Installation and Operating Manual

Cowa COMPACT Cell SH

Table of Contents

Technopark Luzern Platz 4
6039 Root D4, Schweiz
info@cowa-ts.com | www.cowa-ts.com

1 Introduction

The Cowa COMPACT Cell SH is a compact thermal battery that serves as a buffer tank. Thanks to its special thermal storage technology based on phase change materials (PCM), heating water is heated on demand using the flow-through heater principle. The following sections provide more information about the product as well as instructions for installing and operating the Cowa COMPACT Cell SH.

2 Product Description

2.1 Functionality

Phase change materials are substances that store energy through a phase change by absorbing or releasing heat. Cowa uses materials in its heat storage systems that change their state between solid and liquid. This phase change occurs at a specific temperature, referred to as the melting point or freezing point. During the melting process, large amounts of energy are absorbed and stored without loss and then released again during the freezing process. The phase change is a purely physical process and thus loss-free and reversible. By exploiting the phase change, up to 250 J/g (95 kWh/m³) of thermal energy can be stored. Over a defined temperature delta ΔT, this results in a specific storage density that is several times higher than that of water.

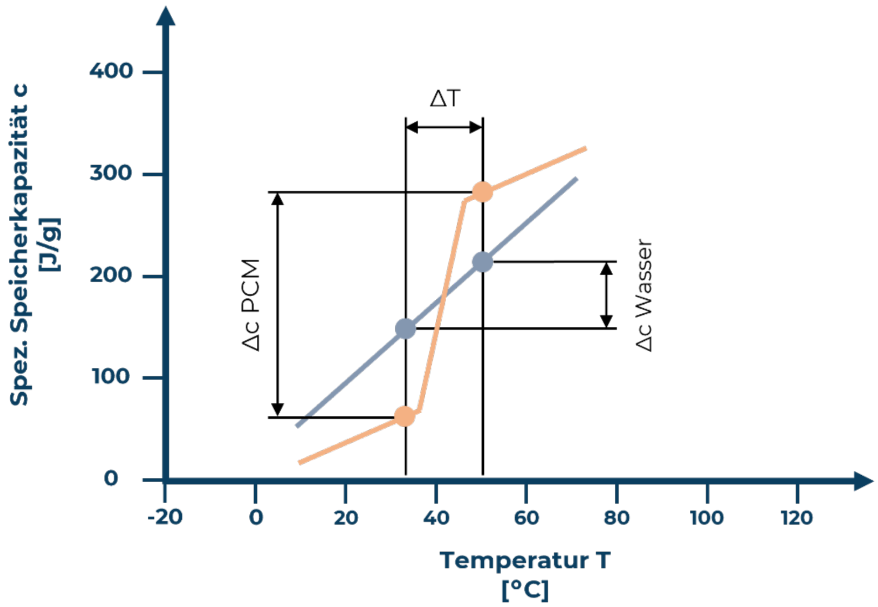


Figure 1: Graphical representation of PCM storage capacity compared to water

In the COMPACT Cell, PCM is used in combination with a heat exchanger. During a charging process, the PCM is melted via hot heating water; during a discharging process, cooled heating water is heated using the heat from the PCM. The use of the heat exchanger has, on the one hand, the advantage that water never comes into contact with PCM, and on the other hand, that the COMPACT Cell housing can be built non-pressurized.

2.2 Advantages

The Cowa COMPACT Cell technology offers many advantages compared to a conventional hot water storage tank.

Most compact heat storage

The use of Cowa PCM results in an energy density that is 2 to 3 times higher compared to conventional systems. This either significantly reduces the required space or greatly increases the storage capacity.

Cubic shape

The Cowa COMPACT Cell housing is non-pressurized, which enables a cubic shape. The dimensions are coordinated so that the storage unit can be easily transported and installed.

Simple installation and planning

Thanks to its modular and compact design, the Cowa COMPACT Cell can be easily integrated into an overall system, especially in existing buildings, without major construction work.

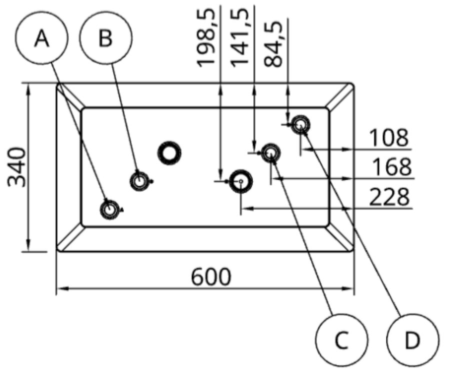
Low maintenance and corrosion-resistant

The storage container is made entirely of plastic and is corrosion-free. There is no need for a sacrificial anode or similar protective devices. The heat exchangers are made of copper pipes approved for drinking water.

