Construction, Installation, Operation, and Troubleshooting of Kanchan™ Arsenic Filter (KAF) Gem505 Version

Kanchan™ Arsenic Filter Local Entrepreneur's Training Workshop
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@
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Important Notice

This manual is prepared by CAWST, MIT, and ENPHO, for use in entrepreneurs and technician training. Despite the apparent simplicity of the Kanchan™ Arsenic Filter, construction and installation requires certain technical expertise and training in order to implement properly. It is strongly advised that if organizations are interested in constructing and implementing the Kanchan™ Arsenic Filter, that they receive proper training and instruction by CAWST/MIT/ENPHO.

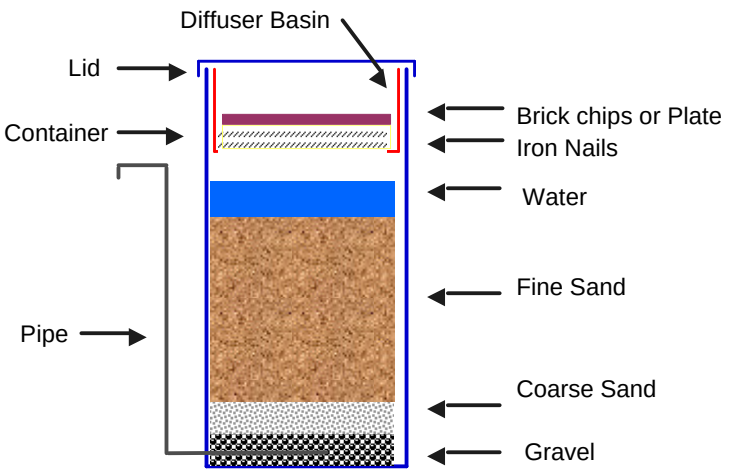
CAWST, MIT, and ENPHO and it's employees, contractors, directors and volunteers do not assume any responsibility for and make no warranty with respect to the results that may be obtained from the use of the information provided. Under ideal circumstances, the Kanchan™ Arsenic Filter can produce drinking water of high quality. However, this can not always be assured or guaranteed due to variations in construction and installation of the Kanchan™ Arsenic Filter. CAWST/MIT/ENPHO shall not be liable to anyone whatsoever for any damage resulting from reliance on any information provided in the document or attachments thereto. This also applies to the consumption of water from the Kanchan™ Arsenic filter. It should be noted that the Kanchan™ Arsenic Filter can not be relied upon to remove certain or all forms of water contamination.

Presentation Outline

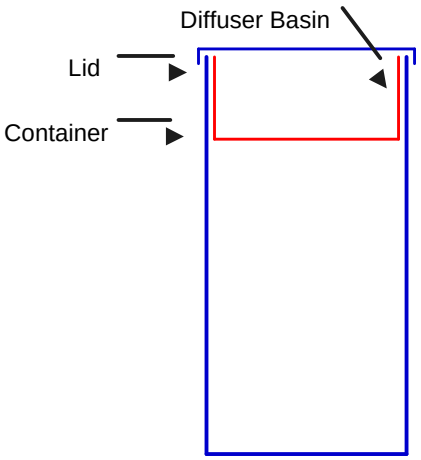
- Major Filter Components
- Filter Construction
- Filter Installation
- Operation and Maintenance
- Troubleshooting

Major Filter Components

Major Filter Components



Major Filter Components



Specifications:

Container & Lid
→ Gem model 505

Diffuser Basin
→ Gem model 1700

Major Filter Components

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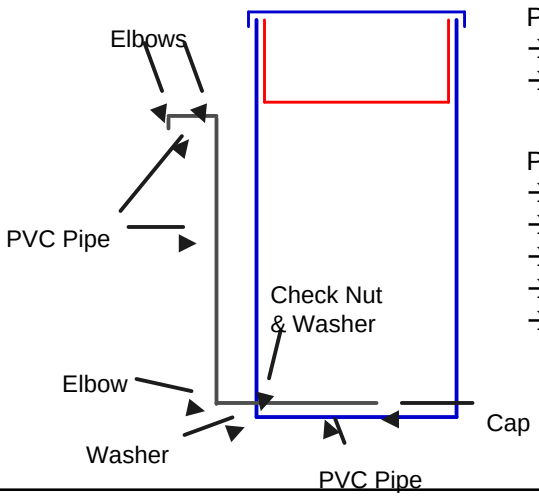
Major Filter Components

