Weber
Cooling

Vacuum for Cooling

The perfect technology for Flowers & Cold Chain

webervacuum.group

Sales | Rentals | Support | Refurbishments

Weber Cooling is a worldwide leader in Vacuum Cooling Technology

In the past few years more and more systems have been installed at flower farms, exporting companies and logistic hubs. The importance of proper temperature management during the entire flower cold chain ensuring adequate quality of flowers transported over long distances is getting more and more attention throughout the entire flower sector. The combination of long-distance transportation and poor temperature control results in flowers with inadequate longevity being sold to consumers. Temperature control plays a key role and Vacuum Cooling is the perfect answer.

The importance of Pre-Cooling

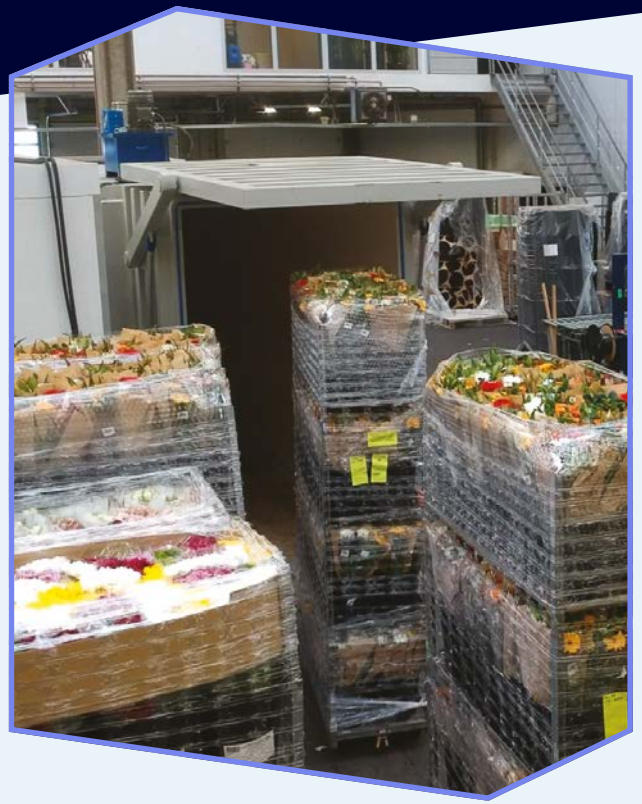
Proper pre-cooling will further:

- Prevent wilting
- Minimize the risk of Botrytis infection
- Reduce the rate of ethylene production
- Prevent premature ageing and poor flower opening
- Prevent stem bending
- More stems per box

Pre-cooling is the rapid removal of field heat from fresh produce. It is among the most efficient quality enhancements available to commercial producers and ranks as one of the most essential value-added activities in the horticultural chain. Precooling is a very important step in the post-harvest stage of the perishable-produce industry as all flowers get into stress after harvesting.

This results in **transpiration** (sweating, resulting in loss of weight and in the building of moisture on the skin of the produce) and **respiration** (breathing = burning sugars), resulting in loss of life, but at the same time in an increase in product temperature, especially when packed tightly.

Both respiration and transpiration can be greatly reduced by pre-cooling. On average both can be reduced by a factor of 4, 5 or even more, if cooled down from harvesting (on average at 20-30°C) down to below 5°C.



Overall vacuum cooling helps to preserve flower quality after harvesting, and increases vase-life. Both will positively affect consumer satisfaction and will result in higher profits to all parties in the value chain.

Available Pre-Cooling Methods

There are different alternative methods for the pre-cooling of flowers:

