Narrow Diameter CMT Multilevel System

Assembly Manual

May 25, 2018

Solinst®

CMT® Multilevel
Continuous Multichannel Tubing

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3-Channel CMT Assembly

CMT Multilevel System Pre-installation Requirements

Please complete this form, for each CMT Multilevel System to be installed, to verify that proper consideration has been given to design and borehole specifications (CMT tubing 1.1" OD)

a) Minimum information required for effective design of the CMT Multilevel System

Accurate borehole depth _____ Borehole angle _____

Depth to which CMT System is to be installed _____

Borehole geology _____

Drilling method _____

Casing size (minimum ID) _____

Depth to base of well casing _____

Number of monitoring zones _____

Approximate depth to static water level _____

Expected maximum pressure heads at each port location _____

Site conditions (eg. dry field, bush, swamp, paved, etc.) _____

Any special surface requirements for completion of installation (eg. flush mounted, angled, etc) _____

Solinst can assist the client in the component selection for the CMT Multilevel System based on the above requested information, but final design and installation details remain the responsibility of the purchaser.

Note: If bentonite cartridges are selected for CMT Multilevel Systems, the boreholes must be circular, smooth and straight for trouble-free installation and proper seal. Irregularities in borehole straightness can prevent effective sealing of a CMT installation. Great care should be taken to ensure a suitable fit.

b) Ensure that these additional items are available on site during installation

- CMT Installation Tool kit (as shown at right)
- Measuring tape
- Hacksaw
- Marking pen or wax pencil
- Model 102 or 102M Water Level Meters
- Model 103 Tag line for checking backfill depths
- At least two client representatives to supervise and assist with installation.
- Adjustable wrench

NOTE

Always follow local health and safety guidelines. Work safely.

NOTE

Practice making one or two ports in a short section of CMT before starting out on the real thing.

NOTE

The torque driver for the 3 Channel CMT is 12.5 in-lbs. For 7 Channel CMT it is 10 in-lbs.

NOTE

Allow 2 ft or more of sand above and below each port.

NOTE

If you are installing sand or bentonite cartridges, please also read 'Cartridge Installation' section.

Introduction

The Solinst Model 403 CMT Multilevel System for monitoring wells represents a significant improvement in multilevel groundwater and soil gas monitoring. The CMT System provides the simplicity of a bundle type installation with the benefits of backfilling or sealing around a single tube.

This manual describes the above-ground assembly of CMT wells. This consists of creating intake ports in the various channels at the desired depths, installing water-tight plugs below each intake port, adding mesh screens, sealing the bottom of the tubing, and attaching low-profile borehole centralizers to the tubing, or installing Sand and Bentonite Cartridges.

Assembling CMT wells is straightforward and can be performed by either drilling contractors or environmental consultants, however Solinst offers training to ensure proper installation. The wells can be assembled on site while the borehole is being drilled or, off site and then transported to the job location. While the assembly of CMT wells is not difficult, it is important to follow all of the steps described in this manual. It is especially important when creating the monitoring ports to avoid cutting into one of the adjacent channels. Doing so creates a hydraulic connection between the two channels that cannot be repaired. Please read this manual carefully before assembling your first CMT well. In addition we suggest that you practice making one or two ports in a short section of CMT tubing before starting out on the real thing.

Installing CMT wells can generally be done in three ways:

1) The simplest way is to allow the formation sediments to cave around the CMT.
2) A traditional burial of the CMT by dropping layers of sand and bentonite in a depth-discrete sequence.
3) For the 1.1" (28 mm) 3 Channel CMT System, use specially designed Sand and Bentonite Cartridges.

Preparation

Before making any ports in the CMT tubing, make a sketch of the desired well design. Show the depths of the desired monitoring zones and centralizers (if used) in feet or meters below ground surface. Also, indicate the depths of the desired lifts of sand and bentonite, as shown graphically on Figure 1.

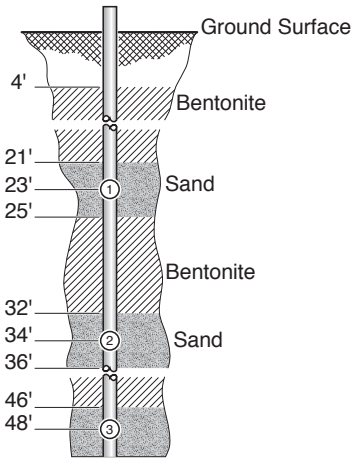
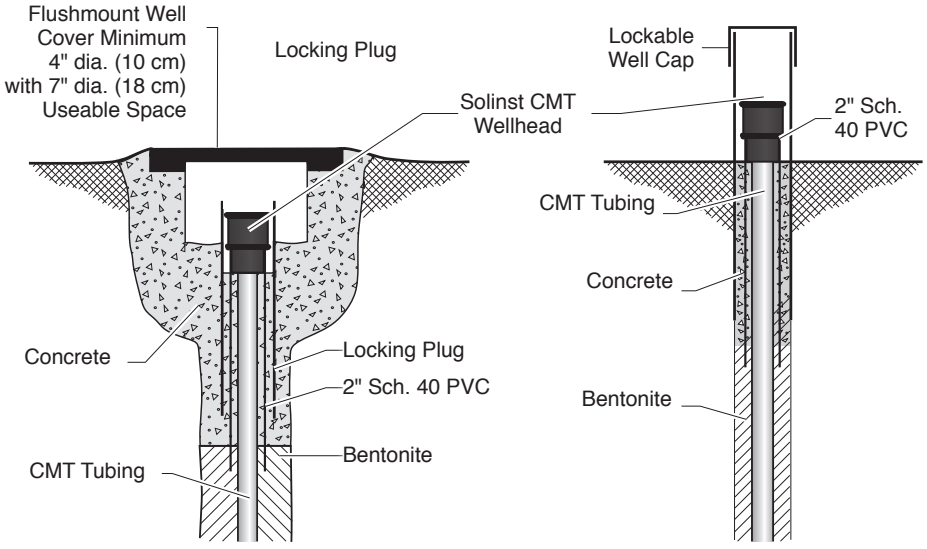


