

OPERATING INSTRUCTIONS

10.06 MULTI CHANNEL WELL (MCW)



Contents

On these operating instructions	2
1. Installation of a Multi Channel Well	2
1.1 Introduction.....	2
1.2 This manual.....	2
1.3 Ordering checklist Multi Channel Well 7 and 3 ports types.....	3
1.3.1 Tools.....	3
1.4 Consumables.....	4
2. Mounting a Multi Channel Well (MCW)	8
2.1.1 Example	8
2.1.2 Soil profile	8
2.2 Preparing the MCW tube.....	8
2.2.1 Marking the levels	8
2.2.2 The bottom filter	9
2.2.3 Marking	9
2.2.4 Making the holes.....	10
2.2.5 Slotting the ports.....	11
2.2.6 Mounting the pie plugs.....	11
2.2.7 Stringing the prefab filters and sand-bentonite catchers	12
2.2.8 Fixing prefab filters and sand-bentonite catchers	12
2.2.9 Finishing assembling the MCW.....	13
2.2.10 Lowering in casing or borehole.....	13

P.O. Box 4, 6987 ZG Giesbeek, NL
T +31 313 880200
F +31 313 880299
E eijkkelkamp@eijkkelkamp.com

www.eijkkelkamp.com



On these operating instructions



When the symbol shown on the left is placed before a piece of text, this means that an important instruction follows.



When the symbol shown on the left is placed before a piece of text, this means that an important warning follows pointing out a risk of injury to the user or damage to the device. The user is always responsible for it own personal protection.

Text

Text in italics means that the actual text is shown on the display screen.

1. Installation of a Multi Channel Well

1.1 Introduction

We supply two types of Multi Channel Wells. A seven level type and a narrower three level type. The picture on the right shows what is visible above the ground, once the system is installed and ready for use.

The system works with a smart multisection tube that is opened at different levels from the side; there where you want a water sample or a water level. Prefab filters are positioned around the opened sections. Prefab bentonite blocks are positioned in between at least just below and above the filters. It is by far the simplest, cheapest and most secure multilevel sampling system in use. It cannot be used in hollow stem augers. Maximum diameter: 100 mm swelling.



1.2 This manual

This manual starts with an ordering checklist. If you ordered already you may use it to check if you have all necessary parts. Later you can read how a 7 channel type Multi Channel Well (MCW7) is mounted. Mounting a 3 channel type (MCW3) is identical except there where mentioned in the text.

How to proceed? First quickly view all images. Then entirely read the text. Then read again while using effectively the consumables and tools. After a few times you will be able to assemble a fully equipped 7 channel tube in one hour with two persons. You may also consider preparing well strings back home in a clean area. With the filters at fixed regular depths.

- Bentoblocks 58 mm O.D. can fill a bored hole (so with the casing pulled out) of 100 mm maximum.
- Also look at the video film made from this procedure.










1.3 Ordering checklist Multi Channel Well 7 and 3 ports types

To understand the well you may look at the end of the mounting section of this document with a sketch showing all parts.

All available options for tool and consumables are mentioned in the tables below.

1.3.1 Tools

To assemble a well in the field you will need special tools. Some are the same for MCW 3-port and 7-port type and some differ from each other.

Art. No.	Short description	Additional description	Needed for MCW7	Needed for MCW3	
Clamping and measuring					
10060729	Clamp diam 41 mm, for fieldwork on the MCW7	Simple clamps attached at the end of the tube during preparation	2	-	
10060329	Clamp diam 28 mm, for fieldwork on the MCW3	Simple clamps attached at the end of the tube during preparation	-	2	
17200150	Measuring tape 50 m	Standard measuring tape to easily determine position of ports on the MCW tube	1	1	
Making the ports					
10060735	Port cutter for filter chambers in MCW7	Essential to punch three holes per port without damaging the rest of the tube	1	-	
10060335	Port cutter for filter chambers in MCW3	Essential to punch three holes per port without damaging the rest of the tube	-	1	
10060002	Handcutter for the filter slots type Wiss M3	Essential to "connect" two of the punched holes to form a slot for water entrance of sufficient length	1	1	
10060004	Electrical cutter Makita, 220 V	Rapid and easier alternative for hand-cutter.	option	option	
Plugging channels					
10060003	Torque wrench hex for filter-plugs MCW	Torque wrench that will prevent under- or overtightening of the plugs that plug channels	1	1	

