

# Quality monitoring well

This manual contains two main sections:

1. Description of the products concerned.
2. Mounting the well parts

This manual successively treats the properties of the various parts of the Quality well. At last a chapter is spent on how to mount the parts. Please read the manual carefully and completely before starting to use this product. Eijkelkamp Agrisearch Equipment does not accept any liability upon incorrect application of (one of) these products.

## 1. Description of the products concerned.

The quality well is composed out of three main parts:

1. The Quality filter
2. The blind pipe fitted with the bentonite collar
3. The sand catcher with spacer

Together these products compose the Quality well. The Quality well can be applied in casing and boreholes from 75 to 100 mm maximum. The larger the diameter the longer it takes for the bentonite to swell and consequently, to plug the borehole.

The quality well was developed for three reasons:

- Many traditional wells poorly give water even when installed in permeable soil. By improving the filter section of the well, more water can be collected from a well per time-unit. This highly shortens purging times every time a well is sampled. It also improves the quality of the obtained water samples (less aeration) and the lifetime of the well.
- Bentonite pellets often block in boreholes and casing above the level where an impermeable layer has to be restored. This causes leakages between layers and nasty time consuming cleaning procedures of casings or even making a new borehole.
- Logistics get simpler when using the Quality well. No loose sand has to be used anymore. No hassle carrying heavy bags to the drilling area or time consuming mounting of filter parts. No centralizers are needed since the bentonite collars and pre-packed filter sections centralize automatically.



### 1.1 The quality filter

The quality filter is an HDPE perforated pipe section with filter sand packed around it and held together by an extremely tight filter gauze. A gauze directly around a perforated pipe uses only 6% of the filter capacity of the gauze and blocks at least half the slots of the screen.

This pre-packed filter enables the gauze to use its filtering capacity for 100%, optimizes the filtering capacity of the filter sand and keeps the pipe slots open. This improves the hydraulic characteristics greatly and lengthens lifetime of the well.

- The quality well can be used in boreholes and casings 70 mm inner diameter and larger.

#### Quality filter



## All it takes for environmental research

P.O. Box 4, 6987 ZG Giesbeek,  
The Netherlands

T +31 313 88 02 00  
F +31 313 88 02 99

E info@eijkelkamp.com  
I www.eijkelkamp.com



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## 1.2 The blind pipe with fixed bentonite collar

An extrusion process is used to 'mount' a fibre reinforced highly active bentonite around a 1 m long blind pipe section. The bentonite is partly dried. Biggest advantage is that the bentonite can be located exactly and without any risk or doubt at the desired depth. No "bridging" is possible hindering the correct downward movement of pellets. Cleaning casings that have been pulled out still containing all the bentonite you poured down is history. There is no need for an expensive grouting machine with, again, extensive cleaning after each use. However, in certain cases the swelling time of the bentonite collar can be a disadvantage.

Therefore this revolutionary product has to be used with care. So carefully read the following chapters to prevent any risks or disappointments.



- The bentonite collar was developed to plug impermeable layers starting from boreholes or casings between 75 and 100 mm outside diameter. Swelling will take some 24-190 hrs. Swelling time mainly is influenced by the diameter of the annular space to be plugged. After filling the space to be plugged it will take weeks before the water sorbed into the bentonite is evenly distributed throughout the bentonite. This is of course caused by the internal low water permeability of the bentonite itself! After the initial 'rapid' swelling there is still a 'spare' swelling capacity. The mentioned maximum of 100 mm is the diameter of the bored or cased hole. A hollow stem auger with an internal 'casing' of e.g. 80 mm will allow inserting this collar. However the hole to be plugged upon retrieval of the auger will be much larger than 100 mm. This means that the collars **cannot** be used with a hollow stem auger! One may assume that when applying a lost point technique the diameter of the created hole is not the gross diameter of the point itself (e.g. 110mm) but the gross diameter of the casing (e.g. 100 mm or even less). This because of the plasticity / elasticity of the soil when pulling up the casing.

