



**THE ART
OF STORAGE**

BESSELING GROUP

CONTROLLED ATMOSPHERE

CO₂ ADSORBER

PSA NITROGEN GENERATOR

ETHYLENE CONVERTER

MEASUREMENT & CONTROL TECHNOLOGY

COLD STORE PROTECTION / ACCESSORIES

Besseling, the art of storage

Storing and protecting, two words which are key to everything Besseling does: giving your products exactly the care and attention they need in order to achieve the highest possible returns. As a specialist in CA/ULO/DCA and other storage technologies, we offer tailored solutions to create a protective atmosphere.

Why Besseling Group? The answer is simple: proven technology. Our products are tried and tested under the most difficult and most extreme conditions. We set the most stringent requirements for our products. Not surprisingly, because our founders have been active in the agrarian sector for generations and have always remained on the lookout for the best ways to store your precious products.

Thanks to our expertise, we are able to offer you integrated solutions for all your storage needs and, if desired, advice on the many facets of atmosphere, cold and moisture control. Our high-quality products have been specially developed to store your products - long-term, affordable, reliable and with a minimum of maintenance. In short: a complete program to preserve your products/income.

Besseling offers you peace of mind in your cold store and beyond. And that is exactly what we mean by **"the art of storage"**.



Research & Development

The strength of our products lies in their simplicity. The equipment we produce provides the ultimate proof that high-quality technology does not automatically need to be complicated. Simple but smart constructions prevent failures and require only minimal maintenance in

order to keep the equipment in perfect condition. Our Research & Development department is engaged in ongoing research into new applications for our equipment. At our own testing and development centre, we are constantly devising and testing new ways to improve storage technologies. Extensive tests are also carried out in order to find the optimum storage conditions for numerous products.





Controlled Atmosphere storage

The market price for fruit and vegetables is primarily determined by quality, supply and demand. But how do you maintain the best quality in your products until the most suitable moment? Simple: by opting for storage under Controlled Atmosphere (CA) conditions.

By using CA, the physiological processes in the

stored product are slowed down, resulting in an extended storage life. The product is put into hibernation so to speak. The required conditions are achieved by creating and maintaining a special protective atmosphere.

Lowering the oxygen level slows respiration and reduces the metabolism of important nutrients. The aim is to keep the oxygen level as low as possible in order to preserve these nutrients - hence quality.

The remaining oxygen is converted into CO₂, which in turn ensures that the respiration of fruit and vegetables is further slowed down. However, excess CO₂ will damage your product and must therefore be removed.

Ethylene is produced by fruit and vegetables and stimulates the ripening process - hence the ageing process. In order to slow down these processes, it is necessary to remove this harmful ethylene gas from the air of the cold stores for some products.

Each product variety requires different conditions. Depending on factors such as climate, weather, soil conditions, growing conditions and the time of picking, the optimum conditions vary not only year by year, but also from one product to another and even from one variety to another. As experts in CA storage, we offer you tailored solutions and every opportunity to keep a close watch on your valuable produce.

These days, many different storage concepts are available: ULO, DCA, ILOS, DILOS, DCE, etc. Besseling can supply both the protocols and the required equipment for these concepts.

Pallet Fresh System

Soft fruit, a great product but also a sensitive one. It is a product that must be marketed at the right moment in order to fetch the best price. Especially for these sensitive fruit varieties Besseling has developed the Pallet Fresh System. This storage system enables you to store your products under CA conditions per pallet/cover in order to maintain their quality for as long as possible.

Particularly for smaller quantities, the Pallet Fresh System is the ideal solution. Various types of fruit and vegetables are stored in a product-specific atmosphere per pallet immediately after harvest in order to supply the highest quality and the correct quantity on demand. Flexibility is important; single or multiple pallets can be removed or added to the system without affecting the conditions of the other pallets.

The Pallet Fresh System works both with individual pallets or groups of pallets, depending on the quantity and the variety of the product that needs to be stored. Each Pallet Fresh Unit consists of a cover and a special pallet on which the crates, boxes or even a pallet with products can be placed.

Also required are:

- A cold store
- Measurement and control system (ACS) for creating and managing the CA conditions
- Nitrogen from a Besseling PSA nitrogen generator
- CO₂ from gas cylinders
- Oxygen from an air compressor

Besseling also measures the composition of the air outside the pallets/covers.





CO₂ adsorber

Fruit and vegetables 'breathe', a natural process in which oxygen is converted into CO₂ (carbon dioxide). An increased CO₂ level in a cold store 'calms' the fruit, but an excess will cause damage and must therefore be removed.



an 'adsorber lung'. This patented system guarantees absolute low oxygen operation which means that virtually no oxygen can enter the cold store (ideal for storage under ULO and/or DCA conditions).