Fixing prefab filters and sand-bentonite catchers					
10060005	Plier for fixing and cutting the tie ribs		1	1	
10060006	Plier for fixing heavy duty tie ribs		1	1	

1.4 Consumables




Let us assume that you want to install **three MCW3 wells** and **three MCW7 wells** all up till **30 meters** depth. You want to use **all available** ports, which means three filters on the MCW3 tube and seven on the MCW7 tube.






To get water only from the layers where you are going to install a prefab filter you need to plug the soil layers directly above and below the prefab filters with bentonite plugs. The prefab filter placed at the bottom of course only needs to be plugged directly above the filter. We assume a length of **50 cm per bentonite plug** which means that one prefab filter has a plug of 50 cm of BentoBlocks above and 50 cm below the prefab filters. We also assume that you want to use prefab filters with a **length of 50 cm**. We will call a well with such specifications a **standard well**.

Notes: A bentonite plug of 30 cm would be the absolute minimum in non-critical applications with no vertical cross flows in the borehole. Bentonite plugs of 100 cm would be the minimum in critical situations (brackish or salt water or expected vertical water pressures between aquifers).

When two filters are placed close together (< 100 cm) the space between the two filters is completely filled up with BentoBlocks.



MCW7





Art. No.	Short description	Additional information	Needed for one standard well	Needed for this project	Remaining parts	Image
10060701	Wellhead for MCW7, with markings for 7 canals, pack of 5pcs	Numbers the channels and keeps dirt out. All channels are vented from this wellhead.	1 pc	1 set	MCW7	
10060702	MCW7 tubing diam 41 mm, HDPE, coil of 30 m		1 pc of 30 m	option	2 pcs.	
10060703	MCW7 tubing diam 41mm, HDPE, coil of 60 m		1 pc of 30 m	option		
10060704	MCW7 tubing diam 41 mm, HDPE, coil of 90 m		1 pc of 30 m	1 roll	0 mtrs	
10060711	Prefab filters for round the slot in the MCW7, HDPE, 25 cm, pack of 20 pcs		option	option		

10060712	Prefab filters for round the slot in the MCW7, HDPE, 50 cm, pack of 20 pcs	3 wells with 7 ports have 21 filters of which 3 bottom filters and 18 normal filters	6 pcs	1 set	2 pcs	
10060715	Lower filter part HDPE, 25 cm, for MCW7, pack of 5 pcs		option	option		
10060716	Lower filter part, HDPE, 50 cm, for MCW7, pack of 5 pcs		1 pc	1 set	2 pcs	
10060719	Filterplugs for MCW7 canals, pack of 5 pcs	Per well you will need to plug 6 channels at the bottom and 5 channels at the lower end of every slot/port. This means 11x3 plugs.	11 pcs	7 sets	2 pcs	
10060720	BentoBlock diam. 40 x 60 mm, length 10 cm, box with 50 pcs	Per well you have 1 bottom filter with 50 cm of Bento-blocks and 6 filters with 2 times 50 cm of Blocks = 50 cm + 6x2x50 cm = 650 cm per well so 19.5 m for the MCW7 project	65 pcs or 6.5 m of Bento-Blocks	4 boxes	5 pcs	
10060725	Bentonite/sand catchers PE, diam 40 x 170 mm, pack of 50 pcs	Catchers are needed just above and just below every bentonite section. We do have 12+1=13 sections. So we need 13x2=26 catchers per well. We also need 1 catcher 1 m below soil surface to allow backfilling with bentonite pellets or soil. Total 27 catchers per well = 81 for the MCW7project.	27 catchers	2 sets	19 pcs	 Spacer and sand catcher
10060727	Spacer MCW7, to keep sand catchers away from Bento-Blocks, pack of 50 pcs	Spacers are needed to prevent a catcher from getting blocked between Bento-Blocks and casing during lowering. In practice every catcher gets a spacer on top. We need 81 catchers so we need 81 spacers.	27 pcs	2 sets	19 pcs	 Spacer (below BentoBlock)

