DC Receptacles & Plugs

Unsafe Connectors?

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Derivation: from Latin receptaculum, *to receive.*

For small electrical applications in boats, RVs, and cabins, direct current (DC) electricity can still make sense. Using DC can eliminate the need for an inverter, and the 10 to 20 percent efficiency penalty it carries. Unlike AC systems, though, high-quality, safe, and standard DC receptacles aren't yet available. Many types of receptacles are being used in DC systems, and various kluges have been the end result, with systems made up of poorly matched components.

DC systems use various connector types, such as Anderson connectors, spade connectors, or specialty connectors from the audio, professional lighting, electronics, or industrial fields. None of these has the convenience of a typical AC plug, and many of the robust receptacles that can be used for DC are quite expensive.

The most commonly used DC receptacle is the cigarette lighter receptacle, like those found in automobiles, recreational vehicles, and boats. These plugs and receptacles can be purchased in most hardware, marine, automotive, or RV stores. Many 12 VDC appliances come with this type of plug.

But these plugs have serious shortcomings. They are often not high quality. In many cases, both the plugs and the receptacles fail prematurely, and the cheaper ones frequently do not make good contact. Another drawback is their exposed electrified terminals. In a cigarette lighter socket, the DC positive terminal is at the bottom of the socket well, and within reach of fingers or metal tools. The DC negative terminal is the whole sleeve of the socket, and easily accessible, making for an ever-present shock and short-circuit hazard.

In the off-grid renewable energy world, installers and homeowners are in a bind—if we're using DC, we're faced with needing a safe and durable way to connect and disconnect appliances. If we reject the flimsy and unsafe cigarette lighter plugs, the next most common solution is to use standard 120 VAC receptacles. But besides the fact that many of these are not tested or rated for DC use, an even more important drawback is that you may accidentally plug 12 VDC appliances into 120 VAC receptacles or vice versa. I've seen older off-grid homes that rely on labels or even just the color of the receptacle to distinguish between 12 VDC receptacles and 120 VAC receptacles. This is not a good solution! Plugging in the wrong load can damage the appliance, the circuit, and you.

Cigarette lighter receptacles are the most common 12-volt DC receptacle, but they have multiple problems.

A better (although more expensive) solution, short of developing a universal standard receptacle and plug, is to use an unusual receptacle that's not commonly found in homes. Many choose a 240 VAC receptacle with one or both prongs perpendicular to the normal 120 VAC receptacle prong orientation; others use 240 VAC twist-lock plugs. This avoids any confusion about what plugs belong in what receptacles, unless you have friends who bring 240 VAC appliances with them when they visit.

I wish I could report that using these receptacles is the best answer. Unfortunately, it may be only a step along the way. I hope that at some point users, installers, and regulators come to an agreement on a safe, durable, economical, and approved connector for DC applications. I welcome your input and suggestions.

But after living with DC systems in my home for more than twenty years, I wonder if the answer for most renewable energy systems is just to switch to high-quality inverters and AC loads. While I still have a great love for the simplicity and efficiency of DC, having a single, AC distribution system with conventional, safe, and approved wiring and receptacles has a lot going for it.

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