

Enardo EN-7 Series Flame Arrestor (ISO 16852 Certified)

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Figure 1. Enardo EN-7 Series 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.

Fisher™ flame arrestors 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.

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 shall install or service the Enardo EN-7 Series flame arrestor.

Introduction

Scope of the Manual

This manual provides specifications, installation and maintenance instructions and parts ordering information for the Enardo EN-7 Series flame arrestor.

Flame Arrestor Classification

The flame arrestors within the scope of this document have been tested and certified in accordance with ISO 16852 as in-line deflagration flame arrestors and are therefore suitable for confined deflagrations propagating along a pipe into connecting pipework.

Outside North America Only

Enardo EN-7 Series

Specifications

The Specifications table lists the specifications for the 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 Construction See Table 1 and Figure 2 Gas Group IIA and IIB3 Flange Size and Rating 1 to 12 in. / 25 to 300 mm CL150 FF and RF Housing Size 4 to 24 in. / 100 to 600 mm Maximum Operational Temperature (T_o)⁽¹⁾ 140°F / 60°C Maximum Initial Operational Pressure⁽¹⁾ 14.7 psia / 0.10 MPa	Temperature Rating of Gaskets⁽¹⁾ Fiber Gaskets (standard): 450°F / 232°C Graphite Gaskets (Optional): Higher temperature Burning Time Rating Less than 1 minute Pipe Length See Table 3 Housing Material Carbon steel, 304 Stainless steel, 316 Stainless steel and Hastelloy® Element Material 304 Stainless steel, 316 Stainless steel and Hastelloy® Standards Compliance ISO 16852:2016 Certified
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1. The pressure/temperature limits in this Instruction Manual and any applicable standard or code limitation should not be exceeded.

ENARDO EN	7					/		-						-			
Series 7		Housing Size		Connection Size		IEC		Housing Material		Element Material		Connection Type		Options			
						Gas Group											
		04 = 4 in. through 24 = 24 in.		01 = 1 in. through 12 = 12 in.		IIA IIB3		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 Port 2 = Pressure Tap 3 = Temperature Port (standard) 4 = Miscellaneous 5 = Protective coating 6 = Special feature			

Figure 2. Enardo EN-7 Series Flame Arrestor Available Constructions and Model Numbering System

Table 1. Enardo EN-7 Series Available Construction

MODEL	FLANGE SIZE		HOUSING SIZE	
	In.	mm	In.	mm
Enardo EN-70402	2	50	4	100
Enardo EN-70602	2	50	6	150
Enardo EN-70603	3	75	6	150
Enardo EN-70803	3	75	8	200
Enardo EN-70804	4	100	8	200
Enardo EN-71204	4	100	12	300
Enardo EN-71206	6	150	12	300
Enardo EN-71606	6	150	16	400
Enardo EN-71608	8	200	16	400
Enardo EN-72008	8	200	20	500
Enardo EN-72010	10	250	20	500
Enardo EN-72410	10	250	24	600
Enardo EN-72412	12	300	24	600

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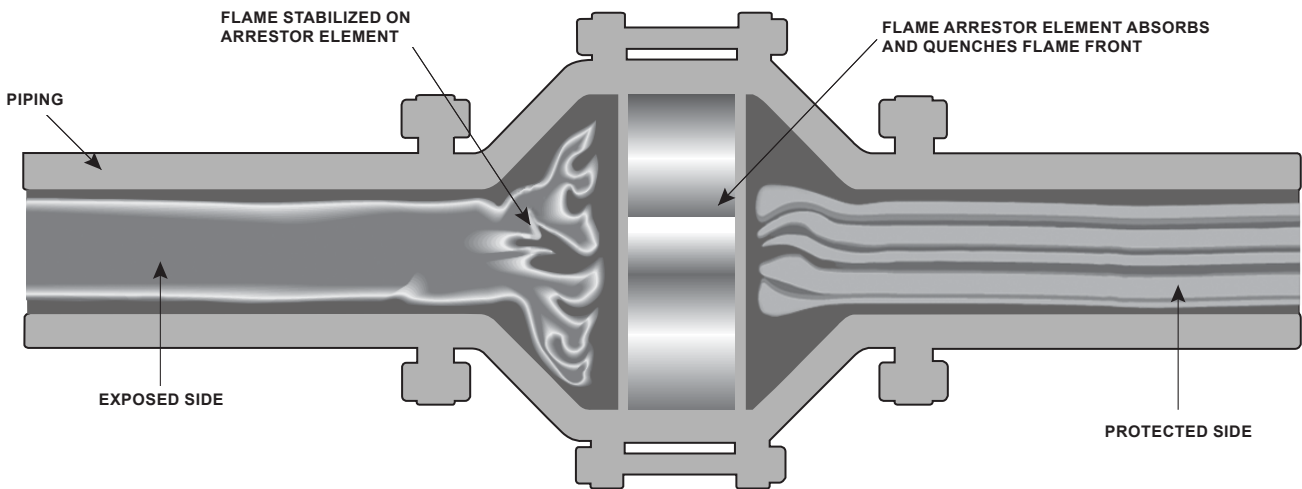


