

Ultra-superfine, cementitious injection grout for stabilising and strengthening soil / sand substrates

Uses

Alofix-MC is an inorganic grouting material composed of ultra-superfine particles, and as a grout has excellent permeability, strength and durability.

It is suitable for sealing and/or stabilising sandy soil foundations, and especially for grouting soils for permanent structures such as foundations, tunnels, dams, oil tanks etc.

- Preventing settlement of roads and embankments to be constructed on weak ground
- Preventing heaving and boiling embankments inside cofferdams
- Stabilisation of soil in zones susceptible to landslides
- Remedying and preventing differential settlement of oil tanks
- Fixation and water sealing in fractured zone during tunnel construction
- Curtain grouting for dams and embankments
- Ensuring leak-tightness of retention dykes around oil tanks
- Stabilisation and sealing of work faces in shield tunnelling and pipe insertion work
- Water sealing of joints on water and sewerage mains
- Water sealing of tunnel walls
- Water sealing of dam bases
- Water sealing of reservoir bases
- Underground oil storage facilities
- Preventing seepage or river embankments
- Preventing seepage of embankments on polder dykes
- Preventing seepage of soil in reclaimed land
- Preventing liquefaction of sandy soil

Advantages

- No soil polluting properties - consists entirely of inorganic materials ensuring no pollution of underground water or soil
- Remarkable penetrating abilities - the average particle size of Alofix-MC is 4 microns with a grain size distribution finer than 12 microns. The specific Surface Blaine fineness of 8150 cm² / g, enables penetration comparable to chemical grouts
- High hardened strength - the ultra fine grains of the Alofix-MC are chemically activated, so that curing provides rapid hardening to a high strength. This initial hardening is followed by further hardening during an extended period

- Excellent durability - after hardening by hydration, Alofix-MC acquires impermeability, which protects it from underground and sea water, to ensure extremely long durability
- Easy handling - with its strong dispersive quality, Alofix-MC is highly resistant to separation and sedimentation, which provides protection against damage for the injection equipment, and prevents obstruction of pipework
- Fast set time - the set time of Alofix-MC is generally between 4 - 8 hours

Description

Alofix-MC, ultra-superfine cementitious soil stabilisation grout is supplied as a ready to use dry powder. MC helper improves the ease of use, viscosity, permeation and strength of the grout. With the addition of MC Helper, a dispersing agent, and clean water, Alofix-MC is a highly permeable grout, suitable for low pressure injection into sandy soil to produce solid foundations.

Technical Support

Parchem offers a technical support service to specifiers, end-users and contractors, as well as on-site technical assistance.

Properties

Alofix-MC

Appearance:	Greyish white ultra fine particles
Specific gravity:	3.0 ± 0.1
Unit weight:	0.9 ± 0.1 kg / litre
Blaine fineness:	Approx 8000 cm ² / g

Chemical composition of Alofix-MC

lg. loss	SiO ₂	Al ₂ O ₃	Fe ₂ O ₃	CaO	MgO	SO ₃	Total
0.3	29.0	13.2	1.2	49.2	5.6	1.2	99.7

Gradation of Alofix-MC particle sizes

% of sieve Grain size (microns) Specific Surface Blaine

% of sieve	Grain size (microns)	Specific Surface Blaine
D98%	12.0	8150 cm ² / g
D50%	4.2	8150 cm ² / g
D25%	3.2	8150 cm ² / g

MC Helper

Appearance:	dark-brown liquid
Specific gravity:	1.24 ± 0.01, PH 9 + 1
Viscosity:	approx 50 (cps at 20°C)

Alofix MC

Application Methods

Preliminary checks:

The following checks should be carried out before the application of Alofix-MC in order to decide which method is the most appropriate:

- Investigation of existing city water, power, gas and underground watercourses.
- Investigation of ground water level and direction of flow. Finding whether the location planned to be injected with Alofix-MC is above or below water level.
- Investigation of soil and its density, and of the borders between layers.
- Test of water permeability of the soil.

Soil Investigation

To determine the suitability of soil to be grouted (it's groutability) with Alofix-MC, the soil is to be in accordance with guidelines of The Corps of Engineers Water Ways Experiment Station:

$$D_{15} / G_{85} \geq 15$$

$$D_{10} / G_{95} \geq 8$$

Where D_{15} and D_{10} are the particle size of the 15% and 10% accumulative distributions of the soil, respectively and G_{85} and G_{95} are the particle size of 85% and 95% accumulative distributions of the grout material, respectively. In the case of Alofix-MC, G_{85} and G_{95} are approximately 6 μm and 8 μm respectively.

If soil is in a wet condition prior to Alofix-MC injection, compressive strength may be slightly reduced.

The required injection pressure depends upon the load pressure at the position to be injected, characteristics of the soil and grouting material, injection rate (speed), expected period of duration of the injection, etc. In general, Alofix-MC is applied at the rate of 2 to 30 kgf / cm^2 .

It is also recommended that the injection is carried out at low pressure as much as possible. The required flow rate should be determined on-site after some trial injection, as low-pressure operation with the depressed flow rate results in increased material being required. In sandy soil, the injection rate could be in the order of 10 - 12 litres per minute.

