FLAME ARRESTER

DETONATION BI-DIRECTIONAL

MODEL : [FDI-FA-710]

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DEVICES INDIA PRIVATE LIMITED
Dedicated to People & Environment Protection

INTRODUCTION : FLAME ARRESTER

In Simple terms ,Detonation type Flame Arrester are used for Flame / Explosion which are above supersonic speed. Flame Arrester are Static Passive Safety Device that allows transmission of gas and vapors mixtures, and it prevents the Fire Transmission.

Failure to stop a Flame propagation - Explosion by primary safety devices like Isolation Valve, Hydraulic Seals, Oxygen Analyzer, Multigas Analyzer etc., can result in extensive damage to personnel, equipment, environment and potential loss of production. that's why Flame Arresters are used as Passive-Backup Device to Improve Safety.

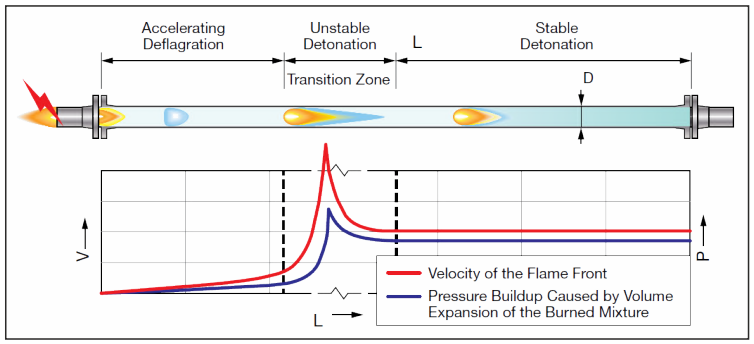
So, Working principle of this is based on Combustion Triangle, for Combustion Three Elements needed as,

1) Fuel - which here in our case is Gas and Vapors mixtures
2) Oxygen - which is obtained through air mixture
3) Heat - (or Temperature) which can be elevated through uncertain various parameters.

There are several classification of this device, but mainly it goes by,

1) In Line Type Flame Arrester
   - generally connection is in between the pipeline nearby to the potential Ignition Source.
2) End of Line Type Flame Arrester
   - which is free to atmosphere - free vent type.

Further Sub-Categories are based on type of Explosions can occur, like Deflagration & Detonation which are defined by Speed of Explosion.Deflagration is considered when Explosion Speed is Below Supersonic and Detonation is considered for Supersonic speed and Above. Speed of Explosion can differ from L/D Ratio in Pipeline System. Mostly , L/D < 50 is Deflagration, and L/D > 50 falls under Detonation Category , can be calculated with Reference to Potential Ignition Source in your Pipeline System.



So, as Flame Arrester working principal is by Reducing Temperature-Heat, Heat should be absorbed efficiently, but majority of the time Explosions are for very short amount of time (very quick speeds - supersonic - Mach >= 1), so in this very quick moments heat isn't absorbed quickly with respect to it's speed. that's where flame quenching is presented.

Flame Quenching means to distribute - break - separate the flames into small flamelets (voxels) by passing the Flame through very narrow gaps up to 0.2 mm , where it will extinguish due to heat loss and insufficient air and only gas-smoke may pass which is below the flashpoint of that particular gas / vapors.

Definitely Narrower the gap , greater the extinguishing effectiveness but, gap have been optimized through various tests relative to gas-vapor flashback capacity , flashback - Explosion Redirects to it's source path. this optimized narrow gaps are also known as M.E.S.G. (Maximum Experimental Safe Gap), Derived for each Gas and Gas Groups which is helpful in selection process of Flame Arresters for your Application.

Specifications - MESG - Maximum Experimental Safe Gap

Each Gas and Gas Groups have different Flame Propagation capacities and further categorized in explosion groups corresponding to their hazard level. The standard for characteristic values measured in Laboratory for flame propagation ability of the Product.

MESG or Standard gap width is the largest gap width between the two parts of the interior chamber of a test setup which, when internal gas mixture is ignited under specific conditions, prevents ignition of the external gas mixture through 25mm Long gap for all concentrations of tested gas vapor in air.

MESG is Property of Respective gas mixture [EN-1127-1] , the test setup and methods are specified in [EN 60079-20-1]. The Most explosive composition is close to the stoichiometric mixture of gas-vapor-air.

