

## Gas tightness testing of the piping system

### Background information:

Gas-tightness is an important feature of a fully functioning biogas plant. To ensure the tightness, all biogas plants should be equipped with a testing unit. It allows differentiating if a problem derives from the piping or from within the digester. To allocate the leakages is crucial before any further steps are taken.

At a long piping system, it is useful and recommended to plan and install several sections, separated from each other with valves, which then can be tested independently. This way leakages can be detected easily.

Only if the piping system is tight, it is worthwhile to conduct a pressure test on the gas dome. If the pressure indicator shows a decrease, the dome cannot hold gas or the biogas plant cannot build up its maximum pressure, thus one can conclude that there is a leakage in the dome.

### Pressure and gas tightness testing of a biogas digester and gas piping system

*To execute troubleshooting with minimum expenditure of time and resources a systematic procedure shall be followed. Most malfunctions related to insufficient flame quality can be located and solved by starting with a pressure test. If only the gas pipe shall be tested for leakages the usage of the existing pressure indicator at the kitchen site is adequate (see*

Figure 1). Installed is usually a gas pressure gauge to indicate the pressure in kilopascal (kPa) or a manometer (water-filled hosepipe), which indicates the gas pressure in the system in cm water column (1 cm water column  $\approx$  1 mbar = 0.1 kPa). If the kitchen site is not equipped with a pressure indicator a testing unit needs to be installed at the digester site. When a gas pressure gauge is installed, the pressure indicator valve should always be closed when no pressure test is conducted. This is to prevent gas losses through the membrane in the gas pressure gauge, as it is not always completely gas tight.

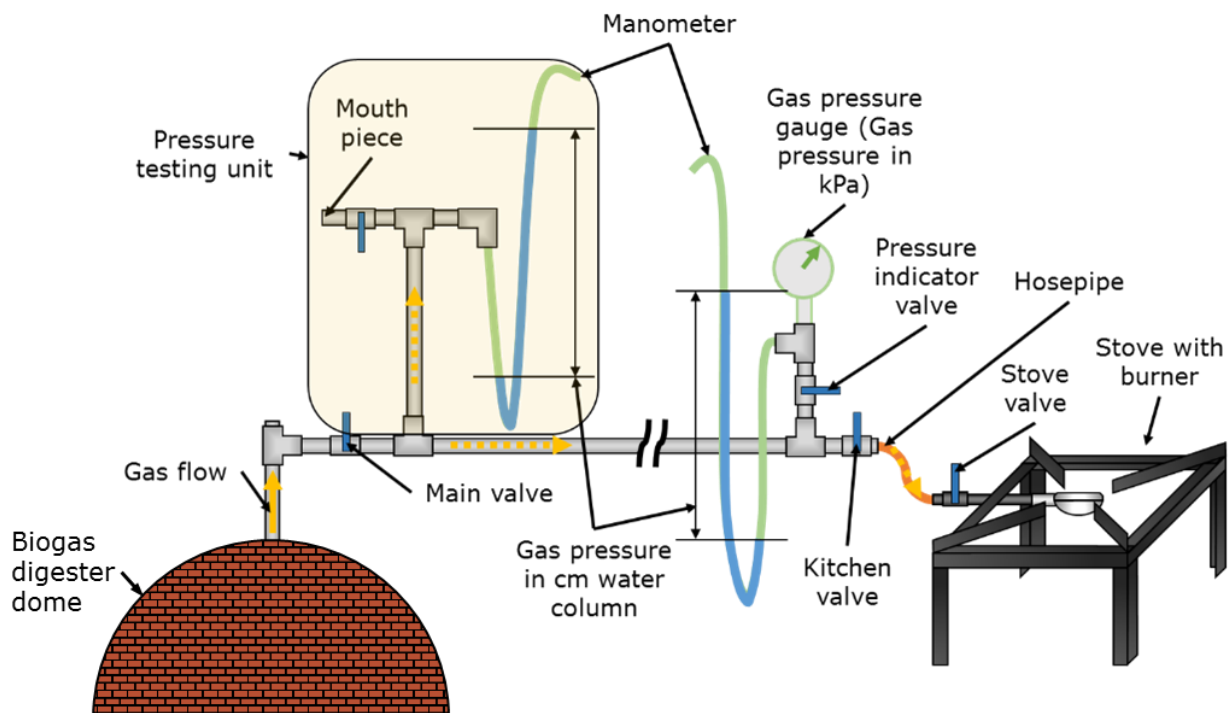


Figure 1: Biogas piping system with pressure testing unit and pressure indicators