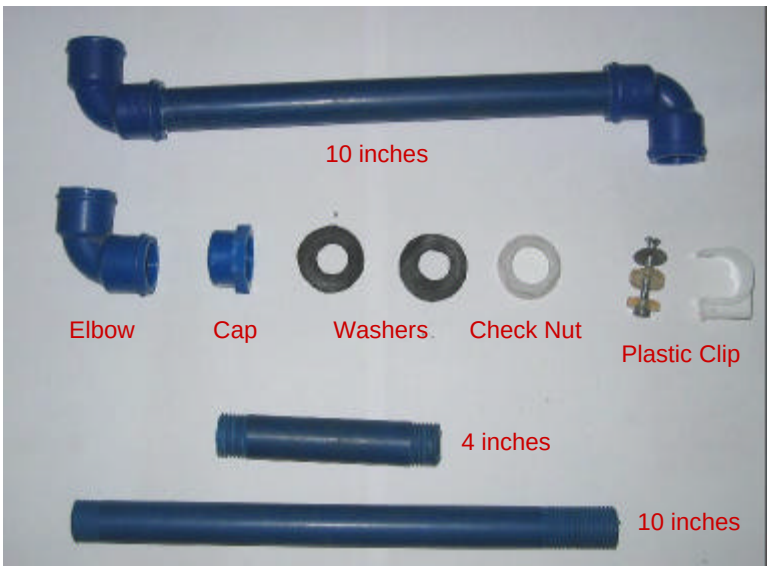


Specifications:

PVC pipes
→ 4, 10, 10 inches long
→ ½ inch pipe

PVC fittings
→ 3 elbows
→ 2 rubber washers
→ 1 check nut
→ 1 end cap
→ 1 plastic clip

Major Filter Components



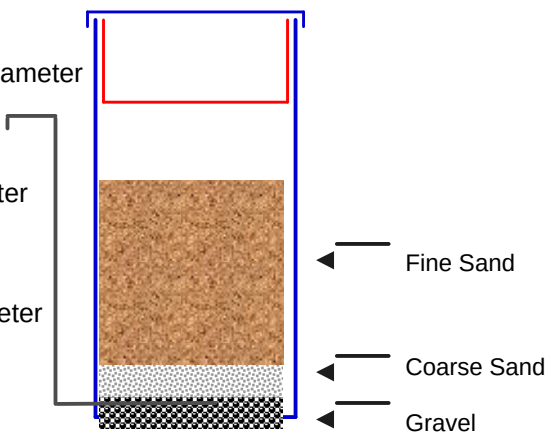
Major Filter Components

Specifications:

Fine Sand
→ 20 to 22 Liters
→ less than 1mm diameter

Coarse Sand
→ 4 Liters
→ 3 to 6 mm diameter

Gravel
→ 6 Liters
→ 6 to 15 mm diameter



Major Filter Components

Sand and Gravel can be obtained from nearby rivers or crushers

Major Filter Components

Ideal gravel
– correct size, clean with no silt, dirt, small particles or other visual contaminations

Poor gravel
– too big size, mixed up with silt and dust

Major Filter Components

Ideal coarse sand
- correct size, clean with no silt, dirt, small particles or other visual contaminations

Poor coarse sand
– dirty, mixed up with lots of dirt, silt, and fine sand

Major Filter Components

Ideal fine sand
- correct size, no large particles or visual contamination

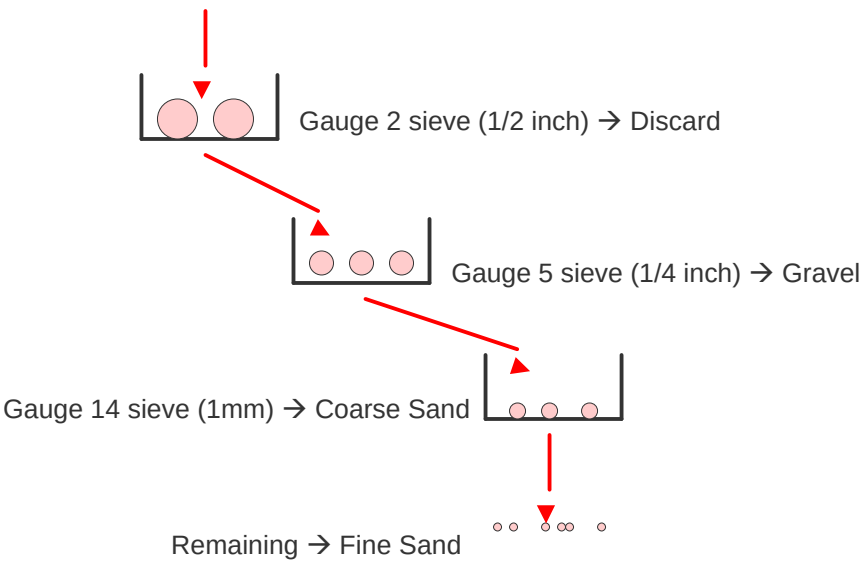
Poor fine sand
– non uniform size, mixed up with lots of dirt, silt, and large particles

