EN-DFA Series Detonation Flame Arrestor (EN ISO 16852 Certified)

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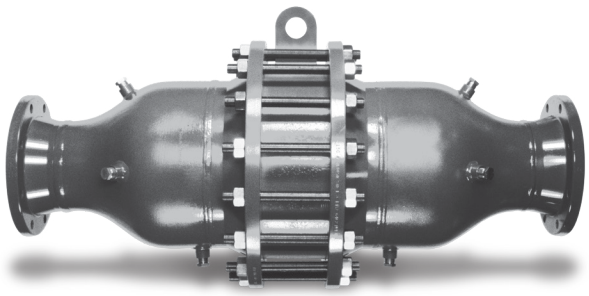

Figure 1. *Typical EN-DFA Series Detonation Flame Arrestor*

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, (Emerson) LLC 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, startup, maintenance and parts ordering information for the EN-DFA Series detonation flame arrestor.

Flame Arrestor Classification

The flame arrestors within the scope of this document have been tested and certified as unstable detonation flame arrestors and are therefore suitable for deflagrations, stable detonations and unstable detonations, as defined by EN ISO 16852:2016, propagating along pipe into connecting pipework. This is the highest performance rating available for a detonation arrestor and it exceeds the performance rating of an arrestor certified for stable detonations and deflagrations only.

Detonation flame arrestors may be used for open and closed pipe work on the unprotected (“hot”) side.

North America Only

ENARDO™

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Specifications

The Specifications table lists the specifications for the detonation flame arrestors. The following information is stamped on the nameplate attached to the arrestor: model number, flange size and rating, maximum initial operating pressure, ISO reference number (International Standard), ISO type examination certificate, notified body number, gas group, date of manufacture and serial number; other identification and customer tag number are optional.

Available Constructions

See Table 1 and Figure 3

Gas Group

IIA and IIB3

Flange Sizes and Rating

2 to 12 in. / 50 to 300 mm
CL150 RF and CL150 FF **(standard)**
Other connection flange sizes and ratings available upon request

Housing Size

4 to 26 in. / 100 to 660 mm

Maximum Experimental Safe Gap (MESG)

See Table 4

Maximum Initial Operating Pressure

See Table 5

Operational Temperature (T_o)[1]

-4 to 140°F / -20 to 60°C

Temperature Rating of Metal Reinforced Graphite[1]

850°F / 450°C

Burning Time Rating

Less than 1 minute

Housing Material

Carbon steel, 304 Stainless steel, 316 Stainless steel and Hastelloy®

Element Material

304 Stainless steel, 316 Stainless steel and Hastelloy®

EN Number (European Standard)

EN ISO 16852:2016

1. The pressure/temperature limits in this Instruction Manual and any applicable standard or code limitation should not be exceeded.

Table 1. *EN-DFA Series Detonation Flame Arrestor Available Construction (ATEX Approved)*

MODEL	FLANGE SIZE		HOUSING SIZE	
	In.	mm	In.	mm
EN-DFA-0402	2	50	4	101
EN-DFA-0603	3	75	6.6	168
EN-DFA-0804	4	100	10	254
EN-DFA-1206	6	150	14	356
EN-DFA-1608	8	200	18	457
EN-DFA-2010	10	250	22	559
EN-DFA-2412	12	300	26	660

Product Description

The EN-DFA Series detonation flame arrestor represents the best value in flame arrestor protection. The detonation flame arrestor provides protection against flame propagation in piping systems that are manifolded or have long run-up distances. These are typically used for extended pipe length or multiple pipe bend configurations to stop high pressures and flame velocities with detonations and overdriven detonations. It also stops confined and unconfined, low and high pressure deflagrations. The design is unique in the ability to provide large flame channels which requires less frequent maintenance and greater ease in cleaning when service is required, translating to less down time. EN-DFA Series detonation flame arrestors are bi-directional and proven to stop an ignited flammable vapor mixture approaching from either direction that can be travelling at subsonic or supersonic velocities. The patented element offers maximum flow to pressure drop characteristics enhancing the value of the flame arrestor in any system.