Gas Groups

Group A
Acetelyne

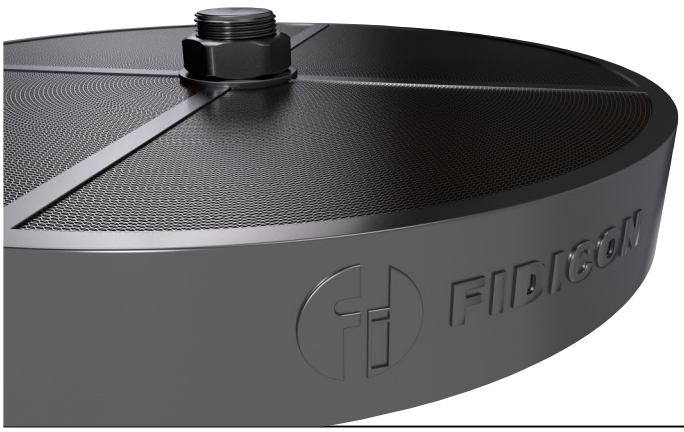
Group B (II C)
Butadiene
Ethylene Oxide

Hydrogen Processed Gases Containing more than 30% Hydrogen By Volume

Propylene Oxide
Propyl Nitrate

Group C (II B)
Acetaldehyde
Cyclopropane
Diethyl Ether
Dimethyl Hydrazine
Ethylene
Hydrogen Sulphide
Methanol (Methyl Alcohol)
Methyl Mercaptan
Unsymmetrical Dimethyl Hydrazine
UDMN

Group D (II A)
Acetone
Acrylonitrile
Ammonia
Benzene
Butylene
Butyl Alcohol
Secondary Butyl Alcohol
Cyclohexane
N-Butyle Acetate
Isobutyl Acetate
Ethane
Ethanol
Ethyl Acetate
Ethane Dichloride
Gasoline
Heptanes
Hexanes
Isoprene
Methane-Natural Gas
Methyl Acrylate
Methylamine
Methyl Ethyl ketone
Methyl Mercaptan
Isoamyl Alcohol
Methyl Isobutyl ketone
Isobutyl Alcohol
Tertiary butyl alcohol
Nephtha (Petroleum)
N-Propyl Acetate
Octanes
Pentanes
1-Pentanol (amyl alcohol)
Propane
1-Propanol (propyl alcohol)
2-Propanol (isopropyl alcohol)
Propylene
Styrene
Toluene
Turpentine
Vinyl Acetate
Vinyl Chloride
Xylenes



NEC	IEC	MESG	Test Gas List
Group II C	Group A	0.25	Acetylene
Group II C	Group B	0.28	Hydrogen
Group II B	Group B	0.65	NEC
Group II A	Group D	0.90	Propane
Group I	G.M	1.1	Methane

Temperature Classification		
Maximum Surface Temperature	**NEC® 500 / CEC®**	**NEC® 505 - IEC GROUP II**
450 ° C - (842 ° F)	T1	T1
300 ° C - (572 ° F)	T2	T2
280 ° C - (536 ° F)	T2A	
260 ° C - (500 ° F)	T2B	
230 ° C - (446 ° F)	T2C	
215 ° C - (419 ° F)	T2D	
200 ° C - (392 ° F)	T3	T3
180 ° C - (356 ° F)	T3A	
165 ° C - (329 ° F)	T3B	
160 ° C - (320 ° F)	T3C	
135 ° C - (275 ° F)	T4	T4
120 ° C - (248 ° F)	T4A	
100 ° C - (212 ° F)	T5	T5

STANDARD FLAME ARRESTER SELECTION CRITERIA

Parameters	End of Line Type	In-Line Type	Detonation Type
Maximum Length of Pipe Between Arrester & Ignition Source with No Bends.	Mounted on End of Pipe	20 Ft. / 6m	No Limit
Maximum Length of Pipe Between Arrester & Ignition Source with 1 to 90 Degree Bend.	Mounted on End of Pipe	20 Ft. / 6m	No Limit
Maximum Length of Pipe Between Arrester & Ignition Source with Multiple Bends.	Mounted on End of Pipe	20 Ft. / 6m	No Limit
Maximum Stabilization at stoichiometric mixture & ambient temperature exceed at 140°F/ 60°C	5 Minutes	5 Minutes 30 Minutes (factory approved units)	2 Hours
Operating Pressure	Atmospheric	106 kPa	143 kPa

