

CMC-INJECTION BASED UPON "NONE FLUIDLOSS" PRINCIPLES

SHORT SUMMARY ON HEADLINES OF TECHNIQUE AND MATERIALS

General

The fluidloss technique combines the use of fluidloss additives, ultra rapid setting cement and high speed and pressure pumping.

Goals

Low cost due to reduced down-time compared to normal standard injection principles.

Technique of injection

Start with relatively high viscosity grout, corresponding to w/c-ratio at 1.0-1.5.

Injection of 1-4 holes at the same time.

Apply high pumping pressure from the start, which require high pumping capacity

Injection to be stopped at an in advance decided and agreed :

- Total quantity of grout per holes
- Or
- When reaching an upper pumping pressure

Benefits

- Injection of fine and coarser cracks at the same time
- Reduced time consumption for each round of injection
- No(or very little) down-time waiting for cement to set
- Immediately start of drilling/driving tunnel operations
- Reduced/cutting amount of rounds of injection
- Cutting total costs

Basic principles of standard injection

Long holes for injection will contain a combination of fine, narrow and coarser type of cracks
Standard injection start with a low viscosity grout, w/c-ratio 2-3. Only the coarser cracks will be grouted because of a "filter cake" that will be produced as a bridge over the finer cracks.

As the pumping pressure increases, the finer cracks are lost, that means impossible to inject. This kind of filter cakes can even block the drilled holes completely, only metres from the packers.

The need for extra rounds of injection will thus be required as the control holes show no effect of the last injection.

To solve this problem, the packers must alternatively be placed stepwise, beginning metres from the bottom of the borehole, only. Consequently stepwise waterloss measurements will be required as these results normally are used for evaluating the exact starting mix (w/c-ratio).

Basic principles of new technique

Fluid-loss additives are here the most important ingredience followed by ultra rapid setting cement.
The result is a grout without water separation.

Filter-loss testing

- Ca 0.5 l of the grout are pressurised at 50 bar in a testcylinder, containing a 45 micrometer filter in the bottom
- Expelled quantity of water is measured after 2, 5 and 30 minutes
- Thickness of filtercake produced inside the cylinder are measured, in mm, and consistency described, soft, hard etc.
- Fluidity of grout above filtercake to be described
- Viscosity at 600, 300, 200 and 100 rpm are measured in seconds

By standard cement grout without additives, even micro-cements, can show total loss of water, and thus producing heavy filtercakes with no grout of any kind above.

Introducing/adding special fluid-loss additives, the loss of water can be regulated down to only a minimum, controlled by producing a filter cake over the finer cracks. As a consequence the pressurising of the grout does not influence on the flowability/viscosity of the grout elsewhere in the milder and coarser cracks.

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This explains the new technique.

Finer cracks are sealed off by a thin filtercake and with no influence on the performance of the narrower/coarser cracks that normally are more effectively injected by a corresponding thick cement grout at high pressure.

Use of ultra rapid setting cement, cuts down time waiting for cement to set, likewise it also naturally shows up low and reduced time for any water separation. Consequently the cracks will be completely filled.

Sealing off finer cracks implies that these cracks will remain completely isolated in the rock, without influence on the proceeding water loss measurements.