

MINING

Ground Support | Rock Reinforcement | Roadway & Cast Concrete | Water Control | Mine Backfill



Mining

Normet has established a long term relationship with the underground mining industry over its more than 50 years of experience. Primarily an equipment manufacturer/supplier over its life, Normet has evolved substantially since 2007 to incorporate global Life Time Care (aftermarket support), Construction Chemicals and Rock Reinforcement business lines to its offering.

Our Mission is that with knowledge and new technologies, we improve underground mining processes to benefit our clients and society. We do this by

- Employing people with industry-leading skills who actively listen to our clients' needs and are passionate and inspired about their work.
- Continuously seeking to improve the processes of our customers.
- Caring for our clients by providing local, hands-on support.
- Rolling our sleeves up to solve problems, optimize processes and maximize productivity and safety.
- Developing innovative, quality products which enable the industry to work harder, safer and smarter.



Normet's Construction Chemicals offering addresses a number of critical aspects of underground mining including sprayed concrete, structural support liner (SSL), in-situ concrete placement, mine backfill, rock reinforcement, and injection for ground consolidation or water control. All are detailed herein.

In addition, our Rock Reinforcement Line features the D-Bolt, a safe, cost effective and efficient energy-absorbing bolt available to underground mining.

All this technology, while available, delivers the greatest results when used in a knowledgeable, systematic and holistic manner to ensure that the needs of the customer's processes are correctly met. Our offering is enhanced by the expertise of our trained professionals around the world. They speak your language, travel to your sites, and get underground to ensure that you get just what is required.

Should you have any questions regarding the information herein, please contact your local Normet professional or access us at:

www.normet.com

Ground Support – Sprayed Concrete

Sprayed concrete, or wet-mix shotcrete as it is commonly referred to in many parts of the mining world, has proven itself to be a ground control component of choice over the last 20 years. As a quantum evolution to the prior method of dry-mix shotcreting, sprayed concrete has proven its distinct advantages in logistics, application and performance and has become a first line choice of ground support for underground mines globally. Its ability to be quickly applied, its predictable and durable performance, and its complementary qualities to widely accepted reinforcement measures, make it a logical choice for ground support systems.

Normet globally offers a holistic approach to sprayed concrete for your underground mine. In order to optimize the returns of your investment, a sprayed concrete program at a mine needs to function correctly on all levels:

- Raw material selection
- Mix design
- Sprayed concrete production
- The logistics of getting the concrete to the workplace
- Accelerator selection
- Application
- Quality assurance and quality control

Our experienced representatives will work closely with you to understand the objectives of your program and to study the detailed aspects of its design and function, and advise on the ideal solutions for the project. Our solutions consist of our construction chemicals range including the state-of-the-art alkali-free accelerators, plasticisers and hydration control agents, application aiding technologies, as well as our industry-standard mechanised sprayers. We will work alongside your engineers, supervisors and operators, so that you can effectively and efficiently achieve your goals of safety, productivity and reduced cycle times.

Normet's Spray Masters are trained according to EFNARC standards and understand the sprayed concrete process from beginning to end. So, in addition to our proven equipment, our parts and service support, and our full line of construction chemicals, Normet has the ability to work with you holistically across all aspects of your program to assist you in ensuring that your objectives are met consistently and economically.

Sprayed Concrete Equipment

Normet offers a complete range of mobile equipment for all sprayed concrete applications in underground mining including the Spraymec SF 050 series, with different sizes for different needs, the Spraymec MF 050 / LF 050 series and the Alpha 20 and Alpha 30. All machines come in varying configurations and include choices for diesel or electric operation as well as the possibility of on-board compressors. For smaller workings, Normet's range includes the NorStreamer 30 trailer or skid mounted sprayed concrete pump and also the Minimec spray arm robot.

