Kullfallet Manual

Björn Morén 2026-04-17

This document describes the property details, the freshwater system, the heating system and the solar powered electrical system.

Property details

- Property identification (fastighetsbeteckning): **Sunne Långjohanstorp 1:17**
- Mail address: **Västerrottna 570, 67196 Mangskog**
- Alternate address: **Långjohanstorp 1, 68698 Gräsmark**
- Parish (socken): **Gräsmark**
- Municipality (kommun): **Sunne**
- County (län): **Värmland**
- Area: **6.047 hectares (14.94 acres),** around 235 m by 255 m

The property is technically in Gräsmark, but the mailbox is in Mangskog, hence the different mail address. The mailbox is at the T-junction at the end of the exit road.

Note that the property line on digital maps does not match reality. The line is 10 m further south (can be seen by physical markers on the ground).

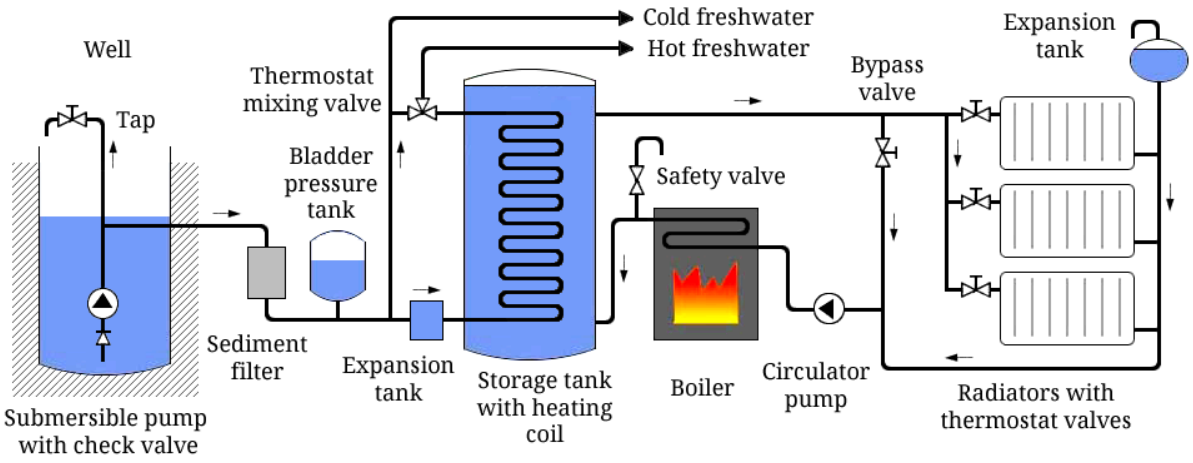
House details

- Traditional stone foundation with a ventilated subfloor.
- Subfloor from 145x45 mm joists, 145 mm mineral wool insulation, covered by a 27 mm wooden floor.
- Walls are from inside out: 12 mm OSB, 10 mm fiber board, 170 mm wooden log, 95 mm stud with mineral wool insulation, paperboard, 25 mm lath, 21 mm exterior board. Note: no vapor barrier is in the walls, which is standard for traditional Swedish houses.
- Roof is made from 112 cm cc 195x45 mm joists with 145x45 mm rafters, covered with tongue-and-groove boards creating the roof surface. This is covered in tar paper and corrugated steel sheets.
- Well is 2.8 m deep, 100 cm diameter, with a 32 mm PEM pipe dug down at 1.8 m depth leading up to the house.
- Indoor freshwater pipes are 15 mm PEX.

See separate documents that show the entire construction process.

Freshwater and Heating

System overview



Key points

- **When there is a fire in the boiler the bypass valve must be open and the circulation pump must be running. Failure to do so will make the system boil and the safety valve will release steam.**
- **When outdoor temperature is below freezing (0 C / 32 F), the heating wire for the freshwater pipe must be connected to the wall socket. Alternatively, the pipe must be drained of water. Failure to do so will freeze damage the pipe.**

Specifications

- Storage tank: Termoventiler “LaddoTank”, 500 L, with stainless steel freshwater heating coil
- Boiler: Wamsler K158
- Circulator pump: Grundfos Alpha2 15-60 130
- Radiators: 2 x Purmo Compact C22, 100x60cm, 1 x Purmo Compact C22, 40x60cm
- Well pump: Grundfos SQE 2-55
- Freshwater pressure tank: Pentair Wellmate, 14 L.
- Stainless steel expansion tank in the attic. This is an open air non pressurized system.

Heating overview

Kullfallet uses a **two-pipe** radiator configuration. This means that the radiators are connected in parallel, and each radiator valve can close the flow using a thermostat. If the house gets sufficiently hot, all radiator valves will close and there is no flow in the circuit. This is normal and by design. However, this

also means that they can cut off circulation through the boiler and the water will eventually start to boil. Then pressure will rapidly increase, and water/steam will rush out through the safety valve. Before this happens you will hear loud bangs in the pipes. The stove is technically called a “boiler” but the water in it should never boil.