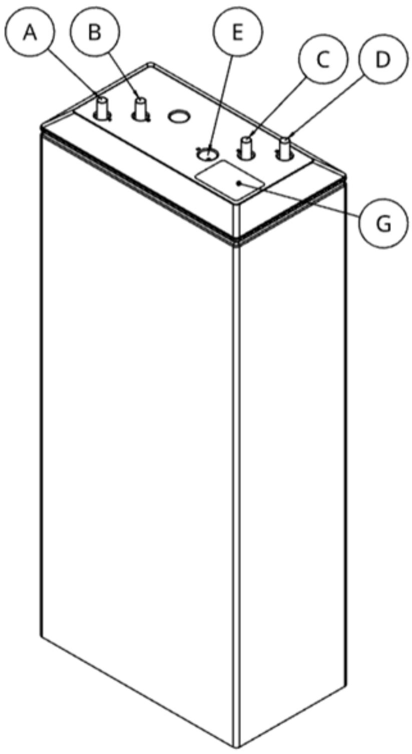
Modularity

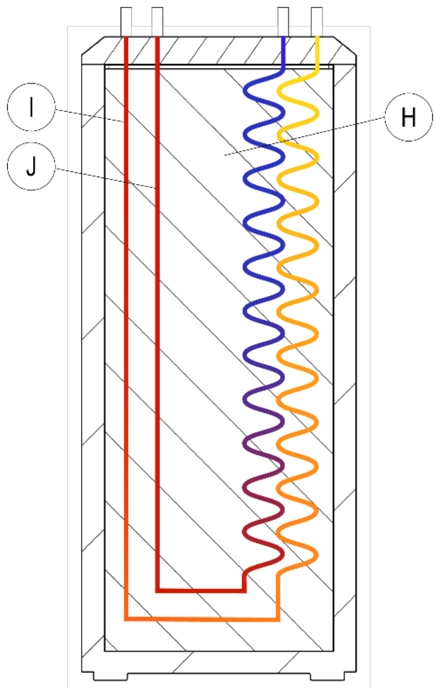
The storage capacity can be increased by connecting several Cowa COMPACT Cells. They can be connected in parallel or in series. However, special attention must be paid to the increased pressure drop in series connections.

2.3 Structure and components



A&B	Flow (22 mm copper pipe)
C&D	Return (22 mm copper pipe)
E	Immersion sleeve for temperature sensor(s)
F	COMPACT Cell casing (incl. insulation)
G	Nameplate
H	Phase Change Material (PCM)
I&J	Heat exchanger





2.4 Accessories

Hydraulic connection

The connections can either be mounted directly onto the copper pipes of the COMPACT Cell or via the optionally supplied push-fit connections (Nyffenegger sudoFIT).

WARNING: The pipes of the Cowa COMPACT Cell are permanently installed. If press fittings are used, the pipes may not be able to be cut and re-pressed.

Examples:

- Nyffenegger sudoFIT
- VSH Tectite connector IG/IG Typ 316 22x3/4"
- VSH Tectite connector IG/IG Typ 316 22x1"

Bypass Valve

To use the Cowa COMPACT Cell as a buffer storage unit, a bypass valve is required in the return line (see diagram Chapter 4.1).

Example:

- Oventrop bypass valve 25
- Danfoss bypass valve AVDO 25
- Or similar product, setting range 0 – 0.4 bar

Emergency Heater

If the heat pump does not have an integrated emergency heating function, we recommend installing an external electric auxiliary heater.

Example:

- ASKOMA PV Elektro OP
- ASKOMA Askoheat + 2.0 PV Elektro AHIR-TI-plus
- Tenko SDKE 9-400 (with circulation pump)

2.5 Optional Accessories

Storage Expansion

If the thermal output of a single Cowa COMPACT Cell is not sufficient, multiple COMPACT Cells can be connected in parallel and in series. The Tichelmann principle must be observed. In a series connection, increased pressure loss must be considered.