10060001	Tie ribs, model 116 EC, pack of 10 pcs	Prefab filters should be very firmly strapped on the smooth tubing. We have the bottom filter needing one strap and the other filters needing two straps. So $6 \times 2 + 1 = 13$ straps per well	13 pcs	4	1 pc	
100113	Tie ribs, model 3H, pack of 100 pcs	These straps can be used to fix the position of the sand catchers with spacers. One strap per catcher will do	27 pcs	1	19 pcs	

MCW3

Art. No.	Short description	Additional information	Needed for one standard well	Needed for this project	Remaining parts	Image
10060301	Wellhead for MCW3, with markings for 3 channels, pack of 5 pcs	Numbers the channels and keeps dirt out. All channels are vented from this wellhead.	1 pc	1 set	2 pcs	
10060302	MCW3 tubing diam 28 mm, HDPE, coil of 30 m		1 pc of 30 m	1 coil	0 mtr	
10060303	MCW3 tubing diam 28 mm, HDPE, coil of 60 m			1 coil	0 mtr	
10060304	MCW7 tubing diam 28 mm, HDPE, coil of 150 m		option	option		
10060311	Prefab filters for round the slot in the MCW3, HDPE, 25 cm, pack of 20 pcs		option	option		
10060312	Prefab filters for round the slot in the MCW3, HDPE, 50 cm, pack of 20 pcs	3 wells with 3 ports have 9 filters of which 3 bottom filters and 6 normal filters	2 pcs	1 set	14 pcs	
10060315	Lower filter part HDPE, 25 cm, for MCW3, pack of 5 pcs		option	option		
10060316	Lower filter part, HDPE, 50 cm, for MCW3, pack of 5 pcs	3 wells with 3 ports have 9 filters of which 3 bottom filters and 6 normal filters	1 pc	1 set	2 pcs	

10060319	Filterplugs for MCW3 canals, pack of 5 pcs	Per well you will need to plug 2 channels at the bottom and 2 channels at the lower end of every slot/port except for the lowest filter. This means 11x3 plugs.	4 pcs	3 sets	3 pcs	
10060320	BentoBlock diam 27x60 mm, length 10 cm, box with 50 pcs	Per well you have 1 bottom filter with 50 cm of Bento-blocks and 2 filters with 2 times 50 cm of Blocks = 50 cm + 2x2x50 cm= 250 cm per well so 7.5 m for the project	25 pcs or 2.5 mtr of Bento-Blocks	2 boxes	25 pcs	
10060325	Bentonite/sand catchers PE, diam 28 x 170 mm, pack of 50 pcs	Catchers are needed just above and just below every bentonite section. We do have 4+1=5 sections. So we need 5x2=10 catchers per well. We also need 1 catcher 1 m below soil surface to allow backfilling with bentonite pellets or soil. Total 11 catchers per well = 33 for the project.	11 catchers	1 sets	17 pcs	 Spacer and sand catcher
10060327	Spacer MCW3, to keep sand catchers away from Bento-Blocks, pack of 50 pcs	Spacers are needed to prevent a catcher from getting blocked between Bento-Blocks and casing during lowering. In practice every catcher gets a spacer on top. We need 11 catchers per well so we need 33 spacers.	11 pcs	1 set	17 pcs	 Spacer (below BentoBlock)
10060001	Tie ribs, model 116 EC, pack of 10 pcs	Prefab filters should be very firmly strapped on the smooth tubing. We have the bottom filter needing one strap and the other filters needing two straps. So 2x2+1=5 straps per well	5 pcs	2	5 pcs	
100113	Tie ribs, model 3H, pack of 100 pcs	These straps can be used to fix the position of the sand catchers with spacers. One strap per catcher will do	11 pcs	1	67 pcs	

2. Mounting a Multi Channel Well (MCW)

2.1.1 Example

In this manual we will work with an example. We suppose that we need to install an MCW7 (or MCW3) at -10 m below soil level with at the bottom a filter; at -7 m a filter and at -4 m a filter. If you need mounting more filters (of course only possible on the MCW7) then this is done in an identical way. Groundwater level is set at -1 m.