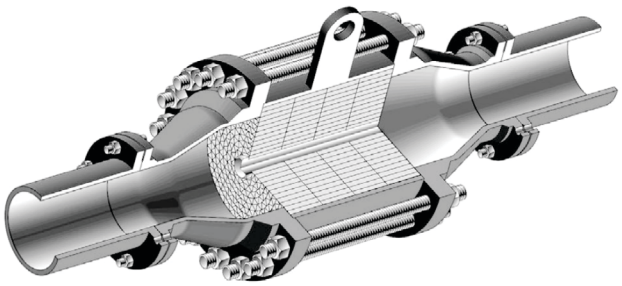

Figure 2. *Cut-away view of EN-DFA Series Detonation Flame Arrestor*

EN	DFA					/		-				-			
	Detonation Flame Arrestor	**Housing Size**		**Connection Size**			**IEC Gas Group**		**Housing Material**	**Element Material**	**Connection Type**		**Options**		
	(Concentric)	04 = 4 in. through 26 = 26 in.		02 = 2 in. through 12 = 12 in.			IIA (D) IIB3 (C)		C = Carbon Steel 4 = 304 SST 6 = 316 SST H = Hastelloy®	4 = 304 SST 6 = 316 SST H = Hastelloy®	F = Flat face flange R = Raised face flange		1 = Drain Plug 2 = Pressure Tap 3 = Temperature Probe Tap **(standard)** 4 = Miscellaneous 5 = Protective coating 6 = Special feature		

Figure 3. *EN-DFA Series Detonation Flame Arrestor Available Constructions and Model Numbering System*

The EN-DFA Series is designed with flanged connections, and the arrestor provides the option of the removal of the flame cell element for easy cleaning and replacement without disconnecting of the pipe connection.

Principle of Operation

Detonation flame arrestor prevents flame propagation as it enters the exposed side of the unit to the protected side by absorbing and dissipating heat using spiral wound crimped ribbon flame cells. This detonation flame arrestor utilizes a patented element assembly that dampens the high velocities and pressures associated with deflagrations and detonations while quenching the flame front. These cells allow maximum flow with maximum protection.

Detonation flame arrestor has the heat capacity and structural design to withstand all the dynamic conditions of flame propagation and still stop the flame. Detonation flame arrestor is used when the flame can be in any of the detonation states.

Limits for Use

The operational temperature, T_0, shall be limited as follows:

$-4°F \leq T_0 \leq 140°F$ / $-20°C \leq T_0 \leq 60°C$

The operation pressure, p_0, shall be limited as follows:

See Table 5

Hastelloy® C is a mark owned by Haynes International, Inc.

Flame arrestor use shall be limited to gas-air mixtures with an Maximum Experimental Safe Gap (MESG) equal to or greater than that tested.

Additional Protection Measures: Flame arrestors may be used with additional protection measures. The overall safety of the combined installation shall be accessed, taking account of any hazardous area classification (zones) and the likelihood of additional ignition sources.

Factors Affecting Flame Arrestor Performance

Gas Group

The type of gas in the system determines its gas grouping and therefore predetermines the type of arrestor element required. The element must be designed to accommodate the specific gas group that could possibly ignite and propagate in the system. The more explosive gases require the flame cell to absorb the heat more quickly and efficiently. The International Electrotechnical Commission (IEC) groups gases and vapors into Groups IIA through IIC categories depending on a number of factors including the MESG of the gas.

WARNING			
Flame Arrestors have installation and application limits Type designation in accordance with EN ISO 16852:2016			
DET 2	L_u/D = n/a	BC: b; t_{BT} = 1 min	
	Ex. G IIA	T_o = 60°C	P_o = 122.3 kPa (absolute)

WARNING LABEL OF EN-DFA-0402/IIA THROUGH EN-DFA-1206/IIA (SEE TABLE 2)

WARNING			
Flame Arrestors have installation and application limits Type designation in accordance with EN ISO 16852:2016			
DET 2	L_u/D = n/a	BC: b; t_{BT} = 1 min	
	Ex. G IIA	T_o = 60°C	P_o = 116.3 kPa (absolute)

WARNING LABEL OF EN-DFA-1608/IIA THROUGH EN-DFA-2412/IIA (SEE TABLE 2)

Ex G IIA

WARNING			
Flame Arrestors have installation and application limits Type designation in accordance with EN ISO 16852:2016			
DET 2	L_u/D = n/a	BC: b; t_{BT} = 1 min	
	Ex. G IIB3	T_o = 60°C	P_o = 118.3 kPa (absolute)

WARNING LABEL OF EN-DFA-0402/IIB3 THROUGH EN-DFA-2412/IIB3 (SEE TABLE 2)