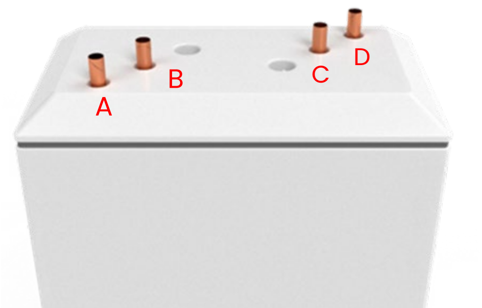
3 Installation

3.1 General Requirements

a) Dynamic minimum pressure of the water supply = 1.5 bar
b) Dynamic maximum pressure of the water supply = 6.0 bar

3.2 Connecting the Flow and Return

The COMPACT Cell has four connections. To connect the COMPACT Cell correctly, connections A and B must be connected and act as the flow. The return is connected to connections C and D, which also need to be connected. The Tichelmann principle must be observed.



A & B: Flow
C & D: Return flow

The connections can either be mounted directly onto the copper pipes of the COMPACT Cell or via the optionally supplied push-fit connections (Nyffenegger sudoFIT).

WARNING: The pipes of the Cowa COMPACT Cell are permanently installed. If press fittings are used, the pipes may not be able to be cut and re-pressed.

3.3 Water Distribution Network Requirements

The water distribution system must be designed and sized to comply with the requirements of the relevant sections of DIN EN 1717.

3.4 Heating Water Requirements

To prevent corrosion and deposits, standard technical guidelines must be followed. The heating water must be demineralized and should have a conductivity < 100 µS/cm.

If these values are not adhered to, the service life may be reduced. The responsibility for this lies solely with the operator.

4 Hydraulics & Sensors

The Cowa COMPACT Cell SH can be integrated as a parallel buffer storage with a mixing group, based on WPSM 1.5 and 1.6

For integration with a domestic hot water tank, Cowa also offers a solution – the Cowa COMPACT Cell DHW.

4.1 Cowa Buffer Storage

Figure 2 shows the hydraulic integration of the Cowa COMPACT Cell SH as a standalone parallel buffer (based on WPSM 1.5). Due to Cowa PCM technology, there are two essential differences compared to a conventional water tank:

1. **Pressure Loss:** The Cowa COMPACT Cell has a pressure loss. To ensure the cell discharges correctly, a bypass valve must be installed in the return line of the heat pump, set to 0.2 bar.
2. **Temperature Measurement:** Unlike a water tank, temperatures cannot be measured directly in the storage unit but must be monitored in the piping. To capture the temperatures precisely in all operating states, they should be measured close to the T-pieces of the flow and return.
   - T1: corresponds to the "top" temperature in the tank
   - T2: corresponds to the "bottom" temperature in the tank

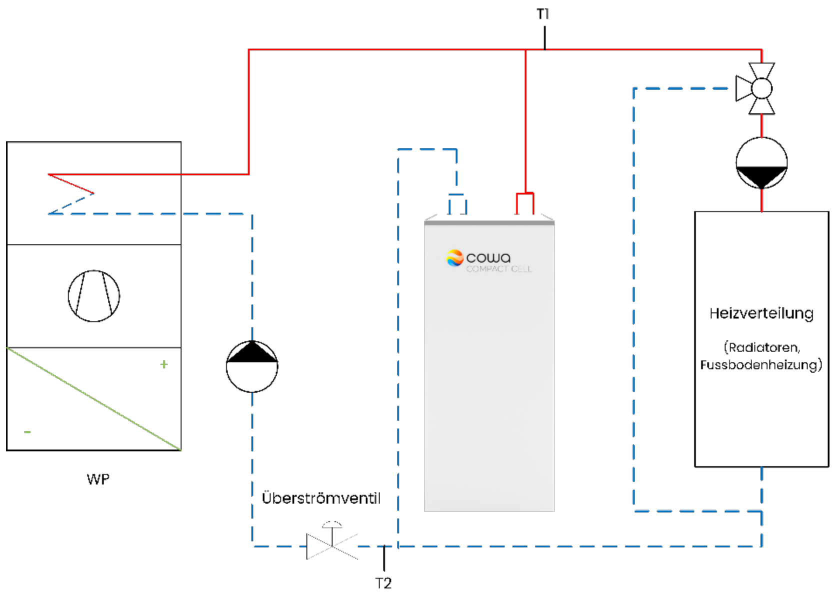


Figure 2: Connection diagram for integrating the Cowa COMPACT Cell SH as a parallel buffer storage unit.