NEC Group "C" or IEC Group IIB3			
Parameters	**End of Line Type**	**In-Line Type**	**Detonation Type**
Maximum Length of Pipe Between Arrester & Ignition Source with No Bends.	Mounted on End of Pipe	6 Ft. / 2m (Open Ended Pipe)	No Limit
Maximum Length of Pipe Between Arrester & Ignition Source with 1 to 90 Degree Bend.	Mounted on End of Pipe	6 Ft. / 2m (Open Ended Pipe)	No Limit
Maximum Length of Pipe Between Arrester & Ignition Source with Multiple Bends.	Mounted on End of Pipe	Not recommended for Multiple Bends	No Limit
Maximum Stabilization at stoichiometric mixture & ambient temperature exceed at 140°F/ 60°C	5 Minutes	5 Minutes	15 Minutes
Operating Pressure	Atmospheric	106 kPa	143 kPa

NEC Group "B" or IEC Group IIIB3			
Parameters	**End of Line Type**	**In-Line Type**	**Detonation Type**
Maximum Length of Pipe Between Arrester & Ignition Source with No Bends.	Mounted on End of Pipe	4 Ft. / 4.5m (Open Ended Pipe)	No Limit
Maximum Length of Pipe Between Arrester & Ignition Source with 1 to 90 Degree Bend.	Mounted on End of Pipe	Not Recommended for Multiple Bends	No Limit
Maximum Length of Pipe Between Arrester & Ignition Source with Multiple Bends.	Mounted on End of Pipe	Not recommended for Multiple Bends	No Limit
Maximum Stabilization at stoichiometric mixture & ambient temperature exceed at 140°F/ 60°C	2 Minutes	2 Minutes	15 Minutes
Operating Pressure	Atmospheric	106 kPa	122 kPa

IEC Group IIA Gases or NEC Group "D"			
Parameters	**End of Line Type**	**In-Line Type**	**Detonation Type**
Maximum Length of Pipe Between Arrester & Ignition Source	Mounted on End of Pipe	2 In. to 6.5 Ft. 3 In. to 7 Ft. 4 In. to 10 Ft. 6 In. to 13.1 Ft. 8 In. to 13.3 Ft. 10 In. to 16.6 Ft. 12 In. to 19.7 Ft.	2 to 12 In.
Maximum Stabilization at stoichiometric mixture & ambient temperature not to exceed at 60°C	Mounted on End of Pipe	Not Recommended for Multiple Bends	No Limit
Maximum Stabilization at stoichiometric mixture & ambient temperature exceed at 140°F/ 60°C	Short time Burning Rating	Short time Burning Rating	Short time Burning Rating
Operating Pressure	Atmospheric	110 kPa	2 In. - 6 In. (143 kPa), 8 In.- 12 In. (116.5 kPa)

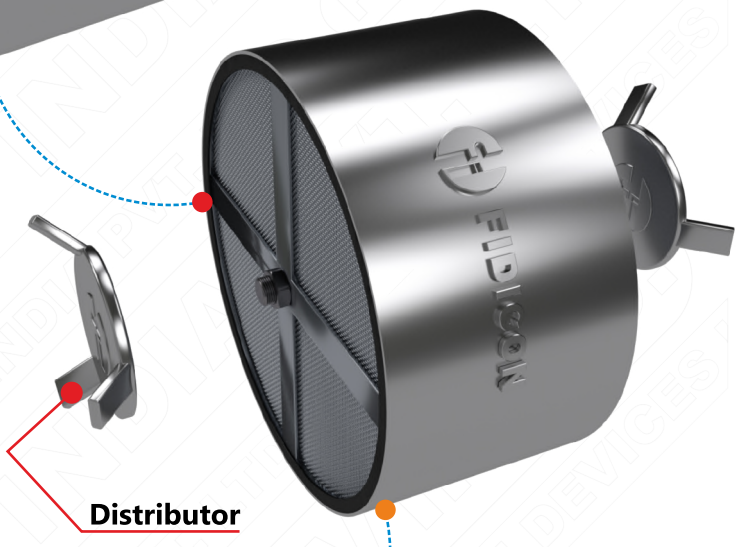
IEC Group IIB3 Gases or NEC Group "C"			
Parameters	**End of Line Type**	**In-Line Type**	**Detonation Type**
Maximum Length of Pipe Between Arrester & Ignition Source	Mounted on End of Pipe	2 In. to 8.3 Ft. 3 In. to 12.5 Ft. 4 In. to 16.6 Ft. 6 In. to 25 Ft. 8 In. to 33.3 Ft. 10 In. to 39.3 Ft. 12 In. to 39.4 Ft.	2 to 12 In.
Maximum Stabilization at stoichiometric mixture & ambient temperature exceed at 140°F/ 60°C	Short time Burning Rating	Short time Burning Rating	Short time Burning Rating
Operating Pressure	Atmospheric	110 kPa	118 kPa

