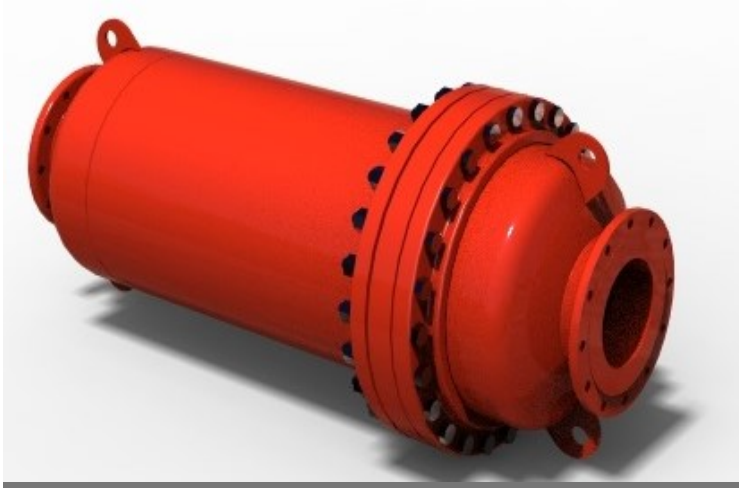
Hydrogen Detonation Flame Arrester Series D-R1 & D-R2



*The Paradox Models C-xR1 -GB & C-xR2-GB Hydrogen Detonation Flame Arrestors ,*represents the only technology other than liquid seals for arresting detonations with high levels of hydrogen and air and/or oxygen.

Detonation Flame Arrester for Hydrogen

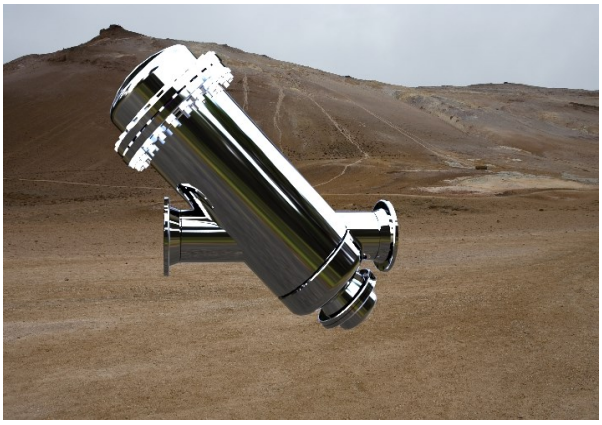
A Detonation Flame Arrestor (DFA) is designed to extinguish a flame front resulting from an explosion or detonation of a gas in a pipeline. However, in addition to extinguishing the flame, the DFA must be capable of dissipating (attenuate) the pressure front that precedes the flame front. The pressure front (shock wave) is associated with the propagation of the flame front through the unburnt gas toward the DFA. The flame induced pressure front is always in the same direction as the impinging flame travel. The pressure rise can range from a small fraction to more than 100 times the initial absolute pressure in the system and cause significant structural damage causing the DFA element to fail..

DFAs are used in installations where large volumes of gas must be vented with minimal back pressure on the system.

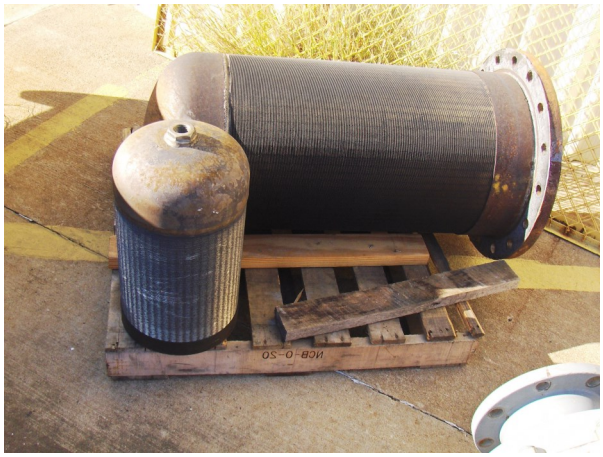
DFAs known presently in industrial applications are not known to be effective for low Maximum Experimental Space Gap (MESG) gases, such as hydrogen gas or enriched oxygen and hydrogen applications. Crimped Ribbon or parallel plate DFA constructions cannot be cost effectively produced to meet the requirements of low MESG applications and inherently create un-acceptably high pressure drops. A need, therefore, exists for a DFA design which can be manufactured in a cost effective manner which is capable of operation in low MESG gas environments.

