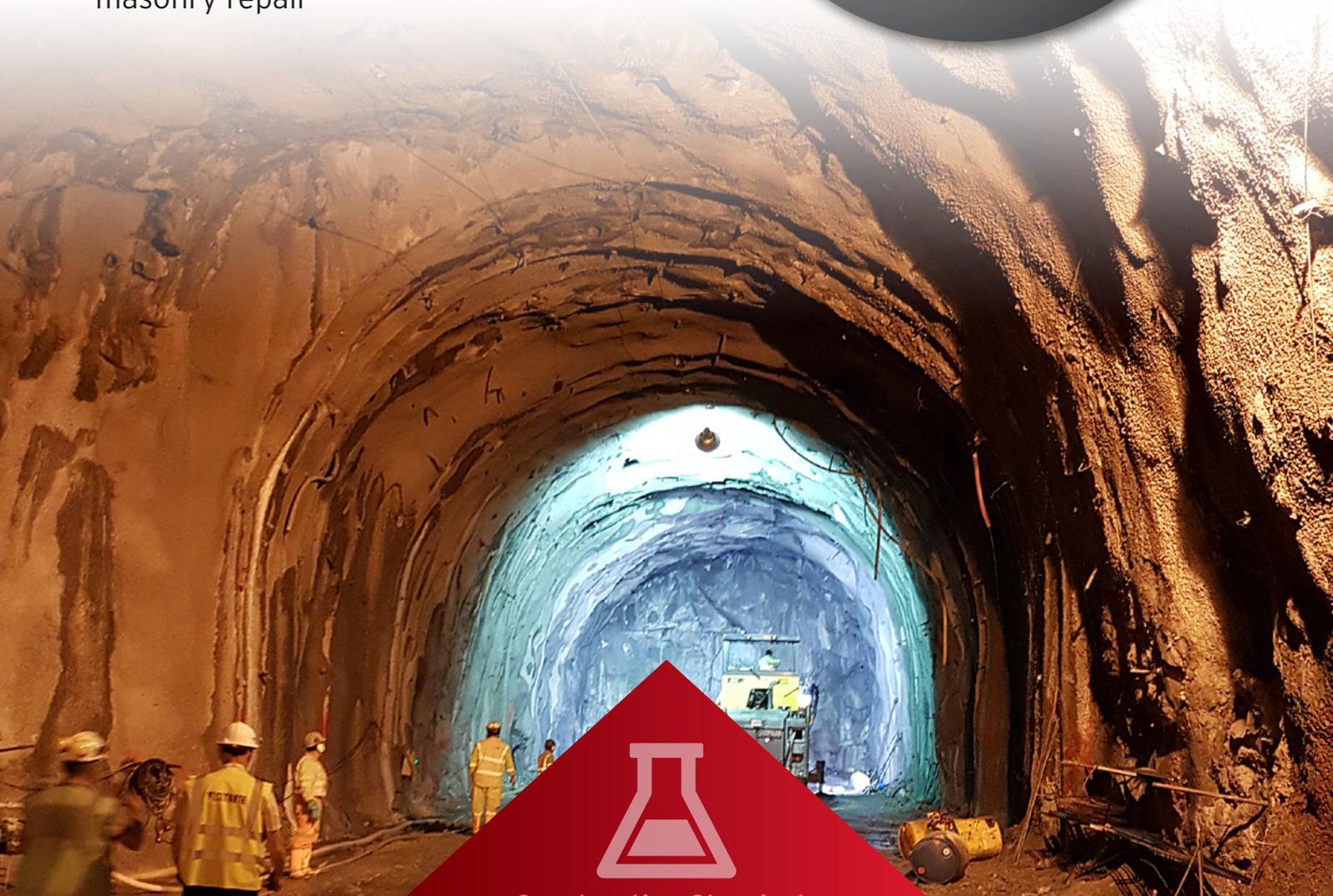


# NORMET MICROFINE CEMENT

A comprehensive range of microfine and ultrafine cements for rock, and soil injection and general concrete and masonry repair



# NORMET MICROFINE CEMENTS

Normet is at the core of modern technology with our comprehensive range of microfine and ultrafine cements, permitting contractors to undertake their works efficiently and effectively with products developed specifically for the chosen application. Our range of fast setting MFC grades for example used predominantly for pre-excavation grouting (PEG), offer time savings in the tunnel excavation cycle, ultimately contributing to lower overall project cost. Normet's ultrafine cements (UFC) have been designed for ground engineering applications where superior penetration into soils or greater reduction in rock hydraulic conductivity is required. Our low and high pressure packers, injection resins and accessories complement our cement offering enabling contractors to source all their product needs through one dedicated source!