PRODUCT FUNCTIONALITY

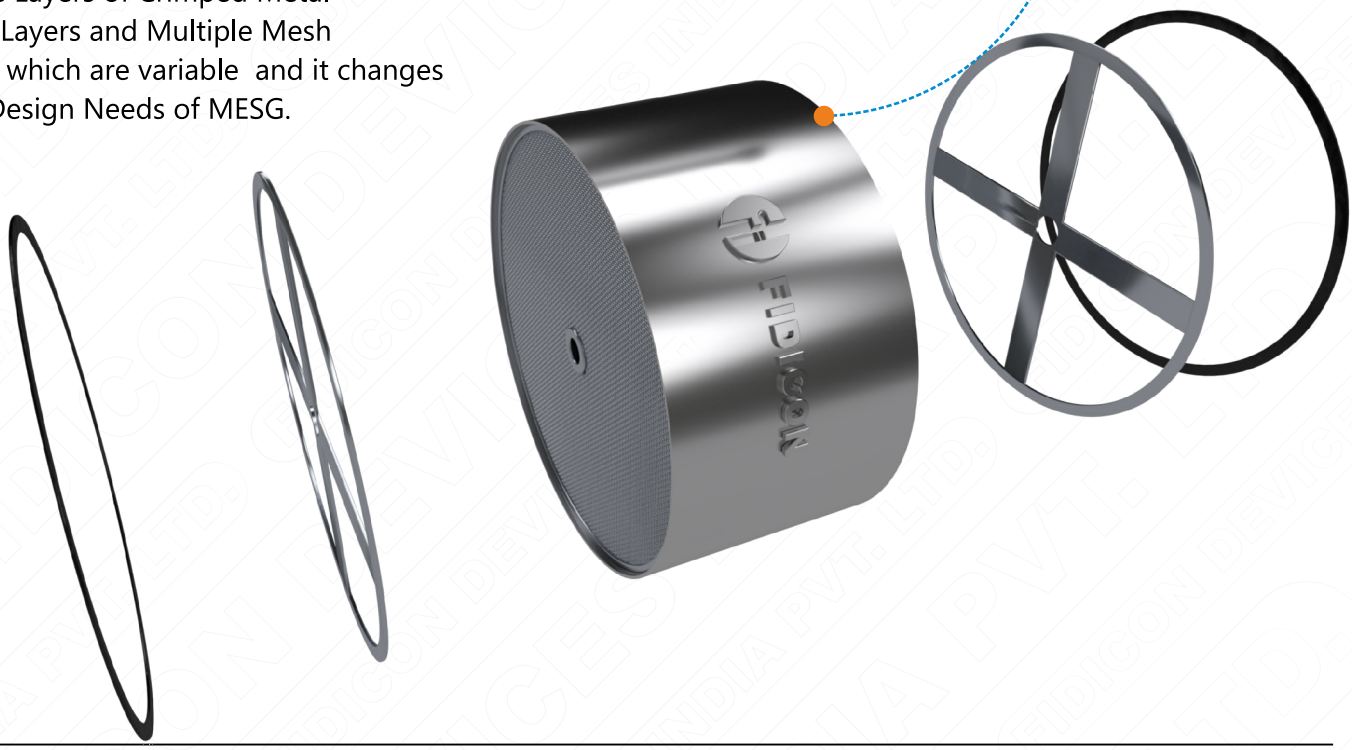
Reducer / Housing is Designed as per needs of Existing End Connection Flange, Suggested as per Flow Requirements.
Flanged as per ANSI B 16.5 #150 RF, can be customized as per Request.

Detonation Flame Arrester Assembly with Flame Filter Bank , Distributor/Divider, and Reducer which all are designed and tested at our Facility for Specific Service Gas Type / Customer Requirements.

Distributor Separates Flame into Efficient area for Better Cooling and it's Main Function is to Reduce Explosion Velocity - Intensity, which generally are at Supersonic Speed. Only Applied to Flame Arresters with certain demanding situations.