Product Range

Alpha 20 & 30
 Spraymec SF 050 series
 Spraymec MF 050 series
 Spraymec LF 050 series
 NorStreamer 30
 Minimec



Ground Support – Sprayed Concrete

Sprayed Concrete Accelerators

TamShot 70AF, TamShot 80AF, TamShot 90AF, TamShot 100AF & TamShot 80PAF are high performance, alkali-free accelerators for sprayed concrete applications. With typical dosage rates of 5% - 6%, TamShot's unique function also suppresses dust development, providing a cleaner working environment.

Product Range

TamShot 70AF
TamShot 80AF
TamShot 90AF
TamShot 100AF
TamShot 80PAF

Hydration Control Admixtures

TamCem HCA is a special admixture that prevents the early hydration of cement. It can be added at the concrete batching plant or directly into the truck mixer on site to extend the working life of both concrete and sprayed concrete. The dosage depends on the working time required, and the open time of sprayed concrete can be extended from between 3 hours to 72 hours. This is ideal for tunnel applications where sprayed concrete has to be available at all times during excavation in challenging geology.

Product Range

TamCem HCA
TamCem HCA Plus

TamCem HCA Plus has dual functionality: it provides both the benefits of hydration control as the standard TamCem HCA and it also boosts the setting and early strength development of the applied sprayed concrete. TamCem HCA Plus functions with all cement types, but works particularly well with blended cements that are becoming more prevalent in the construction industry. The product's ability to improve setting and strength development can help to reduce the cement content of the mix, lower set accelerator consumption and reduce re-entry time.

High Performance Superplasticisers

These products ensure optimum strength development irrespective of the total cement content and other constituents of the mix. Due to the cohesiveness of the mix, both aggregate and fibre rebound is substantially reduced, saving both time and cost.

Product Range

TamCem 23SSR
TamCem 53
TamCem 60

Application Aids

Normet offers a selection of simple and easy to use, non-toxic, environmentally friendly protective agent, lubricant and concrete remover for machinery and equipment. With the proper use of the application aids, it can prevent the build-up of cement laitance and rebound and aid the removal of concrete, which in return helps to extend the working life of equipment.

Product Range

TamCrete CR
TamCrete EasyClean
TamCrete PLL



Ground Support – Structural Support Liner 5

A Structural Support Liner (SSL) can be used when no other means of support is available. SSLs can be applied rapidly and safely, supporting the rock mass in the early stages before it moves too far down the ground reaction curve. With the use of a resin injection system and associated bolting or a SSL system and bolting, we can provide a safe and efficient working environment with cost benefits.

SSL is used for applications including:

- Rock support on drives
- Lining of shafts
- Service declines
- Undercutting of stopes
- Anti-oxidisation barrier
- Quick re-entry areas

Product Range

TamCrete SSL

Our TamCrete SSL is a non-cementitious acrylic polymer shell which has the following benefits properties:

- Fast setting times and high early and final strength
 - Tensile strength > 4 MPa after 1 hour / > 10 MPa after 28 days
 - Shear strength > 24 MPa, 28 days
 - Flexural strength 6.8 MPa, 28 days
 - Compressive strength > 40 MPa, 28 days
 - Bond Shear strength > > 10 MPa, 28 days
- Helps stop oxidisation
- Can be sprayed onto Kimberlite
- Variable set time of 4 seconds to 4 minutes
- Can be sprayed onto wet substrates
- Fire retarding (self-extinguishing)
- Environmentally and user friendly



Ground Support – Structural Support Liner

TamCrete SSL has set the standard in polymeric liner. Over the years TamCrete SSL has evolved from a high strength sealant into a robust cost effective structural support liner that continues to maintain its sealing characteristics.

Advantages of using TamCrete SSL:

- Excellent sealant and support mechanism due to good adhesion capability
- Prevents weathering and deterioration of fractures
- Preserves the excavation for long term mining
- Savings on spray time, transport, labor, etc, due to the reduced amount of material that is applied
- Highly adaptable
- Can be sprayed on live water by decreasing the gel time

TamCrete SSL structural support mechanism is considered to be particularly relevant in stress situations in which some loosening will have taken place and in which on-going stress-induced fracturing does occur. TamCrete SSL penetrates into the rock mass along open fractures and joints and acts as a hard rough gouge, filling and increasing the cohesion across the fractures. This strengthens the rock mass and limits the ability of the rock fabric to move (Key block-interlocking).