Figure 3. Flame Arrester Operation

Product Description

Enardo EN-7 Series flame arrestors are designed to stop the propagation of confined low pressure deflagrations. The Enardo EN-7 Series is typically used for end-of-line and near-end-of-line applications when the system operating pressure is near atmospheric levels and when there is minimal probability of a flame stabilizing on the flame arrester element for an extended period.

Designed with flanged connections, this arrester allows removal of the flame cell element for easy cleaning and replacement without removing the arrester body from the pipe connection. Standard housing construction is Carbon steel or Stainless steel. The element is available in stainless steel. Special material and protective coating are available on request.

Principle of Operation

Flame arrester allows gas to pass through it but stops flame in order to prevent a larger fire or explosion. Arrester prevents flame by absorbing and dissipating the heat from flame as it attempts to travel through the spiral wound crimped ribbon flame cells. These cells allow maximum flow with maximum protection.

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

Factors Affecting Flame Arrester Performance

Gas Group

The type of gas in the system determines its gas grouping and therefore predetermines the type of arrester 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 Maximum Experimental Safe Gap (MESG) of the gas.

Burn Time Rating



WARNING

Temperature sensors must be used with this product if there is a potential for stabilized burning to occur inside the arrester. The response time of the sensor must be a Type K thermocouple. Additional external safety equipment is required to ensure appropriate corrective measures are taken to protect the system if an abnormal temperature is detected. Never disconnect or remove these devices in active process systems.

Temperature sensors may be provided by Emerson and included with the arrester at the time of shipment or may be provided by and installed by the customer prior to installation. The temperature detector must be installed for compliance to ISO 16852:2016 short time burn rating. If no temperature detector is installed, the deflagration arrester is not suitable for short time burning or for any application that includes a potential for a flame to stabilize within the deflagration arrester.

Pipe Lengths

The pipe length between the actual ignition source and the flame arrester shall not exceed the values in Table 3.

Enardo EN-7 Series

WARNING			
Flame Arrestors have installation and application limits Type designation in accordance with ISO 16852:2016			
DEF	$L_v/D =$ (See Table 3)	BC: b; $t_{BT} = 1$ min	
	Ex. G IIA	$T_o = 60^\circ\text{C}$	$P_o = 0.10$ MPa (absolute)

MARKING PLATE (SEE TABLE 2)



HAZARDOUS LOCATIONS

Figure 4. Product Identification and Marking

Table 2. Marking Plate Information (See Figure 4)

INFORMATION	DESCRIPTION
DEF	Indicates product is a Deflagration Flame Arrestor
L_v/D	The ratio of pipe length (between the potential ignition source and the flame arrestor) and pipe diameter. See Bends and/or Flow Obstruction under Factors Affecting Flame Arrestor Performance section.
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
T_o	Indicates maximum operational temperature of flame arrestor
P_o	Indicates maximum operational pressure of flame arrestor

Bends and/or Flow Obstructions



CAUTION

For maximum safety, avoid bends and flow obstructions within 10 pipe diameters on the protected side of the flame arrestor.

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 flame temperatures, and higher flame front pressures than would occur in normal flow conditions.

Installation



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.

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

Fisher™ flame arrestors are normally provided with CL150 raised or flat face flanges. Other flange patterns are available upon request. Make sure the companion flanges installed in adjacent piping match the flanges on the flame arrestor.