4.2 Cowa Buffer + Domestic Hot Water Tank

In a similar way, the Cowa COMPACT Cell SH can be combined with a Cowa COMPACT Cell DHW (WPSM 1.6)

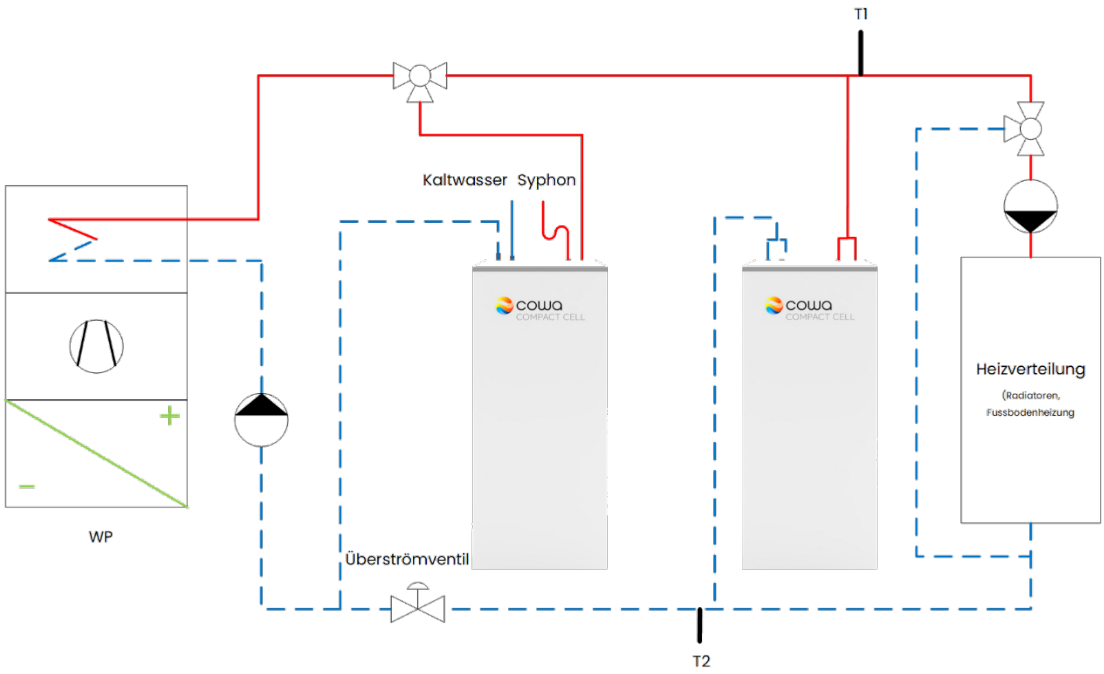


Figure 3: Connection diagram for integrating the Cowa COMPACT Cell DHW as a domestic hot water tank in combination with the Cowa COMPACT Cell SH

5 Operation

The Cowa COMPACT Cell SH is designed to store excess photovoltaic (PV) energy in the form of heat. In normal operation, it functions like a conventional water tank and provides thermal energy, e.g., for defrosting the heat pump. Once excess PV energy is available, the Cowa COMPACT Cell SH can be charged via the phase change to fully utilize its storage capacity.

5.1 Heat Pump Requirements

Cowa PCM technology offers various advantages, which can only be fully utilized if the heat pump meets certain requirements:

COMPACT Cell SH 48	COMPACT Cell SH 58
• Modulating heat pump • Possible flow temperature: **min. 57°C** • Possible return temperature: **min. 52°C** • Setting option for PV surplus utilization, raising the heating circuit to **55°C**	• Modulating heat pump • Possible flow temperature: **min. 65°C** • Possible return temperature: **min. 60°C** • Setting option for PV surplus utilization, raising the heating circuit to **65°C**

The following requirements must also be met for both variants:

- Temperature measurements:
  a. For heat pumps with two temperature inputs:
  - T1 ($T_{Storage, top}$): ON signal
  - T2 ($T_{Storage, bottom}$): OFF signal

  b. OR: For heat pumps with only one temperature input (e.g., return flow control), a **sensor switch** must be used.
- Power-controlled
- Capability for signal processing via **SG ready** or **LAN**

The two operating modes and the necessary requirements are explained below

5.2 Modulating Operation

In regular heating mode, the Cowa COMPACT Cell SH is gradually charged along with the heating system, similar to a water storage unit. The stored energy corresponds to a buffer tank with approximately **75 liters** volume, which is sufficient to store enough thermal energy for **defrosting** and **reducing the switching cycles** of the heat pump.

The following parameters can be set for controlling the heat pump.

Table 1: Heat pump settings for floating operation.