Major Filter Components

Avoid sand/gravel sources with animal contamination

Use gauge 2 screen for gravel, gauge 5 for coarse sand, gauge 14 for fine sand

Major Filter Components



Major Filter Components

Major Filter Components

- Fine sand should be washed fairly clean.
- If sand is placed in a clear glass of water, and the sand is stirred, the suspended solids should be minimal.

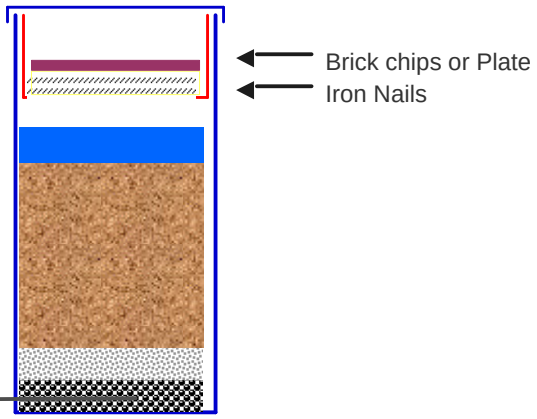
Major Filter Components

Specifications:

Iron nails
→ 5 kg
→ smallest size is best
→ length < 20mm
→ must be non-galvanized (must rust)

Brick chips
→ any brick is fine
→ about 5 to 10 cm diameter

Plate
→ any perforated plate that can protect the iron nails



Major Filter Components

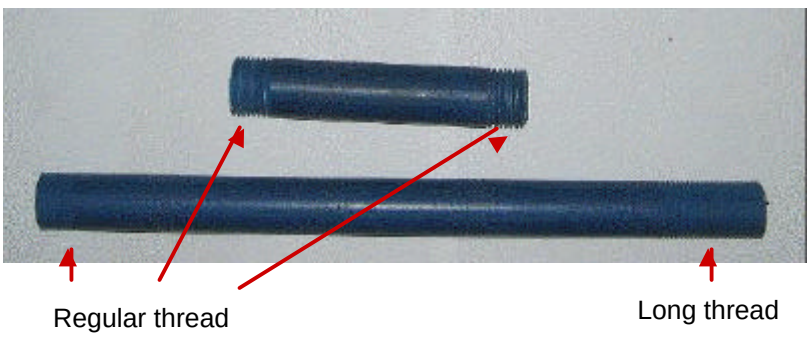
Choose the smallest, cheapest, non-galvanized iron nails from your local dealers. Buying in bulk to save money.

Filter Construction

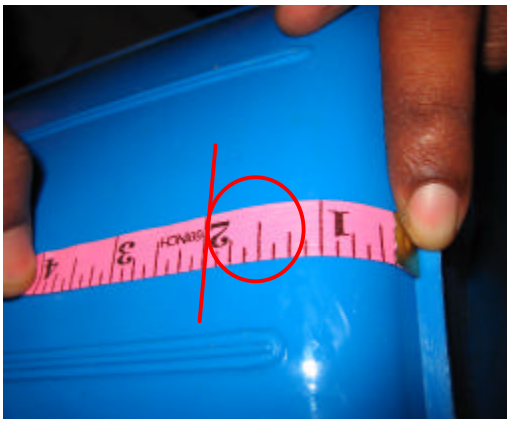
Filter Construction

1. Cut and thread the three required pieces of PVC pipes (4, 10, and 10 inches long)

2. Make sure the inside pipe (10 inches) has a long thread on one end



Filter Construction



3. Make a fire to heat a ½ inch G.I. Pipe
4. Draw a line at 2 inches from the bottom of the Gem505. Puncture one hole below the line using the hot pipe