Standard compressed fiber gaskets that will withstand temperatures of 450°F / 232°C are standard. Graphite gaskets with higher temperature ratings are available as an option.

For proper bolt torquing of the flame arrestor flange to the piping, please refer to Tables 4, 5 and 6.

Positioning



CAUTION

The 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 flame arrestor may result from improper lifting. Heavy units should be lifted using appropriately rated Nylon (PA) straps rigged on the outside of the tension studs.

The flame arrestor should be positioned such that the element is accessible for removal. The tension studs are supplied with jacking nuts on one half of the bolting circumference. Install the unit so that the jacking nuts (on the inside of the studs) are positioned on the opposite side from the direction that the element assembly will be removed.

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.

Flow Direction

This Fisher™ flame arrestor 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, page 5.

Table 3. Pipe Length

CONNECTION SIZE		GAS GROUP IIA MODELS			GAS GROUP IIB3 MODELS		
		Length-to-Diameter Ratio (L/D)	Length (L)		Length-to-Diameter Ratio (L/D)	Length (L)	
In.	mm		Ft	m		Ft	m
2	50	≤ 40	6.56	2.00	≤ 50	8.20	2.50
3	75	≤ 30	7.22	2.20	≤ 50	12.4	3.78
4	100	≤ 30	9.83	3.00	≤ 50	16.3	4.97
6	150	≤ 26.7	13.1	3.99	≤ 50	22.9	6.98
8	200	≤ 20	13.1	3.99	≤ 50	33.4	10.2
10	250	≤ 20	16.3	4.97	≤ 47.2	39.3	12.0
12	300	≤ 20	19.7	6.00	≤ 40	40.0	12.2

Table 4. Torque Values for Raised Face Connection Flanges (Steel Only)

NOMINAL PIPE DIAMETER	NUMBER OF BOLTS	BOLT DIAMETER		TORQUE	
		In.	mm	Ft-lbs	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 5. Torque Values for Flat Face Connection Flanges (Steel)

NOMINAL PIPE DIAMETER	NUMBER OF BOLTS	BOLT DIAMETER		TORQUE	
		In.	mm	Ft-lbs	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: Flat faced flanges should never be mated to a raised face flange for installation.
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 6. Torque Correction Factors for Common Lubricants

DESCRIPTION	COEFFICIENT OF FRICTION	MULTIPLY TORQUE VALUE IN TABLE 4 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
Heavy-Duty Lubricating Paste	f = 0.06	0.30

Piping Expansions and Reductions Adjacent to Flame Arrestors



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.

A Fisher flame arrestor may be installed in any vapor control line that is smaller than or equal to the nominal pipe diameter of the arrestor's connection flanges.

When it is necessary to increase the diameter of the piping on the downstream side of the flame arrestor, a length of pipe at least 120 pipe diameters must be installed between the flame arrestor and the expansion. A pipe diameter is considered as the inside diameter of pipe having a nominal size equal to the flame arrestor's connecting flanges.

Maintenance

1. Inspect flame cells for damage immediately following a deflagration and/or stabilized burn.
2. Carefully remove the element assembly from the arrestor and place it on a soft surface such as plywood.
3. Inspect the flame cell visually for any signs of corrosion or other damage.
4. Inspect the flame cell 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 – 0.038 in. / 0.965 mm
 - Explosion Group IIB3 – 0.017 in. / 0.432 mm

If any damage is noted, or crimp openings exceed maximum size allowable, replace the element assembly.

5. Clean the entire element surface. For best cleaning results, use a high pressure sprayer with spray wand (1500 to 3000 psig / 103 to 207 bar). Hold the spray nozzle 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.

6. After cleaning, thoroughly inspect the element for damage. If damaged, replace the element.

Note

Under no circumstance should the element bank be disassembled from its shell for cleaning or replacement. The element section must be replaced as a complete assembly.

Element Assembly, Disassembly and Reassembly Instructions



WARNING

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

1. Loosen all jacking (inside) nuts on tension studs between conical sections of the flame arrestor.
2. Tighten the inside jacking nuts on the tension studs forcing the two conical sections apart. When the two flange faces have separated, remove the tension studs that do not have inside jacking nuts, so that the element assembly can be removed. The inside jacking nuts are installed on all tension studs that facilitate jacking the unit apart. The inside jacking nuts are not installed on tension studs that are taken out, for ease of removal.