TamCrete SSL is applied using highly mobile and light equipment without sacrificing spray production. TamCrete SSL can be sprayed in small inaccessible areas with relative ease. Owing to TamCrete SSL's fast strength gain, ground support could be carried right up to the working face.

The use of TamCrete SSL enables quicker re-entry time unlike any other current system. TamCrete SSL could be used in conjunction or in addition to sprayed concrete, mesh and bolt ground support systems. It can be used to complement, strengthen or increase the life and durability of existing ground support systems.



Rock Reinforcement – Injection for Ground Consolidation

Normet has developed a range of polyurethane grouts for ground consolidation, void filling and water ingress control within the underground mining environment. The Normet portfolio of polyurethane grout includes rigid, flexible, semi-flexible, water activated, temperature adjustable and low viscosity polyurethane grouts.

Normet's Hybrid Silicate TamPur 116 is a two-component 1:1 ratio resin which is the leader in ground consolidation, providing cost effective solutions for fractured ground and highly stressed areas and has been used extensively in Block Cave mining operations in addition to traditional ground support such as fiber reinforced sprayed concrete and mesh & bolt and is currently used by some of the largest mining houses globally. Normet resin is typically applied using a high pressure twin piston air operated pump such as the Normet TP2 unit.

Typical Applications:

- Stabilisation of rock, coal, sand, gravel and concrete materials
- Stabilisation of convergence
- Stabilisation of caved material
- Control of water ingress
- Pre injection into faulted zones to secure before advancement
- Primary and secondary support injection of any type of cable bolt, spiling bar or Irma bolt etc.
- Anchoring and securing

Types of polyurethane grouts:

- Hybrid Silicate Resins (TamPur 115 / TamPur 116 / TamPur 116T / TamPur 117)
 - Fast or very fast reacting foaming and non-foaming product
 - Hardens flexible or semi-brittle with high strength
 - High permeability into strata
- Polyurethane Resin (TamPur 125 / TamPur 130)
 - Fast or very fast reacting foaming product
 - Reacts with water
 - Hardens ductile-elastic
 - High permeability into strata

Product Range

TamPur 115
 TamPur 116
 TamPur 116T
 TamPur 117
 TamPur 125
 TamPur 130

Advantages to using resin injection for consolidation:

- Faster set times compared to traditional cementitious grouting reducing delays in production
- High permeability into strata
- Excellent adhesion and flexural properties
- Much higher early strengths compared to cementitious grout (reaches maximum strength in minutes)
- Reduction in manual handling and underground logistics



Rock Reinforcement – D-Bolt

Underground mining is moving deeper and the construction of tunnels and underground spaces are facing more challenging ground conditions. The risk of rock bursts and deformations are increasing, causing potentially unsafe conditions for people, equipment and the operation as a whole, requiring innovation in ground control management. Rock bursts and large rock deformations may even lead to closure of part or the entire mine or work site, consequently lowering revenues and impacting viability.

To manage these conditions, reliable rock reinforcement systems are critical tools in modern underground operations. Such systems should not only be able to carry high loads, but also accommodate rock deformation by absorbing the energy released in the rock mass. Dynamic rock bolts are an essential part of these systems and have to be efficient and reliable, easily installed without requiring special equipment, and reduce the need for downstream rehabilitation.

Together with sprayed concrete, grouting and injection technologies and products, Normet offers the D-Bolt system for active rock reinforcement.

The D-Bolt represents a new generation energy-absorbing rock bolt system, specifically designed for efficient and reliable rock reinforcement, in both squeezing and burst-prone strata conditions. The D-Bolt's patented technology is based on a smooth steel bar with a number of anchor points along its length. It is anchored in a borehole with either cementitious grout or resin. The D-Bolt is only fixed with the grout in the anchor point positions, while the smooth sections between the anchor points can freely deform when subjected to rock dilation. The D-Bolt absorbs the rock dilation energy through fully mobilizing the strength and deformation capacities of the bolt material. The smooth sections of a D-Bolt independently provide reinforcement functions to the rock, and failure of one section would not affect the reinforcement function of other sections of the D-Bolt.