2.1.2 Soil profile

Of course the levels of installing the filters at various levels is found based on the description of the soil profile.

2.2 Preparing the MCW tube

Cut a piece of MCW tube at least one meter longer than the installation depth. Take care that you do not contaminate the filter sections of the tube. Cover the soil surface with plastic sheets if there is any doubt about the environmental quality. If you have a stretching apparatus you pull the tube through this apparatus to straighten the tube. Adjust the central wheel to go with the diameter of tube you want to stretch (MCW7 or MCW3).

Slip the tube guide cutter (figure 1) over the tube and mount the tube clamps on both ends of the tube (figure 2). Tie straps around the clamps and stretch/hang the tube 1 m above the ground between vehicles or trees. This will facilitate the work.

2.2.1 Marking the levels

Do not make any errors while marking the channel numbers and levels. Therefore mount a measuring tape on the tube. Fixing the measuring tape is done in the following way: First look at the tube guide cutter. At the top it is marked 1-6 for all the channels (or 1-3 for the MCW3). This side will point to the top of the MCW tube !!



Fig. 1 Tube guide cutter



Fig. 2 Tube clamp



Fig. 3 Markings

2.2.2 The bottom filter

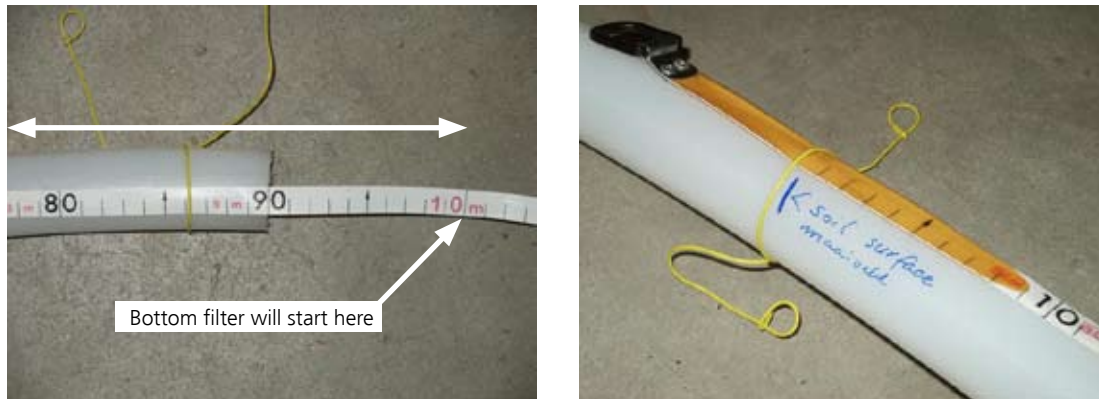


Fig. 4 Mounting measuring tape

The bottom filter will be 10 cm **lower** than the MCW tube itself. So fix the tape at the level 990 cm - soil surface (ss). See the images that show this procedure. Stretch the tape and also fix it at the soil surface level.