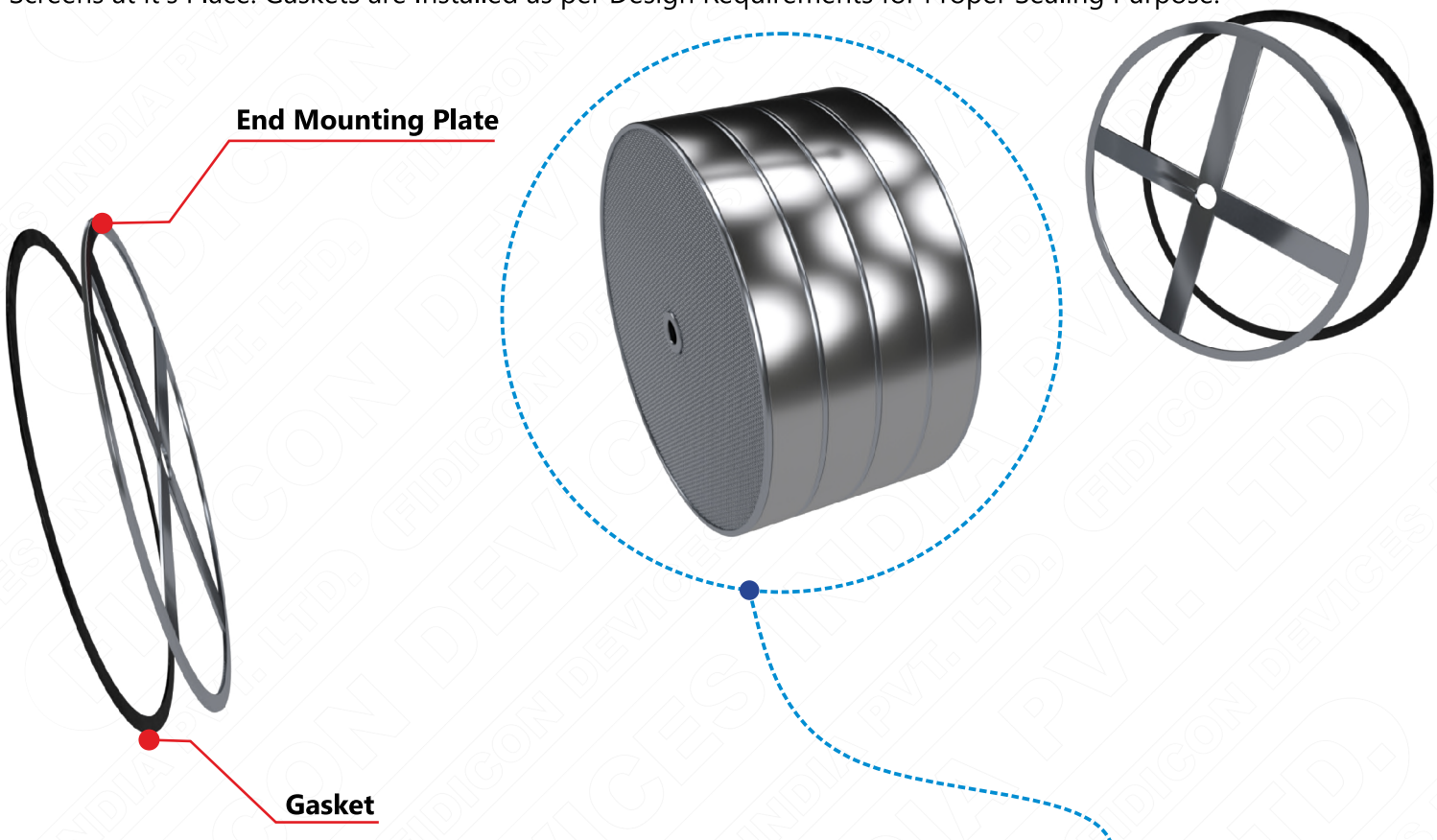


Flame Filter Bank is Packed with Multiple Layers of Crimped Metal Ribbon Layers and Multiple Mesh Screens which are variable and it changes as per Design Needs of MESG.