Room Cooling

in a conventional cold storage

Forced Air Cooling

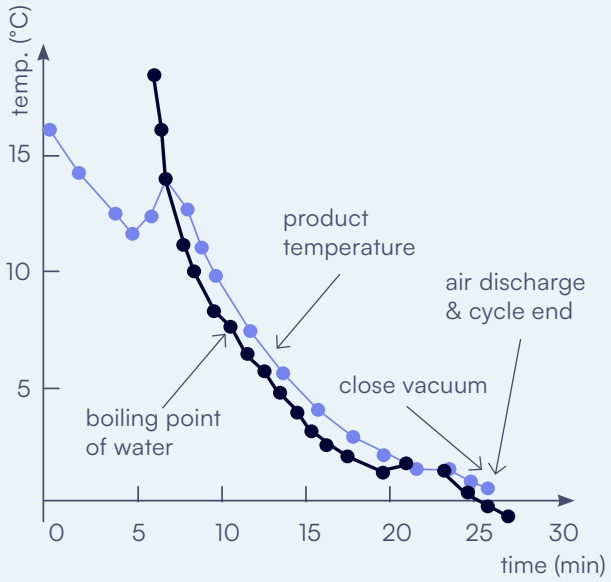
or blast air cooling, forcing cold air through your produce

Vacuum Cooling

uses the boiling energy of water to cool down your produce

Energy consumption

To cool down 100 kg / 220 lbs of produce (from 23°C / 73 °F down to 3°C / 37 °F), you will need roughly 1 kWh of energy (+/- 20%), in a vacuum cooler. With forced air this can be more than 3 kWh! On the internet different studies can be found confirming that Vacuum Cooling has an up to three times higher energy efficiency compared to Forced Air.



Flash point reached, cooling process starting

Vacuum Pre-Cooling

Vacuum cooling is **5 - 20 times faster** and more effective than conventional Room Cooling, only vacuum cooling can cool ultra-fast and uniformly to the core down to 0 - 5 °C for most produce **within 15 - 30 minutes!**

Compared to Forced Air Cooling, vacuum cooling is also way faster, both in cooling as in the handling required. Full loads can be cooled fast & to the core, without worrying about correct air flow, and not being able to cool to the heart of the flowers, in the center of the boxes:

With vacuum cooling all flower surface is cooled at the same time & speed, independent of the position in the box or on the pallet. With minimum labor.

Other advantages of vacuum cooling include that paper and plastic packaging materials in the boxes do not affect the efficiency of cooling, free water is removed, **boxes can be packed tightly** and stacked in any manner in the precooler, and it can work equally well with dry packs and wet packs for cut flowers and greens and for potted plants.

Vacuum Cooling
Technology Explained

Vacuum works with pressure. There is a relation between the pressure level and the boiling point of water. The lower the pressure, the lower the boiling point of water. When introducing a product recently harvested into the vacuum room, vacuum pumps start evacuating much of the air lowering the pressure inside the room. When the pressure level reaches the product's temperature, a fraction (0,8 — 2%) of the moisture inside the product is being forced to evaporate. This evaporation process extracts energy (=heat) from the product, cooling the in- and outside of the product evenly, from the core. Because of the created vacuum, not only the outside is cooled down, but the product's core as well, as cooling takes place from inside the product.

Relation Pressure and Boiling point of water

Pressure on system		Temperature at which water boils	
mBar	Torr mm Hg	°F	°C
1000	760	212	100
56.2	42.2	95	35
42.4	31.8	86	30
31.7	23.8	77	25
28.4	21.3	68	20
20.6	15.5	64.4	18
18.2	137.7	60.8	16
17.0	12.8	59	15
16.0	12.0	57.2	14
15.0	11.3	55.4	13
14.0	10.5	53.6	12
13.1	9.8	51.8	11
12.3	8.6	48.2	9
10.7	8.0	46.4	8
10.0	7.5	44.6	7
9.3	7.0	42.8	6
8.7	6.5	41	5
8.1	6.1	39.2	4
7.6	5.7	37.4	3
7.1	5.3	35.6	2
6.6	5.0	33.8	1
6.1	4.6	32	0

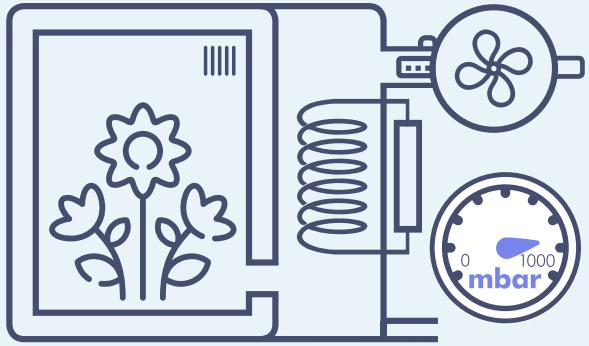
What happens inside the vacuum room and how is the vapor flow handled?