Ex G IIB3

HAZARDOUS LOCATIONS

Figure 4. *Product Identification and Marking*

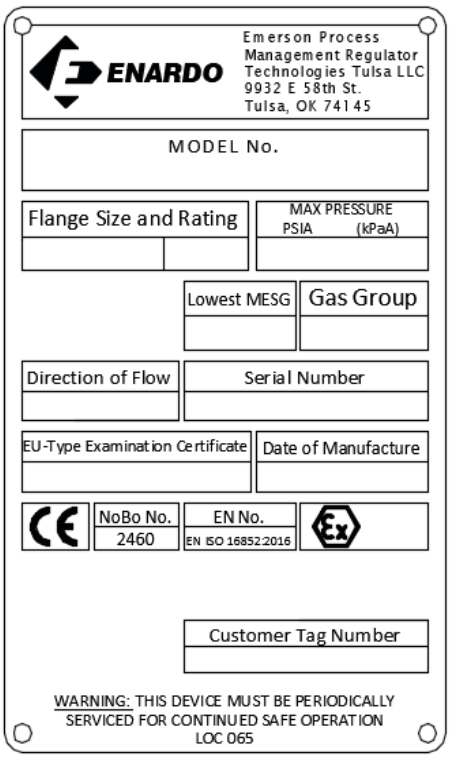

Figure 5. *Marking Plate*

Table 2. *Warning Label Information*

INFORMATION	DESCRIPTION
DET	Indicates product is a Detonation Flame Arrestor
2	Tested for unstable detonation without restriction
L_u/D = n/a	The ratio of pipe length (between the potential ignition source and the flame arrestor) and pipe diameter. It indicates unlimited
BC: b	Indicates the flame arrestor is for short-time burning not to exceed 1 minute
Ex. G IIA	Indicates the arrestor is rated for use in Explosion Group IIA vapors
Ex. G IIB3	Indicates the arrestor is rated for use in Explosion Group IIB3 vapors
T_o	Indicates maximum operational temperature of flame arrestor
P_o	Indicates maximum operational pressure of flame arrestor

Table 3. *Marking Plate Information*

MARKING PLATE FIELD	MARKING
MODEL No.	Per order, ex. EN-DFA-1206/IIA-C4R-2
Flange Size and Rating	Per order, ex. 3 in CL150
Max Pressure (P_o)	Appropriate value from Table 5
Lowest MESG	Appropriate value from Table 4
Gas Group	IIA or IIB3, per order
Direction of Flow	Bi-directional. If product ordered with (1) temperature sensor, flow arrow will be added to unit
Serial Number	Per order
EU-Type Examination Certificate	Based on unit ordered
Date of Manufacture	Date of manufacture
Customer Tag Number	Based on customer request

Table 4. *Maximum Experimental Safe Gap (MESG)*

NATIONAL ELECTRIC CODE (NEC)	INTERNATIONAL ELECTROTECHNICAL COMMISSION (IEC)	MESG		TEST GAS LIST
		In.	mm	
Group D	Group IIA	> 0.035	> 0.90	Propane
Group C	Group IIB3	≥ 0.026	≥ 0.65	Ethylene
Group B	Group IIC	< 0.020	< 0.50	Hydrogen

Table 5. *Maximum Initial Operating Pressure P_o*

EXPLOSION GROUP	CONNECTION SIZE		P_o	
	In.	mm	psia	kPa a
IIA	2 to 6	50 to 150	17.7	122.3
IIA	8 to 12	200 to 300	16.9	116.3
IIB3	2 to 12	50 to 300	17.2	118.3

Maximum Experimental Safe Gap (MESG)

The MESG is the measurement of the maximum gap between two equatorial flanges on a metal sphere that will prevent a flame from being transmitted from the sphere to the surrounding flammable mixture. MESG is dependent on gas composition. The stoichiometric mixture (the ideal air/fuel ratio for the most efficient combustion) is used to determine the minimum MESG for a given gas.

Maximum Initial Operating Pressure, p_0

Detonation flame arrestors tested at p_{TB} (pressure before ignition) are suitable for operational pressures $p_0 \leq p_{TB}$ in the same or smaller pipe size when the application is limited to mixtures with an MESG equal to or greater than that tested. See Table 5 for maximum initial operating pressure limits, p_0. If p_0 is exceeded at the time of ignition, there is a risk of the flame arrestor being unable to stop the flame front and flame transmission through the flame arrestor is possible.

