

TECH NOTES

VB-TN-009

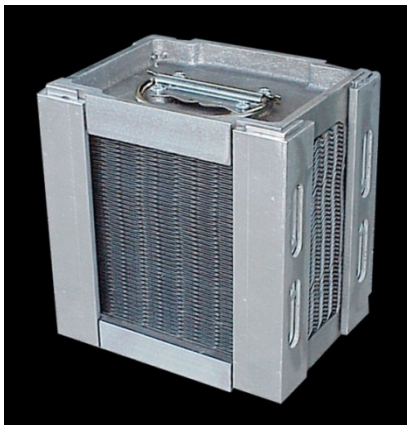
August 16

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5000/5010 Series Flame Arresters – Make the Right Choice

In biogas systems, flame arresters are typically installed on top of digester roofs or gas holders to prevent any potential for igniting the biogas accumulating in the digester. Flame Arresters are also installed where there is an open flame or possible sparking from compressors, flares, boilers or engine-generators. Additional protection of utilizing thermal shut-off valves and pressure (explosion) relief valves are typically specified along with the flame arrester.

The Varec 5000/5010 Series Flame Arrester is a square flame arrester (shown at right). The bank assembly includes corrugated rectangular sheets housed in an extensible frame (see photo below). When neatly stacked together, the sheets form tiny passages. These passages comprise the net free area that will dissipate the heat and quench the flame.



How does it work?

The type of gas and the type of flame determines the size of the passages.

Understanding flame characteristics

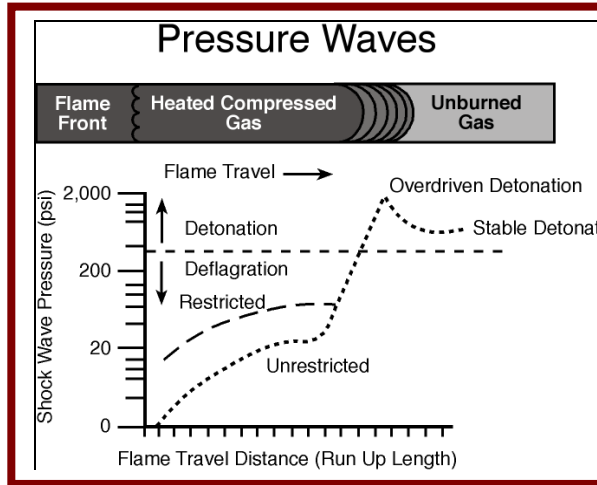
Upon ignition, a pressure shock wave occurs. The compressed gases travel ahead of the flame. The flame traveling through the pipe increases in velocity and pressure (see chart-next page).

Overdriven detonation occurs at the point where the flame ignites the compressed gases.

The flame arrester should be able to sustain a flame flashback (deflagration), and in some applications, the flame arrester must be able to stop the potential for detonation.

Gas Classification

Flame Arresters are also classified into four basic groups according to the reactivity of the gas/vapor and air mixture application. Classification for biogas being primarily composed of Methane is Group D in the United States, and Group 1 in Europe.



Gases are classified using the Maximum Safe Experimental Gap (MESG). The MESG is the maximum width of a gap, one inch (25mm) long in an enclosure through which a flame cell of a particular gas cannot pass through. The MESG value is smaller for more reactive gases. The tiny passages that are formed when the corrugated rectangular sheets are neatly stacked together on the flame arrester need to be smaller than the MESG of the gas. This will ensure that the flame cells are subjected to a smaller area and assist in reducing its velocity and temperature.

Arresters are tested and approved according to the classification of the test gas selected by the

Flame Arrester Manufacturer. Flame Arresters tested to this gas can only be used for this type of gas or for less reactive gases.

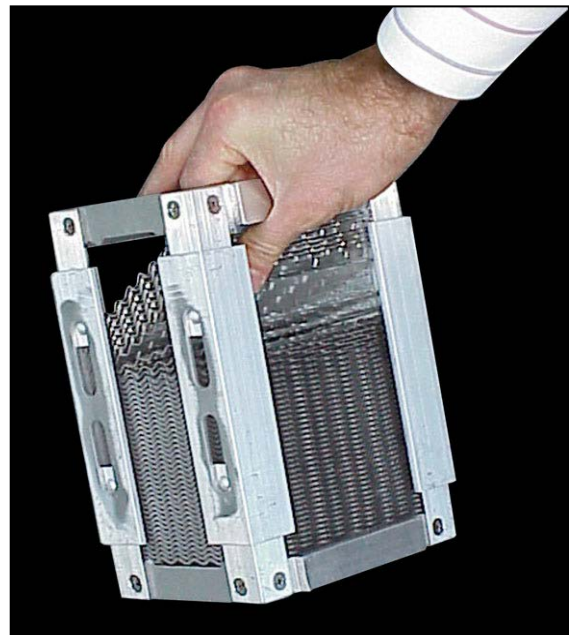
It is therefore important to note that the flame arrester specified should be particularly designed to handle Group D – Methane Gas by accounting for the overall net free area. If a flame arrester is misapplied, it will potentially compromise the device's effectiveness and may not prevent flame passage nor flame re-ignition within the arrester.

How is it better?

The 5000/5010 Flame Arrester has become the standard for biogas application because its design takes into account the nature of wet and dirty biogas.

Net Free Area

A higher overall net free area creates the barrier for flame front propagation. The position of the rectangular sheets in the bank assembly allows condensate or sediment to properly drain when installed either in the vertical or horizontal position. Proper draining prevents condensate pooling and sediment build-up ensuring proper operation of the flame arrester.



Maintainability

Easy maintainability with the bank assembly prevents any need to remove the entire unit off line. The connecting pipe flanges remain undisturbed when the cover plate is removed. Hence, there is no stress applied to the connecting piping when maintaining the 5000/5010 flame arrester.

