

Admixture for grout for prestressing tendons**Description of Product**

RHEOMAC[®] GF320 is a chloride free admixture in powder form. It is added at the rate of 5 to 6% by weight of cement to product (dependent upon type of cement being used). This will produce a flowable, pumpable, non-shrink, non-segregating, low permeability grout, providing high strength and high bond to steel. The most important property RHEOMAC[®] GF320 imparts to grout is the ability to protect cables against corrosion from aggressive agents and stress.

Fields of Application

- Grouting of post - tensioned cable ducts.

The inadequate protection against corrosion offered by normal grouts is due to:

- High macro-porosity caused by bleed water collecting under strands and in the upper part of the sheath (Fig. 1). When bleed water evaporates and is reabsorbed by the cement paste, voids form thus providing easy access for corrosive substances. European recommendations on prestressed concrete (FIP) prescribe that the volume of bleed water must not exceed 0.5%. With use of RHEOMAC[®] GF320, the volume of bleed water is considerably lower: it ranges from 0 to a maximum of 0.2% depending upon the type of cement used.
- Extremely low w/c are achievable (0.03-0.35) affording low permeability.
- Shrinkage of cement paste and consequent cracking. RHEOMAC[®] GF320 allows not only shrinkage to be eliminated completely, but also slight expansion to occur during setting and hardening.
- RHEOMAC[®] GF320 is a chloride free product, which is especially important in the case of cables.

Features and Benefits

The main properties of grouts containing 5 to 6% of RHEOMAC[®] GF320, shown in Tables 1 and 2, can be summed up as follows:

- Exceeds the performance specification for cable duct grouting.

- Very high flowability (as measured by the Flow Cone Test) without bleed water or with a very flowable mix. Under vacuum, of 600mm Hg, over 90% of the water is retained by the flowable grout. Inadequate water retention would allow water to separate from solid components when the grout is forced through strands of tendons.
- High mix water retention. This is very important property imparts high cohesion to the very flowable mix. Under vacuum, of 60mm Hg, over 90% of the water is retained by the flowable grout. Inadequate water retention would allow water to separate from solid components when the grout is forced through strands of tendons.



Fig. 1

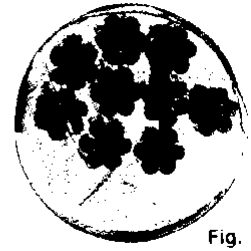


Fig. 2

Fig. 1

Section of sheath of post-tensioned cables filled with a cement paste showing bleeding water.

Fig. 2

Section of sheath of post-tensioned cables filled with a cement paste containing RHEOMAC[®] GF320. No bleed water is observed.

- Absence of shrinkage, and expansion ranging from 200-800 $\mu\text{m}/\text{m}$ depending upon the type of cement used.
- Initial setting time in excess of 3 hours at +30°C.
- High early and ultimate strengths: depending on the type of Portland cement used, strengths can range from 20-40 N/mm^2 at 1 day and from 50-70 N/mm^2 at 28 days. Slightly lower values are obtained if pozzolanic or slag cements are used.

Owing to its high flowability, a grout made with cement and RHEOMAC[®] GF320 (5 to 6%) assures the complete filling of sheath, especially among the strands of cables. This ensures maximum protection of steel against corrosion caused by aggressive agents. As this high flowability is obtained with a low water/cement ratio, the hardened cement past is dense, compact, impermeable and, therefore, highly durable. The high cohesion and fluidity of the fresh mix and no shrinkage, prevents the formation of voids which are often responsible for the penetration of aggressive agents.

Application Procedure

Mixing

Introduce approx. 25 litres of water per 100 Kg of cement into the mixer.

Start the mixer and add RHEOMAC[®] GF320 (5 to 6% by the weight of cement) followed by the cement. Mix 3 minutes until a plastic and homogeneous mixture is obtained. Add approx. 5-7 litres of water and mix for a further 2 minutes until the grout is flowable, without lumps and the flow cone empties in approx. 20 sec. If a high-speed mixer is used (about 1500 r.p.m.) the total mixing time can be reduced from 5 to 3 minutes. The amount of mixing water necessary by weight of cement and RHEOMAC[®] GF320 is approx. 34% but

can range from a minimum of 30% to a maximum of 38% depending upon the cement used. Finely ground cement usually requires a higher amount of water. The grout obtained can generally be pumped for at least 2 hours, unless the cement used shows a rapid or false set.