Figure 1

This will come in handy when you are measuring the depths of the backfill materials while you are building the well. If you are building a CMT well where alternating layers of sand and bentonite backfill are added from the surface, try to allow for two feet or more of sand above and below the monitoring ports to ensure that the bentonite does not cover the monitoring ports. Allow sufficient wellhead access when you install the protective cover over the well.

Use a large well cover (greater than 4" diameter is recommended) to allow plenty of room to access the wellhead. A diagram showing suggested dimensions of the wellhead and protective cover is shown in Figure 2 for flushmount and above ground completions.



Flushmount Completion **Above Ground Completion**

Figure 2

Assembling Standard CMT Multilevel Systems

Table 1 shows the design of a hypothetical CMT Multilevel System. Each channel in this well can be used for both collecting a groundwater sample (with either a peristaltic pump, inertial pump or micro double valve pump) and measuring the depth to water. Each channel therefore functions both as a sampling port and an observation port.

Monitored Zone	Channel Number	Depth to Center of Port (from ground surface)
1	1	23 ft (7.0 m)
2	2	34 ft (10.4 m)
3	3	48 ft (14.6 m)

Table 1

Hypothetical Design for a Standard CMT Well (Well ML-1)

NOTE

Newly uncoiled CMT tubing has a "memory" which can make it difficult to lay out straight. Sand bags help to hold down the ends of the tubing. The "memory" goes away relatively quickly, especially in warm weather. Placing the tubing on black plastic sheeting can warm the tubing, helping it straighten out more quickly.

NOTE

The Channel 1 identifier is a low profile repetitive marking "<< CMT >>".

NOTE

The channel identifier on the CMT tubing is intentionally subtle to avoid being a conduit for vertical leakage.

Marking and Cutting the Tubing

Step 1) Uncoil Tubing

Uncoil the CMT tubing on the ground or other flat surface. Stretch out a measuring tape at least as long as the depth of the well, next to the CMT tubing.

Step 2) Indicate Ground Surface on Tubing

Allowing for your desired wellhead stick up (2-3 feet above ground surface), place the end of the measuring tape below the length of tubing you want above ground. This is your measuring point which represents ground surface and all depths below this point are depths below ground surface.

Step 3) Locate Channel 1 Identifier

The next step is to make marks on the CMT tubing at the depths corresponding to the midpoint of the desired monitoring ports. Before you do this, you will note that there is a faint "<< CMT >>" identifier that runs along the entire length of the CMT tubing opposite one of the 3 channels. This identifier facilitates identification of the 3 channels anywhere along the length of the tubing. The channel that has the faint identifier is always Channel 1. By convention, Channel 1corresponds to the shallowest monitoring zone. The other two channels are numbered clockwise as you are looking down on the completed well from above.

Step 4) Mark Monitoring Port 1

Make a mark across Channel 1 on the exterior of the CMT tubing at the depth corresponding to the center of the uppermost monitored port (Figure 3 which is 23 feet below ground surface in our hypothetical example in Table 1). A permanent marker or a "Chinamarker" wax pencil works well for this. Write "Port 1" on the CMT tubing about 6 inches above the mark.

Figure 3

NOTE

The next series of instructions use hand tools and materials that are sharp. Use proper protective equipment. Work safely.

Step 5) Mark Port 1 for Port Cutting Guide

Next, draw a line along the Channel 1 "<< CMT >>" identifier extending approximately 6" above and 6" below the depth mark (Figure 4). You will use this line (and other similar lines drawn at the other port depths) to index the Port Cutting Guide. This ensures that you cut holes only in the intended channels corresponding to the desired monitoring zones.

Figure 4

Step 6) Mark all Ports and Cut Tubing at Deepest Port

The Port Cutting Guide has been indexed so that it always references the Channel 1 identifier when it is used to cut holes in the other two channels. Therefore make similar marks at the depths corresponding to the next two monitoring zones (i.e., 34 and 48 feet below ground surface). Make the marks identical to the ones you drew at Port 1. That is, draw the depth mark across Channel 1 in the center of the port and draw the longitudinal line along the Channel 1 "<< CMT >>" identifier. Label these depth marks as Port 2 and Port 3, respectively about 6 inches above each mark. Finally, make a mark at the depth of the bottom of the well (at 49 ft., 1 ft. below the deepest port in our example). Cut the CMT tubing at this mark using a hacksaw, sharp knife, or PVC cutter (Figure 5).

Figure 5

Step 7) Complete Design

The design of the well has now been transferred to the CMT tubing.

Cutting the Outer Ports and Vent Holes

Step 8) Install the Port Cutting Guide

Slide the Port Cutting Guide over the CMT tubing down to Port 1. Align the notch stamped "1" on the Port Cutting Guide with the line you drew along the Channel 1 identifier. Position the Port Cutting Guide so that the depth mark "+" (indicating the centre of the Port) is visible in the window in the center of the Port Cutting Guide (Figure 6). Secure the Port Cutting Guide to the CMT tubing by tightening the knurled Locking Bolts on the underside of the guide (Figure 7). Tighten the bolts, by hand only, to prevent the Port Cutting Guide from moving.

