# NITROSource PSA & Compact Snowstorm Filling Method



**PSA nitrogen generators - Carbon Molecular Sieve, (CMS) Filling Method**

A significant advantage of the modular aluminium construction over twin tower construction is the access it provides to the top of the CMS chamber, This is unique to modular aluminium nitrogen generators.



This unrestricted access allows the oxygen adsorbing CMS material to be filled using a specialist filling technique.

This filling technique combined with the modular design greatly improves nitrogen generator performance when compared to the loose filled beds of twin tower designs.

**Specialist CMS Filling Method**

The specialist method used to fill the CMS material is called "Snowstorm Filling" and it requires the use of a specialist filling device, the "snowstorm filler".





**Each snowstorm filler is optimised for:**

- **The diameter of the column being filled**
- **The size of the CMS bead**

As snowstorm filling requires access to the full cross-sectional area of the column, this method cannot be used with fabricated steel twin tower nitrogen generators.

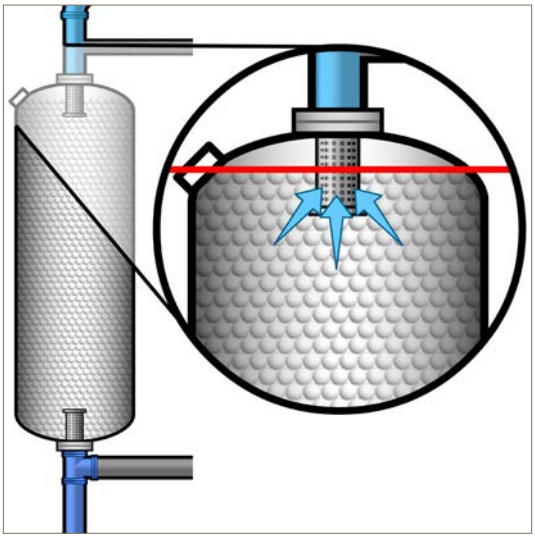
**Snowstorm filling the CMS material:**

- Achieves maximum packing density for the material being filled
- It fully utilises all of the available space envelope
- It allows more CMS to be filled into a nitrogen generator column that would be possible if no filler was used

## Twin Tower Nitrogen Generators CMS Fill Method

Twin tower nitrogen generators have a filler boss located on the top dome of the vessel. Due to the position of the outlet piping, this is not at the top of the vessel. The welded construction and their large size does not allow access to the full cross sectional area of the vessel, preventing the vessels from being snowstorm filled.

CMS material is therefore poured in through the filler boss until it reaches the height of the filler. As the CMS cannot be filled to the top of the vessel, a void will exist (above the red line in the image right). When compressed air is applied, the void allows the CMS to move about inside the vessel

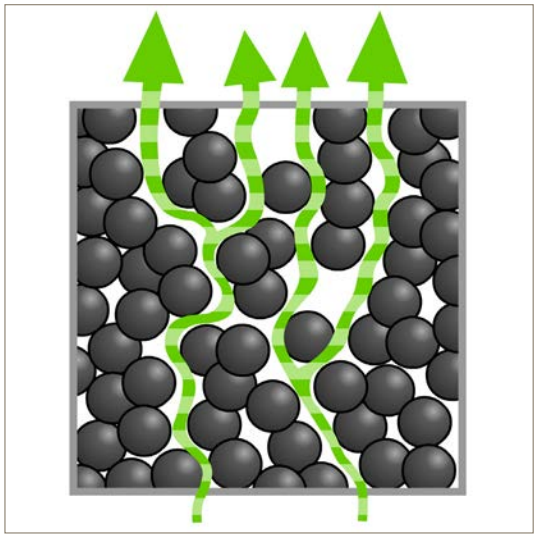


**The Problems Associated with Loose Filled CMS Beds**

Due to the loose filling process, the compressed air will take the path of least resistance through the CMS material and this results in air channelling through the adsorbent bed.

**Channelling in the CMS column results in:**

- Bypass of the CMS material
- Oversized CMS beds to provide the required contact time between air and adsorbent
- Oversized vessels to hold the extra CMS material
- CMS attrition resulting in dusting
- Premature blockage of downstream filtration & pneumatics due to dusting
- Inconsistent oxygen adsorption
- An inconsistent outlet purity

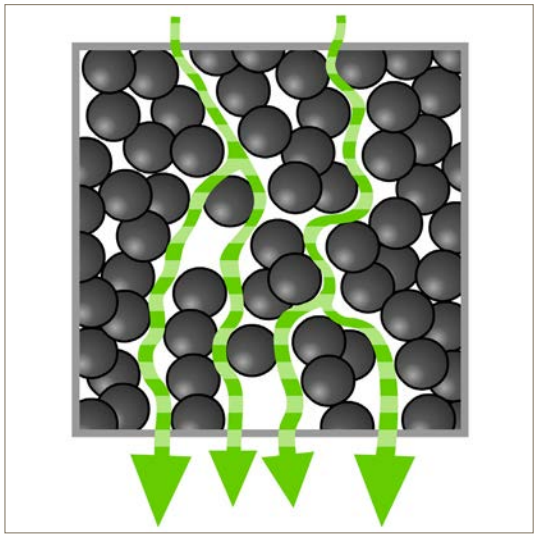


**Loose Filled**
**Channelling & Bypass in Generating Column**

Once the CMS is saturated with oxygen, it must be regenerated.

