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Jan-March 2024

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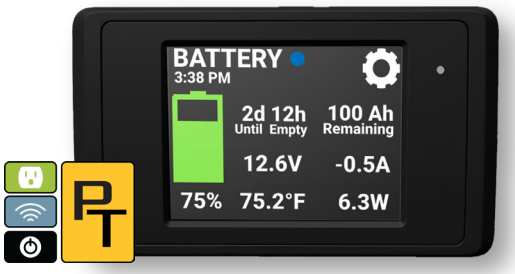

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January - March 2024 Volume 4, Number 1

INSIDE

Furnace on the Fritz? - Keeping an eye on internal components and knowing what to look for when your RV furnace fails or becomes erratic can make a big difference when it comes to enjoying the interior space in comfort. Here are the top 10 reasons why furnaces fail — and how to rectify them.

Power to the People - There's no denying the appeal of camping off-grid — until, that is, you wake up to no power. Our first in a series of boondocking articles takes a look at new developments in batteries and battery storage systems that make it possible to veer off-road with assurance.

Trap Door - There's probably nothing less desirable than working on a dump valve that has failed while on the road — especially if the holding tank is full. Adding an access panel in the corrugated plastic belly pan eliminates the frustration of making nasty repairs when in the field.

Power Trip - It doesn't matter if you camp with an entry-level travel trailer or luxury fifth wheel — there will come a time when you're stymied by a lack of a readily accessible 120-volt AC outlet where you want it. Here's how we added power to the galley — on a separate circuit — in a fifth wheel.

DEPARTMENTS

One of the most important tools at your disposal when maintaining, repairing or upgrading your RV isn't found in that rollaway chest in your garage — it's that smart phone in your pocket. Here's an old gearhead hack that works: Take photos before (and during) the process.

Winnebago ups the ante when it comes to "smart" RVs with its new Winnebago Connect system, while TAXA Outdoors and Goal Zero partner up on an adventure trailer with a comprehensive energy management system, Brinkely RV enters the travel trailer space — and more.

It's never good to smell propane in and around your RV…but neither is it any fun to suffer a front-tire blowout in a motorhome or confront a roof membrane that's seen better days. These and other questions are posed by readers; Tech Director Bill Gehr provides solutions.

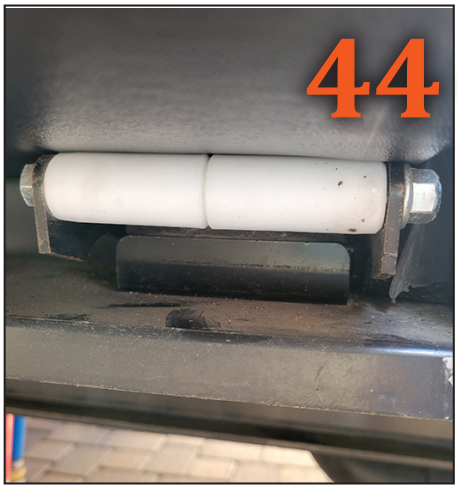
On The Cover

RVE Technical Director Bill Gehr shows how under-floor wiring and plumbing can be easily addressed after crafting a belly pan access panel.

INSIDE

Special Section! Weekend Projects

Freeze Warning



On the Skids

Have Sili(gun), Will Travel

Water World

Don't Bug Me

On the Hook

EDITORIAL STAFF

PUBLISHER - BOB LIVINGSTON
(805) 320-6909
BLIVINGSTON@RVEMEDIAGROUP.COM

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

TECHNICAL DIRECTOR
BILL GEHR
(805) 340-5015
BGEHR@RVEMEDIAGROUP.COM

ART DIRECTOR - MIKE ACCUARDI
MACCUARDI@RVEMEDIAGROUP.COM

BUSINESS OFFICE
RV ENTHUSIAST/
RVE MEDIA GROUP INC.
26362 DOUGLAS AVE.,ELKHART, IN 46514

ADVERTISING
ADVERTISING DIRECTOR
SUE SEIDLITZ
(805) 816-8759
SSEIDLITZ@RVEMEDIAGROUP.COM

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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 Technical Director Bill Gehr 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.

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SEMA CERTIFIED EMISSIONS

On the Road

By Bruce Hampson

One of Your Most Valuable Tools isn't in that Craftsman Rollaway Chest in the Garage — it's in Your Pocket.

When I first started rebuilding and modifying cars, there was no Internet. In some ways, that was a blessing. There's little worse today than being stymied by a problem halfway through a repair, logging onto your favorite forum to explain your conundrum and getting a hundred or so replies — some of which tend to either back up one of a half-dozen or so competing "fixes," while others usually include a cadre of members practicing a style of sophomoric humor most of us thankfully left in the fifth grade.

No, "back in the day" we developed our own information sources. Among my most trusted "consultants" were the guys across the counter at the local speed shop, who were only too happy to collect my weekly paycheck and dispense wisdom with my change. I was also fortunate enough to make friends with a group of guys who hung around at a machine shop in a neighboring city. The owner accepted me into the group, which meant that not only did he become a source of information but made everything in the shop available — from the typical array of engine-rebuilding machinery to a table grinder for resurfacing flywheels and a bead blaster for stripping parts. For free.

That said, most of my modifications were done in the driveway at home. Alone. Because of that, I used a time-honored hack that performed flawlessly: I took photos of what I was doing during the disassembly process in order to have some sort of guide to help during reassembly. No, we didn't have smartphones "way back when" — but what we did have were cheap disposable cameras and 1-hour photo kiosks in the parking lot of every neighborhood mall.

I was reminded of this some time ago while reading the "RVelectricity by Mike Sokol" forum on FaceBook. Unlike many groups found on social media, this is one of the most technically accurate forums on the world wide web. Sokol is an all-around electric guru and one of the most respected engineers in his field.

In his post, Mike included this nugget: "You should never attempt to commit any wiring connections to memory. In your pocket you probably have one of the greatest inventions of all times for DIY fixers: A cell phone with a camera.

"So, before you take anything apart, take plenty of pictures of it from every angle possible. And if all the wires are the same color, get a roll of yellow or white electrical tape and a Sharpie marker. Then mark each pair of connections as 1, 2, 3 or A, B, C, etc. Plus, again, take plenty of pictures! No matter how many times I do something, I still try to take pictures to help me reassemble whatever it is."

It's great advice — and it was nice to know I'm in good company. Since Mike was writing on his RVelectricity forum, he limited his comments to that segment — but this is something that can (and should) be done by every back yard wrench whenever attempting a parts repair, swap or upgrade. Tearing into your air-conditioning unit? Take photos along the way. Replacing your furnace? Ditto. Heck, for that matter, take pics for something as easy as replacing the plumbing beneath your kitchen sink. Why? Because stuff happens. Having a photo you can refer to of the stock factory setup can prevent a whole host of potential problems — and keep you from taking shortcuts.

It's just good common sense to have something to fall back on and refer to — even on those all-too-rare occasions when you receive components with installation diagrams well-written instructions. A diagram is nice to fall back onto — but a photo lets you see everything as it should be.

Granted, some things may not need the photographic backup — if, for example, you're replacing brake pads on your trailer, you can just look at one of the other assemblies to guide you. For the most part, though, taking photos along the way will undoubtably ease your frustration level — to say nothing of eliminating all those "extra" parts that always seem to be part and parcel to many repairs. Heck, I've been known to take photos of every phase of a teardown as added insurance so I don't "forget" something when it comes time to put it all back together again. And that holds doubly true when there's a time gap between disassembly and reassembly.

The onrush of technology means that cameras are omnipresent today. They allow government employees to watch for scofflaws, while many municipalities hook them up to light poles and use them as a deterrent to traffic disobedience. (Don't get me started on that one.) Closer to home, it's not unusual today to see homeowners and even RVers rig their property front and back with the watchful eyes of security cameras. And for travelers, cameras have made backing up a trailer or motorhome infinitely easier, while dashcams have enabled motorists of all vehicles to capture problems and accidents while on the road.

So, use the technology to your advantage. As Mike and countless other veteran gearheads know full well, one of your most valuable tools isn't in that Craftsman rollaway chest in the garage — it's in your pocket. RVE

On a separate note: The New Year hasn't been kind to *RV Enthusiast* staffers, several of whom had to work their way through illnesses. That resulted in our combining the first three months into this one issue. Rest assured *RVE* subscribers will receive six full issues this year.

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Winnebago Intros 'World-Class' Smart RV System

RV manufacturers have been working for years on ways to incorporate an ever-greater array of residential features into their products — and this extends to electronics, as well. At the recent Florida RV SuperShow, Winnebago Industries introduced what may be the "smartest" RV yet: the Winnebago Connect.

In development for two years, the Connect system — which debuted on a View 24T Class C motorhome, is, according to the company, an "intelligent RV system empowered with intuitive control that proactively manages on-board systems according to user preferences."

The Connect development team puts it another way, calling it a "world-class experience that's easy to use and intuitive."

While other RV platforms simply monitor certain systems and controls them via a mobile app, Winnebago Connect intuitively controls those systems according to pre-determined preferences as well as analysis of the user experience.

For example, Connect doesn't just tell owners how much power is left in the batteries, it will also tell them, based on their typical usage, how many days they have left before they run out of juice. And if the owner has the right setting engaged, Connect will automatically turn on and switch over to the generator if the batteries run out of power.

Another example is Connect might alert the owner that the black tank is 83% full – notice the detailed measurement – and then add that, based on typical usage, there's another 36 hours before it reaches capacity.

In addition, Connect integrates seamlessly with the Winnebago app to make RV operations and maintenance more convenient than ever. Like a proactive assistant, it also keeps you in the know with smart messaging and timely alerts. Furthermore, Connect can perform a full system diagnostic scan and its remote diagnostics capability can help expedite any needed service work, while over-the-air software upgrades automatically enhances the RV systems as updates become available.

Also, Connect's PetMinder feature means the pets can be taken care of in climate-controlled comfort while their owners are off taking a hike. And that's only the highlights. Indeed, a full run-down of everything the Connect can do would fill a book. The system will soon be finding its way across a number of Winnebago models.

Custom Mattress Factory Launches RV Mattress Line

Admittedly, we don't usually feature new products in News & Notes — but we're also cognizant of the fact that the mattresses that come stock in many RVs are a literal sore point among campers. Now, there's a new choice when it comes to alleviating those painful mornings. Custom Mattress Factory has announced its latest line of mattresses — designed to bring the continued comfort of home to those seeking adventure on the road with a full line of Certi-PUR RV mattresses.

What Makes a Certi-PUR Mattress certified? They contain no formaldehyde or ozone depleters, are manufactured without phthalates or mercury, lead, or any other heavy metal, maintain low volatile organic compound (VOC) emissions for indoor air quality (with less than 0.5 parts per million) and are screened for relevant chemicals, including fire retardants (which are classified as carcinogens, mutagens, or reproductive toxins and are harmful to human health). We aren't saying your mattress has any of these things in it — Custom Mattress Factory is saying theirs do not.

Custom Mattress Factory also offers a complete line of custom bedding to accommodate all RV mattress types — and can create custom-sized mattresses meeting exact width, length and height required to fit each space perfectly and can also design round corners, cut corners, and notched corners, as well as hinged mattresses to create total flexibility. For more information, visit Custom Mattress Factory.

TAXA, Goal Zero Collaborate on Off-Grid Prototype

There's no denying that the RV industry is affected by things going on in the world at large. One example of this was on display at January's Consumer Electronics Show in Las Vegas, where —TAXA Outdoors, an innovative outdoor brand known for lightweight, garageable, off-grid adventure vehicles, and Goal Zero, an industry leader in smart, portable power, partnered on the development of a custom-built Mantis Adventure Vehicle outfitted with Goal Zero's Escape Ecosystem and featuring the powerful Yeti PRO 4000 Portable Power Station. This integration marks a significant leap forward in off-grid adventure technology, providing adventurers with a comprehensive vehicle energy management system.

While the unit on display was essentially a prototype, "the solution we are showing is for right now and is right-now-practical," said Garrett Finney, TAXA Outdoors founder and chief design officer.

Built around the angular, NASA-inspired Mantis adventure trailer, the unit featured Goal Zero's state-of-the-art Boulder 100i solar panels, Yeti PRO 4000 Power Station and Expansion Tank, Escape smart control display and accessories, ensuring a seamless, sustainable power supply for extended off-grid journeys.

The Yeti PRO 4000 Portable Power Station offers adventurers a reliable and powerful source of clean, renewable energy. With this portable power station, adventurers can enjoy comforts such as air conditioning, lighting, and electronics even in the remotest locations. The Yeti PRO 4000 comes with 3,600-watt power out and 7,200 watt surge, enabling it to run almost any appliance. When you're ready to charge up, the Yeti PRO 4000 has 3,000-watt solar input to charge from 0% to 80% in under 90 minutes when you're off grid.

325.5M Visit National Parks in 2023

Solar viewing glasses and scopes made for safe viewing of the annular eclipse at Glen Canyon National Recreation Area in October 2023. Photo courtesy NPS

While overall visitation continues to grow across America's national parks, visitors are increasingly discovering opportunities in less well-known parks and during park off-seasons. In fact, the National Park Service announced

today (Feb. 23) that 400 national parks reported a total of 325.5 million recreation visits in 2023 — an increase of 13 million or 4% over 2022.

In addition to the continued growth in overall numbers, NPS said in a release that data shows that visitation is increasing in the more traditional off-seasons at many parks, with more visits in the spring and fall than seen in years past. And 20 parks — many of them less well-known — broke visitation records in 2023.

Visitation figures and trends guide how the National Park Service manages parks to ensure the best experience possible for park visitors. The Visitation Statistics Dashboard on NPS.gov provides recreational visit statistics for every park in the U.S. for 2023 and also for previous years, dating back to 1979 for some parks.

Go RVing Announces a Dozen 'Experiential Events' for 2024

Do you know someone interested in the RV lifestyle you're always talking about? Are you searching for more information? One way for everyone to pick up a fast education is courtesy of Go RVing's "experiential" events — displays at an array of programs as diverse as music festivals And state fairs intended to introduce new enthusiasts to RVing.

This year, Go RVing will be participating in 12 events coast-to-coast, including:

•Guardians of Freedom (Wichita Falls, TX): April 27-28, 2024

•Lovin' Life Music Festival (Charlotte, NC): May 3-5, 2024

•Cinco De Mayo Omaha (Omaha, NE): May 10-12, 2024

•Fiesta Hermosa – SS (Los Angeles, CA): May 25-27, 2024

•Carolina Country (Myrtle Beach, SC): June 6-9, 2024

•National Cherry Festival (Traverse City, MI): June 29-July 2, 2024

•American Century Championship (Lake Tahoe, NV): July 11-14, 2024

•Yarmouth Clam Festival (Yarmouth, ME): July 19-21, 2024

•Minnesota State Fair (1st weekend) (Saint Paul, MN): August 22-25, 2024

•Santa Cali-Gon Days (Independence, MO): August 30-September 2, 2024

•Salmon Days (Issaquah, WA): October 5-6, 2024

•Go Outside Festival (Roanoke, VA): October 18-20, 2024

Private Camping Properties Adding Campsites

We all are painfully aware of the dearth of good campsites — especially on popular holiday weekends. Fortunately, The Dyrt — the No. 1 app for camping availability, photos and reviews — has found that 50% of private camping properties added campsites in 2023 in response to continued demand from the booming camping industry. These statistics are from the newly released 2024 Camping Report presented by The All-New Toyota Tacoma, the most in-depth and comprehensive look at the camping industry to date.

Property managers across all 50 states were surveyed to gather information for the report. The addition of new campsites was spurred in part by results from the previous year's report, when 58.4% of campers reported difficulty booking a site because a campground was sold out. That number decreased to 45.5% last year.

More than a third (34.7%) of the properties surveyed expanded an existing camping type in 2023. The top two types for expansion were RV sites at 26.2% and glamping at 22.1%. Also, 46.9% of properties added an entirely new type of campsite, with glamping leading the way at 10%.

New camping accommodations arrive at Emberglow Outdoor Resort in North Carolina. Photo courtesy of The Dyrt camper Michaela C.

Type 2 Campers Unveils VW-Styled Model T2.3

Looking for a compact new travel trailer with a whole lot of personality? Woodburn, Oregon-based Type 2 Campers has launched its new Model T2.3 camper – the only RV that blends the nostalgic appeal of Volkswagen camper vans with the robust standards of automotive design. According to the company, its release marks a new chapter in camper innovation, offering a unique combination of durability, style, longevity and functionality.

The new Model T2.3 camper is engineered with automotive-grade stamped steel panels and weighs under 1,000 pounds. The steel body also ensures unmatched road durability, elevates safety and lengthens the product lifecycle. Plus, the Model T2.3 camper can be towed by practically any car with a standard hitch, including EVs. It is 9.6 feet long and provides more than 6 feet of head room while the pop-up roof is extended. In the lowered roof position, the Model T2.3 can be stored comfortably inside a standard garage.

As VW aficionados may recognize, the T2.3 name is a tribute to VW's iconic heritage, where the VW Beetle was referred to as "Type 1" post-World War II, and the subsequent bus in 1948 was named "Type 2". The ".3" refers to the three windows on the sides of the campers.The T2.3 campers are now available exclusively at www.type2campers.com in five color options and three distinct packages: Sleeper, Sleeper Plus and Kitchenette.

Brinkley RV Debuts 'Model Z Air' Travel Trailer

at every wheel location.

About the only option on this luxury unit, which has an MSRP of about $83,000, are dual-pane windows. For more information, visit brinkleyrv.com/rvs/travel-trailers/model-z-air/.

While Brinkley RV has only been around for about 1 ½ years, it's made quite an impact with its well-designed and quality-built fifth wheels. Not surprisingly, the company opted to bring its style and craftsmanship to the travel trailer market, debuting the new Model Z air in February.

The new brand — its first model is the 295 — incorporates many of Brinkley's signature elements including CraftSense wood trim construction, dovetail drawer joints, flush-floor slides with through-frame slideout mechanisms, Euro frameless square windows with integrated window screens and insulated blackout blinds and an automotive-grade sealant package.

Items unique to the Z Air line include a composite floor atop a drop-frame chassis featuring more than 100 cubic feet of exterior storage, one-touch leveling system, 5,600-pound-rated axles, and E-rated Goodyear tires riding on 16-inch custom aluminum wheels.

Other Z Air highlights include solid-surface counters, 18,000-Btu variable-speed main air-conditioner and a 13,500-Btu second A/C unit, tankless on-demand water heater, heated enclosed underbelly with electric waste valves, custom LP box with battery storage, premium utility center with retractable 65-foot water hose, industry-first brass plumbing connections and an industry-first low-maintenance roof that offers a 370-watt solar panel and is pre-wired for another panel. Down below, the 34-foot, 9-inch, 11,495-pound GVWR model 295 utilizes Lippert Road Armor Equalizers and shock absorbers

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A Jayco Pinnacle fifth wheel with Overlander EXT solar package.

Making the Most of RV Solar Power

To say that boondocking — camping off-grid — is popular today would be an understatement, and for increasing numbers of RV enthusiasts looking for experiences well away from traditional campgrounds, there's no better way to maintain essential RV power while away from hookups than with a good self-contained power system. That said, the freedom made possible by solar power is only as good as your panel(s) and battery bank, and at Jayco we now offer every new model with solar as either standard or optional equipment.

With four packages to choose from, we've created systems to meet the power requirement levels of virtually all RVers looking for their boondocking escape. Carrying our recognizable Overlander monicker, our packages stand against competitors with safety features like DC-to-DC power chargers, solar controllers and much more. These are standards that you won't find anywhere else — and in addition to our safety feature, you can pair your setup with a generator.

Campers can now add one of our Overlander Packages to almost any of Jayco's towable products — from luxury fifth wheels to single-axle travel trailers, there is now a solar package option for your Jayco trailer. It's time for you to take charge of your next adventure.

Here's a quick look at each package. For more information visit jayco.com/solar/.

Overlander EXT

Gear up for the ultimate off-the-grid RV setup with our Overlander EXT package. Order your luxury fifth wheel fully loaded with six 200-watt solar panels paired with six self-heated 100AH lithium batteries. With the added features of soft start power saver A/C in the living room and 12-volt 13,500-Btu bedroom A/C, you will be sure to enjoy hours of energy without the worries of running out of power. Other system components include a 100-amp MPPT solar controller, 3,000-watt split-phase inverter charger, DC-to-DC power charger, battery monitor and energy management system (EMS).

Available on: 2024 North Point, Pinnacle & Seismic Luxury Series

Overlander 4

With features like the DC-to-DC power charger, the Overlander 4 Solar Package allows you to have a charge once you arrive at your destination without worrying about your batteries overheating. With our solar package features, you can now charge while hooked up, manage and regulate energy going into your batteries with the added benefit of being able to add a generator to your self-sustaining setup. The package includes four 200-watt solar panels, two 100AH lithium self-heated batteries, 60-amp MPPT solar controller, 3,000-watt split-phase inverter charger, DC-to-DC power converter, soft start power saver bedroom and living room 15,000-Btu A/C with heat pump (one system on Eagle products), battery monitor and EMS.

2024 Jayco Eagle FW

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Solar Tax Credit

Did you know that the U.S. Government has extended the Residential Renewable Energy Tax Credit to the end of 2034? If you own an RV you could qualify for the credit, giving you back up to 30% of the cost of a complete solar package or most additions to your current system that have been made in the past five years. A tax credit is a dollar-for-dollar reduction in the amount of income tax you would otherwise owe. There are no income limits on the solar tax credit, so all individual taxpayers are eligible to claim the credit on qualifying solar energy equipment investments within the United States.

To learn more visit: energy.gov/eere/solar/homeowners-guide-federal-tax-credit-solar-photovoltaics

Note: This is for informational purposes only and should not be relied on as a source for tax, legal or accounting advice. The IRS has additional resources to help determine eligibility. Always consult your tax or legal professional and refer to your RVs owner's manual and warranty for further information.

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- Plywood construction: Floor, Roof, Bed and Bunk Base
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- Linoleum throughout - including slide floors

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Nervous About Blowouts

I recently had a front-tire blowout on my 2007 Winnebago Journey. Yes, it was a bit scary, especially for my wife as it was on the passenger side. Somebody suggested that I install Tyron safety bands in the front tires to prevent future scary moments. Do they work as well as they claim? More importantly, are they worth the money?

