

The JAYCOMMAND® system puts RVers in full control of their unit. The system was custom-built by our product development teams along with various supplier partners (depending on the model), so that owners can monitor and control key RV operations from a phone or a tablet.

Generations of family fun.

jayco.com/products/toy-haulers/2021-seismic