## NORMET MICROFINE CEMENTS

The limitation of the maximum grain size  $d_{95}$  distinguishes microfine cements from standard cements. According to the European Standard EN 12715:2000 "Grouting" microfine cements can be characterised through a steep, uniform grain size distribution. The maximum grain size value  $d_{95}$  may not exceed 20 micron. The specification of the specific surface area (Blaine) is not significant for microfine cement as it gives no information about the maximum grain size, which is the key parameter from groutability.

### Uses

- > Rockmass grouting for tunnels, caverns, mines, etc., used for pre and post excavation injection. Ground water sealing and ground stabilisation.
- > Soil Injection: Ground stabilisation, ground water sealing.
- > Concrete crack injection
- > Consolidation of weak and fractured rock
- > Sealing of water channel

TamCrete microfine cements are finely ground Ordinary Portland based products for pre and post excavation grouting. The superfine particle size, together with the addition of TamCem Superplasticiser provides superior penetration into tight joints and fissures providing a water-tight grouted rock mass.

TamCrete microfine cements achieve initial and final setting faster than OPC offering increased productivity in a tunnel grouting operations. The initial set time for the Rapid and Fast grade is between 45 and 120 minutes, reducing the waiting time to a minimum for the next tunnelling activity to start.

TamCrete microfine cements are quality assured by the Cement Industry Quality Assurance Scheme, independently monitored by the British Standards Institute (BSI QAS 2420/47).

Rapid	MFC Rapid	MFC Fast	MFC Standard	SFC
Grain Size $d_{50}$	< 5 $\mu\text{m}$	< 5 $\mu\text{m}$	< 7,5 $\mu\text{m}$	< 10 $\mu\text{m}$
Grain Size $d_{95}$	< 16 $\mu\text{m}$	< 16 $\mu\text{m}$	< 20 $\mu\text{m}$	< 25 $\mu\text{m}$
Run out time after mixing	31 - 35 sec	31 - 35 sec	31 - 35 sec	31 - 35 sec
Initial Gel	30 - 45 min	70 - 110 min	120 - 180 min	150 - 250 min
Initial Set (50 kPa shear strength)	45 - 75 min	90 - 150 min	180 - 300 min	200 - 350 min
Bleeding Maximum	< 2%	< 2%	< 5%	< 5%
Mud Balance	1.45 - 1.50 kg/l	1.45 - 1.50 kg/l	1.45 - 1.50 kg/l	1.45 - 1.50 kg/l
Compressive Strength, 1 day	~5 MPa	~5 MPa	~4 MPa	~3 MPa
Compressive Strength, 2 days	~10 MPa	~10 MPa	~7 MPa	~5 MPa
Compressive Strength, 28 days	~15 MPa	~15 MPa	~15 MPa	~12 MPa

Particle Size (approx.)				
Grain Size $\mu\text{m}$	MFC Rapid	MFC Fast	MFC Standard	SFC
< 40	100 %	100 %	100 %	99
< 30	100 %	100 %	99 %	97
< 20	99 %	99 %	95 %	90
< 15	95 %	95 %	85 %	75
< 10	83 %	83 %	70 %	60
< 5	56 %	56 %	45 %	35
< 2	30 %	30 %	25 %	15

All technical data stated herein is based on tests carried out under laboratory conditions

# APPLICATIONS - ROCK INJECTION

Pre-excitation rock grouting (PEG) is considered one of the most important aspects in modern day underground tunnelling construction, especially in sensitive locations where the environmental impact has to be considered or when excavating beneath built up urban areas.

The reduction in rock mass permeability using pre-excitation grouting (PEG) has fundamentally changed over the years with new technology introduced to improve the whole grouting process along with the development of more efficient finer grade cement types (microfine), incorporating state of the art additives.