— Dean Capo

The Tyron safety bands (www.tyron-usa.com) really do improve the safety in the event of a front-tire blow out. They are not cheap, but since they only go on the steering axle, you're just talking about two wheels. Blowouts can affect steering, braking and traction, as well as handling. With a heavy motorhome, it's not uncommon to experience rapid deflation of the tire, which can send the motorhome off the road.

Tyron safety bands are installed in the center well of each wheel, which prevents the tire bead from coming off the wheel during a blowout or deflation. When the tire comes off the wheel, handling diminishes — and if the tire comes apart, you'll be looking at quite a bit of collateral damage to the wheel well and other nearby areas, like the fuel filler and other trim.

Roof Membrane is in Sorry State

I own a 2006 Hitchhiker and the rubber roof has pretty much seen better days. After calling a couple of local RV repair outfits, the price seems to be kind of up-and-down and nobody seems to agree on which type of rubber roof material to use. I want to keep the fifth wheel for several more years and would like to have a quality install. Any suggestions?

—Jim Anderson

Jim, I can relate to what you're going through. The materials and price can differ quite a bit. There are three basic choices — EPDM, PVC and TPO — and they all vary in price. I prefer the TPO because it won't oxidize as easily as the EPDM, which came on your rig. TPO will not bleed black stains as readily and, more importantly, it is more tear-resistant than the others. The prep and process to lay down a new roof is labor-intensive and is quite extensive, especially considering the the labor rates nowadays. It's also important that the installer use the proper glue and self-leveling sealant around the vents, seams and other accessories on the roof.

You should also consider replacing the roof with one that is more durable and likely be the last one you'll ever have to install. There are a few companies competing in this space, like RV Armor (rv-armor.com), that offer complete renovation and lay down material that offers superior service.

Boondocking Batteries

Bill, my wife and I have decided to do a lot more boondocking. While looking on the Internet I have noticed that a lot of people are switching over to lithium batteries. I also saw that they are rather expensive and I've heard bits and pieces of having to change the charging system to accommodate a lithium bat-

teries. What are your thoughts on this changeover?

—Jason Siblie

Although the price of lithium iron phosphate batteries has come down considerably, they are still expensive. If you amortize the cost over a longer period of time, however, the cost can be justified — and the performance is much better. Most lithium batteries are good for at least 10 years. After 10 years of use/charging cycles, there is still roughly about 75% of the battery capacity remaining. The real bonus, though, is the ability to discharge almost completely while retaining the necessary voltage to operate your appliances and accessories. Open (flooded) cell and most AGM batteries should only be discharged to 50% before recharging. Lithium units are capable of handling several thousand more charging cycles than other batteries.

Lithium batteries charge at a different rate, so you may need to replace the power converter; most people looking to boondock will install an inverter/charger that can handle the lithium batteries. If you already have solar panels, make sure the charge controller can accommodate lithium batteries. If you do not have solar and you're going to add a system, you'll need roughly 200 watts per battery to be minimally effective. Of course, the more wattage the faster the batteries are going to charge — and this also will be more effective on cloudy or rainy days.

As far as safety goes, all lithium batteries come with a battery management system (BMS), which safely regulates discharge and conditioning. With a good solar system and lithium batteries, you will enjoy your boondocking far more than if you were just depending on a generator.

If price is a concern, consider the ODYSSEY line of absorbed glass mat (AGM) batteries. By using patented Thin Plate Pure Lead (TPPL) technology, the company is able to fit more plates inside the case — and the added surface area creates more power and ample cranking power even at very low Depth of Discharge (DOD) situations (up to 400 cycles at 80% DOD). According to ODYSSEY, the batteries deliver twice the overall power and three times the life of conventional flooded lead acid batteries. They are also extremely temperature-tolerant (with an operating range from -40°F (-40°C) to 140°F (60°C).

Smelling a Propane Odor

I've been smelling propane in my 1997 Pace Arrow 34-foot motorhome for several months and nobody has really been able to track it down. Finally, a friend of mine and I thoroughly went through every fitting and gas line that we could find and tested them with the appropriate leak-detector solution. After several hours, we narrowed it down to somewhere around the frame-mounted propane tank. After testing the regulator where it goes into the valve, the hoses and everything else that we could find, we finally discovered it was leaking around the packing nut on the shut-off valve. We tightened the packing nut carefully as to not strip it, but we still have a small leak. Are there replacement packing parts available for this? If so, where could I purchase them?

—Gerard Daniels

Gerard, this is a great question. It's pretty rare that you see one of the valves leaking around the packing nut, but it does happen from time to time. No, there are no packing nut replacements available that I know of — and more importantly, I would not suggest trying to repair a gas valve because you can make things worse. My suggestion is to replace the valve, which should be done by a competent technician certified to work on LP-gas systems.

While you're at it, take the time to check the propane regulator — it should be replaced every five years, whether it looks good or not, for safety's sake. Pay close attention to the vent on the regulator; the newer two-stage regulators have side and bottom vents, so be sure that you get the correct one. While you're changing the regulator, carefully inspect the neoprene hose that runs from the regulator to the fixed gas pipe attached to the motorhome. Be sure to check all fittings that been changed with your leak detector before calling it "good." And to be even safer, have a technician perform a LP-gas leak-down test, which should be done every year or anytime the system has been opened. RVE

Bill Gehr

Bill started his 50-year career in the RV industry when he went to work for an Airstream dealership. After the gas shortages in the 1970s, Bill decided to start his own business and opened up Bill's RV Service in Ventura, California. After several years in business, he met Bob Livingston, and together they worked on hundreds of technical editorial projects at his shop while becoming great friends. Bill eventually joined Bob on the TV show "RVtoday," filming a number of hands-on projects. After retiring, Bill headed out full-time in his fifth wheel and toured 39 states while writing technical articles for *Trailer Life* and *MotorHome* magazines. He now is Technical Director for *RV Enthusiast*. RVE

Furnace on the FRITZ?

Furnace models with an outside access door are much easier to inspect and service. When it comes to blowing out debris, compressed air is your friend.

Understanding the top 10 reasons why furnaces fail — and how to rectify them — will help keep your interior toasty warm during colder weather

By Bill Gehr / Photos by author and Bob Livingston

Winter can be a special season to travel in an RV — and when the temperature drops, modern comfort heating systems will keep the interior cozy. Granted, there are a number of ways to warm up the interior, but most RVers rely on their LP-gas furnaces. Everything is copesetic when they work, but when something goes awry, it can be a challenge to keep occupants comfortable inside the RV. That's why it's important to have at least a basic understanding of what can go wrong and how to mitigate the situation — even when on the road, far from service centers.

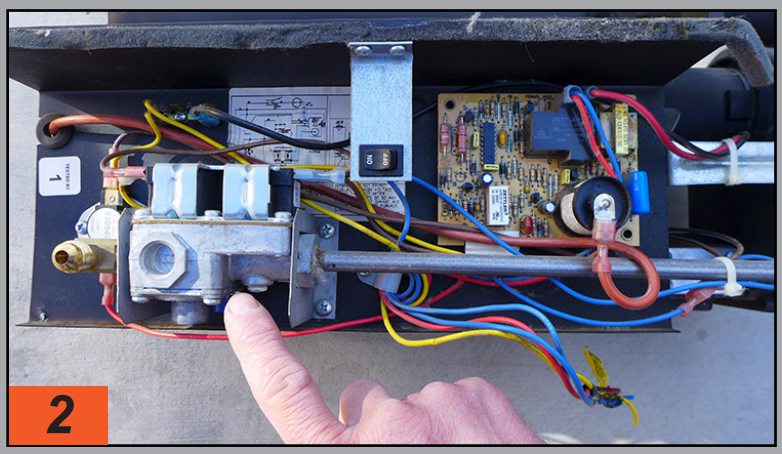
It's not possible to have an effective HVAC system without a source of heat. Murphy's Law suggests that a furnace will only fail when it's needed the most. Keeping an eye on internal components and knowing what to look for when a furnace fails — or becomes erratic — can make a big difference in whether you'll be shivering inside a blanket or enjoying the interior space in comfort. The following applies to typical furnaces found in RVs. (Hydronic and Truma models are not covered here.)

1 LP-gas Pressure

Inadequate LP-gas pressure is one of the more common maladies affecting furnace performance. Pressure should be checked if you suspect a problem with ignition; a dial manometer is the most convenient tool for checking LP-gas pressure — and regulator integrity.

Inadequate gas pressure will cause short cycling or a faulty ignition. Test the system for proper LP-gas pressure using a manometer (most people use a dial manometer), which should be 11 inches water column with all the appliances off. While testing the gas pressure, start the furnace ignition procedure to verify that the pressure does not completely drop out, which will indicate that the pressure regulator is defective and needs to be replaced. It's a good idea to replace the regulator every five years, regardless of whether or not it's working.

If you find yourself far from a service center and do not have access to a manometer, a quick way of checking for a drop in gas pressure is to ignite the burners on your stove and turn the furnace on; if the burner flames drop considerably in size or completely go out, the pressure regulator is likely defective.



This is a typical gas valve used in most older furnaces, especially Suburban models. There is a tap at the bottom of the valve allowing you to diagnose low pressure problems with a manometer.

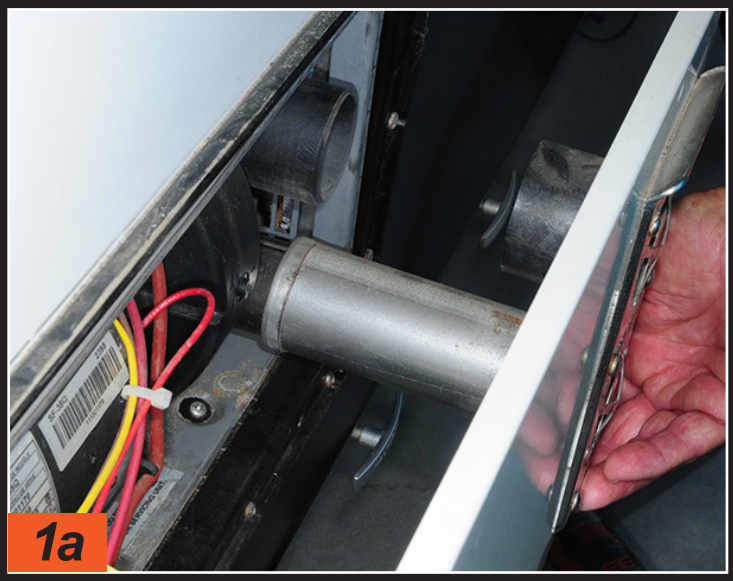
2 Home Sweet Home — for Bugs

The exterior panel on this Suburban furnace can be removed easily, providing access to the components.

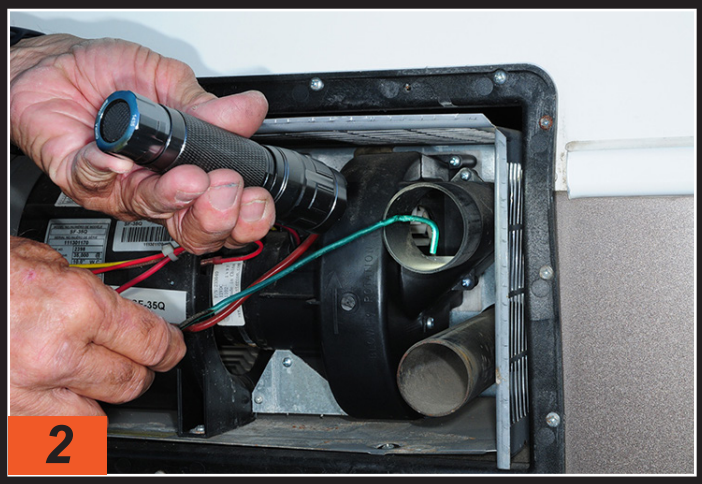
Mud daubers love the smell of propane and will nest in the intake or discharge pipes, creating a blockage. (Of course, debris can also cause a similar problem.) Using a bright flashlight, look into both pipes to detect any blockage. If the blockage is deep into the system — normally a problem caused by a mud dauber nest attached a blower wheel — you will not be able to see an obstruction from the outside. If you suspect there is a mud dauber nest inside the blower wheel, it will be nec-

essary to remove the furnace and dismantle the blower assembly.

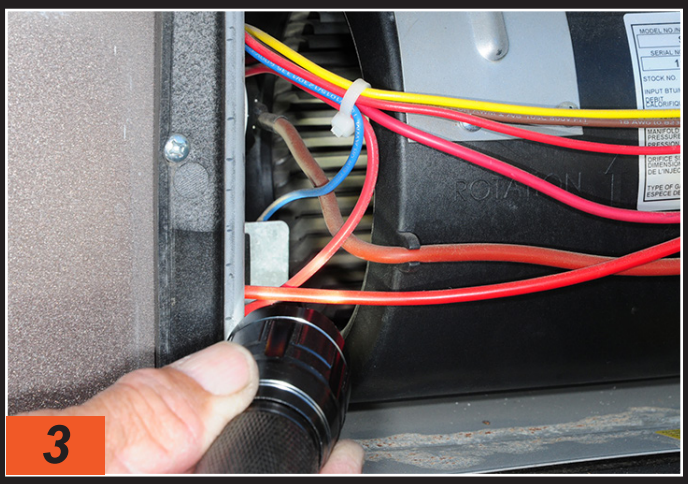
Another possible blockage could be traced to bug screens attached to the outside of the furnace at the intake and discharge ports. Manufacturers do not recommend this as it can impede air intake and discharge if the screens are allowed to plug up. If you insist on using these screens, make it a point to inspect the surface for blockage on a regular basis.



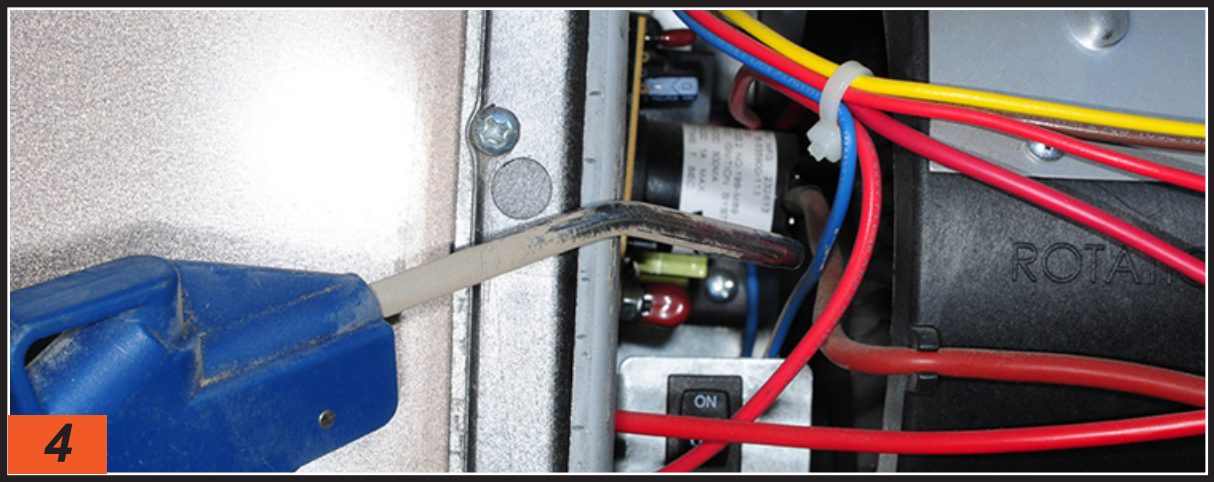
Carefully pull the access panel away from the sidewall, exposing the intake and exhaust tubes. Mud daubers love the smell of LP-gas and will hang out in the intake and exhaust tubes, restricting airflow, which leads to performance issues and possible furnace failure.



Use a bright flashlight to inspect the intake and exhaust tubes for insects and other debris. These obstructions can be cleared with a wire hanger after bending a makeshift hook in the end.



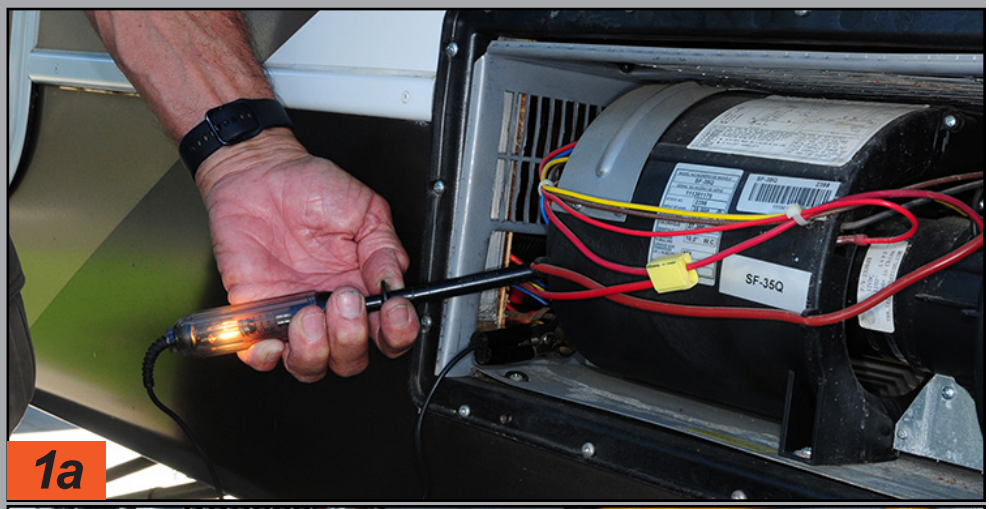
A flashlight can also be used to inspect a portion of the fan, which can be bombarded by mud daubers and other debris.



An air gun with a long nozzle can make short work of clearing debris and dust from most of the furnace components, including the circuit board. Cleaning is more difficult in furnaces without an outside access panel.

3 Oh No, the Furnace Won't Come On

The obvious first check is for a blown fuse. If it's good, make sure you have adequate voltage at the fuse and the furnace. Voltage can be verified using a multimeter and probes. There should be no less than 10.8 to 11 volts DC for the furnace to operate, but keep in mind that if voltage is that low, don't expect the furnace to run very long. Nominal voltage with a fully charged battery should be more than 12 volts DC. At this point, you'll need to evaluate whether the charging system — be it via the converter, inverter-charger or solar panels — is functioning properly. Most furnaces will have an on/off switch, which must have power across it. This switch is accessible via an outside door, but those furnaces without such access will have to be removed to check for power. If there is power at and through the switch, the next check is at the time delay relay, if so equipped. Replace as necessary after testing. While checking these components, be aware that a loose connection can also cause a no-start problem.



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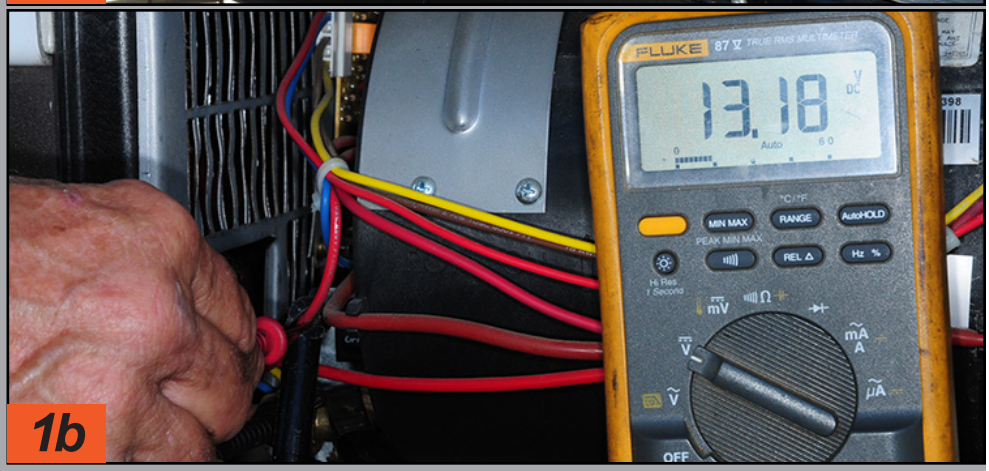
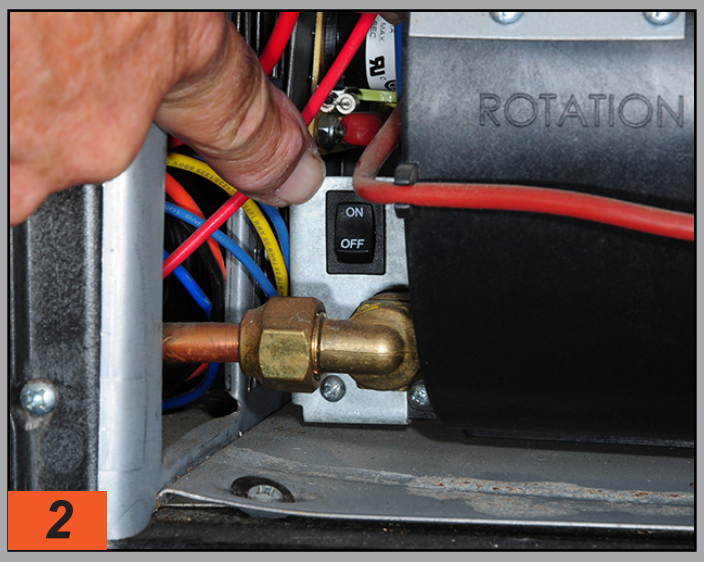


1b

Incoming 12-volt DC power is checked with a simple test light. At this point, you are only checking for the presence of power, not exact voltage. Voltage to the circuit board is verified by using an accurate multimeter. A furnace will actually work when voltage dips to 10.8 to 11, but don't expect it to run for long. If voltage is low, suspect poor battery charging, or even bad batteries and/or converter.



