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# Model 2400 In-line Duct Flame Arrestor

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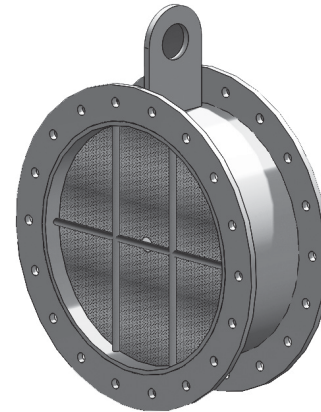


Figure 1. In-line Duct Flame Arrestor



### WARNING

**Failure to follow these instructions or to properly install and maintain this equipment could result in an explosion, fire and/or chemical contamination causing property damage and personal injury or death.**

**Enardo detonation flame arrestor must be installed, operated and maintained in accordance with federal, state and local codes, rules and regulations and Emerson Process Management Regulator Technologies Tulsa, LLC (Emerson) instructions.**

**Failure to correct trouble could result in a hazardous condition. Call a qualified service person to service the unit. Installation, operation and maintenance procedures performed by unqualified person may result in improper adjustment and unsafe operation. Either condition may result in equipment damage or personal injury. Only a qualified person must install or service the detonation flame arrestor.**

## Introduction

### Scope of the Manual

This Instruction Manual provides instructions for installation, operation, maintenance and parts ordering information for the Model 2400 In-line Duct Flame Arrestor.

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## Product Description

This manual applies to the Model 2400 In-line Duct Flame Arrestor which is intended for applications where the maximum distance between the most distant system ignition source and the connection flange of unprotected (hot) side of the flame arrestor are with the limits indicated in the installation section of this manual. This product is to be used in Gas Group IIA flammable vapor applications where the minimum Maximum Experimental Safe Gap (MESG) of the stream is 0.035 in. / 0.90 mm or higher.

## Product Identification and Marking

The product is provided with product identification consisting of a nameplate and an appropriate warning label in accordance with ISO 16852:2016. Please review this information prior to installing the product.

## Construction

The Model 2400 In-line Duct Flame Arrestor consists of a housing assembly consisting of 24 in. Sch. 40 nominal pipe and plate flanges available in Carbon steel, Stainless steel or Hastelloy®. The flame element is available in 304, 316 Stainless steel or Hastelloy®. The housing is fitted with 1/2 in. threaded pipe couplings which are used for the installation of a temperature sensor on the unprotected side of the arrestor. A temperature sensor must be used in order for this product to comply with ISO 16852 guidelines. Standard construction consists of a 10 in. / 254 mm face-to-face dimension.

North America Only

# Model 2400

## Specifications

The Specifications section on this page provides specifications for the Model 2400 In-line Duct Flame Arrestor. Specification is stamped on the nameplate attached to the arrestor. Refer to the Product Identification and Marking section for the nameplate details.

|  |  |
|--|--|
| <b>Available Configuration</b><br>See Figure 2   | <b>Cell Material</b><br>304 Stainless steel, 316 Stainless steel, Hastelloy® |
| <b>Gas Group</b><br>D  | <b>Maximum Experimental Safe Gap (MESG)</b><br>0.035 in. / 0.90 mm           |
| <b>Connection Size</b><br>24 in.   | <b>IEC Gas Group</b><br>IIA  |
| <b>Housing Material</b><br>Carbon steel, 304 Stainless steel,<br>316 Stainless steel, Hastelloy® | <b>Test Gas</b><br>Propane   |

## Principle of Operation

The Model 2400 In-line Duct Flame Arrestor is a passive device that does not require direct operator interaction, provided it is installed in accordance with the installation guidelines. Flame arrestors are designed to stop the propagation of confined low pressure deflagration. They prevent flame propagation by absorbing and dissipating heat using spiral wound crimped ribbon flame cells. These cells allow maximum flow with maximum protection.

## Factors Affecting Flame Arrestor Performance



### WARNING

**Verify that the flame arrestor being installed has the appropriate gas group rating for your process. This information is shown on the nameplate attached to the element housing. Do not remove or alter this nameplate.**

**Do not exceed the maximum initial operating pressure of the flame arrestor. If flame propagation occurs when the system pressure is higher than the maximum initial operating pressure,  $P_o$ , the flame arrestor could be ineffective in stopping the flame propagation.**

**Do not exceed the burn time rating of the flame arrestor. An overheated flame arrestor will fail and allow flame propagation to move into the protected side of the process.**

### Limits of Use

This product is designed to prevent the transmission of a deflagration. This product is not intended to prevent the transmission of detonations. See Table 1 for maximum distance between ignition source and the flame arrestor.

The following vapors are not within the scope of this product:

- Vapors with an MESG less than 0.035 in. / 0.90 mm.