TamCrete MFC pre-excitation grouting using chained off packers

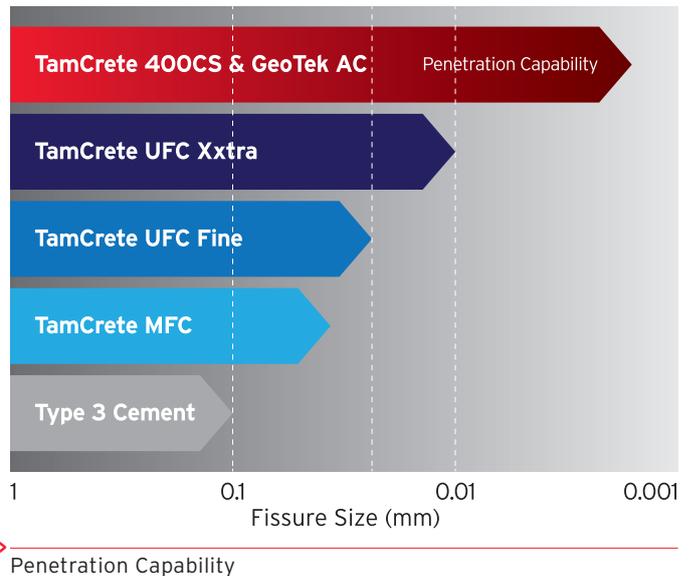
TamCrete Microfine cements are widely used in pre-excitation grouting and post excavation grouting applications both in drill and blast and TBM construction.

TamCrete MFC offers significant advantages and benefits over the use of standard OPC materials. The ability for TamCrete MFC to penetrate finer rock fractures is one obvious benefit, often decreasing rock mass permeability to the required level through the primary grouting operation. This can often negate the need for secondary microfine grouting or the injection of low viscosity chemical resins. TamCrete MFC also offers an improvement in rock mass stability through the filling of rock discontinuities with a stable, high strength grout.

TamCrete Rapid and Fast set microfines incorporate selective set regulating additives, which produces a grout slurry with shorter initial set times but still maintaining the desired open time (working time). This ability to control early set reduces the tunnel construction cycle time by allowing early drilling and blasting operations to commence, ultimately increasing the tunnel advance rate and reducing overall construction costs.

## Key Benefits

- > Standard cement injection equipment can be used
- > Superior penetration into rock fissures
- > Fast initial gel and setting
- > High stability
- > Higher strengths achievable than with chemical grouts
- > Greater penetration imparts greater water tightness
- > Better working environment and no hazardous components
- > Durable
- > Economical solution



# NORMET ULTRAFINE CEMENTS

TamCrete UFC range of ultrafine cements are OPC based (UFC fine) or incorporated selected granulated blast furnace slag and Portland Cement as an activator (UFC Ultra and Xxtra). Their superfine particle size, together with the addition of TamCem Superplasticisers offers superior penetration ideally suited for soil permeation grouting applications. Our range includes:

**UFC Fine:** 95% PSD smaller than 16  $\mu\text{m}$ , mainly used for grouting coarse sands and soils (0.63 - 2 mm).

**UFC Ultra:** 95% PSD smaller than 9.6  $\mu\text{m}$ , mainly used for grouting medium sands and soils (0.2 - 0.63 mm).

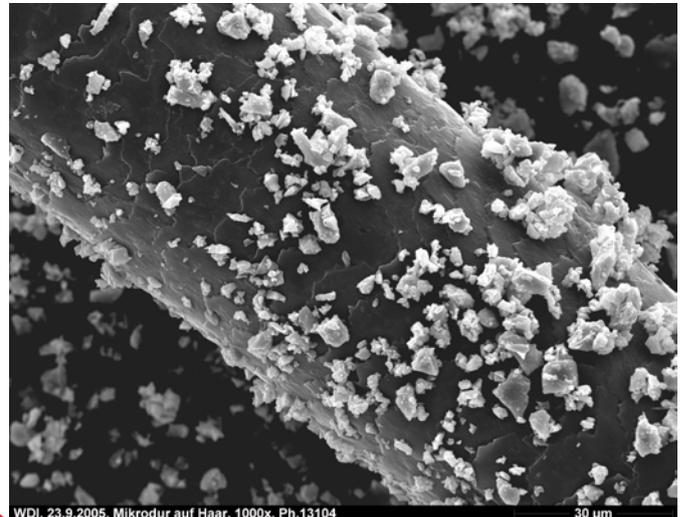
**UFC Xxtra:** 95% PSD smaller than 6  $\mu\text{m}$ , mainly used for grouting fine sands and soils (0.063 - 0.2 mm).