Vapor flow at final pressure is huge and would require very big vacuum pumps. Using a condenser to trap the vapor flow is more economical! Weber Cooling vacuum coolers operate with very efficient condensers using glycol/water coolant (-5 to -0°C) for a fast cooling. The hot vapor passes through the heat exchanger through which it is re-condensed and drained out of the room. When the cycle is finished, vacuum pumps pump air into the room and the door can be opened again.

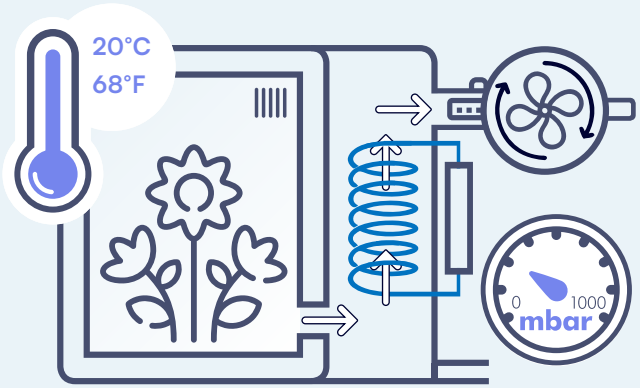
NOTE: For every 6-7°C reduction in temperature, approximately 1% of the produce weight needs to be turned into water vapor. In an average cycle of 15-25 minutes, weight loss can vary between 2-3%.

Watch the video! →

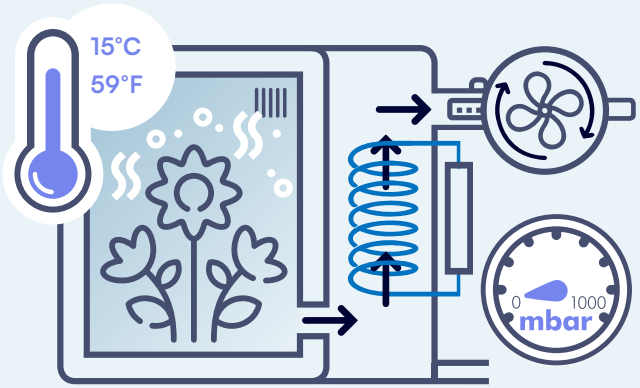
Cyclus - What happens inside the vacuum room?



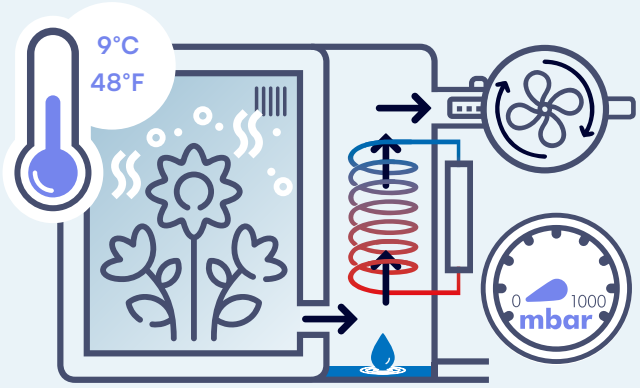
1 The product is placed in the vacuum room and room is closed.



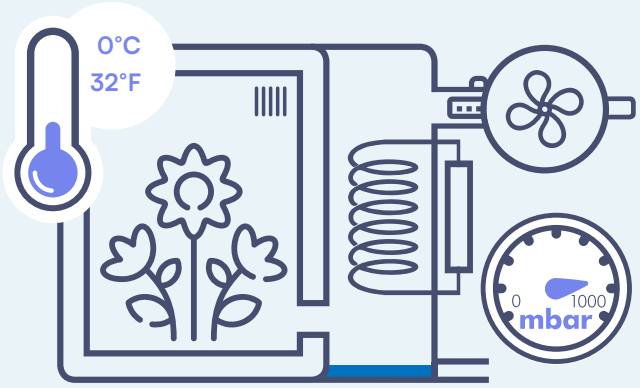
2 The vacuum pump starts and reduces the air pressure in the room from 1000 mbar to the desired pressure.



