

How Long Can My Caravan Battery Run an Electric Storage Water Heater While Off-Grid?

Meta Descriptions

If you choose the compact water heater here, you can expect comfortably warm water in just 8 minutes. The hot water system is also highly efficient, delivering 20+ full heating cycles from a typical battery.

The last thing you want in your adventure van is a water heater that drains your battery after just one heating cycle. You also want to avoid a heater that takes up all day to warm your water— it's not only inconvenient but also wastes your limited off-grid power supply, ruining the comfortable home-away-from-home experience you looked forward to.

In today's guide, we'll show you how to easily calculate the amount of power an electric water heater draws from your campervan, caravan, or RV's energy source. We'll also explain how to determine the number of full heating cycles you can expect from your battery bank and the approximate time each cycle takes to complete.

Electric Storage Water Heaters as a Convenient Heating Solution

Electric water heaters are the most common [hot water systems](#) for caravanners and RVers in Australia. They heat water using electricity as the energy source, with heating elements that can be powered by alternating current (AC), direct current (DC), or both.

Generally, electric water heaters can be divided into two main types:

- **Storage/tank electric water heaters** — these feature a tank that stores a large volume of hot water ready for immediate use.
- **Tankless electric water heaters** — these have no storage tank; cold water passes through a heating chamber and flows out hot from the faucet or showerhead.

Because tankless heaters must heat an endless flow of cold water, they typically require a much stronger electrical supply (measured in kilowatts) to provide truly “endless” hot water. For this reason, storage electric water heaters are the most practical choice for caravanners and RVers, thanks to their lower power requirements (measured in watts).

For example, the Aqueous and Duoetto electric storage water heaters we recently tested use between 180 and 1000 watts, depending on the model. The right choice for you will vary with the unit size that best suits your needs and setup.

How to Determine the Power and Energy Usage of an Electric Storage Water Heater for Your Van

When choosing an electric storage water heater for your campervan or caravan, one key factor to consider is its power requirements. This includes the type of power source it's compatible with and how much power it will draw from your leisure battery bank or solar system.

Typically, the power consumption of electrical appliances is directly proportional to the energy they use. The greater the energy needed to heat the water, the more power the heater will draw from your battery or solar setup.

To calculate the energy required (Q) to heat the water in a storage heater, we use the formula:

$Q = m \times c \times \Delta T$, where:

- **m** is the mass of water in the tank. (1 litre of water has a mass of about 1 kg.)
- **c** is the specific heat capacity of water, standardised at 4184 J/kg°C (or 4.184 J/g°C). This value represents the energy required to raise the temperature of 1 kg (or 1 g) of water by 1°C.
- **ΔT** is the temperature rise, calculated as the desired hot water temperature (Th) minus the incoming cold-water temperature (Tc).

Real-Life Examples

What amount of energy is required to heat a full tank water heater to the maximum thermostat setting when the incoming cold water is 20°C?

1. Aqueous 6L 12V DC Electric Water Heater

The [Aqueous 6L 12V DC Electric Storage Water Heater](#) is one of the simplest hot water systems available for caravans and campervans. For this calculation, the relevant specifications are:

- 6-liter tank capacity (m = 6 kg when full)
- Maximum thermostat setting: 75°C
- Specific heat capacity: 4184 J/kg°C

$$Q = 6 \text{ kg} \times 4184 \text{ J/kg}^\circ\text{C} \times (75^\circ\text{C} - 20^\circ\text{C}) = 1,380,720 \text{ joules} \approx 383.53 \text{ Wh}$$

Thus, heating the water from 20°C to 75°C in this 6-litre heater requires approximately 1,380,720 joules (or 383.53 Wh).