! NOTE

When using the Port Cutting Guide, ensure that the three cutting bolts are located below the number 1 on the front of the Guide. The two locking bolts are on the back of the Port Cutting Guide.

Figure 6

Figure 7

Step 9) Use Cutting Bolts to Cut Holes

Next, make three holes, as described below into Channel 1 using the cutting bolts screwed into the Port Cutting Guide. Do not rush when screwing the cutting bolts into the Port Cutting Guide. Ensure the bolts are properly lined up with the holes in the Port Cutting Guide so that cross threading does not occur.

! NOTE

Do not rush when screwing the cutting bolts into the Port Cutting Guide. Ensure the bolts are properly lined up with the holes in the Port Cutting Guide so that cross threading does not occur.

Start by threading a cutting bolt into one of the holes located on the same side as the window. Use the hex wrench to tighten the Cutting Bolt. Tighten the bolt a few revolutions, then loosen it one revolution. Continue doing this until the Cutting Bolt "bottoms out" (Figure 8). Remove the Cutting Bolt. There should be a plastic disk inside of the cutting bolt. If there isn't, re-insert the cutting bolt and repeat the cutting process (make sure that the knurled Locking Bolts are tight). Push out the piece of plastic from the inside of the Cutting Bolt by inserting an Allen wrench through the small hole drilled in the head of the Cutting Bolt (Figure 9). Repeat this process to cut all three holes. The two upper holes, on either side of the depth marked "+", will provide the port plug access and the lowest hole is the vent hole (Figure 10).

! NOTE

For easy effective cutting, advance the cutter bolt in alternating increments of ~1.5 turns clockwise, and then 0.5 turn counter-clockwise, repeatedly.

Figure 8

Figure 9

! NOTE

If installing numerous systems, spare cutting bolts can be ordered, as they may become dull after repeated use. It is recommended to order an extra bolt per 10 ports constructed.

Figure 10

NOTE

The two upper holes allow you to use snips to cut out a panel of plastic between them, creating a 3" long opening in Channel 1.

The bottom hole is a vent hole. This vent hole is needed to allow air to escape from the channel beneath the monitoring port when the CMT tubing is inserted into the water-filled borehole during well installation.

Step 10) Cut Panel Between Upper Two Port Holes

Loosen the cutting tool and move it "down" the CMT and out of the way. Next, use the snips as shown in Figure 11 to cut out the panel of plastic between the upper two port holes. **Do this carefully and keep the snips parallel to the channel side wall to avoid cutting into the walls separating Channel 1 from Channels 2 and 3**. Make the opening as large as possible to facilitate the insertion of the expansion plug as described in the next step.

Figure 11

NOTE

The vent hole does not allow cross connection with other monitoring zones because the bottom of the channel is sealed with a water-tight plug.

Step 11) Insert Expansion Plug

Insert an expansion plug through the opening (Figure 12) so that it seals Channel 1 below the monitoring port and above the vent hole. If necessary, use the torque driver to gently push the plug into place (Figure 13). Use the snips to trim the port opening if you have difficulty inserting the plug. **Tighten the plug to a torque of 12.5 inch-pounds** using the supplied torque driver.

Figure 12

Figure 13

NOTE

If you are installing Sand or Bentonite Cartridges, please see Cartridge Installation section before proceeding. Spring Cartridges must be placed on the tubing before Port Screens are installed.

NOTE

Wetting the Oetiker Clamp reduces friction, making installation easier.

Step 12) Install the Well Screen

The last step in making the Channel 1 port consists of wrapping the stainless steel mesh around the port, forming a well screen over the opening. Center the mesh over the port opening and wrap it tightly around the CMT tubing (Figure 14). Use the low profile Oetiker clamps and pliers to firmly secure the mesh to the tubing. Use three clamps for each monitoring port (Figure 16). Construction of Port 1 is now finished. You are now ready to make Port number 2.

Installing Oetiker Clamps

Wrap the Oetiker clamp around the part (eg. screen, centralizer, guide point) you are clamping. Allow the first (closest) retaining hook to pass through the long slot opening. Squeeze the clamp by hand until the retaining hook catches the end of this opening. Figure 15 shows this step. Fit the 'jaw tips' of the Oetiker pliers into each of the clamp's 'tunnels'. Squeezing/closing the Oetiker pliers simultaneously draws the two tunnels together. With the two tunnels drawn together, push down on the tail of the clamp, so that the furthest retaining hook passes through the last slot. Now release the pliers so that the retaining hook catches the clamp and holds.

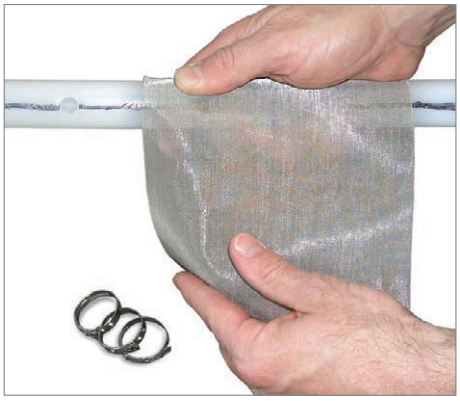


Figure 14

Figure 15

Figure 16

NOTE

To avoid installing ports in the wrong channels, start by positioning the Port Cutting Guide so that the depth mark is visible in the window, then rotate the guide so that the appropriate number (corresponding to the port number) is indexed against the line you drew earlier along the <<CMT>> Channel 1 identifier. This step is very important.