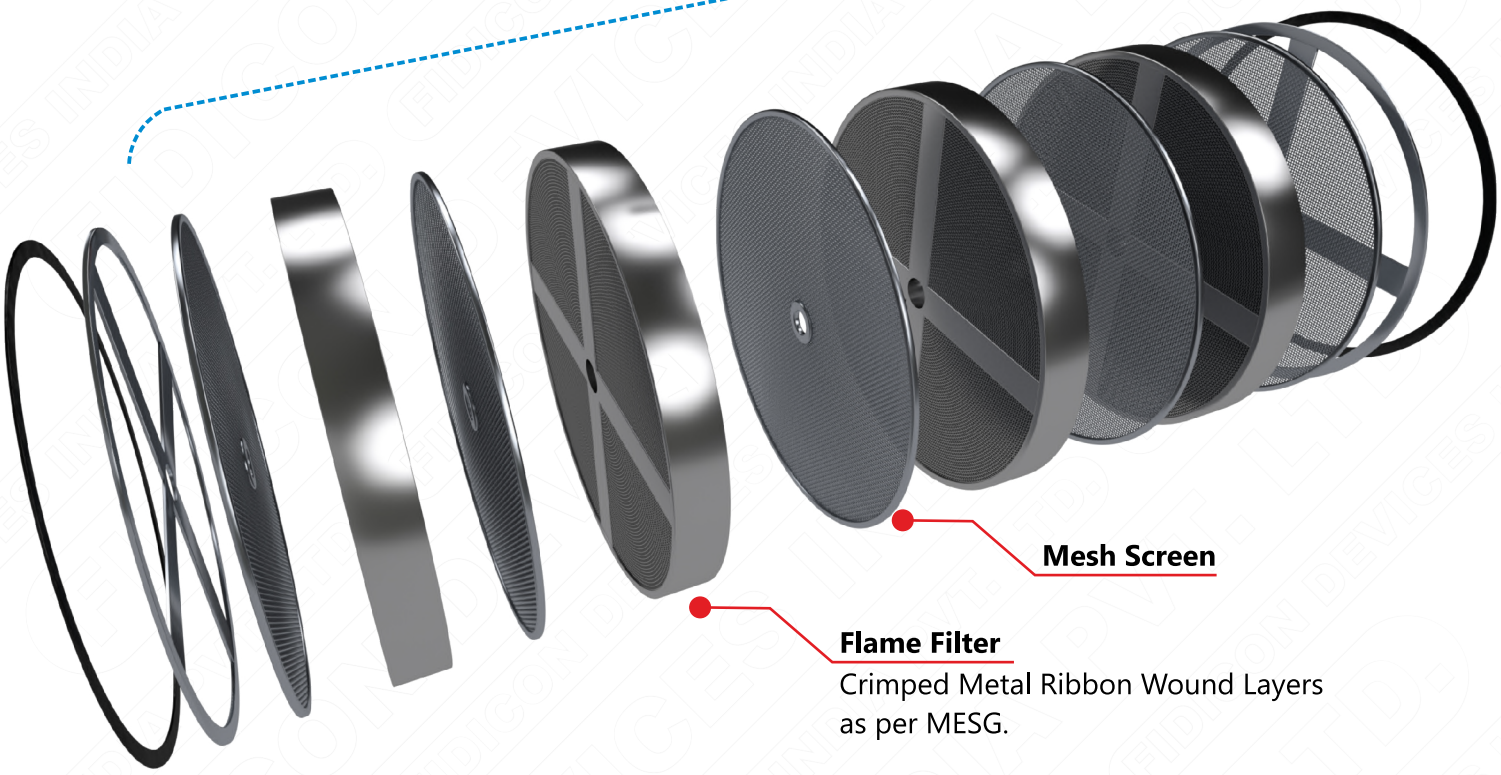


PRODUCT FUNCTIONALITY

Flame Filter Bank is Assembled with End Mounting Plates which Holds Inner Flame stage wise Banks and Mesh Screens at it's Place. Gaskets are Installed as per Design Requirements for Proper Sealing Purpose.



Each Flame Filter Bank Layers have been defined Proper Length Thickness - Requirements for Relative Gas Type / it's application Ensuring the Minimum Pressure Drop is achieved.



APPLICATIONS

Flame arrester are used in different fields of chemical and engineering, as refining, pharmaceutical, chemical, petrochemical, pulp & paper, oil - exploration & production, landfills, mining, power generation and management, bulk liquid transportation, storage tanks etc.

Some cases flames involved with exothermic reaction rather than oxidation process which generates the combustible or reactive gases , process like blending, reacting, separation, mixing, drilling and digesting.

BENEFITS OF PRODUCT

Safety will be Improved implementing our flame arrester product, in your pipeline system which has potential ignition source and risks , it will prevent hazardous acts which can cause harm to personnel, extensive damages to equipments, process plants, environment and production loss.