Table 6. *Temperature Sensor Safety Specifications*

TECHNICAL DATA	THERMOCOUPLE	
Design Type	**Standard** with thermowell	**Standard** without thermowell
Model	185 03J1	Code 0185 thermocouple (IEC 584 Class 1) without thermowell
Manufacturer	Emerson Rosemount	Emerson Rosemount
EC-Type Approval Certificate	FM12ATEX0065X ATEX: EN 60079-0:2012+A11:2013; EN 60079-1: 2014	FM12ATEX0065X ATEX: EN 60079-0:2012+A11:2013; EN 60079-1: 2014
Temperature Sensor Design	Type-K thermocouple	Type-K thermocouple
Type of Ignition Protection	II 2 G Ex d IIC T6...T1 Gb, T6(–50°C ≤ Ta ≤ + 40°C), T5... T1 (–50°C ≤ Ta ≤ + 60°C)	II 2 G Ex d IIC T6...T1 Gb, T6(–50°C ≤ Ta ≤ + 40°C), T5... T1 (–50°C ≤ Ta ≤ + 60°C)
Protection Type (Connection Head)	Rosemount Aluminum Explosion proof, 2-wire, 3-wire, 4-wire type A, 4-Wire type as specified by customer Intrinsically safe option is available	Rosemount Aluminum Explosion proof, 2-wire, 3-wire, 4-wire type A, 4-Wire type as specified by customer Intrinsically safe option is available
Measuring Probe (Measuring Insert)	1/2 MPT or optional M24 x1.5. Intended for installation into thermowell.	1/2 MPT. Intended for installation without thermowell.
Connection Thread	1/2 MPT. Intended for installation into thermowell	1/2 MPT. Intended for installation without thermowell.
Transmitter	Optional by customer request	Optional by customer request
Intended Application	In-line flame arrestors and detonation arrestors	End-of-line flame arrestors. Free-vent style.

TECHNICAL DATA	THERMOCOUPLE	
Design Type	**Standard** with thermowell	**Standard** without thermowell
Model	TC 10-2 (for additional Thermowell)	TC10-H (threaded for direct insertion without thermowell)
Manufacturer	WIKA	WIKA
EC-Type Approval Certificate	ATEX and IECEx certifications	ATEX and IECEx certifications
Temperature Sensor Design	Type-K thermocouple	Type-K thermocouple
Type of Ignition Protection	II 2 G Ex d IIC T6...T1 Gb, T6(–50°C ≤ Ta ≤ + 40°C), T5... T1 (–50°C ≤ Ta ≤ + 60°C)	II 2 G Ex d IIC T6...T1 Gb, T6(–50°C ≤ Ta ≤ + 40°C), T5... T1 (–50°C ≤ Ta ≤ + 60 °C)
Protection Type (Connection Head)	Explosion proof, 2-wire, 3-wire, 4-wire type A, 4-Wire type as specified by customer. Intrinsically safe option is available .	Explosion proof, 2-wire, 3-wire, 4-wire type A, 4-Wire type as specified by customer. Intrinsically safe option is available.
Measuring Probe (Measuring Insert)	Spring loaded plate Probe allows use of transmitter. Length varies by flame arrestor size.	Probe length varies by flame arrestor size. Adjustable insertion length.
Connection Thread	1/2 MPT or optional M24 x1.5. Intended for installation into thermowell.	1/2 MPT. Intended for installation without thermowell.
Transmitter	Optional by customer request	Optional by customer request
Intended Application	In-line flame arrestors and detonation arrestors	End-of-line flame arrestors. Free-vent style.

Table 7. *Torque Values for Raised Face Connection Flange (Steel Only)*

NOMINAL PIPE DIAMETER	NUMBER OF BOLTS	BOLT DIAMETER		TORQUE	
		In.	mm	Ft-lb	N•m
1	4	0.50	12.70	9	12.20
1-1/4	4	0.50	12.70	13	17.63
1-1/2	4	0.50	12.70	18	24.40
2	4	0.63	16.00	35	47.45
2-1/2	4	0.63	16.00	41	55.59
3	4	0.63	16.00	60	81.35
3-1/2	8	0.63	16.00	34	46.10
4	8	0.63	16.00	43	58.30
6	8	0.75	19.05	80	108.5
8	8	0.75	19.05	109	147.8
10	12	0.88	22.4	101	136.9
12	12	0.88	22.4	135	183.0

Assumptions: Use of SAE grade 5 bolts or studs or stronger
No lubricant
Compressed mineral fiber material or similar
Notes: If lubricant is used on bolts, apply torque reduction factor listed in Lubricant Table. For best results hardened steel washers should be used on all cast flange bolted connections.