A frequency-controlled ventilator reduces energy consumption to a minimum - an important benefit

A CO₂ adsorber, also known as a scrubber, removes carbon dioxide from cold stores, along with a small portion of the harmful ethylene present. The CO₂ adsorber contains active carbon, which has the characteristic of adsorbing CO₂ molecules (binding them to it). By efficiently transporting the air from the cold store, passing it over the active carbon and returning it to the cold store, the CO₂ is effectively removed from the air in the store.

Besides a user-friendly control panel for setting the actions per cold store, the adsorber is equipped with

because an adsorber runs for the majority of the day. In addition, the diameter of the pipe is matched to the size of the ventilator so no heat can enter the cold store as a result of friction.

Every fruit and vegetable variety has its own CO₂ production and maximum permitted CO₂ value. For this reason, Besseling produces different capacities of adsorbers so that we can always supply a solution for your application.

PSA nitrogen generator

By lowering the level of oxygen in the cold store, respiration is slowed down and the 'metabolism' of important nutrients in fruits and vegetables is reduced. The objective is to keep the oxygen level in a cold store as low as possible in order to maintain quality and delay the ageing process as much as possible.

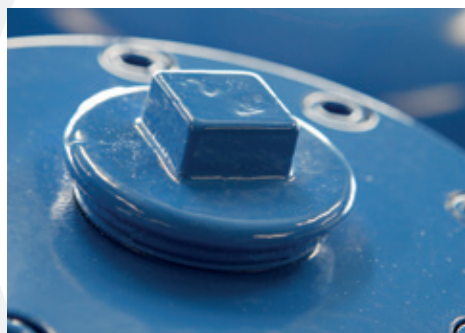
The reduction of the oxygen level in a cold store can be accelerated using a PSA (Pressure Swing Adsorption) nitrogen generator. A PSA generates pure nitrogen from normal ambient air which will be used to expel the oxygen from the cold store.

The Besseling PSA nitrogen generator consists of two vessels fitted with extremely high-quality CMS (carbon molecular sieve). A CMS is capable of adsorbing oxygen molecules for a particular length of time. When saturation is reached, the system automatically switches to the other vessel by means of valves. The saturated vessel is

prepared for the next cycle by depressurizing it, after which the adsorbed oxygen molecules are released and purged. Thanks to this simple principle, the reliability and lifespan of the PSA nitrogen generator is extremely high.

All our PSA nitrogen generators are provided with filters and automatic drains so no fluid or oil can reach the CMS.

Besseling offers different capacities of PSA nitrogen generators. The capacity is chosen/determined depending on the volume and number of the cold stores.



N2





Turnkey projects

Besseling's experienced specialists can guide your construction or rebuilding projects from start to finish. The entire planning, organization and management of your project will be in the hands of one fixed contact. Thanks to short communication lines, transparent planning and an efficient working method, we guarantee you the best results and quality within the agreed time frame.

We implement the majority of turnkey projects in partnership with local Besseling distributors so that future service and maintenance can also be provided at local prices.

Ethylene converter

Ethylene gas is produced by fruit and vegetables and accelerates the growth, development, ripening and ageing of the product. Some fruit varieties, for example kiwis, are extremely sensitive to ethylene. The Besseling ethylene converter quickly and easily removes this harmful ethylene gas. In this way, your products retain their 'eternal youth'.

The ethylene converter consists of two columns, each with a heat storage medium, a catalyst, heating elements and one ventilator. In turns, cold store air is guided upwards and heated per column. The air then passes through the catalyst bed where the ethylene gas is broken down. Finally, the air flow passes through the second catalyst bed, where the remaining ethylene is broken down and the air cooled back down.

With the Besseling ethylene converter, an ethylene level of 1 ppb (0.000001%) can be achieved without making use of chemicals. This makes the process extremely environmentally-friendly. Thanks to heat recovery and accurate control of the optimum temperature, the converter consumes minimal energy.



Origins

The area around Zwaag and Blokker has long been known for fruit-growing. For over 90 years, the Besseling family from this West-Frisian municipality has been working in this sector. From an early stage, the Besseling family was conscious of the importance of good storage technologies and built its first cold stores and cold storage facilities in the early 1950s. A logical consequence was our interest in Controlled Atmosphere storage, resulting in the construction of the first CO₂ adsorber in 1965. High demand from growers for this equipment led in 1987 to the founding of Besseling Agri-Technic BV. In 2009 the name of the company was changed into Besseling Group BV. Besseling Group BV has since grown to become a firm specializing in virtually every aspect of climate control. The company nowadays supplies a broad range of high-quality installations worldwide, focused on the needs of every client.



