



EUCLID CHEMICAL



GUIDE TO COLD WEATHER CONCRETING AND PRODUCING FREEZE RESISTANT CONCRETE

WITH EUCLID CHEMICAL ACCELGUARD SERIES ACCELERATING ADMIXTURES

COLD WEATHER CONCRETE

FREQUENTLY ASKED QUESTIONS

WHAT IS COLD WEATHER CONCRETE?

Cold weather concreting is defined by ACI as placing concrete during a period where average ambient temperature falls below 40°F (4°C) for more than three continuous days. These cold conditions create the need for special precautions when placing, finishing, curing and protecting concrete against the effects of cold weather. Since weather conditions can change rapidly in the winter months, good concrete practices and proper planning should be taken seriously. The use of a traditional accelerating admixture can ensure that concrete be placed, finished, and protected in these conditions.

However, if temperatures continue to drop and the concrete temperature itself reaches temperatures below 32°F, traditional accelerators may be insufficient to protect from freezing. In this scenario, a Freeze Resistant Concrete system is recommended.

WHAT IS FREEZE RESISTANT CONCRETE?

A subcategory of cold weather concreting, Freeze Resistant Concrete Systems should be used when concrete temperatures are at or below 32°F (0 °C) at the location of concrete placement. This system is typically designed using a specialty accelerating admixture that allows the placement of quality concrete in such conditions. If concrete is not protected and exposed to early freezing, it can result in a reduction of up to 50% in ultimate strength. Once concrete has achieved a compressive strength of 500 psi (3.45 MPa), it is commonly considered to have enough strength to resist expansion and internal damage from a freeze thaw cycle. For repeated cycles of freezing and thawing, concrete should develop a strength of 3500 psi (24.13 MPa) or greater.

Specialty Non-chloride accelerating admixtures such as ACCELGUARD G3 are recommended when placing concrete in such conditions. Not all traditional non-chloride accelerators are successful with this unique type of concrete. The proper use of ACCELGUARD G3 at dosages determined by trial mixes and a suitable air void system will ensure that the concrete can resist freezing prior to setting and reaching the strength needed to resist a freeze thaw cycle. Concrete produced with this system will reach its ultimate design strength and maintain durability for the normal life of the concrete along with being able to endure repeated freeze thaw cycles.

ACCELGUARD G3 benefits:

- Allows for concrete placement in below freezing conditions where normal concrete could not be placed
 - Can reduce initial set 1 to 6 hours depending on concrete temperatures
 - Cuts construction costs - concrete placing cycle is accelerated
 - Rapid acceleration of strength development at early ages
 - Decreases overtime by allowing same day finishing
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WHY CHOOSE FREEZE RESISTANT CONCRETE?

Freeze Resistant Concrete allows contractors to safely place concrete that can be risky or impossible without adapting the mix design with specialty accelerating admixtures. This may help avoid costly delays or penalties, reduce the need to heat the area or using heat blankets, and save on labor and time. Schedules can remain on target and volume may increase during the winter months. Developing a Freeze Resistant Concrete System may be worthwhile economic choice for contractors during the cold winter months.

Although conventional accelerators will work for normal cold weather condition, creating Freeze Resistant Concrete is only possible with ACCELGUARD G3 and can be marketed as a specialty concrete.





DOSAGE RATE CHARTS

Normalizing Initial Set During Cold Weather with Accelguard G3

Ambient Temperature	Concrete Temperature		
	50 - 59 °F (10 - 15 °C)	60 - 69 °F (16 - 21 °C)	70 °F + (21 °C +)
20 to 24 °F (-7 to -4 °C)	Refer to Freeze Resistant Concrete Chart*		
25 to 29 °F (-3 to -2 °C)	30 - 70	25 - 60	20 - 50
30 to 32 °F (-1 to 0 °C)	20 - 60	20 - 60	20 - 40
33 to 39 °F (1 to 4 °C)	15 - 50	10 - 40	10 - 40
40 °F + (5 °C +)	10 - 30	10 - 20	10 - 20

Dosage in oz/100 lb of cement.