Table 8. *Torque Values for Flat Face Connection Flange (Steel Only)*

NOMINAL PIPE DIAMETER	NUMBER OF BOLTS	BOLT DIAMETER		TORQUE	
		In.	mm	Ft-lb	N•m
1	4	0.50	12.70	14	18.98
1-1/4	4	0.50	12.70	16	21.69
1-1/2	4	0.50	12.70	18	24.41
2	4	0.63	16.00	32	43.39
2-1/2	4	0.63	16.00	43	58.30
3	4	0.63	16.00	47	63.72
3-1/2	8	0.63	16.00	26	35.25
4	8	0.63	16.00	32	43.39
6	8	0.75	19.05	49	66.44
8	8	0.75	19.05	68	92.20
10	12	0.88	22.4	69	93.55
12	12	0.88	22.4	98	132.9

Assumptions: Use of SAE grade 5 bolts or studs or stronger
No lubricant
Elastomer < 70 Durometer Shore A
Notes: If lubricant is used on bolts, apply torque reduction factor listed in Lubricant Table. For best results hardened steel washers should be used on all cast flange bolted connections.

Table 9. *Torque Correction Factors for Common Lubricants Applied on Connection Fasteners*

DESCRIPTION	COEFFICIENT OF FRICTION	MULTIPLY TORQUE VALUE IN TABLE 8 BY
Machine Oil	f = 0.15	0.75
API SA2 Grease	f = 0.12	0.60
Nickel-based Lubricant	f = 0.11	0.55
Copper-based Lubricant	f = 0.10	0.50
Molydisulfide Based Lubricating Paste	f = 0.06	0.30

Burn Time Rating

WARNING

Temperature sensors must be used with this product if there is a potential for stabilized burning inside the arrestor. Additional external safety equipment is required to ensure appropriate corrective measures are taken within 30 seconds to protect the system if an abnormal temperature is detected. Never disconnect or remove these devices in active process systems.

All Model EN-DFA detonation flame arrestors are rated for short time burning, t_{BT} not to exceed one minute in accordance with EN ISO 16852:2016. This burn time was determined at atmospheric pressure. If there are operating conditions which can lead to a stabilized burning event, additional safety measures are required. Depending on the operating conditions, the devices shall be equipped with temperature sensors on one or both sides of the flame arrestor element. These temperature sensors are installed into the system in such a way that they trigger the initiation of measures for the elimination of the stabilized burning (for example, emergency functions like switching-off the system, inerting or similar). These measures must occur within half of the time for which the flame arrestor is short-time burn proof (0.5 x t_{BT}). See Figure 4 for warning labels showing burn rating, t_{BT}. This requires that measures must be able to be taken within 30 seconds.

Threaded instrumentation ports, with standard 3/4 NPT threads, are integrated into each end section. Other instrumentation port thread sizes can be requested.

If the user requests the addition of temperature sensors by Emerson, they will either be installed and shipped threaded into the appropriate instrumentation ports in the flame arrestor end sections or shipped separately with the flame arrestor. To install the temperature sensors that have been shipped separately, simply remove any protective packaging from the temperature sensors and thread the temperature sensors into the appropriate threaded instrumentation ports on the flame arrestor end sections making sure to follow temperature sensor manufacturer's instructions, particularly for wiring.

In the case where only one temperature sensor was requested from Emerson, the flame arrestor will be marked with a flow arrow to indicate flow direction and the temperature sensor will be installed on the downstream or unprotected ("hot") side of the flame arrestor. This is the side of the flame arrestor closest to the source of ignition. If the temperature sensor is shipped separately, the user shall be responsible for