**Table 1. Model 2400 In-line Gas Group IIA Maximum Pipe Length**

| MODEL                | MAXIMUM PIPE LENGTH <sup>(1)</sup> |
|----------------------|------------------------------------|
| 2400/IIA-IL-XX-X-046 | 10 L/D (20 ft. / 6 m)              |
| 2400/IIA-IL-XX-X-059 | 7 L/D (14 ft. / 4 m)               |

1. Maximum length of pipe between the flame arrestor and the ignition source without bends or other turbulence inducing devices ( $L_u$ ).

- Explosive mixtures of vapors and gases which tend to self-decompose (e.g. acetylene) or which are chemically unstable.
- Carbon disulphide, due to its special properties.
- Mixtures other than gas-air or vapor-air mixtures (e.g. higher oxygen-nitrogen ratio, chlorine as an oxidant, etc.).

Arrestors shall only be installed into piping with a nominal size that is smaller than or equal to the nominal size of the flame arrestor connection.

No restrictions or flow obstructions (partially open valve, orifice plate, piping reduction, etc.) on the protected side of the arrestor within the equivalent L/D that the flame arrestor has been tested for on the unprotected side ( $L_u$ ). For example, if the flame arrestor has been tested for  $L_u = 10$  L/D, then restrictions on the protected side cannot be less than 10 L/D.

### Maximum Initial Operating Pressure

This is the pressure of the system at or near static flow conditions. High pressure deflagrations can occur more easily at higher system operating pressures than at pressures near atmospheric. Elevated pressures condense the ignitable gas giving the flame more matter and energy to release thereby boosting the flame heat intensity. Verify that your system pressure at or near static flow conditions does not exceed the maximum pressure shown on the arrestor's nameplate and warning plate.

### Stabilized Burning

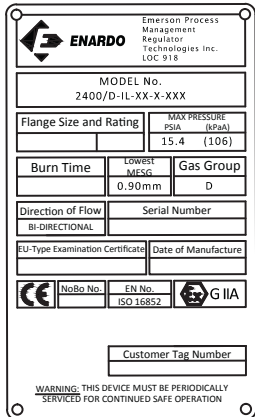


### WARNING

**This flame arrestor has been tested and certified for short time burning,  $t_{bt}$ , of 8 minutes. A temperature sensor must be incorporated**

|                        |   |                      |                       |   |  |  |   |  |   |                          |
|------------------------|---|----------------------|-----------------------|---|--|--|---|--|---|--------------------------|
| 2400                   | / | IIA                  | - IL                  | - | C  | 4  | - | A  | - | 046                      |
| <b>CONNECTION SIZE</b> |   | <b>IEC GAS GROUP</b> | <b>IN-LINE SERIES</b> |   | <b>HOUSING MATERIAL</b>  | <b>CELL MATERIAL</b>   |   | <b>HOLE PATTERN</b>  |   | <b>CRIMP DESIGNATION</b> |
| 2400 = 24 in.          |   | IIA                  |                       |   | C = Carbon steel<br>4 = 304 Stainless steel<br>6 = 316 Stainless steel<br>H = Hastelloy® | 4 = 304 Stainless steel<br>6 = 316 Stainless steel<br>H = Hastelloy® |   | A = ASME CL150<br>B = DIN PN10<br>C = DIN PN6<br>D = Standard<br>E = Other |   | 046<br>059               |

Figure 2. Model 2400 In-line Duct Flame Arrestor Model Number



Example Nameplate

Figure 3. Product Marking Plates

into the unprotected side of the flame arrestor assembly in order that the flow of explosive vapors be stopped within  $t_{st}/2$  (4 minutes) in the event of an elevated temperature relative to normal operating conditions. Bypassing, sufficient diluting or inerting are measures equivalent to stopping the flow.

Stabilized burning is steady burning of a flame stabilized at, or close to, the flame arrestor element. This flame arrestor has been tested for the time it takes for a stabilized flame, at greatest heat saturation conditions, to heat the arrestor element above the auto-ignition temperature of the process gas stream resulting in flame propagation through the arrestor. The short time burn rating is shown on the product warning plate. Stabilized burning after ignition creates additional hazards in applications where there could be a continuous flow of the flammable mixture towards the unprotected side of the flame arrestor.

## Installation



**WARNING**

Always ensure that the system is at atmospheric pressure and there is no ignitable gas that could flash when installing this unit.

## Flow Direction

The Model 2400 In-line Duct Flame Arrestor is bi-directional, however, the temperature sensor must be located on the unprotected (hot) side of the arrestor.