2

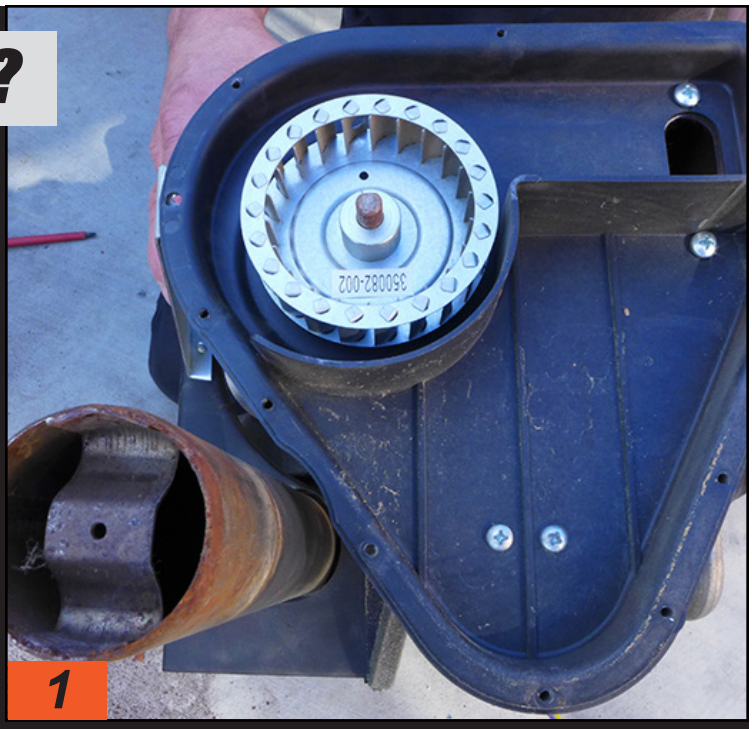
On/off switches are provided in most furnaces. While it may seem over simplified to suggest that the switch must be in the "On" position to operate, this step is overlooked more often than expected.

3

If the furnace fails to start, the first step is to check power at the fuse panel.

4 Where's the Air?

If the blower motor fails or is functioning erratically, the furnace will not ignite. The first step is to determine if there is adequate voltage to the furnace (see No.3). Does the motor sound like it's running too slowly? If so, the brushes may be worn and not making proper contact on the motor windings. A mud dauber nest can also prevent the blower wheels from turning at top speed. Some furnaces may give you an audible hint that the motor is about to fail: If you hear squealing from inside the furnace upon start up, the chances are the motor is toast. If the blower motor tries to start and then stops, check the voltage at the blower motor. The furnace board determines that the fan is running and providing adequate air flow by using a sail switch, which closes when enough air hits the sail to activate the switch. These fail frequently; some RVers will carry extras in their toolbox, just in case. (See No. 7 for more.)



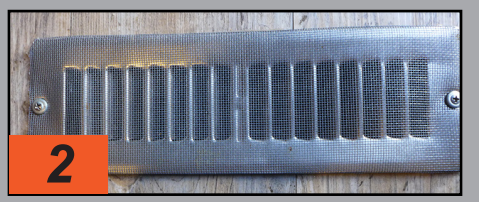
This image shows the typical configuration of an intake blower in a Suburban furnace. Not all intake blowers are accessible without removing the cover. Nests or other debris can create an improper air-fuel mixture.

5 Keeping the Air Flowing

Blocking the return air vent and/or heat registers is a no-no. For example, it's not uncommon for towels or other items to fall out of drawers and/or cabinets and block the return air vent. Manufacturers require a certain amount of space (in square inches) around the return air vent and a certain number of heat registers to properly evacuate heat from the furnace.

Floor registers can collect an unbelievable amount of dirt over time — including pet hair, which can cause a serious problem by blocking the air flow through the ducting. If you have pets that shed and are concerned about the integrity of the floor registers, remove them and apply a coarse screen material that will not impede the air flow, but will keep pet hair and debris out of the ducting — and inspect/clean frequently to make sure air flow is not impeded. Some fifth wheels have a return air vent in the basement, which can be blocked unintentionally by nearby stored items. Become familiar with the return air configuration and take measures to keep the vent clear at all times. If the return air vent is located in the galley, remove it and check periodically for anything that could have been dropped out of a drawer and possibly impede air flow.

Although furnace manufactures suggest otherwise, many owners cover the intake and exhaust ports with screens available in RV supply stores. These screens must be inspected frequently and cleaned of any obstructions to prevent furnace disfunction and overheating.



Floor registers are susceptible to blockage caused by dog air and other debris. While these registers can be covered with screen material, air flow must not be impeded. Frequent inspection and cleaning are in order.

Shown is a typical direct discharge type of furnace common in small trailers. As you can see, simple access makes it easy to clean and inspect for wayward materials (think towels, etc.) that may block air flow.

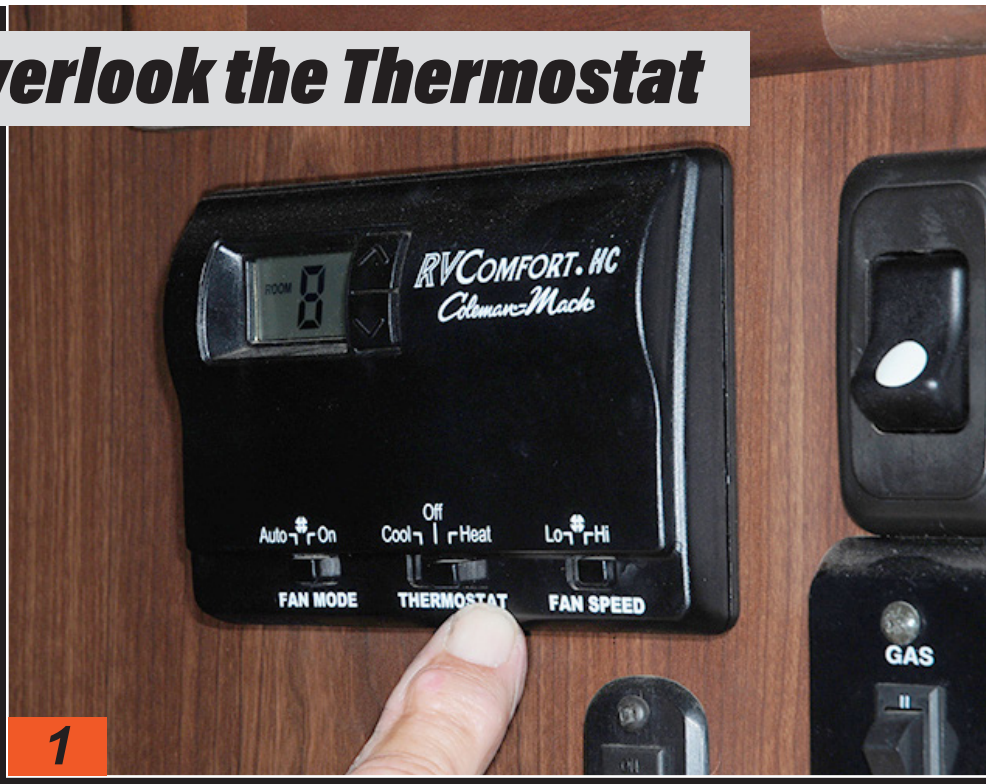
6 Don't Overlook the Thermostat

Most modern thermostats are very reliable, but they are still made by humans, so a failure is not impossible. Diagnosing a thermostat problem requires that it be taken off the wall to inspect all the connections for integrity.

In the old days, wall thermostats were basic with an on-off switch and a lever to set temperature. For these models, normally there are two blue wires coming from the furnace, which must be connected. Mechanical thermostats are still around but are not super accurate; owners learned to adjust the set points based on trial-and-error and interior comfort. If you suspect that the thermostat has failed, it can be removed from the wall and a jumper wire can be placed across the two terminals to test-activate the furnace. Keep in mind that every furnace has a fan-control board or time-delay relay and you will need to wait 20 or 30 seconds for it to start, and up to three minutes for the fan to shut off after the flame ceases.

Modern digital thermostats that control the air-conditioner(s) and the furnace are a bit more complicated. You can remove them to check for loose connections; testing is accomplished using an accurate voltmeter. In many cases, the blue furnace wire will go to the air-conditioner control board and not the thermostat.

Thermostats integrated into touch-screen control panels are more complicated and require testing by a trained technician, although many resets and testing can be accomplished right from the screen. Companies like Thor Industries, which includes a touch-screen panel to control systems in many of its RV lines, provide excellent support over the phone and online.



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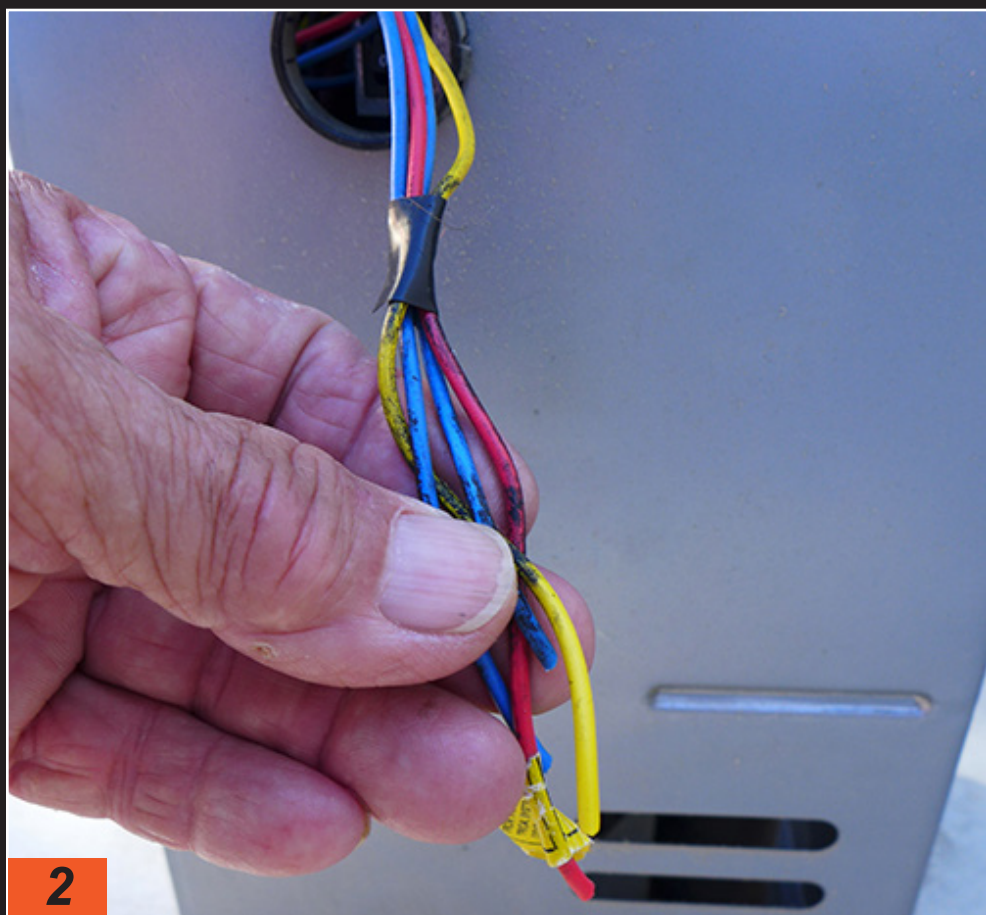
Although it seems elementary, don't discount a failed thermostat when the furnace fails to function. In its simplest form, two (usually) blue wires control the furnace, and can be checked for continuity. More exotic thermostats that need attention will require the services of a trained technician.



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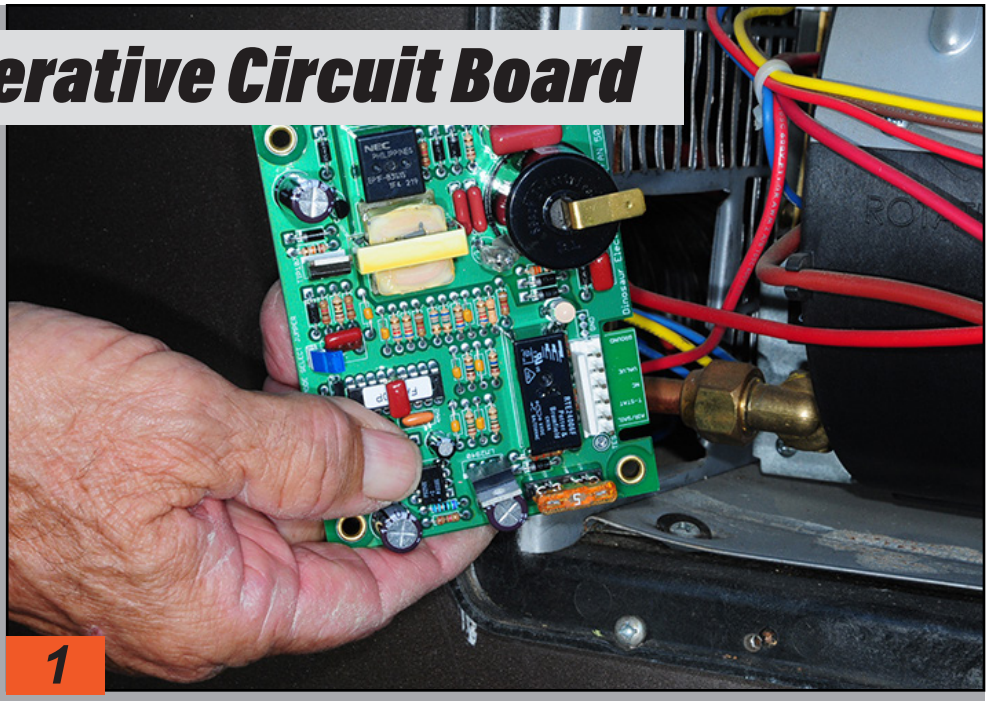
In this example, the two blue wires are for the thermostat, the red is the 12-volt DC positive wire and yellow wire is the ground — typical wiring schematic on most forced- air heating systems in RVs.

7 Uncooperative Circuit Board



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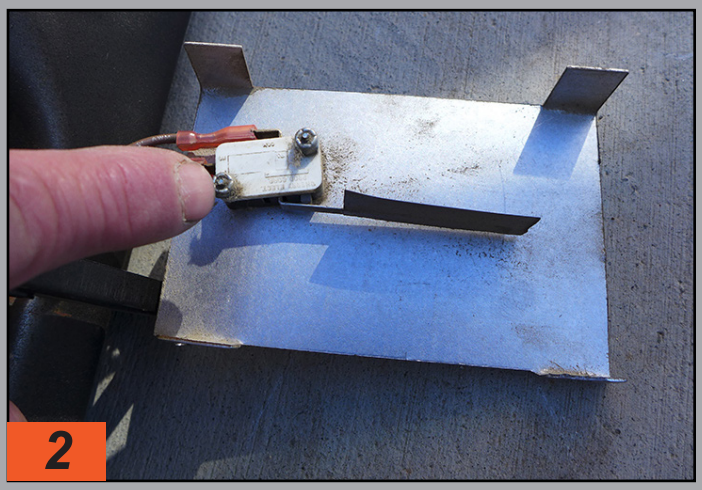
Circuit boards control furnace function and can be tested at most RV repair centers what have the proper equipment. This replacement board by Dinosaur Electronics includes fan control, so the time-delay relay is not used. Dinosaur Electronics boards are considered the best in the business.

Depending on the age of your RV, the circuit board may or may not have an indicator light to let you know if this electronic component has failed. If the blower motor comes on and you hear no flame ignition, the circuit board and/or the sail switch may be an issue.

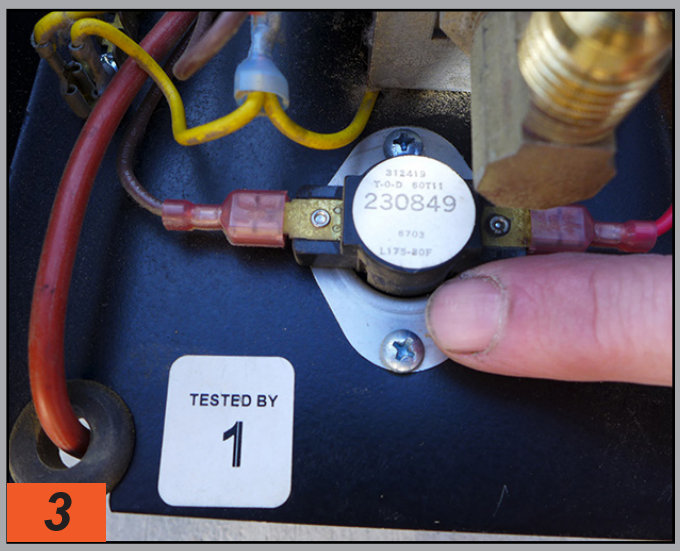
Gaining access to the circuit board and sail switch is fairly easy on units with an outside access panel, but units without this feature require complete removal. Test for voltage flowing through the sail switch to the circuit board if the indicator light on a circuit board is not lit. If you have an older-style PC board without an indicator light, you can test the voltage at the circuit board that comes from the sail switch or from the limit switch, depending on the model of your furnace. The limit switch is a thermal disc that will shut the furnace off when the burner heat exceeds set limits. The sail switch closes the circuit when the air flow from the fan is strong enough to move the flat portion on the switch arm. This is a safety device that will prevent flame ignition if there is not enough air moving through furnace. Should the combustion chamber overheat, the limit switch will shut down the power to the circuit board so that the flame goes out and allows the furnace to cool down. This usually only occurs when there's a problem with venting (see No. 5). It's fairly rare to find a limit switch that has failed.

Subsequent furnace models morphed to the use of a Fan 50 Plus circuit board, which was designed to eliminate the time-delay relay (see No. 10) and control the fan motor when there was a lack of ignition. Manufacturers transitioned to the current fan control circuit board, which is found on all furnaces today.

Most modern circuit boards can be tested with a tool utilized by RV dealerships and repair centers. You may be able to take the board to the local shop and ask if its technicians will test it. The best replacement circuit boards are made by Dinosaur Electronics.


2

This is the type of sail switch used in all models of forced air furnaces. If the blower motor slows down below the recommended RPM, the sail switch will shut down the flow of LP-gas, preventing overheating. The integrity of the switch can be checked with a multimeter, although this switch does not fail that often.



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The limit switch (models will vary) prevents the combustion chamber from overheating to the point where safety could be compromised. This is one of the checkpoints for tracing voltage to the circuit board or the sail switch.

8 The Right Flame

Soot appearing on and around the furnace vent indicates that there's an issue with the air/fuel mixture. Proper ignition is affected by LP-gas pressure, air intake/discharge integrity, mud dauber nests or debris in the burner tube. This is usually indicated by a flame that is yellow and dancing around the top of the burner. Once the soot has begun to show up, it will only get worse until the problem is solved.

Remove the furnace and find a suitable bench or location to clean all the parts in the combustion chamber. Cleaning soot from the furnace will require a large volume of air pressure, not to exceed 200 PSI. The tricky part is removing the burner from the furnace for cleaning. Keep in mind that rust can be an issue with some older burners, clogging the slots (in the burner) over a period of time and causing an improper flame. Blow air through the intake and discharge vents and through the front of the furnace after removing the electrode assembly to gain access to the combustion chamber. This is very messy, and black dust will go everywhere; wear a mask.

Extreme cases of improper ignition could be traced to the burner orifice; seek professional help if you are not familiar with this procedure. Another cause of improper ignition could be LP-gas pressure (see No. 1). Use caution when working with combustion systems; it can be very dangerous.

1

With the front cover removed from this older Suburban T-Series furnace, you can see there is access to a sight glass to determine whether the flame is in good condition. Too much air causes a big yellow flame, which can cause an improper heating.

2

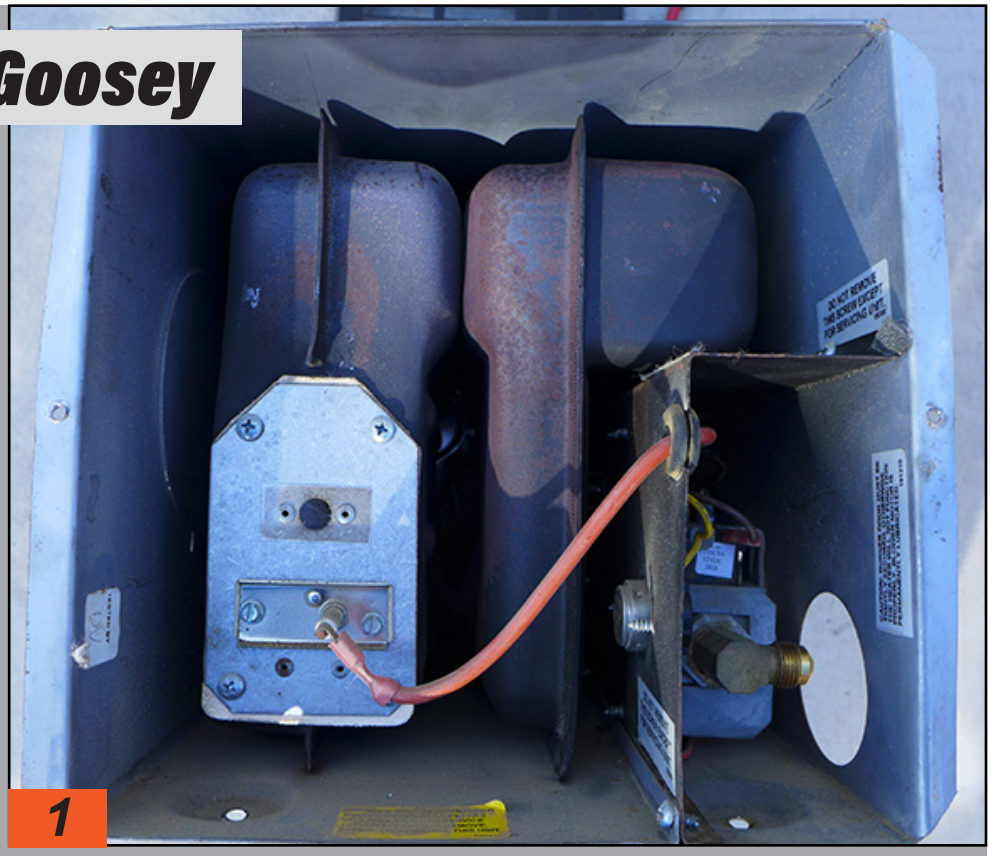
It's not uncommon for rust to build up over the years in a forced-air furnace. Rust is created by condensation caused by intense heating through combustion and cool down. Rust building up over time will affect the air-fuel mixture, leading to an erratic flame—and in some cases, no flame.