The D-Bolt is today used as an important rock reinforcement safety device at leading mines throughout the global mining community.

Product Range

D-Bolt
D-Bolt accessories



Roadway & Cast Concrete

Normet, having extensive trackless equipment knowledge, is now able to offer advice and admixtures to optimize underground travelways and concrete shaft linings. This hostile environment for rubber tyred vehicles offers significant challenges for the design and application of concrete travelling surfaces.

Normet has the know-how, technology and expertise to provide the placement of high quality, durable and safe pavements underground.

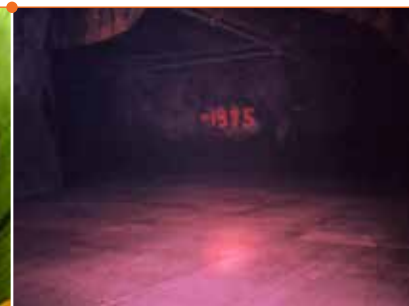
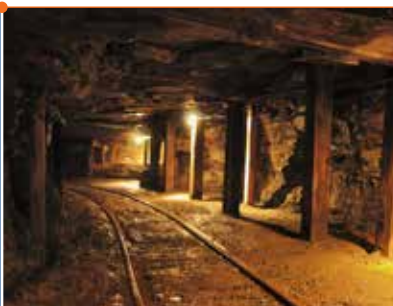
Our TamCem HCA allows open ended time while transporting the material underground and when combined with the TamCem 60 range of superplasticisers provides early high strength concrete.

For shafts, our extensive range of chloride-free admixtures allows manufacture of self-compacting concrete which needs no vibration and gives extremely fast setting times, low porosity and outstanding durability allowing early stripping of formwork so that sinking is not delayed.

Product Range

TamCem HCA

TamCem 60



Water Control

The control of water utilizing chemical resins and microfine cements has long been associated with the mining industry. Technology advances have seen materials being designed specifically with mining applications in mind, ranging from ultra-low viscosity acrylate based resins and colloidal silica to highly reactive, high foaming water cut off polyurethane systems to microfine and ultra fine cements.

Normet offers a complete solution package to the mining sector including a comprehensive range of advanced resins, packers, pumping equipment and unrivaled technical expertise. Manufacturing facilities worldwide also offers fast and efficient delivery of materials reducing overall time for project completion significantly improving on downtime costs.

The type of resin, microfine or ultrafine cement used in each application is dependent on many variables, all of which have to be considered prior to the works commencing. These may include the degree of water ingress or flow, ambient rock and water temperature, depth of injection through to access and available equipment. The correct choice of resin, microfine or ultrafine cement, installation and pumping equipment is paramount in achieving a successful result.

Resin and Microfine Cements

Normet have long been leaders in the development of resins and microfine cements for water control in mining applications. Our range of resins is extensive with materials for:

- Pre-injection, effectively controlling water flow through fissures prior to excavation
- Post-injection applications such as controlling loss of backfill grout through fractured Stopes to controlling water ingress through rock bolt drill holes.

Our range of polyurethanes includes single component hydro reactive systems through to dual component high foaming, high strength 1:1 ratio types that react and form without the need for available water in the injection zone. In addition to the foaming systems, Normet manufactures solid based resins formulated on polyurethane and silicate/polyurethane hybrid technology.

The acrylic and colloidal resins are all water based ultra-low viscosity materials designed for pre-injection into fine "tight" rock fissures or loose unconsolidated ground. They are also used extensively in post grouting applications to seal leaking grouted rock bolt holes and general rock fracture grouting.

Our microfine and ultrafine cements complete our portfolio of injection materials and have been designed specifically for pre-injection into fractured ground to seal rock fissures prior to excavation. Our fast set microfine material enables excavation in the shortest possible time significantly reducing downtime and costs.