*For Freeze Resistant Concrete use the chart below

Freeze Resistant Concrete Recommendations for Accelguard G3

Ambient Temperature	Concrete Temperature		
	50 - 59 °F (10 - 15 °C)	60 - 69 °F (16 - 21 °C)	70 °F + (21 °C +)
20 to 24 °F (-7 to -4 °C)	75 - 90	70 - 90	60 - 90
25 to 29 °F (-3 to -2 °C)	70 - 90	60 - 90	60 - 80
30 to 32 °F (-1 to 0 °C)	60 - 75	60 - 70	60 - 70

Minimum dosage for freeze resistant concrete is 60 oz/100 lb of cement. The exact dosage should be based on satisfactory field tests, with the selected mix.

RECOMMENDATIONS FOR FREEZE RESISTANT CONCRETE:

1. Minimum recommended cement content: 600 lbs/yd³ (355 kg/m³). *Lower cement content can be used with prior testing that meets freeze resistant requirements.
2. Variations in mix designs and cement content allows for a possible dosage adjustment of Accelguard G3, depending on placing conditions and temperature exposures.
3. Minimum starting concrete temperature should be greater than 50° F (10° C)
4. Minimum ambient temperature is 20° F (-7° C) in the 8-hour placement window.
5. Entrained air is recommended if the concrete will be subjected to multiple freezing and thawing cycles.
6. Euclid Chemical PLASTOL Water Reducing Admixtures are recommended to reduce the overall water used in the concrete mix design and EUCON Air Entraining Admixtures should be used to establish a properly designed air void system.
7. At elevated levels of non-chloride accelerator, the contractor may need to be prepared for early stiffening of the concrete after placement. Additional labor may be required.
8. It is highly recommended that concrete be protected from rapid surface drying using wind breaks and be cured and protected immediately after placement and final finishing.

INDUSTRY LEADERSHIP

For more than a century, The Euclid Chemical Company has served as a leading supplier to the concrete and masonry industry offering a full line of engineered concrete admixture and construction products marketed under the EUCCO brand name. These products include concrete admixtures, block and masonry additives, curing and sealing compounds, epoxy adhesives, floor and wall coatings, structural grouts for columns, equipment and machinery, joint fillers and repair products. The Euclid Chemical Company strives to bring innovative technologies and products to the concrete market with industry leading customer service.

CUSTOMER SOLUTIONS

The Euclid Chemical Company is unique in our offering of superior products, unparalleled customer service and industry support. The Euclid team delivers a range of value-added resources and in-depth industry experience to architects, designers, engineers, building contractors and owners. Comprised of highly trained professionals who are available in local offices across the Americas, our experts are active members on industry technical committees including American Concrete Institute (ACI), International Concrete Repair Institute (ICRI) and American Society for Testing and Materials (ASTM). Our experienced field team is available to support you and your projects using Euclid Chemical solutions and products manufactured under the stringent standards of our ISO 9001 certified quality system. The Euclid Chemical Company works hand-in-hand with customers:

- supplying field evaluations, recommendations and application problem-solving on a project-by-project and technology basis.
- assisting in product selection, specification, installation and related technology.
- attending pre-design meetings, assisting in clarifying specifications and recommending product selection.
- supporting you by providing proper pre-installation instructions and methods for achieving quality results.

LABORATORY SERVICES

Our world class Cement and Concrete Reference Laboratory (CCRL) inspected facilities are equipped with state-of-the-art technologies and staffed by an exceptional team of professional, ACI certified technicians. These outstanding resources provide The Euclid Chemical Company the capability to offer comprehensive analytic and petrographic evaluation and testing services via programs that conform to the standards prescribed by the American Society for Testing and Materials, the U.S. Army Corps of Engineers (USACE), the American Concrete Institute and the International Concrete Repair Institute.

TRAINING

The Euclid Chemical Company generously shares product information and technical knowledge through training and seminars conducted for project owners, contractors, distributors and design professionals. Many programs are AIA/CEU registered, allowing eligible attendees to earn professional development hours. Euclid Chemical is proud to sponsor these opportunities for our associates and colleagues as part of our ongoing commitment to the concrete construction industry.

BUILDING GREEN

The Euclid Chemical Company offers an extensive line of green products that are specific to LEED guidelines. The LEED (Leadership in Energy & Environmental Design) Green Building Rating System provides a national standard for defining an environmentally friendly, sustainable "green" building. Points awarded to building projects based on water savings, energy efficiency, materials and indoor environmental quality.



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