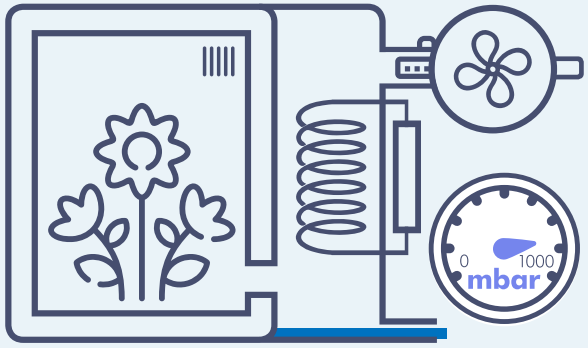
3 A small amount of water within the product will start boiling when pressure reaches temperature level of the product. This boiling process requires heat that is extracted from the product, enabling the cooling.



4 The water vapor is condensed by passing a “cold wall”. The dried air goes out through the vacuum pump.



5 The cycle ends when the product is cold and the pressure returns to 1000 mbar.



6 The condensed water is drained and the vacuum cooler is ready for the next load.

Cold chain management

Vital for optimal Logistics & Vase Life

Poorly controlled transportation temperature levels reduce vase life, increase respiration rates, and increase heat production. Both time and temperature influence flower and plant quality.

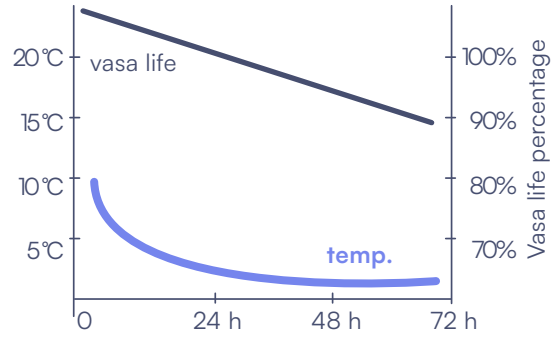
Data in the following table show the effects of temperature on the average respiration rates (heat production) for cut carnations (adapted from Maxie, 1973 and 1974).

Temperature (°F)	**Respiration for carnations and roses** (mg CO_2/kg/hour)	**Increase in respiration compared to 32 °F** (0 °C)
32	**10**	-
50	**30**	**3 times higher**
68	266	27 times higher
86	523	52 times higher

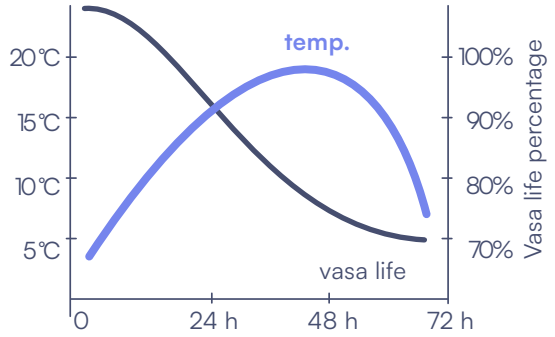
NOTE: **Add temperatures in C**:
0 °C / 32 °F — 10 °C / 50 °F — 20 °C / 68 °F — 30 °C / 86 °F

A study by Celikel and Reid (2001) showed that the respiration rates of roses increased by a factor of three when stored at 50 °F compared to the proper storage temperature of 32 °F. They also showed that there was a strong negative relationship between respiration during storage and subsequent vase life: the higher the respiration, the shorter the vase life.

Furthermore, higher temperatures during the cold chain can also result in sleeves becoming wet due to the formation of condensate, normally on all surfaces. Too warm temperatures increase respiration rates, which again results in moisture formation on sleeves, often more on the inside. The higher the moisture content, the higher the probability that Botrytis will develop.