3

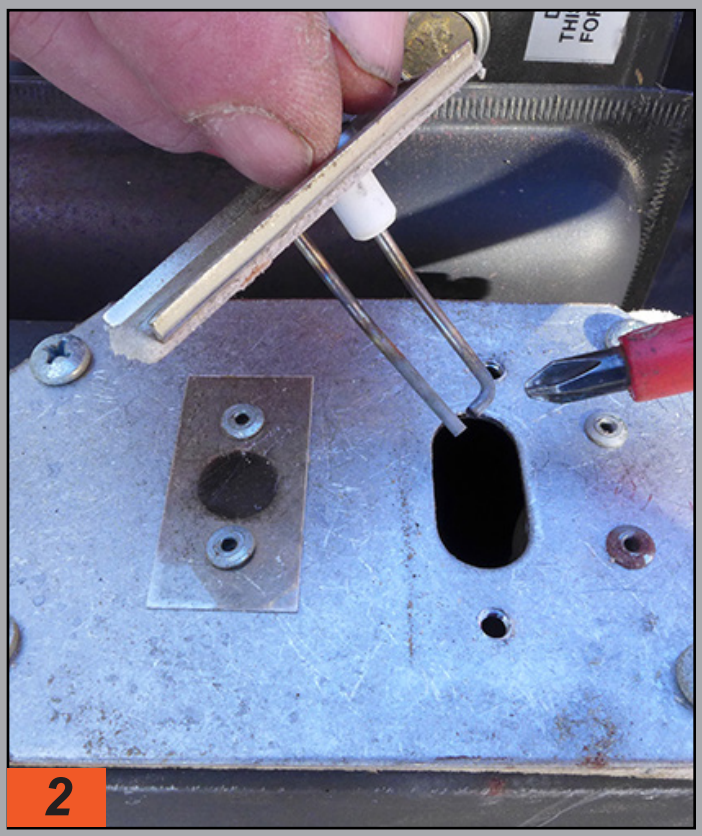
The Suburban NT 30 Series furnace has an access panel that can be dropped down to inspect the flame and gain access to the electrode so it can be removed and cleaned.

9 Loosey Goosey

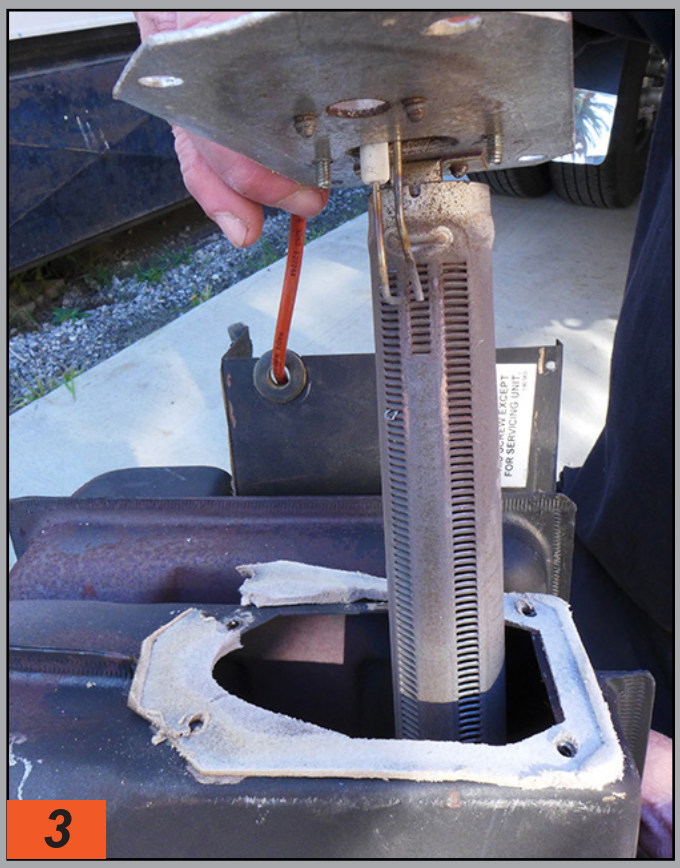
With all the vibration and movement RVs endure while on the highway — and wires running everywhere — it's not uncommon to find a loose connection or a wire that has been compromised. Loose connections can be found just about anywhere from the fuse panel to the furnace itself; sometimes bad connections are obvious, but more often you'll need to use a voltmeter to identify the culprit. One overlooked item is the ignition wire from the electrode to the circuit board. Built-up corrosion or a loose terminal can create enough resistance to cause ignition failure. If you suspect a loose connection, you will need to check the 12-volt DC, thermostat and internal wiring.



This is a typical view of the electrode assembly mounted in the front of a Suburban T-Series furnace; a sight glass allows you to visually check the flame for proper air/fuel ratio.



Electrodes used in all direct-spark-ignition forced-air furnaces can become inoperative if the gap is not correct (specs are provided for all furnaces). The gap between the ground and the electrode is somewhat critical, as well as the gap between the electrode and the top of the burner.



Here, the electrode is placed in position above one of the slots in the burner assembly. When inspecting an electrode, be sure that the slots are clear of rust and debris below the electrode assembly for proper spark and ignition.

10 Where's the Air?

Older model furnaces use a time-delay relay, which delays the blower wheel from coming on — and, most importantly, allows the combustion chamber to cool down before shutting down the furnace. This is important because of the intense heat in the combustion chamber; repeated shutdowns without cooling the combustion chamber will ultimately lead to furnace failure.

Normally, a defective time-delay relay will not allow the furnace blower motor to come on. There are instances when the blower motor will cycle several times before remaining off or on. The time-delay relay functions by sensing voltage via a signal from the thermostat. If you suspect the time-delay relay is defective, use a voltmeter to check power coming into the relay and to the thermostat side of the relay. If it has power at both terminals, then the relay could be defective, providing you already confirmed that the ground to the relay is adequate. The ground on the relay is usually a short wire running to a ground block and can be checked visually. When replacing the time delay relay, be sure that you get the proper one for the particular furnace; they are not interchangeable.

RVE

1

The time-delay relay was used in older furnaces before the advent of fan-control circuit boards. If it's defective, the blower motor will not run. If the blower motor cycles before remaining on, suspect a failing time-delay relay. Shown is a replacement time-delay relay from Dinosaur Electronics sold on Amazon.

Power to the People

Anyone contemplating going off-grid in search of adventure needs to make sure their onboard energy system is up to the task. And that starts with the battery bank.

By Bruce Hampson

True self-containment in an RV is not possible without a reliable and rechargeable power source.

Amazing, isn't it, that such a simple, direct declaration can create so much confusion? There are a lot of reasons for this — and, admittedly, plenty of "blame" to go around. But whether the culprit is the outdoor hospitality industry (campgrounds) that were caught flat-footed as pandemic-fueled buyers gravitated towards camping — a bit of a reach, because no one undertakes the costly construction of new RV resorts without good reason — or simply a younger generation of RVers looking for experiences found outside a rented RV space, the fact remains that, today, batteries in RVs are under much greater loads than any time in the past because of the push to go off the grid and not give up creature comforts.

Manufacturers are well aware of this, as evidenced by the burgeoning number of units rolling off assembly lines with at least a modicum of battery-and-solar packages intended to try and keep the "lights on." So, too, is the supplier side of the industry, which is flooding the shelves of RV and automotive parts stores with a mind-numbing number of new and increasingly cheaper 12-volt batteries embracing — at least in theory — the latest energy technology.

But even cheap batteries aren't really

Go Power! recently debuted its 300Ah Advanced Lithium Smart Battery, a quick-charging Bluetooth-enabled unit with built-in DC heater, over- and under-voltage and temperature protection and more. It weighs just 70 pounds.

ODYSSEY Extreme and Performance dual-purpose batteries offer both the cold cranking amps (CCAs) for SLI and deep cycling for the longer but deeper discharge rates to support house loads.

cheap. Unfortunately, a lot of RVers won't understand the benefits of a better — read that "more expensive" — onboard energy system until they are in their second day of a long weekend and wake up to an electrically dead RV due to depleted batteries.

And, while there are a lot of parts to crafting an off-grid RV capable of maintaining the RV lifestyle without being tethered to shore power — from solar panels to feed the batteries to inverters to power 120-volt AC systems — it all starts with onboard energy storage: batteries. And when we're talking about batteries, we're talking about either absorbed glass mat (AGM) or lithium technologies. Yes, traditional lead acid batteries are still commonplace in the RV space, but they are so limited in performance that any RVer veering off the asphalt needs to step up their game.

By way of description, most dual-purpose batteries use AGM technology, in which fiberglass separators are saturated with the electrolyte and compressed tightly between the lead alloy plates. The battery is sealed, which eliminates the need to replenish the electrolyte with distilled water to make it virtually maintenance-free.

An RV with a conventional flooded lead acid battery will likely have separate starting, lighting, ignition (SLI) and deep-cycle batteries. Dual-purpose batteries, however, produce both the cold cranking amps (CCAs) for SLI and deep cycling for the longer but deeper discharge rates to support house loads.

Lithium-ion batteries, meanwhile, utilize lithium-ion cells along with a protective circuit board. In a lithium cell, ions move internally through electrolyte between the cathode at one end and the anode at the other; electrons move in the opposite direction in another circuit. This migration creates the electrical current.

"There are a lot of factors in trying to correctly size components, especially for solar systems and batteries, because an owner or installation facility has to figure out when the customer is going, where they're going, how long do they want to go for, and then usually figuring out how long are they planning to run it versus what they actually end up doing. And then building in some buffer," said Mark Spilsbury, RV division manager-mobile power solutions, for Go Power! (The company offers technical support as well as handy solar and inverter size calculators on its website: gopowersolar.com).

While Go Power! is primarily a supplier of lithium batteries for the RV space, the division of Dometic also carries 6-volt and 12-volt AGM batteries because, noted Spilsbury, campers need to factor in the higher cost when determining needs.

"Lithium is great, but not everybody really needs it," he said. "If you're not going out all the time and only need it for a weekend here and there, you could still do that with AGMs or even lead acid batteries, depending upon your power requirements. But if you're really into going off-grid and trying to keep weight down and get the most out of your system, that's where lithium comes in and has a lot of benefits."

For example, comparing a Go Power! 100AH 12-volt lithium battery to a 200Ah flooded lead-acid unit, lithium can be discharged to 100% (though it's recommended that they not go below 95%), an act that's the kiss of death to lead-acid units. Lead-acid batteries can only be safely discharged to 50%, so a 100Ah lithium battery is equivalent to a 200Ah flooded lead-acid bank under real world use. Self-discharge rates when not in use also differ dramatically: 2-3% per month (lithium) versus an average of 33% for lead-acid 12-volt batteries. There's also a substantial weight difference — 31 pounds as opposed to 144 pounds.

And, for frequent or full-time RVers, even the higher tariff shouldn't be much of a deciding factor. Lithium batteries can actually save money in the long run. The battery life of a lithium unit is 3,000-5,000 cycles, compared to 500-1,200 for a conventional lead-acid battery. Some advanced lithium batter-

Xantrex lithium-ion batteries are available in sizes ranging from 105Ah to 310Ah, in both 12- and 24-volt applications with weights starting at just 25.4 pounds.

100Ah 12-volt LiFePO4 battery from Battle Born Batteries, a division of Dragonfly energy.

ies such as those from Go Power! also carry a reserve capacity of 5% to allow users to perform emergency actions even when the battery is completely discharged.

While ODYSSEY batteries (odysseybattery.com) come under the AGM description, they are actually a bridge of sorts between traditional AGM units and lithium — and, in fact, provide many of the advantages of lithium.

"ODYSSEY is an AGM battery — done to an extreme level," said Bryce Gregory, product manager-transportation and specialty, for the subsidiary of EnerSys, a global leader in stored energy solutions for automotive, military and commercial applications. "Our key advantage is what's called Thin Plate Pure Lead (TPPL) technology, which allows us to design a battery with more plate surface area in the same footprint as a comparably sized conventional lead acid battery. This increase in surface area provides much greater power in any group size."

According to Gregory, the patented TPPL technology allows ODYSSEY deep-cycle dual-purpose batteries to generate twice the overall power and three times the life of conventional flooded lead acid batteries. And unlike traditional flooded lead acid batteries, Gregory noted that ODYSSEY batteries have an "amazing" deep-cycling capability: up to 400 cycles at 80% Depth of Discharge (DOD).

"They handle that DOD very well," he added. "You can recover the battery up from hundreds of times from 20%. So, it's a much more reliable battery in the exact same application."

Like many popular spiral-wound batteries, ODYSSEY Extreme batteries employ dry cell AGM technology to contain acid, allowing the battery to be installed even on its side. "A big difference is we don't use calcium in our batteries," Gregory added. "Calcium and lead are not good elements to mix together because the one causes corrosion (sulfation) in the other. Using pure lead allows for deep cycling without the buildup of corrosion, which extends battery life."

For his part, Gregory also cites cost of premium batteries as being either a positive or negative influence on battery selection — but for other reasons.

"Most people don't keep their RVs for more than five or six years — they're going to upgrade or go from one class to another," he pointed out. "So, a big investment in their off-grid power system may not pay off; people aren't going to move their entire electrical integration from one camper to another. That's a lot of work.

"The nice thing about ODYSSEY AGM batteries is, they can be used in any of the systems in play," he continued. "You can use them in 24-volt systems, 48-volt systems, they work well in series or parallel, they can be charged fast off of a big charger or generator. And they are going to handle this

Proper Battery Care for Decommissioning

Before an RV is put into storage, its onboard battery(ies) should be inspected, cleaned, tested and fully charged. Always make sure to follow the battery manufacturer's guidelines for proper maintenance and care, and direct any questions to an appropriate battery professional. Here are some basic steps courtesy of the crew at ODYSSEY that anyone with a 12-volt battery system should be aware of and put into practice:

*• **Inspection**: Inspect the condition of the battery's case, cables and terminals for any damage or corrosion. Replace frayed or worn cables and terminals — but if the case or terminals are damaged, also replace the battery itself.*

While maintenance-free AGM and lithium batteries are finding their way into more RVs from the factory, many continue to be equipped with lead acid batteries — most of which use plates made of an alloy of lead and calcium or antimony for electrodes. The electrolyte is a solution of sulfuric acid and water, and in the case of conventional flooded lead acid batteries, is housed in cells. The electrolyte levels in these cells should be checked and, if low, filled with distilled water to the manufacturer's specified level.

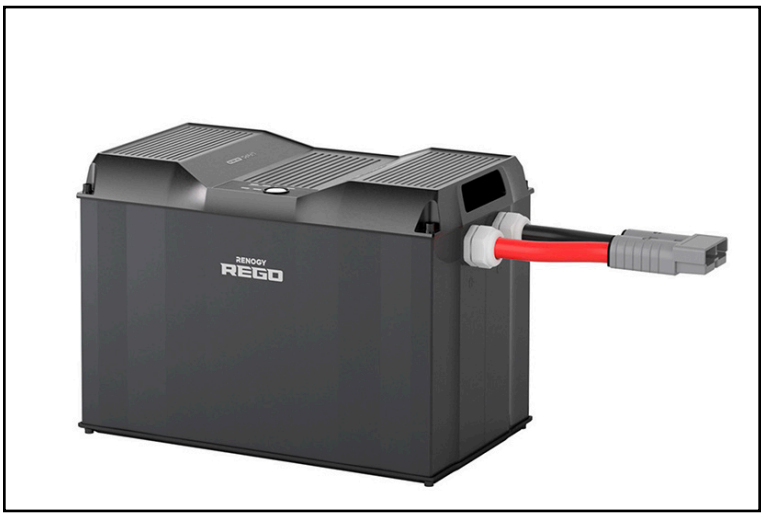
*• **Cleaning**: Clean dirt and corrosion from the terminals with a battery terminal brush or an emery cloth and wipe down the case with mild soap and water, rinse and dry.*

*• **Testing**: Load testing is one method of assessing the battery's State of Charge (SOC). An auto parts store associate, mechanic or battery dealer can perform a load test at a service facility. Another method is to use a digital voltmeter to measure the battery's Open Circuit Voltage (OCV). The battery manufacturer's specifications will indicate what OCV corresponds to 100% SOC. For a conventional flooded lead acid battery, a hydrometer will confirm the specific gravity of each cell, which should read 1.265 - 1.285 to indicate 100% SOC.*

*• **Charge**: A full charge is the most important precaution to help safeguard the battery's performance when recommissioned and through its intended service life. Excessive discharging of flooded lead-acid batteries can cause the voltage to decline, which reduces the level of sulfuric acid in the electrolyte. Decreased sulfuric acid increases the amount of water in the solution and, with it, the risk of the electrolyte freezing in cold weather and damaging the battery case.*

In addition, a fully charged battery is stored with a significantly reduced risk of sulfation, which is the accumulation of lead sulfate crystals on the surface of the plates when the battery is persistently undercharged. This accumulation reduces the plates' surface area, which interferes with the battery's ability to hold a charge.

To prevent internal damage, flooded lead acid batteries should not be discharged to less than 50% SOC. Dif-



Renogy offers a number of battery configurations, including deep-cycle AGM 12-volt batteries such as this 100Ah maintenance-free unit featuring 3% self-discharge rate and 1,100-amp max discharge current and its REGO line of cold-weather LiFePO4 batteries with a 30% smaller footprint.

cycling. One thing many people don't know about lithium is, if you over-discharge it, it will shut off — and they're not necessarily easy to turn back on unless you have the equipment to do so. You don't have to worry about that with a lead acid battery."

There is one drawback that owners would need to pay attention to: weight. The use of TPPL technology means that ODYSSEY is able to fit a greater number of plates inside the same sized case, and lead is heavy. An ODYSSEY Group 24 battery, for example, weighs 57 pounds.

That said, the popularity of lithium-ion batteries has created a cottage industry of sorts, with a lot of new manufacturers entering the space — often, with private-label units manufactured overseas and not always to the same rigorous standards employed by companies like Go Power!, Battle Born, Xantrex, Renogy and others.

"It can be tough for consumers to decide," said Spilsbury. "They see a 'lithium' battery at a low price and may just go for it. But not all lithium batteries are built the same. Many of the drawbacks are internal, in things like the lithium tube, that they can't see, but at the very least they should read the specs for the battery management system (BMS) that's a part of it. The BMS monitors all the things going on with the battery and then — depending on how it's been

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ferent battery chemistries have their own charging requirements, which are available through the manufacturer or a battery specialist.

*• **Managing Parasitic Loads**:*

If a battery in storage remains connected to an RV's "house" loads — especially those that use memory — it may be discharged from parasitic loads. This occurs when those loads continue to consume small amounts of power from the battery. Each load may consume only a minimal amount of power in a day — but combined over a period of time in storage, they can drain the battery significantly if it is idle long enough. For example, if a steady parasitic draw of just 20 milliamps occurs while the battery is stored for 150 days, the load will consume more than 70Ah.

One method of maintaining a consistent SOC while the battery remains installed during storage is to use a trickle charger. Batteries should be fully charged before being connected to a trickle charger. An alternative to using a trickle charger is to disconnect the negative battery cable or the terminals, or use a battery disconnect switch, to cut off parasitic loads. Even so, batteries should be checked and charged monthly while in storage.

*• **Deep-cycle batteries**: are essential for providing dependable power to your rig, designed to stand up to energy-hungry appliances such as your RV's heating, ventilation and air-conditioning (HVAC) systems as well as the microwave, television and refrigerator, just to name a few. Deep-cycle batteries come in a variety of types and price points. Some are called marine batteries, which are interchangeable with RV batteries with comparable ratings. The best RV batteries have a large reserve capacity to power everything you need between charges, as well as a low self-discharge rate.*

There are several ratings you want to look for when making a deep-cycle battery purchase for your RV:

*• **Capacity or Reserve Capacity** — Higher Ampere Hours (AH) or Reserve Capacity (minutes) means a battery can deliver more energy and perform longer.*

*• **Depth of Discharge/Cycle Life** — Depth of Discharge (DOD) indicates the percentage of the battery that has been discharged relative to the overall capacity of the battery. Because the number of times a battery is charged and discharged — and the depth of those discharges — affects its lifespan, you want a battery that also features long cycle life.*

*• **Charging** — A battery that recharges quickly is the best option to help ensure you'll reach full capacity in less time.*

*• **Temperature Resistance** — Ideally, you want a battery that is engineered to perform well in both hot- and/or cold-temperature environments.*

*• **Shock and Vibration Resistance** — Things can — and usually will — get bounced around considerably in your RV. Make sure your battery is built to handle any rough terrain or road conditions.*

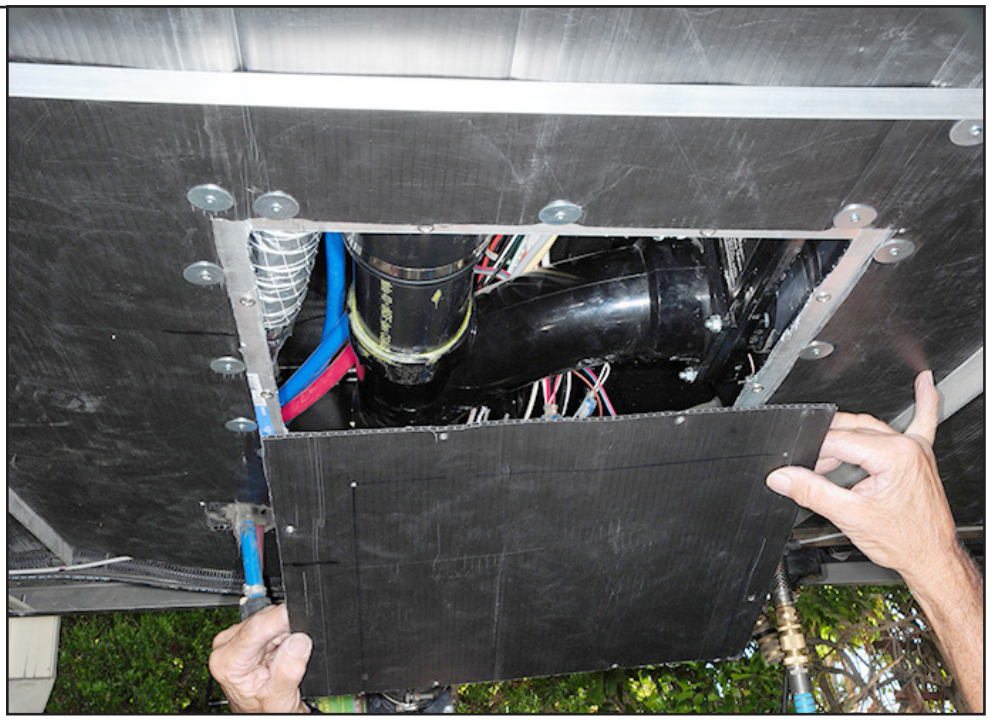
Trap Door

There's probably nothing less desirable than working on a dump valve that has failed — especially if the holding tank is full. Adding an access panel in the corrugated plastic belly pan eliminates the frustration of making nasty repairs when in the field.