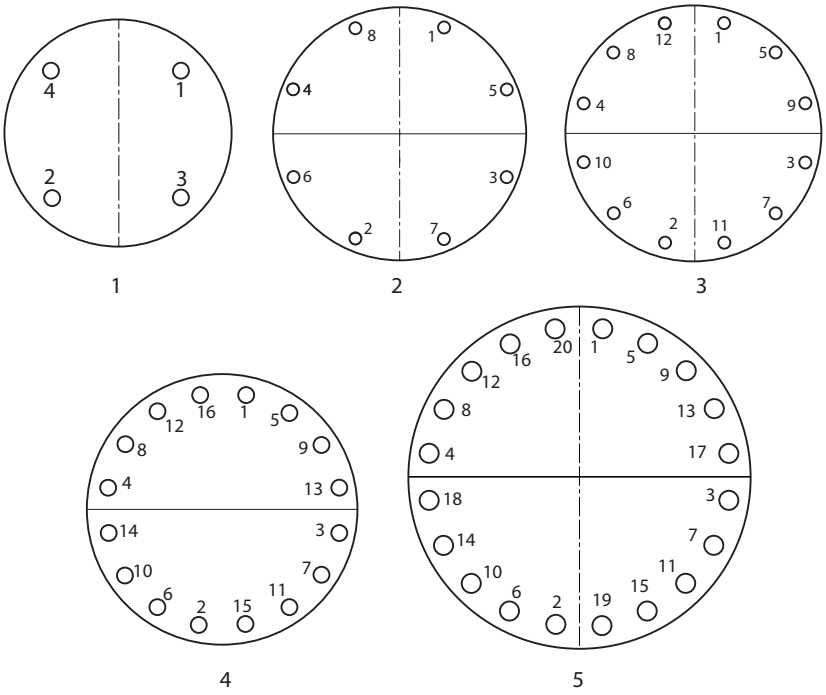

Figure 6. *Flange Pattern Tightening Sequence*

installing the temperature sensor in the appropriate instrumentation port on the downstream or unprotected (“hot”) side of the flame arrestor. Model EN-DFA detonation flame arrestors are bi-directional, so if a temperature sensor is not requested with the flame arrestor, then no flow arrow will be installed on the unit, and the end user shall be responsible for installation of the temperature sensor on the unprotected (“hot”) side of flame arrestor. This is the side of the flame arrestor closest to the source of ignition.

A temperature rise of 20 K (36°F / 20°C) above the flame arrestor maximum operating temperature or 20 K (36°F / 20°C) above the process operating temperature, whichever is lower but not to exceed 20 K (36°F / 20°C) above the flame arrestor operating temperature, is the recommended activation temperature for initiation of measures against stabilized burning.

Note that a rise in temperature measured by the temperature sensor can indicate to the user deflagration and/or detonation events have occurred as well. This should be used as a trigger to investigate what conditions have lead to ignition of flammable vapors, to inspect the flame arrestor for damage, and to initiate appropriate corrective actions relative to process system and safety.

Temperature sensors installed by Emerson or installed by the user shall follow the specifications or Table 6. Different temperature sensors may be installed by the end user, however these must comply with the safety specifications in Table 6. The use of alternate temperature sensors must include evidence of equivalent response rates to the specified sensors in Table 6, particularly as the EN-DFA Series is rated for short time burning.

If t_{BT} is exceeded during a short-time burning situation, the flame arrestor safety cannot be assured.

If an elevated temperature has been detected by the temperature sensor, whether due to flash back or stabilized burn, the temperature sensor shall be inspected for damage and replaced as necessary. If the recorded temperature exceeds the design temperature of the temperature sensor then the measuring probe shall be replaced.

Pipe Length

Extended lengths of pipe allow the flame to advance into more severe states of flame propagation such as high pressure deflagrations and detonations. Although the detonation flame arrestor is not limited by pipe length, using a minimum length is a preferred design and installation practice.

Bends and/or Flow Obstructions

CAUTION

For maximum safety, avoid bends and flow obstructions within 10 pipe diameters but not less than 10 ft / 3 m on the protected side of the detonation flame arrestor.

Table 10. *Tightening Steps and Torque Values for Body Fasteners for Element Assembly[1][2]*

MODEL	PATTERN[3]	BOLT SIZE	TIGHTENING STEPS AND TORQUE (FT-LB / N•m)					
			1	2	3	4	5	6
EN-DFA-402	1	5/8-11	Snug	10 / 14	35 / 47			
EN-DFA-603	2	3/4-10	Snug	30 / 41	80 / 108			
EN-DFA-804	2	3/4-10	Snug	50 / 68	100 / 135	160 / 217		
EN-DFA-1206	3	7/8-9	Snug	50 / 68	100 / 135	175 / 237		
EN-DFA-1608	4	1-8	Snug	50 / 68	120 / 163	200 / 271	285 / 386	
EN-DFA-2010	5	1-1/8-8	Snug	50 / 68	120 / 163	200 / 271	310 / 420	
EN-DFA-2412	5	1-1/4-8	Snug	75 / 102	150 / 203	280 / 380	400 / 542	535 / 725

1. Using machine oil as lubricant. See Bolt Lubrication section on page 12 and torque correction factors for other lubricants in Table 11.
2. Alloy steel element assembly fasteners are provided with a low friction polymer coating. No additional lubrication should be required. When stainless steel fasteners are provided, lubrication is recommended to reduce tightening torque and to prevent potential galling.
3. See Figure 6.