Vase life under good conditions



Vase life under bad conditions

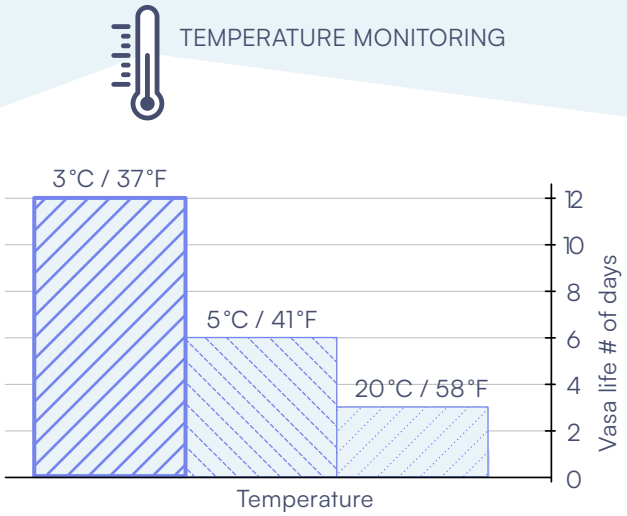
Consequently, cold-chain management has emerged in recent years as a vital success factor in the post-harvest life of fresh flowers. Flowers are delicate, living produce which need optimal storage & shipping conditions to ensure beauty preservation and long vase life. Packed tightly in boxes, flowers generate a lot of heat during storage and transportation which contributes to discolouring, wilting, poor flower opening, and premature ageing. The result is reduced vase life by several days and problems associated with Botrytis infection and growth.

Vacuum cooling is the perfect pre-cooling method for (almost) all flowers and has been successfully implemented at all stages of the cold chain, at growers as well as at logistic hubs.

The Vacuum Cooling Effect

Vacuum cooling for floral crops date back to the 1950's. Only in recent years we see the technology being used widely, at airports, logistics centers, trading companies and also the flower growers, are the value of a good cold chain is more and more appreciated, and affordable systems are more widely available.

Happy customers, profitable supply chains!



The effect of temperature on vase life

Cooling the flowers to the core is the only way to ensure low temperatures during transportation over large distances. And only with vacuum cooling, you can quickly reduce the temperature of flowers down to the core. This brings the flower into hibernation, minimizing respiration & transpiration, preserving freshness and maximizing storage and vase life.

Conventional Vacuum

The effect of vacuum cooling on transpiration and moisture build up within the sleeve

Conventional Vacuum

The effect of vacuum cooling on the prevention of botrytis

Vacuum Cooling
at the Farm

At the farm, vacuum cooling will guarantee the ‘perfect start’ of the cold chain. Dependent on the situation, flowers are cooled directly after hydration, or after packing, before storage/shipment. Pre cooling directly after harvesting will reduce respiration & transpiration by a factor of 4 to 6.

Lowering flower temperature to around 1 °C / 35 °F will ensure that flowers can start their journey sleeping quietly, preserving their energy. Cooling to very low temperatures becomes vital when shipping flowers by sea. We offer the perfect vacuum pre-cooling solutions, both for smaller & larger farms! Up to two loads can be cooled each hour.

Enthusiastic users of our vacuum cooling systems:

With our **Compact ONE**, a single pallet or trolley can be cooled, fast & efficient. Supplied as plug & play solution, this system is extremely easy to install & operate.

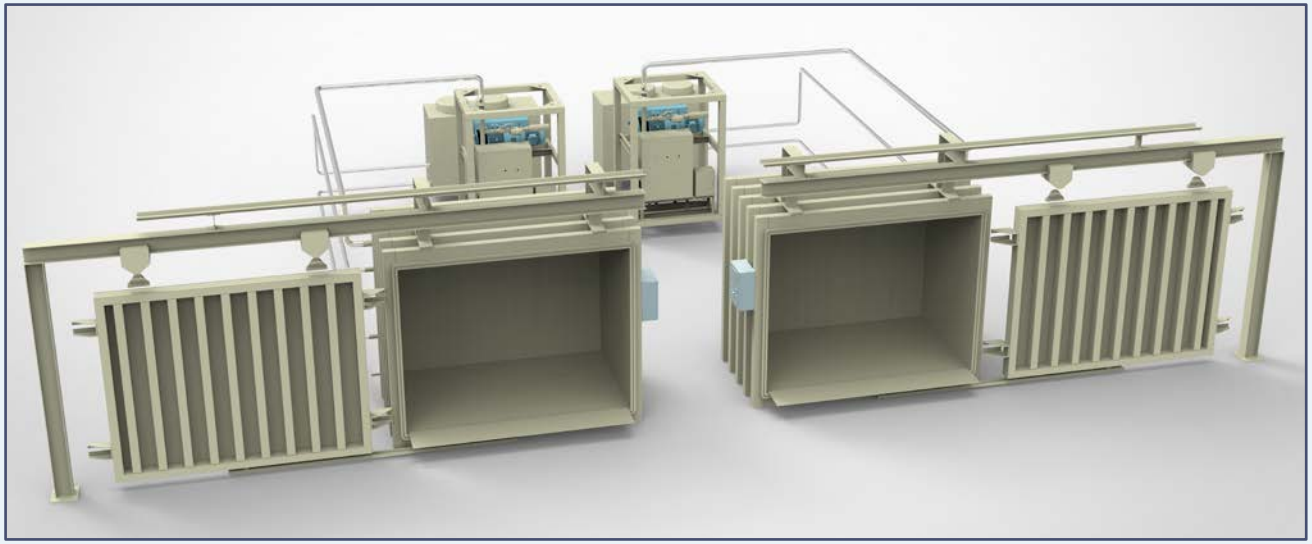
Our **Compact TWO** is suitable for two pallets, placed side by side. With the front loading door, (un)loading the flower pallets (or trolleys) can be done easy & fast.