By Bill Gehr / Photos by author

Covering the bottom of any travel trailer or fifth wheel with a one-piece corrugated plastic sheeting protects the innards below the floor from succumbing to road/environmental hazards — plus, it provides a smooth, finished look. The downside of this belly pan is the inability to access tanks, valves, pipes and wiring without taking a large section down, which can be a big project and most likely messy. Case in point is having access to the cable-operated dump valves that have a propensity to fail — usually at the worst time.

There are several scenarios that can develop, the worst being when you pull the dump valve handle, located in the utility compartment or under the rig, and the cable pulls out without opening the valve. The only way to get the valve open at this point is to either reattach the cable, if possible, or pull the valve open temporarily with a Vice-Grip pliers, but that requires access to



The original project resulted in individual access panels that were fastened to an aluminum frame. It worked well, but the improved version requires only one larger panel, which allows for better access.

For the most part, the project was accomplished with common hand tools, including an impact driver, which was necessary to pull the frame bolts and install the rivet nuts. I borrowed an air rivet tool to save my hands from installing dozens of heavy-duty steel rivets.

the valves. I originally tried dropping a small section of the corrugated plastic to peek in and locate the exact area of the valves, but access was restricted and compounded by a rat's nest of wires and pipes.

RV Enthusiast Publisher Bob Livingston and I have more than a few years of RVing under our collective belts, and we've both been through this exercise many times. That's why, a few years back, we devised a removable-panel system on his fifth wheel to gain easy access to the dump valves without dropping the belly pan (see "Belly Pains," May 2022 issue). It works great, but after brainstorming the pros and cons of this underbelly project, we came up with an improved version for my new fifth wheel.

Essentially, we figured out a way to make access even better (and easier) through a single port.

I began by releasing a large section of the belly pan and making accurate measurements for the new access panel. The first thing that I noticed was that the holding tank heating pads we're laying on the corrugated plastic because the adhesive failed. Also, there was a bunch of wiring loose on the belly pan that was going to take some time to clean up and secure with cable ties. With the measurements in hand, it was time to seek out a suitable material for the new access panel that was not too difficult to work with but rigid enough to maintain a tight seal when closed.

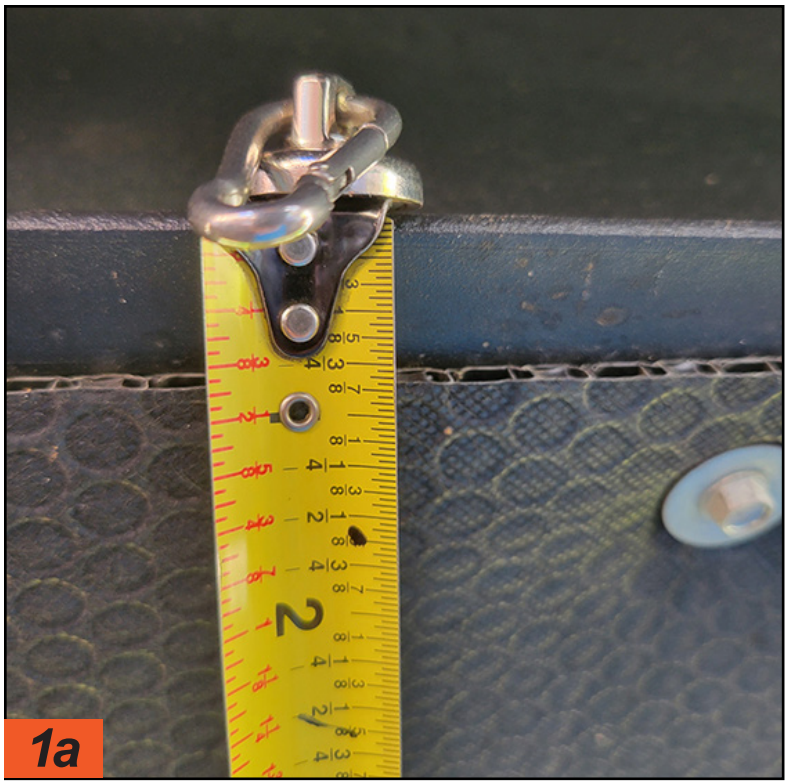
Because the black-tank valve was close to the driver's side of the fifth wheel and both gray-tank valves were almost all the way to the passenger side, it made sense to build an access panel that covers as much area as possible between the I-beams on both sides of the frame. Livingston and I figured aluminum diamond plate was the best way to go since it's strong, lightweight and should be durable for many years. After that, it was just a matter of designing a method for mounting the diamond plate on a hinge that could be latched in place during travel. We thought about angle aluminum to bridge the 72-inch gap across the frames, but ultimately went with steel angle iron.

I also decided to use a heavy-duty piano hinge that could be riveted to the angle iron and diamond plate. Four rivet nuts and 5/16-inch bolts were used to latch the other side of the diamond plate to a parallel piece of angle iron spanning the width of the fifth wheel. The entire panel system added only a little more than 20 pounds to the trailer.

As luck would have it, a friend had an old piece of diamond plate aluminum tucked away in his backyard that was close to the size I needed for the project. I actually wanted a piece of diamond plate that was a little bit wider, but at 25 x 72 inches, this well-used piece reduced the overall cost of the project. Aluminum diamond plate is available in various sizes; figure on paying at least $100 for a precut piece that measures 24 x 72 inches (which should be wide enough for most access points). You'll pay quite a bit less for plain aluminum, which would also work for this project.

Because the old piece of diamond plate was sitting outside for years, it needed a serious cleaning. Some of the stains would not come off even after scrubbing with a wire brush and

It was decided to cut the panel from standard, aluminum diamond plate. The stars must have been aligned for me to find an old, almost perfectly sized piece of diamond plate in a friend's backyard. That saved me almost $100.



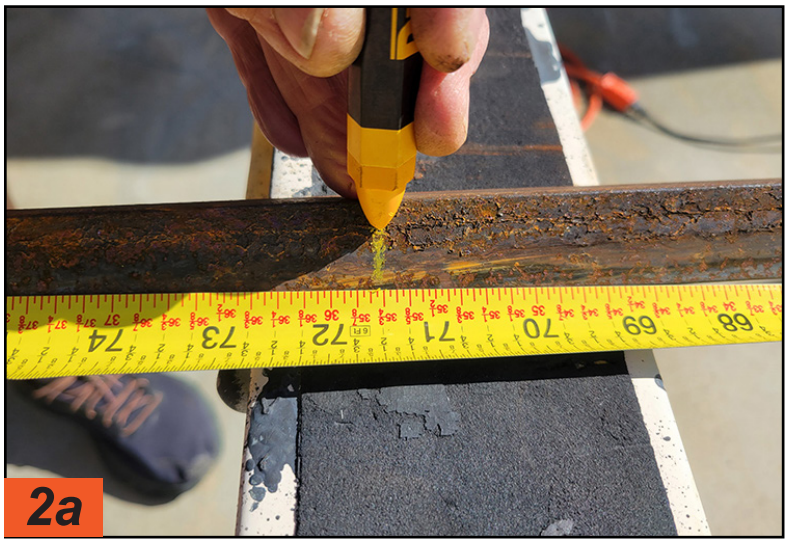
Sometimes you have to be creative when you don't have someone to hold the dumb side of a measuring tape. To get the needed length of angle iron across the fifth wheel, I used a strong magnet to hold the end of the tape in place. You'll have to measure the distance from the outer edges of the frame to get the right length.

degreaser, but the flaws were eventually concealed with a rubberized truck-bed coating — and it's under the fifth wheel anyway, so it wouldn't take long for the road debris to make it dirty again; both sides were treated with the rubberized coating.

Coating the diamond-plate surface with the rubberized material took some patience — and more work than anticipated. After stirring the gooey liquid thoroughly, a stick was used to glob on the material before smoothing out with a foam roller. Unfortunately, it started to dry before all the material was spread out. Applying material to smaller sections made the job easier, though it was still difficult to make sure all the spots were covered before the rubber cured. A few doses of plastic dip designed for tool handles touched up any exposed areas and should last nearly as long as the truck-bed coating.

The angle iron was 8 feet long, which required cutting with a chop saw to make each length fit properly. I then sanded and spray-painted the angle iron with an all-in-one primer and paint to prevent rust from eating away at the metal. After copious measuring sessions, I also decided to cut the hinge a little bit shorter so that after the angle iron was cut, the protruding rivets would not prevent the ends of the angle iron from mounting flush against the frame, which has a fairly narrow lip.

I decided it would be much easier to assemble all the pieces on a 4- x 8-foot sheet of half-inch plywood placed across two sawhorses. I had a suspicion that installing all of the rivets would be a challenge — and it could have



Once the length is established, the area to cut was marked with a construction crayon, which is more visible. A speed square was used to make a straight line.


3a


3b

The angle iron was cut with an old chop saw, designed for cutting steel. The remaining assembly work was done on a 4- x 8-foot sheet of plywood set on two sawhorses.

been without the use of a friend's air rivet gun. Squeezing a hand tool for setting dozens of 3/16-inch short steel pop rivets would have been brutal.

I was pretty confident that the steel rivets would be more than strong enough to hold the diamond plate to the hinge for the lifetime of my fifth wheel. It was important that multiple measurements were taken to ensure that the rivets would not need to be drilled out and reset, which is a pain.

As it turned out, attaching the piano hinge was the trickiest part of the project. The hinge was purchased on Amazon (852777 Continuous Pin 72" x 2" Nickel; $30.99). After confirming that the aluminum plate would fit flush against the corrugated plastic flap (more on that later) at a 90-degree angle without restriction, the hinge was riveted to the diamond plate first. This made it much easier to handle the long piano hinge. One rivet on each end of the hinge was installed initially to prevent it from drifting during the process of adding rivets. Then the other rivets were installed in the middle of the piano hinge to make sure that it didn't create a bow, which could have inhibited the action of the aluminum plate when opened or closed. Because of the strength of these large rivets and the hinge, a rivet was installed in every other hole rather than in all of them, which would have been overkill.

4

After cleaning up and sanding the angle iron, which was acquired at a local metal shop, it was painted with a combination primer/paint from a rattle can.

Once I was confident that the hinge was centered on the angle iron, a rivet was first installed on each end and then from the middle out — while constantly stopping to make sure it would fit properly; 36 rivets were finally installed. Surprisingly, even with all the precautions, the hinge drifted while installing all the rivets, but the weight of the panel made it an operational non-issue.

The next step required cutting a notch in the aluminum to accommodate the 3-inch sewer drain, made even more complicated by the two low point drains hanging down about 3 or 4 inches near the sewer outlet. Fortunately, after cutting the plastic around the sewer outlet, there was enough slack to move the drain lines under the belly pan, which in turn allowed a smaller opening to be cut in the aluminum panel. Next, a flexible piece of rubber was riveted to the aluminum and a few slits cut into the material made it possible to wrap around the sewer pipe.

Installing the aluminum and angle iron assembly required some unique logistics when it came time to position it under the fifth wheel. Using a floor jack initially made sense, but moving it through the dirt and across a tarp (on


5

A section of belly pan was unbolted and pulled down on both sides to locate the dump valves. You'll probably need a powerful flashlight to have a clear view.

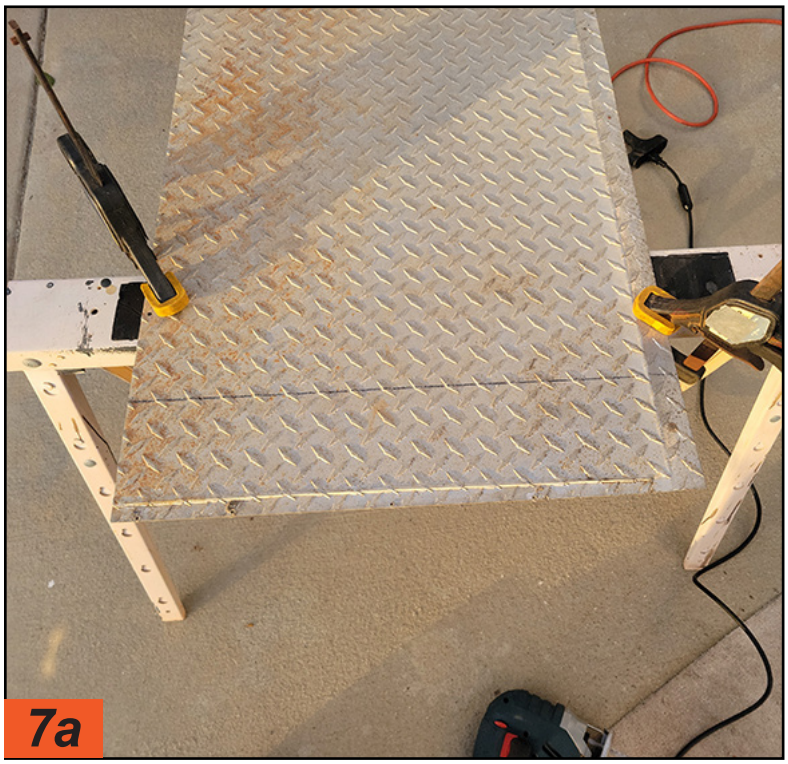
The frame was marked at the edge of the frame where the dump valves were located. Next the corrugated plastic was also marked after determining where the angle would be installed.

mud) while balancing the large, bulky access panel structure didn't seem feasible. Ultimately, a helper (my girlfriend) crawled under the fifth wheel and held the fully assembled structure against the frame with her back while I marked where the holes needed to be drilled — so, yeah, you'll need a friend to help with the installation. The holes were drilled first with an 1/8-inch bit, followed by a 3/16-inch bit and finally 5/16-inch holes were drilled for placing the bolts, lock washers and nuts.

With the unit bolted into place, it was time to install the rivet nuts ("HIFESON Hand Rivet Nut Tool, Handy Rivnut Tool—Metric & SAE with 30pcs Steel Rivet Nuts;" Amazon $27.88) into the other angle iron, which will accept ¼-inch bolts to keep the door closed. When it comes time to open the access panel, the ¼-inch bolts are simply removed and the panel hinges down, exposing a large opening for working on the valves and adjacent wiring/tubing. Rather than remove the corrugated plastic entirely, it was cut in such a way that it drops down in concert with the diamond-plate panel. It worked perfectly and provided another layer of insulation.

It was necessary to fabricate brackets to move the propane-hose junction block beyond the frame I-beam in order to make way for the attachment point of the new angle iron. The next step was to install the aforementioned rubber flap to the aluminum panel with 3/16-inch rivets. With this configuration, the flap was solid, yet still flexible enough to mold around the sewer line and gas lines when the aluminum panel was closed. Lastly, all of the self-tapping screws that held the belly pan in place were reinstalled.

Satisfied that everything was in place and all the bolts and screws were tight, a bead of silicone rubber was run along



Once the diamond plate was marked for the exact length needed to build the panel, it was clamped to the sawhorses for stability while cutting with a circular saw and a carbine-tipped blade. A piece of wood was used as a guide for cutting.

It was necessary to scrape off previously applied caulking from the old piece of diamond plate. A power grinder with a sanding disc was used to finish the clean-up after the bulk caulking was removed with a putty knife.

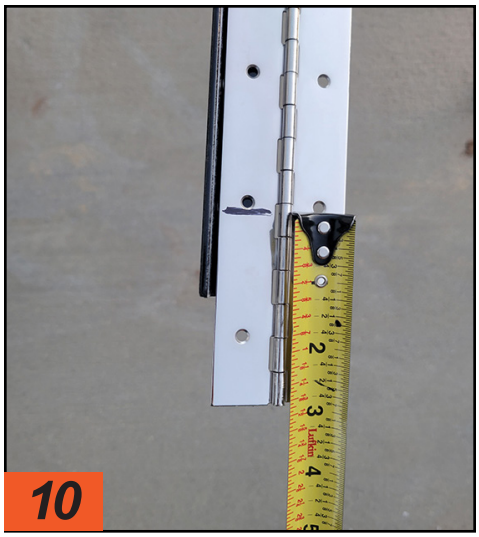
the angle iron against the corrugated plastic to prevent water intrusion while driving on wet or rainy roadways.

Though not the main impetus for this project, a side benefit was access to the wiring and pipes, which I will rearrange later, and bundle neatly. Also, while I was there, I added extra insulation between the belly pan and floor where cold air seemed to be finding its way into the storage compartment.

As Livingston can attest after living in his fifth wheel for nearly two years with our previous panel design, having easy access to the dump valves and surrounding area is a godsend when it comes to unexpected service. It takes just a few minutes to open the panel and be working on the valves. When deciding on the size of the access panel for your trailer or fifth wheel, make sure you can get both hands and wrenches on each side of the dump valve without turning your arms and body into a giant pretzel.

Expect to spend quite a bit of time planning a project like this, and figure on spending around $300 to get it done. But you won't regret the added convenience.

I made an executive decision to coat both sides of the diamond plate with a thick layer of rubberized truck-bed coating. The inside was done before assembling. Make sure the surface is cleaned thoroughly with alcohol before applying the coating.



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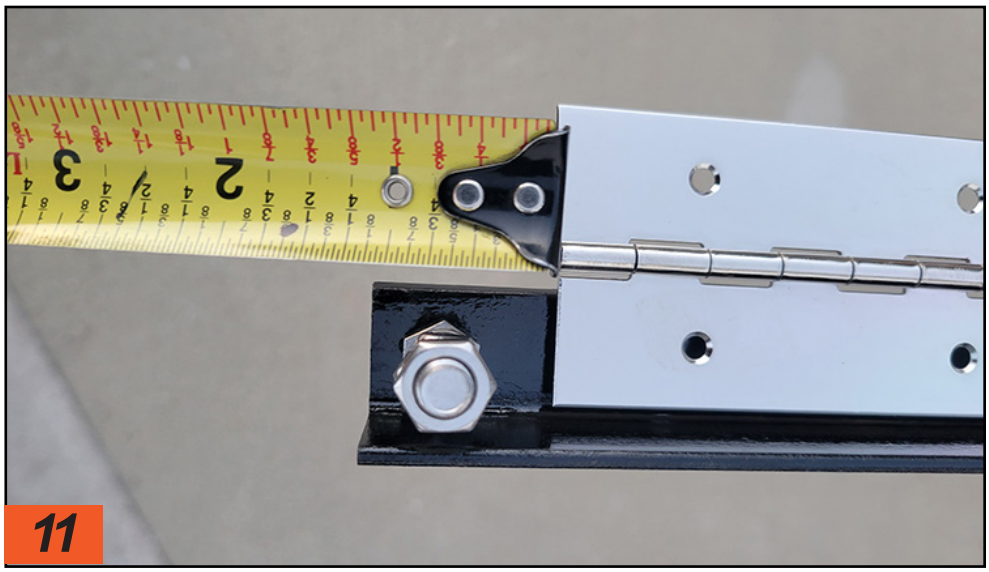
A heavy-duty, nickel-coated piano hinge was marked for cutting. This hinge is readily available on Amazon.



11

First, the bolts on each end of the angle iron were temporarily installed to make sure the hinge had enough clearance before installing.

12

Every other hole in the hinge was drilled out accommodate the 3/16-inch steel pop rivets that would be used for attaching to the diamond plate.

13

Here the location for attaching the hinge to the diamond plate was marked all the way across to make sure the hinge was not drifting while setting the rivets.

14

Once the hinge was in place, the corresponding holes were drilled through the angle iron. I started in the middle, then halfway to the ends on both sides, and then one on each end to make sure the hinge was not drifting. The rest of the holes were then filled in along the hinge.

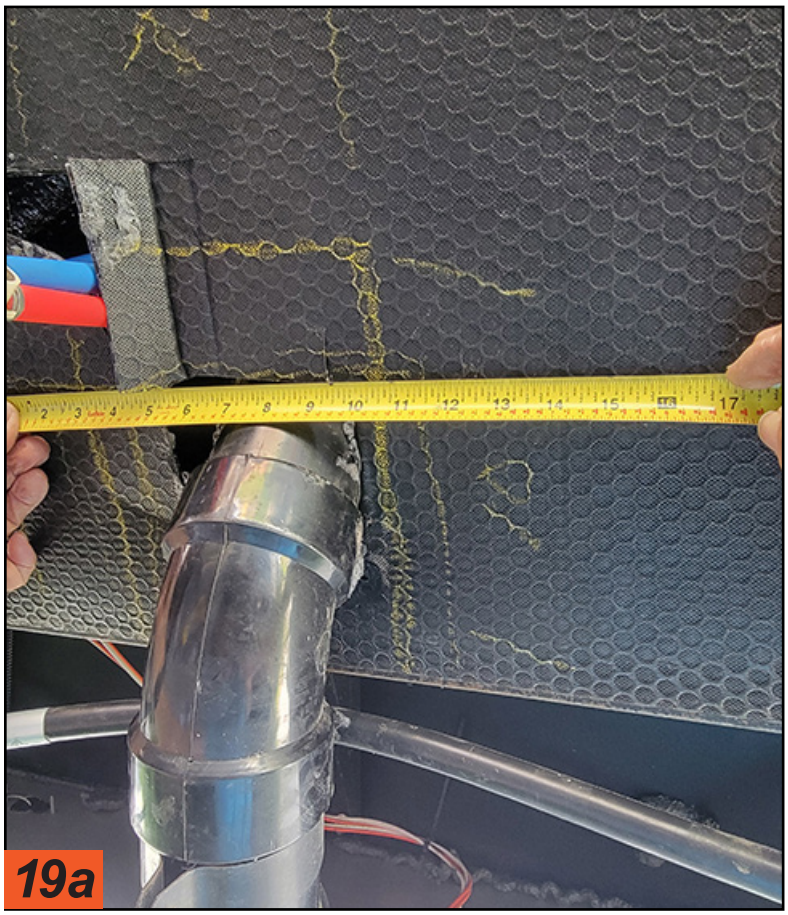
15

The holes for the rivet nuts that would be used for opening and closing the panel were drilled into the other angle iron.