As regeneration takes place, channelling again occurs.

The off-line CMS material is typically regenerated in the opposite direction to the generating flow (known as co-current regeneration) and the channels created during regeneration may bypass areas of oxygen saturated CMS, resulting in inconsistent regeneration and again affecting nitrogen purity on column changeover.



**Loose Filled**
**Channelling & Bypass in Regenerating Column**

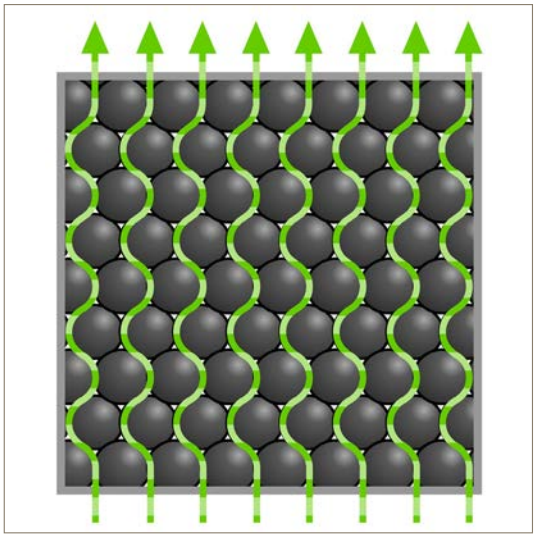
## Modular Aluminium Nitrogen Generator CMS Fill Method - Snowstorm Filling

A mesh plate is located between the lower manifold and the bottom of the CMS column. CMS is snowstorm filled to the top of the column. An additional mesh gasket plate is then placed between the top of the column and the upper manifold. No void exists at the top of the column and the CMS is fully retained and is unable to move.

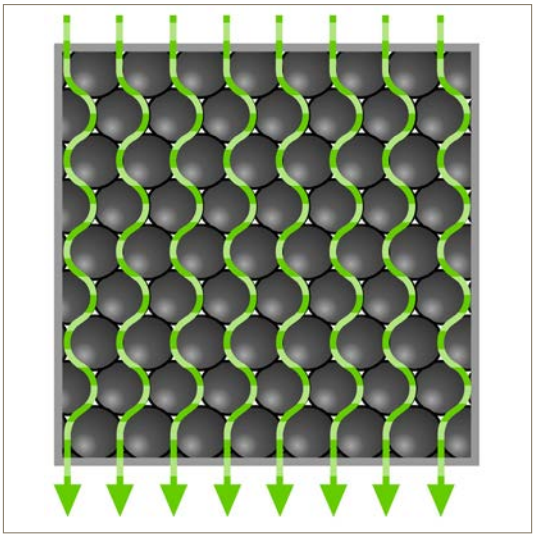


**Benefits of Snowstorm filling the CMS material:**

- Prevents the channelling of air through the CMS as seen on twin tower designs
- Utilises 100% of the available CMS material providing consistent purity and flow
- Reduces the amount of CMS required to achieve purity
- Significantly reduces CMS attrition which leads to dusting, blocked filters and loss of purity
- Provides consistent regeneration of the CMS material as the exhaust gas back-flow and purge is in contact with 100% of the CMS
- Provides a low and equal resistance to the air flow, allowing multiple CMS chambers to be used without preferential flow
- Also allows multiple nitrogen generator banks to be used without preferential flow, a feature unique to modular nitrogen generators known as multi-banking



**Snowstorm Filled**
**100% Contact in Generation Column**



**Snowstorm Filled**
**100% Contact in Regenerating Column**

## Frequently Asked Questions

**Can I loose fill a modular nitrogen generator?**

*Yes, but the generator performance will not be the same as a snowstorm filled generator as snowstorm filling allows more CMS to be filled into a column than would be possible if it were loose filled.*

**What is the service life of the CMS?**

*The Parker NITROSource PSA and Compact nitrogen gas generators are designed to operate with the same CMS throughout their service lives. Parker does not consider the CMS an item that needs to be replaced under normal operational circumstances.*

*Snowstrom filling is one of the key attributes to ensuring the CMS does not suffer from attrition and therefore functions at maximum performance for continuous operation, expected in excess of 10 years.*

*Replacing CMS in twin tower style nitrogen generators is costly and messy, while origianl factory performance is difficult* to regain. Attrition of CMS in twin tower designs can cause a progressive reduction in purity and flow from an early stage."

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