Signal	Control in the flow	Control in the return
HP_{ON}	$T_1 < T_{target} - \Delta T$	$T_2 < T_{target} - \Delta T$
HP_{OFF}	$T_2 > T_{target} + \Delta T$	$T_1 > T_{target} + \Delta T$

5.3 PV-Surplus

When there is a surplus of photovoltaic energy, the target value in the Cowa COMPACT Cell SH is increased by intensified operation of the heat pump, controlled via appropriate interfaces (see Chapter 5.1).

The PCM in the cell is completely melted, storing approximately 10 kWh of thermal energy. Discharging takes place at a later time, as in conventional systems, by raising the buffer storage temperature via the mixing group. The necessary parameters are shown in the following table. The required parameters are listed in the following table.

Table 2: Heat pump settings for intensified operation with PV surplus

Variant	Signal	Control in the flow	Control in the return
COMPACT Cell Puffer 48	HP_{ON}	$T_1 < T_{target} + \Delta T$	$T_2 < T_{target} + \Delta T$
	HP_{OFF}	$T_2 > 52°C$	$T_1 > 57°C$
COMPACT Cell Puffer 58	HP_{ON}	$T_1 < T_{target} + \Delta T$	$T_2 < T_{target} + \Delta T$
	HP_{OFF}	$T_2 > 62°C$	$T_1 > 67°C$

6 Maintenance

Cowa technologies offer a very low-maintenance product. The use of PCM eliminates corrosion risk from stored water, as well as the need for tank cleaning. No sacrificial anode or similar protection is required.

Due to relatively high flow rates in the water-carrying pipes and thermal or pressure expansion, any possible lime deposits are loosened and flushed out.

7 Technical Data

The table lists the dimensions and technical data of the Cowa COMPACT Cell SH.

Table 3: Dimensions and technical data

COMPACT Cell Puffer		48	58
Height	mm	1400	1400
Width	mm	600	600
Depth	mm	340	340
Weight	kg	262	250
Capacity[1] fully charged to 55°C/65°C	kWh	10 / 12	- / 13
Capacity per m^3	kWh/m^3	70	75
Storage equivalent fully charged	L	350	350
Storage equivalent modulating operation	L	75	75
Discharge temperature	°C	45	55
Energy label[2]		B	B
Possible volume flow	L/min	25	25
Pressure drop at max. volume flow	kPa	18	18
Minimum operating pressure	bar	1.5	1.5
Maximum operating pressure	bar	6	6
Maximum operating temperature	°C	75	75
Compatible heat pumps		Standard WP	R290, R454 C
Min. flow temperatur	°C	57	65
Min. return temperatur	°C	52	60

[1] Storage capacity measured from charge state > 55°C resp. >65°C to temperature at outlet < 25°C.
[2] Calculated at an average storage temperature of 60°C and ambient temperature of 15°C

7.1 Pressure Drop Curves

The following graphic shows the pressure drop curves. In addition, the graphic shows which heat pump outputs can be operated depending on the spread (difference between flow and return temperature).

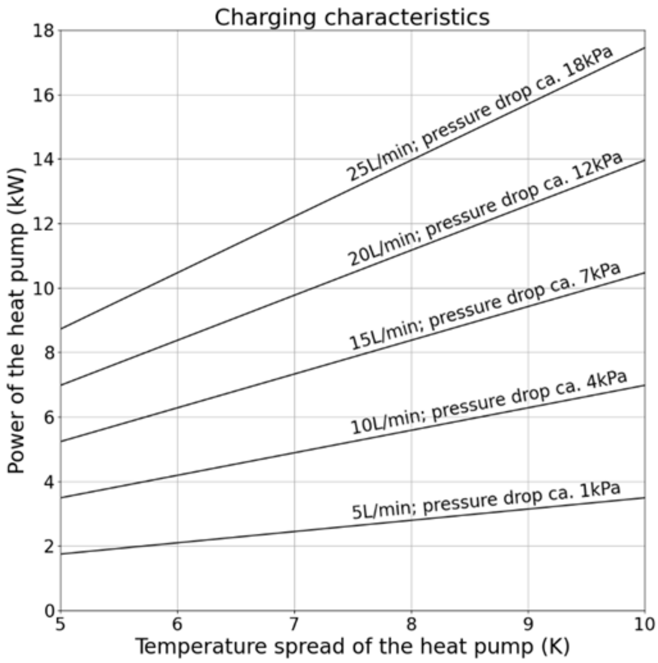


Figure 4: Pressure drops depending on the flow rate

7.2 Nameplate

COMPACT Cell Puffer 48	COMPACT Cell Puffer 58