Installing rivet nuts takes some patience, but using the tool that was part of the kit with the stainless-steel rivet nuts and an impact gun made it easier on the hands. Basic tools (not shown) that require two wrenches require a lot more time and effort.

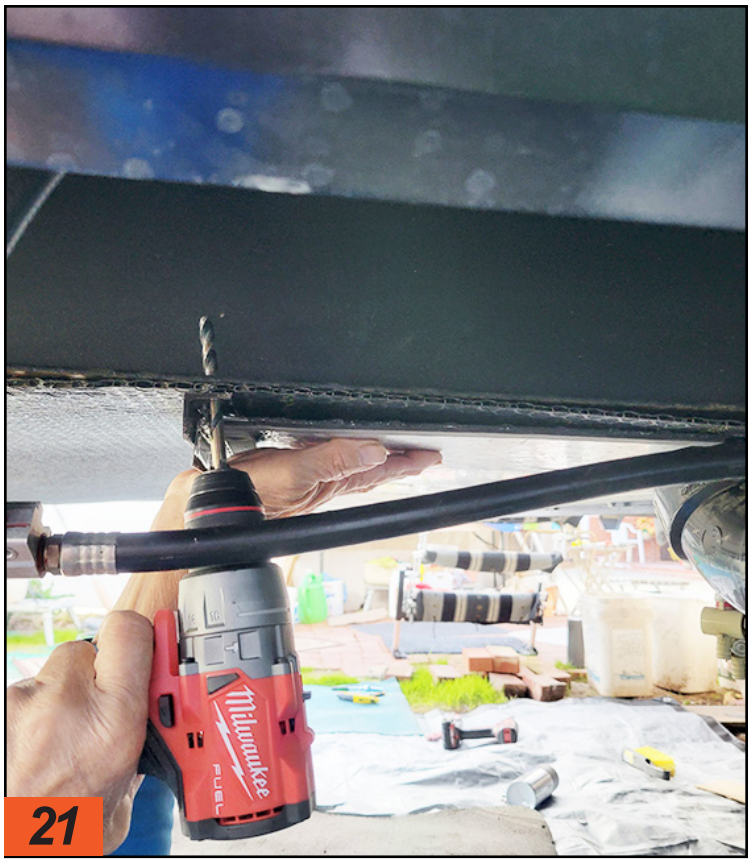
With the parts placed on the sawhorses," the angle iron and hinge were tested for proper fit—and to make sure the bolts and rivet nuts were in the right place.

The locations for lining up the edge of the diamond plate with the rivet nuts were marked with a center punch. Once all the positions were marked, holes were drilled and then enlarged slightly with a uni-bit for a little wiggle room.



It was necessary to provide clearance for the 3-inch termination pipe and the two low-point drains. Once the area was measured and marked, the diamond plate was notched using the circular saw with the carbide-tip blade.

Later, after refining the location for the notch in the diamond plate to clear the termination pipe, a jig saw was used to make the last cut (after drilling a hole in each corner to accommodate the jig saw blade).

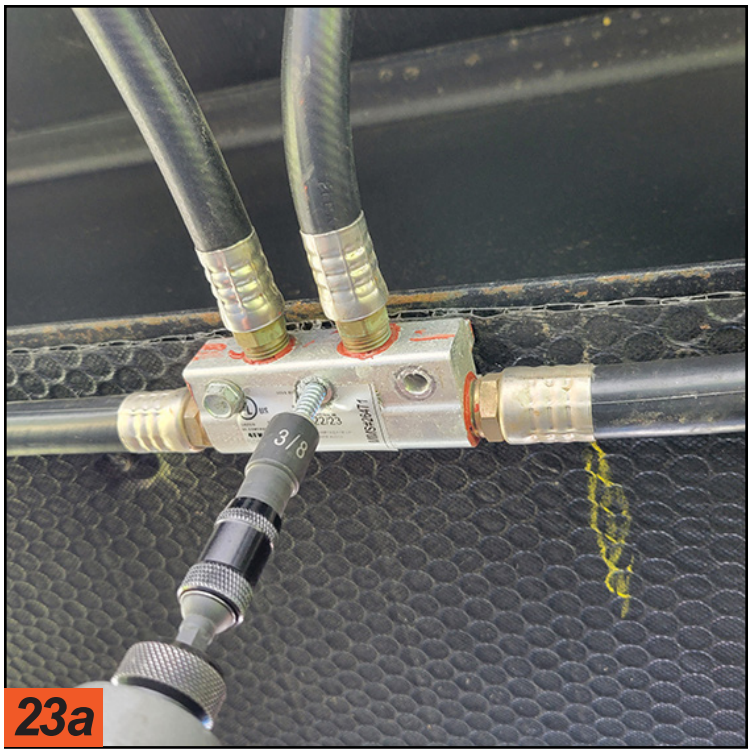


The holes were drilled though the angle iron in relation to the mounting position on the I-beam frame. Thanks to my girlfriend's sense of humor for bracing the entire assembly on her back, the holes lined up perfectly.

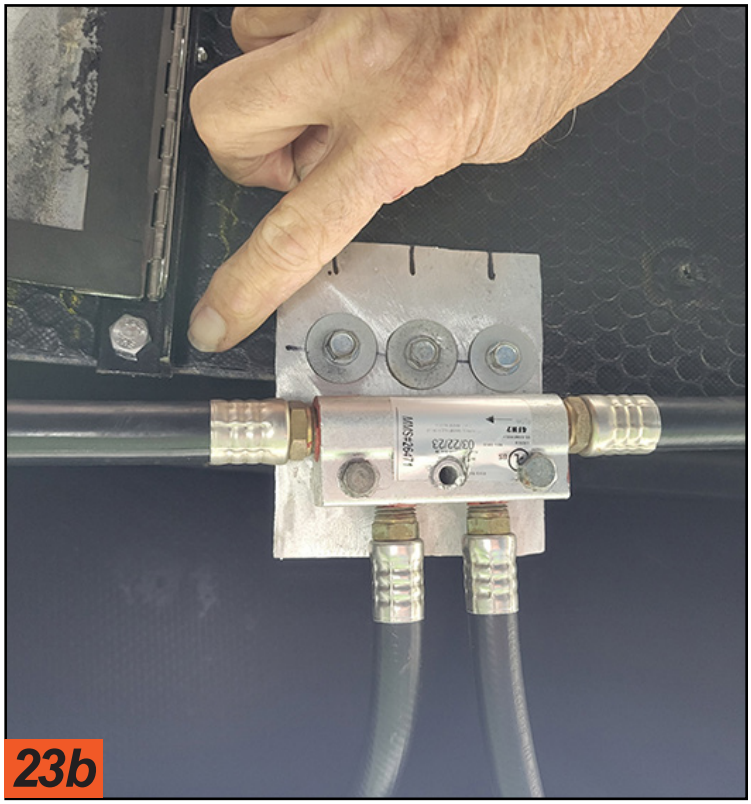
22

Once the angle iron was in bolted in place, the panel was dropped down and a cut made in the corrugated plastic along the inside edge of the angle iron. This was done with a razor knife.

24



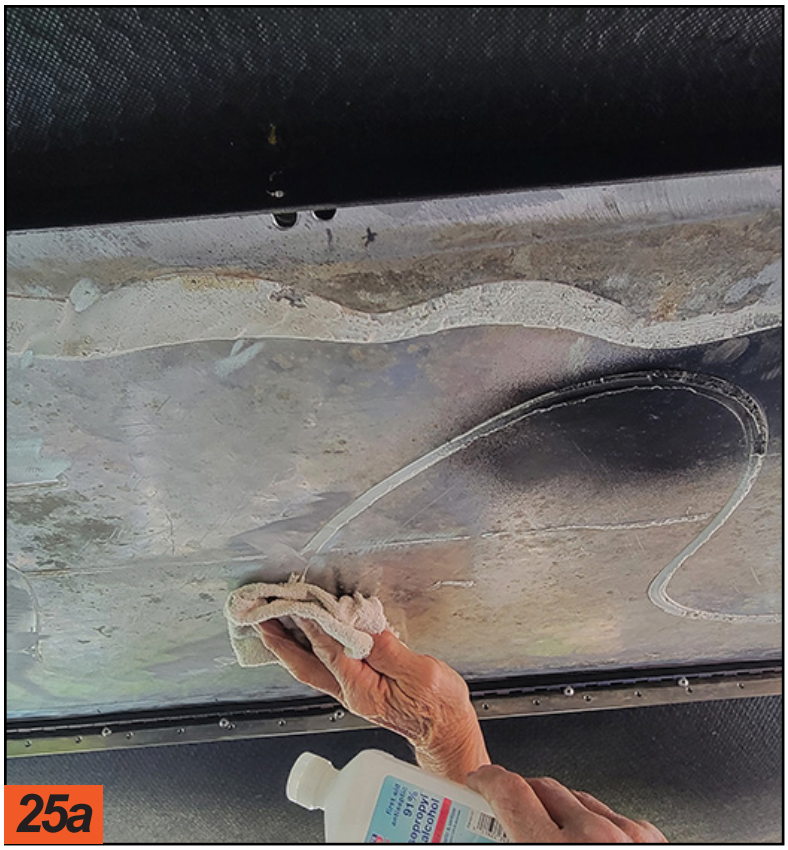
23a



23b

Originally, the LP-gas-line distribution block was removed to accommodate the angle iron. It was ultimately mounted outward from the I-beam using a piece of leftover diamond plate.

A thick piece of rubber roof membrane (from the housing industry) was cut to mount on the diamond plate so that it would seal around the 3-inch termination pipe. The low-point drains were reconfigured behind belly pan and secured inside, because it was too difficult to wrap around the drains and termination pipe with the rubber membrane. The rubber was riveted to the aluminum, using strips of heavy-duty metal plumber's tape.



Prepping the diamond plate for a good dose of rubberized truck-bed coating required thorough cleaning with alcohol. This was accomplished after the assembly was mounted and the panel hanging down.

Finally, the bolts were installed and tightened into the rivet nuts to keep the "trap door" in place. When it comes time to access the dump valves, wires and pipes the six bolts are simply removed and the panel dropped on its hinge.

The final installation of the new panel looks like it came from the factory. No doubt it will be greatly appreciated when dump valve service is needed. RVE

continued from page 12

AAA Trip Canvas, RoverPass Partner on New Category

AAA Trip Canvas, AAA Travel's digital travel planning tool, has added a new campgrounds category in collaboration with RoverPass, a leading platform in booking campgrounds and RV parks. The new feature allows travelers to browse campgrounds and RV parks with detailed information about the area and amenities.

By leveraging RoverPass's extensive network of campground and RV park options, AAA Trip Canvas users now have the unique opportunity to browse and book a wide range of outdoor accommodations. From lavish RV resorts to cozy campgrounds, the integration offers something for every type of outdoor enthusiast.

In addition to discovering camping destinations, Trip Canvas users can find inspiration through curated road trips, points of interest, and informative articles about U.S. National Parks. The platform's extensive planning tools also allow travelers to save their favorite campgrounds, streamline their booking process through RoverPass, and organize other aspects of their trip, including flights, rental cars, and activities, ensuring a memorable and hassle-free outdoor adventure.

RVE

News & Notes from Jayco *continued from page 12*

The roof is also pre-wired for additional solar panels.

Available on: 2024 Eagle TT, Eagle FW, North Point, Pinnacle, Seismic and Seismic Luxury Series

Overlander 2

With the added power conversion of two 200-watt solar panels, a consistently regulated charge from our 30-amp MPPT RV-C Solar Controller and the added assurance of energy compatibility from a 1,800-watt RV-C Inverter, our Overlander 2 solar package will give you the power you need to run some of the small amenities on your RV worry-free all through solar energy. (Jay Feather products utilize a Digital PWM Solar Controller and non RV-C inverter.)

Available on: 2024 Jay Feather Products, White Hawk, Eagle TT, Eagle FW, North Point, Pinnacle, Seismic & Seismic Luxury Series

Overlander 1

With the Overlander 1 package, you can now order your travel trailer factory-direct with a 200-watt solar panel installation without worrying about voiding your warranty to up-fit for solar. As the entry-level package in our solar lineup, we pair the 200-watt panel with a 30-amp solar controller to ensure the power flowing into your battery will not overwhelm the system and you can enjoy your battery investment for a longer duration.

Standard on: 2024 Jay Feather Products, White Hawk & Jay Flight; Available on: 2024 Jay Flight SLX. RVE

2024 Jayco Jay Feather

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Freeze Warning

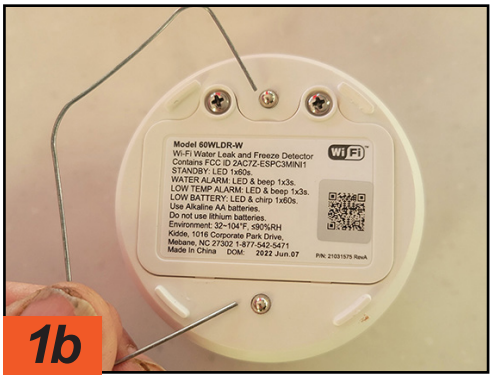
Being "in the know" before pipes will freeze and rupture can circumvent costly repairs and downtime to your RV. A simple device from Kidde is your first line of defense.

By Bill Gehr / Photos by author

When my tankless water came on recently in the wee hours of the night in order to protect itself from freezing ambient temperatures, the reality of winter set in. Fortunately, the water heater is able to protect itself automatically — but there are other vulnerable points that need attention to prevent damage from below-freezing temperatures. For example, the plumbing behind the water manifold in the utility bay or in the area around the pump. And, of course, any water lines that are not protected by furnace heat and/or additional insulation can be damaged.

While I use wireless probes in exposed areas to monitor temperature, I wanted a device to sound an alarm before the area was subject to freeze-ups. In today's world there are specialty devices for just about everything, so I was not surprised to find one made by Kidde, a well-known company that markets smoke and carbon monoxide detectors. This product, interestingly, also monitors the surrounding area for water leaks. The device can be found on Amazon by searching "Kidde WiFi Water Leak Detector & Freeze Alarm Alexa Device, Smart Leak Detector for Home with App Alerts, White." It's available on the Kidde storefront (kidde.com/home-safety/en/us/) and other websites with prices starting at less than $30.

The Kidde freeze and water detector is a compact unit that operates on two alkaline AA batteries, which should last around one year of normal use. I dug out my temperature gun to help with testing of the freeze detection component.



Access to the battery compartment is via two screws on the back of the detector. This compartment is sealed against moisture intrusion, for obvious reasons. Two AA batteries are included with the detector; Kidde prohibits the use of lithium batteries. You can test the audible alarm by jumping the two sensors on the back of the detector with a paper-clip. The alarm sends out an 85-db beeping alert, which can be heard throughout the RV.

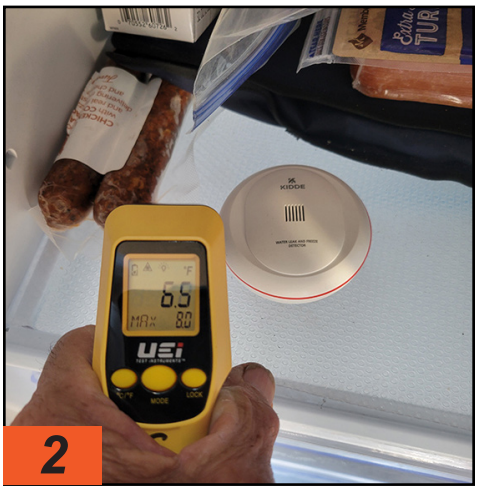
Since my main concern was to detect frozen water lines, the leak detection component was secondary; it's nice to have but there are dozens of such devices on the market (including the Govee H5054 sensors featured elsewhere in this section).

The Kidde freeze detector operates on two supplied AA alkaline batteries (which should last around a year) and will sound an 85-db alarm when the temperature drops to 37 degrees F, or during a rapid decrease in temperature. The company prohibits the use of lithium batteries.

There is no installation requirement other than to set the device in areas susceptible to freeze damage. In my fifth wheel, the logical location was in the vicinity of the central water system that was plumbed with several valves and a spaghetti-type mass of water lines running in multiple directions. I had to remove the divider wall in the front storage compartment to gain access to the area. The compartment is right below the bedroom, so I knew that I would hear it, but it's really loud enough to be heard anywhere in the fifth wheel. Since the device is Wi-Fi enabled, an alert during a freezing/water leak incident can also be viewed on a smartphone (iPhone or Android). All you do is download the App and set up the communications using the QR code on the back of the device. Keep in mind you'll need Internet service to make this work, but it's a great feature when leaving the RV unattended.

I tested the unit's capabilities by following the suggestions in the short owner's manual. The device was placed in a shallow dinner plate with a little bit of water, and it didn't take long before the alarm sounded. Next, I placed the device in the freezer compartment, and in short order the device started to blare the alarm.

A perfect place for the device was behind the water manifold in the utility bay located in the fifth wheel storage compartment. Here, there's a spaghetti bowl of water lines that are susceptible to freezing temperatures. The divider that closes off the front section had to be removed to gain access to this location for the Kidde device. The device was simply placed on the floor in the vicinity of the water lines and connections. It takes up very little space.



The device was placed in the freezer compartment to test the alarm under low temperatures. It goes off went the temperature hit 34-37 degrees F. As you can see, ultimately this freezer was plenty cold.

The cost for this device is peanuts when compared to the expense — and hassle/down time — of making repairs due to freeze and water damage. I am a big proponent of preventive maintenance and even though I rarely travel to places when the temperature plummets, I have found myself in extreme cold weather that was not forecasted, so being prepared is my mantra — and should be yours, as well.

In order to activate the Wi-Fi feature, an app is downloaded to your smartphone (or tablet) and the QR code on the backside of the Kidde alarm is used to set up communications. Just keep in mind that you'll need Internet service to make this feature work. It offers great peace of mind when away from your RV. RVE

On The Skids

Living with slideouts that stick and grind when moving in-and-out is no fun. Installing Duo Form RV Slide Out Skis smooths out the operation — and curtails any damage.

By Bill Gehr / Photos by author

Slideout rooms have evolved tremendously since their inception years ago, and while they aren't completely fault-free, for the most part minor maintenance will keep them functioning as intended. One issue they are susceptible to, though, is when the bottom of the slideout catches on something while moving in and out. Warping of the wood or even an errant screw or small rock can cause problems — and in most cases, the result is damage to the waterproof covering underneath the slideout room. Sometimes, the main floor can also be scratched or even gouged.

Removing the entire slideout to replace the material is a big job — and making spot repairs with tape (sorry, duct tape fans) rarely works. Adding skids to the bottom of the slideout, on the other hand, is great preventative medicine. After a friend found slideout "skis" online and I installed them, I was a believer.

The Duo Form RV Slide Out Ski System (duoformplastics.com) is comprised of two lengths of a synthetic material that is incredibly tough. Each section is 53 inches long and 6 inches wide, which makes the kit (retails for $81) suitable for one slideout. In effect, the installation of these skis prevents further damage to the bottom edges of the slideout — where the damage is most likely to occur.

The waterproof material under the slideout floor was damaged because the rollers were not installed properly. In the first year (from new), the material was shredding; it was only a matter of time before this protection would lose its resistance to moisture.

Duo Form's RV Slide Out Ski kit offered a good solution to smoothing out the operation, while preventing potential gouging and eliminating grinding that could lead to jamming.

The first step was to remove the molding on the front and rear slideout walls using a screw gun. Once the screws were removed, the molding was pulled off the sides with little effort. Make sure you do not bend the molding while removing.

We determined that the problem with the slideout we were working on was due to incorrectly installed rollers. The result was serious gouging of the material that covered the bottom of the slideout floor. The first step was to remove the molding on the outside of the front and rear slideout walls. Once the old caulking was removed, time was spent determining where to cut the skis. These skis are typically installed on the edges of the slidout and can be positioned up against or under the molding — and if you cut off the lip, they can be installed in the middle or anywhere underneath the slideout room. There is a link in the instructions for an online video of the installation process, which we watched for this project.

Duo Form recommends that the installation be performed by an experienced technician because if not done properly, jacking up the bottom of the slideout to provide clearance for the skis can be dangerous. In our case, the installation was a little tougher because the rollers were so close to each sidewall that we had difficulty installing the skis — but we persisted with some cutting and were able to get them placed properly. With a little patience, experienced do-it-yourselfers should be able to complete the installation.

We used two six-ton hydraulic bottle jacks that were positioned between a built-up pile of lumber and another piece of wood under the slideout to lift the floor high enough (until you can see light under the floor) to gain access for the skis; one side of the slideout was lifted at a time. In the video, 2x4s in a T-shaped configuration were used for support, but our system seemed to be stronger and more stable. With the slideout lifted, measurements were taken, which was tough because there was not much room to work with. Fortunately, this will not be an issue in all RVs.

We cut the skis to length and held them into place to make sure the fit was right. Before we jacked the room up to install the skis, we moved the slideout room in about 12 to 16 inches to gain access from the inside, where the skis were installed.

We soon learned, however, that there were obstructions in the way, so we had to make cuts to accommodate the fit — especially to clear the roller brackets. For this malady, a file was used to take down the sharp edges, which we determined caused the tearing of the material on the bottom of the slideout. Satisfied that we could put the skis in place without any obstructions, the double-sided tape supplied with the kit was installed. It took some doing to get our fingers in the tight space to remove the backing from the double-sided tape. Once we had the technique down, though, installing the second ski was much easier and faster.

Finally, butyl tape was applied to the moldings that were reinstalled on both sides of the slideout. After a few in-and-out tests, everything stayed in place and worked smoothly, gaining our confidence that damaging the slideout — and the potential for floor gouging, sticking and grinding — was now a thing of the past.

A utility knife was used to cut through the old sealant and a putty knife made short work of lifting the sealant away from the molding.