Product Range

TamCrete 400CS
TamCrete MFC
TamPur 125



Pumps, Packers Equipment

Normet complement the range of injection resins by providing a selection of pumping systems each designed specifically for each material and application. These include:

- High output, high pressure twin and single piston pneumatically and gear operated pumps
- High output, low pressure twin and single piston pneumatically and gear operated pumps
- Stainless steel twin piston pneumatically operated pumps
- Single and dual piston manually operated pumps
- Single piston electrically operated pumps

Packer choice is also critical in designing an effective grouting solution. Our range of packers includes:

- Single and dual inflatable hydraulic packers
- Disposable mechanical packers
- Re-usable mechanical packers
- Combined bolt packers

Normet also supplies the full range of packer accessories including inner and outer tube assemblies, couplings and inflatable packer pumps.

We have a global team of experienced mining professionals offering full technical support, training and site services.

Product Range

Tam EP1
Tam HP1
Tam TP1
Tam TP2
Tam TP3 SS
Tam TP4 SS
Grout Packers
Inflatable Packers
Injection Packers



Mine Backfill

There are many challenges associated with mine backfill, not the least of which is the necessity to fill production voids underground in order to safely sustain mining operations. Broken down further, the challenges include manufacture (often with a waste material), transportation, placement, in-situ performance and durability.

Normet, with our construction chemical expertise, is positioned to assist mine backfill operations from a variety of different perspectives:

- Binder optimization
- Binder hydration
- Flow characteristics
- Durability

For all of the above factors, construction chemicals can be applicable to paste fill, rock fill and hydraulic fill, as well as a variety of grouts used around the mining world.

Binder Optimization

Many, if not most, rock or paste fills contain a binder, typically a hydraulic Portland cement or alternate cementitious material. Even in small quantities, this portion of binder can make up a majority of the material cost of the backfill and therefore ensuring its optimum effect is very important.

Construction chemical technology is designed to stimulate a backfill mix to get the most out of each particle of binder. Whether polymer or conventionally based, dispersants will ensure that the surface area of the binder in the backfill is maximized, such that hydration and strength development will proceed as effectively as possible, resulting in optimum strengths at earlier and ultimate ages.

Dispersants are introduced into the backfill mix either slightly before, at the same time or shortly after the binder is added and can permit a mine operation to reach targeted backfill strengths at a lower binder content. The additional cost of the dispersant is rewarded with a greater reduction in cost of binder per unit volume of fill. This is particularly true in remote areas, as the landed cost of binder increases, and magnifies over time with volume of backfill placed.

Binder Hydration

Different fill types (ie. Rock vs. Paste), and different mix designs of the same type, and different job site parameters will have varying requirements for set times. Perhaps more time may be required to allow for placement of a rock fill. Perhaps a more rapid rate of strength development is required for a hydraulic or paste fill to perform quickly in-situ, after placement. Perhaps an "insurance policy" is required for a paste fill that may be resident in a borehole or slick-line for a protracted period.



Construction chemicals are a very effective method for controlling the rate of hydration of binder in a Mine Backfill, either prolonging its open time, slowing down its set, or speeding it up.

Retarders may be used to slow down the set of a fill, typically in order to allow for greater time of placement, or to eliminate a possible effect of a cold joint, such as with a cemented rock fill. Retarders are conventional technology and affect one or two phases of binder hydration.

Hydration control agents will affect all four phases of binder hydration, effectively putting the fill mix “to sleep” for a period. This is particularly useful where a paste fill is transported via borehole or slick-line and may be resident in the system for durations which may otherwise risk setting of the fill in the system, which has a myriad of disastrous effects.

In the event that fill needs to rapidly develop strength once in place, conventional or alkali-free accelerators are added to the mix either during manufacture or at point of placement in order to gain strengths of set more rapidly, perhaps to either allow operations to begin using the fill as a base or possibly for mining alongside the filled void.