CAUTION

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

3. Thoroughly clean the gasket sealing faces being careful not to damage the sealing surface. For reassembly, lightly grease one side of a new gasket and place it in the machined recess of each interior flange on the two conical sections.
4. Replace the flame element assembly with a new assembly or properly cleaned and inspected existing unit.
5. Loosen the jacking nuts on the tension rods until the flame cell assembly seats onto the gaskets.
6. Replace all tensioning studs and hand tighten the outer nuts. Check to be sure that all the jacking nuts are completely loose and not making contact with the flange face.

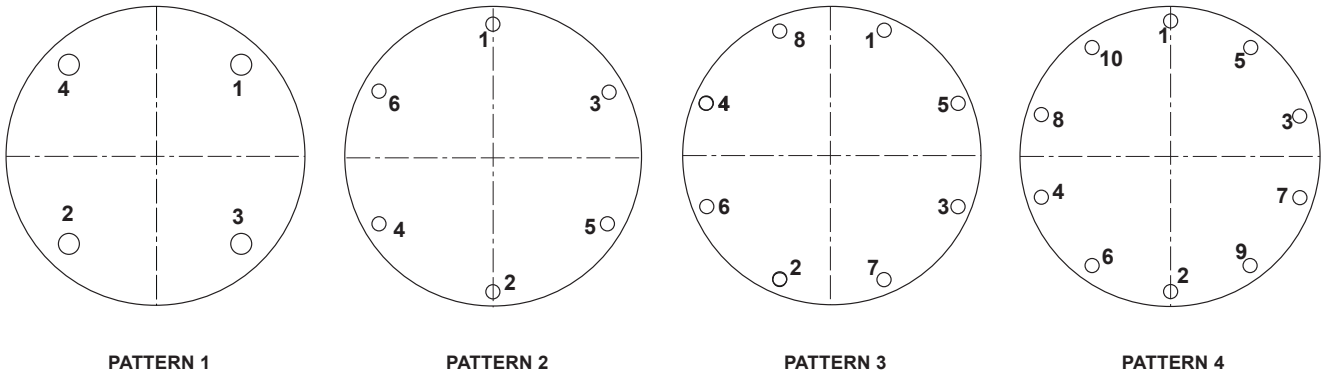


Figure 5. Flange Pattern Tightening Sequence

Table 7. Tightening Steps and Torque Values⁽¹⁾

ENARDO EN-7 SERIES FLAME ARRESTORS WITH STEEL OR STAINLESS STEEL END SECTIONS ONLY		TIGHTENING STEPS AND TORQUE (lbf-ft / N•m)				
Model	Pattern ⁽²⁾	Step 1	Step 2	Step 3	Step 4	Step 5
Enardo EN-70402, Enardo EN-70602, Enardo EN-70603, Enardo EN-70802, Enardo EN-70803 and Enardo EN-70804	1	Snug	20 / 27	50 / 68		
Enardo EN-71204 and Enardo EN-71206	2	Snug	20 / 27	50 / 68		
Enardo EN-71606 and Enardo EN-71608	3	Snug	25 / 34	50 / 68	80 / 108	100 / 135
Enardo EN-72008 and Enardo EN-72010	3	Snug	25 / 34	50 / 68	75 / 102	
Enardo EN-72410 and Enardo EN-72412	4	Snug	35 / 47	70 / 95	100 / 135	130 / 176

1. Using machine oil as lubricant. See Bolt Lubrication section on page 9 and torque correction factors for other lubricants in Table 8.
2. See Figure 5.

Torquing Instruction



CAUTION

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

Tools/Supplies Required

- Torque wrench appropriate for the specified torque
- Socket wrenches of the proper size to fit the hex nuts being tightened
- Molydisulfide based lubricating paste, heavy-duty lubricating paste or equivalent
- 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.
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 7 following the designated sequence, repeating the sequence as shown. Flange pattern tightening sequences are shown in Figure 5.

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 6 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.

Enardo EN-7 Series

Recommended Spare Parts

For installations that require frequent maintenance and minimum downtime 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 should be replaced each time the cell assembly is loosened and removed to insure a gas tight seal.

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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