PERFORMANCE AFFECTING PARAMETERS

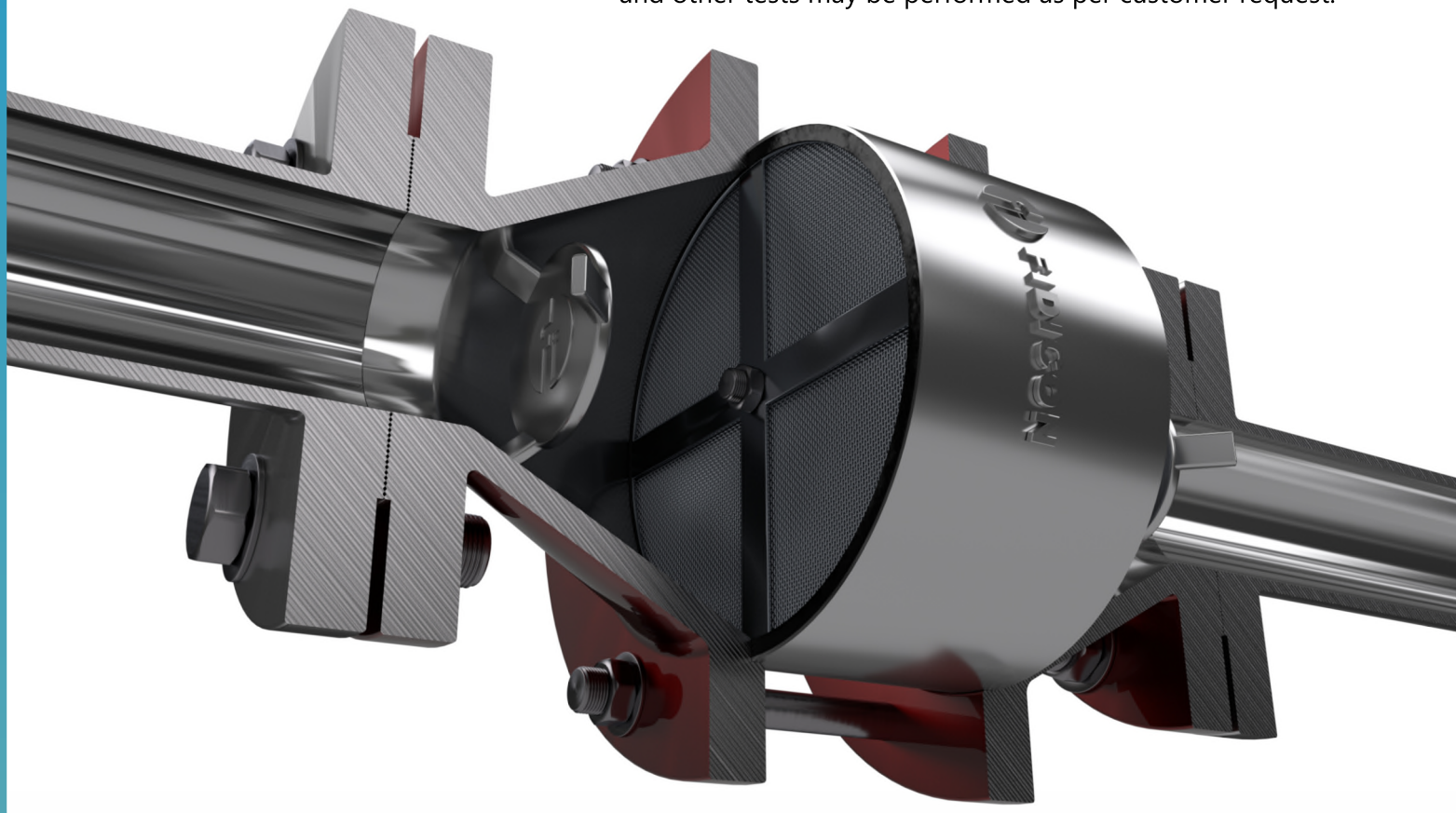
The Performance affecting part here is related with the MESG gap of flame element bank. gap holes may get clogged due to changes in operating conditions of service media - gas / vapor. so in order to maintain Efficiency it's advised to clean and treat Element Bank once in while to maintain it's steady performance and efficiency. it's kindly advised to follow the maintenance procedure from service and maintenance handbook provided or to consult our experts.