Step 13) Line-up Port Cutting Guide

Slide the Port Cutting Guide "down" to Port 2. Position the Port Cutting Guide exactly as you did for Port 1. The depth mark should be visible in the window of the Port Cutting Guide and the longitudinal Channel 1 identifier should be indexed to the number "1" stamped on the guide (Figure 17). Now, rotate the Port Cutting Guide (without moving its position along the CMT tubing) so that the "<< CMT >>" identifier is now indexed to the number "2" stamped on the guide (Figure 18).

This positions the Port Cutting Guide so that the cutting bolts will cut holes only into Channel 2. Secure the Port Cutting Guide using the knurled Locking Bolts as before. Cut the two port holes and one vent hole into Channel 2. Next, loosen the cutting tool and slide it "down" the tubing out of the way.

Figure 17

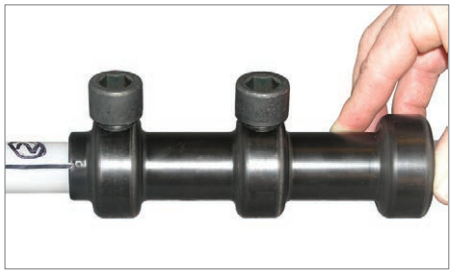


Figure 18

Step 14) Create Port 2 Opening

Snip away the panel of plastic between the upper two holes, creating an opening for Port 2.

Step 15) Finish Constructing Port 2

Insert an expansion plug though the opening, positioning it below the monitoring port, and tighten it to 12.5 inch-pounds as before. Finally, wrap a piece of stainless steel mesh around the opening and secure it with three stainless steel clamps. You have now finished constructing Port 2.

Step 16) Construct Port 3

Continue the steps described above for Ports 3.

NOTE

When constructing the bottom assembly, only insert the expandable plugs into the monitored channels, leaving the other channel(s) open so that they can fill with water as the CMT tubing is inserted into the borehole (e.g. If only 2 channels are monitored, only those channels should have plugs inserted at the base.) This reduces buoyancy during well installation.

NOTE

Wetting the Oetiker clamp reduces the friction, making installation easier.

Configuring the Bottom of the CMT Tubing

Step 17) Insert Expansion Plugs

Insert an expansion plug into each of the constructed channels in our example, all 3 channels. Tighten each to a torque of 12.5 inch-pounds using the torque driver

Step 18) Attach the Guide Point Port

Slide the Guide Point over the end of the CMT tubing and secure it to the tubing with one stainless steel clamp (Figure 19). The guide point is a solid piece without any port opening. The end of the Guide Point Assembly is tapered to prevent the bottom of the CMT tubing from getting snagged on a rock ledge or casing joints as it is being inserted into a borehole.

Figure 19

CMT Placement

Step 19) Lower the CMT System

Lower the assembled CMT System into the borehole slowly.

If buoyancy is a problem, wait, as the channels below water level will slowly fill and allow the system to be lowered further. To speed this process along, pour or pump clean water into the vent holes.

When the required depth is reached, suspend the system with the System Support Clamp (Figure 20) to prevent it from moving during well construction.

Figure 20

! NOTE

Once the backfilling operation is complete, the System Support Clamp is removed and can be reused for the next installation.

Step 20) Complete the Well Installation

Complete the installation by carefully pouring or using a tremie to place sand and bentonite at appropriate levels to seal the borehole annulus.

! NOTE

Solinst has developed special tubing centralizers that ensure that the tubing is centered in the borehole during well construction. The fins on the centralizers are low-profile to prevent them from obstructing the tremie tube, or sand and bentonite pellets poured from the surface.

Attaching the Standard Wellhead

(after the well has been installed)

Step 21) Attach the Wellhead

After the well has been built, cut the CMT tubing to the final elevation. You may choose to finish your CMT installation above ground surface. If so, you can leave the CMT stick-up as is and install the standard wellhead register or “house” the CMT inside a cut length of 2" dia. PVC riser pipe (not supplied).

If housing in a PVC pipe, first slide the PVC pipe over the CMT stick-up, and push below the final elevation of the CMT. Slide the wellhead base over the tubing and onto the PVC pipe. The wellhead base provides a tight friction fit on the PVC pipe.

! NOTE

The Solinst Tag Line, (Model 103), is recommended for accurate sand and bentonite placement.

Locate Channel 1 and slide the wellhead register over the tubing, flush with the end. Align the stamped number one on the register with the Channel 1 identifier marking on the outside of the tubing. Secure the wellhead register to the CMT tubing by tightening the hex screw on the side of the register using a 1/8" Allen Key. Bring the PVC pipe up so the register seats in the wellhead base (Figure 21). Grout or cement the PVC pipe in place.