Table 11. *Torque Correction Factors for Common Lubricant*

DESCRIPTION	COEFFICIENT OF FRICTION	MULTIPLY TORQUE VALUE IN TABLE 7 BY
Machine Oil	f = 0.15	1.00
API SA2 Grease	f = 0.12	0.80
Nickel-based Lubricant	f = 0.11	0.73
Copper-based Lubricant	f = 0.10	0.67
Molydisulfide Based Lubricating Paste	f = 0.06	0.40

Bends in piping, pipe expansions and/or contractions, valves, orifice plates or flow obstructing devices of any kind cause turbulent flow. Turbulent flow enhances mixing of the combustible gases, greatly increasing the combustion intensity. This can result in increased flame speeds, higher flame temperatures and higher flame front pressures than would occur in normal flow conditions. Obstructions in protected side piping can cause reflective pressures that might inhibit the effective performance of the EN-DFA Series under certain conditions.

Installation

⚠ WARNING

Always make sure that the system is at atmospheric pressure and there is no ignitable gas that could flash when either installing or maintaining the unit.

Connection

EN-DFA Series are normally provided with CL150 or PN 16 raised or flat faced flanges. Other flanges are sometimes provided on special request. Make sure the companion flanges installed in adjacent piping match the flanges on the detonation flame arrestor.

For proper bolt torquing of the detonation arrestor to the piping, please refer to Tables 7, 8 and 9.

Standard compressed fiber gaskets that will withstand temperatures of 450°F / 232°C or higher are normally used, but other materials of equal or higher temperature capability may be used at the customer's discretion.

Flow Direction

This EN-DFA Series is bi-directional and can be installed either vertically or horizontally. Consideration should be given to non-symmetrical assemblies that include features such as clean-out ports, temperature sensors or other devices that might have a preferred installation direction to suit the needs of the customer. Compliance with warning associated with temperature sensors is essential. See Burning Time Rating section.

Positioning

⚠ WARNING

If the detonation flame arrestor is equipped with a single factory installed temperature sensor, the arrestor shall be installed with the sensor on the unprotected side of the arrestor, the side nearest the potential source of ignition.

⚠ CAUTION

The detonation flame arrestor is fitted with lugs for lifting the element assembly during servicing operations.

These lugs are not intended for lifting the entire unit during installation. Damage to the detonation flame arrestor may result from improper lifting. The unit should be lifted using appropriately rated Nylon (PA) straps rigged on the outside of the tension studs.

The arrestor should be positioned such that the entire arrestor is accessible for removal. Models that have drain plugs are designed for horizontal installation and should be installed with the drain plugs aligned at the bottom of the unit. Models that have pressure taps are designed to allow pressure gauges to be installed on both sides of the flame cell assembly to determine blockage. The pressure taps should be aligned at the top to allow easy viewing of the gauges. Units that are equipped with optional internal cleaning systems should be connected to a source of cleaning media such as water, steam or other suitable solvent. Observe recommended installation practice as previously described.

Piping Expansions and Reductions Adjacent to Detonation Flame Arrestor

⚠ WARNING

No instrument, tubing or other device whatsoever shall circumvent the detonation 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 and at a minimum be capable of withstanding a hydrostatic pressure test of 350 psig / 24 bar.

For an in-line flame arrestor, the pipe diameter on the protected (“cold”) side shall be no less than the pipe diameter on the unprotected (“hot”) side. For an in-line flame arrestor, the pipe diameter on the unprotected (“hot) side shall be no greater than the flame arrestor connection. When it is necessary to increase the diameter of the piping on the downstream side (unprotected) of the detonation flame arrestor, a length of pipe at least 120 pipe diameters must be installed between the detonation flame arrestor and the expansion. A pipe diameter is considered as the inside diameter of pipe having a nominal size equal to the detonation flame arrestor’s connecting flanges.

Maintenance

⚠ WARNING

Isolate gas supply and bring system to atmospheric pressure to prevent ignitable gas from flashing while performing maintenance.

⚠ CAUTION

The flame cells in the arrestor’s element assembly are not retained once the element assembly has been removed from the arrestor. They can slide out of the housing during handling. It is recommended that the element assembly only be removed after the entire arrestor has been removed from the piping system.

Element Disassembly

1. Loosen all nuts on tension studs between conical sections of the detonation flame arrestor.

⚠ CAUTION

Element assemblies are heavy and will require the use of adequate equipment and manpower to prevent injury.

2. Carefully force the two conical sections apart while the nuts are still on the tension studs. When the two flange faces have separated, remove enough of the tension studs such that the element assembly can be removed. Not all studs are required to be removed to be able to rotate the element assembly out of the housings. It is possible for the elements to come out of the housing once the end sections have been removed.