Flame arrester shall only been used in the conditions they have been designed and tested for. since the depth of the arrester is specified for certain conditions any changes in temperature, pressure or composition of gas / vapor entering arrester can cause flame spatial velocity to increase making the depth of the flame arrester insufficient to stop flame front - flow, the deflagration may continue downstream of the arrester.

TESTING OVERVIEW

- Flow Capacity
- Dimensional Checks
- Endurance Burn & Continuous Flame Test
- Explosion & Flashback Test
- Hydrostatic Pressure Test
- Pneumatic Air Leakage test
- Leak Test
- Deflagration test
- Additional Burning Test
- Flame Transmission test etc.

*and other tests may be performed as per customer request.



STANDARDS FOLLOWED BY US.

- **API 2000** (American Petroleum Institute)

- **API RP 2210 :** Benefits & Detriments associated with use of Flame Arrester for Vents of Tanks Storing Petroleum Products.

- **API 2028 :** Standard for Flame Arrester in Piping System.
- **USCG 33 CFR154 :**
  (Appendix A : Guidelines for Detonation Flame Arrester)
  (Appendix B : Standard Specification for Tank vent Flame Arrester)

- **UL525 :** Standard for Safety for Flame Arrester UL Gas & Oil Equipment Directory
- **CEN EN 12874 :** Flame Arrester Performance Requirements, Test Methods & Limits for Use.
- **ASTM F 1273 :** Standard Provides Minimum Requirements for Design, Construction, Performance, & Testing of Tank vent flame arrester.
- **IS 11006: 2011 :** Flame Arrester Specifications
- **EN ISO 16852 :** ATEX Compliance Atmospheric Explosible
- **ISO 16852:2016 :** Flame Arrester Performance Requirements Test Methods, & Limits for use.
- **NEC/CEC** (National Electrical Code / Canadian Electrical Code)
- **ASME B 31.3 : 2002**

CERTIFICATIONS

- **IS 11006 : 2011 CSIR-CIMFR**
- **EN 12874 : EN ISO 16852 ATEX COMPLIANCE**
- **ISO 16852 : 2016**

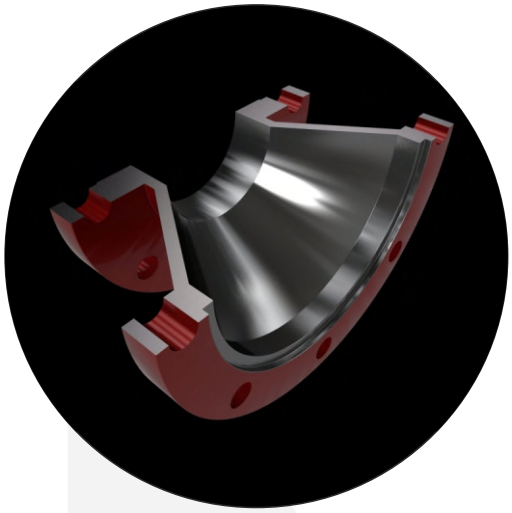
RECOMMENDED DISPOSAL

- Give it back to us & we will take care of recycling & possible disposal.
- User can dis-assemble the product in multiple stage
- The above may be handed over (state pollution board), authorized re-cycler item-wise.

ORDER GUIDE & RECOMMENDED SPARES

ENQUIRY SPECIFICATIONS :

1. Service
2. Density of Gas - Vapour
3. Flow Rates
4. Temperature Ranges
5. Pressure Ranges
6. Allowable Pressure Drop
7. Type of Product (Inline, End of Line etc.)
8. Orientation
7. Connection Type / Pipe Size
8. Material Specifications (For Body , Internal, Fasteners etc.)



STANDARD MATERIAL LIST :

Body M.O.C. (Reducer, Distributor)	Internal M.O.C. (Bank Shell, Element Bank)
ASTM A216 Gr. WCB (CS), SS 316, LM 6 ALUMINUM, SS 304, Forged Steel ASTM A 105, etc.	SS 316 (ASTM A351 GR. CF8M), SS 304 (ASTM A351 GR. CF8), HASTELLOY C (276), etc.
Fasteners	other Materials can be used as per Customer Requirements
SS 304 SS 202	

RECOMMENDED SPARES :

- Flame Element Bank

SOME SIMILAR RANGE OF PRODUCTS,

- End of Line Flame Arresters
- Eccentric Type Flame Arresters
- Deflagration Flame Arresters
- Breather Valve
- Breather Valve cum Flame Arrester , and Many More.

Any Query?
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