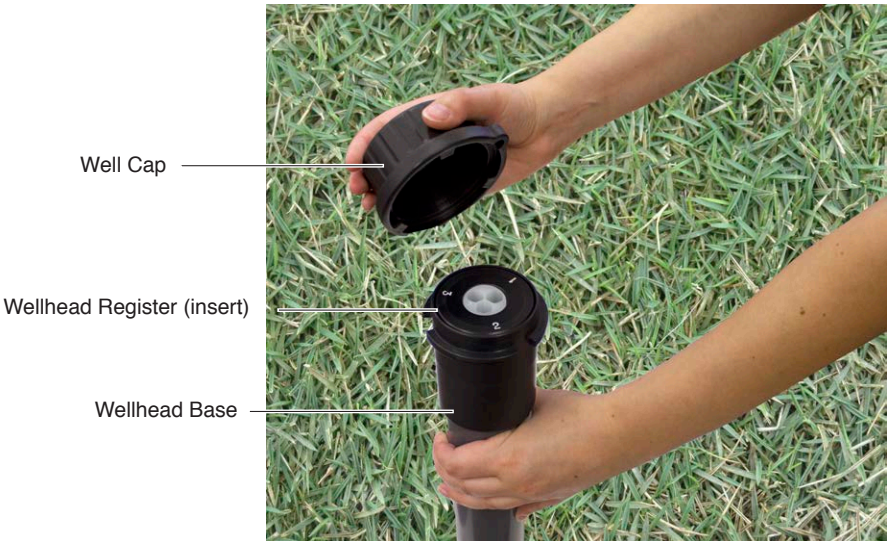


Figure 21

Optional Flow Control Monitoring Assembly

Under flowing artesian conditions or for vapor sampling, the CMT can be fitted with a flow through seal assembly (Figure 22) to allow the user to collect a sample, measure hydraulic or pneumatic pressure, and prevent uncontrolled flow from the well.

Figure 22

The flow through seal assembly is tightened using a 11/32" (9 mm) wrench. Once tightened, press down on the black ring while pulling up to remove the red plug. Then push the 1/4"OD tubing into the fitting, which creates a leak proof seal.

Figure 23

Optional Multi-Purge Manifold Assembly

To purge and sample up to 3 (up to 7 for the 7 Channel CMT System) Micro Double Valve Pumps, at a single location, a Multi-Purge Manifold Assembly is available.

1. Mount the Multi-Purge Manifold over the well installation.
2. Thread the pumps down through the collar opening in the Multi-Purge Manifold below the head assembly.
3. Connect each individual pump manifold to the appropriately numbered Multi-Purge Manifold connection by pushing the male LL10 connector (on the pump manifold) into the brass quick connect fitting (on the assembly) while pulling back the brass sleeve on the fitting.
4. Connect the compressed gas source/controller to the Multi-Purge connection at the top of the head assembly, using the same method as described in step 3.
5. Open and adjust valves on the top of the head assembly of the Multi-Purge Manifold for those pumps that require purging/sampling. Operate control box according to the instructions provided.

NOTE

Airflow adjustments are made using the valves on the top of the head assembly of the manifold.
A clockwise turn reduces air supply, counter-clockwise increases the air supply. If a valve is all the way down, it is in the off position. Valves can be adjusted by hand, but if they are too tight, a slot head screwdriver can be used.

Figure 24

CMT Installation with Sand and Bentonite Cartridges

Introduction

When using Cartridges, there are Sand Cartridges, and Bentonite Spring Cartridges, where the Cartridge is filled in the field with 3/8" (9.5 mm) diameter bentonite pellets. These Cartridges, shown in Figure 25, can be used in series or in combination with each other.

NOTE

Installations using Cartridges are done in 3.25" OD direct push and NQ boreholes.

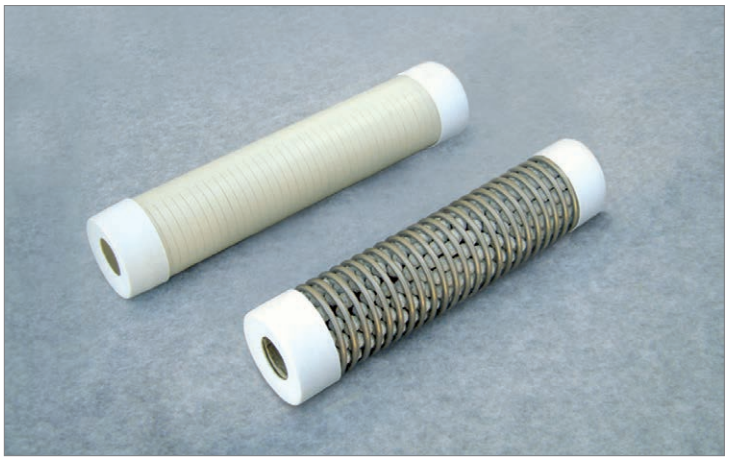


Figure 25

NOTE

Bentonite Spring Cartridges are used for low pressure seals (<5psi) in non-caving boreholes < 4.0" dia. Allow 2 to 3 days to seal.

NOTE

If using 3.25"diameter "Direct Push" casing, ensure you are using a knock-out cutting shoe for the installation.

The use of Sand and Bentonite Cartridges allow the CMT System to be installed in 3.25" (82.5 mm) (2.6" ID (66 mm)) diameter "Direct Push" casing fitted with a knock-out cutting shoe. Bentonite and Sand Cartridges are 2.5" (64 mm) in diameter and are a nominal 12" (305 mm) length. The Cartridges slide onto the CMT and a Gear Clamp is torqued in place to stop each Cartridge from moving. One 3.5" (89 mm) diameter Separator Disk is below each Cartridge to help minimize the potential for vertical sediment movement. Spacers are used between each Cartridge and Separator Disk. Thus, the entire CMT Assembly is built right at the borehole, and then inserted hand-over-hand to the desired depth. Figure 26 shows all of the above described components required for Cartridge installation.

Figure 26

Installation Design Example

Monitored Zone	Channel Number	Depth to Center of Port (from ground surface)
1	1	20 ft (6.1 m)
2	2	30 ft (9.1 m)
3	3	50 ft (15.2 m)

NOTE

Each 50 lb (22.7 kg) bag of sand will fill about 25 ft (7.6 m) of sand cartridges.