Opening the bypass valve prevents the water from boiling. Closing the valve after a burn keeps the storage tank temperature layered (cold at the bottom, hot at the top), which improves efficiency. If you don’t want to bother with the bypass valve, just leave it open at all times, and you get slightly less efficiency.

Circulation Pump

The most efficient setting is number 1, which uses around 7 W. Press the gray arrow button until a single vertical line symbol is active to the left of the AUTO sign. If you need maximum flow (overheated boiler) then press the arrow until the symbol at the far right lights up.

Burning of firewood

If you have experience from a firewood boiler, this is not difficult and you can use common sense. If not, then follow the steps below:

1. **Open the bypass valve one and a quarter turns or more. You find it to the right of the gas stove.**
2. **Double check that the circulation pump is running.**
3. Close the chimney cleanout door so the boiler can get enough air draft.
4. Open the draft door on the boiler (lower door).
5. Open the fire pit door (upper door). Crumble up four pages from an old magazine and put them in the fire pit. Add some finger sized firewood on top, then some normal pieces of fire wood. Open the small ignition door and light the paper. Close the fire pit door.
6. Wait five minutes or more until there is a strong fire.
7. Close the draft door and turn the dial to 2.
8. Continually adjust the draft dial to get the fire intensity you want. High intensity is more efficient (less wood consumption) but also slightly shorter lifespan of the boiler.
9. Continue adding fire wood as it is used up.
10. Keep track of the temperature in the storage tank. When it reaches 70 C, add your last batch of firewood and let it burn to completion. You should end up at around 80 C in the tank. This is a safe margin to max temperature (100 C).
11. When the fire is out, optionally close the bypass valve.

You will use up around 11 m3t (cubic meters of neatly piled) firewood in a full year. The firewood shed can store around 18 m3t.

Freshwater

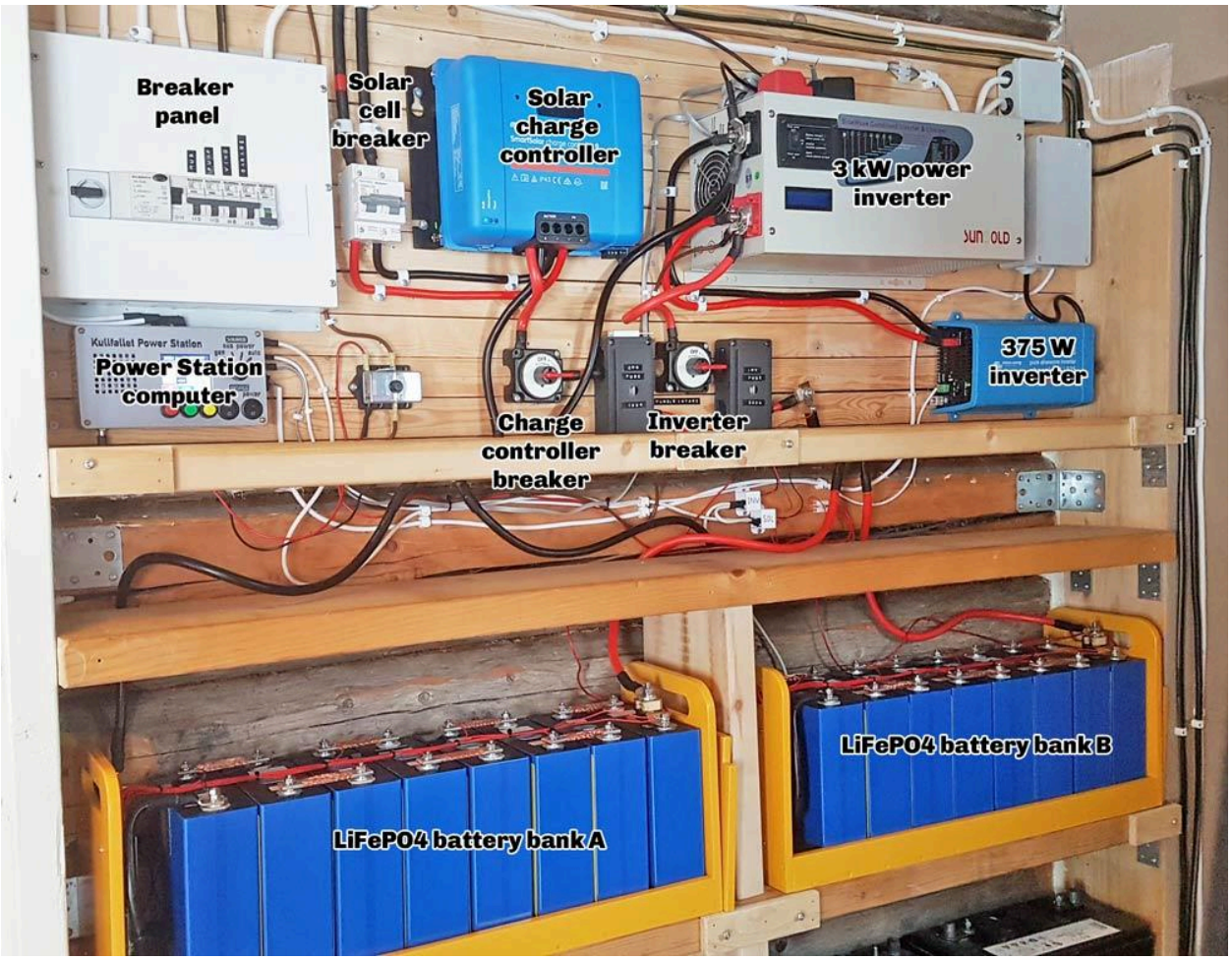
The water is pumped from the well down in the valley next to the house. This is close to a large bog which is a good safe guard against it ever running dry. The peat in the bog also filters away contaminants.