2. Duoetto 12V/240V Dual-Voltage Electric Water Heater

The [Duoetto 12V/240V Dual-Voltage Electric Water Heater](#) is one of the most versatile hot water systems we've tested for van life. Its key specifications for energy calculation are:

- 10-liter tank capacity (m = 10 kg when full)
- Maximum thermostat setting: 75°C on 240V AC; 70°C on 12V DC
- Specific heat capacity: 4184 J/kg°C

$$\text{On 240V AC mode, } Q = 10 \text{ kg} \times 4184 \text{ J/kg}^\circ\text{C} \times (75^\circ\text{C} - 20^\circ\text{C}) = 2,301,200 \text{ joules} \approx 639.22 \text{ Wh}$$

$$\text{On 12V DC mode, } Q = 10 \text{ kg} \times 4184 \text{ J/kg}^\circ\text{C} \times (70^\circ\text{C} - 20^\circ\text{C}) = 2,092,000 \text{ joules} \approx 581.11 \text{ Wh}$$

Therefore, when running on 240V AC, this Duoetto water heater requires approximately 2,301,200 joules (639.22 Wh) to heat 10 litres from 20°C to 75°C. On 12V DC, it requires about 2,092,000 joules (581.11 Wh) to reach 70°C.

3. Aqueous MK2 240V AC Electric Water Heater

The [Aqueous MK2 240V AC Electric Water Heater](#) is essentially a simpler, 240V-only version of the Duoetto water heater above. In terms of energy consumption, the two models are comparable, as the MK2 shares the same key specifications:

- 10-litre storage tank
- Maximum thermostat setting of 75°C
- Specific heat capacity of water: 4184 J/kg°C

$$Q = 10 \text{ kg} \times 4184 \text{ J/kg}^\circ\text{C} \times (75^\circ\text{C} - 20^\circ\text{C}) = 2,301,200 \text{ joules} \approx 639.22 \text{ Wh}$$

Thus, the Aqueous MK2 240V water heater also requires approximately 2,301,200 joules (or 639.22 Wh) to heat 10 litres of water from 20°C to 75°C.

4. Aqueous 6L-240V Electric Water Heater

As the name indicates, the [Aqueous 6L-240V Electric Water Heater](#) is the 240V AC version of the Aqueous 6L-12V model mentioned earlier. The two models share the same core specifications, including:

- 6-litre storage tank

- Maximum thermostat setting of 75°C
- Specific heat capacity of water: 4184 J/kg°C

$$Q=6\text{kg}\times 4184\text{J/kg}^\circ\text{C}\times(75^\circ\text{C}-20^\circ\text{C})=1,380,720\text{J}\approx 383.53\text{Wh}$$

Therefore, this 6-litre Aqueous 240V water heater requires approximately 1,380,720 joules (or 383.53 Wh) to heat 6 litres of water from 20°C to 75°C.

Power and Energy Usage of the Four Water Heaters at Other Key Temperature Changes

Using the same formula, we can estimate the power consumption of these electric storage water heaters at other key temperature differences as follows:

	Aqueous 6L-12V	Duoetto 12V/ 240V	Aqueous MK2-240V	Aqueous 6L-240V
20 – 75°C	383.53 Wh	639.22 Wh	639.22 Wh	383.53 Wh
20 – 70°C	348.67 Wh	581.11 Wh	581.11 Wh	348.67 Wh
20 – 40°C	139.47 Wh	232.44 Wh	232.44 Wh	139.47 Wh
20 – 38°C	125.52 Wh	209.2 Wh	209.2 Wh	125.52 Wh
10 – 75°C	453.27 Wh	755.44 Wh	755.44 Wh	453.27 Wh
10 – 70°C	418.4 Wh	697.33 Wh	697.33 Wh	418.4 Wh
10 - 40°C	209.2 Wh	348.67 Wh	348.67 Wh	209.2 Wh
10 – 38°C	195.25 Wh	325.42 Wh	325.42 Wh	195.25 Wh

Quick Notes

- 20°C is the average cold-water temperature during summer, though it can reach as high as 30°C depending on the month and time of day.
- 10°C is the average cold-water temperature during winter, though it can drop as low as 4°C or rise to 30°C depending on the region and time of day.
- 40°C is the highest temperature most people find comfortable on the skin for bathing, dishwashing, handwashing, or cleaning.
- 38°C is the lowest temperature most people find comfortable for touching or showering.

How Long Can My Caravan Battery Run an Electric Storage Water Heater?

Remember that formula we used to determine [how long a battery can run Starlink while off-grid?](#) We can use the same formula to estimate how long the leisure battery can run your electric water heater.