The **Next Gen & Sense range** are fully modular build, from 3 up to 10 pallet places (in one row). Larger models (double wide, or front loading) and multi-room solutions can be built to suit even the highest cooling demands.

Seeing is believing

View our videos on Vimeo →

Vacuum Cooling
at the Farm



Vacuum Cooling
at Logistic Centers

Even if flowers are shipped at perfect conditions, they will still warm up when shipped over a long distance. Cooling back to the core on arrival - **at the airport or logistic hub** — is an important step in fully controlling the cold chain management process. The only efficient and truly effective way of cooling is by vacuum, since no other technology can cool (consolidated) shipments so fast.

Both at origin and destination, vacuum coolers have been installed (or are under consideration), all around the world. Also more & more im/export companies are implementing vacuum cooling to better control & preserve their flower quality. In many cases — Weber Cooling is the preferred supplier, due to their expertise and high quality solutions.

Enthusiastic users of our vacuum cooling systems:

The **Next Gen & Sense** range are perfectly suited for handling large volumes of pallets, up to 10 pallet places (in one row), or as double wide, or front loading solution, for up to 20 pallets. Multi-room solutions are perfect if you want to optimize your logistics flow, (un)loading rooms almost continuously.

For the highest capacities Weber Cooling offers the **Weber AIR range**, suitable for cooling standard Aircraft pallets. As ONLY supplier in the world we offer standardized (single and double room) systems for one and two AirCraft pallets. With our AIR 2+2 one of our customers cools up to 300.000 kg of flowers — a day! For years on end now, with hardly any interruption.

Seeing is believing

View our videos on Vimeo →

Vacuum Cooling
at Logistic Centers

Weber Cooling is the world leading supplier of Vacuum Cooling Solutions

Weber Cooling is the largest supplier of vacuum cooling solutions in the world. We ONLY do vacuum cooling. For ALL applications where vacuum cooling is used.

We've developed dedicated, tailor made solutions for each of these vacuum cooling applications.

FOOD APPLICATONS

Bread & Pastry | Food & Kitchen | Rice & Sushi

FRESH APPLICATONS

Vegetables & Herbs | Flowers & Cold Chain | Turf, Sedum & Substrate

Weber Cooling can provide highest quality solutions at lowest costs, thanks to our:

- **Economies of scale** – we are the largest vacuum cooler supplier in the world.
- **Low overhead** – we combine a lean and agile organization with a strong partner network.
- **Intelligent design** – using modular technology and innovative solutions.

Installation, maintentance and support

Weber Cooling ONLY builds vacuum coolers — this is where we excel. All vacuum coolers are designed by our Dutch engineering team and build using premium (European) components.

As a result of our economies of scale (we produce up to 100 systems/year), our intelligent design and strategically, positioned and highly efficient production locations in Europe and Asia, we are able to offer a premium price/performance level.

Our global presence ensures the availability for installation support and after-sales service, worldwide. In collaboration with our partners, we are always nearby to assist you and can also offer you testing facilities, at our offices, or by bringing our research systems to you!

Contact

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