Lab analysis from 2025 confirms that the well water is good for human consumption, but with the remarks that it has low pH (slightly acidic), high in iron, and high in manganese. Because of the low pH all pipes are plastic, which prevents the problem with pipe corrosion. The iron and manganese will over time leave yellow stains in the sink and shower, but these are easy to clean off. If you care about these cosmetic issues it is easy to install an iron filter.

The pressure tank keeps the domestic water pressure to between 1.4 and 2.5 bar with the help of a pressure switch.

Near the pressure tank are also two sediment filters that remove possible debris from the water. Under the sink are two carbon filters that remove iron from the drinking water. Note that iron is not toxic, this is purely cosmetic.

Electrical system



Key points

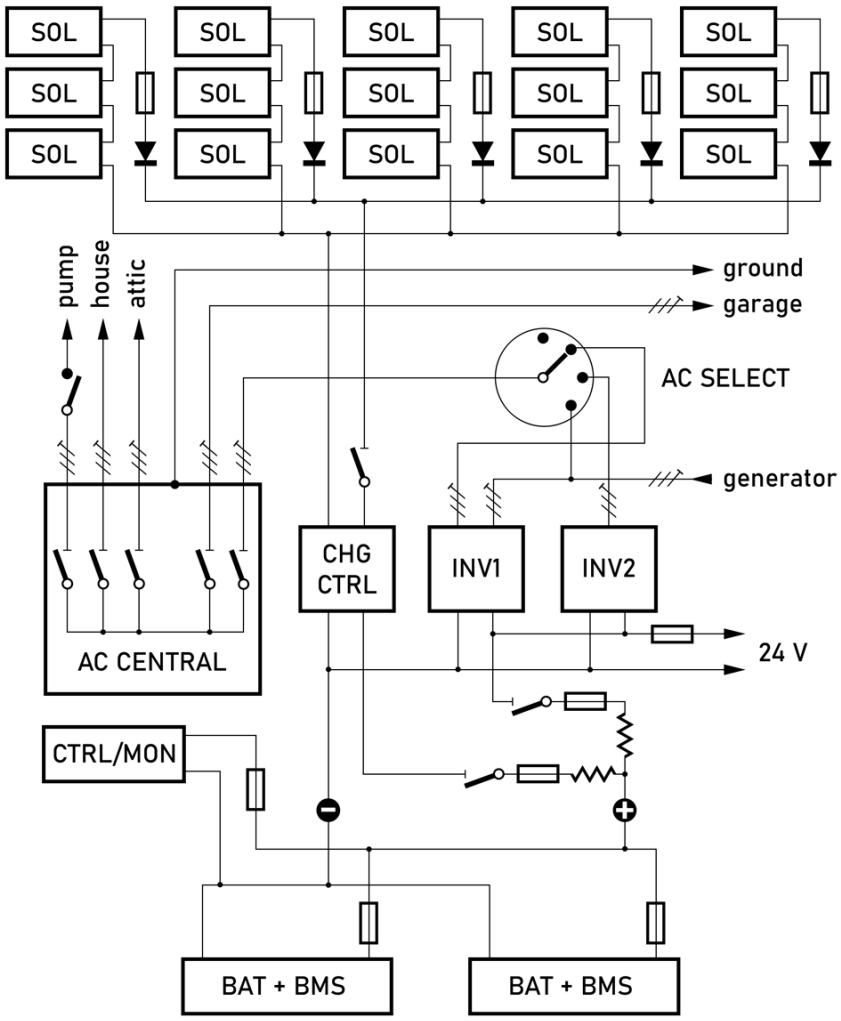
- **You need to turn off the electrical system when you are away from the cabin for long periods of time (months). Failure to do so might completely discharge the batteries.**

Specifications

- 5.5 kW solar cells (15 x IBC MonoSol 370 OS9-HC) mounted to the roof of the cabin.
- Victron MPPT 250/100 solar charge controller (max 100 A charge current)
- Sungold PSW7 3024E power inverter, max 3 kW continuous, max 9 kW surge
- Victron Phoenix 24/375 inverter, max 375 W continuous.
- Custom “Kullfallet Power Station” controller/monitor for the electrical system (see separate document for details).

