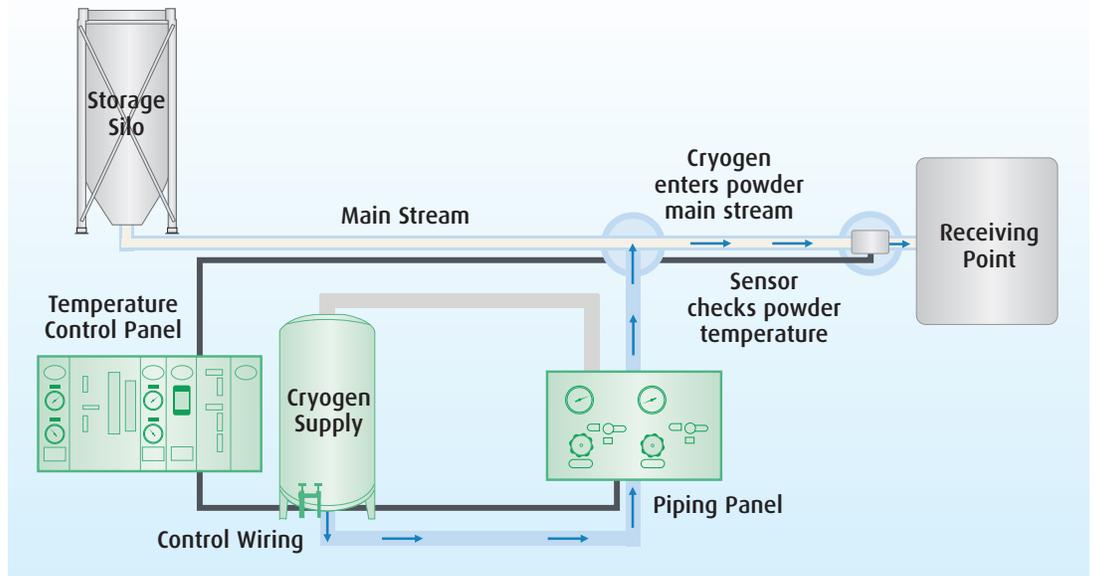




ColdFront™ Powder Cooling System Technology

Cryogenic Powder Cooling



Schematic representation of the powder cooling system using either liquid nitrogen or carbon dioxide

Linde's *ColdFront* powder cooling technology efficiently and uniformly cools powdered ingredients in order to maintain consistent dough temperatures both seasonally and batch-to-batch especially during summer months when experiencing peak temperatures and humidity levels.

The *ColdFront* powder cooling system also replaces problematic dry ice shoveling or water ice use as a dough cooling method.

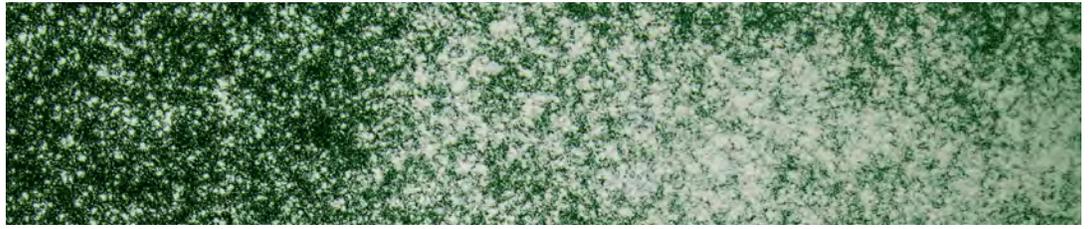
Predictable and Precise Temperature Control

Many dough or mix formulations require precise temperature control for achieving high product quality and consistent results. Warmer summer months can make temperature control difficult, but even week-to-week and day-to-day variations can lead to inconsistent products. Cooling the mix with CO₂ ice pellets is laborious, while cooling with water ice introduces variability in the amount of water. Linde's *ColdFront* powder cooling system uses cold cryogenic nitrogen or carbon dioxide in order to rapidly cool bulk powder ingredients.

The system offers precise temperature control and can easily adapt to changing production levels, batch sizes, and hourly, daily, or seasonal changes in temperature. Consistent temperature control is critical to maintaining high product integrity, preventing temperature and humidity from degrading delicate ingredients, and protecting any meltable ingredient, mix-in, or temperature sensitive additions.

Implementation

Linde's *ColdFront* powder cooling system delivers very cold cryogenic liquid to the pneumatic powder delivery line near the storage silo reducing powder temperatures to the desired levels as the product leaves the silo. Proprietary injection of the liquid nitrogen or liquid CO₂ into the pneumatic line reduces temperature quickly while preventing product build-up and injector clogging. Using a sophisticated control system quickly adjust powder temperatures even as flow rates change. Powder reaching the process floor maintains a tightly controlled temperature range. *ColdFront* powder cooling can be used on either pressure or vacuum systems and across a wide range of flow rates from 100 lb/min to more than 350 lb/min and temperature differentials up to 45°F.



Implementation (Continued)

The system can be easily sized and retrofitted into existing pipe and may ultimately help reduce operating costs and increase return to the bottom line.

The Linde system cools ingredients quickly and efficiently as they are pneumatically transported into the production process. Chilled flour entering the mixer means no batch time is consumed for a cooling step. Shorter batches means more batches.

The Process in Action

Among the successful installations of Linde's *ColdFront* powder cooling systems is a large Midwest bakery producing a variety of baked goods such as frozen dough, pie crusts, and biscuits. The plant was using Linde CO₂ to cool all of their flour cooling lines, however the bakery wanted to convert a few lines to nitrogen, so that if CO₂ availability is tight, especially in the summer months, the bakery would still be able to continue cooling in order to meet production requirements. Linde sized and installed a liquid nitrogen *ColdFront* powder cooling system and successfully achieved the target ingredient temperature reduction of 45°F resulting in the required dough temperature and quality specifications.

Linde was able to provide the technology needed to address the challenges they faced in their production process. Linde understands that maintaining the required temperature of your ingredients, whether its flour, powdered sugar, starches, or cocoa power, can be critical to your manufacturing process.

Features and Benefits

- Cooling during product transfer window
- Eliminate hydrating problems associated with water ice cooling
- Automated control system
- Achieve consistent product quality during seasonal changes
- Lower losses stemming from condensation buildup
- Protects meltables
- Reduction in batch time
- Reduce manual labor costs
- Easy to maintain

A Wealth of Experience and Support

Years of research at our food technology center have identified the ideal cooling conditions for a broad range of products. When you choose Linde, you're selecting more than the largest supplier of industrial gases in North and South America.

You're also selecting a support team that includes:

- Experienced food scientists and engineers.
- A complete array of services, on-site evaluation, designed experimental testing, installation and start-up support known as Linde's Total System Approach.
- A food technology center featuring an analytical laboratory to evaluate your product in full-sized production equipment.

It's everything you need to improve the quality and consistency of your products.

Contact Linde Today

For more information about cryogenic, process analytical and industrial gases used throughout your operation, call Linde at **1-844-44LINDE**, or visit our website at www.lindefood.com

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