### How to conduct a pressure test of the gas piping system

To conduct a pressure test of the gas piping system, the steps to be followed are:

1. All gas consumption points have to be closed (stove valves)
  - In case the piping system includes water traps the open end should be tightly closed (with a valve or a plug)
  - If the kitchen site is equipped with a manometer or gas pressure gauge this can be used for pressure testing (continue with step 4)

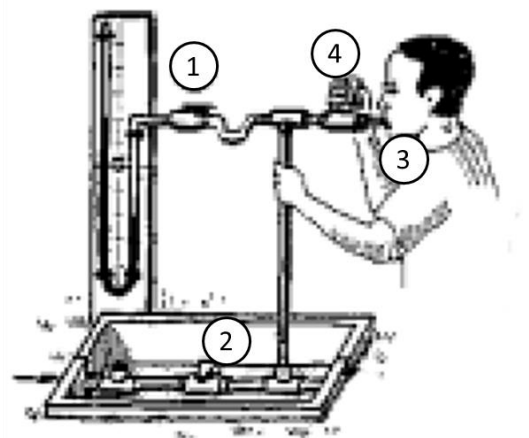
*If the kitchen site is not equipped with a manometer or gas pressure gauge the testing unit has to be mounted at the digester site (see*

- Figure 1) (continue with step 2)
2. Close the main valve
 

*The pressure test is done with a pressure testing unit which is connected to the T-joint at the gas outlet pipe after the main valve (see*
  3. Figure 1 and Figure 2)
    - Mount the hosepipe to the pressure testing unit and fill it with water (approximately half of the pipe shall be filled)
    - Open the end plug at the gas outlet pipe; beware of outflowing gas which was trapped in the piping system
    - Connect the pressure testing unit and tighten it properly using thread tape
    - Check and ensure tightness of the connection every time when reassembled using soap foam
    - Continue with step 5

4. Open the main valve (2), the kitchen valve and the pressure indicator valve (if present)

5. The pressure indicator (manometer or pressure gauge) displays the pressure in the digester and the piping system
  - If the pressure is read from a manometer (see Figure 2) it has to be ensured that the hosepipe is fixed in vertical position to read accurate results (1). It is best if the hosepipe is fixed on a scaling board for convenient reading
  - The pressure should be at least 70 cm water column/ 7kPa to conduct a meaningful pressure test of the piping system



*digester through the mouth piece of the testing unit*

- If the pressure is too low, the piping system can be pressurised by blowing air into the piping system through the mouth piece. While doing, this observe the pressure to avoid to blow out the water from the transparent U-pipe.

Procedure if kitchen site is equipped with a pressure indicator:

- Close the main valve
- Disconnect the hosepipe at the stove site
- Clean the end of the hosepipe with a tissue or cloth
- Blow air into the piping system through the open end of the hosepipe
- Close the kitchen valve when pressure is at maximum level
- Connect the hosepipe to the stove and tighten thoroughly
- Open the kitchen valve again

Procedure if pressure testing unit is used:

(see Figure 2):

- Blow into the mouth piece (3) and open the valve at the mouth piece (4) immediately after starting to blow
- Close the valve at the mouth piece (4) when pressure is at maximum level, for which the system is designed for (usually between 60 – 120 cm water column)

6. Close the main valve for about 30 min, check and document the indicated pressure in 5min intervals (cm water column or kPa)
  - In case the pressure falls, there is a leakage somewhere in the piping system and the gas piping system has to be repaired
7. Open the main valve again
  - If the pressure has increased as in comparison to the beginning of the testing procedure, either gas was produced or liquid (sewage or feeding material) has entered the digester.
  - No initial pressure indicated and no pressure increase during closure of the main valve could indicate, that the gas pipe is clogged or that there is no biogas production in the digester.  
 In that case, it is necessary to open the t-joint at the gas outlet pipe to remove the blockage with a stick or to conduct a pressure test of the digester