- 24 V, 14.3 kWh battery made from 2 x 8 EVE LF280K LiFePO cells with JK BMS (see separate document for details).

Schematic overview



SOL: 15 x IBC 370 W, 34 V solar panels.
CHG CTRL: 100A charge controller.
BAT: 2 x 25.6 V, 280 Ah LiFePO4 batteries.
INV1: 3000 W inverter. INV2: 375 W inverter.

“CTRL/MON” is the “Kullfallet Power Station” monitor/controller computer (see separate document).
“AC SELECT” are relays in a box to the right of the power inverter.

“Ground” leads to a grounding rod dug down into the earth near the cabin. The AC central is equipped with an automatic ground fault breaker.

Batteries

These LiFePO4 batteries are very robust and have a lifespan of at least 20 years. They are sealed and maintenance free. The batteries are equipped with a Battery Management System (BMS) that monitors battery health, and disconnects the battery before any condition can happen that might break the cells. These conditions are: overcharging, becoming completely discharged, and charging in sub zero (0 C) temperature.

Washer

It is possible to use the laundry washer just like normal without any special consideration. However that will put some strain on the power inverter, so if you want to extend its lifespan then use hot water:

1. Make sure the storage tank temperature is at least 60 C.
2. Connect the power cord to the washer, select the ”Daglig tvätt 40C” program.
3. Insert laundry and detergent.
4. Open the hot water faucet at the nearby sink. Wait until the water is very warm. Close the faucet. Connect the hose from the washer. Open the hot water faucet again.
5. Press ”Start” on the washer to run the program. It takes around 60 minutes.

Seasonal

Reopen the cabin for the summer

Step 1: Turn on the electrical system.

1. Turn on the inverter power by using the second rotating breaker.
2. Insert the power plug into the bottom of the “Kullfallet Control Station” box. Follow the setup procedure (fill in date and time). When you are done, press the green button to turn on the small inverter. Press it again to turn on the large inverter. Please see the Power Station document in case you need details.
3. Turn on the charge controller by using the rotating breaker directly below it.
4. Wait for the charge controller lights to show that it is on. Then locate the solar cell breaker (white with the label Heschen) and turn it on (up).
5. Flip all breakers to on (up) on the breaker panel, except for the well pump. Turn on ceiling lights to double check that you have electric power in the cabin.

Step 2: Start up the freshwater system.

1. Optionally walk down to the well, open the lid, and verify that everything looks good and that the drain valve is closed.
2. Check that all valves are in their correct position near the sediment filters and that the drain nut below the manometer is screwed on tight. Open the kitchen faucet.
3. Mount the water filters and water locks. Optionally apply petroleum jelly to the threads to make them leak proof.
4. Try to run the well pump: Flip the pump breaker to on (up) on the breaker panel. Wait for the pump to start (you’ll hear the water flow in a few seconds). If not, the Power Station is not configured for automatic pump power yet: Press the yellow button until you get to the Setup page. Press the red button to go into edit mode. Change “pump auto” to “on”.

Close down the cabin for the winter

Step 1: Drain away water to prevent freeze damage.

1. Turn off the pump by flipping its breaker on the breaker panel.
2. Open the kitchen and bathroom faucets and let all water run out.
3. Open one of the valves to the right of the sediment filters to allow air to rush into the well pipe.
4. Walk down to the well, open the lid, and open the drain valve. Wait one minute to allow the upper portion of the pipe near the house to drain its water. Close the valve.

5. In the cabin, open the drain nut at the bottom below the manometer of the pressure tank. Let all water drain out. Optionally use an air compressor to blow out all water from the pipes. Perhaps not necessary, just an extra precaution.
6. Drain all water locks and water filters.

Step 2: Close down the electrical system to prevent complete discharge of the battery.

1. Flip all breakers to off (down) on the breaker panel.
2. Locate the solar cell breaker (white with the label Heschen) and turn it off (down).
3. Verify again that the solar cell breaker is off (down), then turn off the charge controller by using the rotating breaker directly below it.
4. Pull out the power plug from the bottom of the “Kullfallet Control Station” box. All inverters should turn off.
5. Turn off the inverter power by using the second rotating breaker.