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| WARNING  |                   |  |
|--|-------------------|--|
| FLAME ARRESTORS HAVE INSTALLATION AND APPLICATION LIMITS. TYPE DESIGNATION IN ACCORDANCE WITH ISO 16852. |                   |  |
| DEF  | $L_{U}/D \leq 10$ | BC: $b; t_{BT} = 8 \text{ min}$  |
| Ex. Gp   | IIA               | $T_0 = 60 \text{ }^\circ\text{C}$ $P_0 = 0.106 \text{ MPa}$ (absolute) |

Example Warning Plate 046 Option

| WARNING  |                  |  |
|--|------------------|--|
| FLAME ARRESTORS HAVE INSTALLATION AND APPLICATION LIMITS. TYPE DESIGNATION IN ACCORDANCE WITH ISO 16852. |                  |  |
| DEF  | $L_{U}/D \leq 7$ | BC: $b; t_{BT} = 8 \text{ min}$  |
| Ex. Gp   | IIA              | $T_0 = 60 \text{ }^\circ\text{C}$ $P_0 = 0.106 \text{ MPa}$ (absolute) |

Example Warning Plate 059 Option

## Pipe Connections

The Model 2400 In-line Duct Flame Arrestor is fitted with plate flanges with ANSI, DIN or custom bolting patterns which require the use of full faced gaskets. Do not use ring gaskets for the installation since excessive distortion of the plate flanges can occur.

## Pipe Length



**WARNING**

Do not exceed the maximum L/D pipe length rating ( $L_U$ ) of the flame arrestor. If flame propagation occurs at a distance greater than the L/D rating of the flame arrestor, the flamer arrestor could be ineffective in stopping the flame propagation.

Extended lengths of pipe allow the flame to advance into more severe states of flame propagation including high pressure deflagrations or detonations. All Flame Arrestors included in this series should be installed in accordance with Table 1.

$L_U$ , expressed as a multiple of pipe diameters, is the allowable length of pipe between the flame arrestor and the ignition source without bends or other turbulence causing devices.

## Bends and/or Flow Obstructions



**WARNING**

No instrument, tubing or other device whatsoever shall circumvent the flame arrestor in such a manner to allow a flame path to exist around the flame element of the arrestor. When instrumentation is installed in such a manner that it creates a path circumventing the flame element of an arrestor, measures must be taken to prevent passage of flame through the instrumentation device and/or system. Instrumentation must be capable of withstanding the maximum and minimum pressures and temperatures to which the device may be exposed.

Bends in piping, pipe expansions, and/or contractions, valves, orifice plates or flow obstructing devices of any kind contribute to turbulent flow. Turbulent flow enhances mixing of the combustible gases, greatly increasing the combustion intensity. This can result in increased flame speeds, higher

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flame temperatures, and higher flame front pressures than would occur in normal flow conditions. The Model 2400 In-line Duct Arrestor should not be used in systems where these or similar turbulence inducing components are installed in the unprotected side piping.

No restrictions or flow obstructions (partially open valve, orifice plate, piping reduction, etc.) on the protected side of the arrestor within the equivalent L/D that the flame arrestor has been tested for on the unprotected side ( $L_u$ ). For example, if the flame arrestor has been tested for  $L_u = 10$  L/D, then restrictions on the protected side cannot be less than 10 L/D.

## Maintenance



### WARNING

**Isolate gas supply and bring system to atmospheric pressure to prevent ignitable gas or vapors from flashing while performing maintenance. Eliminate all potential sources of ignition when performing maintenance.**

**Gaskets between the duct arrestor and piping must be replaced each time the duct arrestor is loosened and removed to ensure a gas tight seal when duct arrestor is reinstalled.**

It is important to keep the element openings clean to prevent loss of efficiency in absorbing heat. The flame arrestor assembly should be removed and the element cleaned to prevent the openings from becoming clogged with particulate matter. Clean the element with a suitable

cleaning media (solvent, soap, water, or steam) then blow dry using compressed air. Special care should be taken not to damage or dent the cell openings as this would hamper the effectiveness of the unit. Arrestor elements shall not be cleaned by rodding to remove blockages, as this practice could damage the elements and seriously impair the arrestor's performance. If the arrestor element cannot be cleaned satisfactorily, it must be replaced.


For best cleaning results, a high pressure sprayer with spray wand should be used (1,500 to 3,000 psig / 103 to 207 bar ) to clean the entire element surface. The spray nozzle should be held perpendicular to the surface being cleaned to maximize spray media penetration into the element. Alternately spray each side of the element surface until clean.

The cleaning interval should be governed by the amount and type of particulate in the system to which it is installed and must be determined by the user. To determine the maintenance interval the user should check the element in the first few months of operation to find how quickly particulate accumulates in the cells. After cleaning, the element should be thoroughly inspected for damage. If damaged, it must be replaced. **Under no circumstance should the flame element bank be disassembled from its housing.** The Model 2400 In-line Duct Flame Arrestor must be replaced as a unit if damaged.

## Parts Ordering

When corresponding with your local Sales Office about this equipment, always reference the equipment serial number stamped on the nameplate.

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