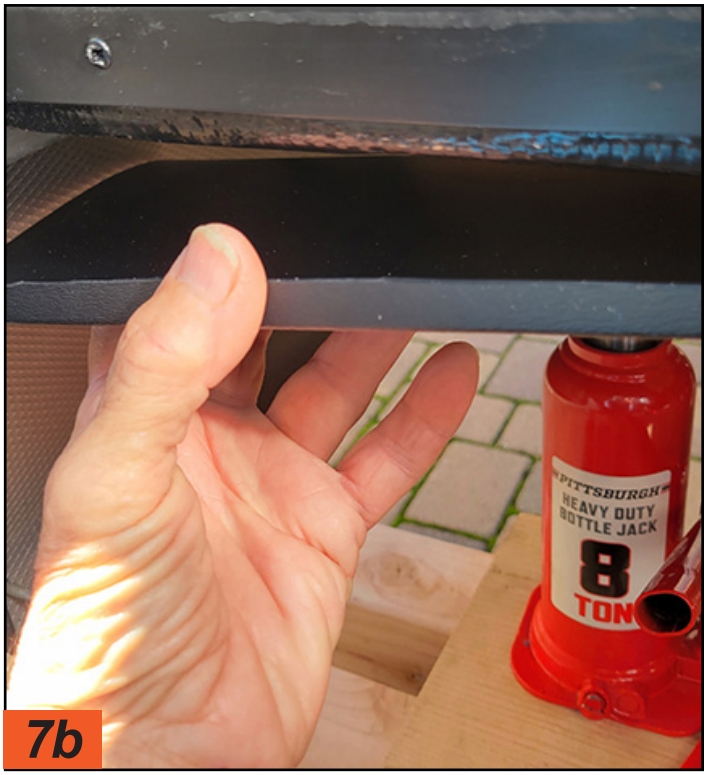
Be sure to clean off any old putty from the molding before applying new material. Final cleaning was done with alcohol (not shown).

It was necessary to lift the slideout enough to see daylight through the frame. Extreme care must be taken, and Duo Form recommends that this step be left to RV technicians. Experienced do-it-yourselfers, though, should be able to complete this task — just be sure to use enough wood to build up a stable structure for the bottle jacks.

Once the measurement was confirmed for the length of the ski, it was cut easily with tin snips. It can also be cut by scoring the material with a utility knife and bending until it breaks apart. Each ski is specific to the front or left side of the slideout; they are not interchangeable, so be sure before cutting.

It's possible to install the skis in places other than the outer edges of the slideout structure by cutting off the end of each ski.


7a



7b

The skis were installed from inside the RV once cut to size. It took a little juggling to make sure they fit properly. In our case we had interference from the roller brackets, which were filed down to ensure proper clearance (not shown). The skis can be installed butted up to the molding as shown here, or under the molding.


8

Double-sided tape, supplied with the kit, was applied to the skis. It's best to clean with alcohol first for a strong bond. Pulling the backing off the tape can be "entertaining" due to restricted access, but it can be accomplished with patience.


9a

9b

Once the skis were solidly in place, butyl tape (not supplied) was applied to the molding, which was reinstalled using the existing screws. Finally, a bead of exterior sealant was applied neatly to prevent water intrusion. RVE

Have (Sili)Gun Will Travel

Laying down a bead of sealant can be a work of art for some and make a terrible mess for others. You can level the playing field with the use of a Siligun caulking tool — and smooth out the results.

By Bill Gehr / Photos by author

Most RV service technicians will tell you that a good caulking gun is indispensable. Just look around any RV and you'll find countless places where a bead of sealant makes the difference between a watertight interior and one that is plagued with leaks. An ugly looking bead of sealant is not (or shouldn't be) an option — and even though many sealants are clear or blend in with the exterior color scheme, poorly placed sealant stands out like a sore thumb.

Resealing the roof seams and accessory flanges, as well as other places throughout the exterior that have weathered over the years, should be part of a regular maintenance routine — so having the right caulking gun is paramount. There are many types of caulking guns on the market, from the simplest (and cheapest) to more elaborate models that provide better control of the sealant. There's nothing exotic about a caulking gun, so inventing a "better mousetrap" didn't seem like it was on the horizon. But someone has done it — and the tool is called a

There is quite a bit of size difference between the Siligun and a common caulking gun. The standard plunger sticks out around 9 inches from the gun and has a 23-inch overall length, which is less suitable for working in tight spaces. The Siligun measures 13 inches total — and when the spent cartridge is cut off, the length becomes even shorter. The smaller profile also fits your hands nicely and offers greater control when laying down a bead of sealant.

Loading the Siligun for the first time may seem a little awkward, but after a few tubes the process seemed much more natural. To load the cartridge, the tip is cut off and the clutch lever is pulled back all the way while the tube is pushed into the gun until it's seated against the cutter.

The blade built into the barrel cuts the tube as the sealant is dispensed. It cuts well but takes a little more pressure to squeeze the handle. You'll acclimate quickly.

"SiliGun Compact 4" (siliguns.com).

The professional caulking gun that I have used for many years is very high quality, but one of the things that made it difficult to handle was getting off the trigger and pushing the release button at the same time to stop the flow of sealant (still under pressure) to prevent gobs of goo from dripping all over everything. Naturally, this made it much more difficult to terminate a beautiful bead without leaving a clump of sealant. I can't even begin to think how many tubes of caulking I've used in 51 years, and I've tried other caulking guns that supposedly stopped the sealant from running after you let go of the lever. However they really didn't work — and it's difficult to restart a bead of sealant.

The Siligun, on the other hand, is a game changer. It's much more compact than a standard caulking gun and the ABS plastic frame is much lighter. Coupled with those attributes, the non-drip feature solidified the deal. And, since there is no long plunger handle to deal with, it's much easier to get into tighter spaces. It uses standard 10-ounce cartridges — and as the sealant is depleted, the back portion of the tube can be cut off to make the gun even smaller. With a full tube of sealant loaded into a standard caulking gun, the plunger handle sticks out about 9 inches for an overall length of 23 inches, which is not great for tight spaces. A loaded Siligun measures only 13 inches total.

At first, I was a little skeptical about the plastic frame, but I was pleasantly surprised how well it performed and conformed to my hand. The 10-ounce tube of silicone rubber needed for the test RV repair was, at first, a little difficult to load from the front of the gun and push against the cutting blade — which splits the tube as the sealant is dispensed — but I quickly got used to it. The internal cutting blade does a good job of slicing through the tube, but it does require quite a bit of pressure on the trigger. Actually, once you acclimate to it, it only takes seconds to load/remove the cartridge and use the gun. I also liked the removeable tool for puncturing the membrane seal after cutting off the tip of the tube (it's also good for clearing the nozzle after sitting in storage).

During a test, I cut off the end of the nearly spent caulking tube and was amazed how much that reduced the overall size. If you really need to caulk something in an incredibly tight space you could always squeeze out half the tube and cut the end off, but you won't have much to hold on to when removing what's left of the cartridge from the gun.

When selecting a particular type of caulking, be sure that you read the directions — not all tubes will fit into the Siligun. It may be necessary to peel off the outside vinyl cover on some tubes.

The provided hook makes it easy to hang the Siligun from a storage compartment rafter, although the gun's diminutive stature also allows it to easily store in a toolbox or bag. Once you use the Siligun, you'll have a fresh outlook when it comes to sealing projects — and since you won't make a mess, the $19.99 investment (Amazon) makes it an even a better deal.

If you're working in tight spaces, the spent portion of the cartridge can be cut off with a utility knife. The only caveat: It's more difficult to grab on to the remaining tube to remove it from the gun.

Laying down a bead of sealant was smooth and accurate. The anti-drip function is a game-changer. Once the lever is released the flow of sealant stops, eliminating the chances of leaving an unwanted glob at the end of the line. The Siligun is capable of dispensing latex, acrylic and silicone caulking. RVE

Weekend Projects

Water World

Using inexpensive sensors to detect moisture in places that shouldn't be wet can prevent costly, unexpected damage.

By Bob Livingston / Photos by author

When leaking water goes unchecked in an RV, the results can be disastrous. If you don't find out about a leak until water drips on the ground — or pours out the entry door — it's likely too late. You can prevent an expensive clean-up by taking a proactive stance and installing inexpensive leak detectors that can give you advance warning before things get out of control.

There's a proliferation of such devices on the market — they're well-known among folks who have owned a brick-and-mortar house with a basement prone to flooding — and if you search the Internet, the choices are extensive. My guess is that most will do the job, but when a friend praised the performance of the Govee water sensors he's used for some time, that's all I needed to make a good choice. It's all about experience with products and reviews these days.

The Govee H5054 sensors can be purchased on Amazon ($12.99 each or in packs of five for $49.99). These sensors are small and inconspicuous — just 1.77 x 1.04 x 3.46 inches in size — and are self-contained. Running on two AAA batteries, they are capable of sensing water on flat surfaces via two groups of built-in probes on the backside or will alert to dripping water when the moisture hits one group of probes on the front of the device. A low battery alert is also provided.

When water is detected, a loud (100 db) alarm can be heard from anywhere inside the RV and on an RV site. A red light also signifies the leak. For those who would like to be informed offsite, there's a Wi-Fi component that will send messages via email to your phone or tablet. It works on 2.4G Wi-Fi but not on 5.0G versions, so check your system to make sure it's compatible.

These sensors can be placed anywhere there's a potential for moisture. For example, logical locations to monitor are under the bathroom and kitchen sinks, behind the toilet, next to the demand water pump, inside storage compartments and in a utility bay. And the sensors are very sensitive — one even went off in our RV when the floor was washed a few minutes before returning the sensor to its previous location. If it does sound an alarm, dry the sensors with a towel and press the mute button and you're ready to be protected again.

When moisture is detected, the sensor sends a 100-db audible alarm and the red LED is illuminated. The sound is loud enough to be heard throughout the RV and almost anywhere on an RV site. The device runs on two AAA batteries and an audible alarm reminds the owner when they need replacing.

After the water pipe to the toilet let go a few months ago, the owner who recommended the Govee sensors repaired the cracked pipe fitting and added a sensor to detect the future presence of water behind the "throne" before it hits "flood" stage.

The Govee water alarm sensors have two groups of probes on the backside that detect leaks on flat surfaces. Probes on the front side detect dripping water (not shown). RVE

Don't Bug Me

Cleaning insect splatter from the front of an RV or tow vehicle seems like a never-ending battle when traveling in buggy areas. Having the right products tempers the grunt factor.

By Bob Livingston / Photos by author

Anyone who has traveled through different regions of the country knows that some places tend to be more "buggy" than others — but no matter where you travel, stopping for any length of time means dealing with bug splatter on your rig.

Over the years, products designed to remove bugs have come and gone; some worked, and some were snake oil. My go-to product for cleaning the mess has long been a Bugs Off Pad (formerly called "The Love Bug Eraser"), which works great with just plain water and a little elbow grease (bugsoffpads.com). Last summer, though, I added another "weapon" for removing squashed bugs to my arsenal of cleaning products: ProSol Works Bugs N All Multi-Use Vehicle Cleaner (bugsnall.com). The combination of the Bugs Off Pad and Bugs N All cleaner makes the job even easier — especially if the bug splatter is allowed to bake on the surface for a while.

The nice thing about Bugs N All is that the spray-on formula does most of the work for you. You just spray it on and hang around for 30 to 120 seconds while the liquid neutralizes the acid and turns the bugs into mush. Then, it's just a matter of wiping the surface with a wet towel; you can also hose off the area after wiping.

While Bugs N All proved to be highly effective, I found that using the Bugs Off Pad to break up the stuck-on splatter allowed the contents to be whisked away more quickly. Although tempting, it's important to refrain from wiping the solution off with a dry towel — you might scratch a painted surface. If the directions are followed, there's no risk of damaging paint or decals; nor will it remove wax.

You do have to make sure the surface is always wet, which requires reapplications of the Bugs N All solution (it's best to clean the bugs off in the shade to prevent premature drying). The formula is non-abrasive, non-toxic, biodegradable and has no petroleum distillates — and, as such, is also touted for cleaning rubber roofs (which I did not verify). But the solution did clean dirt as advertised.

Bugs N All solution is not cheap, but it's concentrated so the overall cost can be amortized. It takes 2 ounces mixed in a quart of water to make an effective bug-removal solution. The basic kit sells for $18.99 and includes 4 ounces of concentrate and an empty spray bottle that's clearly marked. For $36.59, you get the same empty bottle and a quart of the concentrate. Bugs N All is sold on the company's website and Amazon.

Now I have a new summer travel mantra: Bring em' on!

The basic Bugs N All kit comes with a clearly marked, empty spray bottle that holds a quart of cleaner. Just mix 2 ounces from the 4-ounce bottle of concentrated liquid that comes with the kit into 30 ounces of water for effective bug removal.

Bugs N All easily removed the splatters that "graced" the front of the fifth wheel. If you do this after the day's drive, there won't be a build-up and the job will take less time.

Removing the cleaner and splatter with the Bugs Off Pad upped the ante quite a bit. The combination of the Bugs Off Pad and Bugs N All made short work of the dried-on bugs on my truck's bumper. It proved to be a winning combination. RVE

Weekend Projects

On The Hook

Finding nooks and crannies for things like baseball caps can be challenging. No one wants to thin out their collections of favorite stuff even when on the road, so utilizing over-the-door hooks provides out-of-the-way places to reduce clutter.

By Bob Livingston / photos by author

One of the challenges of RV ownership is finding places to stash stuff. Over time, closet and drawer space seems to shrink as more items are brought on board. Longtime friends and authors, Bill and Jan Moeller, who spent most of their lives in an RV and are now in the RV park in the sky, perfected the art of managing belongings in confined quarters. I learned a lot from the Moellers, who sometimes had radical ideas like removing book covers to reduce weight and to always discard an equal-size item to make room for another.

The Moellers stuck to their regiment and wrote books on how to fulltime, which have become classics (just search “Bill and Jan Moeller” and you’ll find sources for their published works). The Moellers were masters at finding cubbyholes. For those less enamored with this topic, there are simple ways to improve storage, like adding over-the-door hooks.

There is nothing exotic about over-the-door hooks, which open a plethora of places to hang things like hats, jackets and other apparel. One way to utilize otherwise wasted space is to place these hooks over the top molding that normally graces slideout rooms. For example, placing these hooks overhead in the bedroom slideout provides generous locations for baseball caps or other hats. Hats are normally strewn all over the place and always get in the way. And RVers love their hats — I can

Everyone loves baseball caps, but typically most collections are too big for the available storage in an RV. Over-the-door hooks are the solution for hanging hats out of the way. These hooks were placed on the slideout room overhead molding in the bedroom and have no negative impact on space.

Hooks ganged into a single frame are commonly found on the Internet, where dozens of sizes, styles and colors can be perused. Most cost less than $15, but it's possible to pay much more for designer brands. The model shown here has three hooks.

attest to that.

If you search the Internet, you'll find dozens of types, shapes, styles and sizes of over-the-door hooks. Stick to the metal versions in lieu of plastic for durability reasons. I like the individual hooks since they are more versatile for hanging single items in multiple places. Most will allow the door to close without removing the hook, which is ideal when using them in the bathroom or on cabinet doors. Individual hooks also allow for flexible spacing, whereas the products that have four or five hooks in a larger frame have symmetrical dimensions.

You won't have to spend a lot of money — the majority of these hooks sell for $5-10 for a package of four and are available in sizes to accommodate most door widths (combo units generally run less than $15). For placing on the molding over the slideout, look for something that is as close to the thickness of the wood as possible; most will likely be larger than necessary. In just about all cases, fasteners are not necessary.

The sky's the limit when it comes to uses for over-the-door hooks. You can also place them on cabinet doors to hold purses and other items that typically get in the way on counters or shelves.

One thing to keep in mind, though — you'll be tempted to buy more stuff with the extra room afforded by these versatile hooks. I take no responsibility for that.

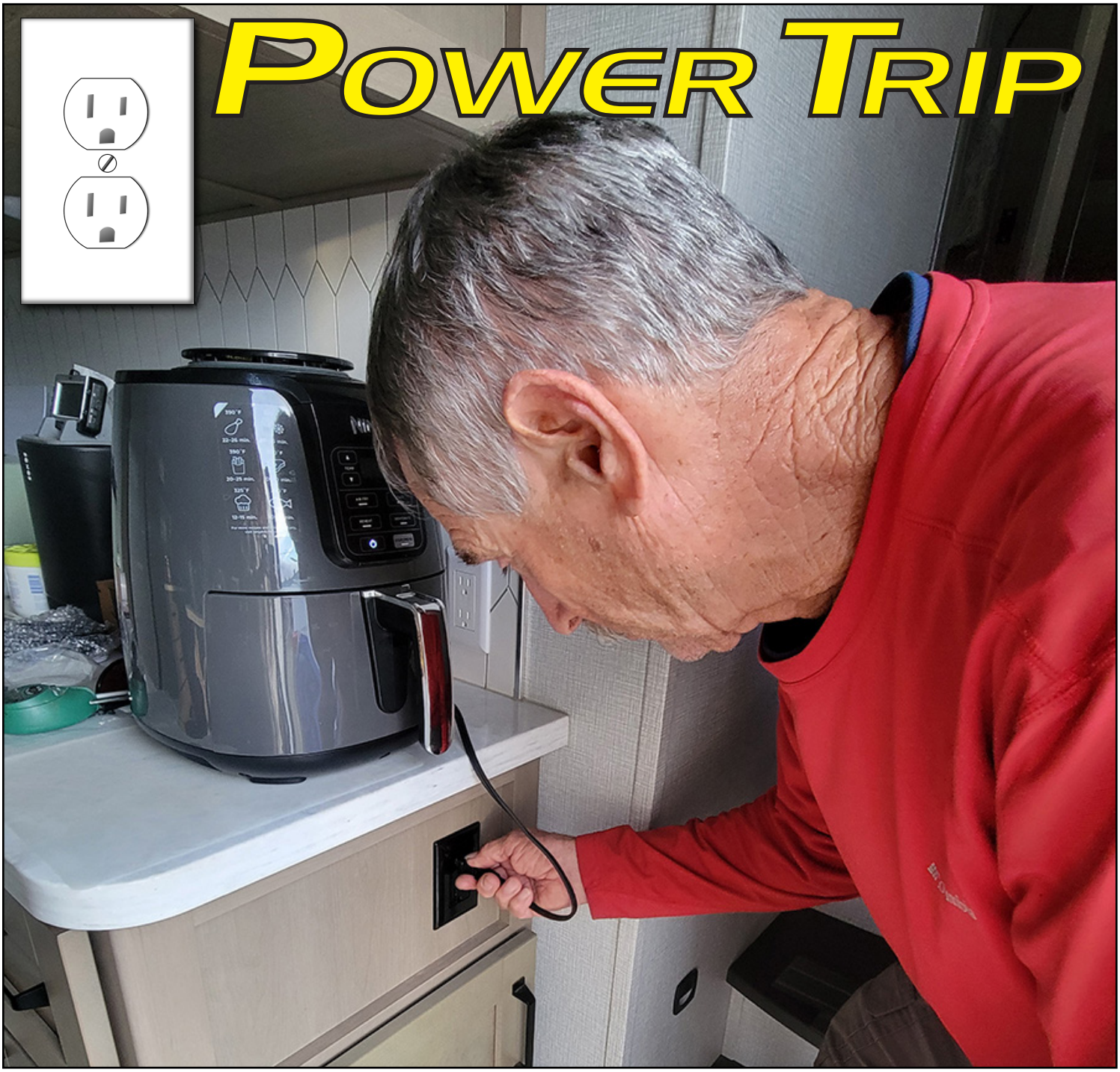
It's best to opt for metal brackets and hooks for better durability. Most hooks have some type of rubber pad to prevent scratching and to keep the frame from slipping. This frame has three hooks, but you can opt for more in different lengths. Obviously, you don't need long hooks for baseball caps, but they do hang best below the molding.

This frame has five hooks and is chrome-plated. To provide more room between the hats, individual hooks can be found in different sizes and colors (see above). Most individual hooks are only around $6 for a pack of four.

Measure the width of the door before purchasing individual hooks or sets. Most individual and multiple hook frames allow the door to close without removing the hooks.

These owners really got into the over-the-door hook "groove." They have different styles of hooks scattered throughout their motorhome, which are handy for hanging all sorts of personal items. **RVE**

Power Trip



After learning that all the galley-area 120-volt AC outlets and microwave in my fifth wheel were tied to a single 15-amp circuit, it was time to pull more power to the area. Adding a new outlet to a separate circuit did the trick — now I can run my air fryer and microwave at the same time.

By Bill Gehr / Photos by author

Over the years, RV owners have become spoiled with the proliferation of electric appliances. From the health benefits of cooking in an air fryer to baking a Thanksgiving turkey or using a portable electric heater, RVers have become reliant on 120-volt AC powered appliances — and the industry has responded with a greater selection of all-electric RVs.

For those of us without an all-electric RV, however, ganging 120-volt AC outlets can make it difficult to operate multiple appliances at the same time. For example, in my fifth wheel, the electric supply in the kitchen and the hutch was totally inadequate. All the outlets were tied into a single 15-amp breaker, which made it difficult to run two appliances at the same — unless power consumption was limited to maybe 700-800 watts. It didn't take long to realize that I needed to add another circuit in the hutch area.

In my fifth wheel, the power distribution center was on the end of the hutch where I keep the air fryer, laptop computer and printer. Adding a 120-volt AC outlet in the wall right above the distribution panel made the most sense, since routing the wiring was not

The distribution panel was located in the end of the hutch, behind a door that was removed for better access. After removing the four screws holding the panel door and trim, the entire distribution panel was pulled out, only limited by the wiring on the backside.

going to be complicated. There's no front air-conditioner in my fifth wheel (I ordered it that way to allow for a fan in the bedroom for boondocking jaunts), which made it easy to use the 20-amp circuit that was already in the panel. If the panel is filled — usually with circuits dedicated to the second air-conditioner and/or washer/dryer —you can replace one of the other breakers with a tandem-style counterpart. Tandem breakers are available at hardware and home improvement stores.