Filter Construction

Filter Construction

5. Use a clip bolt to puncture a small hole using the same heating method

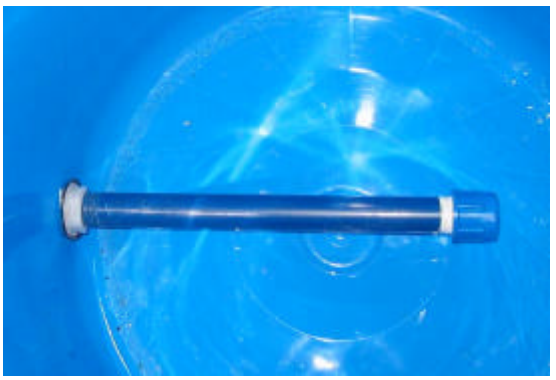
6. Use a bicycle rod to puncture two small holes (2mm diameter) on the inside pipe

Filter Construction

7. Seal all threaded ends with sufficient amount of Teflon Tape to prevent leakage

8. Cap the end of the inside pipe

Filter Construction



9. Attach fittings. Tighten and position the inside pipe using the check nut. The two holes of the inner pipe should be on the bottom (down) side

Filter Construction

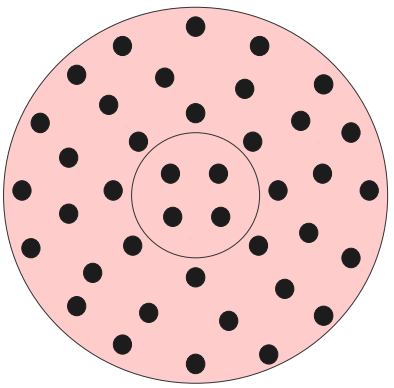
10. Attach the other piping parts.

11. Attach the clip. Make sure the rubber washers tightly seal the hole.

Filter Construction

12. Heat bicycle wheel rod. Puncture holes on the bottom side of basin

40 evenly distributed holes →



Filter Construction

14. Fill up the container to full with water
- Visually check for leakage from the outside
- Check time needed to fill a 1L jug (Gem016). Time should be between 2 to 3 minutes.

Filter Construction

17. If time is less than 2 minutes (i.e. flow rate too fast), then

- Use your fingers to close the two holes in the drainage pipe. There should be no flow
- If there is no flow → the holes are too big. Need to make a new drainage pipe
- If there is flow → check for leakage at the connection. Tighten if necessary.

Construction is complete!

Filter Installation

Filter Installation

1. Prepare a flat and stable surface. The surface must be very flat or the filter may become unstable and be broken

2. If brick is used, put a thick layer (at least 3 cm) of sand on the brick surface. This sand layer should be flat.

Sand layer

Flat and stable surface

Filter Installation

4. Add two bottles of Piyush in 10 Liters of water.

5. Pour Piyush water into filter

6. Using a Gem016 jug (1 L capacity), measure 6 L of previously washed gravel.

7. Slowly add gravel to the filter. Flatten the gravel surface with your hand. The gravel should cover the entire drainage pipe. If not, then the drainage pipe was incorrectly setup. Either the hole in the Gem505 is at the wrong location, or the check nut is not tight enough. Secure the outer PVC pipe using a clip may also help to level (lower) the drainage pipe inside.

8. Using a Gem016 jug, measure 4 L of previously washed coarse sand.

9. Slowly add coarse sand to the filter. Make sure the interface is flat, and do not mix the gravel and sand

10. Using the Gem016 again, slowly add 5 L of water (non-Piyush) to the container. Do not disturb the sand and/or gravel layers.

Filter Installation

11. Measure about 20-22 L of previously washed fine sand.

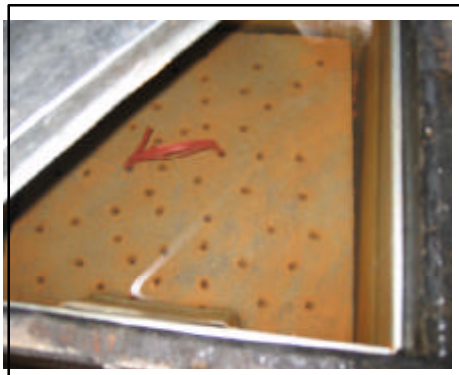
12. Slowly add fine sand to the filter. Make sure not to disturb/ mix the different media layers. Add until there is 5 cm of standing water.

Filter Installation

13. The water may appear little dirty with minimal foam. (as shown in left) This is fine. However, if there is too much foam (as shown below), then the fine sand has not been cleaned enough. The fine sand must be cleaned again, and the filter must be re-installed again.

Filter Installation

13. Put iron nails in the diffuser basin. Lay the nails flatly. Then add brick chips or stones to cover the entire basin.