In our example (Table 2) there are ports at 20 ft, 30 ft and 50 ft (6.1 m, 9.1 m and 15.2 m) depths. Each monitoring zone is 2 ft (0.6 m) length. Sand Cartridges are a nominal 1 ft (0.3 m) length, therefore, a total of six Sand Cartridges will be required to complete this installation. The annulus volume of filter sand required is about 0.015 cu.ft/ft (0.0014 cu.m/m) per Sand Cartridge, therefore, a 50 lb (23 kg) bag of sand will provide an ample 25 ft (7.6 m) of sand pack.

In this example, we will use a 3 ft (0.9 m) bentonite seal on either side of our monitoring zone, with an exception at Port 3, the deepest. We chose not to place a bentonite seal below Port 3. Thus, three monitoring zones equates to five 3 ft (0.9 m) sealed areas. As the Bentonite Spring Cartridges are nominally 1 ft (0.9 m) in length, five seal locations, each 3 ft (0.9 m) long, mean fifteen Cartridges will be needed. Each Cartridge will require about 1 lb (0.5 kg) of 3/8" dia. bentonite pellets, therefore about 15 lbs (7.5 kg) is required.

NOTE

Each Bentonite Spring Cartridge will require about 1 lb (0.5 kg) of 3/8" dia. bentonite pellets.

Preparation

If installing Sand and Bentonite Spring Cartridges, you will need the items listed below and shown in Figure 27, to facilitate Cartridge assembly.

1) Sand: purchase locally
2) Feeder Assembly Kit, consisting of a 3/4" (19 mm) OD x 18" (457 mm) Sch 40 PVC Feeder Tube (comes with gear clamp in place) and Feeder Key.
3) 12.5 in/lbs (0.7 mm/g) Torque Tool.
4) Bentonite Pellets: 3/8" (10 mm dia.) **non coated**, purchase locally.

Figure 27

Before making any ports in the CMT tubing, sketch the desired well design. Be sure to show depth intervals of the proposed monitoring zones and the areas where Bentonite Cartridges will be used. This will be your guide to follow when sliding the cartridges in the correct order and position. Each individual Cartridge Assembly is nominally 1 ft (0.3 m) long. You will need to determine the length of each seal and filtered zone you would like to achieve, as this will dictate the total number of cartridges you will need to have prepared. Always check Local and State Regulatory Agency Guidelines and/or Requirements for proper monitoring well construction.

NOTE

The Bentonite Spring Cartridges will NOT physically slide over port screen and clamped assemblies. Thus, the progress of CMT Assembly will be outward from the middle port (Port 2 in our example) and towards Ports 1 and 3. Sand Cartridges can slide over a completed port to cover a screen assembly.

Installation

Transfer your desired port layout onto the CMT tubing as described on Pages 4 and 5 of the '3-Channel CMT Assembly Section'. Place Sand and Bentonite Cartridge Assemblies along side the CMT tubing (see Figure 28) in the order as shown on your layout. Be sure to include at the bottom of each Cartridge, a Spacer, Separator Disk, and Gear Clamp

When using Bentonite Cartridges, it is necessary to start at the middle port (Port 2 in our example) and then install the Bentonite Cartridges on either side of that port, before making the other ports.

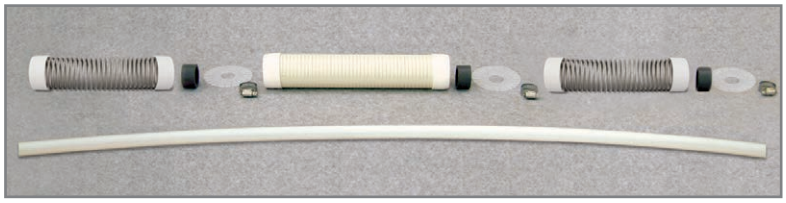


Figure 28

Port Assembly

Follow the Port Assembly Instructions described earlier in this Manual to proceed with the construction of the middle port. If longer screens are desired, slide the Port Guide Cutter up the tubing and make three more access holes for each extra Sand Cartridge you will use. Clamp on the appropriate length of screens to cover these inlet holes.

Ports 1 and 3 will not be assembled until after all the Bentonite Cartridges on either side have been installed.

Installing Sand Cartridges

Figure 29 shows everything required to construct a Sand Cartridge; PVC screen, sand, two black plugs (one as spare), two End Caps, Spacer, Separator Disk, and Gear Clamp.

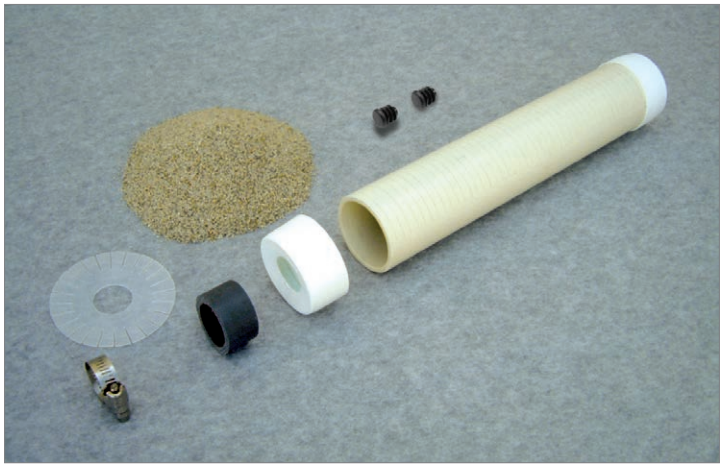


Figure 29

! NOTE

Remember to construct the CMT System from the middle port and work outward and towards the top and bottom. BELOW each Cartridge, slide on a Spacer, Separator Disk and Gear Clamp.