Inspecting and Cleaning the Flame Cells

1. Inspect flame cells for damage immediately following a deflagration, detonation and/or stabilized burn.

2. Carefully remove the element assembly from the arrestor. Place the element assembly on a soft surface such as plywood and push the flame cells from the housing. It might be necessary to tilt the housing to facilitate removal of the flame cells.
3. Note the order in which the flame cells were removed. For Group IIA units, there are four 2 in. / 51 mm thick flame cells. For Group IIB3 units, the outer two flame cells are 2 in. / 51 mm thick and the two inner flame cells are 1 in. / 25 mm thick. A screen of expanded metal is located between each adjacent set of flame cells.
4. Inspect the flame cells and the screens visually for any signs of corrosion or other damage and inspect the flame cells with a calibrated pin gauge to ensure maximum crimp size openings do not exceed the following values for their respective gas group:

   • Explosion Group IIA – 0.051 in. / 1.295 mm
   • Explosion Group IIB3 – 0.0216 in. / 0.549 mm
5. If any damage is noted or crimp openings exceed maximum size allowable, the flame cells and/or the screens must be replaced.

Note

Under no circumstance shall any other screens not provided by Emerson be used in this assembly. Failure to use the correct screens may lead to arrestor failure.

6. It is important to keep the element openings clean to prevent loss of efficiency in absorbing heat. The element assembly should be removed and the elements cleaned to prevent the openings from becoming clogged with particulate matter or other contaminants. 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 with wire or other hard objects 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.
7. For best cleaning results, a high pressure sprayer with spray wand should be used (1500 to 3000 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.
8. 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.
9. Thoroughly clean the gasket sealing faces being careful not to damage the sealing surface. For reassembly a new gasket must be used and placed in the machined recess of each interior flange on the two conical sections.
10. Replace the flame element assembly with a new assembly or properly cleaned and inspected existing unit.
11. Locate the flame cell assembly such that it seats onto the gaskets.
12. Replace all tensioning studs and tighten the outer nuts hand tight only.
13. Torque the bolts in sequence as shown in the following instructions.

Torquing Instructions

CAUTION

Excessive or uneven torque can cause permanent damage to gaskets and housing.

Tools/Supplies Required

- Hand operated conventional torque wrench or power assisted torque wrench appropriate for the specified torque.
- Socket wrenches of the proper size to fit the hex nuts being tightened.
- Lubricant for fasteners, as appropriate.
- Brush suitable for applying lubricant to the studs.
- Wiping rags necessary for the clean up of excessive lubricant.

Procedure

1. Use studs and nuts that are free of visible contamination and corrosion.
2. Apply lubricant to the threads of the stud protruding outboard of the interior flanges and to the face of the hex nuts which will contact the flange for stainless steel fasteners. Alloy steel fasteners have a polymer coating and do not require additional lubrication.

3. Assemble the nuts to the studs such that the amount of thread extending outboard beyond the nut is approximately equal on both ends.
4. Tighten the nuts to the torque values shown in Table 10 following the designated sequence, repeating he sequence as shown. Flange pattern tightening sequences are shown in Figure 6.

Bolt Lubrication

Lubrication will affect required torque of clean fasteners in good condition more than any other factor. In fact, 90% of applied torque goes to overcome friction while only 10% actually stretches the bolt. Table 10 assumes that only factory polymer coating is used for alloy steel fasteners and machine oil is used for stainless steel fasteners as a lubricant. Table 9 shows a list of several common lubricants and their effect on torque required to stretch bolts to 50% of their yield strength. Most are available from local bearing distributors.

Recommended Spare Parts

The crimp openings in Enardo™ detonation flame arrestors are relatively large and are therefore quite easy to clean. Plugging will normally be limited to the flame cell and screen that are installed at the inlet side of the arrestor's element assembly. If plugging should occur, the plugged flame cell(s) and screen(s) can be cleaned as detailed above, reinstalled and used again, provided there is no damage and not plugged to an extent that cleaning is not effective. For installations with dirty process conditions where frequent maintenance is necessary, it is recommended that the user purchase a spare element assembly and several spare element gaskets. The spare element assembly can be installed immediately and the dirty assembly can then be cleaned and be stored as a spare for the next maintenance interval.

Note

Element gaskets must be replaced each time the cell assembly is loosened and removed. Gasket must be made from high temperature graphite material. It is recommended that replacement gaskets be ordered from Emerson.

Parts Ordering

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

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