Soil Injection

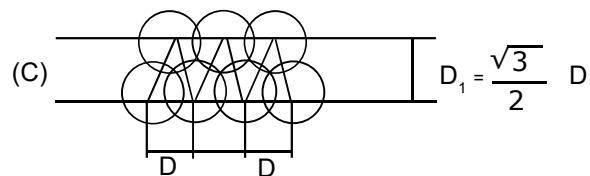
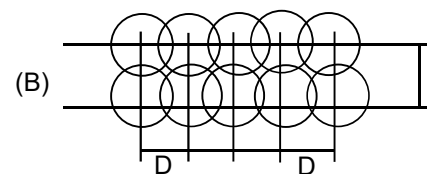
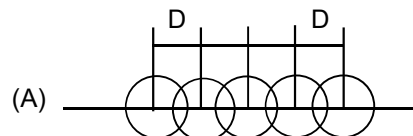
Steps for injection of the Alofix-MC consist of:

- Driving (drilling) the injection nozzle down to the planned depth.
- Commencement of injection with the mixed material.
- Controlled withdrawal of the nozzle, at set distances, at pre-determined time intervals.
- Repetition of the preceding process with injection points spaced to overlap injected soil / Alofix-MC columns.

Injection spacing

Vertical spacing of the injection points varies according to the nature of the soil and of the type of injection, but ranges from 0.5 to 1.0 metres approximately.

Horizontal spacing of the injection points is different for water stopping applications and soil strengthening applications, as shown below.



(1) Water Stopping

- D 0.6m ~ 0.8m
- D 0.8m ~ 1.0m
- D 1.0m ~ 1.2m

(2) Soil Strengthening

- D 0.8m ~ 1.0m
- D 1.0m ~ 1.2m

Equipment

Alofix-MC requires a high energy mixer with a low agitation mixing vessel and low pressure injection pump.

Dual mixing vessels enable continuity of mixed product feed.

Mixing

- The selected water content should be accurately measured into the mixing vessel.
- Second, add the MC Helper (accurately measured at 0.2 litres MC Helper per 20 kg bag of Alofix-MC) to the water.
- Pour Alofix-MC into mixing vessel and mix for a minimum of 5 minutes. Mixed grout should be kept continuously moving.

Alofix MC

Table 1 - Standard mix proportions of Alofix-MC / MC Helper / water

Water / ALOFIX-MC %	300	500	800
ALOFIX-MC (kg)	60	38	24
MC Helper (Lt)	0.4	0.3	0.2
Water (Lt)	180	187	192

Supply

Alofix-MC is supplied in 20 kg bags
Material Code: FC509090-20KG

MC Helper* is made to order and supplied in 20 litre drums
Material Code: FC509095-20L

*(MC Helper is added at 0.5 - 1.5 parts by weight per 100 parts of Alofix-MC).

Yield

Allowances should be made for wastage when estimating quantities required. The approximate yield for different consistencies is:

Alofix-MC per mixed 20 kg bag

Permanent structures:	100 litres
Temporary installations / semi-permanent structures:	130 litres
Temporary installations:	160 litres

Storage

Alofix-MC has a shelf life of 6 months if kept in a dry store in sealed bags. Store the product on pallets (or similar) in a dry warehouse. Do not place directly on floor.

If stored in high temperature and high humidity locations, the shelf life may be reduced. Do not use Alofix-MC from a broken bag.

Reference Tables

Table 1: Permeation comparison of various grouts

Grouts	Gravel	Sand			Silt	Clay
		Course	Medium	Fine		
A	Alofix MC	→				
	Cement	→				
	Bentonite		→			
	Sodium silicate-cement			→		
B	Lignin group			→		
	Urea resin group				→	
	Acrylamid group				→	
Grain size	→					
Coefficient of Water Permeability (cm/sec)	2	0.6	0.2	0.06	0.002	
	10 ⁰	10 ⁻¹	10 ⁻²	10 ⁻³	10 ⁻⁴	10 ⁻⁵

Table 2: Compressive and bending strengths of hardened mortar of Alofix-MC and other cements

Age (days)	Compressive Strength (MPa)				Bending Strength (MPa)			
	3	7	28	50	3	7	28	50
Alofix MC	24	38	50	60	4	6	7	8
Colloid Cement	12	20	42	50	2	4	6	7
High early strength Portland cement	23	32	44	47	5	5	7	8
Ordinary Portland cement	12	21	38	45	3	4	5	7

Alofix MC

Table 3:
Sand / cement - gel
compressive
strength of various
grouts

Grout		Compressive strength of cement / sand-gel MPa (7 day curing)												
		0.2	0.3	0.5	1	1.5	2	3	4	5	10	15		
Particulate grout	Alofix MC grout													
	Sodium silicate cement													
Chemical grout	Sodium silicate group													
	Lignin group													

**Table 4: Physical
properties of Toyoura
standard sand**

D_{max} : maximum grain size
 D_{60} : percent grain size
 D_{10} : effective grain size
 U_c : uniformity coefficient

Item	Grain size				D_{max} (mm)	D_{60} (mm)	D_{10} (mm)	$U_c = D_{60}/D_{10}$
	Grain coarser by weight (%)							
	297 microns	210 microns	149 microns	105 microns				
Toyourea standard sand	0.2	46.4	96.5	99.4	0.42	0.21	0.17	1.24

Important notice

A Safety Data Sheet (SDS) and Technical Data Sheet (TDS) are available from the Parchem website or upon request from the nearest Parchem sales office. Read the SDS and TDS carefully prior to use as application or performance data may change from time to time. In emergency, contact any Poisons Information Centre (phone 13 11 26 within Australia) or a doctor for advice.

Product disclaimer

This Technical Data Sheet (TDS) summarises our best knowledge of the product, including how to use and apply the product based on the information available at the time. You should read this TDS carefully and consider the information in the context of how the product will be used, including in conjunction with any other product and the type of surfaces to, and the manner in which, the product will be applied. Our responsibility for products sold is subject to our standard terms and conditions of sale. Parchem does not accept any liability either directly or indirectly for any losses suffered in connection with the use or application of the product whether or not in accordance with any advice, specification, recommendation or information given by it.