Battery Life (hours) = Available Battery Capacity ÷ Power Consumption

Battery capacity is usually given in amp-hours (Ah), so you need to convert it to watt-hours (Wh) to match the heater's energy consumption:

Wh = Ah × Voltage

For example, a 12V 200Ah battery will have 2400Wh capacity— 200 x 12. If you have a **12V 200Ah Lithium battery** with 12.8V nominal voltage, the power capacity in Wh becomes 2560Wh. Lithium batteries typically allow 100% depth of discharge, so the full capacity is usable.

To find the number of full heating cycles a battery can support, we'll use the formula:

Number of Heating Cycles (Hc) = Total Usable Energy (Wh) ÷ Energy Required per Cycle (Wh)

Therefore, for the Aqueous 6L-12V heater at 20–75°C, a 2560 Wh lithium battery can support approximately 6 full cycles (2560 ÷ 383.53 ≈ 6).

The table below summarises the approximate number of full heating cycles a fully charged 12V 200Ah lithium battery (2560 Wh usable) can provide:

Table: Approximate Full Heating Cycles on a 12V 200Ah Lithium Battery

	Aqueous 6L-12V	Duoetto 12V/ 240V	Aqueous MK2-240V	Aqueous 6L-240V
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20 – 75°C	6	4	4	6
20 – 70°C	7	4	4	7
20 – 40°C	18	11	11	18
20 – 38°C	20	12	12	20
10 – 75°C	5	3	3	5
10 – 70°C	6	3	3	6
10 - 40°C	12	7	7	12
10 – 38°C	13	7	7	13

Key Takeaway

In addition to energy usage and the number of full heating cycles that a leisure battery can support, you may also want to know how long each full heating cycle takes. To calculate the time (t) required to heat the water to your desired temperature, we use the formula:

Time (t) = Energy required (Q) ÷ Heating element power

For example, heating 6 litres of water from 20°C to 75°C with the Aqueous 6L-12V water heater takes approximately 2.13 hours (2 hours 8 minutes)— $383.53 \text{ Wh} \div 180 \text{ W}$.

Below are the approximate heating times for the other storage water heaters we've mentioned:

Table 3: Approximate Heating Times for Electric Storage Water Heaters on a 12V 200Ah Lithium Battery

	Aqueous 6L-12V	Duoetto 12V/ 240V (on 12V DC mode)	Aqueous MK2-240V	Aqueous 6L-240V
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20 – 75°C	2 hrs 8 mins	2hrs 8 mins	39 mins	24 mins
20 – 70°C	1 hr 57 mins	1 hr 57 mins	35 mins	21 mins
20 – 40°C	47 mins	47 mins	14 mins	9 mins
20 – 38°C	42 mins	42 mins	13 mins	8 mins
10 – 75°C	2 hrs 32 mins	2hrs 32 mins	46 mins	28 mins
10 – 70°C	2 hrs 20 mins	2 hrs 20 mins	42 mins	26 mins
10 - 40°C	1 hr 10 mins	1 hr 10 mins	21 mins	13 mins
10 – 38°C	1 hr 5 mins	1 hr 5 mins	20 mins	12 mins

Notes

- All times have been rounded for practical use in real-world conditions.
- The Duoetto 12V/240V and Aqueous MK2-240V models have identical energy requirements and a 1000 W heating element when operating on 240V AC, so they take the same time to heat water on mains power. Therefore, the table shows heating times for the Duoetto only in 12V DC mode.
- As expected, heating time decreases as the required temperature rise (ΔT) decreases.
- 240V water heaters heat water much faster than their 12V counterparts.

Final Thoughts

In summary, this is everything you need to calculate how long a leisure battery in your caravan, campervan, or boat can power an electric water heater. From the examples provided, the 6-litre Aqueous models stand out as the most energy-efficient, delivering up to 20 full heating cycles (or more, depending on incoming water temperature).

When choosing a hot water system for your adventure van, do not base your decision solely on power or energy consumption. You must also consider other important factors—such as the unit's physical dimensions, build quality, thermostat settings, and more.