The blank wall near the distribution panel was the perfect place for mounting the new outlet. I located the outlet as far to the right as possible to keep the additional blank space open for possibly mounting other monitors down the road. The only potential issue was allowing enough room to clear the drawer and slide on the other side of the wall. To accommodate the available space, I used the same type of electric outlet that's found in most RVs, which is a one-piece unit that occupies less space. These outlets are available at RV parts stores or on Amazon ("RV Designer S817, Self Contained Dual Outlet with Cover Plate, Black, AC Electrical") for $13.74. You'll need GFCI protection if the new outlet is installed in a wet environment. You'll also need 3-4 feet of Romex wire. I carry a coil of it for emergency repairs; if you don't have any handy, it's available at any home-improvement store or online.

The first thing that you will need to do is disconnect the RV from electricity and make sure the inverter is Off before removing the distribution panel — never perform any repairs or modifications to your RV's electrical system without first ensuring all power is off. Then, I held the new electrical outlet plate against the wall where it was going to be mounted and made a rough outline for the cutout. A step-type drill bit was used put holes in each corner of the markings and an oscillating-tool blade made short work of cutting a rectangle opening for the outlet. I allowed extra space beyond the markings for a little more clearance.

The next process was to drill a hole in the shelf above the distribution panel — also with the step-bit — and run the Romex to the back of the distribution panel. Fortunately, there was an extra inlet with a set of jaws to provide stress relief for the Romex should the distribution panel need to be pulled out in the future.

With the Romex routed, a portion of the yellow exterior casing was removed, exposing the cooper, white and black wires for connection into their designated places in the new outlet, which was tricky without the $160 tool that compresses the wires into the slots. This tool assures the wires will not come out, even on bumpy roads — but my tool was forfeited when I sold my RV repair business, so I had to improvise. I needed a solid surface where I could lay the outlet flat and try to drive the wires with a screwdriver. A 2-foot-long piece of 4 x 6 lumber fit the bill, but the wide-blade screwdriver was not capable of driving the wires into their respective slots (which are marked); if you get the white and the black reversed some appliances may not function.

Thinking outside the box, I rummaged through my tools and found a small chisel that worked. All it took was one whack of the hammer for each wire. Now it was just a matter of clamping the cover on the back; again, my makeshift lumber work top — covered with a cloth to prevent damaging the outlet — came in handy.

After double checking all of the con-

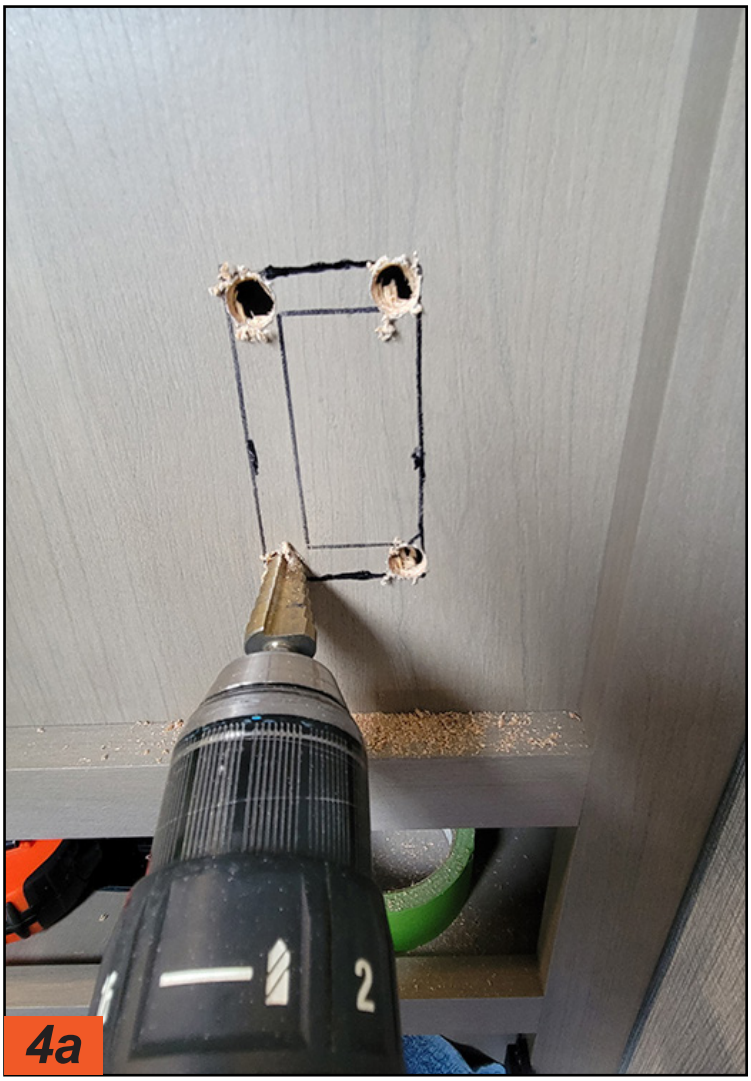
Since the fifth wheel was ordered without a front air-conditioner, the breaker in the panel was available and used for wiring the new outlet. (Having your breakers identified always makes working with them easier.)

nections, I restored power and tested the outlet for polarity. Keep in mind that this project assumes you have 50-amp service, which is the case if the RV is equipped with two air-conditioners. Now I have plenty of power to run my air fryer and microwave at the same time without overloading the circuit.

3a

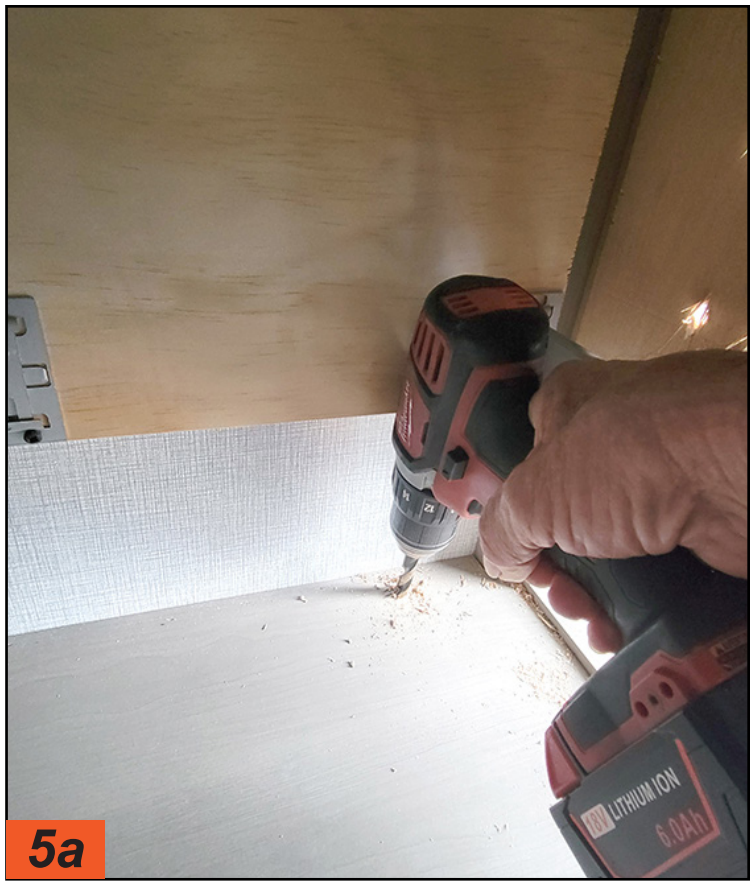

3b

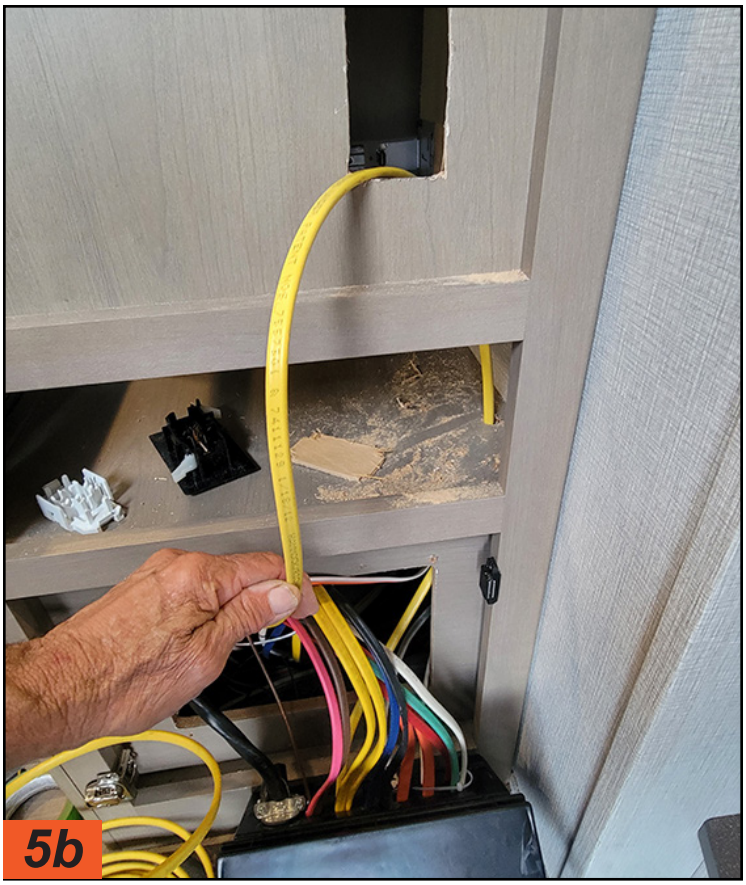
I ordered a one-piece RV-type 120-volt AC outlet because it doesn't require a junction box and was able to clear the adjacent drawer and slide. The new outlet was marked for installation to the far right of the blank space in the structure to allow for future instrumentation/monitors. This outlet is available at RV supply stores or from Amazon.


4a


4b

Once the position for the new outlet was established, the corners were drilled with a step-bit and the opening cut with an oscillating-tool blade.

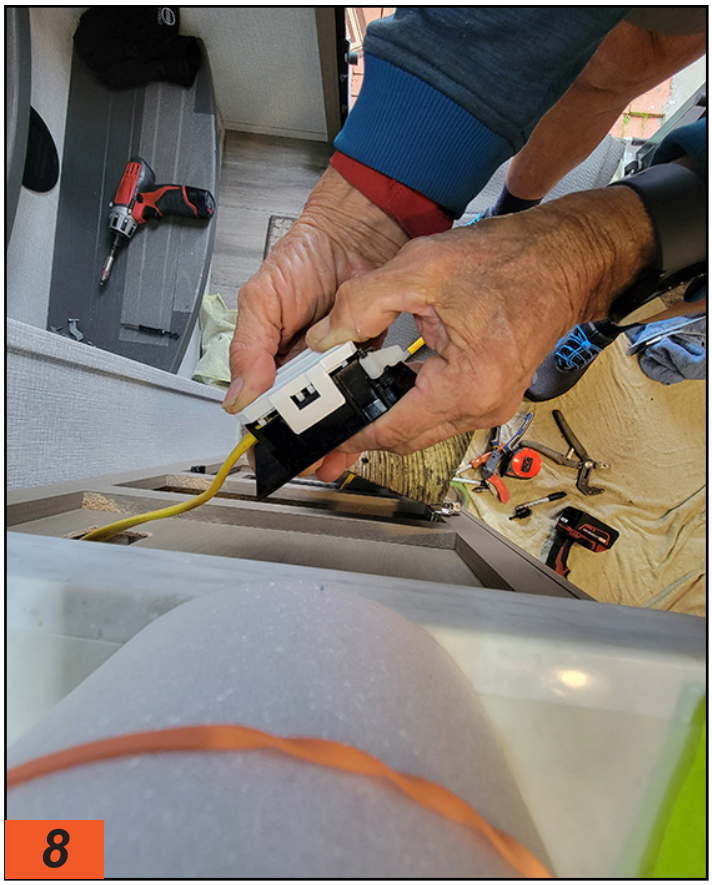




A hole was drilled in the shelf above the distribution center to make way for the Romex from the new outlet. As you can see, the location for the new outlet was very close to the back of the distribution panel. The Romex was cut from the wire roll once enough length was provided to work in the back of the panel without creating undue stress on the connection points.

Proper wire length was necessary to make sure the connections in the outlet were clean and tight. A section of insulation was cut away with a utility knife.

Without the use of an expensive tool for seating the wires in the outlet, it was time to improvise. Ultimately, an old blunt, 7/8-inch chisel made short work out of seating the wires properly.



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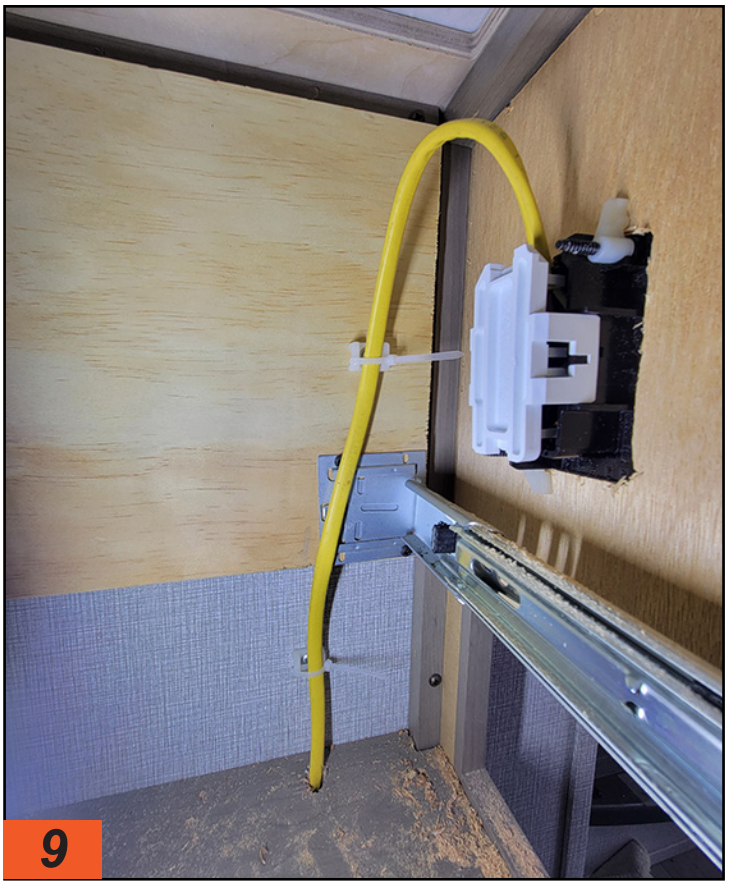
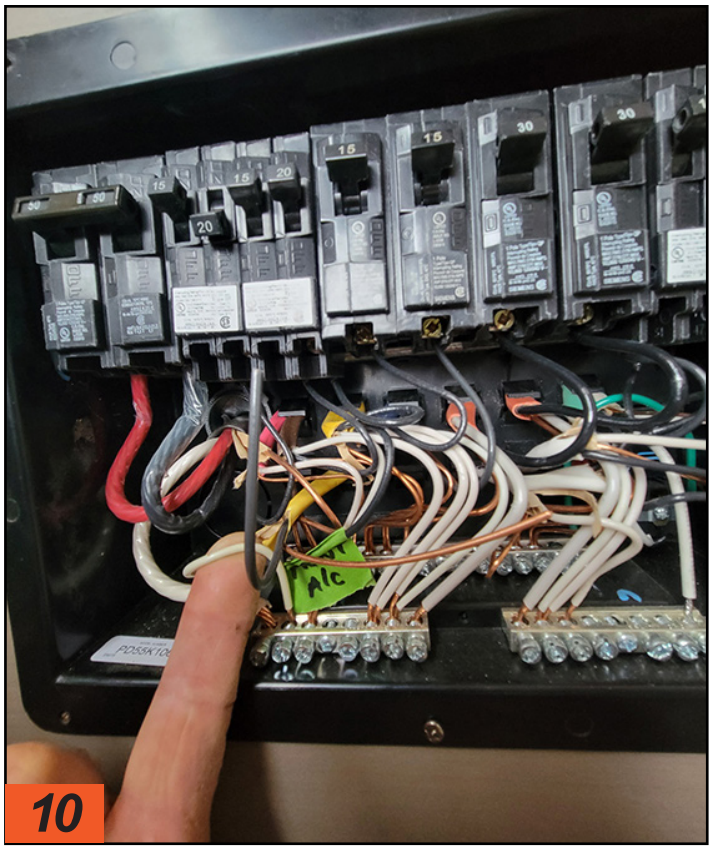
The back cover snaps on the outlet to protect the wires from being exposed. It takes quite a bit of pressure to do this, but it's important that both sides are snapped in securely.



9

Once the new outlet was installed, the Romex was secured tightly against the wall using small clamps and cable ties to make sure there's no contact with the drawer or slide.



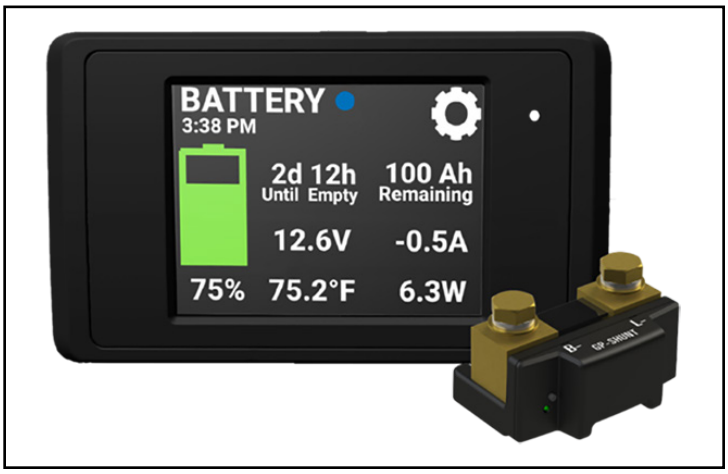
10

The existing wire for the front air-conditioner was marked and pulled from the breaker and the new black (hot wire) was connected to the breaker, which must be very tight. The white and copper wires were connected to their respective bus bars.

11

Finally, the new outlet was tested for proper polarity, making it ready for the air fryer and other accessories. If the new outlet is installed in a wet environment, it needs to have GFCI protection.
RVE

continued from page 29



The Go Power! Battery Manager Kit is an easy upgrade that adds smart functionality to older battery banks. It includes an intuitive touchscreen interface and smart shunt.

designed — how much current can go back into the battery at one time. That can make a big difference. We ran into some competitors in our space where their products only allow 50 amps of charging at one time back into the battery. If an end-user has a bunch of solar panels putting out 30-plus amps, along with a converter charger operating, some batteries don't like that. Then they have to really dial it back — and those usually come with a lower price point."

Spilsbury also recommends that potential buyers check to ensure that the battery also carries UL (Underwriter's Laboratories) approval, "because there can be issues with lithium if it's not taken care of properly or does not have that approval.

One advantage enjoyed by lithium batteries may not be just limited to that battery class for long: monitoring of the battery performance. Go Power!, like most other premium lithium-ion batteries, uses a management system that incorporates a built-in shunt that allows the user to track the amperage leaving and entering the battery.

"It's kind of like a 'gas gauge' for the batteries," said Spilsbury. "It tells you what percentage of power you have in the battery, how many amps remain and can calculate how much time you have remaining in them. We have a digital touchscreen power track display or you can use our app to check performance."

Go Power! recently released its new Battery Manager kit that includes a shunt, intuitive interface monitor and wiring.

"With our advanced lithium batteries, we have a shunt built in, said Spilsbury. "but let's say you've got an older lithium battery or a brand new set of AGMs and yet you wanted to use our display because you want to tie it in with our solar and our solar controller and inverter. You can add that shunt to an AGM or some other brand of lithium battery and then be able to use our touchscreen display just like you would if it was with our battery. It allows you to turn a not-so-smart battery into a smart battery and get that information out of it."

ODYSSEY, for its part, is developing a similar system. Plans call for it to be included on the company's Group 31, Group 24 and Group 27 products.

"We're working on releasing new technology that we call Odyssey Connect," said Gregory. "It's a monitor that comes on the battery and connects with Bluetooth. Once you've synched it to, say, your smart phone, anytime you get within range you can see what your state of charge is, what it's been exposed to in terms of temperature and charging/discharging voltage and even how many cycles it may have seen."

The need for a capable energy system for going off-grid, added Gregory, is all the more important today due to constantly evolving accessories and appliances.

"The 'elephant in the room' is parasitic draw," he noted. "A lot of RVs are built today with a non-ammonia refrigerator. And in the higher end, they use residential refrigerators. Those things are parasitic drains on a battery of significant proportion that most RVers have never seen before. On top of that, many dealers are putting the least-expensive battery they can buy in them to get customers out of the door. Yes, you can add an inverter to help run these appliances, but the parasitic drains are just like what a chassis battery goes through — even just driving down the road is drawing those batteries down, they're getting cycled. And a lot of times, those batteries just aren't designed for cycling — they may just be starting batteries put in a cycling application. No one wants to be in a position of having to replace their batteries every year."

If you've got the space and need the power, Battle Born Batteries' new Lithium Power Pack 6500 is "the ultimate generator replacement and all-in-one power solution for RVs." Designed to mimic the dimensions and mounting points of traditional RV generators, the LPP6500 is clean, silent, safe and offers 540Ah of reliable lithium power from (2) 270Ah 12V LiFePO4 Deep Cycle GC3 Battle Born batteries and Victron Energy charging, distribution and monitoring components. The built-to-order Power Pack 6500 MSRPs at $12,999. **RVE**

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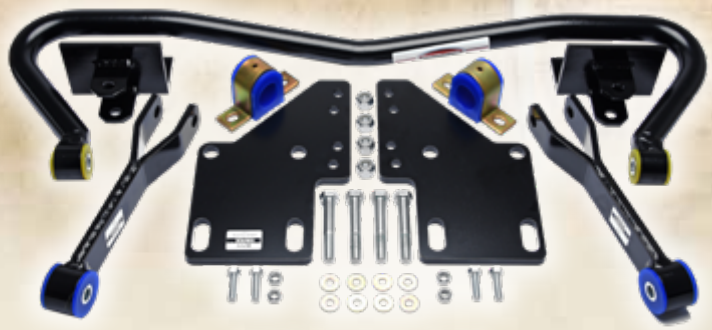

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