Flow Characteristics

No two paste fill or hydraulic fill placement systems are exactly alike. The same point can be made for Fill mixes, as these are typically manufactured from an ore processing waste material. Accordingly, it can be said that these types of fill have non-ideal flow characteristics which can vary significantly from one period to the next.

Construction chemical technology may be effectively used to modify fill flow characteristics and to compensate for the non-ideal characteristics of the fill materials. Hydration control agents (which have the added benefit of eliminating residue in the fill manufacturing and placement system) and rheology or viscosity modifiers have shown technical and economic benefit, in particular for paste fill.

Durability

Once in place, mine backfill needs to perform over a specified time period, depending upon the nature of the underground mining operation. The durability of the fill, and its ability to perform as specified over time, may be negatively affected in certain cases by aggressive environments.

Depending upon the nature of the durability challenge, construction chemical technology may offer a, or in some cases the only, technical solution to the challenge.

The Value Proposition

Certainly, the ability to formulate, manufacture and supply a quality, proven construction chemical is a basic capability of Normet and of immense value to our underground mining customer base. At the same time, a truly effective and efficient application of these technologies, designed to provide a mine backfill operation with solutions to tough challenges, also requires expertise and experience in application, and a commitment to understanding site conditions.

Normet has the resources, deployed globally, to bring solutions to bear. We are ready to listen and understand your challenge and to evaluate potential solutions cooperatively with you. We have the experience and facilities to follow up with joint testing programs and to put the potential solutions to the test prior to site application.

Normet Construction Chemicals does much more than provide solutions to mining projects

Normet Construction Chemicals has over 30 years of problem-solving experience in locations around the world.

Other Normet Construction Chemicals product groups

Normet also manufactures and distributes products for -



> Tunnelling

Sprayed concrete technologies including high performance water reducing admixtures, alkali-free accelerators and hydration control additives. Spray applied waterproofing systems, specialist injection resins and grouts for water leakage control. TBM tail skin grease, soil conditioning foams and backfill grouting solutions.



> Rehabilitation and Maintenance

Comprehensive range of leak sealing resins, cement and epoxy based structural repair mortars and grouts, bonding agents, additives, protective coatings and impregnation systems.



> Ground Engineering

Specialist resins and cement based injection grouts for permeation grouting, fissure grouting, underpinning, void filling and ground stabilisation.



> Readymix and Precast

Solutions to enhance concrete placing efficiency and optimizes overall concrete performance for all types and grades of pre-cast, pumped and sprayed concrete.



> Watertight Structures

Includes a range of coating and liquid applied systems along with in-depth, integral and impregnating materials.

Please ask for more information or visit

www.normet.com

Note to Specifiers

Normet's technical team is available to assist you with any questions on product suitability along with technical support on the installation or application of our mining materials and systems.

Please contact your local Normet office, distributor or applicator for further advice or information.

Global Presence / Local Support

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NORMET AMERICAS
UNION GROVE, WI (USA)

NORMET INTERNATIONAL
HÜNENBERG (SWITZERLAND)

NORMET
IISALMI (FINLAND)

NORMET CHILE
SANTIAGO (CHILE)

NORMET SINGAPORE
SINGAPORE

NORTH AMERICA

Canada
Mexico
USA

SOUTH AMERICA

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For more information, please contact your local Normet representative,
visit www.normet.com for contact details.

NORMET BROCHURES

GENERAL

FOR TOUGH JOBS

LTC - LIFE TIME CARE

EQUIPMENT

CONCRETE SPRAYING & TRANSPORT

CHARGING

LIFTING & INSTALLATIONS

SCALING

UNDERGROUND LOGISTICS

SEMMCO PRODUCT LINE

ESSVERK PRODUCT LINE

CONSTRUCTION CHEMICALS

CONSTRUCTION CHEMICALS

> MINING

TUNNELLING

REHABILITATION & MAINTENANCE

GROUND ENGINEERING

READYMIX & PRECAST

WATERTIGHT STRUCTURES

ROCK REINFORCEMENT

ROCK REINFORCEMENT