Shorter maintenance downtime can be achieved when cleaning the bank assembly. First, having a spare bank assembly handy for easy replacement while one is cleaned is important. Next, the unit requiring cleaning can be removed from service by simply unbolting the fasteners on the cover plate of the 5000/5010 Flame Arrester.

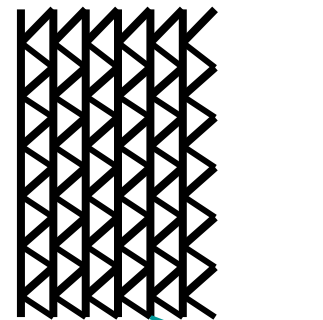
Cleaning is simplified as well. High spray wash water is not necessary for cleaning because the low copper extensible frame allows the sheets to be individually inspected for any sediment build-up. Simple soaking in solvents does the trick. You also eliminate the possibility of distorting the flame element when using a high-pressure spray wash system for cleaning. Any flame element distortion could represent a flame path. This is one of the main reasons why Varec no longer sells individual sheets because possible mishandling of the sheets could lead to a potential flame path. No margin of error is allowed!

There is a choice of square flame arresters design, so it's important to make an informed choice and know the distinct differences.

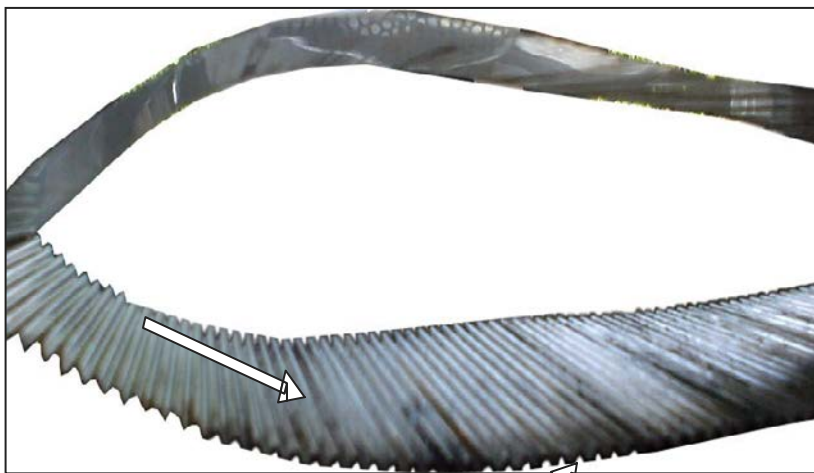
Another type of square flame arrester utilizes alternating flat and crimped ribbon versus Varec's multiple corrugated sheets.

When stacked together, there is no drainage path and potential for condensate pooling can still occur.

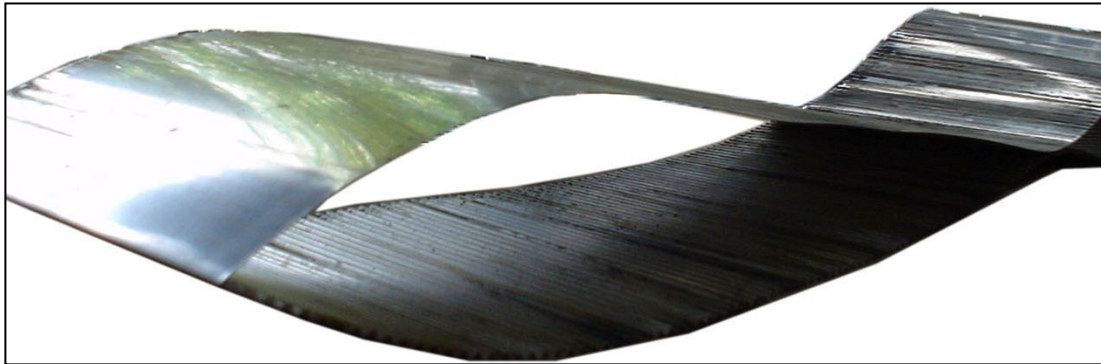
Overtime, the plates will all lay flat which reduces its ability to stop flame propagation. The thinner construction makes it more susceptible to damage and deformation during handling and cleaning.



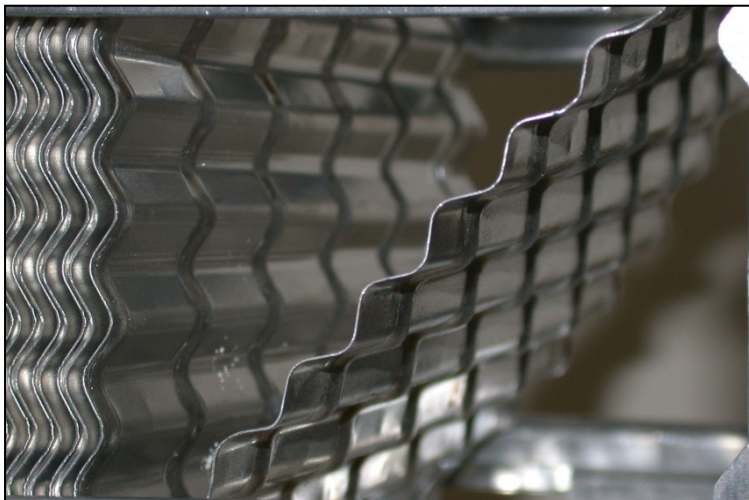
No drainage path



Alternating flat plates



Alternating crimped plates



The Varec Biogas bank assembly is provided with multiple corrugated rectangular sheets which maintain its integrity when in service. This results in overall product longevity.

Make the right choice when specifying flame arresters because not all square flame arresters are like the Varec Model 5000/5010.