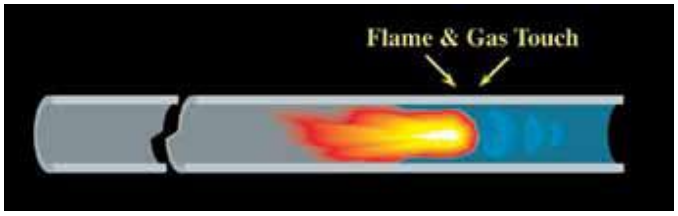
# Reduce Complexity and Increase your Margin of Safety with the use of Detonation Arrestors certified for both stable and unstable detonations

Detonation arrestors are flame arrestors designed to prevent the transmission of a detonation in a confined system. **It is often assumed that detonation arrestors are essentially the same with the exception of certain features that might be offered by various manufactures. This is not true.**

Arrestors designed only for stable detonations require up to 2 additional independent measures of protection, according to EN ISO 16852. This requirement recognizes that stable-only detonation arrestors alone do not provide adequate protection against the most severe detonation events. Additional protection measures add to capital, installation and maintenance costs, and may require electrical or other utilities.

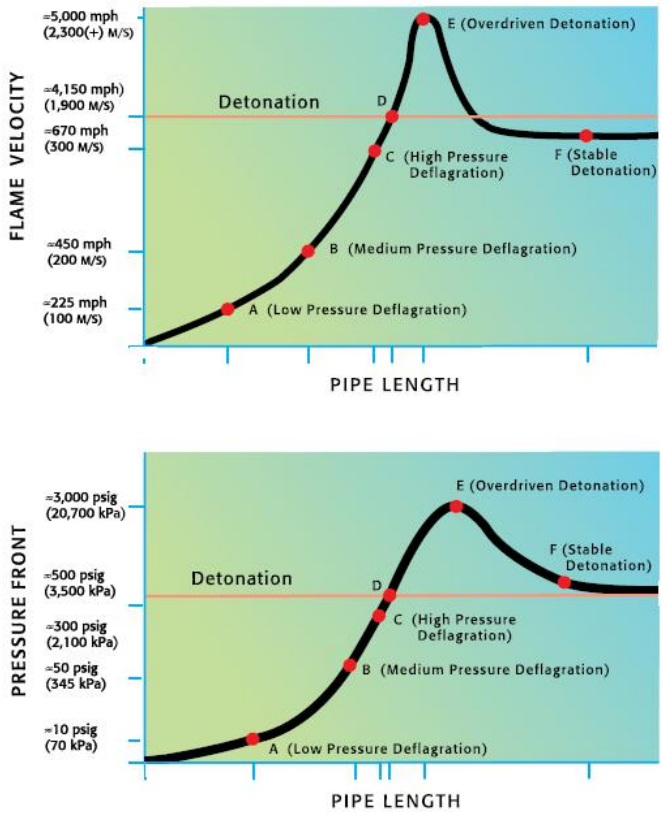
The following discussion is provided to help users of this product understand the important distinctions between detonation arrestors that are designed for all detonation propagation states as opposed to those that are limited to only the diminished stable detonation state.

In enclosed venting systems where flammable vapors are present, flame propagation will normally start as a slow deflagration, a flame front moving at subsonic velocity and if the system allows, will accelerate to a detonation via a phenomenon known as "Deflagration-to-Detonation Transformation" (DDT). DDT will occur when the highly pressurized vapors ahead of the flame front come in contact with the flame.




*Concept of deflagration-to-detonation transformation (DDT) in a pipe.*

When this takes place, an explosion occurs and the pressure wave ahead of the flame front becomes a shock wave. This shock wave produces tremendous compression of the gases both upstream and downstream from the initial point of DDT. A detonation is a flame driven shockwave at or above the speed of sound in the unreacted medium as measured at the flame front. As the flame propagates farther down the pipe, it goes into a dynamic state known as an unstable or overdriven detonation. This is the most severe state of flame propagation which moves at supersonic or even at hypersonic velocity while generating extremely high localized pressure.




*Conceptual graphs showing velocity and pressure of a flame front at points along a long pipe, beginning with ignition at a closed end.*
*All scales are logarithmic.*

When this happens, multiple shock waves will be developed and will move in all directions within the piping system. As the flame front continues moving along the pipe, it will degrade to a stable detonation with a sustained velocity and a pressure. It is assumed that in this instance, the ignition is caused by a low energy ignition source such as a static discharge or an overheated mechanical device.

Turbulence inducing configurations will cause deflagrations to pass through the DDT more rapidly, even where short piping runs are involved. These devices include pipe bends, elbows and tees as well as check valves, butterfly valves and especially spiral wound vapor hoses.

Detonation arrestors specifically designed and tested for unstable (overdriven) detonations should always be used instead of deflagration arrestors in applications that have multiple turbulence inducing devices. Since piping configurations are quite variable with respect to the type and location of these devices, it is not possible to predict where DDT might occur within the piping system. Therefore, it is not appropriate to use detonation arrestors that have been tested only for stable detonations, since they are not able to effectively stop detonations that might occur at or between the DDT and the point at which the detonation becomes stable. If conditions are right, a galloping detonation can occur. This is a type of detonation that intermittently fails and reinitiates via DDT during propagation.

In summary, **it is strongly recommended that arrestors that have been tested and certified as effective for protection against unstable detonations be used in applications that require the use of detonation arrestors**. Attention must also be given to selecting an arrestor with appropriate ratings for the most explosive vapor that might be encountered. Emerson detonation arrestors designed and certified for both stable and unstable detonations protect against the most severe detonation events without requiring any utilities, control devices or operator intervention.

View Enardo EN-DFA Series Detonation Flame Arrestor
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