Push an End Cap onto the 2" (50 mm) diameter screen and push the Feeder Tube all the way through the centre of the PVC screen. By hand, (see Figure 30) slowly add sand to the Sand Cartridge. Do NOT overfill the Sand Cartridge. Leave about 2" (50 mm) of head space so as to ensure the assembly will slide along the CMT without creating too much friction. Once filled, add the other End Cap to the Sand Cartridge Assembly.

Remember to construct the CMT from the middle (Port 2 in our example) and work outward and towards Ports 1 and 3.

Figure 30

NOTE

Push a small black plastic plug into the vent hole below the port, to prevent sand draining out of the Sand Cartridge.

Insert the Feeder Tube and Key into the end of the CMT tubing. To prevent sand infiltration while placing the Sand Cartridge, use a black plug to block the vent hole. Slide the Sand Cartridge along the CMT over the screened port, and into position at Port 2 (see Figure 31). Do not forget to slide on a Gear Clamp, Separator Disk and Spacer. Use the supplied Torque Driver (12.5 in/lbs) and tighten the Gear Clamps.

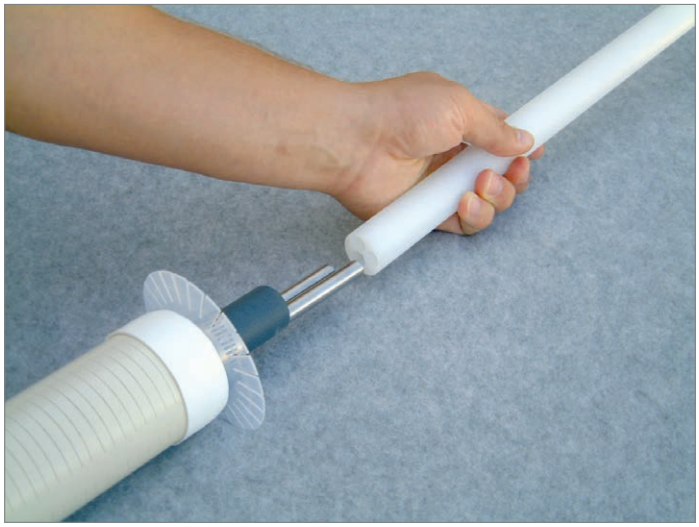


Figure 31

Installing Spring Cartridges

Figure 32 shows all parts required to construct a Bentonite Spring Cartridge.

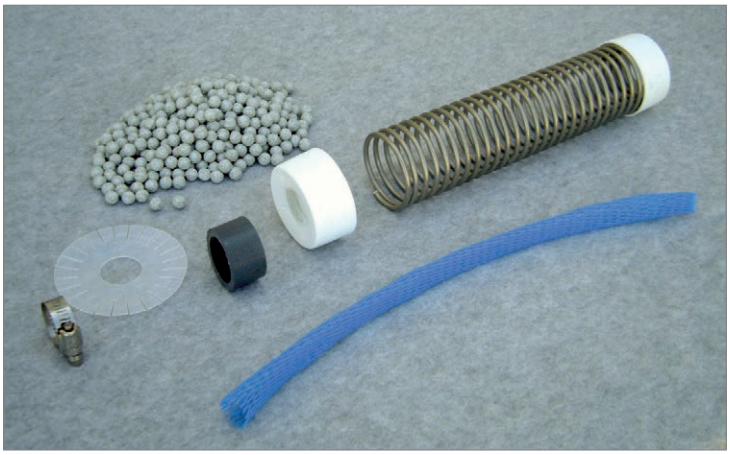


Figure 32

Slide the length of polyethylene mesh over the Feeder Tube. Allow for about 2" (50 mm) of slack in the mesh at each end. You will need this extra length of mesh later to fold up and over the End Cap. Tuck one end of the mesh into the end of the Feeder Tube and slide an End Cap down and over the plastic mesh, then place the empty SS Spring into this End Cap.

Figure 33

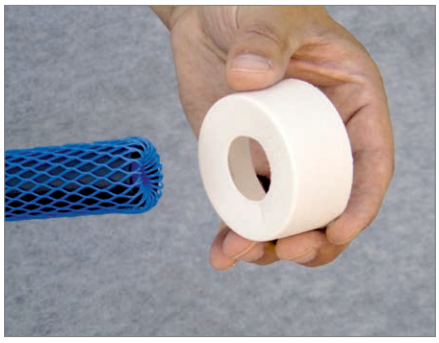


Figure 34

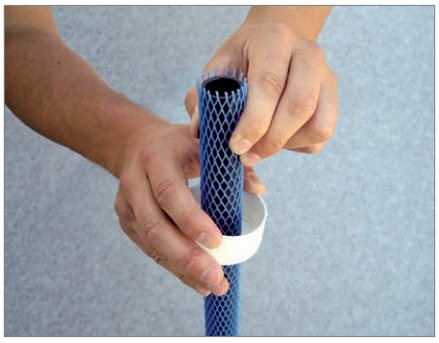


Figure 35

By hand (Figure 36) slowly fill the Bentonite Spring Cartridge. Shake the Feeder Tube to ensure an even filling. Do NOT twist the SS Spring. This will cause the spring to lock onto the Feeder Tube. Once filled, remove the Feeder Tube and add the other End Cap to the Cartridge Assembly. Pull the mesh up and over the End Cap at each end.

Figure 36

NOTE

Remember to slide a Spacer, Separator Disk and Gear Clamp below each Cartridge.