- IIC (B) Tested to U.S. Coast Guard 33 Cfr.
- ATEX (EN 12874 Tested) 4" (101.6mm) - 20" (508mm)

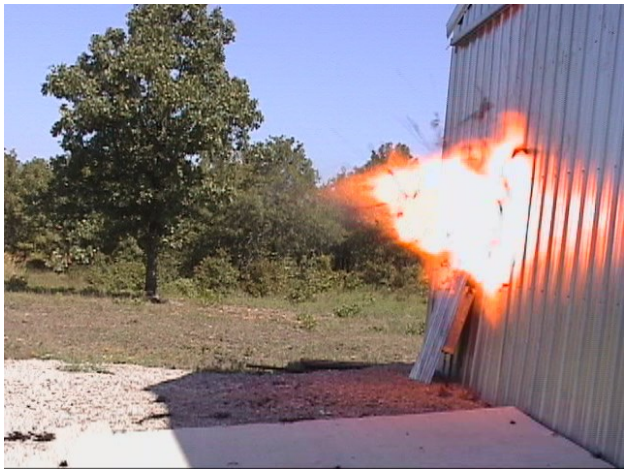
Hydrogen Detonation Flame Arresters



In nuclear reactors stoichiometric mixtures of deuterium and oxygen are produced by the radiolysis of the 'heavy water moderator. Similar mixtures of hydrogen and oxygen are produced from the light water in the liquid zone control system. These gases are diluted by helium and conveyed to a catalytic re-combiner where they are converted back into heavy and light water respectively. Due to the exothermic nature of the reaction and with abnormal operating conditions the catalyst bed



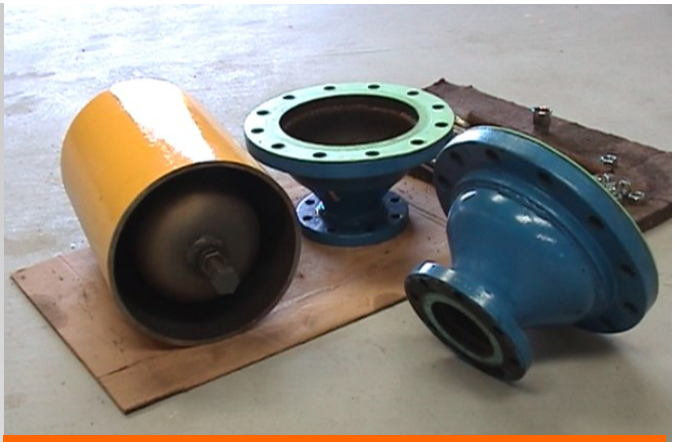
temperature could rise sufficiently to initiate a potentially destructive explosion. To prevent such a sequence of events flame arresters have been installed, in systems, immediately upstream and downstream from the catalyst bed to stop and quench the flames resulting from any unexpected ignition. The major problems encountered when attempting to design flame arresters for such systems: (1) the types of flame arresters in use have been shown to readily stabilize the flames of H2-02 and H2-air mixtures over wide ranges of flow- rate and mixture strength. This could cause the temperature of the metal arrester surfaces to rise to the extent that they may allow passage of the flame to the protected side of the arrester. (2) A survey of the combustion literature indicates that there is very little information available with respect to the design of flame arresters for highly explosive hydrogen-oxygen mixtures



Hydrogen Detonation Flame Arresters

Features and Benefits

- ***All Paradox Detonation Flame Arrestors*** are designed for stable, overdriven & unstable detonations as well as deflagrations.
- ***Removable Element*** design allows for easy replacement.
- outstanding corrosion and chemical resistance.
- ***Standard temperature ports*** on all models.
- ***Standard drains ports*** on all models



Short Flame Path & Large Surface Area Provide;

- Maximum flow
- Less Pressure Drop
- Easy Cleaning
- Less Clogging
- Less Maintenance
- Bi-directional Design
- Available in ANSI, DIN and JIS flanges.

Material Specifications

Housing	Cell	Gas Group
Carbon Steel 304 SS 316L SS Hastelloy	316 SS Hastelloy	IIC (B)

Fax: 1-352-493-4401

Detonation Flame Arrester Order & Contact Information

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