Coverage

Approximately 68 litres of highly flowable grout is obtained by mixing 100 Kg of cement, 5 to 6 Kg of RHEOMAC[®] GF320 and 34 litres of water.

Cleaning

Tools should be washed with water immediately after use

Packaging

RHEOMAC[®] GF320 is supplied in 15 Kg bags.

Storage

Store powder as for cement in cool, dry conditions.

Shelf Life

Minimum 12 months when stored as recommended in unopened containers.

Technical Data/Typical Properties

Table 1 - Examples of properties of cement pastes containing 6% of RHEOMAC[®] GF320.

Type of cement	Water % by weight of cement and RHEOMAC [®] GF320	Flow-Cone Test (1)			Bleed Water (2) (% by volume)	Water Retention (3) (%)	Expansion at 2 Days (4) (m/mm)	Setting Times at 30°C (hrs:mins)		Specific Gravity (g/cm ³)			
		(sec)						0'	30'		1 ^h		
		0'	30'	1 ^h									
525 PTL	34.4	23	33	38	0.13	95.6	450	4:15	4:45	2.030			
425 PTL (A)	33.6	23	25.5	34	0.03	97.2	700	4:35	5:05	2.020			
425 PTL (B)	29.6	25	27	30	0.00	95.4	500	3:25	3:45	2.045			
425 PTL (C)	30.4	25	31	33	0.10	96.0	500	4:15	4:55	2.050			
325 PTL (A)	28.8	22	23	24	0.10	97.4	750	4:00	4:33	2.080			
325 PTL (B)	29.6	23	25	28	0.12	94.0	600	3:47	4:15	2.075			
325 Pozz.	32.4	24	25	26	0.15	93.7	600	5:00	5:40	2.010			
325 Slag	32.0	22	27	30	0.15	92.0	500	5:05	5:55	2.070			

- (1) Flow-Cone Test (conforming to CRD-C-79) after varying times of continuous mixing.
- (2) Test conforming to ASTM C232.
- (3) Test conforming to ASTM C91; the value was taken after 5 mins.
- (4) Test conforming to ASTM C878. Not length changes were observed at later times.

Table 2 - Examples of strength and bond to steel of cement pastes containing 6% of RHEOMAC GF320.

Type of Cement	Strength (N/mm ²)						Bond to Steel (1) N/mm ²	
	1 Day		7 Days		28 Days		7 Days	28 Days
	C	F	C	F	C	F		
525 PTL	31.7	4.1	51.7	4.9	60.7	5.1	17.6	18.1
425 PTL (A)	26.9	3.7	51.4	4.6	65.8	4.9	18.0	18.4
425 PTL (B)	22.6	3.9	52.3	6.4	61.9	6.9	19.6	20.5
425 PTL (C)	22.9	4.2	42.0	4.6	54.2	5.1	15.5	17.4
325 PTL (A)	21.8	4.1	36.5	4.9	52.0	5.4	16.7	18.4
325 PTL (B)	20.1	3.3	40.4	5.0	55.0	5.5	16.7	17.4
325 Pozz.	16.5	3.1	41.9	5.9	55.9	6.2	17.9	18.6
325 Slag	15.7	2.9	40.2	5.4	56.8	6.4	16.2	17.2

- (1) Pull-out test conforming to the standard prescribed by the RILEM-CEB-FIP Committee (1970).
 C = Compressive strength F = Flexural strength

Watchpoints

The temperature of walls and spaces where the grout is to be pumped should be between +5 and +40°C for optimum results. If the temperature is outside this range, consult MBT Feb Technical Services Department.

Chlorides can be introduced into a mix if brackish water or special types of cement are used. Therefore, the use of drinkable water (generally containing less than 40 mg/l of chloride) and chloride-free cements (Cl lower than 0.06% by weight of cement) is recommended.

Though all Portland, pozzolanic or slag cements may be employed, the use of Portland cement Type I and preferably, Type II, is recommended in cold weather.

Spillage

Chemical products can cause damage; clean spillage immediately.

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RHEOMAC[®] GF320 BASF IBC Admixture Systems Limited, Version 6**Health and Safety**

*For full information on Health and Safety matters regarding this product the relevant Health and Safety Data Sheet should be consulted.

The following general comments apply to all products.

As with all chemical products, care should be taken during use and storage to avoid contact with eyes, mouth, skin and foodstuffs, (which may also be tainted with vapour until the product is fully cured and dried). Treat splashes to eyes and skin immediately. If accidentally ingested, seek medical attention. Keep away from children and animals. Reseal containers after use.

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Disclaimer:

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