Insert the Feeder Tube and Key into the end of the CMT. Slide the Cartridge along the CMT and into position, fitting the Spacer, Separator Disk and Gear Clamp below each Cartridge.

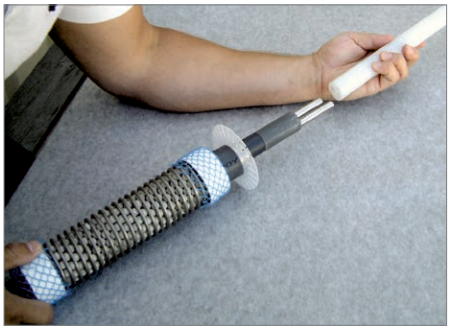


Figure 37

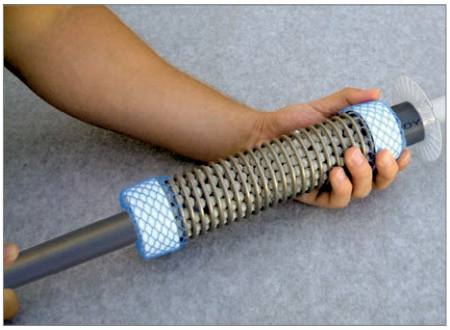


Figure 38

NOTE

If you are installing through 3.25" diameter "Direct Push" casing, once the Spring Cartridge is slid into position, cut the blue plastic mesh off of the plastic end caps. This allows the Spring Cartridge to fit inside the casing.

Continue to install the next Bentonite Spring Cartridges until the clay seals above and below the middle port are in place (In our example, above Port 3 as well as below Port 1.)

Then cut, prepare, and install the next ports, as described on Pages 6-9 and/or install Sand and Bentonite Cartridges as required. Always work from the centre out and complete the CMT System with a Guide Point and Well Head as described on Pages 10 and 11.

Monitoring Options

Water levels and samples can be accurately obtained using the following high quality Solinst instruments:

Water Level Measurement

Model 102 Water Level Meter

The narrow coaxial cable Model 102 Water Level Meter and 102M Mini Water Level Meter with a 0.157" (4 m m) dia. probe can be used to monitor water levels in open tubes. The coaxial cable is accurately laser marked every 1/100 ft or mm.

Well Completion

Model 103 Tag Line

The Tag Line is ideal to aid accurate placement of sand and bentonite during borehole completion.

The durable cable is laser marked every 1/4 foot or 5 cm.

Sampling Methods

Depending on the depth to water at your site, and your sampling protocol, Solinst offers various sampling options.

Model 410 Peristaltic Pump

Ideal for sample retrieval from shallow water levels less than 30 ft. (9 m).

Mini Inertial Pump

This Mechanical pump uses 1/4" LDPE tubing. Typical flow rates of 50 to 250 ml/min. Suitable for use to depths of approximately 150 ft. (45 m). If the water level on your site is deeper than 50 ft. (15 m), PTFE tubing is recommended.

Model 408M (3/8" Dia.) Micro Double Valve Pump

The Small and flexible design makes this gas drive pump ideal for delivering high quality samples, in combination with the Model 464 Electronic Control Unit. Flow rates of 20 to 150 mL/min make the 408M suitable for low flow sampling applications. Constructed of stainless steel and LDPE for lengths less than 50 ft. (15 m) and PTFE tubing for any depths up to 250 ft. (75 m) applications. This is the only viable option in CMT wells with depth to water over 150 ft. (45 m).

Accessories

Multi-Purge Manifold

A multi-purge manifold can be considered for purging multiple CMT channels simultaneously using Micro Double Valve Pumps in each channel.

Model 464
Electronic Control Unit

Durable and easy to operate with the 408M by using built-in presets, or customized saved settings.

Vapor Monitoring & Wellhead Seal Assembly

Channel seal assemblies are available to seal the CMT channels in case of flowing artesian conditions, or for vapor monitoring. If desired, a 3-way valve can be attached to the seal assembly directing vapor to a pressure gauge connected at one end of the valve and a sample vessel at the other.

Solinst®

Terms & Conditions: Training

Model 401 & 403

Terms and Conditions
for Waterloo or CMT® System Multilevel Installation Training
An Understanding of Responsibility

Solinst Canada Ltd. (Solinst) offers installation training only, which includes providing verbal and 'by example' instruction of proper methods of assembling Waterloo or CMT Multilevel Systems. Actual installation of a Solinst Multilevel System is the sole responsibility of the Customer. Solinst cannot offer guidance, nor recommend the location of a monitoring zone, nor advise on the backfilling of the System to achieve the monitoring zones your site requires.

Based on the information that you provide, Solinst may assist with determining sufficient quantities of components to construct your Multilevel System(s), however Solinst assumes no responsibility for the chemical and physical compatibility of materials, initial design or on- site layout design, in-field design changes, or the condition of the borehole(s).

All equipment received by the client for use in their installations must be inspected upon receipt, and any deficiencies noted and reported to Solinst immediately.

Solinst, at its sole discretion, reserves the right to assess the cause and liability of any System fault or equipment failure at the time of receipt, during assembly, or following installation. If the defect is determined to be caused by inadequate materials or workmanship, excluding actual installation procedures – which are the Customer's responsibility – Solinst will, at it's own discretion, replace or refund the cost of the failed component. Solinst is not liable for any contingent costs which may arise from the installation for any reason including the loss of use of any part of the System(s) or borehole(s).

The undersigned understands and accepts the above terms and conditions:

Company: _____ Signature: _____

Name: _____ Date: _____

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