



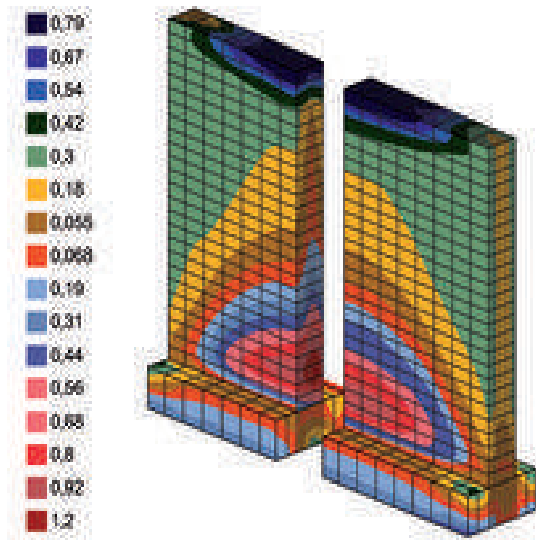
Building without stress

Cryogenic cooling prevents stress cracking in the concrete and assures quality.



A cool response to heat

A considerable amount of heat is liberated when concrete sets. More or less heat can develop during the first 48 hours, depending on the temperature of the fresh concrete (activation energy of the exothermal reaction). An excessively high temperature can prove dangerous to many buildings and building parts, for cracks caused by thermal stresses during the curing process can impair their functionality.



*FEM analysis; longitudinal stress distribution [N/mm²]
(seven days after production)*

The temperature of the fresh concrete should be optimized during the manufacturing process. In winter this is achieved by heating the raw materials. In summer, on the other hand, cooling processes must be used to limit the temperature of the fresh concrete. These processes' specific guidelines and technical regulations ensure that the required temperature of the fresh concrete is reliably maintained.

Messer can offer an efficient and economical solution to the problem by cooling the fresh concrete or its raw materials. Cryogenic gases ensure that fresh concrete can be supplied with a constant "cool" temperature between 5 and 25 °C.

Always the right cooling method

For many years, Messer has tested various methods for controlling the maximum temperature of fresh concrete in test series and applied these in practice.

Generally speaking, the following methods can successfully be used to cool fresh concrete:

- Use of a binder with low heat of hydration
- Cooling the added water
- Cooling the concrete aggregates either by sprinkling water or in a continuous stream
- Cooling the fresh concrete with the aid of lances filled with liquid nitrogen while still in the mixer truck
- Addition of flake ice or cryogenic snow instead of the added water
- Cooling the cement

Cement cooling plant on a large construction site near Vienna





Setting up a cement cooling plant



Cooling the cement during the unloading process



Cooling concrete on a large scale

Which method is ideal in each case depends on the amount of concrete to be cooled, the cooling time and the maximum required rate of cooling.

Lance cooling: quick and compact

Lance cooling can be used to cool small or medium amounts of concrete to a few degrees Celsius within a corresponding time frame.

Features of lance cooling

- + Unlimited cooling rates
- + Concrete is cooled immediately before it is laid
- Little heat transfer due to small interfaces
- Time-consuming
- High thermal stress for aggregate and mixer drum
- Considerable fog formation during the cooling process
- Poor energy utilization
- Requires intensive manpower

Cryogenic snow: spot-on and efficient

Cooling with cryogenic or artificial snow, as it is also known, is an effective means of cooling large quantities of concrete requiring high cooling rates.

Features of cryogenic snow:

- + High cooling rates are possible
- + Can be metered reliably
- + Concrete temperature can be adjusted without difficulty
- + Efficient energy utilization
- High investment costs
- Continuous production required

Cooling the cement (Cryoment): efficient and homogeneous

Cooling the cement is a suitable method when medium to large amounts of concrete have to be cooled at high outdoor temperatures and at high rates per hour. The technology comprises two separate processes with different application areas:

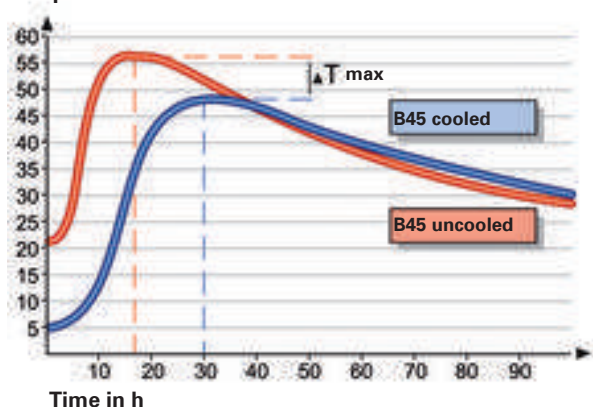
Cryoment-Flow

In this case, the cement delivered by tanker trucks is cooled to the required target temperature as it is transferred to the local cement silos for storage.

Cryoment-InTime

With this method, the cement is cooled to a temperature of minus 190 degrees in a fluidized bed and then conveyed directly to the cement weigh-bridge. The process operates on a "just-in-time" basis. Cold cement is not actually stocked, thus reducing the loss of low temperature.

Temperature in °C



Heat of hydration for cooled and uncooled concrete

Features of Cryoment

- + Only process with which the temperature of the fresh concrete can be adjusted over a large range
- + High cooling rates
- + Reliable metering
- + Suitable for all concrete quantities
- + Good to very good energy utilization

Our services for manufacturers of fresh concrete go far beyond the supply of cryogenic gases. Together with cement manufacturers, construction contractors and the manufacturers of fresh concrete, we develop technologies for optimum and energy-efficient cooling of the fresh concrete.



Cooling cement near Innsbruck, Austria



Large construction site at Tsankov Kamak Hydro, Bulgaria

Jointly finding the best solution

The best cooling technology for your particular application is selected together with our development engineers and application technologists.

Do not hesitate to contact us if you have any questions or require personal advice from our application technologists.

Technology	H ₂ O	Aggregate	Lance	Flake ice	Cement	
					Cryoment- Flow	InTime
Investment costs	low	medium	low	high	medium	high
Operating costs/Losses	low	medium	high	medium	low	low
Max. cooling rate (°C) in concrete	3	5 - 8	5 - 10	5 - 8	8 - 10	22

■ low
 ■ medium
 ■ high

The individual cooling values in the table show which method is most appropriate in each case.

This and many other brochures can also be downloaded as pdf-files from: www.messergroup.com



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