If iron nails is not protected, then arsenic removal efficiency will decrease as water passes through the basin without contact with iron nails.

Filter Installation

14. Cover with lid.
15. Wait for 48 hours for Piyush to disinfect the sand and gravel.
16. After 48 hours, perform filter maintenance, that is, to clean the top layer of sand according to maintenance procedure.

Filter Installation

17. Clean the top layer of sand until you get clear water

Filter Installation

18. Pour 50 L of water in the filter and discard the filtered water.
19. Now the filter is ready to be used
20. Remember to write the date of filter installation on the bucket

Operation & Maintenance

Filter Operation

1. Pour water into top basin. Water will pass through filter and flow up the pipe
2. Collect filtered water at the pipe outlet
3. If flow rate is insufficient, then cleaning is required

Filter Cleaning/ Maintenance

1. Wash your hands with soap

2. Remove diffuser basin

3. Stir the uppermost ½ inch of sand with your fingers

Filter Cleaning/ Maintenance

4a. Remove turbid water with a cup.
4b. Replace the basin and add more water.
4c. Repeat the stirring process for two additional times.

5. Discard the turbid water in a dug hole with some cow dung in it

6. Now the filter can be used again

Filter Cleaning/ Maintenance

If arsenic concentration is high, then once a year, remove the iron nails, break it apart, wash thoroughly, and put the nails back into the basin, cover with brick chips/stones.

This will expose new iron surface for more effective arsenic removal, and to extend the life of the iron nails

Trouble Shooting

Trouble-Shooting

Problem No.1 - Too low flow rate (less than 5 Liters per hour)

1. Filter maintenance. Clean the top layer of sand. If doesn't work, then
2. Check clogging in the diffuser basin. Take the basin out and pour water into the basin. If basin clogs, then remove and wash iron nails and brick chip to clean out the dirt. Also wash the basin and clear out any holes that has been blocked by iron sludge/ dirt. If doesn't work, then
3. Remove all sand and gravel. Check for blockage in the pipe. Sieve sand and gravel. Re-install gravel and sand. Keep in mind that that there should be always water in the filter before adding gravel and/or sand to avoid trapped air bubbles. If doesn't work, then
4. Contact ENPHO. This is interesting. We also want to know why.

Top sand layer will clog. It is normal. It is because of the accumulation of dirt, dust, iron particles, and/or other contaminant particles.

Filter maintenance (i.e. cleaning the top layer of sand) can often return the flow rate to normal

Iron nails and/or brick chips can be very dirty. They must be washed to remove dirt and sand particles before placing into the diffuser basin

Remove the diffuser basin to check for clogging in the basin

Iron nails and/or brick chips were not washed prior to installation. Dirt from nails and/or brick clogs the holes in the diffuser basin.

Holes too small will get clogged easily.
Holes too large will allow iron nails to pass.
Proper size is necessary.

Trouble-Shooting

Problem No.2 – Pipe broken

1. Replace the broken part with a new part. Use plastic fittings if available.
2. Don't tighten the pipe fittings too much. Use more Teflon tape.
3. Make sure the outer pipe is secured, preferably using a clip.
4. Place the filter away from children and animal to prevent hitting and damaging the pipe.
5. Re-installation of sand and gravel may be necessary in order to prevent trapped air bubbles

Trouble-Shooting

Problem No.3 – Pipe and container leakage

1. If the leakage in on the outside pipe system, re-seal with Teflon tape and/or glue. If not, then
2. Check leakage at the bottom of the Gem505 container. There may be a crack. Seal with glue. Put the filter on a very flat surface with a 3cm layer of sand. If not, then
3. Remove all sand and gravel. Check for seal for the entire piping system. Re-seal if necessary. The tank nipple rings may be jammed. Replace entire pipe or fitting parts if necessary. If doesn't work, then
4. Replacement of the plastic Gem505 container may be needed.

Trouble-Shooting

Leakage is commonly found here. Possible reasons may include:
- insufficient Teflon tape
- jammed rubber washer
- inadequate tightening

Trouble-Shooting

Due to the pressure of the sand and water, the bottom of the Gem505 container may crack. To prevent this problem, the filter must be placed on a very flat surface with a 3cm thick layer of sand. This will help support the pressure of the sand and water.

Trouble-Shooting

The filter should be placed indoors, away from the sun. Sun's UV ray will damage the plastic, making it fragile.

The filter should be placed on a flat, stable surface.

For Further Information

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