Measurement & control technology

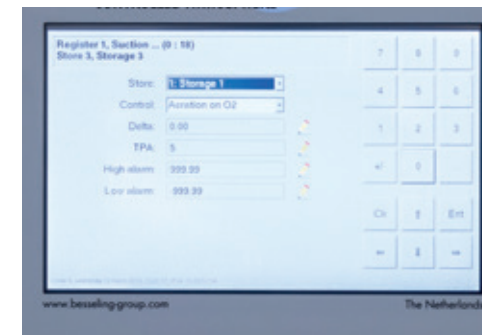
Measuring is knowing! Without accurate measurement and the appropriate control of the equipment, all kinds of things can go wrong. Besseling has developed its own measurement and control system (ACS - Atmosphere Control Station) which can be used to control your cold storage facility fully automatic. You only need to set the required values and the system will measure, control and maintain your chosen atmosphere.

Quality and reliability at the heart of your system are extremely important! As such, the sensors approved by Besseling meet four important requirements; sustainability, stability, accuracy and response time.

ACS can easily be expanded with the addition of a cooling module that allows any type of cooling system to be managed. It controls the cooling valves, defrost valves and ventilators, based on target values which you can set yourself. Besides temperature, relative humidity can also be measured and regulated, as can the quantity of defrost water, if required. Thanks to this total concept, ACS is capable to control your entire cold storage facility.

The analysis system can be connected to a PC with BatNetWin™ Software. In this way settings can easily be changed and the measured data are stored automatically. The registered data can be graphically displayed and printed, making it possible to generate various reports and, for example, compare different periods.

Besseling also supplies portable measuring equipment for manual measurement of O₂ and CO₂ values.





Service & support

In all facets of our operational management, we attach great importance to service. For this reason, our equipment is always installed by our own experts or the experienced technicians from our dealers. In this way, you are assured of reliable and trouble-free operation, even after many years of intensive use.

If a service need does occur despite the extensive precautions taken, our service engineers and helpdesk staff guarantee a fast and efficient solution. In our simulation area, we can replicate any system supplied by us, simulate possible faults, identify the problem and immediately provide a solution.

Cold store protection

During a storage season, a cold storage facility is constantly exposed to changing conditions that can directly affect the atmospheric conditions inside. Besseling offers solutions for optimum protection and security.

Breather bag / Bufferlung

As a result of changing air pressure and the temperature fluctuations inside the cold store, the air volume is constantly subject to changes. In order to neutralize these variations, a breather bag is fitted onto the cold store. The bag stores the excess air of the cold store and if necessary (in case of low pressure) returns it to the store. This prevents ingress of oxygen-rich outside air into the cold store.

Overpressure / underpressure protection

Under extreme conditions, a breather bag only is not sufficient anymore. For this reason, cold stores must also be equipped with overpressure and underpressure safety valves which starts operating at an overpressure/ underpressure of 10 mm water column. Without this safeguard, the ceiling and/or walls of the cold store can be severely damaged.

Aeration ventilator

The aeration ventilator keeps the CO₂ percentage low during the loading and cooling period and allows oxygen to enter the store in a controlled manner during CA storage.



Accessories

In addition to the equipment, Besseling also supplies all the necessary accessories, such as:

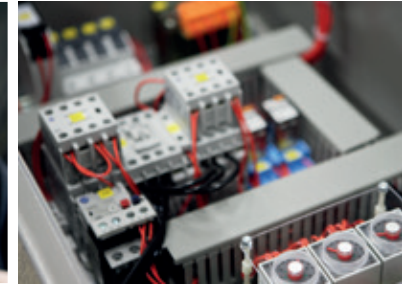
- Gas-tight flanges
- Gas-tight doors
- Special coating for the gas-tight finishing of corners and panel joints in a CA cold store
- Gas-tight store connections
- Compressed air supply
- Compressed air conditioning
- Water measurement
- Humidification, ultrasound and compressed air
- Filters
- Emergency power supply

These are just a few of our many accessories. Please contact us for other accessories or tailored solutions.



BESSELING GROUP

CONTROLLED ATMOSPHERE



Besseling Group BV

Oosterblokker 17a, 1696 BA Oosterblokker, The Netherlands

Tel. +31 (0)229 212154

sales@besseling-group.com

Fax +31 (0)229 247708

www.besseling-group.com

THE ART OF STORAGE