## Key Benefits

- > Standard cement injection equipment can be used
- > Superior penetration into soils
- > High resistance against chemical attack
- > High stability
- > Better working environment and no hazardous components
- > Durable
- > Economical solution and an alternative to injection gels and resins

## Typical Applications

- > Soil consolidation and stabilisation
- > Increasing soil bearing capacity
- > Rock fissure grouting
- > Forming water cut off barriers in soil
- > Concrete and masonry repair
- > Underpinning



TamCrete UFC on a human hair - SEM Shot

UFC	Fine	Ultra	Xxtra
Grain Density (kg/dm <sup>3</sup> )	2.95	2.95	2.95
PSD d <sub>50</sub>	< 5	< 3.5	< 2.5
PSD d <sub>95</sub>	< 16	< 9.5	< 6
PSD d <sub>99</sub>	< 20	< 15	< 10

UFC	Fine	Ultra	Xxtra
Slurry Density (kg/dm <sup>3</sup> )	1.48	1.48	1.48
Run Out Time (sec/DM <sub>3</sub> )	< 33	< 33	< 33
Bleeding, 2 hours (Vol-%)	2	2	2
CS, 3 days (MPa)	3	3	3
CS, 7 days (MPa)	13	13	10
CS, 28 days (MPa)	20	20	15

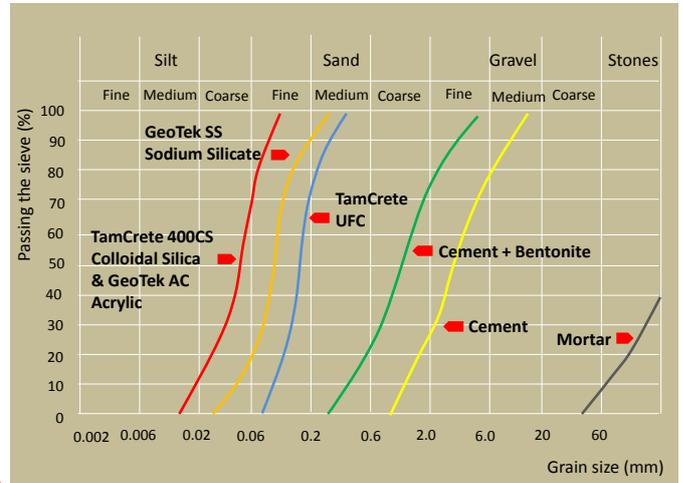
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# APPLICATIONS - SOIL CONSOLIDATION

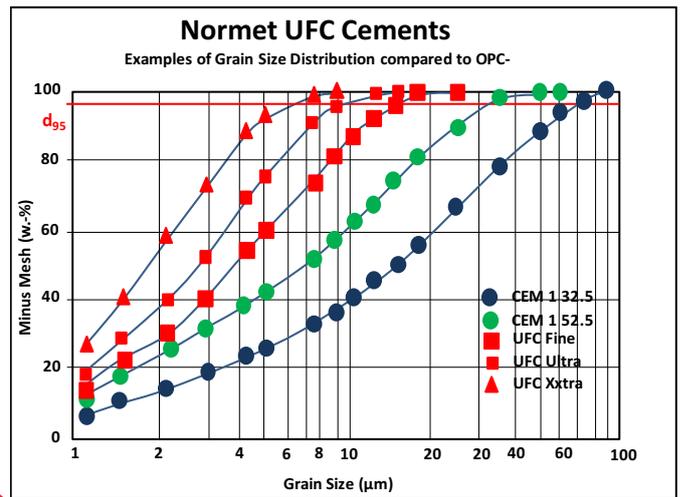
TamCrete ultrafine cements are typically used for stabilisation or consolidation of soils where standard cement types are not suitable due to their larger grain size. Normet Ultrafine cements have extended the range of soils that can be treated through permeation grouting with 80% of fine soils groutable with the UFC range of products.

The ability of our UFC cements to permeate medium to fine soils up to a permeability of x2 (Xxtra) provides an economical alternative to conventional injection gels such as colloidal silica, acrylic and sodium silicate. The addition of TamCem superplasticiser in to the grout mix enhances the grout-ability of the UFC system along with reducing bleed and increasing early and long term strength.