Inner diameter of test tube	Plugging time
Ca 70 mm	4-24 uur ( 1 day)
Ca 80 mm	37-49 uur (1.5 – 2 days)
Ca 90 mm	61-129 uur ( 2.5 – 5 days)
Ca 100 mm	123-189 uur ( 5 – 8 days)

Tested in ordinary drinking water at 15 °C.



- Pure hydrocarbons will not be sorbed by bentonite. So it will not expand. Apply a lost casing of PVC or steel then and leave it to protect the soil layers for vertical transport of 'water'. Injecting a water-bentonite grout may be an alternative there because the water needed to have the bentonite expand is injected together with the bentonite. However be aware of the fact that chlorinated hydrocarbons will crack the bentonite gel after a certain period of time.
- Brackish water or brine will influence the swelling characteristics and cohesion of bentonite. Above a salt content of 0,5% (9 mS/cm = 9 mmho/cm) reduced swelling has been noted. At a salt content of 1% or higher the collar should not be used to plug holes > 90 mm.
- Swelling bentonite will stay sticky in drinking water. In salt water cohesion forces are limited and particles of bentonite can become mobile. Because of this, extra measurements have to be taken when using bentonite collars in salty water. This is even more important when a pressure difference between the two separate water conducting layers may play a role. In seawater (40 mS/cm) the swelling capacity of bentonite is reduced to 55%.

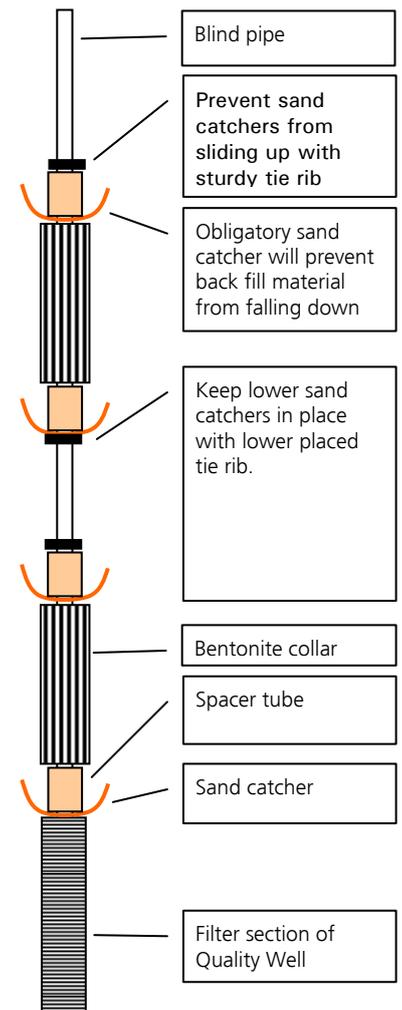
### 1.3 Sand catcher

The sand catcher is a disc of white bendable polypropylene. It will prevent wet liquid sand or backfill material (soil or loose bentonite pellets) from passing along the bentonite collars or even entering the area of the pre-packed filter as long as the bentonite itself is not swollen. The sand catcher folds in when it slides into the casing or borehole. When the casing is pulled up it will partly unfold. Its main task is to prevent liquid sand from flowing down into the zone where the bentonite should plug an impermeable layer.

Secondary tasks are to keep the monitoring well centralized in the casing or borehole and to prevent vertical flow between aquifers as long as the bentonite has not plugged impermeable layers yet.

On top of a sand catcher a spacer is needed to prevent the sand catcher from getting stuck between bentonite collar and casing wall. The sand catchers can be kept in place by tie ribs.

Sand catchers should be situated below and above every bentonite collar.



## 2. Mounting the quality well parts

### 2.1 The sand catcher

The sand catcher is slipped on the top section of the pre-packed filter. Then slip on a spacer. The screw a pipe with bentonite collar on the filter and lower the string in a casing or borehole.