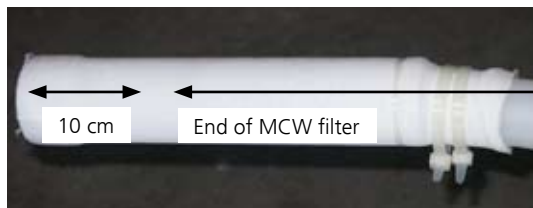


Fig. 5 Lower MCW filter

2.2.3 Marking

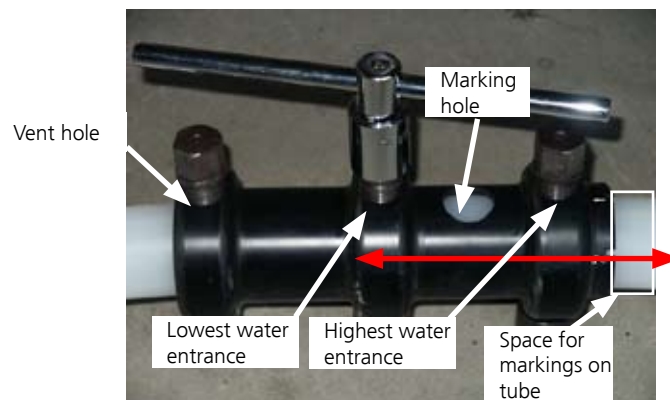


Fig. 6 Port guide cutter

Only start making holes if you are absolutely sure that all markings are OK.

Look at the picture of the port guide cutter and the surrounding text blocks. It is indicated what will be the lowest point in the tube where water can enter the MCW tube and what will be the highest point. The “lowest” hole will be made only to vent the channel below the point of water entrance.

Use a permanent marker. In our example holes have to be made at -7 m and -4 m. The horizontal double pointed arrow shows the trajectory where the prefab filter will be located later. Between the lowest and highest water entrance hole there is a hole for marking the level of the filter. We found it easier to make all markings in the rectangle drawn at the far right on the photo. That is 15 cm higher than the entrance level of the port (the middle cutting bolt of the port guide cutter). This can easily be read on the measuring tape.

Follow this sequence:

1. First number **all** channels (1-6) at **all** filter levels. This will avoid later errors. Channel 1 is the channel that has a CMT imprint on the sidewall of the tube.
2. Also indicate the level to where the port guide cutter has to be sled to cut the holes at the right spots (in our example -6.85 en -3.85m -mv)
3. Indicate, specially in bad weather conditions, the exact position of the walls of the channels.

Note: The picture shows the situation where holes will be made in channel one. That is why the numbers on the port guide cutter and the markings on the tube are the same. At all other levels this will be different.

2.2.4 Making the holes

When the port guide cutter is positioned correctly at the right level and the right channel, fix it gently with the two blunt bolts. Then twist the three cutter bolts one by one and remove them one by one to push out the plastic round piercings. The bolts are very sharp. Then slip the port guide cutter to the next position and repeat untill all levels have their three holes.



Fig. 7 Markings on tube



Fig. 8 Holes ready



Fig. 9 Clearing bolt

2.2.5 Slotting the ports

The two top holes need to be interconnected now until you obtain one large slot with the width of the channel. This can be done with hand metal shear pliers or with an electric metal sheet cutter. Leave the lower vent hole untouched !



Fig. 10 Slotting the port

2.2.6 Mounting the pie plugs

Pie plugs (trapezium shaped rubber extender bolts) need to be fixed at two heights: One at the bottom of each channel and one from the lower water entrance point directed towards the vent hole of each channel. Note: The channel from the MCW3 that will get water from the bottom filter does not need holes in the side wall of the tube.



Fig. 11 Putting pie plug in place

Do not fix the bottom plugs until **all parts** have been mounted so at the end of the entire assembling process. Use the special torque screwdriver to prevent overstretching the plugs + tube.



Fig. 12 Plugging MCW7

2.2.7 Stringing the prefab filters and sand-bentonite catchers

Now remove the measuring tape and also at the bottom side of the MCW the tube clamp. From that side you can then start slipping the various parts (spacers, sand-bentonite catchers and prefab filters) over the MCW tube.

To determine the height of the sections to be covered with bentonite blocks mind the following rule of thumb:

If the highest placed filter will be situated closer than 1 m from the (average lowest) groundwater level, place two sand-bentonite catchers above the filter. If the distance to the groundwater is larger (in our example 3 meters) then fit four sand-bentonite catchers above that filter. Two of them will localize the bentonite blocks just above the filter and two will localize the bentonite just below the groundwater table.

If the distance between two filters anywhere on the tube is larger than 1.50 m than slip four catchers with spacers between these filters. Two catchers will keep some 0.5 m of bentonite above the filter in place and the two other catchers will do the same but below the higher situated filter. If the distance is smaller (say 1.30 m), the full length of 1.30 m is filled with bentoblocks.