Normet UFC cements are specifically used for ground engineering applications where increased bearing capacity is required or where consolidation of the soil is needed to allow effective excavation of the adjacent soil mass. Normet UFC cements can be used for underpinning, curtain grouting, general grouting works along with rock fissure grouting where a finer cement particle size may be required over TamCrete MFC cements.



Soil penetration examples



Examples of grain size distribution compared to OPC



Foundation grouting with TamCrete UFC



Consolidated soil using TamCrete UFC

# AUXILIARY PRODUCTS

Apart from offering unrivalled site and technical support, Normet supply a full range of auxiliary products for all grouting operations.

Our ranges of cement additives (TamCem) have been specifically manufactured to enhance the groutability of our microfine products along with reducing bleed and shrinkage. Normet also produces hydration control materials allowing greater flexibility on grout gel time and initial set, especially in warmer ambient conditions along with accelerators used where excessive grout take may be an issue.

Complementing our cement additives, Normet manufacture a comprehensive selection of chemical injection resins for pre and post grouting operations. Each resin has been specifically developed for particular applications and range from ultra-low viscosity acrylics and colloidal silica through to our fast reacting, high expansive two and single component polyurethanes.

Our colloidal silica (TamCrete 400CS) and acrylic resins (TamAcryl) are used extensively for pre-injection or secondary grouting operations where a greater reduction in the hydraulic conductivity of the rock mass is required.

Normets range of polyurethanes such as our TamPur 125 and TamPur 100 are ideally suited for pre or post injection grouting where conventional microfine cements are not appropriate for use. The range of polyurethane resins Normet manufactures offers complete flexibility to the end user.

Our GeoTek resins offer additional scope for use in ground engineering applications such as increasing bearing capacity, consolidation of soils or forming water cut off barriers. Our hybrid silicate modified polyurethanes are extensively used in void filling applications or binding rock mass in high convergence zones or loose rock formation.



Pre-injection grouting with TamCrete MFC



TamCrete 400CS secondary grouting

# GROUT INJECTION PACKERS

Complementing our chemical materials for tunnelling, Normet supplies an extensive range of grout injection packers and accessories designed with performance and safety in mind. All of our packers and packer accessories are thoroughly tested and certified for use in high pressure applications.

Our packer range includes mechanical disposable and reusable types ranging from 32mm - 125mm in diameter and capable of being used for drill hole diameters between 29mm - 128mm. Our GX-UP single use inflatable packer constructed of aluminium and rubber is specifically designed for TBM grouting operations. These types of packers self-expand at set pressures between 30 and 60 bar.



C - open packer



C - packer



GX - packer



CU/GU - reusable packers



High pressure

Low pressure

Complete range of low and high pressure reusable and disposable packers



Reusable inflatable packers

## Low Pressure Packers

Diameter	Length	Hole diameter (mm)	GU/CU	C	CO	GX	GX AL
32	140	29-33				X	
34	140	33-36				X	
36	140	35-38	X	X	X	X	
38	140	37-40	X	X	X	X	X
41	140	40-43	X	X	X	X	X
45	140	44-47	X	X	X	X	X
48	140	47-50	X	X	X	X	X
51	140	50-53	X	X	X	X	X
54	140	53-55	X	X	X	X	X
57	140	56-59	X	X	X	X	X
60	140	59-62	X	X	X	X	X
63	140	62-65	X	X	X	X	X
67	140	66-69	X	X	X	X	X
70	140	69-73	X	X	X	X	X
75	140	74-78	X	X	X	X	X
80	140	79-83	X	X	X	X	
90	140	89-93	X	X	X	X	
102	140	101-105	X	X	X	X	
110	140	109-112	X	X	X	X	
115	140	114-117	X	X	X	X	
120	140	119-123	X	X	X	X	
125	140	124-128	X	X	X	X	

## High Pressure Packers

Diameter	Length	Hole diameter (mm)	GX HD	CS	CS Open
48	140	47-50	X	X	X
51	140	50-53	X	X	X
54	140	53-55	X	X	X
57	140	56-59	X	X	X
60	140	59-62	X	X	X
63	140	62-65	X	X	X
67	140	66-69	X	X	X
70	140	69-73	X	X	X
75	140	74-78	X	X	X

For information on our full range of packers, extension tubes and accessories, please contact your nearest Normet office.

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