On top of the bentonite collar slip a sand catcher again. And fix it with a tie rib on top of it. No spacer is needed here except if you mount again a blind pipe with bentonite collar. Screw on blind pipes as many as you need. Each time you cross an impermeable layer you mount a sand catcher, spacer, bentonite collar pipe, and a sand catcher (fixed with tie rib) to finish. Just below the surface finish with a sand catcher to allow backfilling of the borehole.

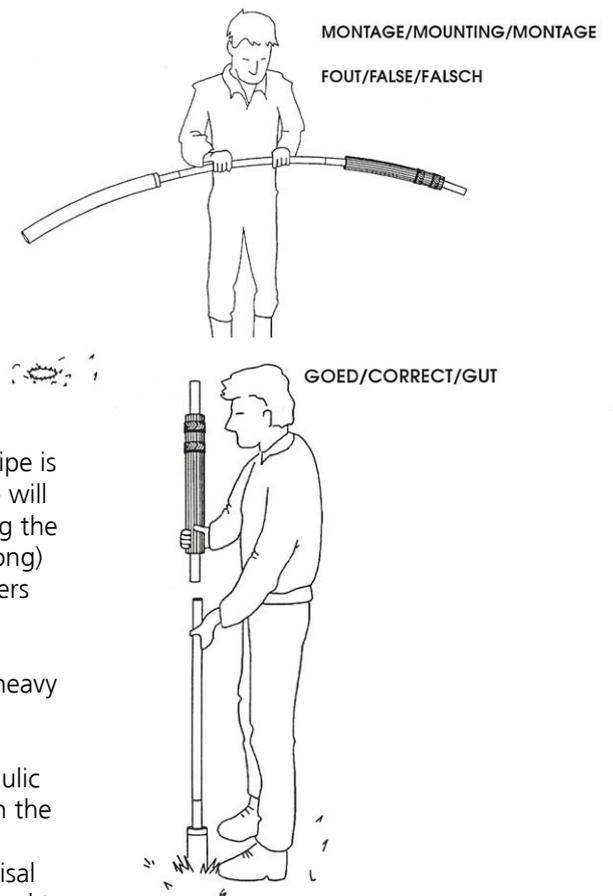
### 2.2 The pipes

The 'spine' of the pre-pack filter and the bentonite collars are the HDPE pipes. HDPE pipes are if the screw connections are water tight with pressure from outside as well as from the inside. They are produced in such a way that an overpressure of twenty to thirty meters water column can be withstood without leakage of the connections. Whether this result is also obtained in the field depends on the conditions of mounting the pipes correctly in the field: Mainly the following rules should be respected:

- Tightening by hand firmly is sufficient. Do not use tools. Tighten until both pipe ends touch slightly; not more.
- Once mounted the pipes should not bend. The wall of the pipe is thin at the connections and overstretching or even breakage will occur with resulting leakage. Mount the pipes while lowering the sections in the casing or borehole. To get grip and handle (long) sections of pipes hanging in the borehole special grip-tweezers (art nr. 10.01.90.90) can be obtained.

Especially when lowering long lengths of pipes even fitted with heavy bentonite collars the weight will become high. To prevent overstretching pipe connections respect two points:

- Lower the pipe-string smoothly specially when using a hydraulic drill-head for lowering. Do not give blows with a hammer on the string. Some pushing is acceptable.
- To prevent any overstretching you may attach a disposable sisal fibre cord to the top of the pre-pack filter section. Use the cord to lower the string each time you have twisted an additional blind pipe section on top of the string. The cord can simply be left behind in the well. It will neither interfere with the operation nor with the samplings.
- Soil + water pressures may apply mechanical sideways pressure on the pipes so also on the connections. This will even count more for pipes that are not centralized in a borehole. Since the collared sections of the Quality well centralize automatically this is less a problem than with traditional pipes where sand and bentonite are applied later.



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