To plug an impermeable layer apply at least 1.0 m of BentoBlocks per bentonite seal. In very thick impermeable layers apply at least 1.5 m of bentoblocks at the top and 1.50 m of blocks at the lowest level of that impermeable layer of which 1.0 meter is situated in the layer and 0.5 m above or below the layer.

In critical cases (brackish or salt water, high pressure differences between different aquifers) apply 1.5 m of bentonite as well). Be aware of the fact that bentonite does not operate at all in pure product layers of hydrocarbons.

In our example you string the tube from below with the following number of catchers, spacers and filters:

Spacer + catcher (4x)

Filter 1

Spacer + catcher (4x)

Filter 2

Spacer + catcher

Bottom filter 3

After stringing you can again mount the tube clamp and stretch the tube at 0.8 - 1 m height once more for better working conditions.

2.2.8 Fixing prefab filters and sand-bentonite catchers

It is important that the prefab filters and spacers be firmly located at the right spot. Use heavy duty tie ribs and a special pair of pliers for this.

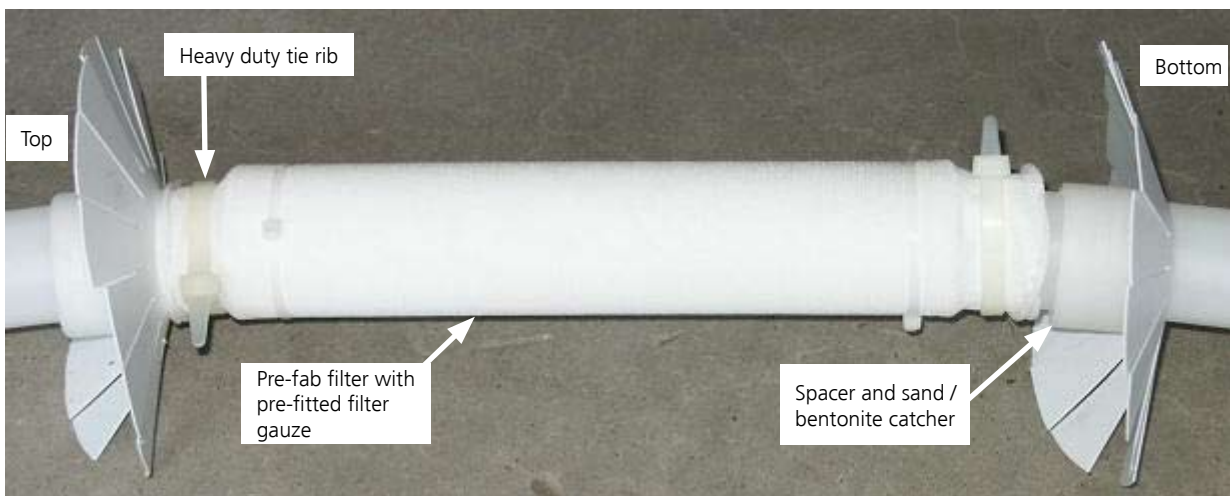


Fig. 13 Tie ribs to fix prefab filter

First fix all prefab filters at the correct spots (except the bottom filter). Position the lower end of the filter just above the vent hole (also see the horizontal arrow marking on the photo above the paragraph "Marking"). In figure 13 you can see that most spacers/catchers are located directly on top or below a prefab filter. You do not need to fix these spacers or catchers further.

If the distance between two filters is larger than 1.50 m you will probably have two catchers extra to fix. These are fixed with a tie rib above and a tie rib below the spacer/catcher combination. Tie ribs can also be fixed while lowering the MCW in casing or borehole.

You may leave the plastic bags wrapped around the filter to prevent contamination until the MCW is lowered in the borehole (see figure 14).



Fig. 14 Plastic bags around the filter



Fig. 15 Catcher localized with tie rib

2.2.9 Finishing assembling the MCW

Now use the torque screw driver to fix all pie plugs in the bottom (6 for the MCW7, 2 for the MCW3). Then mount the bottom prefab filter. Do not forget to keep the spacer tube (10 cm long) in the filter (see figure 16). The MCW is now ready to be lowered in casing or borehole.

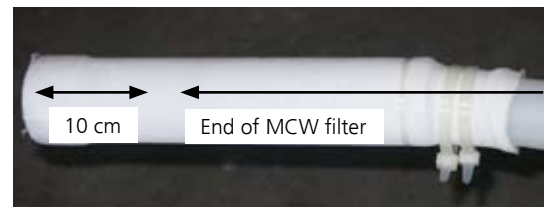


Fig. 16 Lower MCW filter

2.2.10 Lowering in casing or borehole

Now take a sufficient number of BentoBlocks and split them on one side. There are two ribs which are deeper; use one of these for easier cutting (see figure 17). Place these close to the borehole ready for use. Now remove the tube clamps from the MCW filter and move the MCW to the casing peeping out of the bored hole. Let someone slip the bottom filter in the casing together with the lowest catcher (it will fold). Then wrap the BentoBlocks one by one around the MCW tube on top of the spacer and squeeze them tightly. The blocks will break in a few parts but stay together due to fibers that are in the product. Each new block is placed 90° twisted (clock or anticlockwise) compared to the block below. You do not need to fix the blocks. The blocks 60 mm outside diameter will plug a borehole 100 mm in three days. 100 mm is maximum diameter for this diameter blocks. Other (larger) blocks are available for larger boreholes.



Fig. 17 BentoBlocks

Apply blocks until you reach the higher catcher (see figure 19). Each time lower the MCW and apply blocks. After having lowered the MCW tube completely fill the casing with water and pull out the casing. When the casing is pulled up the catchers will fold out; centralize to a certain extend the MCW and prevent bentonite (dry or wet) to move vertically. They will also prevent liquid sand from filling up gaps between impermeable layers to plug and not yet swollen bento-blocks (see the manual on the sand bentonite catchers).

Fill the space between the top catcher and soil level with backfill soil and bentonite pellets to prevent any rainstorm water from entering the freshly bored hole.

Now it is time to develop (pump) the up till seven levels - wells. This should be done within the first hour of wetting the BentoBlocks. If you do not manage this leave the well as it is and come back at least **three days** later for well development. Then the bentonite blocks are (practically) fully swollen and there is no more danger that loose or half swollen bentonite parts will start flowing along the MCW.

The volume to pump during well development or purging (done directly prior to sampling) is of course very limited since the blind section of the tube only contains a very limited quantity of water per meter of tube. So well development is ready within a few minutes per level. After a week (depending on local guidelines or standards) the well can be purged and sampled as any other small diameter well.

Water level can be measured up to a depth of -8 m with the electronic water level measuring device with 4.8 mm O.D. measuring probe and 8 m long cable (art. no. 11.03.18)

Sampling can be done with a peristaltic pump up till 8 m water level depth or with the smallest foot valve (inertia) pump 9 mm O.D. (art.no. 12.13.05) with PE tubing 6 x 8 mm. (art. no. 12.20.04) when water level is deeper.

The last page schematically shows setup and application of an MCW.



Fig. 18 Fitting BentoBlocks



Fig. 19 Bentonite fully swollen

Nothing in this publication may be reproduced and/or made public by means of print, photocopy, microfilm or any other means without previous written permission from Eijkelkamp Agrisearch Equipment.

Technical data can be amended without prior notification.

Eijkelkamp Agrisearch Equipment is not responsible for (personal damage due to (improper) use of the product.

Eijkelkamp Agrisearch Equipment is interested in your reactions and remarks about its products and operating instructions.

Multi tubing well installation system type Eijkelkamp to be accurately and efficiently placed with the SonicSampDrill system

1. Prefab filters and sand catchers have been pre-mounted. While lowering in (still dry) casing BentoBlocks are added.
 2. Directly after having pulled the casing: Sand catchers have folded out. They keep filter screens free from backfill or fluid sand material.
 3. Situation when bentonite has swollen.
- Perfect sampling of filter screens possible after 5 days.

